https://ntrs.nasa.gov/search.jsp?R=19780009310 2020-03-22T06:28:34+00:00Z

CR151614

(NASA-CR-151614) HARDWARE SIMULATION OF SHUTTLE Ku-BAND ANTENNA ACQUISITION, VOLUME 5 (LinCom Corp., Pasadena, Calif.) 167 p HC A08/MF A01 CSCL 20N

N78-17253

Unclas
G3/32 05338

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HARDWARE SIMULATION OF SHUTTLE KU-BAND ANTENNA ACQUISITION

VOLUME V

Prepared for

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Contract Number NAS 9-14636

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OCTOBER 1977

TR No. 7810-0675

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HARDWARE SIMULATION OF SHUTTLE KU-BAND

ANTENNA ACQUISITION

VOLUME V

VOLUME IV: Ku-Band Antenna Acquisition and Tracking Performance Study

VOLUME V: Hardware Simulation of Shuttle Ku-Band Antenna Acquisition

This two volume report documents the work accomplished during amended Phase II of Contract Number NAS 9-14636. The system tradeoff analysis and system performance study that led to three antenna pointing and acquisition algorithms for hardware simulation is provided in Volume IV. The construction of results obtained from the hardware simulation are described in Volume V. A high level software description and a detailed software documentation of the computer programs is to be found in Volume V. The first three volumes of this report documents the work accomplished during Phase I of this contract.

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OCTOBER 1977

ACKNOWLEDGEMENT

The authors wish to thank Mr. Jack Seyl of the Johnson Space Center for providing us with certain technical data pertaining to the Shuttle Ku-Band pointing system and for participating in various stimulating discussions throughout the contract period.

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OBJECTIVES

LINCCMs overall objective under this contract was to develop a hardware simulation which could emulate the Shuttle's Ku-Band Antenna Pointing and Signal Acquisition System. The desire was to develop a simulation in which the antenna pattern, the TDRS search volume, the a priori probability distribution of TDRS satellite position relative to the Shuttle, and the antenna scan procedure could be selected for the purpose of predicting performance for various Shuttle/TDRS antenna pointing and acquisition scenarios.

The simulation was developed under the constaints of assuming a fixed network operation, the system must be real world implementable, it must be cost effective, the program execution time must not be excessive, the modulation technique is PN/BI-ϕ/BPSK, and optimum performance is desirable.

SUMMARY

This document presents the results pertaining to the trade-off analysis and performance of the Ku-Band Shuttle antenna pointing and signal acquisition system. The study was performed assuming the existance of various antenna scanning trajectories and various signal acquisition algorithms. The square, hexagonal and spiral trajectories were investigated assuming the TDRS postulated uncertainty region and a flexible statistical model for the location of the TDRS within the uncertainty volume. The scanning trajectories, Shuttle/TDRS signal parameters and dynamics and three signal acquisition algorithms were integrated into a hardware simulation discussed herein and documented in detail in Volume IV. The hardware simulation is quite flexible in that it allows one to evaluate signal acquisition performance for an arbitrary (programmable) antenna pattern, a large range of C/N_0's, various TDRS/Shuttle a priori uncertainty distributions and three distinct signal search algorithms.

Based upon the data made available during this contract period, certain Ku-Band forward link signal threshold characteristics were studied. The antenna pointing and acquisition threshold is found to be less than 60 dB-Hz with an acquisition time dependent on the antenna scan procedure and acquisition algorithm implemented. Various techniques are discussed in this report and a computer program is presented from which these can be evaluated. It appears that there will be no problem in meeting the system

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spec even in light of the uncertainty associated with the possibilities of antenna sidelobe acquisition. The details are provided herein. Assuming a single channel monopulse system and a 30 MHz IF bandwidth, a monopulse tracking loop bandwidth of one Hz, the monopulse tracking jitter is 0.11 degrees at $C/N_0 = 54$ dB-Hz. The Costas loop arm filter bandwidths can be chosen to be ten times the data rate such that no false-lock problem occurs during carrier acquisition. Assuming loop bandwidth of $B_L = 3$ kHz, the loop jitter is 10 degrees at $C/N_0 = 60.4$ dB-Hz. Acquisition can be accomplished in less than 10 seconds.

For the purpose of antenna scanning analysis, a reference coordinate system, whose z-axis is in line with the center axis of a specified uncertainty cone of the TDRS position, is chosen for the relative relation between the TDRS and the Shuttle antenna. The scan path of the Shuttle antenna can be projected onto the (x,y) plane of the coordinate system; while the uncertainty cone of the TDRS position can be described by a circle in the (x,y) plane. The uncertainty in the position of the TDRS is modeled by a truncated Gaussian probability density p(x,y) with uncertainty parameters $\sigma_x^2 = \sigma_y^2 = \sigma^2$. By changing the value of this variance parameter, the model is sufficiently general to include a uniform distribution of TDRS position uncertainty ($\sigma_p=\infty$) to one which specifies the position with probability one ($\sigma_p=0$).

In the study of antenna scanning three types of trajectories are proposed and evaluated in terms of average scan time and the structure of coverage over the uncertainty cone of the TDRS position. The analysis technique used for finding average scan time is discussed and an illustration of the technique for a specific type of scanning trajectories and motion of the Shuttle antenna is given. The results show that the spiral trajectories is in general better than the other two trajectories, especially for a constant velocity along a trajectory, since the path of a spiral trajectory (from the center of uncertainty cone to its edge) can be shorter than the other two.

From the Ku-band system specifications, it has been recognized that the variation of the received signal level at the Shuttle (due to TDRS EIRP path loss and antenna pointing loss variations) varies as much as 23 dB. If the antenna sidelobes are not sufficiently suppressed, a potential problem called sidelobe acquisition may cause the degradation in system performance. Therefore in this tradeoff analysis study, three different acquisition strategies are proposed and evaluated. The first acquisition strategy may be used for the case where the sidelobe acquisition does not impose a problem to the system. The other two strategies are primarily designed to avoid the sidelobe acquisition (especially the first sidelobe).

In this study, we assume that the first sidelobe of the Shuttle antenna is 17.5 dB suppression from the main lobe of the antenna so that we can study the effectiveness of the acquisition algorithm proposed. Surely, one should note that the sidelobe acquisition can be overcome by tapering down the sidelobes of the Shuttle antenna below 23 dB. However, it has been

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found that with one particular acquisition algorithm studied, a strong sidelobe of the antenna can speed spatial acquisition significantly.

The scan schemes and acquisition algorithms are all integrated by a computer simulation program. This software package, discussed herein, provides a useful tool for predicting the performance of the Ku-band antenna pointing system. Various options are available for users to do tradeoff studies on system parameters in designing an acquisition system. The software package has been tested on UNIVAC 1100 Series computers and verified with analytical results.

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(1) Introduction

The Ku-band antenna pointing acquisition systems based on the noncoherent signal energy detection and scanning scheme discussed previously have been simulated by digital computer for the tradeoff study in the design of the Shuttle antenna acquisition. Several acquisition algorithms implemented are given to provide flexibility in accommodating the different operating ranges of autotrack systems. The acquisition strategies are primarily oriented toward the avoidance of the first side lobe acquisition in the spatial search. In addition, the simulation also provides various options on the scan trajectories, scan rates and a wide range of CNR. It essentially integrates the effect of interaction of spatial search acquisition schemes and the noncoherent signal energy detection. So the simulation program is able to support the design of hardware development.

The simulation program was written in Fortran IV for the Univac 1100 series computer. Originally, it was developed for time-shared operation, which is available at LINCOM Corporation. However, the program can also be used for batch processing with some modification. The program consists of 19 internal subroutine references and two external subroutines MERFIC (from IMSLS package) and BSSL (from MATHPACK) which are normally available for computer systems.

The computing time to run the simulation program depends on the number of tests on the TDRS position and the number of samples taken for channel noises. These two variables are also provided as options for a user. The higher the values of these two variables, the higher the accuracy in predicting the acquisition performance and the longer the CPU time. The CPU time for a typical case is well within 10 sec if the number of noise samples is one and the number of simulated TDRS position is less than 500.

The simulation program provides various options for users to test system performance for a wide range of system parameters. The following options included are:

(1) The size of uncertainty cone of the TDRS position and its statistical distribution function over the cone.

(2) The antenna pattern of the Shuttle receiver (3 dB beamwidth).

(3) The types of antenna scan trajectories--square, hexagonal or spiral with different overlap.

(4) The scan rates--constant angular velocity, constant speed along a trajectory or combination of both previous cases (also a switching angle θ_s).

(5) The probability of false-alarm and the operating range of carrier-to-noise ratio (CNR).

(6) The receiver parameters--dwell time of the signal energy detector, IF filter bandwidth, insertion loss and other circuit losses.

(7) The number of TDRS positions used in the Monte Carlo simulation.

(8) The number of samples taken for channel noises.

(9) The types of acquisition algorithms.

(10) The choices of a detailed printout or final results in the simulation.

The simulation program was structured as functional modules so that each subroutine can be easily replaced to adopt to any required function. For instance, the antenna pattern used in the simulation can be simply replaced by other types of antenna pattern. To do so, one should remove the subroutine ANTNNA and substitute an equivalent subroutine ANTNNA.

The simulation results are presented in two versions--one for a time-shared mode and the other for a batch process mode. For the time-shared mode, the computer asks for input data through interaction with users. A typical output generated by the simulation program consists of the following important parameters:

(1) The threshold TH1 and TH2 used for the signal energy detector in a normal scan and in mini scans (such as adjacent and sidelobe scans), respectively.

(2) Total number of cells to cover the whole uncertainty region.

(3) Maximum scanning time (= time spent to reach the last cell through normal path only).

(4) Average scanning time and corresponding standard deviation.

(5) "Probabilities" of detection, miss and false alarm.

A sample printout is given in Fig. 1.

(2) Functional Diagram of Simulation Program

To clarify the main functions performed in the simulation, a flow diagram of the simulation program is depicted in Fig. 2.

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```
0
10.,1.6,3
30.
1
108.
1.e-3,60.,80.
60.,60.,1.
5.,6.,1.5,0.
500
1
1.,1.,1.
0
0.,0.,0.
0
2
```

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```
RADIUS OF UNCERTAINTY REGION:                    10.0000 DEGREES
BEAMWIDTH:                                        1.6000 DEGREES
SPIRAL TRAJECTORY:              OVERLAP =        30.0000 %
CONSTANT ROTATIONAL SPEED:                      108.0000 DEGREES/S
PROBABILITY OF FALSE ALARM:                        .1000-02
CNR EXPECTED RANGE:                              60.0000 DB   -   80.0000 DB
INTEGRATION TIME:                                 5.0000 MS
IF FILTER BANDWIDTH:                              6.0000 MHZ
INSERTION LOSS:                                   1.5000 DB
OTHER LOSSES:                                      .0000 DB

THE PROBABILITY OF FALSE ALARM WAS RAISED TO 0.1 TO AVOID       SIDELOB
...E DETECTION
WHEN CNR = 80.00 DB/HZ

THRESHOLDS:   TH1 =  1.0568141     TH2 =  1.2276665

NUMBER OF CELLS:  302

MAXIMUM SCANNING TIME =  .3217689+02 SECONDS

NUMBER OF SATELLITE POSITIONS GENERATED:           500
STANDARD DEVIATION:                                   .1000000+01

CARRIER-TO-NOISE RATIO:                               .6000000+02 DB
ACQUISITION AVERAGE TIME:                             .3023562+01 S
STANDARD DEVIATION:                                   .2362385+01 S
PROBABILITY OF DETECTION:                             .1000000+01
PROBABILITY OF DETECTION (SL. VAR.):                  .0000000
PROBABILITY OF MISS:                                  .0000000
PROBABILITY OF FALSE ALARM (IN THE SIMULATION):       .0000000
```

Figure 1a. A Sample of Input and Output Data.

Figure 2b. A SAMPLE OF INPUT DATA FOR BATCH PROCESSES

```
@bk1 ac\cd
BREAKPOINTED
>@tpf,u kuacq
@>@*Del*
>@xqt main
>0
>5.,1.6,2
>3
>108.,5.044,3
>1e-4,60.,80.
>60.,80.,20.
>5.,6.,1.5,0.
>5
>1
>2.5,2.5,1.
>1
>5
>1.e-3,1.e-3,5.e-3
>2
>2
>@bk2,u els
13 PAGES SYMMED BY HUANG.
>@fin
  RUNID: HUANG    ACCT: 0544AA
```

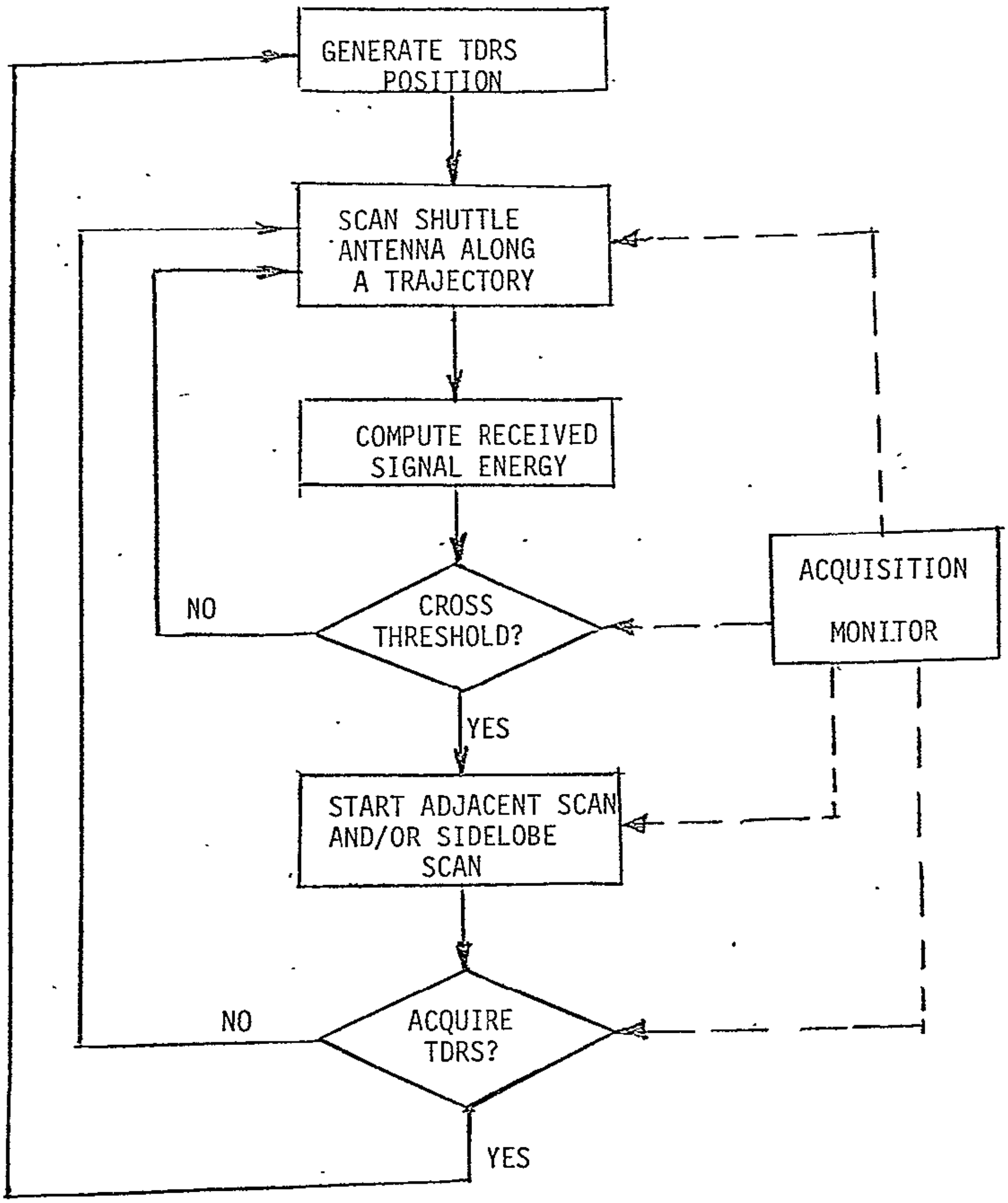

Figure 2 . Functional Flow Diagram of the Simulation Program.

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The TDRS position is simulated by a random generator with a specified distribution function. To measure the spatial acquisition time of the TDRS position, a set of simulated TDRS positions is tested for a specified trajectory and scan rates (speed for constant angular velocity and/or constant velocity along a trajectory). The simulated data reported here are all obtained by 500 simulated TDRS positions.

In the simulation program, the acquisition monitor is not a separate unit, but imbedded in the subroutine ACQ. This is implemented just for the convenience in programming. The detailed structure of the program is referred to herein.

(3) Capabilities of Software Package

The program developed for the Ku-band antenna pointing system provides various options in the size of uncertainty cone for the TDRS positions, the type of scanning and trajectories, and spatial acquisition algorithms. Here are the capabilities of the software package:

(1) Conical angle of the TDRS position can be 4°, 8° or 10°.
(2) The variance σ_p^2 of a priori probability distribution function of the TDRS position can vary from 0.1° to 10°.
(3) Antenna pattern can have beamwidth $\geq$ 10°.
(4) Three scan trajectories and wide range of scan rates (but limited by electrical dwell time) are available.
(5) The noncoherent signal detector can be operated over a wide range of CNR and $B_{IF}T$ product greater than 1000.
(6) Spatial acquisition algorithms with/without avoidance of sidelobe acquisition are selectable.

(7) Probability of false alarm can be from 0.5 down to 10^{-7}.

(8) The number of TDRS positions in Monte Carlo simulation can be selected by users. But it is limited by the CPU time in executing the simulation program.

In addition, the software package also provides a useful feature for system designers to interact with a computer if the time-shared facility is available. Upon user's choices, a detailed spatial acquisition procedure can be printed out for a closed examination on the behavior of acquisition systems. Finally one should also note that the application of the software package should not be limited to the Ku-band system parameters even though it is oriented toward the study of Ku antenna pointing systems.

(4) Computer Program Utilization

The simulation program was designed for two modes of usage--batch process and time-shared modes. Since the computer program was originally developed through time-shared mode, it provides the mechanism of interactions between computers and users. However, this set of interactions should be suppressed for the batch processing. In order to run the program in batch, one should provide the same set of input data as one type in input data in the time-shared mode, except for the first input data. To illustrate the details of the input data required, several examples are given in Figs. 1 and 2 to show the options available in the simulation and the corresponding sets of input data for the batch process are also listed.

(1) Example 1

(a) Time Shared Mode

```
IF YOU ARE ON-LINE, PLEASE TYPE 1
>1
*** ON-LINE ***



INPUT DATA   (FREE FORMAT)

(REAL)  RADIUS OF UNCERTAINTY REGION        (DEGREES)
(REAL)  BEAMWIDTH                           (DEGREES)
(INTG)  TYPE OF TRAJECTORY:                 1(SQUARE)  2(HEXAGONAL)  3(SPIRAL)
>10.,1.6,1

(INTG)  TYPE OF MOTION:
        1 - CONSTANT ANGULAR VELOCITY
        2 - CONSTANT VELOCITY ALONG TRAJECTORY
        3 - COMBINATION OF "1" AND "2"
>2

(REAL)  ANGULAR VELOCITY (DEGREES/S)
(REAL)  VELOCITY ALONG TRAJECTORY (DEGREES/S)
>108.,5.044

(REAL)  PROBABILITY OF FALSE ALARM
(REAL)  EXPECTED MINIMUM CARRIER-TO-NOISE RATIO (DB)
(REAL)  EXPECTED MAXIMUM CARRIER-TO-NOISE RATIO (DB)
>1.e-4,60.,80.

        CNR VALUES TO BE USED IN THE SIMULATION
(REAL)  (MINIMUM, MAXIMUM, INCREMENT.GE.0.)
>60.,80.,5.

        RECEIVER PARAMETERS:
(REAL)  INTEGRATION TIME  (MS)
(REAL)  IF FILTER BANDWIDTH  (MHZ)
(REAL)  INSERTION LOSS  (DB)
(REAL)  OTHER LOSSES  (DB)
>5.,6.,1.5,0.

(INTG)  NUMBER OF SATELLITE POSITIONS TO BE GENERATED DURING THE SIMULATION
>500

(INTG)  0 - SATELLITE POSITIONS ARE ENTERED AS INPUT DATA
        1 - SATELLITE POSITIONS ARE INTERNALLY GENERATED
>1

(REAL)  STANDARD DEVIATION VALUES:  (MINIMUM, MAXIMUM, INCREMENT.GE.0.)  IN DEGREES
>2.5,2.5,1.

(INTG)  INTERMEDIATE RESULTS:  NO(0)   YES(1)
>0

        TRANSITION MODES AND VERIFICATION TIMES:
(REAL)  NORMAL TO SIDELOBE SCANNING
(REAL)  NORMAL TO SURROUNDING CELLS SCANNING
(REAL)  VERIFICATION TIME
>1.e-3,1.e-3,5.e-3

        SCANNING SCHEME:
(INTG)  0 - NORMAL PATH ONLY
        1 - NORMAL PATH AND SIDELOBE CELLS
        2 - NORMAL PATH, NEARBY, AND THEN SIDELOBE CELLS
>0

(INTG)  NUMBER OF NOISE SAMPLES   (EVEN  1<(.)<20 )
>
```

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Figure 3. A Sample Interaction Between a Computer and User.

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 INPUT DATA   (FREE FORMAT)

 (REAL)  RADIUS OF UNCERTAINTY REGION        (DEGREES)
 (REAL)  BEAMWIDTH                           (DEGREES)
 (INTG)  TYPE OF TRAJECTORY:                 1(SQUARE)  2(HEXAGONAL)  3(SPIRAL)
>10.,1.6,3

 (REAL)  OVERLAP                             ( %-)
>30.

 (INTG)  TYPE OF MOTION:
         1 - CONSTANT ANGULAR VELOCITY
         2 - CONSTANT VELOCITY ALONG TRAJECTORY
         3 - COMBINATION OF "1" AND "2"
>3

 (REAL)  ANGULAR VELOCITY (DEGREES/S)
 (REAL)  VELOCITY ALONG TRAJECTORY (DEGREES/S)
 (REAL)  SWITCHING ANGLE (DEGREES)
>108.,5.044,5.5


 (REAL)  PROBABILITY OF FALSE ALARM
 (REAL)  EXPECTED MINIMUM CARRIER-TO-NOISE RATIO (DB)
 (REAL)  EXPECTED MAXIMUM CARRIER-TO-NOISE RATIO (DB)
>1.e-3,60.,80.

         CNR VALUES TO BE USED IN THE SIMULATION
 (REAL)  (MINIMUM, MAXIMUM, INCREMENT.GE.0.)
>75.,75.,1.

         RECEIVER PARAMETERS:
 (REAL)  INTEGRATION TIME  (MS)
 (REAL)  IF FILTER BANDWIDTH  (MHZ)
 (REAL)  INSERTION LOSS  (DB)
 (REAL)  OTHER LOSSES  (DB)
>5.,6.,0.5,1.

 (INTG)  NUMBER OF SATELLITE POSITIONS TO BE GENERATED DURING THE SIMULATION
>1000

 (INTG)  0 - SATELLITE POSITIONS ARE ENTERED AS INPUT DATA
         1 - SATELLITE POSITIONS ARE INTERNALLY GENERATED
>1

 (REAL)  STANDARD DEVIATION VALUES:  (MINIMUM, MAXIMUM, INCREMENT.GE.0.)  IN DEGREES
>1.0,5.5,1.5

 (INTG)  INTERMEDIATE RESULTS:  NO(0)   YES(1)
>1

 (INTG)  HOW MANY RESULTS DO YOU WANT TO SEE IN DETAILS?
>30

         TRANSITION MODES AND VERIFICATION TIMES:
 (REAL)  NORMAL TO SIDELOBE SCANNING
 (REAL)  NORMAL TO SURROUNDING CELLS SCANNING
 (REAL)  VERIFICATION TIME
>1.e-3,1.e-3,5.e-3

         SCANNING SCHEME:
 (INTG)  0 - NORMAL PATH ONLY
         1 - NORMAL PATH AND SIDELOBE CELLS
         2 - NORMAL PATH, NEARBY, AND THEN SIDELOBE CELLS
>2

 (INTG)  NUMBER OF NOISE SAMPLES   (EVEN  1<(.)<20 )
```

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```
 IF YOU ARE ON-LINE, PLEASE TYPE 1
>1
 *** ON-LINE ***



 INPUT DATA   (FREE FORMAT)

 (REAL)  RADIUS OF UNCERTAINTY REGION        (DEGREES)
 (REAL)  BEAMWIDTH                           (DEGREES)
 (INTG)  TYPE OF TRAJECTORY:                1(SQUARE)  2(HEXAGONAL)  3(SPIRAL)
>10.,1.6,2

 (INTG)  TYPE OF MOTION:
         1 - CONSTANT ANGULAR VELOCITY
         2 - CONSTANT VELOCITY ALONG TRAJECTORY
         3 - COMBINATION OF "1" AND "2"
>1

 (REAL)  ANGULAR VELOCITY (DEGREES/S)
>108.

 (REAL)  PROBABILITY OF FALSE ALARM
 (REAL)  EXPECTED MINIMUM CARRIER-TO-NOISE RATIO (DB)
 (REAL)  EXPECTED MAXIMUM CARRIER-TO-NOISE RATIO (DB)
>1.e-4,60.,80.

         CNR VALUES TO BE USED IN THE SIMULATION
 (REAL)  (MINIMUM, MAXIMUM, INCREMENT.GE.0.)
>60.,80.,5.

         RECEIVER PARAMETERS:
 (REAL)  INTEGRATION TIME  (MS)
 (REAL)  IF FILTER BANDWIDTH  (MHZ)
 (REAL)  INSERTION LOSS  (DB)
 (REAL)  OTHER LOSSES  (DB)
>5.,6.,1.5,0.

 (INTG)  NUMBER OF SATELLITE POSITIONS TO BE GENERATED DURING THE SIMULATION
>10

 (INTG)  0 - SATELLITE POSITIONS ARE ENTERED AS INPUT DATA
         1 - SATELLITE POSITIONS ARE INTERNALLY GENERATED
>0

 (INTG)  INTERMEDIATE RESULTS:  NO(0)   YES(1)
>0

         TRANSITION MODES AND VERIFICATION TIMES:
 (REAL)  NORMAL TO SIDELOBE SCANNING
 (REAL)  NORMAL TO SURROUNDING CELLS SCANNING
 (REAL)  VERIFICATION TIME
>1.e-3,1.e-3,5.e-3

         SCANNING SCHEME:
 (INTG)  0 - NORMAL PATH ONLY
         1 - NORMAL PATH AND SIDELOBE CELLS
         2 - NORMAL PATH, NEARBY, AND THEN SIDELOBE CELLS
>1

 (INTG)  NUMBER OF NOISE SAMPLES   (EVEN  1<(.)<20 )
>4
```

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Figure 3. (Cont'd)

(5) Functional Descriptions of Subroutines

The functions of each subroutine used in the computer program for UNIVAC 1100 series are briefly described one-by-one here. Their flow charts and detailed documentations are given in Volume II separately. The description of subroutines is given in alphabetical order to be consistant with the computer printouts from UNIVAC 1108 time-shared mode. The program is, in fact, started from MAIN then SIMULA. The subroutine SIMULA, the core of the simulation, cells and monitors the operations of the Monte Carlo simulation.

Subroutine ACQ

This simulates the acquisition algorithms discussed previously. The variable NULL, used to select the type of the acquisition algorithms for the simulation, is defined as follows:

NULL	=	0	for normal scan
		1	for normal scan plus sidelobe scan
		2	for normal scan, adjacent scan and sidelobe scan

In the process of the spatial acquisition, the time spent in any scan, including the transition from one scan to another and verification time, is accumulated as one of the outputs of the subroutine. The other important output parameters of the subroutine are:

(1) The status of the spatial search--success or failure (IPMISS and IPDET).

(2) How to acquire--the detection was declared by a normal scan or plus sidelobe scans (IPDSL).

(3) The acquired location of the TDRS (KHIT (IHIT)).

Subroutine ANTNNA

The antenna pattern of the simulated Shuttle receivers is assumed to have a first sidelobe of -175 dB from the peak of the main lobe. The antenna gain is computed from the offset angle between the simulated TDRS position and the boresight axis of the Shuttle. Hence, the offset angle (TH) is an input variable in addition to the parameters characterizing the antenna (THB, PATTC). A control variable K is used for computing the antenna parameters as shown here

K =	-2	for computing the angle of first null
	-1	for computing the angle of the peak of of the second sidelobe
	0	for computing the angle of the peak of the first sidelobe
	+1	for -3 dB beamwidth
	2	for normal usage in computing the gain of the antenna at offset TH.

Subroutine CELL

For a specified trajectory (KSCAN), the subroutine computes the locations of search cells (XCTR,YCTR) along the trajectory and the scan time to reach each search cell from the designated center of the uncertainty zone of the TDRS position. The scan time is computed by calling the subroutine TCENTR. Hence, it requires the following input variables

KSCAN =	1	for square trajectory
	2	for hexagonal trajectory
	3	for spiral trajectory

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MOTION = 1 for constant rotational speed

2 for constant speed along trajectory

3 for constant rotational speed first then constant speed along trajectory

VANG = angular velocity for constant rotational speed (in radian/sec)

VLIN = constant speed along trajectory (in radian/sec)

To ensure the electrical dwell time to be smaller than K_D times of the minimal mechanical dwell time, a warning is printed out if the antenna scan is too fast. In the subroutine K_D is set to be 10

Subroutine GAUSS

This is a Gauss random generator whose mean and standard deviation are specified by AVR and SIGMA, respectively. The Gaussian samples are obtained in pair by the following simple relations

$$y_1 = \sigma(-2.\ln x_1)^{1/2} \cos 2\pi x_2 + \mu$$

$$y_2 = \sigma(-2.\ln x_1)^{1/2} \sin 2\pi x_2 + \mu$$

where x_1 and x_2 are a pair of independent random variables uniformly distributed between 0 and 1, and μ and σ^2 are its mean and variance, respectively. The algorithm has been tested for its mean, variance and skew coefficient. The results show that the algorithm gives a high confidence in its statistical nature.

Subroutine HIT

The signal energy detector is simulated by this subroutine. The received signal energy (sum of signal power and noise power) is compared with a preset threshold (TH). If the threshold is crossed, a hit is declared (HIT=.TRUE.); otherwise, no hit is given. The input variables are the position of the TDRS and the location of the boresight axis of the Shuttle antenna. The offset angle TETA is computed, then the antenna gain by calling subroutine ANTNNA, the signal power and noise power.

Subroutine HPOSTN

This subroutine computes the centers of hexagonal cells along the hexagonal trajectory. The computation is proceeded from K^{th} cell to $(K+1)^{th}$ cell.

Subroutine ITR

This subroutine implements the iterative algorithm needed in solving for eqs. (20) and (21). The control variable K is used to indicate the application of the algorithm to eq. (20) or eq. (21).

MAIN

The function of the MAIN defines the dimension of variables used in the simulation. The program has been set to deal with the maximal number of search cells to be 500. If the number of the search cells goes beyond 500, one should expand dimensions of all variables in the first dimension statement.

MAIN/MAP

This is a set-up for executing the simulation program. Two system subroutine packages--MATHPACK and IMSL--are called to satisfy the external references.

Subroutine NOISE

The simulated channel noise power at the output of the integrator is computed here. The number of samples for equivalent Gaussian noises is set by the variable KNOISE.

Subroutine QPOSTN

It computes the center of $(K+1)^{th}$ search cell from the known center of the K^{th} search cell along the square trajectory.

Subroutine SIMULA

This is the core of the simulation program. It reads in the data, prints the outputs and also monitors the operation of the program. The detailed operation of the subroutine is referred to herein.

Subroutine SLCELL

The search cells alons a sidelobe trajectory and adjacent cells to a hit cell are computed here. The adjacent cells are structured as those for hexagonal cells. Hence, the number of the adjacent cells to be scanned is fixed as six. However, the number of cells for the sidelobe trajectory varies depending upon the type of trajectory used for normal scan.

Subroutine SPOSTN

It computes the center of $(K+1)^{st}$ cell along a spiral trajectory from the known center of the K^{th} cell.

Subroutine TCENTR

It computes the scan time required for the Shuttle antenna to sweep along a trajectory to reach a spatial point in the uncertainty zone of the TDRS position. It requires to input the type of motion, scan rate (constant rotation and/or constant speed along a trajectory) and the coordinates of the point.

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Subroutine TDRS

The subroutine generates a simulated TDRS position according to a specified Gaussian distribution. If a Gaussian sample falls outside the uncertainty zone of the TDRS position, it is discarded and another sample is taken. Its input variables are SIGMA, THM2, and its output variables XTDRS and YTDRS.

Subroutine TH1TH2

The setup of threshold levels used for spatial acquisition is done in this subroutine. The threshold TH1 is first computed for the given probability of false-alarm under the channel noise condition. Then it checks the probability of detection P_{fas} due to the second sidelobe of the Shuttle antenna at the maximal value of CNR in the specified operating range. If P_{fas} is larger than the given probability of false alarm, the threshold is adjusted to yield at least 0.1 probability of false alarm due to second sidelobe at the strongest CNR. This implies that the probability of false-alarm at lowest CNR is much smaller than the specified one.

The threshold TH2 is computed based on the assurance of having the specified probability of false alarm due to the first sidelobe at strongest CNR.

Subroutine UNIFOR

This is a uniform random generator over (0,1). A pair of output samples are generated for each cell.

(4) Sample of Computer Run

APPENDIX I

SUBROUTINE DESCRIPTIONS

1. MAIN Program

Purpose: Define the working areas needed throughout the simulation.

2. Subroutine SIMULA

Purpose: Read input data, determine the "a priori" set of data necessary for the "acquisition process," and compute desired time averages and probabilities.

Usage: Call SIMULA(NCELL ,XCTR,YCTR,TCTR,ELEV,AZIM,NSLDIM, XSLO,YSLO,XSL,YSL,NNEARD,XNEARO,YNEARO, XNEAR,YNEAR,KHIT,TH)

```
INPUT PARAMETERS
  NCELLD          -  MAXIMUM NUMBER OF CELLS POSSIBLE TO BE USED TO SCAN THE
                     UNCERTAINTY REGION
  NSLDIM          -  MAXIMUM NUMBER OF CELLS POSSIBLE TO BE USED IN THE
                     SIDELOBE SCANNING
  NNEARD          -  MAXIMUM  NUMBER OF CELLS POSSIBLE TO BE USED IN THE
                     "SURROUNDING CELLS" SCANNING

OUTPUT PARAMETERS
  (XCTR,YCTR)     -  VECTORS WITH THE CENTERS OF THE VARIOUS CELLS
                     (CARTESIAN COORDINATES)
  (ELEV,AZIM)     -  VECTORS WITH THE CENTERS OF THE VARIOUS CELLS
                     (POLAR COORDINATES)
  (XSLO,YSLO)     -  VECTORS WITH THE CENTERS OF THE SIDELOBE CELLS WHEN
                     ANTENNA BORESIGHT IS POINTING TO THE ORIGIN
  (XNEARO,YNEARO)    VECTORS WITH THE CENTERS OF THE NEARBY CELLS WHEN
                     ANTENNA BORESIGHT IS POINTING TO THE ORIGIN
  KHIT            -  VECTOR WITH THE LAST HITS, STARTING WITH THE LAST CELL
                     IN THE NORMAL PATH WHERE A HIT WAS OBSERVED
  TH              -  VECTOR WITH THE THRESHOLDS USED TO SEARCH NEARBY CELLS
```

INTERNAL VARIABLES

THM	- RADIUS OF THE UNCERTAINTY REGION (RADIANS)
THB	- RADIUS OF -3DB ANTENNA MAIN LOBE
OVLAP	- OVERLAP
KSCAN	- TYPE OF TRAJECTORY 1 - SQUARE 2 - HEXAGONAL 3 - SPIRAL
MOTION	- DESIRED ANTENNA MOTION 1 - CONSTANT ROTATIONAL SPEED 2 - CONSTANT VELOCITY ALONG TRAJECTORY 3 - COMBINATION OF "1" AND "2"
VANG	- ANGULAR VELOCITY (RADIANS/S)
VLIN	- LINEAR VELOCITY ALONG TRAJECTORY (RADIANS/S)
SWTCH	- SWITCHING ANGLE (IN RADIANS) TO GO FROM "MOTION=1" TO "MOTION=2"
PFA	- PROBABILITY OF FALSE ALARM
CNRMIN - CNRMAX	- EXPECTED CARRIER-TO-NOISE RATIO DYNAMIC RANGE (DB)
CNR	- ACTUAL CARRIER-TO-NOISE RATIO (IN DB) USED IN THE SIMULATION
TD	- ELECTRICAL DWELL TIME (MS)
BIF	- IF FILTER BANDWIDTH (MHZ)
FLOSS	- FILTER INSERTION LOSS (DB)
OTHERL	- OTHER LOSSES (DB)
NTDRSS	- NUMBER OF SATELLITE POSITIONS GENERATED DURING THE SIMULATION FOR EACH "SET OF CONDITIONS"
SIGMAP	- STANDARD DEVIATION (IN RADIANS) OF THE TRUNCATED GAUSSIAN DENSITY FUNCTION USED TO GENERATE THE SATELLITE POSITION
TSL	- TIME INTERVAL TO SWITCH FROM NORMAL SCANNING TO SIDELOBE SCANNING
TCLOSE	- TIME INTERVAL TO SWITCH FROM NORMAL SCANNING TO NEARBY SCANNING
TVERIF	- VERIFICATION TIME
NULL	- SELECT SCANNING SCHEME 0 - NORMAL PATH ONLY (AUTO-TRACK RANGE < ANGLE BETWEEN 1 - NORMAL PATH AND SIDELOBE CELLS (AUTO-TRACK RANGE < ANTENNA NULLS 2 - NORMAL PATH, SIDELOBE, AND THEN NEARBY CELLS (AUTO-TRACK RANGE < BEAMWIDTH) 3 - NORMAL PATH, NEARBY, AND THEN SIDELOBE CELLS (AUTO-TRACK RANGE < BEAMWIDTH)
TH1,TH2	- THRESHOLDS
PDET	- PROBABILITY OF DETECTION
PDSL	- PROBABILITY OF DETECTION BY SIDELOBE ACQUISITION
PMISS	- PROBABILITY OF MISS
PRFA	- PROBABILITY OF FALSE ALARM (SIMULATED)
TAVR	- AVERAGE TIME (IN SECONDS) TO DETECT THE SATELLITE
SIGMAT	- CORRESPONDING STANDARD DEVIATION

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Subroutines Required: HIT

Function Diagram (see Fig. A1)

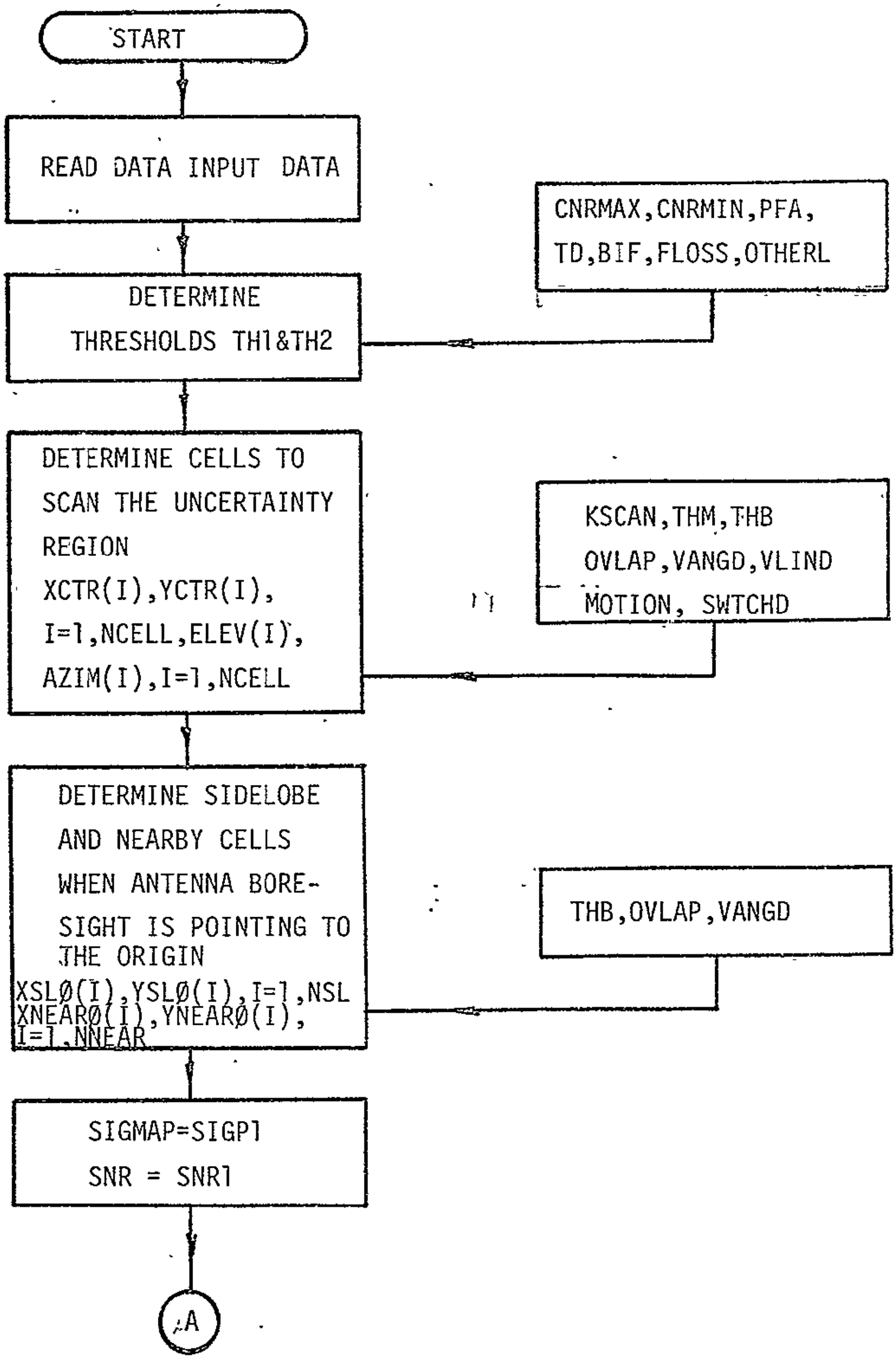

Figure A1. Flow Diagram for Subroutine SIMULA.

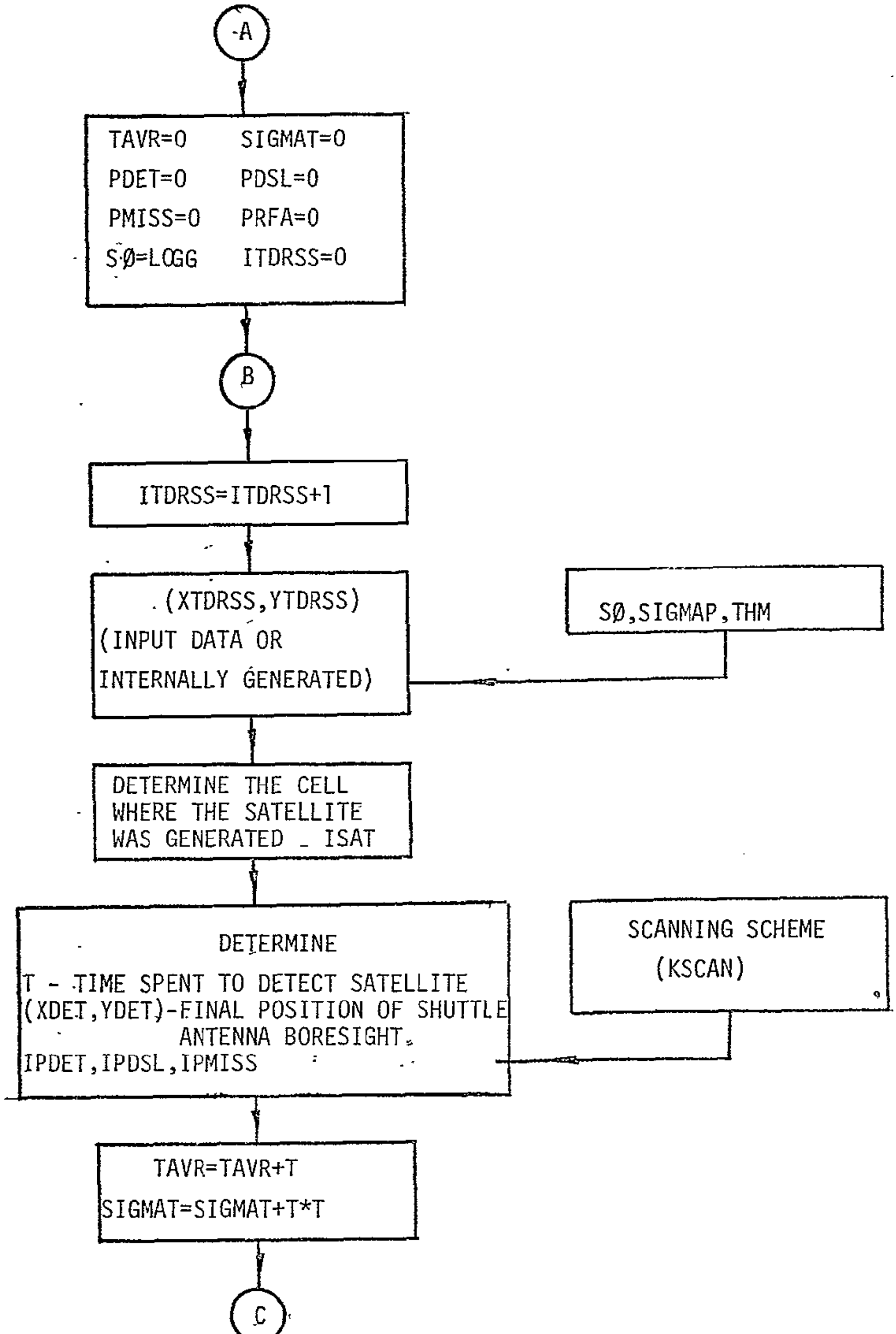

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Fig. A1. Continued

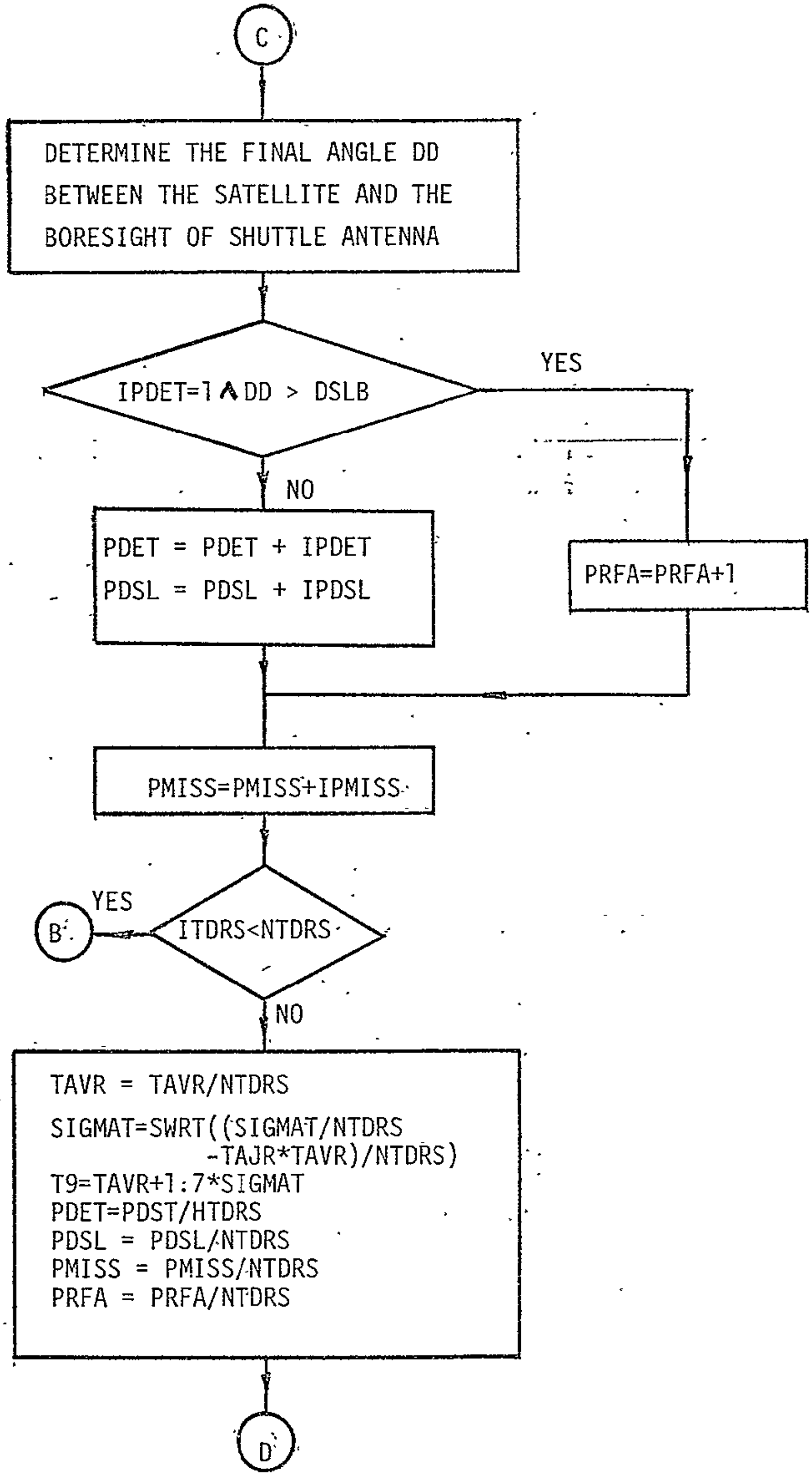

Fig. A1. Continued

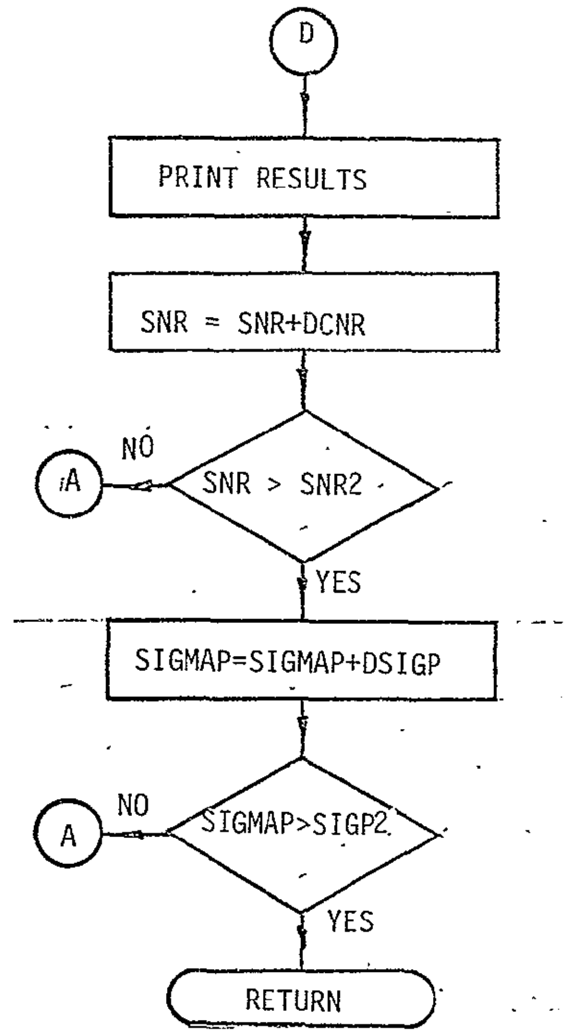

Fig. A1. Continued

16. Subroutine HIT

Purpose: Simulate the noisy output of the integrator and verify if this output is greater than a prescribed threshold (HIT=TRUE) OR NOT (HIT=FALSE).

Usage: Call HIT(X,Y,XTDRS,YTDRS,TH,RECSIG,HIT,SØ)

Input Parameters:

```
(X,Y)          - ANTENNA BORESIGHT
(XTDRS,YTDRS)- SATELLITE POSITION
TH             - THRESHOLD
```

Output Parameters:

```
RECSIG      - RECEIVED SIGNAL POWER + NOISE
HIT         - LOGICAL VARIABLE
              TRUE - IF RECSIG > TH
              FALSE - IF RECSIG < TH
SO          - VARIABLE USED IN THE NOISE GENERATION
```

Subroutines Required: NOISE

17. Subroutine NOISE

Purpose: Generate the equivalent noise power at the output of the integrator.

Usage: Call NOISE(SØ)

Input Parameter:

```
SO          - VARIABLE USED IN THE GAUSSIAN NOISE GENERATION
SIGMAN      - GAUSSIAN NOISE STANDARD DEVIATION (COMMON)
POTXG       - RECEIVED SIGNAL POWER (COMMON)
NSAMPL      - IF FILTER BANDWIDTH*INTEGRATION TIME (COMMON)
```

Output Parameter:

```
EQN         - EQUIVALENT NOISE AT THE OUTPUT OF THE INTEGRATOR
              (COMMON)
```

Subroutines Required: GAUSS

Model:

```
SIGN2 = SIGMAN*SIGMAN
AVR = SIGN2
STD = SQRT((1.+2.*POTXG/SIGN2)/NSAMPL)*SIGN2
EQN = N(AVR,STD)
```

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14. Subroutine UNIFOR

Purpose: Generate two uniformly distributed random numbers in the interval (Ø,1).

Usage: Call UNIFOR(S,X1,X2)

Input Variable:

S - INPUT RANDOM NUMBER (MODIFIED IN THE SUBROUTINE)

Output Variables:

X1,X2 - PAIR OF INDEPENDENT RANDOM VARIABLES UNIFORMLY DISTRIBUTED BETWEEN Ø AND 1

Method:

```
X = MOD(S*7**5,2**21-1)/2**31
```

15. Subroutine ACQ

Purpose: Simulate the Ku-Band acquisition system.

Usage:

Call

```
ACQ(NULL,THB,XKS,NCELL,XCTR,YCTR,TCTR,AZIM,NSL,
    XSLO,YSLO,DTSL,NNEAR,XNEARO,YNEARO,DTNEAR,VANG,
    TH1,TH2,TSL,TCLOSE,TVERIF,XTDRS,YTDRS,NNEARD,SO,
    PRT,T,IPMISS,IPDET,IPDSL,XDET,YDET,KHIT,IHIT,TH,
    XSL,YSL,XNEAR,YNEAR)
```

INPUT PARAMETERS:

NULL - SELECTS SCANNING SCHEME
0 - SEARCH CELLS IN THE NORMAL PATH ONLY WITH THRESHOLD TH1
1 - SEARCH CELLS IN THE NORMAL PATH WITH THRESHOLD TH1 AND THEN SIDELOBE CELLS WITH THRESHOLD TH2 (AUTO-TRACK RANGE < ANGLE BETWEEN NULLS)
3 - SEARCH CELLS IN THE NORMAL PATH WITH THRESHOLD TH1, THEN NEARBY CELLS WITH THRESHOLD, AND THEN SIDELOBE CELLS WITH SAME THRESHOLD TH2 (AUTO-TRACK RANGE < ANGLE BETWEEN NULLS)

THB - RADIUS OF ANTENNA MAIN LOBE
XKS - DISTANCE BETWEEN SUCESSIVE CENTERS
NCELL - NUMBER OF CELLS TO SCAN THE WHOLE UNCERTAINTY REGION
(XCTR,YCTR) - VECTORS WITH THE CENTERS OF THE CELLS
TCTR - VECTOR WITH THE TIME INSTANTS EACH CENTER IS ACHIEVED
AZIM - VECTOR WITH THE AZIMUTH OF EACH CENTER
NSL - NUMBER OF SIDELOBE CELLS
(XSLO,YSLO) - VECTORS WITH THE CENTERS OF THE SIDELOBE CELLS WHEN THE ANTENNA IS POINTING TO THE ORIGIN
DTSL - TIME INTERVAL TO GO FROM ONE SIDELOBE CELL TO THE NEXT ONE
NNEAR - NUMBER OF NEARBY CELLS
(XNEARO,YNEARO) VECTORS WITH THE CENTERS OF THE NEARBY CELLS
DTNEAR - TIME INTERVAL TO GO FROM ONE NEARBY CELL TO THE NEXT ONE
VANG - CONSTANT ROTATIONAL SPEED
TH1,TH2 - THRESHOLDS
TSL - TIME INTERVAL TO GO FROM A NORMAL SCANNING SCHEME TO THE SIDELOBE VARIATION
TCLOSE - TIME INTERVAL TO GO FROM A NORMAL SCANNING SCHEME TO THE NEARBY VARIATION
TVERIF - VERIFICATION TIME
(XTDRS,YTDRS)- GENERATED SATELLITE POSITION
NNEARD - DIMENSION OF VECTORS XNEARO, YNEARO,XNEAR, YNEAR, AND TH IN THE CALLING PROGRAM
SO - VARIABLE USED FOR RANDOM NOISE GENERATION
PRT - LOGICAL VARIABLE
TRUE IF A PRINTOUT SAMPLE IS DESIRED

OUTPUT PARAMETERS:

T - TIME SPENT TO DETECT THE SATELLITE
IPMISS - (0) THE SATELLITE WAS DETECTED
(1) THE SATELLITE WAS MISSED
IPDET - (0) THE SATELLITE WAS MISSED
(1) THE SATELLITE WAS DETECTED
IPDSL - (0) THE SATELLITE WAS NOT DETCTED BY SIDELOBE DETECTION
(1) THE SATELLITE WAS DETECTED WHEN THE SYSTEM WAS SEARCHING SIDELOBE CELLS
KHIT - VECTOR WITH THE LAST HITS, STARTING WITH THE LAST CELL IN THE NORMAL PATH WHERE A HIT WAS OBSERVED
IHIT - KHIT(IHIT) DEFINES THE CELL WHERE THE SATELLITE WAS DETECTED
TH - VECTOR WITH THE THRESHOLDS USED TO SEARCH THE NEARBY CELLS CORRESPONDING TO THE LAST CELL SEARCHED IN THE NORMAL PATH

INTERNAL VARIABLES:

(XSL,YSL) - VECTORS WITH THE CENTERS OF SIDELOBE CELLS CORRESPONDING TO A GENERIC POSITION IN THE NORMAL PATH
(XNEAR,YNEAR) - VECTORS WITH THE CENTERS OF NEARBY CELLS CORRESPONDING TO A GENERIC POSITION IN THE NORMAL PATH

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Subroutines Required:

ANTENNA,THITH2,SLCELL,UNIFOR,TDRSS,ACQ.

Function Diagram (see Fig. A2)

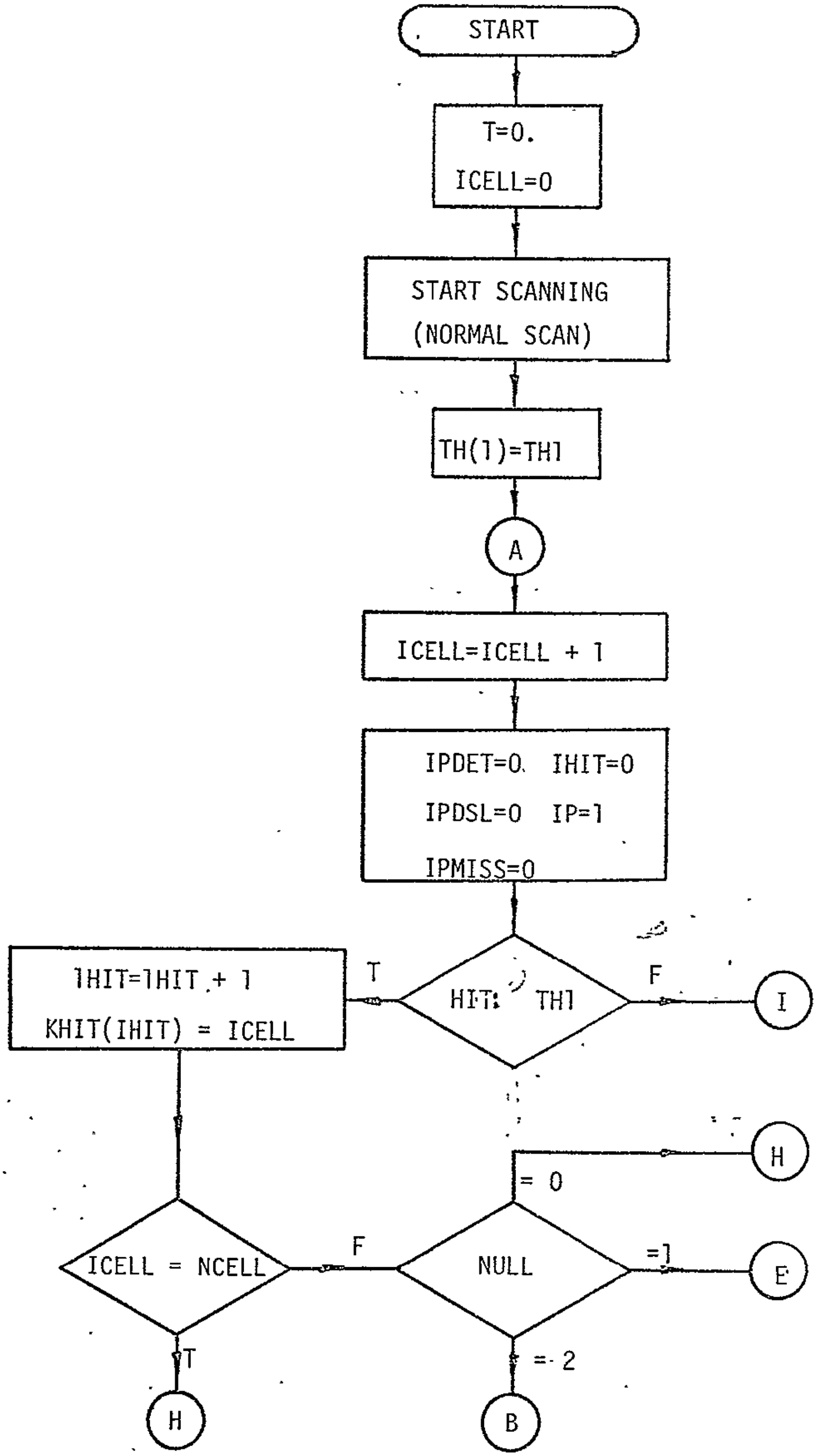

Figure A2. Flow Diagram for Subroutine ACQ.

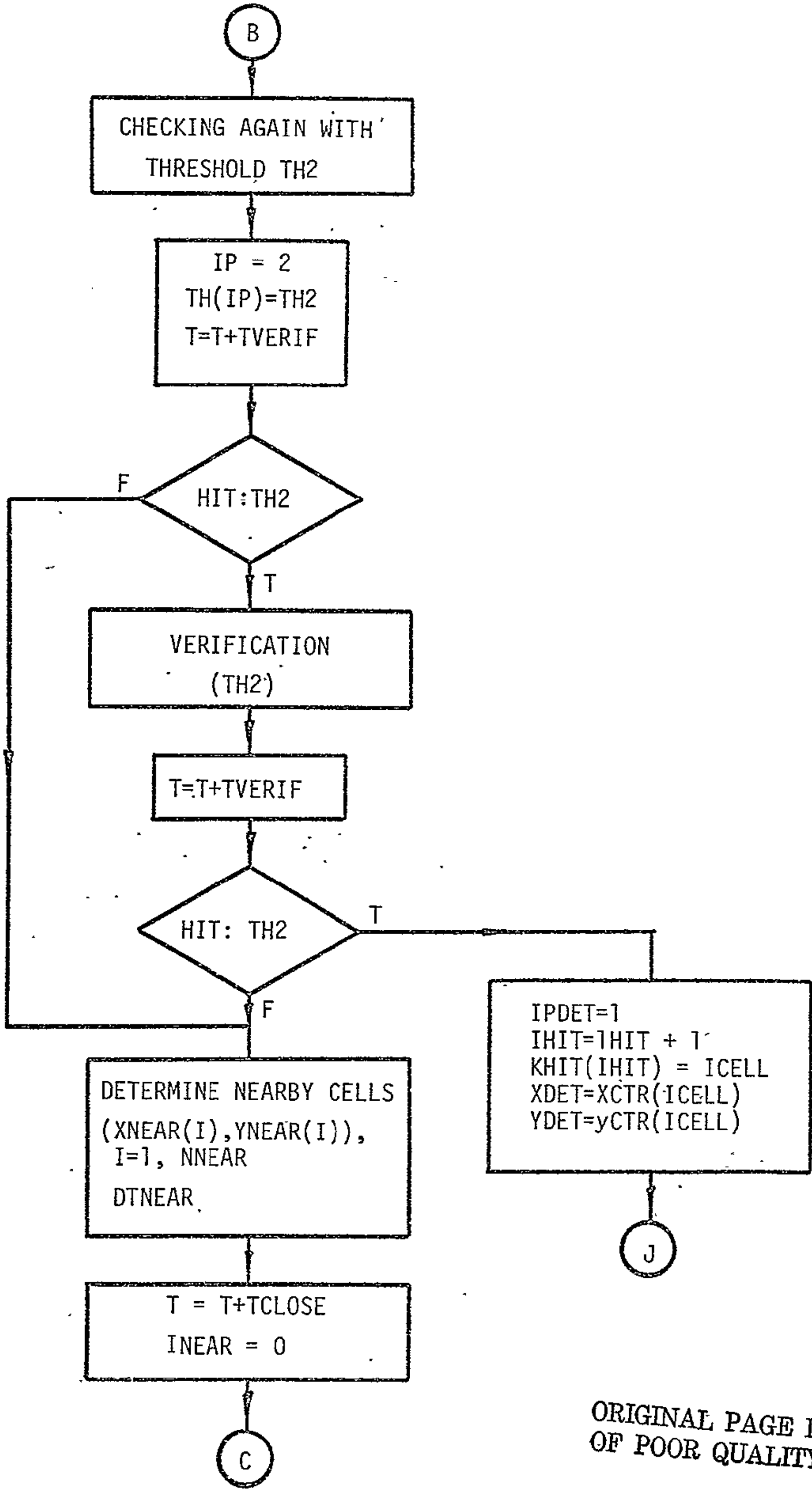

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Fig. A2. Continued

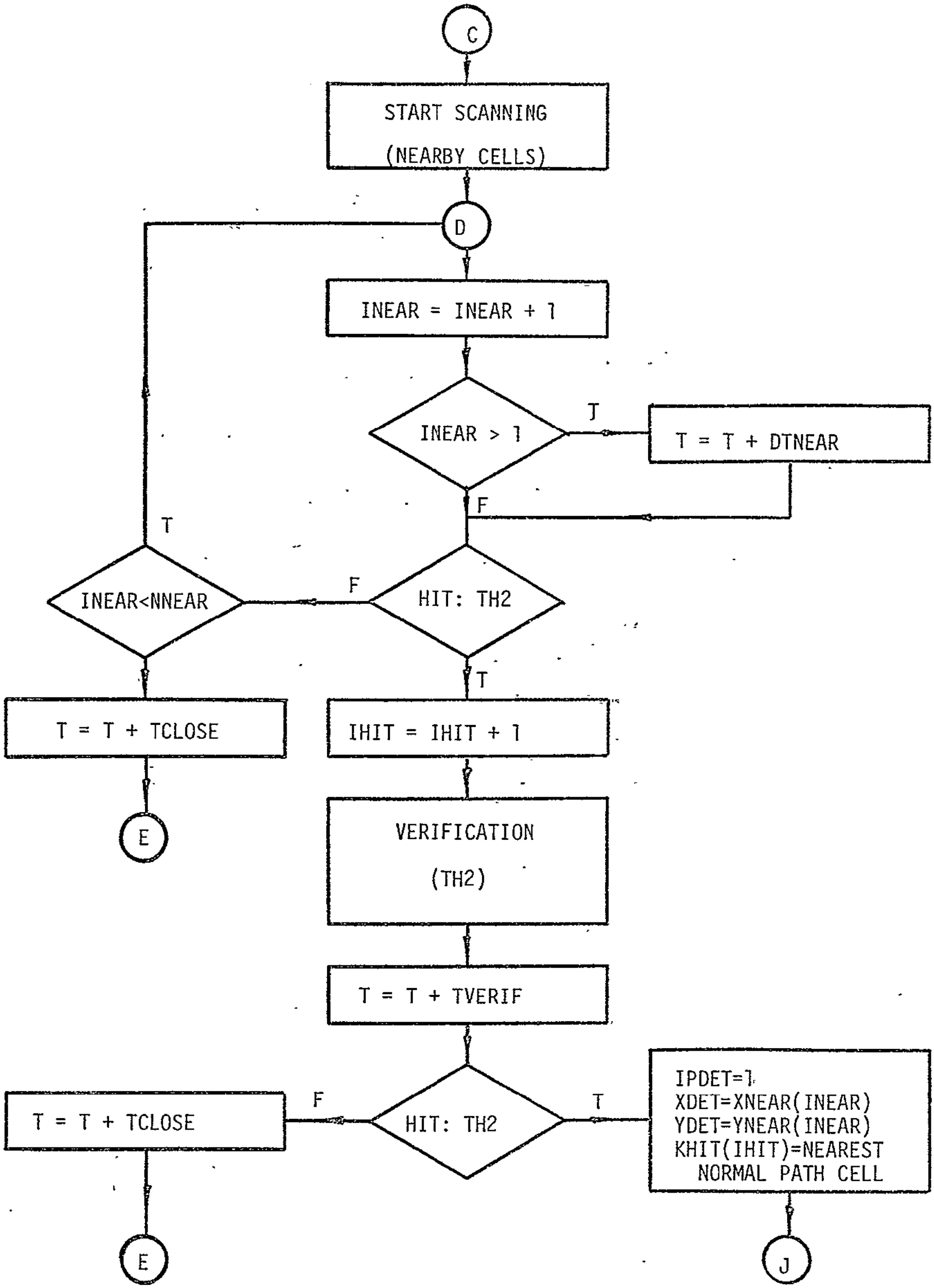

Figure A2. Continued

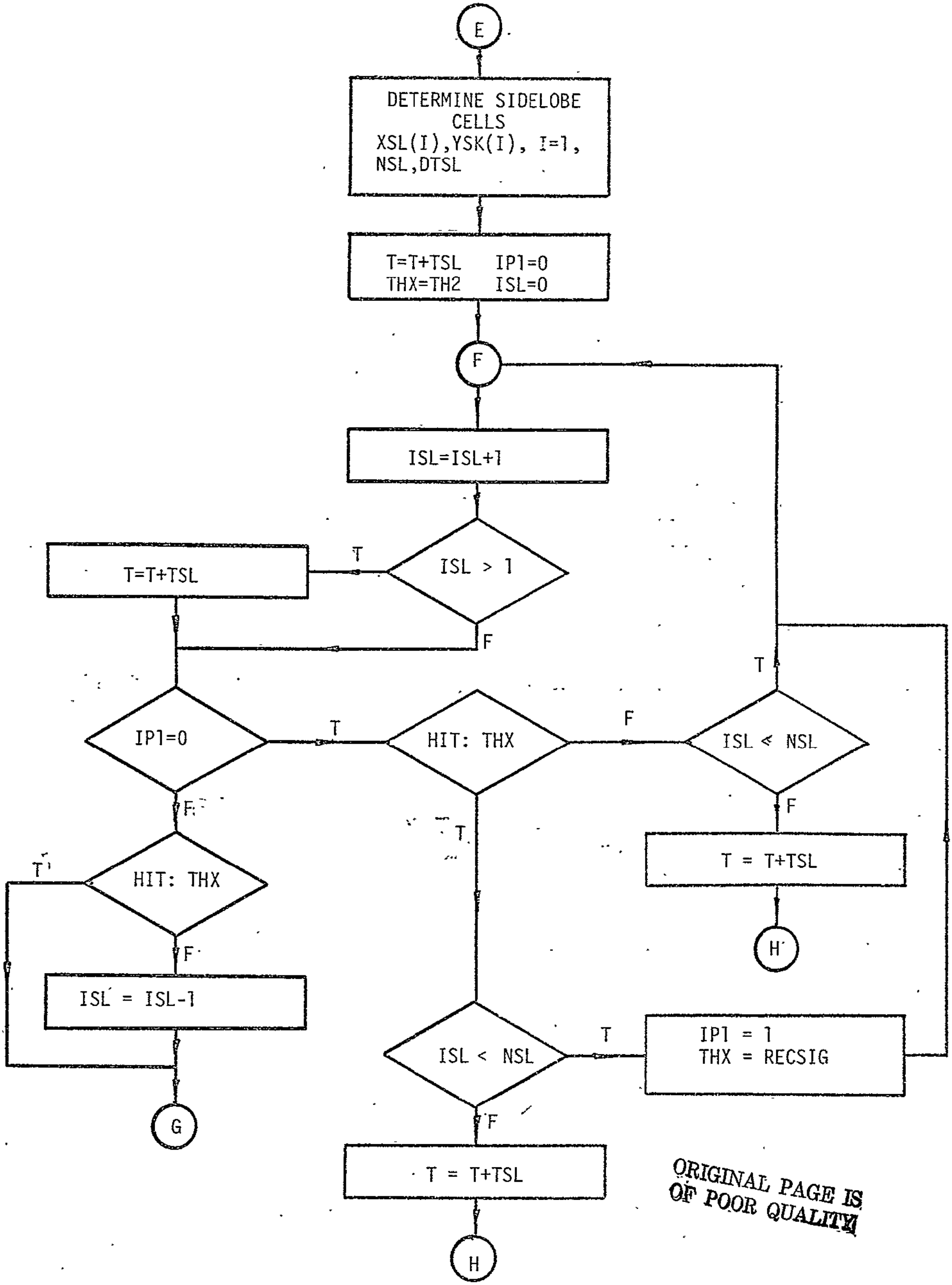

Figure A2. Continued.

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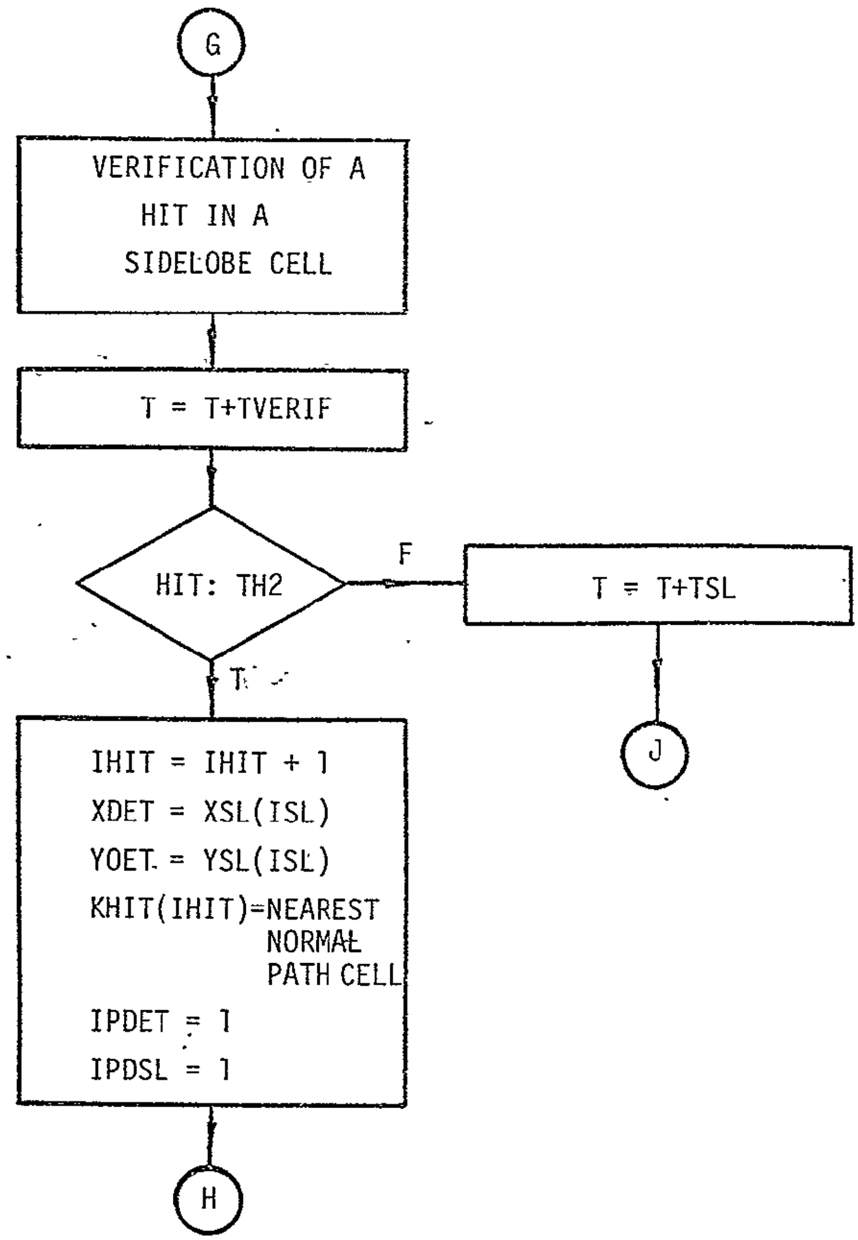

Figure A2. Continued

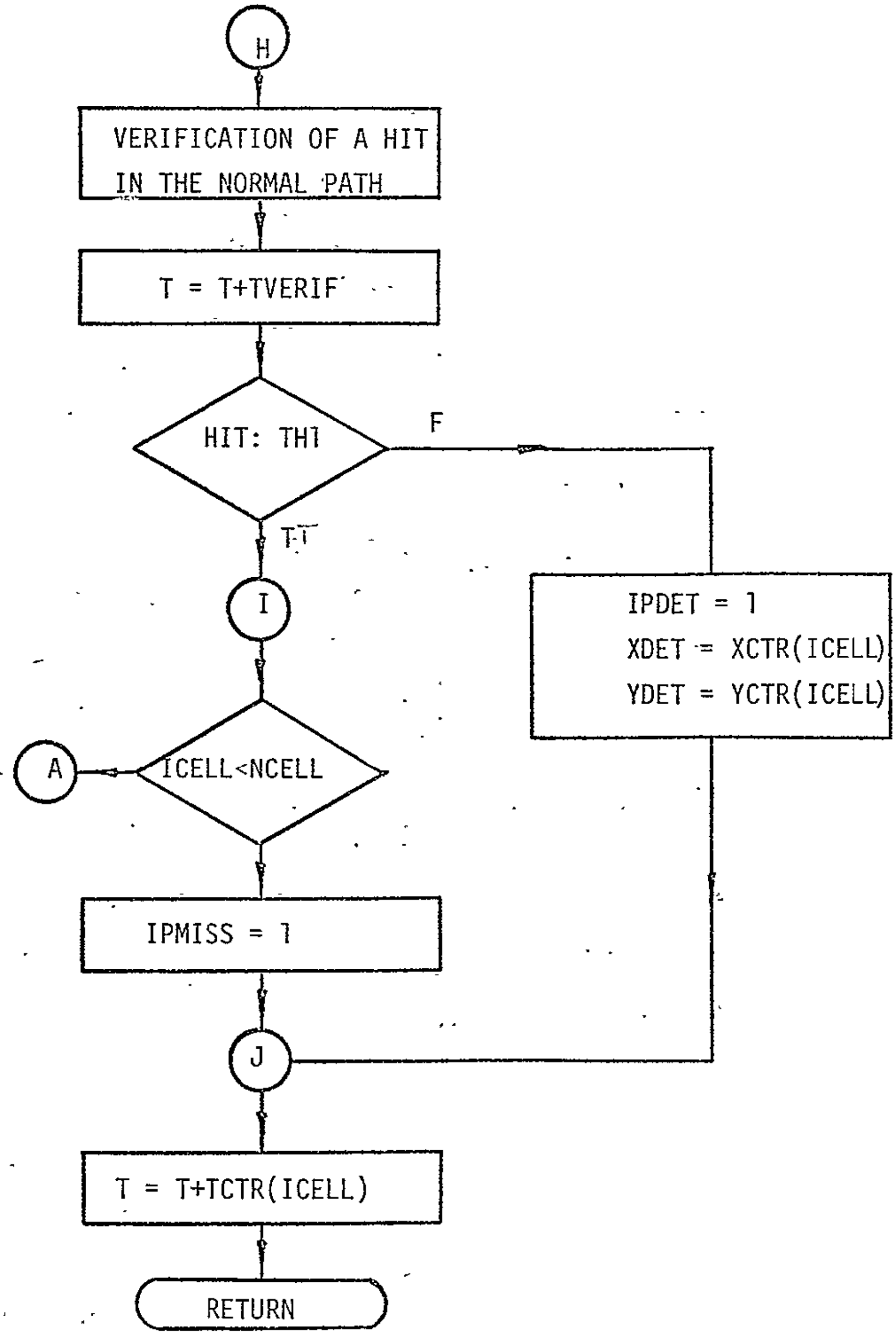

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Figure A2. Continued.

3. Subroutine ANTNNA

Purpose: Determine angle and gain corresponding to (a) first null, (b) second sidelobe, (c) first sidelobe, (d) -3 dB point in the mainlobe, and (e) gain for any input angle.

Usage: Call ANTNNA (K,TH,GAIN)

Input Parameters:

K - CONTROL PARAMETER
- -2 - THE SUBROUTINE DETERMINES ANGLE FOR FIRST ZERO
- -1 - THE SUBROUTINE DETERMINES ANGLE FOR SECOND MAXIMUM AND CORRESPONDING GAIN
- 0 - THE SUBROUTINE DETERMINES ANGLE FOR FIRST MAXIMUM AND CORRESPONDING GAIN
- 1 - THE SUBROUTINE DETERMINES ANGLE CORRESPONDING TO MAINLOBE -3dB POINT AND CORRESPONDING GAIN
- 2 - THE SUBROUTINE DETERMINES THE GAIN FOR THE ANGLE = TH

TH - INPUT ANGLE (K=2)

Output Parameters:

TH - ANGLE OF FIRST NULL (K=-2), OR SECOND SIDELOBE (K=-1), OR FIRST SIDELOBE (K=0), OR MAINLOBE -3 dB POINT (K=1)

GAIN - ANTENNA GAIN

Subroutines Required:

Bessell Function: BSSL (MATHPACK)

Model:

$$GAIN = J_1(x)/x; \quad x = \sin^{-1}(TH) + 1.61/THB$$

4. Subroutine TH1TH2

Purpose: Determine thresholds TH1 and TH2 for a given probability of false alarm.

Usage: CALL TH1TH2 (CN21,CN22,PFA,BSF,FLOSS,OTHERL, NSAMPL,TH1,TH2)

Input Parameters:

CNR1 - CNR2 - CARRIER-TO-NOISE DYANMIC RANGE (DB)
PFA -PROBABILITY OF FALSE ALARM
BIF -IF FILTER BANDWIDTH
FLOSS -FILTER INSERTION LOSS (DB)
ORTHERL -OTHER LOSSES (DB)
NSAMPL -NUMBER OF SAMPLES

Output Parameters:

TH1 -NORMAL PATH SCANNING THRESHOLD
TH2 -SIDELOBE CELLS SCANNING THRESHOLD

Subroutines Required:

ANTNNA,MERFCI (IMSL)

Function Diagram (see Fig. A3)

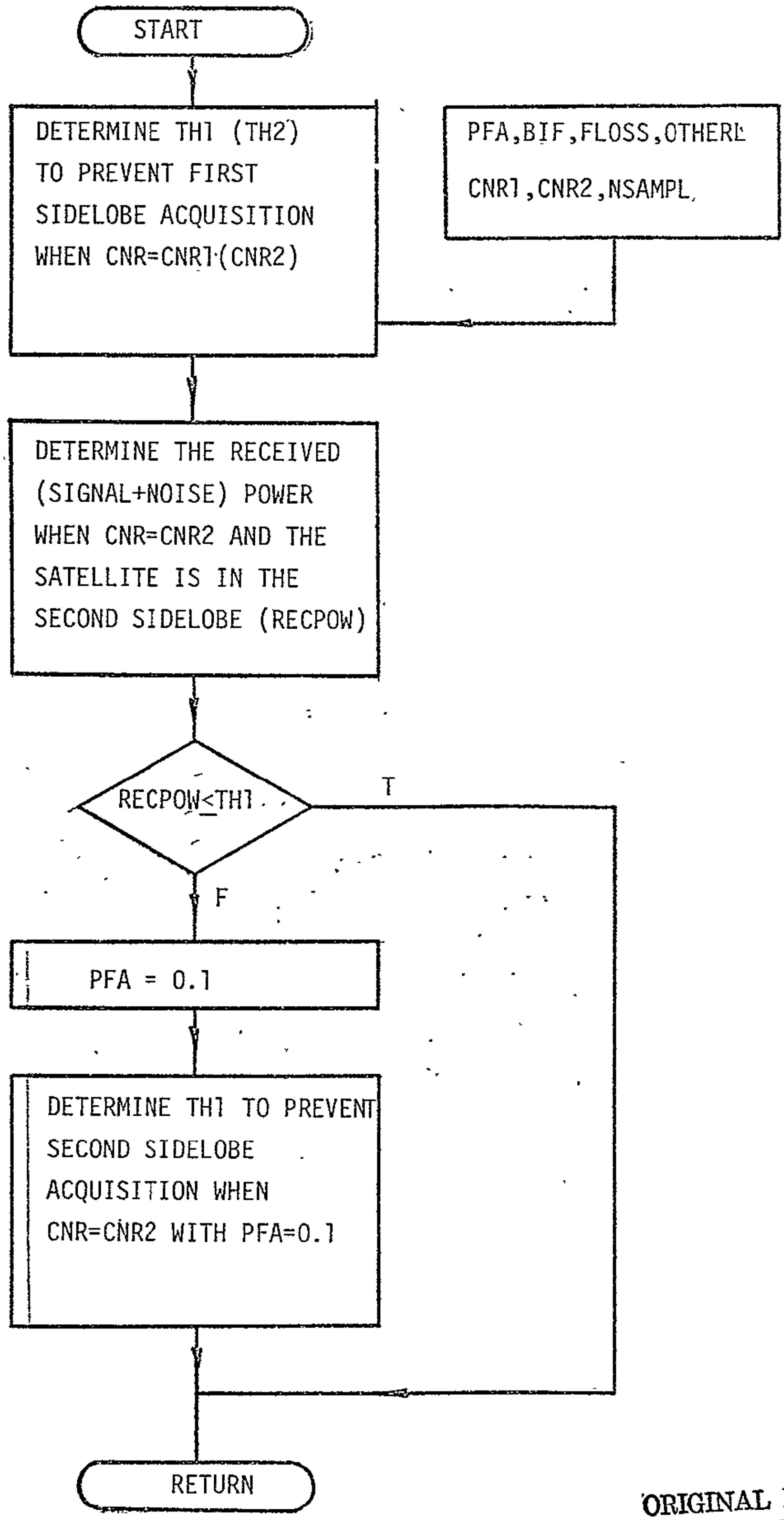

Figure A3. Flow Diagram for Subroutine TH1TH2.

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5. Subroutine CELL

Purpose: Compute number of cells needed for complete scan of the uncertainty region, their centers and the time instants these centers are achieved.

Usage:

```
Call CELL (KSCAN,THM,OV,MOTION,VANG,VLIN,XKS,
          SWTCH,NCELL,XCTR,YCTR,TCTR,ELEV,AZIM,
          NCELLD)
```

Input Parameters:

```
KSCAN     - TYPE OF TRAJECTORY
            1 - SQUARE
            2 - HEXAGONAL
            3 - SPIRAL
THM       - RADIUS OF THE UNCERTAINTY REGION (RADIANS)
OV        - OVERLAP BETWEEN CELLS (%)
MOTION    - DESIRED ANTENNA MOTION
            1 - CONSTANT ROTATIONAL SPEED
            2 - CONSTANT SPEED ALONG TRAJECTORY
            3 - COMBINATION OF "1" AND "2"
VANG      - ANGULAR VELOCITY (RADIANS/S)
VLIN      - LINEAR VELOCITY ALONG TRAJECTORY (RADIANS/S)
XKS       - DISTANCE BETWEEN SUCCESSIVE CENTERS (RADIANS)
SWTCH     - SWITCHING ANGLE (IN RADIANS) TO GO FROM
            "MOTION=1" TO "MOTION=2"
NCELLD    - DIMENSION OF VECTORS XCTR,YCTR,TCTR,AZIM, AND
            ELEV IN THE MAIN PROGRAM
```

Output Parameters:

```
(XCTR,YCTR)   - VECTORS WITH THE CENTERS OF THE CELLS
TCTR          - VECTOR WITH THE TIME INSTANTS THE CENTER OF
                EACH CELL IS ACHIEVED
ELEV          - VECTOR WITH THEELEVATION OF THE CELLS CENTERS
AZIM          - VECTOR WITH THE AXIMUTE OF THE CELLS CENTERS
```

Subroutines Required:

QPOSTN,HPOSTN,SPOSTN

6. Subroutine QPOSTN

Purpose: Determine the (K+1)th cell for the square type of trajectory.

Usage: Call QPOSTN(K)

Input Parameters:

K	-	CELL NUMBER - 1
ELI,AZI	-	ELEVATION AND AZIMUTH OF PREVIOUS CELL (COMMON)
THB	-	RADIUS OF ANTENNA MAIN LOBE (COMMON
XI,YI	-	CARTESIAN COORDINATES OF PREVIOUS CELL (COMMON)

Output Parameters:

ELO,AZO	-	ELEVATION AND AZIMUTH OF FOLLOWING CELL (COMMON)
XO,YO	-	CARTESIAN COORDINATES OF FOLLOWING CELL (COMMON)

Subroutines Required: None

7. Subroutine HPOSTN

Purpose: Determine the $(K+1)^{th}$ cell for the hexagonal type of trajectory.

Usage: Call HPOSTN (K)

Input Parameters:

K	-	CELL NUMBER - 1
ELI,AZI	-	ELEVATION AND AZIMUTH OF PREVIOUS CELL (COMMON)
THB	-	RADIUS OF ANTENNA MAIN LOBE (COMMON)

Output Parameters:

ELO,AZO	-	ELEVATION AND AZIMUTH OF FOLLOWING CELL (COMMON)
XO,YO	-	CARTESIAN COORDINATES OF FOLLOWING CELL (COMMON)

Subroutines Required: None

8. Subroutine SPOSTN

Purpose: Determine the $(K+1)^{th}$ cell for the spiral type of trajectory.

Usage: Call SPOSTN (K)

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Input Parameters:

K	-	CELL NUMBER - 1
ELI,AZI	-	ELEVATION AND AZIMUTH OF PREVIOUS CELL (COMMON)
THB	-	RADIUS OF ANTENNA MAINLOBE (COMMON)
XI,YI	-	CARTESIAN COORDINATES OF PREVIOUS CELL (COMMON)

Output Parameters:

ELO,AZO	-	ELEVATION AND AZIMUTH OF FOLLOWING CELL (COMMON)
XO,YO	-	CARTESIAN COORDINATES OF FOLLOWING CELL (COMMON)

Subroutines Required: ITR

9. Subroutine ITR

Purpose: Determine iteratively the azimuth of the next center, given the position of the previous one, for the spiral trajectory.

Usage: Call ITR(A,B,AZO,GUSS,THB,D,PI,K)

Input Parameters:

```
A,B      - ELEVATION AND AZIMUTH OF PREVIOUS CENTER
GUSS     - INITIAL AZIMUTH GUESS
THB      - RADIUS OF ANTENNA MAIN LOBE
D        - HALF DISTANCE BETWEEN SUCCESSIVE CENTERS
PI       - CONSTANT (3.141592653)
K        - CONTROL PARAMETER
             1 - INTERMEDIATE RESULT
             2 - FINAL RESULT
```

Output Parameter:

```
AZO      - DESIRED AZIMUTH
```

Subroutines Required: None

10. Subroutine TCENTR

Purpose: Determine the time instant. The cell (ELO,AZO) is achieved following the normal path.

Usage: Call TCENTR (KSCAN,MOTION,VANG,VLIN,D2,SWTCH)

Input Parameters:

```
KSCAN    - TYPE OF TRAJECTORY
             1 - SQUARE
             2 - HEXAGONAL
             3 - SPIRAL
MOTION   - TYPE OF ANTENNA MOTION
             1 - CONSTANT ANGULAR VELOCITY
             2 - CONSTANT VELOCITY ALONG TRAJECOTYR
             3 - COMBINATION OF "1" AND "2"
VANG     - ANGULAR VELOCITY (RADIANS/S)
VLIN     - LINEAR VELOCITY ALONG TRAJECTORY (RADIANS/S)
D2       - DISTANCE BETWEEN SUCCESSIVE CENTERS
SWTCH    - SWITCHING ANGLE (IN RADIANS) FROM "MOTION=1" TO
           "MOTION=2"
```

Output Parameter:

TO - INSTANT OF TIME A GIVEN CENTER IS ACHIEVED (COMMON)

Subroutine Required: None

11. Subroutine SLCELL

Purpose: Determine number and position of sidelobe or nearby cells when the antenna is pointing to the origin (ICELL=0).

Usage: Call SLCELL(KSL,THB,OVLAP,VANG,XSL,YSL,NSL,DTSL, NSLDIM)

Input Parameters:

```
KSL      - SELECTS SIDELOBE(=1) OR NEARBY(=0) CELLS
THB      - BEAMWIDTH RADIUS (RADIANS)
OVLAP    - OVERLAP (%)
VANG     - ANGULAR VELOCITY (RADIANS/S)
HSLDIM   - DIMENSION OF VECTORS XSL AND YSL IN THE
           CALLING PROGRAM
```

Output Parameters:

```
NSL       - NUMBER OF SIDELOBE CELLS
(XSL,YXL) - VECTORS WITH THE CENTERS OF THESE SIDELOBE CELLS
            WHEN THE ANTENNA IS POINTING TO THE ORIGIN
DTSL      - TIME INTERVAL TO GO FROM ONE SIDELOBE CELL TO
            THE NEXT ONE
```

Subroutines Required: None

12. Subroutine TDRSS

Purpose: Generate a TDRSS position in the uncertainty region according to a trauncated Gaussian probability density function

```
P(X,Y)=KP*EXP(-(X**2+Y**2)/(2*SIGMAP**2)/(2(PI*SIGMAP**2),
                   X**2+Y**2.LE.THM**2,
     =0,           ELSEWHERE,
WITH
KP=(1-EXP(-THM**2/(2*SIGMAP**2)))**(-1)
```

Usage: Call TDRSS(SØ,SIGMAP,THM2,XTDRSS,YTDRSS)

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Input Parameters:

SO - VARIABLE USED IN THE RANDOM GAUSSIAN VARIABLE GENERATION
SIGMAP - DESIRED STANDARD DEVIATION
THM2 - RADIUS OF UNCERTAINTY REGION SQUARED

Output Parameters:

(XTDRSS,YTDRSS)- GENERATED TDRSS POSITION

Subroutines Required: GAUSS

13. Subroutine GAUSS

Purpose: Generate "N" (even) normally distributed random numbers "X" with mean "AVR" and standard deviation "SIGMA".

Usage: Call GAUSS(SØ,N,AVR,SIGMA,X)

Input Parameters:

SØ - INPUT RANDOM NUMBER
N - NUMBER OF SAMPLES
AVR - DESIRED MEAN
SIGMA - DESIRED STANDARD DEVIATION

Output Parameters:

X - VECTOR OF LENGTH "N" WITH THE GENERATED NORMALLY DISTRIBUTED NUMBERS

Subroutines Required: UNIFOR

Method: Box and Muller

If

X1,X2 - INDEPENDENT RANDOM VARIABLES UNIFORMLY DISTRIBUTED BETWEEN Ø AND 1.

THEN

f1 = SIGMA*SQRT(-2*ALOG(X1))*COS(2*PI*X2)+AVR,

f2 = SIGMA*SQRT(-2*ALOG(X1))*SIN(2*PI*X2)+AVR

ARE NORMALLY DISTRIBUTED ACCORDING TO N(AVR,SIGMA)

LinCom

HARDWARE SIMULATION COMPUTER

FLOW CHART

LinCom

1 1STP 15:14 HUANG EST PGS 42

```
HH          HH      UU          UU        AAAAAAAA       NN        NN      GGGGGGGG
HH          HH      UU          UU       AAAAAAAAAA      NNN       NN     GGGGGGGGGG
HH          HH      UU          UU      AA        AA     NNNN      NN    GG        GG
HH          HH      UU          UU      AA        AA     NN NN     NN    GG        GG
HH          HH      UU          UU      AA        AA     NN  NN    NN    GG
HHHHHHHHHHHH        UU          UU      AAAAAAAAAAAA     NN   NNN  NN    GG
HHHHHHHHHHHH        UU          UU      AAAAAAAAAAAA     NN    NNN NN    GG      GGGG
HH          HH      UU          UU      AA        AA     NN     NNN NN   GG      GGGG
HH          HH      UU          UU      AA        AA     NN      NNNNN   GG        GG
HH          HH      UUU        UUU      AA        AA     NN       NNNN   GG        GG
HH          HH       UUUUUUUUUU         AA        AA     NN        NNN    GGGGGGGGGG
HH          HH        UUUUUUUU          AA        AA     NN         NN     GGGGGGGG
```

PRINTED BY: HUANG
USER NAME: HUANG
ACCOUNT: 0544AA
ON SYSTEM: A
EXEC LEVEL: 32R28-036.
EXEC DATE: 10/14

CREATED BY: HUANG

STARTED PRINTING: 11/10/77 15:14:28
QUEUED: 11/10/77 15:10:55
CREATED: 11/10/77 15:01:13
PART NAME: -BK1-1$-BK2-
PART NO.: 01
FILE NAME: 0544AB(1)

ESTIMATED PAGES: 42
INPUT DEVICE: TDN034
QUEUED TO: ELS
PRINTED ON: ELS

* * * INFORMATION SYSTEMS DESIGN, INC. * 3205 CORONADO DR. * SANTA CLARA, CA 95051 * (408) 249-8100 * * * 1108 1X? * * *

49.

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```
@IPF,U KUACO
READY

@ISD*UTIL.FORFLO KU.ACO

PREPRM ERR-FILE NOT PREVIOUSLY ASSIGNED

ERROR FROM 'FORFLO  =  PREPRM

FORFLO     025416          025510                 15:02:48        11/10/77         1108 TIME-SHARING  EXEC

X REG
000000   004461025322   777777777760   777777777760   030056507600   777777040463   000000004516   000000000000   000000000004
000010   777777777760   030054721200   777777777760   777777025425   000307045026   400010000000   000000000001   000000000003

A REG
000014   000307045026   400010000000   000000000001   000000000003   000000000005   000000000001   000000000013   030054766700
000024   777777777760   777777777760   030056547100   000004604660   000000603641.  000000000000   010000000000   000000012437
000034   777777777760   010000000000

R REG
000100   000000000000   000000000000   252712252722   000000000141   777777777760   777777777760   010000000000   777777777760
000110   777777777760   010000000000   777777777760   777777777760   010000000000   777777777760   777777777760   000000000002

@ISD*UTIL.FORFLO KUACO.ACO
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:03:33
```

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ACQ FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:04:10

```
SUBROUTINE ACQ(NULL,THB,XKS,NCELL,
XCTR,YCTR,TCTR,AZIM,NSL, XSL0,YSL0,
DTSL,NNEAR,XNEAR0,YNEAR0,DTNEAR,VANG,
TH1,TH2,TSL,TCLOSE,TVERIF,XTDRS,
ITDRS,NNEARD,SO, PRT,T,IPMISS,IPDET,
IIDSL,XDET,YDET,KHIT,IHIT,TH, XSL,
YSL,XNEAR,YNEAR)

I
I---- PURPOSE
I     - SIMULATE THE KU BAND ANTENNA
I     -ACQUISITION SYSTEM
I
I---- INPUT PARAMETERS:
I     - NULL = SELECTS SCANNING SCHEME
I     - 0 = SEARCH CELLS IN THE NORMAL
I     -PATH ONLY WITH
I
I---- 1 = SEARCH CELLS IN THE NORMAL
I     -PATH WITH THRESHO
I     - AND THEN SIDELOBE CELLS WITH
I     -THRESHOLD TH2
I     - (AUTO-TRACK RANGE < ANGLE
I     -BETWEEN NULLS)
I     - 3 = SEARCH CELLS IN THE NORMAL
I     -PATH WITH THRESHO
I     - THEN NEARBY CELLS WITH
I     -THRESHOLD, AND THEN S
I     - CELLS WITH SAME THRESHOLD TH2
I     - (AUTO-TRACK RANGE < ANGLE
I     -BETWEEN NULLS)
I     - THB = RADIUS OF ANTENNA MAIN
I     -LOBE
I     - XKS = DISTANCE BETWEEN
I     -SUCESSIVE CENTERS
I     - NCELL = NUMBER OF CELLS TO SCAN
I     -THE WHOLE UNCERTAINTY RE
I     - (XCTR,YCTR) = VECTORS WITH THE
I     -CENTERS OF THE CELLS
I     - TCTR = VECTOR WITH THE TIME
I     -INSTANTS EACH CENTER IS ACH
I     - AZIM = VECTOR WITH THE AZIMUTH
I     -OF EACH CENTER
I     - NSL = NUMBER OF SIDELOBE CELLS
I     - (XSL0,YSL0) = VECTORS WITH THE
I     -CENTERS OF THE SIDELOBE CELLS
I     - WHEN THE ANTENNA IS POINTING TO
I     -THE ORIGIN
I     - DTSL = TIME INTERVAL TO GO FROM
I     -ONE SIDELOBE CELL TO TH
I
I---- NNEAR = NUMBER OF NEARBY CELLS
I     - (XNEAR0,YNEAR0) VECTORS WITH
I     -THE CENTERS OF THE NEARBY CELLS
I     - DTNEAR = TIME INTERVAL TO GO
I     -FROM ONE NEARBY CELL TO THE
```

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```
I    * VANG = CONSTANT ROTATIONAL      C
I    *SPEED .                          C
I    * TH1,TH2 = THRESHOLDS            C
I    * TSL = TIME INTERVAL TO GO FROM  C
I    *A NORMAL SCANNING SCHEM          C

I**** TCLOSE = TIME INTERVAL TO GO     C
I    *FROM A NORMAL SCANNING SCHEM     C
I
I**** TVERIF = VERIFICATION TIME       C
I    * (XTORS,YTORS)= GENERATED        C
I    *SATELLITE POSITION               C
I    * NNEARD = DIMENSION OF VECTORS   C
I    *XNEARD, YNEARD,XNEAR, YNEAR      C
I    * AND TH IN THE CALLING PROGRAM   C
I    * SO = VARIABLE USED FOR RANDOM   C
I    *NOISE GENERATION                 C
I    * PRT = LOGICAL VARIABLE          C
I    *.TRUE IF A PRINTOUT SAMPLE IS    C
I    *DESIRED                          C
I
I**** OUTPUT PARAMETERS:               C
I    * T = TIME SPENT TO DETECT THE    C
I    *SATELLITE                        C
I    * IPMISS = (0) THE SATELLITE WAS  C
I    *DETECTED                         C
I    * (1) THE SATELLITE WAS MISSED    C
I    * IPDET = (0) THE SATELLITE WAS   C
I    *MISSED                           C
I    * (1) THE SATELLITE WAS DETECTED  C
I    * IPDSL = (0) THE SATELLITE WAS   C
I    *NOT DETECTED BY SIDELOBE DE      C
I    * (1) THE SATELLITE WAS DETECTED  C
I    *WHEN THE SYSTEM W                C
I
I**** KHIT = VECTOR WITH THE LAST      C
I    *HITS, STARTING WITH THE LAS      C
I    * IN THE NORMAL PATH WHERE A HIT  C
I    *WAS OBSERVED                     C
I    * IHIT = KHIT(IHIT) DEFINES THE   C
I    *CELL WHERE THE SATELLITE         C
I
I**** TH = VECTOR WITH THE THRESHOLDSC
I    *USED TO SEARCH THE NE            C
I    * CELLS CORRESPONDING TO THE LASTC
I    *CELL SEARCHED IN                 C
I
I**** INTERNAL VARIABLES:              C
I    * (XSL,YSL) = VECTORS WITH THE    C
I    *CENTERS OF SIDELOBE CELLS        C
I    * CORRESPONDING TO A GENERIC      C
I    *POSITION IN THE NORMA            C
I    * (XNEAR,YNEAR) = VECTORS WITH    C
I    *THE CENTERS OF NEARBY CELLS      C
I    * CORRESPONDING TO A GENERIC      C
I    *POSITION IN THE NORMA            C
I    * ...............................C
I    *................................C
I    *...                              C
I
I

**********************************************
*      LOGICAL HITTH,HITTH2,HITTHX,PRT       *
* DIMENSION XCTR(1),YCTR(1),ICTR(1),TH(1),   *
* KHIT(1),AZIT(1)                            *
* DIMENSION XSLN(1),YSLN(1),XSL(1),YSL(1)    *
* DIMENSION XNEARD(1),YNEARD(1),XNEAR(1),    *
```

```
: DIMENSION XNEAR0(1),YNEAR0(1),XNEAR(1),
: YNEAR(1)
: COMMON/SIGMA/SIGMAN,POT,SIGN2,POTXG,EQN
:          PI2=8.*ATAN(1.)
:              T=0.
:           ICELL=0

I
I----> START SCANNING - NORMAL PATH
I
I
                                              FALSE
<                IF(PRT)                   >--------------I
I  TRUE
I
/              PRINT 200                  /
I
O<----------------------------------------
I
:                TH(1)=TH1               :
I
O<------------------------------------------------------------------------O
100                                                                        Z
:             ICELL=ICELL+1              :
:               IPDET=0                  :
:               IPDSL=0                  :
:               IPMISS=0                 :
:               IHIT=0                   :
:               IP=1                     :
I
I
: : CALL HIT(XCTR(ICELL),YCTR(ICELL),   : :
: : XTDRS,YTDRS,TH(1),RECSIG, HITTH,S0) : :
I
I
                                              FALSE
<                IF(PRT)                   >--------------I
I  TRUE
I
/  PRINT 210,ICELL,TH1,RECSIG,EQN,HITTH   /
I
O<----------------------------------------
I
                                              TRUE
<       IF(.NOT.HITTH) GO TO 120           >-----------------------------O
I  FALSE                                                                 X  Z
I
I
:              IHIT=IHIT+1               :
:           KHIT(IHIT)=ICELL             :
I
                                              TRUE
```

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```
< IF(ICELL.EQ.NCELL) GO TO 90 >---- TRUE
      I FALSE
< IF(NULL.EQ.0) GO TO 90 >---- TRUE
      I FALSE
< IF(NULL.EQ.1) GO TO 15 >---- TRUE
      I FALSE
: IP=2
: TH(IP)=TH2
: T=T+TVERIF
      I
: : CALL HIT(XCTR(ICELL),YCTR(ICELL),
: : XTORS,YTORS,TH2,RECSIG, HITTH,90)
      I
< IF(PRT) >---- FALSE
      I TRUE
/ PRINT 210,ICELL,TH2,RECSIG,EQN,HITTH /
      I
      O<-------
      I
< IF(.NOT.HITTH) GO TO 60 >---- TRUE
      I FALSE
      I
      I---- VERIFICATION OF A HIT IN THE
      I     NORMAL PATH WITH THRESHOLD TH2
      I
: T=T+TVERIF
      I
< IF(PRT) >---- FALSE
      I TRUE
/ PRINT 280 /
      I
      O<-------
      I
```

```
CALL HIT(XCTR(ICELL),YCTR(ICELL),
XTDRS,YTDRS,TH2,RECSIG, HITTH,80)

IF(PRT)                                  FALSE
TRUE
PRINT 210,ICELL,TH2,RECSIG,EQN,HITTH

IF(.NOT.HITTH)                           FALSE
TRUE
IP=IP-1

IF(.NOT.HITTH) GO TO 60                  TRUE
FALSE
IPDET=1
IHIT=IHIT+1
KHIT(IHIT)=ICELL
XDET=XCTR(ICELL)
YDET=YCTR(ICELL)

GO TO 130

152
IF(PRT)                                  FALSE
TRUE
PRINT 250

DO 20 I=1,NSL
```

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55

```
XSL(I)=XSLO(I)+XCTR(ICELL)

20¢
YSL(I)=YSLO(I)+YCTR(ICELL)

T=T+TSL
ISL=0

I---> START SCANNING SIDELOBE CELLS ¢

IPI=0
THX=TH2

30¢
ISL=ISL+1

IF(ISL.EQ.1)GO TO 40          TRUE
FALSE

T=T+DTSL

40¢
CALL HIT(XSL(ISL),YSL(ISL),XTGRS,
YTGRS,THX,RECSIG,HITTHX,SO)

IF(PRT)                       FALSE
TRUE

PRINT 210,ISL,THX,RECSIG,EGN,HITTHX

IF(IP1.EQ.0) GO TO 45         TRUE
FALSE

                              TRUE
```

```
  /''''''''''''''''''''''''''''''''''''''''''''  TRUE
 <          IF(HITTHX) GO TO 50               >--------------------------------O
  '............................................/
                      I  FALSE
                      I
                      I
 ..............................................
 :                ISL=ISL-1                    :
 ..............................................
                      I
                      I
          /''''''''''''''''''''
          :     GO TO 50       :---------------------------------------------V
          '...................../

                      O<------------------------------------------------------O
  *    45*            I
  /''''''''''''''''''''''''''''''''''''''''''''  TRUE
 <        IF(.NOT.HITTHX) GO TO 46            >-------------------------------O
  '............................................/
                      I  FALSE
                      I
                      I
  /''''''''''''''''''''''''''''''''''''''''''''  TRUE
 <        IF(ISL.EQ.NSL) GO TO 50             >-------------------------------V
  '............................................/
                      I  FALSE
                      I
                      I
 ..............................................
 :                 IPI=1                       :
 :               THX=HECSIG                    :
 ..............................................
                      I
                      I
          /''''''''''''''''''''
          :     GO TO 30       :----------------------------------------------
          '...................../

                      O<------------------------------------------------------O
  *    46*            I
  /''''''''''''''''''''''''''''''''''''''''''''  TRUE
 <        IF(ISL.LT.NSL) GO TO 30             >-------------------------------O
  '............................................/
                      I  FALSE
                      I
                      I
 ..............................................
 :                I=I+ISL                      :
 ..............................................
                      I
                      I
          /''''''''''''''''''''
          :     GO TO 90       :---------------------------------------------V
          '...................../

                      I
                      I---* VERIFICATION OF A HIT IN A      *
                      I    *SIDELOBE CELL                   *
                      I
                      O<------------------------------------------------------O
  *    50*            I
 ..............................................
 :               I=I+IVERIF                    :
 ..............................................
```

59

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```
IF(PRT)                                   FALSE
  TRUE
PRINT 230,ISL

CALL HIT(XSL(ISL),YSL(ISL),XTDRS,
YTDRS,TH2,RECSIG,HITTH2,S0)

IF(PRT)                                   FALSE
  TRUE
PRINT 210,ISL,TH2,RECSIG,EQN,HITTH2

IF(.NOT.HITTH2)                           FALSE
  TRUE
T=T+TSL

IF(.NOT.HITTH2) GO TO 90                  TRUE
  FALSE
IHIT=IHIT+1
XDET=XSL(ISL)
YDET=YSL(ISL)
IIC=0
XZ=0.*THB

DO 55 J1=1,NCELL

XXD=SQRT((XCTR(J1)-XDET)*(XCTR(J1)-XDET)
+(YCTR(J1)-YDET)*(YCTR(J1)-YDET))
```

85

```
IF(XXD.GT.XZ) GO TO 55                TRUE
      FALSE

XZ=XXD
IIC=J1

* 55*
CONTINUE

KHIT(IHIT)=IIC
IPOSL=1
IPDET=1

GO TO 130

* 60*
IP=IP+1
TH(IP)=TH2

DO 65 INEAR=1,NNEAR

YNEAR(INEAR)=XNEARO(INEAR)+XCTR(ICELL)

* 65*
YNEAR(INEAR)=YNEARO(INEAR)+YCTR(ICELL)

I=I+ICLOSE
INEAR=0

I---> START SCANNING *IN-BETWEEN*
      *NULLS

IF(PRT)                               FALSE
```

69

```
                    I TRUE
          PRINT 260
                    0<---------------------------------
  70    INEAR=INEAR+1
        IF(INEAR.GT.1)          FALSE
                    I TRUE
        I=I+DINEAR
                    0<---------------------------------
        CALL HTT(XNEAR(INEAR),YNEAR(INEAR),
        XTDRS,YTDRS,TH(IP),RECSIG, HITTH,S0)
        IF(PRT)                 FALSE
                    I TRUE
        PRINT 210,INEAR,TH(IP),RECSIG,EDN,
        HITTH
                    0<---------------------------------
        IF(HITTH) GO TO 80      TRUE
                    I FALSE
        IF(INEAR.LT.NNEAR) GO TO 70     TRUE
                    I FALSE
        I=I+ICLOSE
        GO TO (90,15),NULL
                    0<---------------------------------
  800
```

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67

```
   800
   INIT=INIT+1

   I---- VERIFICATION OF A HIT IN A
         NEARBY CELL

   I=I+IVERIF

   < IF(PRT) >  FALSE
     TRUE
   / PRINT 250,INEAR /

   CALL HIT(XNEAR(INEAR),YNEAR(INEAR),
   XTOBS,YTOBS,TH(IP),RECSIG, HITTH,S0)

   < IF(PRT) >  FALSE
     TRUE
   / PRINT 210,INEAR,TH(IP),RECSIG,FOM,
     HITTH /

   < IF(.NOT.HITTH) GO TO 85 >  TRUE
     FALSE

   IPDET=1
   XDET=XNEAR(INEAR)
   YDET=YNEAR(INEAR)
   ITC=0
   XZ=0.*THR

   DO 83 J1=1,NCELL

   XYD=SQRT((XCTR(J1)-XDET)*(XCTR(J1)-XDET)
   +(YCTR(J1)-YDET)*(YCTR(J1)-YDET))
```

```
                  IF(XXD.GT.XZ) GO TO 83          TRUE
                  FALSE
                  XZ=XXD
                  IIC=J1
  83¢             CONTINUE
                  KHIT(IHIT)=IIC
                  GO TO 130
  85¢             I=I+ICLOSE
                  GO TO (130,15),NULL
                  I---- VERIFICATION OF A HIT IN THE   ¢
                  I    -NORMAL PATH                    ¢
  90¢             IF(PRT)                         FALSE
                  TRUE
                  PRINT 240
                  I=I+IVERIF
                  CALL HIT(XCTR(ICELL),YCTR(ICELL),
                  XTDRA,YTDRA,THI,RECSIG, HITTH,80)
```

62

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```
: : XTORS,YTORS,THI,RECSIG, HITTH,80)    : :
:.:....................................:.:
                  I
                  I
 /''''''''''''''''''''''''''''''''''''''''  FALSE
<               IF(PRT)                 >-------------I
 '......................................./             I
                  I  TRUE                              I
                  I                                    I
 /'''''''''''''''''''''''''''''''''''''''/             I
/  PRINT 210,ICELL,THI,RECSIG,ERN,HITTH  /             I
/......................................./              I
                  I                                    I
                  O<-----------------------------------
                  I
 /''''''''''''''''''''''''''''''''''''''''  TRUE
<       IF(.NOT.HITTH) GO TO 100        >---------------------------------------O
 '......................................./
                  I  FALSE
                  I
                  I
:.......................................:
:               IPDET=1                 :
:          XDET=XCTR(ICELL)             :
:          YDET=YCTR(ICELL)             :
:.......................................:
                  I
                  I
       /''''''''''''''''''''
      :     GO TO 130       :--------------------------------------------V
       '................../
                  O<----------------------------------------------------O
  - 100C          I
 /''''''''''''''''''''''''''''''''''''''''  FALSE
<               IF(PRT)                 >-------------I
 '......................................./             I
                  I  TRUE                              I
                  I                                    I
 /'''''''''''''''''''''''''''''''''''''''/             I
/               PRINT 270               /              I
/......................................./              I
                  I                                    I
                  O<----------------------------------------------------O
  - 120C          I
 /''''''''''''''''''''''''''''''''''''''''  TRUE
<     IF(ICELL.LT.NCELL) GO TO 10       >-------------------------------------------O
 '......................................./
                  I  FALSE
                  I
                  I
:.......................................:
:               IPMISS=1                :
:.......................................:
                  I
                  O<-------------------------------------------------O.
  - 130C          I
:.......................................:
:           T=T+TCTR(ICELL)             :
:                    200 FORMAT(' ',//,' START
:                    SCANNING - NORMAL PATH',/)
:                    210 FORMAT(' CELL NO.',I3,3X,'
:                    THRESHOLD =',F13.3,3X, * '
:                    RECEIVED POWER =',E13.7,3X,'EQ.
:                    NOISE = ',E13.7,3), * 'HIT =',L4)
```

```
230 FORMAT(' ',//' VERIFICATION
OF A HIT WITH THRSHOLD TH2', * '
 IN THE CELL NO.',I3)
240 FORMAT(' ',//' VERIFICATION
OF A HIT IN THE NIRMAL PATH',/)
250 FORMAT(' ',//' START
SCANNING SIDELOBE CELLS',/)
260 FORMAT(' ',//' START
SCANNING NEARBY CELLS',/)
270 FORMAT(' ',//' CONTINUE
SCANNING CELLS IN THE NORMAL
PATH',/)
280 FORMAT(' ',//' VERIFICATION
OF A HIT IN THE NIRMAL PATH', *'
 WITH THRESHOLD T12',/)

RETURN
```

64

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```
@ISD*UTIL.FURFLO KUACQ.ANTNNA
FLO-CHARTED BY  FURFLO /X808/ ON 10 NOV 77 AT 15:05:25
```

65

ANTNNA FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:05:56

```
*******************************************
!        SUBROUTINE ANTNNA(K,TH,GAIN)     /
!*****************************************/
                          I
                          I===¬ . . . . . . . . . . . . . . . . .C
                          I    ¬. . . . . . . . . . . . . . . .  C
                          I    ¬ PURPOSE                         C
                          I    ¬ DETERMINE ANGLE AND GAIN        C
                          I    ¬CORRESPONDING TO SECOND SIDELOBEC
                          I    ¬ MAXIMUM, OR FIRST SIDELOBE      C
                          I    ¬MAXIMUM, OR -3DB MAINLOBE POINT,C
                          I    ¬ OR GAIN FOR A GIVEN ANGLE=TH    C
                          I
                          I===¬ INPUT PARAMETERS                 C
                          I    ¬ K = CONTROL PARAMETER           C
                          I    ¬ -2 = THE SUBROUTINE DETERMINES C
                          I    ¬ANGLE FOR FIRST ZERO             C
                          I    ¬ -1 = THE SUBROUTINE DETERMINES C
                          I    ¬ANGLE FOR SECOND MAXIMUM         C
                          I
                          I===¬ 0 = THE SUBROUTINE DETERMINES   C
                          I    ¬ANGLE FOR FIRST MAXIMUM          C
                          I    ¬ AND CORRESPONDING GAIN          C
                          I    ¬ 1 = THE SUBROUTINE DETERMINES  C
                          I    ¬ANGLE CORRESPONDING TO M         C
                          I    ¬ LOBE -3DB POINT AND CORRESPONDIC
                          I    ¬G GAIN                           C
                          I    ¬ 2 = THE SUBROUTINE DETERMINES  C
                          I    ¬THE GAIN FOR THE ANGLE =         C
                          I    ¬ TH = INPUT ANGLE (K=2)          C
                          I
                          I===¬ OUTPUT PARAMETERS                C
                          I    ¬ TH = ANGLE FOR FIRST NULL(K=-2)C
                          I    ¬ OR ANGLE FOR SECOND             C
                          I    ¬ SIDELOBE(K=-1), OR ANGLE FOR   C
                          I    ¬FIRST SIDELOBE (K=0),            C
                          I    ¬ OR ANGLE FOR -3DB IN THE        C
                          I    ¬MAINLOBE(K=1)                    C
                          I    ¬ GAIN = ANTENNA GAIN             C
                          I    ¬ . . . . . . . . . . . . . . . . C
                          I    ¬. . . . . . . . . . . . . . . .  C
                          I
                          I
*******************************************
! COMMON/CPOS/ELI,AZI,ELO,AZO,DELTAZ,THB,  !
! PI,TI,TO                                 !
!          PATIC=1.61/(2.*THB)             !
!******************************************!
                          I
                          I
/////////////////////////////////////////  FALSE
<            IF(K.EQ.-2)               >--------------I
 !.....................................                I
                          I  TRUE                      I
                          I                            I
*******************************************            I
!  TH=ABS(ASIN(5.8317060/(2.*PATIC)))      !           I
!******************************************!           I
                          I                            I
                          0<----------------------------
                          I
```


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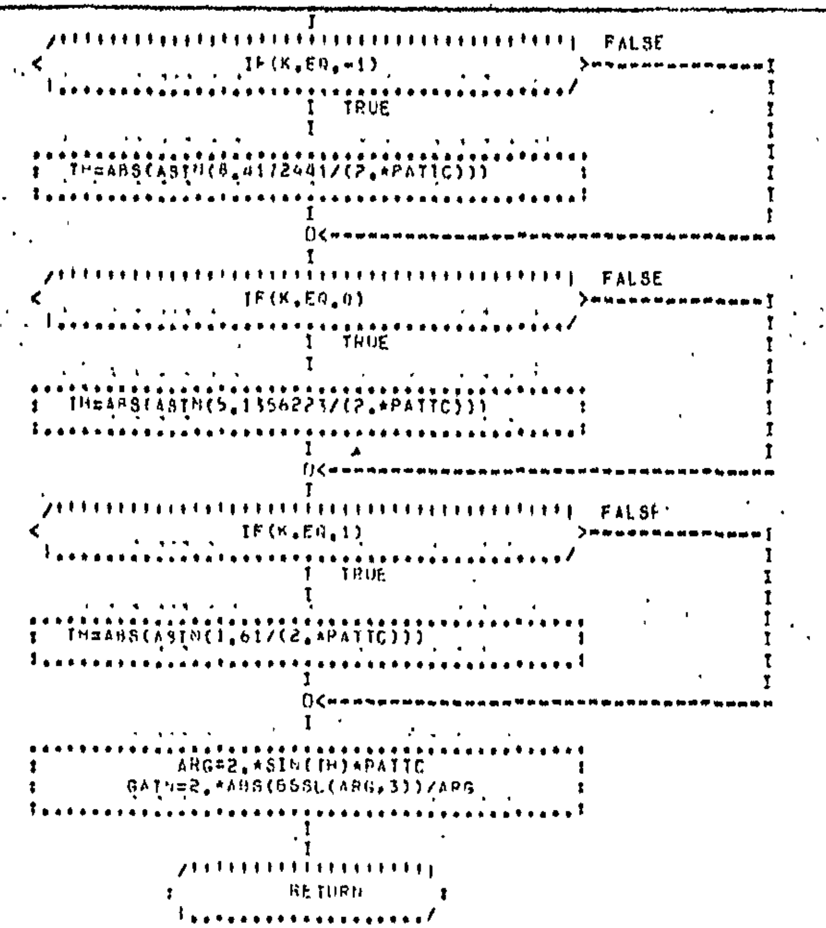
IF(K.EQ.-1)
FALSE
TRUE
TH=ABS(ASIN(8.4172441/(2.*PATTC)))
IF(K.EQ.0)
FALSE
TRUE
TH=ABS(ASIN(5.1356223/(2.*PATTC)))
IF(K.EQ.1)
FALSE
TRUE
TH=ABS(ASIN(1.61/(2.*PATTC)))
ARG=2.*SIN(TH)*PATTC
GAIN=2.*ABS(BSSL(ARG,3))/ARG
RETURN

@ISD4UTIL.FORFLO KUACQ.CELL
FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:06:10

```
 ************************************************
  I   SUBROUTINE CELL(KSCAN,THM,DV,MOTION,       /
  I   VANG,VLIN,XKS,SWTCH,NCELL, XCTR,YCTR,     /
   I TCTR,ELEV,AZIM,NCELLD)                    /
    I........................................./
                      I
                      I---- . . . . . . . . . . . . . . . . .C
                      I    ". . . . . . . . . . . . . . . . .C
                      I    " PURPOSE                         C
                      I    " COMPUTE NUMBER OF CELLS NEEDED  C
                      I    "TO COMPLETELY                    C
                      I    " SCAN THE UNCERTAINTY REGION,    C
                      I    "THEIR CENTERS, AND               C
                      I    " THE TIME INSTANTS THESE CENTER  C
                      I    "ARE ACHIEVED                     C
                      I
                      I---- INPUT PARAMETERS                 C
                      I    " KSCAN = TYPE OF TRAJECTORY      C
                      I
                      I---- THM = RADIUS OF THE UNCERTAINTYC
                      I    "REGION (RADIANS)                 C
                      I    " DV = OVERLAP BETWEEN CELLS ( %  C
                      I    " MOTION = DESIRED ANTENNA MOTIONC
                      I    " 1 = CONSTANT ROTATIONAL SPEED   C
                      I    " 2 = CONSTANT SPEED ALONG        C
                      I    "TRAJECTORY                       C
                      I    " 3 = COMBINATION OF *1* AND *2*  C
                      I    " VANG = ANGULAR VELOCITY (       C
                      I    "RADIANS/S)                       C
                      I    " VLIN = LINEAR VELOCITY ALONG    C
                      I    "TRAJECTORY (RADIANS/S)           C
                      I    " XKS = DISTANCE BETWEEN          C
                      I    "SUCESSIVE CENTERS (RADIANS)      C
                      I    " SWTCH = SWITCHING ANGLE (IN     C
                      I    "RADIANS) TO GO FROM              C
                      I    " *MOTION=1* TO *MOTION=2*        C
                      I    " NCELLD = DIMENSION OF VECTORS   C
                      I    "XCTR,YCTR,TCTR,AZIM, AND EL      C
                      I    " IN THE SUBROUTINE SIMULA        C
                      I    " OUTPUT PARAMETERS               C
                      I    " (XCTR,YCTR) = VECTORS WITH THE  C
                      I    "CENTERS OF THE CELLS             C
                      I    " TCTR = VECTOR WITH THE TIME     C
                      I    "INSTANTS THE CENTER OF EACH      C
                      I
                      I---- ELEV = VECTOR WITH THE           C
                      I    "ELEVATION OF THE CELLS CENTERS   C
                      I    " AZIM = VECTOR WITH THE AZIMUTH  C
                      I    "OF THE CELLS CENTERS             C
                      I    ". . . . . . . . . . . . . . . . .C
                      I    ". . . . . . . . . . . . . . . . .C
                      I
                      I
 ***********************************************
 I    DIMENSION XCTR(1),YCTR(1),TCTR(1)        I
 I         DIMENSION ELEV(1),AZIM(1)           I
 I COMMON/CPOS/ELI,AZI,ELO,AZO,DELTAZ,THO,D,   I
 I PI,TI,TO                                    I
 I          COMMON/CARTS/XI,YI,XO,YO           I
 I COMMON/PARAM/D2,PI2,PI3,PI4,EPS,ANGU,EHR    I
 I        COMMON/DACELL/VANGO,VLINO,TO         I
```

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```
COMMON/DWELL/VANGD,VLIND,TD

PRINT 113
113 FORMAT(' CELL')

PI=4.*ATAN(1.)
FACTUR=10.
D=XKS/2.
PI2=PI*2.
PI3=PI/3.
PI4=PI/4.
THEX=THM/SIN(PI3)
EPS=.01
TDSEC=FACTUR*TD*1.E-3

IF(KSCAN.EQ.1)          FALSE
    TRUE
D=THM*COS(PI/4.)

IF(KSCAN.EQ.2)          FALSE
    TRUE
D=THM*COS(PI/6.)

D2=2.*D
ELI=0.
AZI=0.
XI=0.
YI=0.
TI=0.
ELEV(1)=0.
AZI (1)=0.
XCTR(1)=0.
YCTR(1)=0.
TCTR(1)=0.
IANG=0
ILTN=0
I=1

100
I=I+1

                        FALSE
```

```
IF(I.GT.NCELLD)                      FALSE -> O
  I TRUE
PRINT 60,NCELLD
O<
  I
IF(I.GT.NCELLD) GO TO 50             TRUE -> O
  I FALSE
II=I-1
  I
IF(KSCAN.EQ.1)                       FALSE -> O
  I TRUE
CALL QPOSTN(II)
O<
  I
IF(KSCAN.EQ.2)                       FALSE -> O
  I TRUE
CALL HPOSTN(II)
O<
  I
IF(KSCAN.EQ.3)                       FALSE -> O
  I TRUE
CALL SPOSTN(II)
O<
  I
XO=ELO*COS(AZO)
YO=ELO*SIN(AZO)
ELEV(I)=ELO
AZIM(I)=AZO
XCIR(I)=XO
YCIR(I)=YO
  I
CALL [illegible](KSCAN,OUTTOO,VALG,VLT),
```

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78

```
CALL TCENTR(KSCAN,MOTION,VANG,VLIN,
XKS,SWTCH)

DT=TO-TI

IF(AZO.EQ.0.)                          FALSE
    TRUE
DT=TDSEC+1.

IF((DT.LT.TDSEC).AND.(ELI.LT.SWTCH))   FALSE
    TRUE
IANG=IANG+1

IF((DT.LT.TDSEC).AND.(ELI.GE.SWTCH))   FALSE
    TRUE
ILIN=ILIN+1

TCTR(I)=TO
ELI=ELO
AZI=AZO
XI=XO
YI=YO
TI=TO

GO TO (20,30,40),KSCAN

200
IF(XO-IHM.GT.IHM) GO TO 50             TRUE
    FALSE
GO TO 10
```

```
        GO TO 10

  30
  IF(XQ-THB.GT.THEX) GO TO 50          TRUE
        FALSE

        GO TO 10

  40
  IF(FLQ-THB.GT.THM) GO TO 50          TRUE
        FALSE

        GO TO 10

  50
  NCELL=I

  IF(KSCAN.EQ.1)                        FALSE
        TRUE
  TCTR(2)=TCTR(3)

  IF(IANG.GT.0)                         FALSE
        TRUE
  PRINT 70,VANGD,TD

  IF(ILIN.GT.0)                         FALSE
        TRUE
  PRINT 80,VLIND,TD

  ----80 FORMAT(1.YOU EXCEEDED THE
```

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```
I----60 FORMAT('•YOU EXCEEDED THE      I
I    -MAXIMUM NUMBER OF CELLS TO', * 'I
I    -SCAN THE UNCERTAINTY REGION (', I
I    -I3,' )',/, * ' ***CHECK IF YOU  I
I    -ARE ENTERING THE RIGHT VALUES', I
I    - ' OF THETAM AND BEAMWIDTH***') I
I    -70 FORMAT(' ',//,' ***WARNING!**I
I    -',/, * ' THE SCANNING IS TOO    I
I    -FAST!',/, * ' THE SELECTED      I
I    -ANGULAR VELOCITY (',F9.4,'      I
I    -DEGREES/S)', * ' IS NOT         I
I    -COMPATIBLE WITH SELECTED',/, * 'I
I    -ELECTRIC DWELL TIME (',F7.4,' MSI
I    -',//)                           I
I    -80 FORMAT(' ',//,' ***WARNING!**I
I    -',/, * ' THE SCANNING IS TOO    I
I    -FAST!',/, * ' THE SELECTED      I
I    -VELOCITY ALONG TRAJECTORY (',F9.I
I    -4, * ' DEGREES/S) IS NOT        I
I    -COMPATIBLE WITH SELECTED',/, * 'I
I    -ELECTRIC DWELL TIME (',F7.4,' MSI
I    -',//)                           I
I                                     I
O<-------------------------------------
I
/''''''''''''''''''''
'       RETURN       '
'....................'/
```

```
*ISO*UTIL.FORFLO KUACG,GAUSS
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:07:14
```

95

GAUSS   FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:07:54

```
              ************************************************
              !   SUBROUTINE GAUSS(SO,N,AVR,SIGMA,X)         /
              !.............................................../
                                     I
                                     I----* . . . . . . . . . . . . . . . . . .@
                                     I    *. . . . . . . . . . . . . . . . . .@
                                     I    * PURPOSE                            @
                                     I    * GENERATE *N* (EVEN) NORMALLY       @
                                     I    *DISTRIBUTED RANDOM NUMBER *X*       @
                                     I    *WITH                                @
                                     I    * MEAN *AVR* AND STANDARD            @
                                     I    *DEVIATION *SIGMA*                   @
                                     I    *. . . . . . . . . . . . . . . . . .@
                                     I    *. . . . . . . . . . . . . . . . . .@
                                     I
                                     I
              ************************************************
              !            DIMENSION X(1)                     !
              !           PI2=8.*ATAN(1.)                     !
              !                N1=N-1                         !
              !...............................................!
                                     I
                                     I
              ************************************************
A------------>!           DO 10 I=1,N1,2                      !
A             !...............................................!
A                                    I
A                                    I
A             ************************************************
A             !                 I1=I+1                        !
A             !...............................................!
A                                    I
A                                    I
A             ************************************************
A             ! !        CALL UNIFOR(SO,X1,X2)              ! !
A             !.!...........................................!.!
A                                    I
A                                    I
A             ************************************************
A             !     XX=SIGMA*SQRT(-2.*ALOG(X1))               !
A             !       X(I)=XX*COS(PI2*X2)+AVR                 !
A             !...............................................!
A                                    I
A               *    10@             I
A             ************************************************
-------------->!        X(I1)=XX*SIN(PI2*X2)+AVR              !
              !...............................................!
                                     I
                                     I
                          /!!!!!!!!!!!!!!!!!!!!!!!
                          !      RETURN          !
                          !......................!/
```


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```
@ISD*UTIL.FORFLO KUACO.HIT
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:08:00
```

99

```
SUBROUTINE HIT(X,Y,XTORS,YTORS,TH,
RECSIG,HIT,S0)

  - PURPOSE
  - DETERMINE IF THE NOISY OUTPUT
  -OF THE INTEGRATOR IS GREATER
  - THAN THE THRESHOLD TH (HIT=.
  -TRUE.) OR NOT (HIT=.FALSE.)

  INPUT PARAMETERS
  - (X,Y) = ANTENNA BORESIGHT
  - (XTORS,YTORS) = SATELLITE
  -POSITION
  - TH = THRESHOLD

  OUTPUT PARAMETERS
  - RECSIG = RECEIVED SIGNAL POWER
  - NOISE
  - HIT = LOGICAL VARIABLE

  S0 = VARIABLE USED IN THE NOISE
  -GENERATION

COMMON/SIGMA/SIGMAN,POT,SIGN2,POTXG,EON
LOGICAL HIT

  PRINT 113
  -113 FORMAT(' HIT')

HIT=.FALSE.

  DETERMINING THE ANTENNA GAIN -G

G=1.
TETA=SQRT((X-XTORS)*(X-XTORS)+(Y-YTORS)*(
Y-YTORS))

IF(TETA.EQ.0.) GO TO 10      TRUE -> 10
  FALSE

CALL ANTGAN(2,TETA,G)
```

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```
 I I        CALL ANTNNA(2,TETA,G)          I I                                                  I
 I.I.......................................I.I                                                  I
                     I                                                                          I
                     I==== COMPUTING THE EQUIVALENT NOISE *                                     I
                     I   *AT THE OUTPUT OF THE INTEGRATOR *                                     I
                     I                                                                          I
                     O<-------------------------------------------------------------------------O
        10           I
 ...........................................
 I              POTXG=POT*G*G              I
 I.........................................I
                     I
                     I
 ...........................................
 I I            CALL NOISE(SO)           I I
 I.I.....................................I.I
                     I
                     I
 ...........................................
 I              RECSIG=POTXG+FRN           I
 I.........................................I
                     I
                     I
 /IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII  FALSE
<            IF(RECSIG.GT.TH)              >--------------I
 I........................................./              I
                     I  TRUE                              I
                     I                                    I
 ...........................................              I
 I              HIT=.TRUE.                 I              I
 I.........................................I              I
                     I                                    I
                     O<-----------------------------------
                     I
           /IIIIIIIIIIIIIIIIIII
           I        RETURN      I
           I.................../
```

```
♦ISD♦UTIL,FORFLO KUICG,HPOSTN
FLOWCHARTED BY  FORFLO /XBOB/ ON 10 NOV 77 AT 15:09:37
```

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HPOSTN   FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:10:09

```
*************************************************
 I          SUBROUTINE HPOSTN(K)               /
  I............................................/
                              I
                              I---- ................................*
                              I    *................................*
                              I    *.....                            *
                              I    * PURPOSE                         *
                              I    * DETERMINE THE (K+1)TH CELL      *
                              I    *CENTER FOR THE HEXAGONAL TYPE OF *
                              I    * TRAJECTORY                      *
                              I
                              I---- INPUT PARAMETERS                 *
                              I    * K - CELL NUMBER - 1             *
                              I    * ELI,AZI - ELEVATION AND AZIMUTH *
                              I    *OF PREVIOUS CELL (COMMON)        *
                              I    * THR - RADIUS OF ANTENNA MAIN    *
                              I    *LOBE (COMMON)                    *
                              I
                              I---- OUTPUT PARAMETERS                *
                              I    * ELO,AZO - ELEVATION AND AZIMUTH *
                              I    *OF FOLLOWING CELL (COMMON)       *
                              I    * XO,YO - CARTESIAN COORDINATES   *
                              I    *OF FOLLOWING CELL (COMMON)       *
                              I    * ................................*
                              I    *................................*
                              I    *.....                            *
                              I
                              I
*************************************************
*              LOGICAL CICLE                    *
*           DIMENSION C(6),S(6)                 *
* COMMON/CPOS/ELI,AZI,ELO,AZO,DUM,THR,D,PI,     *
* YI,TO                                         *
* COMMON/PARAM/D2,PI2,PI3,PI4,EPS,XXX,I         *
*         COMMON/CARTS/XI,YI,XO,YO              *
* DATA C/.5,-.5,-1.,-.5,.5,1./, S/.8660254,     *
* .8660254,0.,-.8660254,-.8660254,0./           *
*              CICLE=.FALSE.                    *
*************************************************
                              I
                              I
/''''''''''''''''''''''''''''''''''''''''''''''  TRUE
<          IF(K.GT.1) GO TO 10                  >----------------------------------------O
 '.............................................../                                        Z
                              I  FALSE                                                    Z
                              I                                                           Z
                              I                                                           Z
*************************************************                                         Z
*                  XI=D2                        *                                         Z
*                  YI=0.                        *                                         Z
*                  I=1                          *                                         Z
*************************************************                                         Z
                              I                                                           Z
                              O<----------------------------------------------------------O
 -      10*                   I
*************************************************
*       DELTA=AZI-INT(AZI/PI3)*PI3              *
*************************************************
                              I
```

18

```
                    I
  /''''''''''''''''''''''''''''''''''''''''''''''''''| FALSE
 < IF((DELTA.LT.EPS).OR.(DELTA.GT.PI3-EPS))         >-------------I
  '..................................................'             I
                    I  TRUE                                        I
                    I                                              I
 :..................................................:              I
 :  I=I+1                                           :              I
 :..................................................:              I
                    I                                              I
                    0<---------------------------------------------
                    I
 :..................................................:
 :                 I=MOD(I,7)                       :
 :..................................................:
                    I
                    I
  /''''''''''''''''''''''''''''''''''''''''''''''''''| FALSE
 <                  IF(I.EQ.0)                      >-------------I
  '..................................................'             I
                    I  TRUE                                        I
                    I                                              I
 :..................................................:              I
 :                  I=1                             :              I
 :..................................................:              I
                    I                                              I
                    0<---------------------------------------------
                    I
  /''''''''''''''''''''''''''''''''''''''''''''''''''| FALSE
 < IF((I.EQ.2).AND.(ABS(YI).LT.D).AND.(K.GT.        >-------------I
 < 1)) CICLE=.TRUE.                                 >              I
  '..................................................'             I
                    I  TRUE                                        I
                    I                                              I
 :..................................................:              I
 : 1)) CICLE=.TRUE.                                 :              I
 :..................................................:              I
                    I                                              I
                    0<---------------------------------------------
                    I
  /''''''''''''''''''''''''''''''''''''''''''''''''''| FALSE
 <                  IF(CICLE)                       >-------------I
  '..................................................'             I
                    I  TRUE                                        I
                    I                                              I
 :..................................................:              I
 :                  I=1                             :              I
 :..................................................:              I
                    I                                              I
                    0<---------------------------------------------
                    I
 :..................................................:
 :               X0=XI+D2*C(I)                      :
 :               Y0=YI+D2*S(I)                      :
 :            EL0=SQRT(X0*X0+Y0*Y0)                 :
 :              AZ0=ATAN2(Y0,X0)                    :
 :                   II=0                           :
 :..................................................:
                    I
                    0<------------------------------------------------------------------0
  -  200            I                                                                   I
 :..................................................:                                   I
 :              AZ0=AZ0+II*PI2                      :                                   I
 :                   II=1                           :                                   I
 :..................................................:                                   I
                    I                                                                   I
```

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```
                              I
     /''''''''''''''''''''''''''''''''''''''''''''''''''''| TRUE                                          I
    <        IF(AZU.LT.AZI) GO TO 20                      >-------------------------------------------------O
     '....................................................'
                              I  FALSE
                              I
                              I
     /''''''''''''''''''''''''''''''''''''''''''''''''''''| FALSE
    <                 IF(CICLE)                            >-------------I
     '....................................................'             I
                              I  TRUE                                  I
                              I                                        I
    ........................................................           I
    !                        I=2                           !           I
    !......................................................!           I
                              I                                        I
                              O<---------------------------------------
                              I
              /''''''''''''''''''''''''|
             !         RETURN          !
              '.......................'
```

```
*ISDAUTIL.FURFLO KUACO.ITR
FLO*CHARTED BY  FURFLO /X808/ ON 10 NOV 77 AT 15:10:20
```

```
**************************************************
 /   SUBROUTINE ITR(A,B,AZO,GUSS,THB,D,PI,      /
/    K)                                        /
/**********************************************/
                    I
                    I---- ******************************
                    I    C*****************************
                    I    C*****
                    I    C PURPOSE
                    I    C DETERMINE ITERATIVELY THE
                    I    CAZIMUTE OF THE NEXT CENTER,
                    I    C GIVEN THE POSITION OF THE
                    I    CPREVIOUS ONE, FOR THE
                    I    C SPIRAL TYPE OF TRAJECTORY
                    I
                    I---- INPUT PARAMETERS
                    I    C A,B - ELEVATION AND AZIMUTE OF
                    I    CPREVIOUS CENTER
                    I    C GUSS - INITIAL AZIMUTE GUESS
                    I    C THB - RADIUS OF ANTENNA MAIN
                    I    CLOBE
                    I    C D - HALF DISTANCE BETWEEN
                    I    CSUCESSIVE CENTERS
                    I    C PI - CONSTANT (3.141592653)
                    I    C K - CONTROL PARAMETER
                    I    C I - INTERMEDIATE RESULT
                    I
                    I---- OUTPUT PARAMETER
                    I    C AZO - DESIRED AZIMUTE
                    I    C ****************************
                    I    C*****************************
                    I    C*****
                    I    C PRINT 113
                    I    C113 FORMAT(' ITR')
                    I    C INITIAL GUESS
                    I
                    I
/''''''''''''''''''''''''''''''''''''''''''''''\ FALSE
<                IF(K.EQ.1)                      >--------------I
\**********************************************/                I
                    I  TRUE                                     I
                    I                                           I
************************************************                I
*                  PO=D                        *                I
************************************************                I
                    I                                           I
                    O<------------------------------------------
                    I
/''''''''''''''''''''''''''''''''''''''''''''''\ FALSE
<                IF(K.EQ.2)                      >--------------I
\**********************************************/                I
                    I  TRUE                                     I
                    I                                           I
************************************************                I
*                  PO=0.                       *                I
************************************************                I
                    I                                           I
                    O<------------------------------------------
                    I
************************************************
*                 FA=PI/D                      *
```

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```
FA=PI/D

I---- ITERATION

P1=GUSS

20
FL=P1/FA+P0
TS1=(THR*THR-(FL-A)**2)/(2.*FL*A)

IF(TS1.GT.0.) GO TO 3          TRUE
  FALSE

P1=P1-(GUSS-B)*0.05

GO TO 2

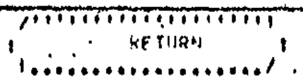
30
ANG=ACOS(1.0-TS1)
C=B+ANG
TS=P1-C

IF(ABS(TS).LE.1.E-6) GO TO 1   TRUE
  FALSE

P1=C+TS*0.9

GO TO 2

10
AZO=P1
```


RETURN

@4K2,U FLS

88

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[illegible]1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO, 06

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 06

* * * INFORMATION SYSTEMS DESIGN, INC. * 3205 CORONADO DR. * SANTA CLARA, CA 95051 * (408) 249-8100 * * * 1108 1X0 * * *

PRINTED BY: HUANG CREATED BY: HUANG FINISHED PRINTING: 11/10/77 15:19:28 ACTUAL PAGES: 41
USER NAME: HUANG QUEUED: 11/10/77 15:10:55 INPUT DEVICE: TRM134
ACCOUNT: 05444A CREATED: 11/10/77 15:01:13 QUEUED TO: EL9
ON SYSTEM: A PART NAME: -BK1-CS-BK2- PRINTED ON: EL9
EXEC LEVEL: 32R2P-036 PART NO.: 01
EXEC DATE: 10/14 FILE NAME: 05444AB(1)
IEOP 15:19 HUANG ACT PGS 41

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*IEOF17890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 06
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 07

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 07

1STP 15:21 HUANG EST PGS 54

```
HH        HH    UU        UU      AAAAAAAA     NN        NN     GGGGGGGG
HH        HH    UU        UU     AAAAAAAAAA    NNN       NN    GGGGGGGGGG
HH        HH    UU        UU    AA        AA   NNNN      NN   GG        GG
HH        HH    UU        UU    AA        AA   NNNNN     NN   GG        GG
HH        HH    UU        UU    AA        AA   NN NNN    NN   GG
HHHHHHHHHHHH    UU        UU    AAAAAAAAAAAA   NN  NNN   NN   GG
HHHHHHHHHHHH    UU        UU    AAAAAAAAAAAA   NN   NNN  NN   GG     GGGG
HH        HH    UU        UU    AA        AA   NN    NNN NN   GG     GGGG
HH        HH    UU        UU    AA        AA   NN     NNNNN   GG        GG
HH        HH    UUU      UUU    AA        AA   NN      NNNN   GG        GG
HH        HH     UUUUUUUUUU     AA        AA   NN       NNN    GGGGGGGGGG
HH        HH      UUUUUUUU      AA        AA   NN        NN     GGGGGGGG
```

PRINTED BY: HUANG
USER NAME: HUANG
ACCOUNT: 05444A
ON SYSTEM: A
EXEC LEVEL: 32R2D-036
EXEC DATE: 10/14

CREATED BY: HUANG

STARTED PRINTING: 11/10/77 15:21:00
QUEUED: 11/10/77 15:20:54
CREATED: 11/10/77 15:11:30
PART NAME: -BK1-15-BK2-
PART NO.: 02
FILE NAME: 0544*AC(1)

ESTIMATED PAGES: 54
INPUT DEVICE: T0N034
QUEUED TO: ELS
PRINTED ON: ELS

* * * INFORMATION SYSTEMS DESIGN, INC. * 3205 CORONADO DR. * SANTA CLARA, CA 95051 * (408) 249-8100 * * * 1108 1X0 * * *

12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 07

```
@TPF,U KUACO
READY
```

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C-2

```
*ISD*UTIL.FORFLO KUACG.MAIN
FLO-CHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:11:57
```

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MAIN   FLOWCHARTED BY FORFLO /XA08/ ON 10 NOV 77 AT 15:12:28

```
               /''''''''''''''''''''''|
              :         BEGIN          :
               '......................./
                           I
                           I
 ......................................................
 : DIMENSION XCTR(1000),YCTR(1000),TCTR(             :
 : 1000),ELEV(1000),AZIM(1000)                       :
 : DIMENSION XSLO(50),YSLO(50),XSL(50),YSL(          :
 : 50)                                               :
 :          DIMENSION KHIT(50),TH(50)                :
 : DIMENSION XNEARO(50),YNEARO(50),XNEAR(50)         :
 : ,YNEAR(50)                                        :
 :                    NCELLD=1000                    :
 :                    NSLDIM=50                      :
 :                    NNEARO=50                      :
 :...................................................:
                           I
                           I
 ......................................................
 : : CALL SIMULA(NCELLD,XCTR,YCTR,TCTR,           : :
 : : ELEV,AZIM,NSLDIM,XSLO,YSLO, XSL,YSL,         : :
 : : NNEARO,XNEARO,YNEARO,XNEAR,YNEAR,            : :
 : : KHIT,TH)                                     : :
 :.:..............................................:.:
                           I
                           I
               /''''''''''''''''''''''|
              :          STOP          :
               '......................./
```

93

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```
@ISO*UTIL,FORFLO KUACO.NOISE
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:12:30
```

NOISE FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:13:07

```
SUBROUTINE NOISE(S0)

* PURPOSE
* GENERATE THE EQUIVALENT NOISE
*AT THE OUTPUT OT THE INTEGRATOR

*** INPUT PARAMETER
* S0 = VARIABLE USED IN THE
*GAUSSIAN NOISE GENERATION
* SIGMAN = GAUSSIAN NOISE
*STANDARD DEVIATION (COMMON)
* POTXG = RECEIVED SIGNAL POWER (C
*COMMON)

*** OUTPUT PARAMETER
* EQN = EQUIVALENT NOISE AT THE
*OUTPUT OF THE INTEGRATOR (COM

DIMENSION X(10)
COMMON/SIGMA/SIGMAN,DUM,SIGM2,POTXG,EQN
COMMON/SAMPLE/NSAMPL,KNOISE
FACTOR=1.
RO=POTXG/SIGM2
AVR=SIGM2
STD=SQRT((1.+2.*RO)/NSAMPL)*SIGM2
EQN=0.
SSTD=0.
KK=0
N=10

IF(KNOISE.LT.N)        FALSE
        TRUE
N=KNOISE

10
KK=KK+N

IF(KK.LE.KNOISE) GO TO 20        TRUE
        FALSE
```

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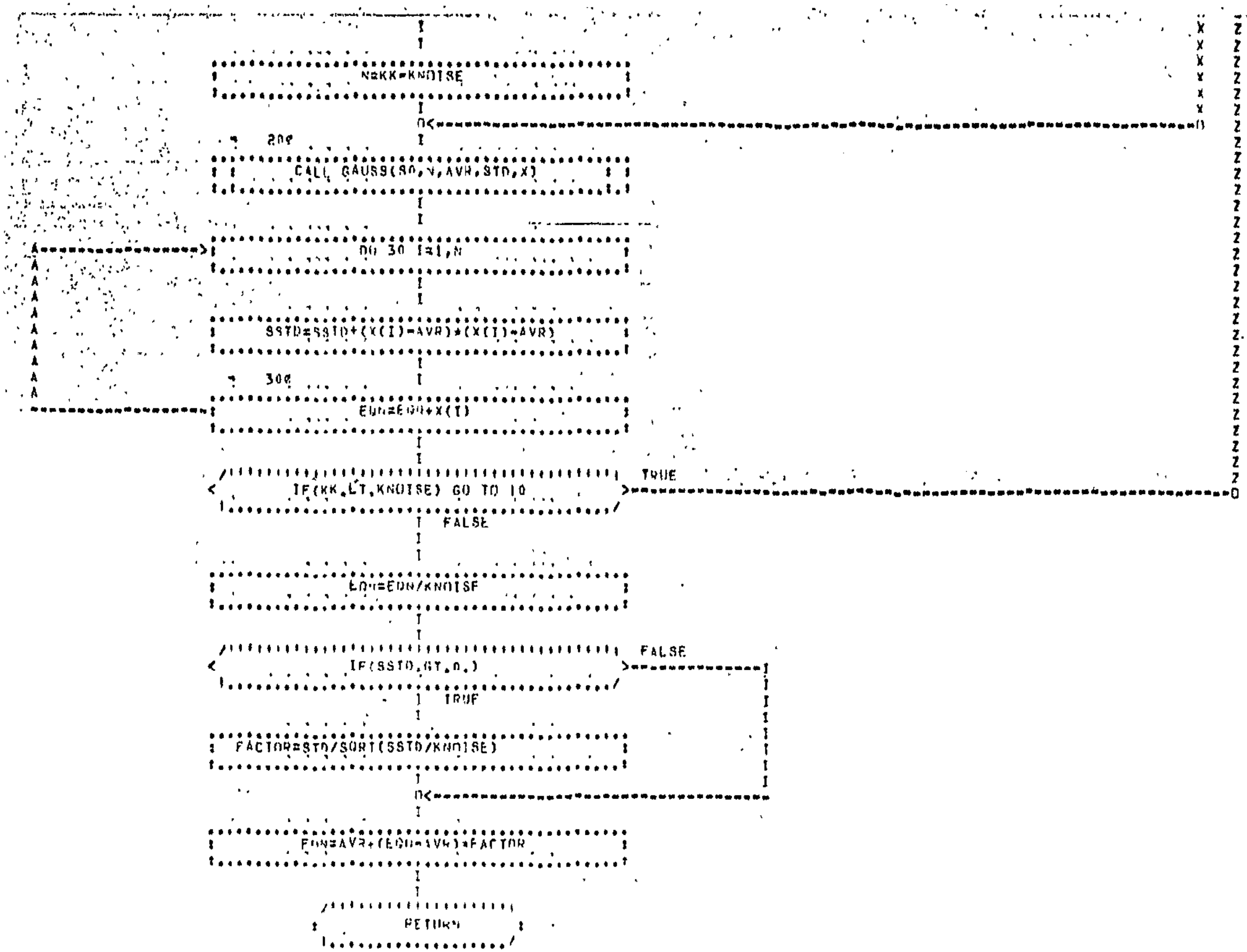

N=KK-KNOISE
20
CALL GAUSS(SO,N,AVR,STD,X)
DO 30 I=1,N
SSTD=SSTD+(X(I)-AVR)*(X(I)-AVR)
30
EQN=EQN+X(I)
IF(KK.LT.KNOISE) GO TO 10
TRUE
FALSE
EQN=EQN/KNOISE
IF(SSTD.GT.0.)
FALSE
TRUE
FACTOR=STD/SQRT(SSTD/KNOISE)
EQN=AVR+(EQN-AVR)*FACTOR
RETURN

@ISC*UTIL,FORFLO KUACO,OPOSTN
FLO-CHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:13:16

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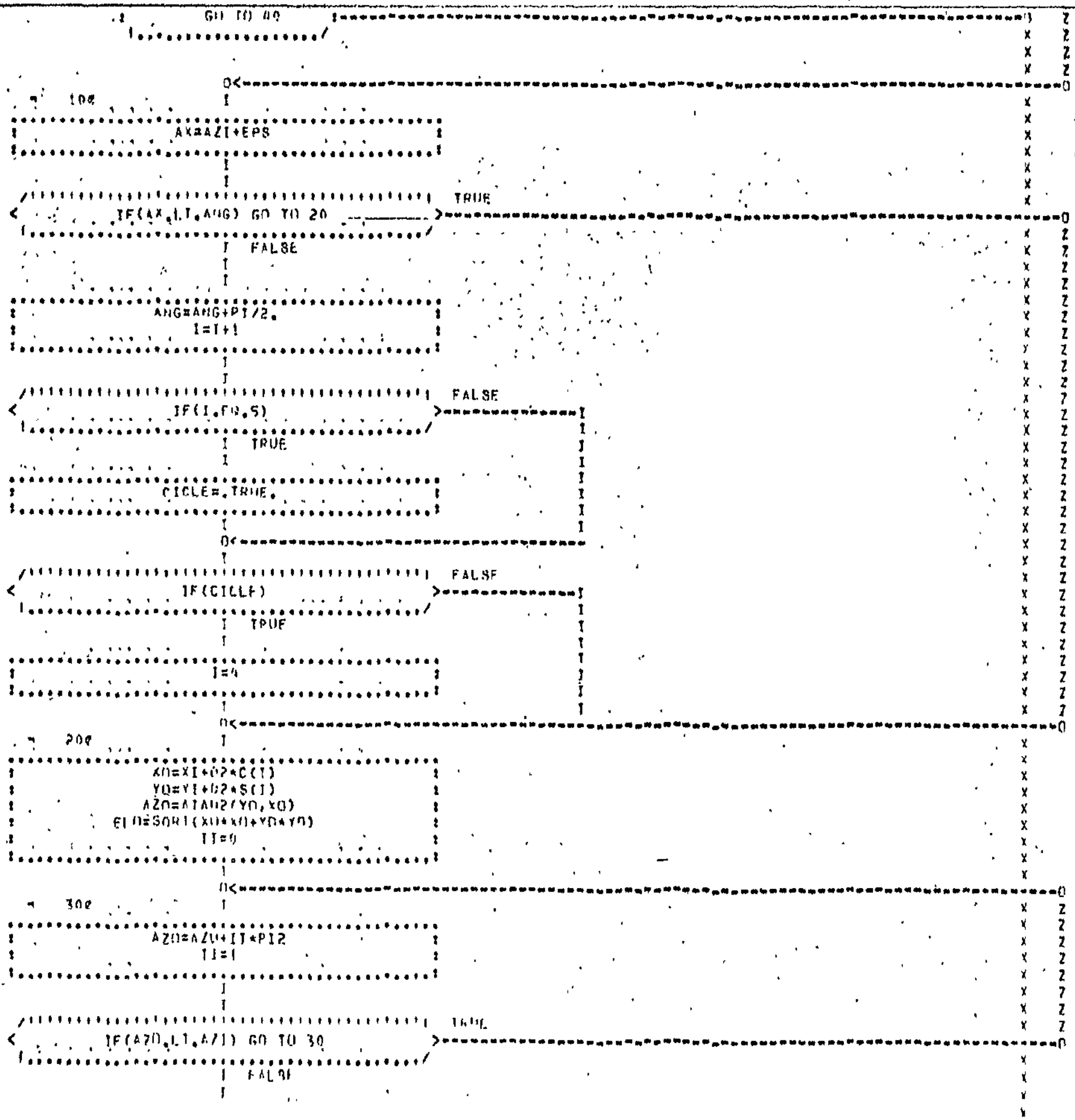
```
QPOSIN                    FLOWCHARTED BY  FORFLO /XA08/ ON 10 NOV 77 AT 15:13:45

          *********************************************
          I          SUBROUTINE QPOSIN(K)            /
           I*****************************************/
                                I
                                I---- ********************************C
                                I     *********************************C
                                I     *.....                           C
                                I     * PURPOSE                        C
                                I     * DETERMINE THE (K+1)TH CELL     C
                                I     *CENTER FOR THE SQUARE TYPE OF   C
                                I     * TRAJECTORY                     C
                                I
                                I---- INPUT PARAMETERS                 C
                                I     * K - CELL NUMBER - 1            C
                                I     * ELI,AZI - ELEVATION AND AZIMUTHC
                                I     *OF PREVIOUS CELL (COMMON)       C
                                I     * THB - RADIUS OF ANTENNA MAIN   C
                                I     *LOBE (COMMON)                   C
                                I     * XI,YI - CARTESIAN COORDINATES  C
                                I     *OF PREVIOUS CELL (COMMON)       C
                                I
                                I---- OUTPUT PARAMETERS                C
                                I     * ELO,AZO - ELEVATION AND AZIMUTHC
                                I     *OF FOLLOWING CELL (COMMON)      C
                                I     * XO,YO - CARTESIAN COORDINATES  C
                                I     *OF FOLLOWING CELL (COMMON)      C
                                I     * *******************************C
                                I     *********************************C
                                I     *.....                           C
                                I
                                I
          *********************************************
          :             LOGICAL CICLE                 :
          :         DIMENSION C(4),S(4)               :
          : COMMON/CPOS/ELI,AZI,ELO,AZO,DUM,THB,D,PI, :
          : TI,TO                                     :
          :          COMMON/CARTS/XI,YI,XO,YO         :
          : COMMON/PARAM/D2,PI2,PI3,PI4,EPS,ANG,I     :
          : DATA C/0.,-1.,0.,1./, S/1.,0.,-1.,0./     :
          :            CICLE=.FALSE.                  :
          :*******************************************:
                                I
                                I
          /'''''''''''''''''''''''''''''''''''''''''''  TRUE
         <          IF(K.GT.1) GO TO 10              >-------------------------------------------O
          I.........................................*                                          Z
                                I  FALSE                                                       Z
                                I                                                              Z
                                I                                                              Z
          *********************************************                                        Z
          :                 XO=D2                     :                                        Z
          :                 YO=0.                     :                                        Z
          :                 ELO=D2                    :                                        Z
          :                 AZO=0.                    :                                        Z
          :                 I=1                       :                                        Z
          :                 ANG=PI4                   :                                        Z
          :*******************************************:                                        Z
                                I                                                              Z
                                I                                                              Z
                  /'''''''''''''''''''I                   ---------------------------------O   Z
```



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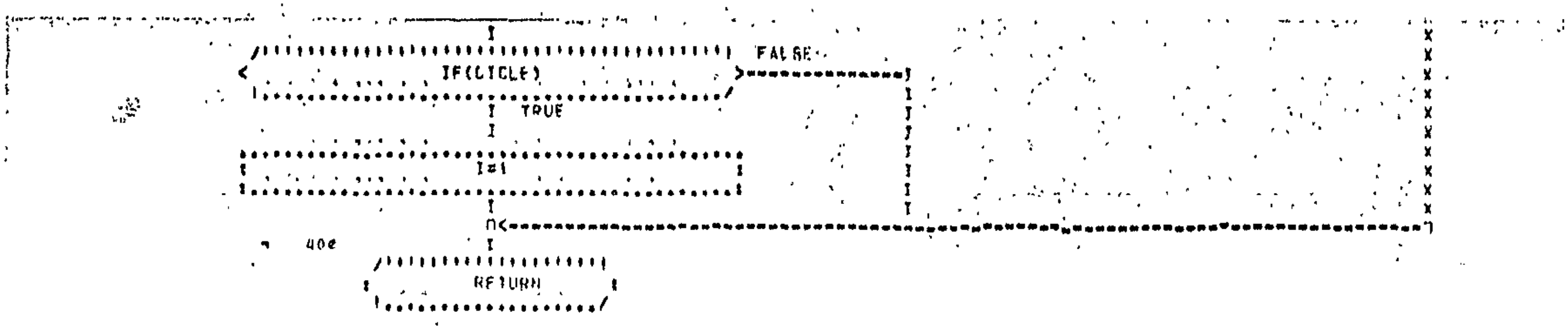
IF(CYCLE)
FALSE
TRUE
I=1
RETURN

```
*ISD*UTIL,FORFLO KUACQ.SIMULA
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:13:51
```


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```
SIMULA                    FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:14:57

          ..............................................
          I    SUBROUTINE SIMULA(NCELLD,XCTR,YCTR,       /
          I   TCTR,ELEV,AZIM,NSLDIM, XSLO,YSLO,XSL,     /
          I  YSL,NNEARD,XNEARO,YNEARO, XNEAR,          /
          IYNEAR,KHIT,TH)                             /
           I........................................./
                          I
                          I---- .................................C
                          I    -.................................C
                          I    -.                                C
                          I    - PURPOSE                         C
                          I    - READ INPUT DATA, DETERMINE THE  C
                          I    -PARAMETERS NECESSARY FOR THE     C
                          I    - *ACQUISITION PROCESS*, AND      C
                          I    -COMPUTE DESIRED *AVERAGES*       C
                          I
                          I---- INPUT PARAMETERS                 C
                          I    - NCELLD - MAXIMUM NUMBER OF      C
                          I    -CELLS POSSIBLE TO BE USED TO S   C
                          I
                          I---- NSLDIM - MAXIMUM NUMBER OF       C
                          I    -CELLS POSSIBLE TO BE USED IN T   C
                          I
                          I---- NNEARD - MAXIMUM NUMBER OF       C
                          I    -CELLS POSSIBLE TO BE USED IN     C
                          I    - *SURROUNDING CELLS* SCANNING    C
                          I
                          I---- OUTPUT PARAMETERS                C
                          I    - (XCTR,YCTR) - VECTORS WITH THE  C
                          I    -CENTERS OF THE VARIOUS CELLS     C
                          I
                          I---- (ELEV,AZIM) - VECTORS WITH THE   C
                          I    -CENTERS OF THE VARIOUS CELLS     C
                          I
                          I---- (XSLO,YSLO) - VECTORS WITH THE   C
                          I    -CENTERS OF THE SIDELOBE CELLS W  C
                          I    - ANTENNA BORESIGHT IS POINTING   C
                          I    -TO THE ORIGIN                    C
                          I    - (XNEARO,YNEARO) VECTORS WITH    C
                          I    -THE CENTERS OF THE NEARBY CELLS  C
                          I    -WHE                              C
                          I    - ANTENNA BORESIGHT IS POINTING   C
                          I    -TO THE ORIGIN                    C
                          I    - KHIT - VECTOR WITH THE LAST     C
                          I    -HITS, STARTING WITH THE LAS      C
                          I    - IN THE NORMAL PATH WHERE A HIT  C
                          I    -WAS OBSERVED                     C
                          I    - TH - VECTOR WITH THE THRESHOLDS C
                          I    -USED TO SEARCH NEARBY            C
                          I
                          I---- INTERNAL VARIABLES               C
                          I    - THU - RADIUS OF THE UNCERTAINTY C
                          I    -REGION (RADIANS)                 C
                          I    - THB - RADIUS OF -3DB ANTENNA    C
                          I    -MAIN LOBE                        C
                          I    - OVLAP - OVERLAP                 C
                          I    - KSCAN - TYPE OF TRAJECTORY      C
                          I
                          I---- MOTION - DESIRED ANTENNA MOTION  C
                          I    - 1 - CONSTANT ROTATIONAL SPEED   C
                          I    - 2 - CONSTANT VELOCITY ALONG     C
```

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```
I     * 2 - CONSTANT VELOCITY ALONG       *
I     *TRAJECTORY                         *
I     * 3 - COMBINATION OF *1* AND *2*    *
I     * VANG - ANGULAR VELOCITY (         *
I     *RADIANS/S)                         *
I     * VLIN - LINEAR VELOCITY ALONG      *
I     *TRAJECTORY (RADIANS/S)             *
I     * SWTCH - SWITCHING ANGLE (IN       *
I     *RADIANS) TO GO FROM *MOTION*       *
I
I---- PFA - PROBABILITY OF FALSE          *
I     *ALARM                              *
I
I---- - CNRMAX - EXPECTED CARRIER-TO-*
I     *NOISE RATIO DYNAMIC RANGE (D       *
I     * CNR - ACTUAL CARRIER-TO-NOISE     *
I     *RATIO (IN DB) USED IN TH           *
I
I---- TD - ELECTRICAL DWELL TIME (MS)*
I     * BIF - IF FILTER BANDWIDTH (MHZ)*
I     * FLOSS - FILTER INSERTION LOSS (*
I     *DB)                                *
I     * OTHERL - OTHER LOSSES (DB)        *
I     * NTDRSS - NUMBER OF SATELLITE      *
I     *POSITIONS GENERATED DURING T       *
I     * SIMULATION FOR EACH *SET OF       *
I     *CONDITIONS*                        *
I     * SIGMAP - STANDARD DEVIATION (IN*
I     *RADIANS) OF THE TRUNCATED .        *
I     * GAUSSIAN DENSITY FUNCTION USED *
I     *TO GENERATE THE S                  *
I
I---- TSL - TIME INTERVAL TO SWITCH       *
I     *FROM NORMAL SCANNING TO            *
I
I---- TCLOSE - TIME INTERVAL TO           *
I     *SWITCH FROM NORMAL SCANNING TO     *
I
I---- TVERIF - VERIFICATION TIME          *
I     * NULL - SELECT SCANNING SCHEME.    *
I     * 0 - NORMAL PATH ONLY (AUTO-       *
I     *TRACK RANGE < ANGLE R              *
I     * 1 - NORMAL PATH AND SIDELOBE      *
I     *CELLS (AUTO-TRACK R                *
I
I---- 2 - NORMAL PATH, SIDELOBE, AND *
I     *THEN NEARBY CELLS                  *
I
I---- 3 - NORMAL PATH, NEARBY, AND        *
I     *THEN SIDELOBE CELLS                *
I
I---- TH1,TH2 - THRESHOLDS                *
I     * PDET - PROBABILITY OF DETECTION*
I     * PDSL - PROBABILITY OF DETECTION*
I     *BY SIDELOBE ACQUISITION            *
I     * PMISS - PROBABILITY OF MISS       *
I     * PRFA - PROBABILITY OF FALSE       *
I     *ALARM (SIMULATED)                  *
I     * TAVR - AVERAGE TIME (IN SECONDS*
I     * TO DETECT THE SATELLIT            *
I     * SIGMAT - CORRESPONDING STANDARD*
I     *DEVIATION                          *
I     * ..............................*
I     *..............................*
I     *.....                              *
I
```

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```
                          I
*******************************************************
*          LOGICAL PRT,TSHARE                         *
*        DOUBLE PRECISION C1,C2,C3                    *
* DIMENSION XCTR(1),YCTR(1),TCTR(1),ELEV(1)           *
* ,AZIM(1)                                            *
* DIMENSION XSLO(1),YSLO(1),XSL(1),YSL(1)             *
* DIMENSION XNEAR0(1),YNEAR0(1),XNEAR(1),             *
* YNEAR(1)                                            *
*          DIMENSION KHIT(1),TH(1)                    *
* COMMON/SIGMA/SIGMAN,POT,SIGN2,DUM,FQN               *
*          COMMON/C1C2C3/C1,C2,C3                     *
* COMMON/CPOS/ELI,AZI,ELO,AZO,DELTAZ,THB,D,           *
* PI,TI,TO                                            *
*       COMMON/SAMPLE/NSAMPL,KNOISE                   *
*       COMMON/DWELL/VANGO,VLIND,TD                   *
*              C1=2.D0**31                            *
*              C2=C1-1.D0                             *
*              C3=7.D0**5                             *
*               ITS=0                                 *
*******************************************************
                          I
                          I---- INPUT DATA
                          I
                          I
  /''''''''''''''''''''''''''''''''''''''''''''''/
 /               PRINT 580                      /
/''''''''''''''''''''''''''''''''''''''''''''''/
                          I
                          I
  /''''''''''''''''''''''''''''''''''''''''''''''/
 /             READ(5,200) ITS                  /
/''''''''''''''''''''''''''''''''''''''''''''''/
                          I
                          I
*******************************************************
*                TSHARE=.FALSE.                       *
*******************************************************
                          I
                          I
 /''''''''''''''''''''''''''''''''''''''''''''''\  FALSE
<               IF(ITS.EQ.1)                    >--------------I
 \''''''''''''''''''''''''''''''''''''''''''''''/               I
                          I  TRUE                               I
                          I                                     I
*******************************************************         I
*                TSHARE=.TRUE.                        *         I
*******************************************************         I
                          I                                     I
                          0<-------------------------------------
                          I
 /''''''''''''''''''''''''''''''''''''''''''''''\  FALSE
<               IF(TSHARE)                      >--------------I
 \''''''''''''''''''''''''''''''''''''''''''''''/               I
                          I  TRUE.                              I
                          I                                     I
  /''''''''''''''''''''''''''''''''''''''''''''''/              I
 /               PRINT 590                      /               I
/''''''''''''''''''''''''''''''''''''''''''''''/                I
                          I                                     I
                          0<-------------------------------------
                          I
 /''''''''''''''''''''''''''''''''''''''''''''''\  FALSE
<             IF(.NOT.TSHARE)                   >--------------I
 \''''''''''''''''''''''''''''''''''''''''''''''/               I
                          I  TRUE                               I
```

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```
                              I                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''/        I
  /                   PRINT 600                    /         I
 /................................................/          I
                              I                              I
                              O<------------------------------
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <                IF(TSHARE)                       >-------------I
   I................................................/            I
                              I  TRUE                            I
                              I                                  I
   /''''''''''''''''''''''''''''''''''''''''''''''''/            I
  /                   PRINT 210                    /             I
 /................................................/              I
                              I                                  I
                              O<----------------------------------
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''/
  /        READ(5,200) THETAM,BEAMW,KSCAN          /
 /................................................/
                              I
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <         IF(TSHARE.AND.(KSCAN.EQ.3))             >-------------I
   I................................................/            I
                              I  TRUE                            I
                              I                                  I
   /''''''''''''''''''''''''''''''''''''''''''''''''/            I
  /   PRINT 640                                    /             I
 /................................................/              I
                              I                                  I
                              O<----------------------------------
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <               IF(KSCAN.EQ.3)                    >-------------I
   I................................................/            I
                              I  TRUE                            I
                              I                                  I
   /''''''''''''''''''''''''''''''''''''''''''''''''/            I
  /   READ(5,200) OVERLP                           /             I
 /................................................/              I
                              I                                  I
                              O<----------------------------------
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <                IF(TSHARE)                       >-------------I
   I................................................/            I
                              I  TRUE                            I
                              I                                  I
   /''''''''''''''''''''''''''''''''''''''''''''''''/            I
  /                   PRINT 220                    /             I
 /................................................/              I
                              I                                  I
                              O<----------------------------------
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''/
  /              READ(5,200) MOTION                /
 /................................................/
                              I
                              I
   /''''''''''''''''''''''''''''''''''''''''''''''''I
  I          GO TO (10,20,30),MOTION               I
   I=...100.........................................I

   ''''''''''''''''''''''''''''''''''''''''''''''''''I  FALSE
```

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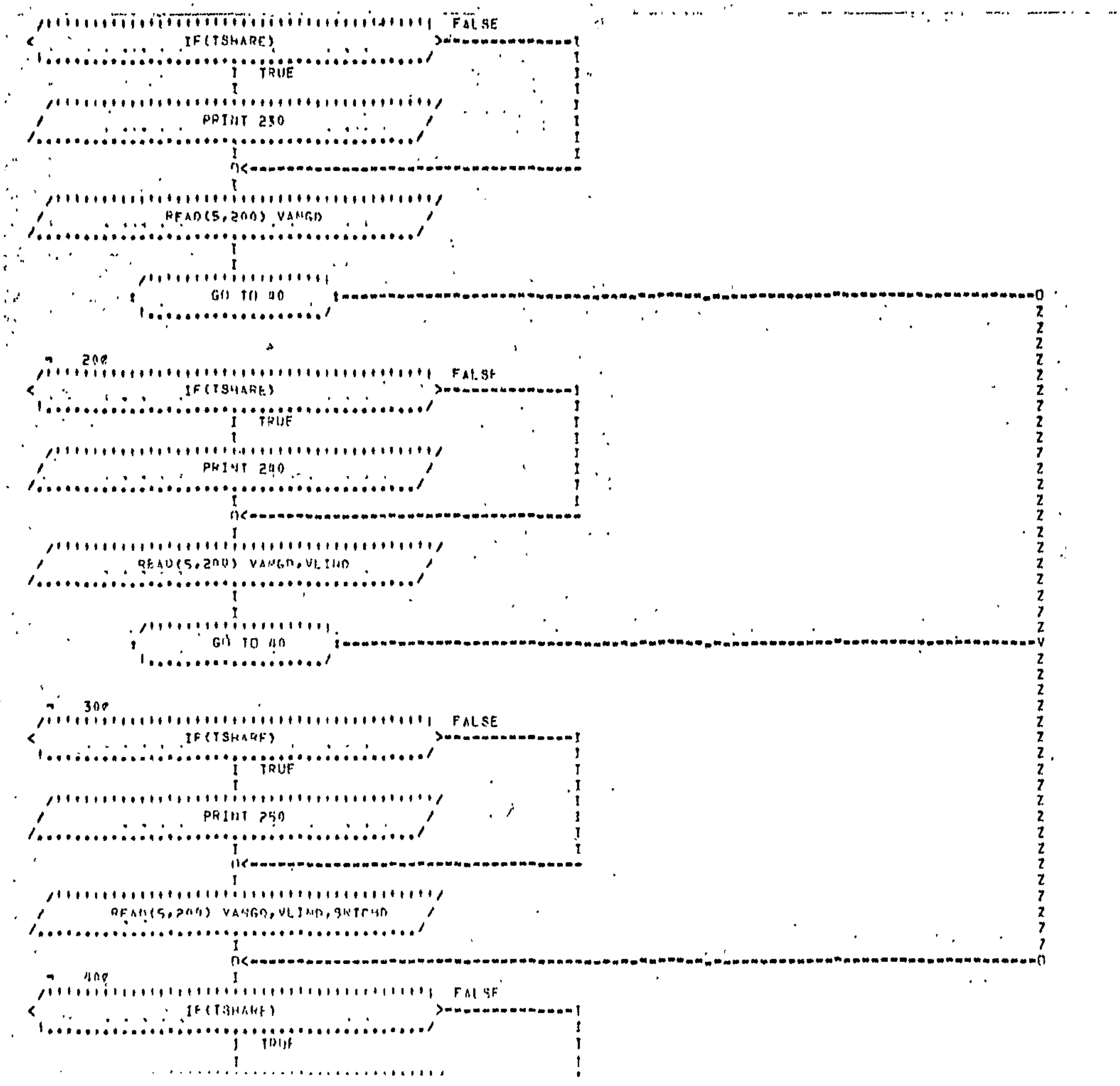
IF(TSHARE)
FALSE
TRUE
PRINT 230
READ(5,200) VANGD
GO TO 40
200
IF(TSHARE)
FALSE
TRUE
PRINT 240
READ(5,200) VANGD,VLIND
GO TO 40
300
IF(TSHARE)
FALSE
TRUE
PRINT 250
READ(5,200) VANGD,VLIND,SWITCHD
400
IF(TSHARE)
FALSE
TRUE

```
PRINT 260
   |
READ(5,200) PFA,CNRMIN,CNRMAX
   |
IF(TSHARE)          FALSE
   |  TRUE
PRINT 270
   |
READ(5,200) CNR1,CNR2,DCNR
   |
IF(TSHARE)          FALSE
   |  TRUE
PRINT 280
   |
READ(5,200) TO,ATF,FLOSS,OTHERL
   |
IF(TSHARE)          FALSE
   |  TRUE
PRINT 290
   |
READ(5,200) NTORSS
   |
IF(TSHARE)          FALSE
   |  TRUE
PRINT 530
```

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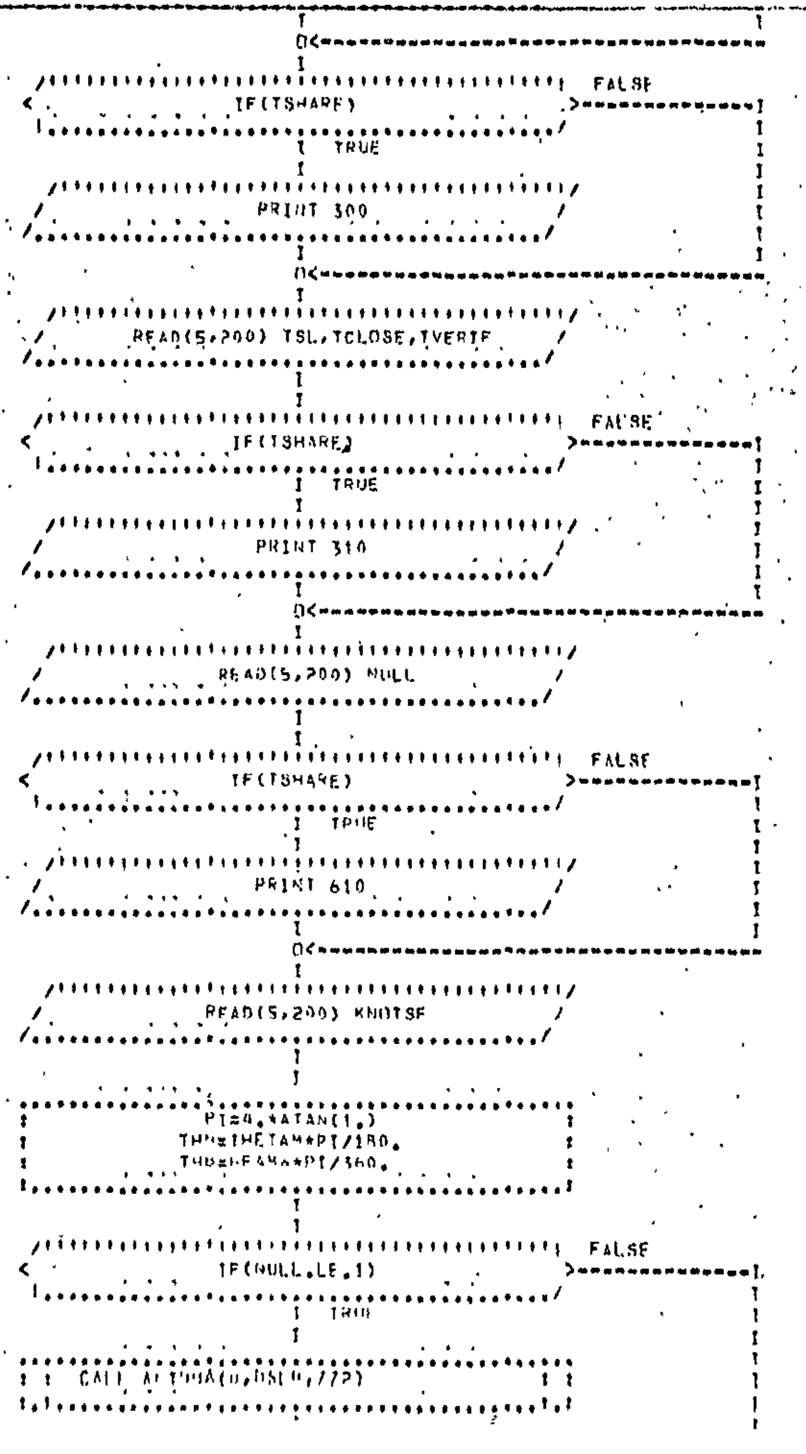
```
  /.........................................../                 I
                       I                                        I
                       O<----------------------------------------
                       I
   /''''''''''''''''''''''''''''''''''''''''''/
  /            READ(5,200) KRAND              /
 /.........................................../
                       I
                       I
   /''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <       IF(TSHARE.AND.(KRAND.EQ.1))          >--------------I
   I........................................../               I
                       I  TRUE                                I
                       I                                      I
   /''''''''''''''''''''''''''''''''''''''''''/               I
  /  PRINT 540                                /               I
 /.........................................../                I
                       I                                      I
                       O<--------------------------------------
                       I
   /''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <            IF(KRAND.EQ.1)                  >--------------I
   I........................................../               I
                       I  TRUE                                I
                       I                                      I
   /''''''''''''''''''''''''''''''''''''''''''/               I
  /  READ(5,200) SIGP1,SIGP2,DSIGP            /               I
 /.........................................../                I
                       I                                      I
                       O<--------------------------------------
                       I
   /''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <              IF(TSHARE)                    >--------------I
   I........................................../               I
                       I  TRUE                                I
                       I                                      I
   /''''''''''''''''''''''''''''''''''''''''''/               I
  /                PRINT 295                  /               I
 /.........................................../                I
                       I                                      I
                       O<--------------------------------------
                       I
   /''''''''''''''''''''''''''''''''''''''''''/
  /            READ(5,200) INTRES             /
 /.........................................../
                       I
                       I
   /''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <      IF(TSHARE.AND.(INTRES.EQ.1))          >--------------I
   I........................................../               I
                       I  TRUE                                I
                       I                                      I
   /''''''''''''''''''''''''''''''''''''''''''/               I
  /  PRINT 500                                /               I
 /.........................................../                I
                       I                                      I
                       O<--------------------------------------
                       I
   /''''''''''''''''''''''''''''''''''''''''''I  FALSE
  <            IF(INTRES.EQ.1)                 >--------------I
   I........................................../               I
                       I  TRUE                                I
                       I                                      I
   /''''''''''''''''''''''''''''''''''''''''''/               I
  /            READ(5,200),TTTD               /               I
 /.........................................../                I
```



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```
                    I
                    0<-----------------------------------
                    I
 /'''''''''''''''''''''''''''''''''''''''''''''''  FALSE
<                IF(NULL.LE.1)                  >--------------I
 '..............................................'              I
                    I  TRUE                                    I
                    I                                          I
 ................................................              I
 :               DISTZ=2.*D9LB                   :             I
 ................................................              I
                    I                                          I
                    0<-----------------------------------------
                    I
 /'''''''''''''''''''''''''''''''''''''''''''''''  FALSE
<                IF(NULL.GT.1)                  >--------------I
 '..............................................'              I
                    I  TRUE                                    I
                    I                                          I
 ................................................              I
 : :  CALL ANTNNA(-2,DNULL,Z2Z)               : :              I
 ................................................              I
                    I                                          I
                    0<-----------------------------------------
                    I
 /'''''''''''''''''''''''''''''''''''''''''''''''  FALSE
<                IF(NULL.GT.1)                  >--------------I
 '..............................................'              I
                    I  TRUE                                    I
                    I                                          I
 ................................................              I
 :               DISTZ=2.*DNULL                  :             I
 ................................................              I
                    I                                          I
                    0<-----------------------------------------
                    I
 ................................................
 :            VANG=VANGD*PI/180.                 :
 :            VLIN=VLIND*PI/180.                 :
 :            SWTCH=SWTCHD*PI/180.               :
 :              TH2=THP*THP                      :
 ................................................
                    I
                    I
 /'''''''''''''''''''''''''''''''''''''''''''''''  FALSE
<               IF(KSCAN.EQ.1)                  >--------------I
 '..............................................'              I
                    I  TRUE                                    I
                    I                                          I
 ................................................              I
 :  OVERLP=(1.-COS(PI/4.))*100.                  :             I
 ................................................              I
                    I                                          I
                    0<-----------------------------------------
                    I
 /'''''''''''''''''''''''''''''''''''''''''''''''  FALSE
<               IF(KSCAN.EQ.2)                  >--------------I
 '..............................................'              I
                    I  TRUE                                    I
                    I                                          I
 ................................................              I
 :  OVERLP=(1.-COS(PI/6.))*100.                  :             I
 ................................................              I
                    I                                          I
                    0<-----------------------------------------
                    I
```

```
 OVLAP=OVERLP/100.
 XKS=2.*THH*(1.-OVLAP)
 NSAMPL=INT(TDARIF*1.E+3)
        I
 PRINT 320,THETAM,BEAMW
        I
 IF(KSCAN.EQ.1)  >---- FALSE ----I
        I TRUE                   I
 PRINT 330,OVERLP                I
        I                        I
        0<-----------------------I
        I
 IF(KSCAN.EQ.2)  >---- FALSE ----I
        I TRUE                   I
 PRINT 340,OVERLP                I
        I                        I
        0<-----------------------I
        I
 IF(KSCAN.EQ.3)  >---- FALSE ----I
        I TRUE                   I
 PRINT 350,OVERLP                I
        I                        I
        0<-----------------------I
        I
 IF(MOTION.EQ.1) >---- FALSE ----I
        I TRUE                   I
 PRINT 360,VANGD                 I
        I                        I
        0<-----------------------I
        I
 IF(MOTION.EQ.2) >---- FALSE ----I
        I TRUE                   I
 PRINT 370,VANGD,VLIMD           I
        I                        I
        0<-----------------------I
```

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```
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''|  FALSE
<               IF(MOTION.EQ.3)                      >-------------I
 |.................................................../              I
                         I  TRUE                                    I
                         I                                          I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/               I
/   PRINT 380,VANGD,SWTCHD,VLIND,SWTCHD            /                I
/.................................................../                I
                         I                                          I
                         0<------------------------------------------
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/
/   PRINT 390,PFA,CNRMIN,CNRMAX,TD,RIF,            /
/  FLOSS,OTHERL                                   /
/................................................./
                         I
                         I---- DETERMINING THRESHOLDS TH1 AND C
                         I     -TH2                           C
                         I
                         I
...................................................
: : CALL TH1TH2(CNRMIN,CNRMAX,PFA,RIF,         : :
: : FLOSS,OTHERL,NSAMPL,TH1,TH2)               : :
:.:............................................:.:
                         I
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/
/              PRINT 490,TH1,TH2                   /
/.................................................../
                         I
                         I---- DETERMINING NUMBER OF CELLS TO C
                         I     -COMPLETELY SCAN THE           C
                         I     - UNCERIATNTY REGION, THEIR    C
                         I     -CENTERS, AND THE TIME INSTANTS C
                         I     - THESE CENTERS ARE ACHIEVED    C
                         I
                         I
...................................................
: : CALL CELL(KSCAN,THM,OVLAP,MOTION,          : :
: : VANG,VLIN,XKS,SWTCH,NCELL, XCTR,YCTR,      : :
: : TCTR,ELEV,AZIM,NCELLD)                     : :
:.:............................................:.:
                         I
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/
/               PRINT 400,NCELL                    /
/.................................................../
                         I
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/
/            PRINT 620,TCTR(NCELL)                 /
/.................................................../
                         I
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''|  FALSE
<               IF(INTRES.EQ.1)                      >-------------I
 |.................................................../              I
                         I  TRUE                                    I
                         I                                          I
 /''''''''''''''''''''''''''''''''''''''''''''''''''/               I
/                PRINT 405                         /                I
/.................................................../                I
                         I                                          I
                         0<------------------------------------------
                         I
 /''''''''''''''''''''''''''''''''''''''''''''''''''|  FALSE
```

```
   /''''''''''''''''''''''''''''''''''''''''''''''| FALSE
  <           IF(INTRES.EQ.1)                    >--------------I
   '...........................................'                I
                      I TRUE                                    I
                      I                                         I
    /'''''''''''''''''''''''''''''''''''''''''''/               I
   / PRINT 410,((XCTR(I),YCTR(I),ELEV(I),      /                I
  /AZIM(I), ICTR(I)),I=1,NCELL)               /                 I
 /...........................................'                  I
                      I                                         I
                      O<-----------------------------------------
                      I
   /''''''''''''''''''''''''''''''''''''''''''''''| TRUE
  <      IF(NULL.EQ.0) GO TO 45                  >------------------------------------------------O
   '...........................................'                                                   Z
                      I FALSE                                                                      Z
                      I                                                                            Z
                      I---- DETERMINING NUMBER AND           *                                     Z
                      I    *POSITIONS OF SIDELOBE CELLS WHEN*                                      Z
                      I    * THE ANTENNA IS POINTING TO THE *                                      Z
                      I    *ORIGIN                           *                                     Z
                      I                                                                            Z
                      I                                                                            Z
 ***********************************************                                                   Z
 * * CALL SLCELL(1,THB,OVLAP,VANG,XSLO,       * *                                                  Z
 * * YSLO,NSL,DTSL,NSLDIM)                    * *                                                  Z
 ***********************************************                                                   Z
                      I                                                                            Z
                      I                                                                            Z
   /''''''''''''''''''''''''''''''''''''''''''''''| FALSE                                          Z
  <           IF(INTRES.EQ.1)                    >--------------I                                  Z
   '...........................................'                I                                  Z
                      I TRUE                                    I                                  Z
                      I                                         I                                  Z
    /'''''''''''''''''''''''''''''''''''''''''''/               I                                  Z
   /  PRINT 510,NSL,DTSL                       /                I                                  Z
  /...........................................'                 I                                  Z
                      I                                         I                                  Z
                      O<-----------------------------------------                                  Z
                      I                                                                            Z
   /''''''''''''''''''''''''''''''''''''''''''''''| FALSE                                          Z
  <           IF(INTRES.EQ.1)                    >--------------I                                  Z
   '...........................................'                I                                  Z
                      I TRUE                                    I                                  Z
                      I                                         I                                  Z
    /'''''''''''''''''''''''''''''''''''''''''''/               I                                  Z
   /  PRINT 520,((XSLO(I),YSLO(I)),I=1,NSL)    /                I                                  Z
  /...........................................'                 I                                  Z
                      I                                         I                                  Z
                      I---- DETERMINING NUMBER AND POSITIONI                                       Z
                      I    *OF NEARBY CELLS WHEN THE ANTENNAI                                      Z
                      I    *I                                   I                                  Z
                      I    * POINTING TO THE ORIGIN             I                                  Z
                      I                                         I                                  Z
                      O<-----------------------------------------                                  Z
                      I                                                                            Z
 ***********************************************                                                   Z
 * * CALL SLCELL(0,THB,OVLAP,VANG,XNEARD,      * *                                                  Z
 * * YNEARD,NNEAR,DTNEAR,NNEARD)               * *                                                  Z
 ***********************************************                                                   Z
                      I                                                                            Z
                      I                                                                            Z
   /''''''''''''''''''''''''''''''''''''''''''''''| FALSE                                          Z
  <           IF(INTRES.EQ.1)                    >--------------I                                  Z
   '...........................................'                I                                  Z
                      I TRUE                                    I                                  Z
                      *                                         I                                  Z
```


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```
PRINT 670,NNEAR,DTNEAR

IF(INTRES.EQ.1)        FALSE
      TRUE

PRINT 520,((XNEAR0(I),YNEAR0(I)),I=1,
NNEAR)

450
S0=1099.

CALL UNIFOR(S0,XDUM,YDUM)

SNR1=CNR1-10.*ALOG10(BIF*1.E+6)-FLOSS-
OTHERL
SNR2=CNR2-10.*ALOG10(BIF*1.E+6)-FLOSS-
OTHERL
SS=SIGP1
SIGMAP=SIGP1*PI/180.

500
CNR=CNR1
SNR=SNR1

600
POT=SIGN2*10.**(SNR/10.)
TAVR=0.
SIGMAT=0.
PDFI=0.
POSL=0.
PMISS=0.
PREA=0.
ITORSS=0

700
ITORSS=ITORSS+1
PRI=.FALSE.

                                        FALSE
```

```
< IF((ITORSS.LE.ITTD).AND.(INTRES.EQ.1))  >------------- FALSE
  I TRUE
: FRIS.TRUE. :
  I
  I---- GENERATING A TORSS POSITION
  I
  0<-----------------------------------------------------------------0
  I   809
< IF(TSHARE.AND.(KRAND.EQ.0))  >------------- FALSE
  I TRUE
/ PRINT 550 /
  I
  0<-------------
  I
< IF(KRAND.EQ.0)  >------------- FALSE
  I TRUE
/ READ(5,200) XTORSS,YTORSS /
  I
  0<-------------
  I
< IF(KRAND.EQ.1)  >------------- FALSE
  I TRUE
: : CALL TORSS(S0,SIGMAP,THM2,XTORSS, : :
: : YTORSS)                           : :
  I
  0<-------------
  I
: ISAT=0 :
: X7=THR :
  I
A------------>: DO 90 I=1,NCELL :
A               I
A : DIST=SQRT((XCTR(I)-XTORSS)*(XCTR(I)-
A : XTORSS) +(YCTR(I)-YTORSS)*(YCTR(I)-
A : YTORSS))
A               I
A / ... >------------- TRUE ----------------------0
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
IF(DIST.GE.XZ) GO TO 90
  FALSE
XZ=DIST
ISAT=I
90
CONTINUE
IF((ISAT.EQ.0).AND.(KRAND.EQ.1))          FALSE
  TRUE
PRINT 560
IF((ISAT.EQ.0).AND.(KRAND.EQ.0))          FALSE
  TRUE
PRINT 570
IF((ISAT.EQ.0).AND..NOT.ISHARE)           FALSE
  TRUE
RETURN
IF((ISAT.EQ.0).AND.(KRAND.EQ.1))          FALSE
  TRUE
RETURN
IF((ISAT.EQ.0).AND.(KRAND.EQ.0)) GO TO    TRUE
80
```

```
                         I  FALSE
                         I
       /''''''''''''''''''''''''''''''''''''''|  FALSE
      <               IF(PRT)                  >-------------I
       '......................................./             I
                         I  TRUE                             I
                         I                                   I
       /''''''''''''''''''''''''''''''''''''''/              I
      /  PRINT 420,XTDRSS,YTDRSS,ISAT         /              I
     /......................................./               I
                         I                                   I
                         I---- DETECTING THE SATELLITE       I
                         I                                   I
                         O<----------------------------------
                         I
   ...............................................
   : : CALL ACQ(NULL,THB,XKS,NCELL,XCTR,        : :
   : : YCTR,ICTR,AZIP,NSL, XSLO,YSLO,DISL,      : :
   : : NNEAR,YNEARV,YNEARO,DINEAR,VANG, TH1,    : :
   : : TH2,TSL,TCLUSF,TVERIF,XTDRSS,YTDRSS,     : :
   : : NNEARD,SO, PRT,T,IPDTSS,IPDET,IPOSL,     : :
   : : XDET,YDET,KHIT,IHIT,TH, XSL,YSL,         : :
   : : XNEAR,YNEAR)                             : :
   :.:..........................................:.:
                         I
                         I
   ...............................................
   :                TAVR=TAVR+T                   :
   :             SIGMAT=SIGMAT+T*T                :
   : DD=SQRT((XTDRSS-XDET)*(XTDRSS-XDET) +(       :
   : YTDRSS-YDET)*(YTDRSS-YDET))                  :
   :..............................................:
                         I
                         I
       /''''''''''''''''''''''''''''''''''''''|  TRUE
      <      IF(DD.LT.DISTZ) GO TO 95          >------------------------------O
       '......................................./                              S
                         I  FALSE                                             S
                         I                                                    S
                         I                                                    S
       /''''''''''''''''''''''''''''''''''''''|  FALSE                        S
      <            IF(IPDET.EQ.1)              >-------------I                S
       '......................................./             I                S
                         I  TRUE                             I                S
                         I                                   I                S
   ...............................................           I                S
   :               PREA=PREA+1                   :           I                S
   :.............................................:           I                S
                         I                                   I                S
                         O<----------------------------------                 S
                         I                                                    S
              /''''''''''''''''''''|                                          S
             <       GO TO 96       >------------------------------------O    S
              '..................../                                     O    S
                                                                         O    S
                                                                         O    S
                         O<---------------------------------------------------O
     950                 I                                               O
   ...............................................                       O
   :               PDET=PDET+IPDET               :                       O
   :.............................................:                       O
                         I                                               O
                         O<----------------------------------------------O
     960                 I
```

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```
PDSL=PDSL+IPDSL
PMISS=PMISS+IPMISS

IF(.NOT.PRT) GO TO 100          TRUE ---> O
   FALSE

IF((IPDET.EQ.1).AND.(IPDSL.EQ.0))          FALSE
   TRUE
PRINT 430,KHIT(IHIT)

IF(IPDSL.EQ.1)          FALSE
   TRUE
PRINT 440,KHIT(IHIT)

IF(IPMISS.EQ.1)          FALSE
   TRUE
PRINT 450,I

IF((IPDET.EQ.1).AND.(DD.GT.DISTZ))          FALSE
   TRUE
PRINT 430,ISAT,KHIT(IHIT)

IF(NDLI.EQ.0)          FALSE
   TRUE
DD=DD/DSLB*100.
```

ORIGINAL PAGE IS
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```
IF(NULL.GE.1)                                   FALSE
  TRUE
DD=DD/DNULL*100.

IF((NULL.EQ.0).AND.(IPMISS.NE.1))               FALSE
  TRUE
PRINT 650,DD,T

IF((NULL.GE.1).AND.(IPMISS.NE.1))               FALSE
  TRUE
PRINT 660,DD,T

100
IF(ITORSS.LT.NTORSS) GO TO 70                   TRUE
  FALSE

TAVR=TAVR/NTORSS
SIGMAT=SQRT(ABS(SIGMAT/NTORSS-TAVR*TAVR)/
NTORSS)
PDET=PDET/NTORSS
PDSL=PDSL/NTORSS
PMISS=PMISS/NTORSS
PKFA=PKFA/NTORSS

PRINT 870,NTORSS,SS

PRINT 860,CHP

PRINT 880,TAVR,SIGMAT,PDET,PDSL,PMISS,
PKFA
```

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ORIGINAL PAGE IS
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```
                  I
 <   IF(DCNR.EQ.0.) GO TO 110   >---- TRUE ---->O
                  I  FALSE
                  I
                  I
 :               CNR=CNR+DCNR                     :
 :               SNR=SNR+DCNR                     :
                  I
                  I
 <   IF(CNR.LE.CNR2) GO TO 60   >---- TRUE ---->O
                  I  FALSE
                  I
                  O<-----------------------------O
 110              I
 <   IF(KRAND.NE.1)             >---- FALSE ----I
                  I  TRUE                       I
                  I                             I
         (    RETURN    )                       I
                                                I
                  O<----------------------------
                  I
 <   IF(DSIGP.EQ.0.)            >---- FALSE ----I
                  I  TRUE                       I
                  I                             I
 :               DSIGP=SIGP2*10.                  :
                  I                             I
                  O<----------------------------
                  I
 :               SS=SS+DSIGP                      :
 :               SIGMAP=SS*PI/180.                :
                  I
                  I
 <   IF(SS.LE.SIGP2) GO TO 50   >---- TRUE ---->O
                  I  FALSE
                  I
                  I----200 FORMAT()
                  I    210 FORMAT(' ',/,' INPUT DATA (
                  I    FREE FORMAT)',//, *' (REAL)
                  I    RADIUS OF UNCERTAINTY REGION (
                  I    DEGREES)',/, *' (REAL) REAL UNITHS
                  I    (DEGREES)',/, *' (INTG) TYPE OF
                  I    TRAJECTORY: 1(SQUARE) ', * ' 2(
                  I    HEXAGONAL) 3(SPIRAL)')
                  I    220 FORMAT(' ',/,' (INTG) TYPE
                  I    OF MOTION:',/, * ' 1 = CONSTANT
                  I    ANGULAR VELOCITY',/, * ' 2 =
                  I    CONSTANT VELOCITY ALONG
                  I    ... 3 = CONSTANT ...
```

```
I      ¬TRAJECTORY',/, * ' 3 = COMBINATI¢
I      ¬N OF *1* AND *2*')                 ¢
I      ¬230 FORMAT(' ',/,' (REAL)          ¢
I      ¬ANGULAR VELOCITY (DEGREES/S)')     ¢
I      ¬240 FORMAT(' ',/,' (REAL)          ¢
I      ¬ANGULAR VELOCITY (DEGREES/S)',/,¢
I      ¬* ' (REAL) VELOCITY ALONG          ¢
I      ¬TRAJECTORY (DEGREES/S)')           ¢
I      ¬250 FORMAT(' ',/,' (REAL)          ¢
I      ¬ANGULAR VELOCITY (DEGREES/S)',/,¢
I      ¬* ' (REAL) VELOCITY ALONG          ¢
I      ¬TRAJECTORY (DEGREES/S)',/, * ' (¢
I      ¬REAL) SWITCHING ANGLE (DEGREES)'¢
I      ¬260 FORMAT(' ',/,' (REAL)          ¢
I      ¬PROBABILITY OF FALSE ALARM',/, *¢
I      ¬' (REAL) EXPECTED MINIMUM          ¢
I      ¬CARRIER-TO-NOISE RATIO (DB)',/, ¢
I      ¬ ' (REAL) EXPECTED MAXIMUM         ¢
I      ¬CARRIER-TO-NOISE RATIO (DB)')      ¢
I      ¬270 FORMAT(' ',/,' CNR VALUES TO¢
I      ¬BE USED IN THE SIMULATION',/, * ¢
I      ¬ (REAL) (MINIMUM, MAXIMUM,         ¢
I      ¬INCREMENT.GE.0.)')                 ¢
I      ¬280 FORMAT(' ',/,' RECEIVER        ¢
I      ¬PARAMETERS:',/, * ' (REAL)         ¢
I      ¬INTEGRATION TIME (MS)',/, * ' ( ¢
I      ¬REAL) IF FILTER BANDWIDTH (MHZ)'¢
I      ¬/, * ' (REAL) INSERTION LOSS (DB¢
I      ¬',/, * ' (REAL) OTHER LOSSES (DB¢
I      ¬')                                 ¢
I      ¬290 FORMAT(' ',/,' (INTG) NUMBER¢
I      ¬OF SATELLITE POSITIONS TO BE ', ¢
I      ¬ 'GENERATED DURING THE SIMULATIO¢
I      ¬')                                 ¢
I      ¬295 FORMAT(' ',/,' (INTG)          ¢
I      ¬INTERMEDIATE RESULTS; NO(0) YES(¢
I      ¬1)')                               ¢
I      ¬300 FORMAT(' ',/,' TRANSITION      ¢
I      ¬MODES AND VERIFICATION TIMES:',/¢
I      ¬* ' (REAL) NORMAL TO SIDELOBE      ¢
I      ¬SCANNING',/, * ' (REAL) NORMAL     ¢
I      ¬TO SURROUNDING CELLS SCANNING',/¢
I      ¬ * ' (REAL) VERIFICATION TIME')    ¢
I      ¬310 FORMAT(' ',/' SCANNING         ¢
I      ¬SCHEME:',46X,'AUTO-TRACK RANGE',¢
I      ¬, * ' (INTG) 0 = NORMAL PATH       ¢
I      ¬ONLY',40X, * '< ANGLE BETWEEN      ¢
I      ¬ANTENNA SIDELOBES',/, * ' 1 =      ¢
I      ¬NORMAL PATH AND SIDELOBE CELLS',¢
I      ¬26X, * '< ANGLE BETWEEN ANTENNA ¢
I      ¬NULLS',/, * ' 2 = NORMAL PATH,     ¢
I      ¬NEARBY, AND THEN SIDELOBE', * ' ¢
I      ¬CELLS',12X,'< ANGLE BETWEEN        ¢
I      ¬ANTENNA NULLS')                    ¢
I      ¬320 FORMAT(' ',/,' RADIUS OF       ¢
I      ¬UNCERTAINTY REGION: ',9X,F8.4, *¢
I      ¬' DEGREES',/,' BEAMWIDTH:',30X, ¢
I      ¬F8.4,' DEGREES')                   ¢
I      ¬330 FORMAT(' SQUARE TRAJECTORY: ¢
I      ¬OVERLAP = ',F9.4,' %')             ¢
I      ¬340 FORMAT(' HEXAGONAL TRAJECTOR¢
I      ¬ : OVERLAP = ',F9.4,' %')          ¢
I      ¬350 FORMAT(' SPIRAL TRAJECTORY: ¢
I      ¬OVERLAP = ',F9.4,' %')             ¢
I      ¬360 FORMAT(' CONSTANT ROTATIONAL¢
I      ¬SPEED: ',F9.4, * ' DEGREES/S')     ¢
I      ¬370 FORMAT(' CONSTANT ROTATIONAL¢
```


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```
I     ¬370 FORMAT(' CONSTANT ROTATIONAL¢
I     ¬SPEED: ',F9.4, * ' DEGREES/S',/,¢
I     ¬* ' CONSTANT VELOCITY ALONG      ¢
I     ¬TRAJECTORY: ',F9.4, * ' DEGREES/¢
I     ¬S')                              ¢
I     ¬380 FORMAT(' CONSTANT ROTATIONAL¢
I     ¬SPEED: ',F9.4, * ' DEGREES/S,    ¢
I     ¬ANGLE < ',F8.4,' DEGREES',/, * '¢
I     ¬CONSTANT VELOCITY ALONG          ¢
I     ¬TRAJECTORY: ',F9.4, * ' DEGREES/¢
I     ¬S ANGLE > ',F8.4,' DEGREES')     ¢
I     ¬390 FORMAT(' PROBABILITY OF      ¢
I     ¬FALSE ALARM: ',E13.4,/, * ' CNR ¢
I     ¬EXPECTED RANGE: ',F8.4,' DB', * ¢
I     ¬-HZ = ',F8.4,' DB-HZ',/, * '     ¢
I     ¬INTEGRATION TIME: ',F8.4,' MS',/¢
I     ¬ * ' IF FILTER BANDWIDTH: ',F8.4¢
I     ¬' MHZ',/, * ' INSERTION LOSS: ',¢
I     ¬F8.4,' DB',/, * ' OTHER LOSSES: ¢
I     ¬,F8.4,' DB')                     ¢
I     ¬400 FORMAT(' ',/,' NUMBER OF     ¢
I     ¬CELLS: ',I4,/)                   ¢
I     ¬405 FORMAT(' ',14X,'CENTERS',38X¢
I     ¬'CENTERS',28X,'TIME',/,' ',7X, *¢
I     ¬'CARTESIAN COORDINATES',26X,'    ¢
I     ¬POLAR COORDINATES', * 21X,'      ¢
I     ¬INSTANTS',/,' ',13X,'(RADIANS)',¢
I     ¬36X,'(RADIANS)',25X, * '(SECONDS¢
I     ¬',/)                             ¢
I     ¬410 FORMAT(' ',/,2(' ',F15.7,3X,¢
I     ¬F15.7,10X),E15.7)                ¢
I     ¬420 FORMAT(' ',///,' (XIDRSS,    ¢
I     ¬YIDRSS) = (',E13.7,',',E13.7, * ¢
I     ¬ ) IN THE ',I3,'TH CELL')        ¢
I     ¬430 FORMAT(' ',///,' (NORMAL     ¢
I     ¬SCANNING) DETECTED IN THE ',I3, ¢
I     ¬ 'TH CELL')                      ¢
I     ¬440 FORMAT(' ',///,' (SIDELOBE   ¢
I     ¬VARIATION ) DETECTED IN THE ',I3¢
I     ¬ * 'TH CELL')                    ¢
I     ¬450 FORMAT(' ',///,' THE         ¢
I     ¬SATELLITE WAS MISSED: ',E17.7,' ¢
I     ¬SECONDS')                        ¢
I     ¬460 FORMAT(' ',/,' CARRIER-TO-   ¢
I     ¬NOISE RATIO: ',15X,E15.7, * ' DB¢
I     ¬HZ')                             ¢
I     ¬470 FORMAT(' ',///,' NUMBER OF   ¢
I     ¬SATELLITE POSITIONS GENERATED:',¢
I     ¬I12,/, * ' STANDARD DEVIATION: '¢
I     ¬29X,E13.7)                       ¢
I     ¬480 FORMAT(' ACQUISITION AVERAGE¢
I     ¬TIME: ',20X,E15.7,' S',/, * '    ¢
I     ¬STANDARD DEVIATION: ',10X,E15.7,¢
I     ¬ S',/, * ' PROBABILITY OF        ¢
I     ¬DETECTION: ',10X,E15.7,/, * '    ¢
I     ¬PROBABILITY OF DETECTION (SL.    ¢
I     ¬VAR.): ',10X,E15.7,/, * '        ¢
I     ¬PROBABILITY OF MISS: ',10X,E15.7¢
I     ¬/, * ' PROBABILITY OF FALSE      ¢
I     ¬ALARM (IN THE SIMULATION): ',E15¢
I     ¬7)                               ¢
I     ¬490 FORMAT(' ',/,' THRESHOLDS:   ¢
I     ¬TH1 = ',F10.7,5X,'TH2 = ',F10.7)¢
I     ¬500 FORMAT(' ',/,' (INIG) HOW    ¢
I     ¬MANY RESULTS DO YOU WANT TO SEE ¢
I     ¬IN ', * 'DETAILS?')              ¢
I     ¬510 FORMAT(' ',/' NUMBER OF      ¢
```

```
I    ¬510 FORMAT(' ',/' NUMBER OF        ¢
I    ¬SIDELOBE CELLS:',I4,/, * ' TIME ¢
I    ¬INTERVAL TO GO FROM A CELL TO   ¢
I    ¬THE NEXT ONE IN' * ' THE        ¢
I    ¬SIDELOBE PATH:',E13.7,' SECONDS'¢
I    ¬//,' ',10X, * 'CENTERS',/,' ',7X¢
I    ¬'CARTESIAN COORDINATES',/,' ',  ¢
I    ¬13X, * '(RADIANS)',/)           ¢
I    ¬520 FORMAT((' ',E15.7,5X,F15.7))¢
I    ¬530 FORMAT(' ',/,' (INTG) 0 -   ¢
I    ¬SATELLITE POSITIONS ARE ENTERED'¢
I    ¬ * ' AS INPUT DATA',/, * ' 1 -  ¢
I    ¬SATELLITE POSITIONS ARE         ¢
I    ¬INTERNALLY', * ' GENERATED')    ¢
I    ¬540 FORMAT(' ',/,' (REAL)       ¢
I    ¬STANDARD DEVIATION VALUES: (    ¢
I    ¬MINIMUM,', * ' MAXIMUM,         ¢
I    ¬INCREMENT.GE.0.) IN DEGREES')   ¢
I    ¬550 FORMAT(' ',/,' ENTER        ¢
I    ¬SATELLITE POSITION (CARTESIAN', ¢
I    ¬ ' COORDINATES)',/, * ' (REAL)' (¢
I    ¬XTORSS,YTORSS)')                ¢
I    ¬560 FORMAT(' ',/' ***ERROR***',/¢
I    ¬ * ' THE POSITION GENERATED FOR ¢
I    ¬THE SATELLITE IS', * ' OUTSIDE  ¢
I    ¬THE UNCERTAINTY REGION')        ¢
I    ¬570 FORMAT(' ',/,' THE SATELLITE¢
I    ¬IS OUTSIDE THE UNCERTAINTY', * '¢
I    ¬REGION',/,' *ENTER NEW SATELLITE¢
I    ¬POSITION*')                     ¢
I    ¬580 FORMAT(' ',///,' IF YOU ARE ¢
I    ¬ON-LINE, PLEASE TYPE 1')        ¢
I    ¬590 FORMAT(' *** ON-LINE ***',//¢
I    ¬)                               ¢
I    ¬600 FORMAT(' *** BATCH ***',///)¢
I    ¬610 FORMAT(' ',/,' (INTG) NUMBER¢
I    ¬OF NOISE SAMPLES (EVEN', * ' 1<(¢
I    ¬)<20 )')                        ¢
I    ¬620 FORMAT(' MAXIMUM SCANNING   ¢
I    ¬TIME =',E13.7, ' SECONDS',/)    ¢
I    ¬630 FORMAT(' ',/,' THE SATELLITE¢
I    ¬WAS GENERATED IN THE ',I3, * 'TH¢
I    ¬CELL AND DETECTED IN THE ',I3,' ¢
I    ¬TH', * ' IN',F15.7,' SECONDS',/,¢
I    ¬* ' ***FALSE ALARM***',/)       ¢
I    ¬640 FORMAT(' ',/, *' (REAL)     ¢
I    ¬OVERLAP ( X )')                 ¢
I    ¬650 FORMAT(' DISTANCE (SATELLITE¢
I    ¬BORESIGHT) = ',E13.7,'%', * ' OF¢
I    ¬DISTANCE BETWEEN BORESIGHT AND  ¢
I    ¬FIRST SIDELOBE',/,' ', * 13X,'  ¢
I    ¬ACQUISITION TIME = ',F13.7,'    ¢
I    ¬SECONDS')                       ¢
I    ¬660 FORMAT(' DISTANCE (SATELLITE¢
I    ¬BORESIGHT) = ',E13.7,'%', * ' OF¢
I    ¬DISTANCE BETWEEN BORESIGHT AND  ¢
I    ¬FIRST NULL',/,' ',13X, * '      ¢
I    ¬ACQUISITION TIME = ',F13.7,'    ¢
I    ¬SECONDS')                       ¢
I    ¬670 FORMAT(' ',/,' NUMBER OF    ¢
I    ¬NEARBY CELLS:',I4,/, * ' TIME   ¢
I    ¬INTERVAL TO GO FROM A CELL TO   ¢
I    ¬THE NEXT ONE IN', * ' THE NEARBY¢
I    ¬PATH:',F13.7,' SECONDS',//,' ', ¢
I    ¬10X, * 'CENTERS',/,' ',7X,'     ¢
I    ¬CARTESIAN COORDINATES',/,' ',13X¢
I    ¬ * '(RADIANS)',/)               ¢
```


ORIGINAL PAGE IS OF POOR QUALITY

```
           I      * '(RADIANS)',/)
           I
           I
 /''''''''''''''''''''''
 '        RETURN       '
 '.....................'/
```

```
@ISD*UTIL.FORFLO KUACQ.SLCELL
FLOWCHARTED BY  FORFLO /XA08/ ON 10 NOV 77 AT 15:15:32
```

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ORIGINAL PAGE IS
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```
***********************************************
 I   SUBROUTINE SLCELL(KSL,THB,OVLAP,VANG,    /
 I  XSL,YSL,NSL,DTSL,NSLDIM)                 /
 I.........................................../
                       I
                       I---- ..................................
                       I     ..................................
                       I     ....
                       I     - PURPOSE
                       I     - DETERMINE NUMBER AND POSITION
                       I     -OF SIDELOBE OR NEARBY CELLS
                       I     - WHEN THE ANTENNA IS POINTING TO
                       I     -THE ORIGIN (ICELL=0)
                       I
                       I---- INPUT PARAMETERS
                       I     - KSL - SELECTS SIDELOB(=1) OR
                       I     -NEARBY(=0) CELLS
                       I     - THB - BEAMWIDTH RADIUS (RADIANS
                       I     - OVLAP - OVERLAP (%)
                       I     - VANG - ANGULAR VELOCITY (
                       I     -RADIANS/S)
                       I     - NSLDIM - DIMENSION OF VECTORS
                       I     -XSL AND YSL IN THE CALLING
                       I
                       I---- OUTPUT PARAMETERS
                       I     - NSL - NUMBER OF SIDELOBE CELLS
                       I     - (XSL,YSL) - VECTORS WITH THE
                       I     -CENTERS OF THESE SIDELOBE CELLS
                       I     - WHEN THE ANTENNA IS POINTING TO
                       I     -THE ORIGIN
                       I     - DTSL - TIME INTERVAL TO GO FROM
                       I     -ONE SIDELOBE CELL TO THE
                       I
                       I---- ..................................
                       I     ..................................
                       I     ....
                       I
                       I
***********************************************
*         DIMENSION XSL(1),YSL(1)              *
*            PI=ATAN(1.)*4.                    *
*          D=2.*THB*(1.-OVLAP)                 *
***********************************************
                       I
                       I
/'''''''''''''''''''''''''''''''''''''''''''''  TRUE
<          IF(KSL.EQ.1) GO TO 5              >----------------------------------------0
 \............................................/                                        Z
                       I  FALSE                                                        Z
                       I                                                               Z
                       I                                                               Z
***********************************************                                        Z
*                NSL=6                         *                                       Z
*               XSL(1)=D                       *                                       Z
*               YSL(1)=0.                      *                                       Z
*          XSL(2)=D*SIN(PI/3.)                 *                                       Z
*          YSL(2)=D*COS(PI/3.)                 *                                       Z
*            XSL(3)=-XSL(2)                    *                                       Z
*            YSL(3)=YSL(2)                     *                                       Z
*              XSL(4)=-D                       *                                       Z
*              YSL(4)=0.                       *                                       Z
```

```
      YSL(4)=0.
      XSL(5)=-XSL(2)
      YSL(5)=-YSL(2)
      XSL(6)=XSL(2)
      YSL(6)=-YSL(2)
      DTSL=PI/(3.*VANG)

      GO TO 80

 50   CALL ANTNNA(0,THSL,GAIN)

      I=1
      XSL(I)=-THSL
      YSL(I)=0.
      ARG1=-PI

 10   ALPHA=(THSL*THSL+XSL(I)*XSL(I)+YSL(I)*
     YSL(I)-D*D)/2.

      IF(XSL(I).EQ.0.) GO TO 20          TRUE
                                         FALSE
      IF(YSL(I).EQ.0.) GO TO 30          TRUE
                                         FALSE
      A=1.+(XSL(I)/YSL(I))**2.
      B=-2.*XSL(I)*ALPHA/(YSL(I)*YSL(I))
      C=(ALPHA/YSL(I))**2.-THSL*THSL
      DELTA=SQRT(B*B-4.*A*C)
      X=(-B+DELTA)/(2.*A)
      Y=(ALPHA-XSL(I)*X)/YSL(I)
      ARG=ATAN2(Y,X)

      IF(ARG.GT.ARG1) GO TO 40           TRUE
                                         FALSE
      X=(-B-DELTA)/(2.*A)
```

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OF POOR QUALITY

```
Y=(-B-DELTA)/(2.*A)
Y=(ALPHA-XSL(I)*X)/YSL(I)
ARG=ATAN2(Y,X)

GO TO 40

200
Y=ALPHA/YSL(I)
X=-YSL(I)/ABS(YSL(I))*SQRT(THSL*THSL-(
ALPHA/YSL(I))**2.)
ARG=ATAN2(Y,X)

GO TO 40

300
X=ALPHA/XSL(I)
Y=XSL(I)/ABS(XSL(I))*SQRT(THSL*THSL-(
ALPHA/XSL(I))**2.)
ARG=ATAN2(Y,X)

400
IF(ARG.GT.PI-ATAN(2.*(HH/THSL)) GO TO 50        TRUE
FALSE

I=I+1

IF(I.GT.NSLDIM) GO TO 60        TRUE
FALSE

XSL(I)=X
YSL(I)=Y
ARG1=ARG

GO TO 10
```

```
                    0<-------------------------------------------------------------------0   X
*   50¢             I                                                              $     X
                                                                                   $     X
   ************************************************                                $     X
   *                NSL=1                         *                                $     X
   *       DTHL=(ARG-ARG1)/VANG                   *                                $     X
   ************************************************                                $     X
                    I                                                              $     X
                    I                                                              $     X
            /''''''''''''''''''''''''|                                             $     X
           '        RETURN            '                                            $     X
            '.......................'/                                             $     X
                                                                                   $     X
                                                                                   $     X
                    0<-------------------------------------------------------------0     X
*   60¢             I                                                                    X
   /''''''''''''''''''''''''''''''''''''''''''''''''/                                    X
  /          PRINT 70,NSLDIM                     /                                       X
 /................................................/                                      X
                    I                                                                    X
                    I----70 FORMAT(' YOU HAVE EXCEEDED    ¢                              X
                    I    -THE MAXIMUM NUMBER OF SIDELOBE' ¢                              X
                    I    -CELLS',/ * ' ***CHECK IF YOU ARE¢                              X
                    I    -ENTERING THE RIGHT VALUE FOR', *¢                              X
                    I    -' BEAMWIDTH***')                ¢                              X
                    I                                                                    X
                    0<-----------------------------------------------------------------------0
    80¢             I
            /''''''''''''''''''''''''|
           '        RETURN            '
            '.......................'/
```

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```
@ISN*UTIL.FORFLO KUACQ.SPOSTN
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:16:23
```

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SPOSIN   FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:17:22

```
      SUBROUTINE SPOSIN(K)
                    I
                    I
                    I==== ¬ PURPOSE
                    I     ¬ DETERMINE THE (K+1)TH CELL
                    I     ¬CENTER FOR THE SQUARE TYPE OF
                    I     ¬ TRAJECTORY
                    I
                    I==== INPUT PARAMETERS
                    I     ¬ K = CELL NUMBER - 1
                    I     ¬ ELI,AZI = ELEVATION AND AZIMUTH
                    I     ¬OF PREVIOUS CELL (COMM
                    I     ¬ THB = RADIUS OF ANTENNA
                    I     ¬MAINLOBE (COMMON)
                    I     ¬ XI,YI = CARTESIAN COORDINATES
                    I     ¬OF PREVIOUS CELL (COMMON)
                    I
                    I==== OUTPUT PARAMETERS
                    I     ¬ ELO,AZO = ELEVATION AND AZIMUTH
                    I     ¬OF FOLLOWING CELL (COMMON)
                    I     ¬ XO,YO = CARTESIAN COORDINATES
                    I     ¬OF FOLLOWING CELL (COMMON)
                    I
                    I
 COMMON/CPOS/ELI,AZI,ELO,AZO,DELT,THB,D,
 PI,TI,TO
                    I
                    I==== PRINT 113
                    I     ¬113 FORMAT(' SPOSIN')
                    I
                FA=PI/D
                    I
                    I
<          IF(K.GT.1) GO TO 2            >  TRUE -------------------0
                    I  FALSE                                        Z
                    I                                               Z
                    I                                               Z
                ELM1=THB                                            Z
                AZM1=FA*(THB-D)                                     Z
                ELO=THB-0.9*D                                       Z
                    I                                               Z
                    0<------------------------------------------0   Z
 ¬    47            I                                           X   Z
                                                                X   Z
         A=2.*ELM1*COS(FA*ELO-AZM1)                             X   Z
```

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```
        :          A=2.*ELM1*COS(FA*FLO-AZM1)          :                                                   X   Z
        :                 TS=ELO-A                     :                                                   X   Z
        :..............................................:                                                   X   Z
                               I                                                                           X   Z
                               I                                                                           X   Z
        /''''''''''''''''''''''''''''''''''''''''''''''|  TRUE                                             X   Z
       <        IF(ABS(TS).LT.1.E-6) GO TO 3             >---------------------------------------------0   X   Z
        :................................................/                                              U   X   Z
                               I  FALSE                                                                U   X   Z
                               I                                                                       U   X   Z
                               I                                                                       U   X   Z
        ................................................                                               U   X   Z
        :                FLO=A+TS*0.9                  :                                               U   X   Z
        :..............................................:                                               U   X   Z
                               I                                                                       U   X   Z
                               I                                                                       U   X   Z
                     /''''''''''''''''''''|                                                            U   X   Z
                     :      GO TO 4        :-------------------------------------------------------------------0   Z
                     :..................../                                                            U       Z
                                                                                                       U       Z
                                                                                                       U       Z
                               0<----------------------------------------------------------------------0       Z
           3@                  I                                                                               Z
        ................................................                                                       Z
        :                 AZ0=ELO*FA                   :                                                       Z
        :           DELT=(AZ0-AZM1)*0.3                :                                                       Z
        :..............................................:                                                       Z
                               I                                                                               Z
                               I                                                                               Z
                     /''''''''''''''''''''|                                                                    Z
                     :       RETURN        :                                                                   Z
                     :..................../                                                                    Z
                                                                                                               Z
                               0<------------------------------------------------------------------------------0
           2@                  I
        ................................................
        :                   A=ELI                      :
        :                   B=AZI                      :
        :              GUSS=AZI+DELT                   :
        :..............................................:
                               I
                               I
        ................................................
        : : CALL ITP(A,B,AZM,GUSS,THB,D,PI,1)        : :
        :.:..........................................:.:
                               I
                               I
        ................................................
        :              GUSS=2.*AZM-AZI                 :
        :                   B=AZM                      :
        :                 A=B/FA+D                     :
        :..............................................:
                               I
                               I
        ................................................
        : : CALL ITP(A,B,AZJ,GUSS,THB,D,PI,2)        : :
        :.:..........................................:.:
                               I
                               I
        ................................................
        :                DELT=AZ0-B                    :
        :                FLO=AZJ/FA                    :
        :..............................................:
                               I
                               I
                     ''''''''''''''''''''''
```

RETURN

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```
@ISD*HTTL,FORFLO KUACO,TCENTR
FLOWCHARTED BY  FORFLO /XR0A/ ON 10 NOV 77 AT 15:17:29
```

```
*********************************************
 /   SUBROUTINE TCENTR(KSCAN,MOTION,VANG,    /
/    VLIN,D2,SWTCH)                          /
/********************************************/
                    I
                    I---* . . . . . . . . . . . . . . . . .C
                    I    *. . . . . . . . . . . . . . . . . C
                    I    * PURPOSE                         C
                    I    * DETERMINE THE TIME INSTANT THE  C
                    I    *CENTER (ELO,AZO) IS ACHIEVED     C
                    I
                    I---* INPUT PARAMETERS                 C
                    I    * KSCAN = TYPE OF TRAJECTORY      C
                    I
                    I---* MOTION = TYPE OF ANTENNA MOTIONC
                    I    * 1 = CONSTANT ANGULAR VELOCITY   C
                    I    * 2 = CONTANT VELOCITY ALONG      C
                    I    *TRAJECTORY                       C
                    I    * 3 = COMBINATION OF *1* AND *2**C
                    I    * VANG = ANGULAR VELOCITY (       C
                    I    *RADIANS/S)                       C
                    I    * VLIN = LINEAR VELOCITY ALONG    C
                    I    *TRAJECTORY (RADIANS/S)           C
                    I    * D2 = DISTANCE BETWEEN           C
                    I    *SUCESSIVE CENTERS                C
                    I    * SWTCH = SWITCHING ANGLE (IN     C
                    I    *RADIANS) FROM *MOTION=1* TO      C
                    I
                    I---* OUTPUT PARAMETER                 C
                    I    * TO = INSTANT OF TIME A GIVEN    C
                    I    *CENTER IS ACHIEVED (COMMON)      C
                    I    * . . . . . . . . . . . . . . . . C
                    I    *. . . . . . . . . . . . . . . . .C
                    I
                    I
*********************************************
: COMMON/CPOS/ELI,AZI,ELO,AZO,DELTAZ,THB,D,  :
: PI,TI,TO                                    :
:         COMMON/CARTS/XI,YI,XO,YO            :
:             TO=AZO/VANG                     :
:.............................................:
                    I
                    I
/''''''''''''''''''''''''''''''''''''''''''''\  FALSE
<          IF(MOTION.EQ.1)                    >------------I
\............................................../           I
                    I   TRUE                               I
                    I                                      I
        /''''''''''''''''''''\                             I
        :      RETURN         :                            I
        \...................../                            I
                                                           I
                    0<-------------------------------------
                    I
*********************************************
:            XKS=D2/(8.*ATAN(1.))             :
:              XKS2=XKS*XKS                   :
:.............................................:
                    I
```

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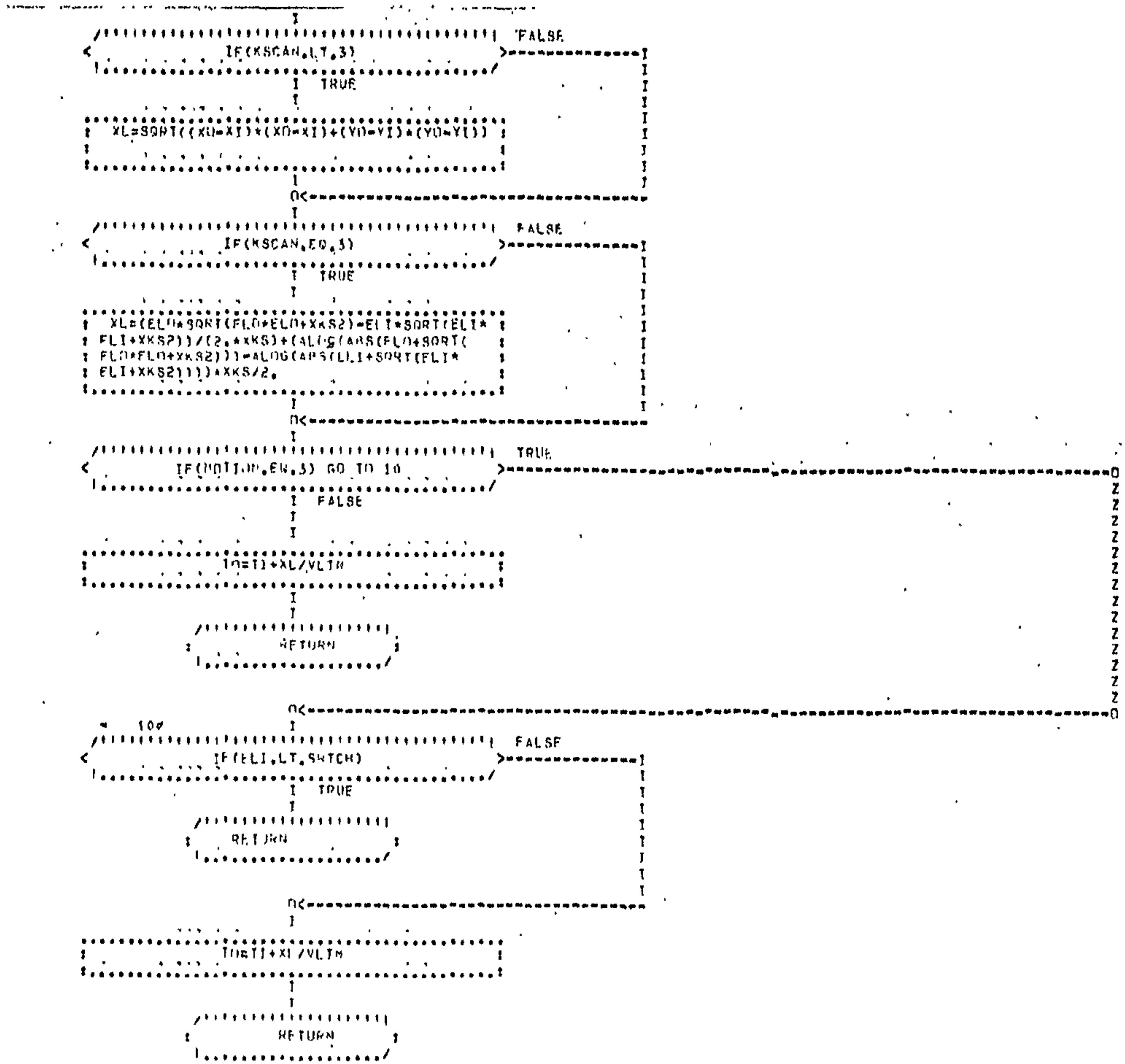
IF(KSCAN.LT.3)
FALSE
TRUE
XL=SQRT((XO-XI)*(XO-XI)+(YO-YI)*(YO-YI))
IF(KSCAN.EQ.3)
FALSE
TRUE
XL=(ELO*SQRT(ELO*ELO+XKS2)-ELI*SQRT(ELI*
ELI+XKS2))/(2.*XKS)+(ALOG(ABS(ELO+SQRT(
ELO*ELO+XKS2)))-ALOG(ABS(ELI+SQRT(ELI*
ELI+XKS2))))*XKS/2.
IF(MOTION.EQ.3) GO TO 10
TRUE
FALSE
TO=TI+XL/VLIN
RETURN
10
IF(ELI.LT.SWTCH)
FALSE
TRUE
RETURN
TO=TI+XL/VLIN
RETURN

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```
@ISD*UTIL.FORFLO KUACQ.YORS

PREPRM ERR=PFS$ ERR RETURN

ERROR FROM  FURFLO  =   PREPRM

FORFLO     025416          025510              15:18:18.         11/10/77          110A TIME-SHARING  EXEC

X REG
000000   004200025462   000000000000   000000000000   230026214111   400000000000   030026214103   230025375400   230025164700
000010   777777777760   030054721200   777777002472   001106025425   000305045105   000001025337   000000000001   000000000001

A REG
000014   000305045105   000001025337   000000000001   000000000001   000000000007   000000000001   000000000030   000000002522
000024   260641000011   040067000050   532531162162   005530002122   000471000000   000000000000   000000000000   000003000000
000034   300022000604   030042002400

R REG
000100   000000000000   000000000000   252712252722   000001050630   000200000000   000020400001   000000000000   200100730061
000110   000000000000   000200000000   000023000000   000023000000   000023000000   000000000000   000100000024   000000000000
```

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```
@ISD*UTIL.FORFLO KUACO,THITH2
FLOWCHARTED BY  FORFLO /X80B/ ON 10 NOV 77 AT 15:19:10
```

```
*************************************************
!   SUBROUTINE TH1TH2(CNR1,CNR2,PFA,BIF,        /
!  FLOSS,OTHERL,NSAMPL,TH1,TH2)                /
 !........................................./
                          I
                          I===* . . . . . . . . . . . . . . . . .C
                          I    *. . . . . . . . . . . . . . . . .C
                          I    * PURPOSE                          C
                          I    * DETERMINE THRESHOLDS TH1 AND     C
                          I    *TH2 FOR A GIVEN PROBABILITY       C
                          I    * OF FALSE ALARM                   C
                          I
                          I===* INPUT PARAMETERS                  C
                          I    * CNR1 - CNR2 - CARRIER-TO-NOISE   C
                          I    *DYNAMIC RANGE (DB)                C
                          I    * PFA - PROBABILITY OF FALSE       C
                          I    *ALARM                             C
                          I    * BIF - IF FILTER BANDWIDTH        C
                          I    * FLOSS - FILTER INSERTION LOSS (  C
                          I    *DB)                               C
                          I    * OTHERL - OTHER LOSSES (DB)       C
                          I    * NSAMPL - NUMBER OF SAMPLES       C
                          I
                          I===* OUTPUT PARAMETERS                 C
                          I    * TH1 - NORMAL PATH SCANNING       C
                          I    *THRESHOLD                         C
                          I    * TH2 - SIDELOBE CELLS SCANNING    C
                          I    *THRESHOLD                         C
                          I    * . . . . . . . . . . . . . . . . .C
                          I    *. . . . . . . . . . . . . . . . .C
                          I
                          I
*************************************************
! COMMON/SIGMA/SIGMAN,POT,SIGN2,DUM1,DUM2      !
!...............................................!
                          I
                          I===* PRINT 113
                          I    *113 FORMAT(' TH1TH2')
                          I
                          I
*************************************************
!                 S2=SQRT(2.)                   !
!...............................................!
                          I
                          I
*************************************************
! !         CALL ANTPNA(0,ARG,GSLP)           ! !
!.!...........................................!.!
                          I
                          I
*************************************************
!               GSLB=GSLP*GSLB                  !
! SNRDB1=CNR1-10.*ALOG10(BIF*1.E+6)-FLOSS-      !
! OTHERL                                        !
!          SNRDB2=CNR2+SNRDB1-CNR1              !
!                 SIGMAN=1.                     !
!                  SIGN2=1.                     !
!        POT1=SIGN2*10.**(SNRDB1/10.)           !
!        POT2=SIGN2*10.**(SNRDB2/10.)           !
!            RO1=POT1*GSLB/SIGN2                !
!            RO2=POT2*GSLB/SIGN2                !
```

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ORIGINAL PAGE IS
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(40)

```
          RO2=POT2*GSLB/SIGN2
             PFA2=PFA*2.
                     I
                     I
         CALL MERFCI(PFA2,X,IER)
                     I
                     I---- DETERMINING THRESHOLD TH1 SUCH
                     I     -THAT FOR THE WORST CONDITION
                     I     - (CNR HAS ITS LOWEST VALUE) THE
                     I     -PROBABILITY OF FALSE ALARM
                     I     - IS .LT.PFA
                     I
                     I
     SIGZ=SQRT(NSAMPL*(1.+2.*RO1))
          AVRZ=NSAMPL*(1.+RO1)
   TH1=(S2*SIGZ*X+AVRZ)*SIGN2/NSAMPL
                     I
                     I
       CALL ANTNUA(-1,ARG,G3SLB)
                     I
                     I
          G3SLB=G3SLB*G3SLB
          P3SLB=POT2*G3SLB
           RO3=P3SLB/SIGN2
     RECPOW=P3SLB+SIGN2*(1.+RO3)
              ICHANG=0
                     I
                     I
                                          TRUE
<     IF(RECPOW.LT.TH1) GO TO 10       >------------------------------0
                     I  FALSE                                          Z
                     I                                                 Z
                     I                                                 Z
              ICHANG=1                                                 Z
                     I                                                 Z
                     I                                                 Z
                                          FALSE                        Z
<          IF(PFA.LT.0.1)              >-------------I                 Z
                     I  TRUE                        I                  Z
                     I                              I                  Z
/          PRINT 20,CNR2              /             I                  Z
                     I                              I                  Z
                     0<-----------------------------                   Z
                     I                                                 Z
                                          FALSE                        Z
<          IF(PFA.LT.0.1)              >-------------I                 Z
                     I  TRUE                        I                  Z
                     I                              I                  Z
              PFA2=0.2                              I                  Z
```

```
SIGZ=SQRT(NSAMPL*(1.+2.*RO3))
AVRZ=NSAMPL*(1+RO3)

CALL MERFCI(PFA2,XMOD,IER)

TH1=(S2*SIGZ*XMOD+AVRZ)*SIGN2/NSAMPL

---- DETERMINING THRESHOLD TH2 SUCH  C
     THAT FOR THE BEST CONDITION      C
      (CNR HAS ITS HIGHEST VALUES)    C
     THE PROBABILITY OF FALSE ALARM   C
      (DUE TO SIDELOBE DETECTION) IS  C
     .LT. PFA                         C

10C

SIGZ=SQRT(NSAMPL*(1.+2.*RO2))
AVRZ=NSAMPL*(1.+RO2)
TH2=(S2*SIGZ*X+AVRZ)*SIGN2/NSAMPL

IF((ICHANG.EQ.1).AND.(PFA.LT.0.1))    FALSE
TRUE

PFA=0.1

----20 FORMAT(' ',//, * ' THE
     PROBABILITY OF FALSE ALARM WAS
     RAISED TO 0.1 TO', * ' AVOID
     SECOND SIDELOBE DETECTION',/, *
      WHEN CNR =',F6.2,' DB/HZ',//)

RETURN
```

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ORIGINAL PAGE IS
OF POOR QUALITY

```
@ISD*UTIL.FORFLO KUACR.UNIFOR
FLOWCHARTED BY  FORFLO /X808/ ON 10 NOV 77 AT 15:20:34
```

FLOWCHARTED BY FORFLO /X808/ ON 10 NOV 77 AT 15:20:51

```
SUBROUTINE UNIFOR(S,X1,X2)

* PURPOSE
* GENERATE TWO UNIFORMLY
*DISTRIBUTED RANDOM NUMBERS IN
* THE INTERVAL (0,1)

DOUBLE PRECISION C1,C2,C3,X,TX
COMMON/C1C2C3/C1,C2,C3
X=C3*S/C2
TX=IDINT(X)
S=C3*S-C2*TX
X1=S/C1
X=C3*S/C2
TX=IDINT(X)
S=C3*S-C2*TX
X2=S/C1

RETURN
```


ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

144

```
* * *.INFORMATION SYSTEMS DESIGN, INC.  *  3205 CORONADO DR.  *  SANTA CLARA, CA  95051  *  (408) 249-8100 . * * *  1108  1X0   * * *

PRINTED BY: HUANG          CREATED BY: HUANG         FINISHED PRINTING: 11/10/77  15:27:29        ACTUAL PAGES: 56
 USER NAME: HUANG                                               QUEUED: 11/10/77  15:20:54        INPUT DEVICE: TDN034
   ACCOUNT: 0544AA                                             CREATED: 11/10/77  15:11:34           QUEUED TO: FLS
 ON SYSTEM: A                                                PART NAME: *BK1-55-BK2*                PRINTED ON: FLS
EXEC LEVEL: 3242H-036                                         PART NO.: 02
 EXEC DATE: 10/14                                            FILE NAME: 0544AAC(1)
 IEND 15:27 HUANG  ACT PGS 56
```

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 00
ISTP 15:30 HUANG EST PGS 14

```
HH          HH     UU         UU      AAAAAAAA       NN          NN      GGGGGGGG
HH          HH     UU         UU     AAAAAAAAAA      NNN         NN     GGGGGGGGGG
HH          HH     UU         UU    AA        AA     NNNN        NN    GG        GG
HH          HH     UU         UU    AA        AA     NNN N       NN    GG        GG
HH          HH     UU         UU    AA        AA     NN NNN      NN    GG
HHHHHHHHHHHHHH     UU         UU    AAAAAAAAAAAA     NN  NNN     NN    GG
HHHHHHHHHHHHHH     UU         UU    AAAAAAAAAAAA     NN   NNN    NN    GG      GGGG
HH          HH     UU         UU    AA        AA     NN    NNN   NN    GG      GGGG
HH          HH     UU         UU    AA        AA     NN     NNNNN      GG        GG
HH          HH     UUU       UUU    AA        AA     NN      NNNN      GG        GG
HH          HH      UUUUUUUUUU      AA        AA     NN       NNN       GGGGGGGGGG
HH          HH       UUUUUUUU       AA        AA     NN        NN        GGGGGGGG
```

PRINTED BY: HUANG
USER NAME: HUANG
ACCOUNT: 0544AA
ON SYSTEM: A
EXEC LEVEL: 32R2B-036
EXEC DATE: 10/14

CREATED BY: HUANG

STARTED PRINTING: 11/10/77 15:30:46
QUEUED: 11/10/77 15:30:42
CREATED: 11/10/77 15:28:05
PART NAME: -BK1-ES-BK2-
PART NO.: 03
FILE NAME: 0544*AD(1)

ESTIMATED PAGES: 14
INPUT DEVICE: TDN034
QUEUED TO: ELS
PRINTED ON: ELS

* * * INFORMATION SYSTEMS DESIGN, INC. * 3205 CORONADO DR. * SANTA CLARA, CA 95051 * (408) 249-8100 * * * 1108 1X0 * * *

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ORIGINAL PAGE IS
OF POOR QUALITY

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890**SEQ NO. 00

```
#TPF,U KUAC9
READY

#XQT MAIN

 IF YOU ARE ON-LINE, PLEASE TYPE 1
 *** BATCH ***

 RADIUS OF UNCERTAINTY REGION:              5.0000 DEGREES
 BEAMWIDTH:                                 1.6000 DEGREES
 HEXAGONAL TRAJECTORY  :      OVERLAP =    13.3975 %
 CONSTANT ROTATIONAL SPEED:               108.0000 DEGREES/S,    ANGLE <    3.0000 DEGREES
 CONSTANT VELOCITY ALONG TRAJECTORY:        5.0400 DEGREES/S     ANGLE >    3.0000 DEGREES
 PROBABILITY OF FALSE ALARM:                 .1000-03
 CNR EXPECTED RANGE:                       60.0000 DB-HZ  -  80.0000 DB-HZ
 INTEGRATION TIME:                          5.0000 MS
 IF FILTER BANDWIDTH:                       6.0000 KHZ
 INSERTION LOSS:                            1.5000 DB
 OTHER LOSSES:                               .0000 DB

 THE PROBABILITY OF FALSE ALARM WAS RAISED TO 0.1 TO AVOID SECOND SIDELOBE DETECTION
 WHEN CNR = 80.00 DB/HZ

 THRESHOLDS:   TH1 =  1.0568141     TH2 =  1.2319816

 NUMBER OF CELLS:   91

 MAXIMUM SCANNING TIME =  .2638802+02 SECONDS
```

CENTERS CARTESIAN COORDINATES (RADIANS)		CENTERS POLAR COORDINATES (RADIANS)		TIME INSTANTS (SECONDS)
.0000000	.0000000	.0000000	.0000000	.0000000
.1209200-01	.2094395-01	.2418399-01	.1047198+01	.5555556+00
-.1209200-01	.2094395-01	.2418399-01	.2094395+01	.1111111+01
-.2418399-01	-.6727535-09	.2418399-01	.3141593+01	.1666667+01
-.1209199-01	-.2094395-01	.2418399-01	.4188790+01	.2222222+01
.1209200-01	-.2094395-01	.2418399-01	.5235988+01	.2777778+01
.2418399-01	-.9597113-10	.2418399-01	.6283185+01	.3333333+01
.3627599-01	.2094395-01	.4188790-01	.6806784+01	.3611111+01
.2418399-01	.4188790-01	.4836798-01	.7330383+01	.3888889+01
.3328675-09	.4188790-01	.4188790-01	.7853982+01	.4166667+01
-.2418398-01	.4188790-01	.4836798-01	.8377580+01	.4444444+01
-.3627598-01	.2094395-01	.4188789-01	.8901179+01	.4722222+01
-.4836797-01	.4612347-08	.4836797-01	.9424778+01	.5000000+01
-.3627598-01	-.2094395-01	.4188789-01	.9948377+01	.5277778+01

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-.2418398-01	-.4188790-01	.4836797-01	.1047198+02	.5555556+01
.1281585-07	-.4188790-01	.4188790-01	.1099557+02	.5833334+01
.2418400-01	-.4188790-01	.4836799-01	.1151917+02	.6111111+01
.3627599-01	-.2094395-01	.4188791-01	.1204277+02	.6388889+01
.4836799-01	-.3838846-09	.4836799-01	.1256637+02	.6666667+01
.6045998-01	.2094395-01	.6398483-01	.1289984+02	.6843580+01
.4836799-01	.4188790-01	.6398483-01	.1328009+02	.7118290+01
.3627600-01	.6283180-01	.7255197-01	.1361357+02	.7393001+01
.1209201-01	.6283184-01	.6398482-01	.1394704+02	.7667711+01
-.1209197-01	.6283184-01	.6398481-01	.1432729+02	.7942422+01
-.3627596-01	.6283185-01	.7255195-01	.1466077+02	.8217133+01
-.4836795-01	.4188790-01	.6398480-01	.1499424+02	.8491843+01
-.6045994-01	.2094396-01	.6398479-01	.1537449+02	.8766554+01
-.7255193-01	.1153086-07	.7255193-01	.1570796+02	.9041264+01
-.6045990-01	-.2094394-01	.6398478-01	.1604144+02	.9315975+01
-.4836794-01	-.4188788-01	.6398479-01	.1642169+02	.9590685+01
-.3627595-01	-.6283183-01	.7255194-01	.1675516+02	.9865396+01
-.1209197-01	-.6283183-01	.6398480-01	.1708863+02	.1014011+02
.1209201-01	-.6283183-01	.6398480-01	.1746889+02	.1041482+02
.3627599-01	-.6283183-01	.7255196-01	.1780236+02	.1068953+02
.4836799-01	-.4188768-01	.6398482-01	.1813583+02	.1096424+02
.6045994-01	-.2094393-01	.6398482-01	.1851608+02	.1123895+02
.7255197-01	.3460694-08	.7255197-01	.1884956+02	.1151366+02
.8464397-01	.2094394-01	.8719662-01	.1909212+02	.1178837+02
.7255198-01	.4188788-01	.8377580-01	.1937315+02	.1206308+02
.6046000-01	.6283181-01	.8719661-01	.1965419+02	.1233779+02
.4836802-01	.8377575-01	.9673594-01	.1989675+02	.1261250+02
.2418405-01	.8377575-01	.8719658-01	.2013932+02	.1288721+02
.6220991-07	.8377575-01	.8377575-01	.2042035+02	.1316192+02
-.2418391-01	.8377575-01	.8719655-01	.2070139+02	.1343663+02
-.4836789-01	.8377576-01	.9673588-01	.2094395+02	.1371134+02
-.6045986-01	.6283183-01	.8719652-01	.2118651+02	.1398605+02
-.7255185-01	.4188790-01	.8377569-01	.2146755+02	.1426076+02
-.8464384-01	.2094396-01	.8719649-01	.2174858+02	.1453547+02
-.9673583-01	.3305607-07	.9673583-01	.2199115+02	.1481018+02
-.8464384-01	-.2094390-01	.8719648-01	.2223371+02	.15 8489+02
-.7255185-01	-.4188783-01	.8377566-01	.2251475+02	.1535960+02
-.6045987-01	-.6283178-01	.8719649-01	.2279578+02	.1563432+02
-.4836789-01	-.8377571-01	.9673584-01	.2303835+02	.1590903+02
-.2418392-01	-.8377571-01	.8719651-01	.2328091+02	.1618374+02
.6401613-07	-.8377571-01	.8377571-01	.2356195+02	.1645845+02
.2418404-01	-.8377571-01	.8719655-01	.2384298+02	.1673316+02
.4836801-01	-.8377572-01	.9673591-01	.2408554+02	.1700787+02
.6046000-01	-.6283178-01	.8719658-01	.2432811+02	.1728258+02
.7255192-01	-.4188785-01	.8377578-01	.2460914+02	.1755729+02
.8464397-01	-.2094392-01	.8719661-01	.2489018+02	.1783200+02
.9673596-01	-.1535538-08	.9673596-01	.2513274+02	.1810671+02
.1088280+00	.2094393-01	.1100250+00	.2532287+02	.1838142+02
.9673597-01	.4188786-01	.1054156+00	.2555130+02	.1865613+02
.8464400-01	.6283179-01	.1054156+00	.2577130+02	.1893084+02
.7255202-01	.8377572-01	.1100249+00	.2596961+02	.1920555+02
.6045965-01	.1047197+00	.1209199+00	.2617994+02	.1948026+02
.3627608-01	.1047196+00	.1100249+00	.2637006+02	.1975497+02
.1209212-01	.1047196+00	.1054155+00	.2658858+02	.2002968+02
-.1209185-01	.1047196+00	.1054155+00	.2681850+02	.2030439+02
-.3627581-01	.1047197+00	.1100249+00	.2703761+02	.2057910+02
-.6045977-01	.1047197+00	.1209198+00	.2722714+02	.2085381+02

-.7255173-01	.8377574-01	.1108248+00	.2741726+02	.2112852+02
-.8464371-01	.6283182-01	.1054153+00	.2763577+02	.2140323+02
-.9673569-01	.4188790-01	.1054153+00	.2786569+02	.2167794+02
-.1088277+00	.2094398-01	.1108247+00	.2808421+02	.2195265+02
-.1209197+00	.7783677-07	.1209197+00	.2827433+02	.2222736+02
-.1088277+00	-.2094380-01	.1108247+00	.2846446+02	.2250207+02
-.9673570-01	-.4188776-01	.1054153+00	.2868297+02	.2277678+02
-.8464372-01	-.6283169-01	.1054153+00	.2891289+02	.2305149+02
-.7255174-01	-.8377562-01	.1108247+00	.2913141+02	.2332620+02
-.6045978-01	-.1047196+00	.1209197+00	.2932153+02	.2360091+02
-.3627581-01	-.1047195+00	.1108247+00	.2951166+02	.2387562+02
-.1209184-01	-.1047195+00	.1054153+00	.2973017+02	.2415033+02
.1209212-01	-.1047195+00	.1054154+00	.2996009+02	.2442504+02
.3627609-01	-.1047196+00	.1108248+00	.3017860+02	.2469975+02
.6046005-01	-.1047196+00	.1209198+00	.3036873+02	.2497446+02
.7255203-01	-.8377563-01	.1108249+00	.3055886+02	.2524917+02
.8464401-01	-.6283169-01	.1054155+00	.3077737+02	.2552388+02
.9673599-01	-.4188778-01	.1054156+00	.3100729+02	.2579859+02
.1088280+00	-.2094360-01	.1108250+00	.3122580+02	.2607331+02
.1209200+00	.7688204-07	.1209200+00	.3141593+02	.2634802+02

NUMBER OF SIDELOBE CELLS: 11
TIME INTERVAL TO GO FROM A CELL TO THE NEXT ONE IN THE SIDELOBE PATH: .2916289+00 SECONDS

CENTERS
CARTESIAN COORDINATES
(RADIANS)

-.4455313-01	.0000000
-.3706045-01	-.2327624-01
-.2023235-01	-.3969025-01
.3486114-02	-.4441654-01
.2617741-01	-.3605170-01
.4115566-01	-.1706039-01
.4400756-01	.6950857-02
.3309288-01	.2691807-01
.1379180-01	.4236070-01
-.1037297-01	.4332878-01
-.3104139-01	.3152624-01

NUMBER OF NEARBY CELLS: 6.
TIME INTERVAL TO GO FROM A CELL TO THE NEXT ONE IN THE NEARBY PATH: .5555556+00 SECONDS

CENTERS
CARTESIAN COORDINATES
(RADIANS)

.2418399-01	.0000000
.2094395-01	.1209200-01
-.2094395-01	.1209200-01
-.2418399-01	.0000000
-.2094395-01	-.1209200-01
.2094395-01	-.1209200-01

(XTDASS,YTDASS) = (-.4499017-01, -.3700439-01)   IN THE 30TH CELL

START SCANNING - NORMAL PATH

CELL NO. 1	THRESHOLD = .1056814+01	RECEIVED POWER = .9994917+00	EQ. NOISE = .9994043+00	HIT = F
CELL NO. 2	THRESHOLD = .1056814+01	RECEIVED POWER = .1005874+01	EQ. NOISE = .1005685+01	HIT = F
CELL NO. 3	THRESHOLD = .1056814+01	RECEIVED POWER = .1006018+01	EQ. NOISE = .1005769+01	HIT = F
CELL NO. 4	THRESHOLD = .1056814+01	RECEIVED POWER = .9968163+00	EQ. NOISE = .9948761+00	HIT = F
CELL NO. 5	THRESHOLD = .1056814+01	RECEIVED POWER = .9951526+00	EQ. NOISE = .9945000+00	HIT = F
CELL NO. 6	THRESHOLD = .1056814+01	RECEIVED POWER = .1005116+01	EQ. NOISE = .1005084+01	HIT = F
CELL NO. 7	THRESHOLD = .1056814+01	RECEIVED POWER = .9979082+00	EQ. NOISE = .9975731+00	HIT = F
CELL NO. 8	THRESHOLD = .1056814+01	RECEIVED POWER = .1002606+01	EQ. NOISE = .1001460+01	HIT = F
CELL NO. 9	THRESHOLD = .1056814+01	RECEIVED POWER = .1005141+01	EQ. NOISE = .1004086+01	HIT = F
CELL NO. 10	THRESHOLD = .1056814+01	RECEIVED POWER = .1005301+01	EQ. NOISE = .1005281+01	HIT = F
CELL NO. 11	THRESHOLD = .1056814+01	RECEIVED POWER = .1005564+01	EQ. NOISE = .1005384+01	HIT = F
CELL NO. 12	THRESHOLD = .1056814+01	RECEIVED POWER = .1005639+01	EQ. NOISE = .1005774+01	HIT = F
CELL NO. 13	THRESHOLD = .1056814+01	RECEIVED POWER = .1004300+01	EQ. NOISE = .1003486+01	HIT = F
CELL NO. 14	THRESHOLD = .1056814+01	RECEIVED POWER = .1029137+01	EQ. NOISE = .9948032+00	HIT = F
CELL NO. 15	THRESHOLD = .1056814+01	RECEIVED POWER = .1025590+01	EQ. NOISE = .1005704+01	HIT = F
CELL NO. 16	THRESHOLD = .1056814+01	RECEIVED POWER = .9999811+00	EQ. NOISE = .9979298+00	HIT = F
CELL NO. 17	THRESHOLD = .1056814+01	RECEIVED POWER = .9986309+00	EQ. NOISE = .9982289+00	HIT = F
CELL NO. 18	THRESHOLD = .1056814+01	RECEIVED POWER = .9990988+00	EQ. NOISE = .9993782+00	HIT = F
CELL NO. 19	THRESHOLD = .1056814+01	RECEIVED POWER = .1005913+01	EQ. NOISE = .1005725+01	HIT = F
CELL NO. 20	THRESHOLD = .1056814+01	RECEIVED POWER = .9945702+00	EQ. NOISE = .9945024+00	HIT = F
CELL NO. 21	THRESHOLD = .1056814+01	RECEIVED POWER = .9982772+00	EQ. NOISE = .9942284+00	HIT = F
CELL NO. 22	THRESHOLD = .1056814+01	RECEIVED POWER = .1005370+01	EQ. NOISE = .1005278+01	HIT = F
CELL NO. 23	THRESHOLD = .1056814+01	RECEIVED POWER = .9948567+00	EQ. NOISE = .9948650+00	HIT = F
CELL NO. 24	THRESHOLD = .1056814+01	RECEIVED POWER = .1003161+01	EQ. NOISE = .1003011+01	HIT = F
CELL NO. 25	THRESHOLD = .1056814+01	RECEIVED POWER = .1003585+01	EQ. NOISE = .1003197+01	HIT = F
CELL NO. 26	THRESHOLD = .1056814+01	RECEIVED POWER = .9969551+00	EQ. NOISE = .9966450+00	HIT = F
CELL NO. 27	THRESHOLD = .1056814+01	RECEIVED POWER = .1002412+01	EQ. NOISE = .1002402+01	HIT = F
CELL NO. 28	THRESHOLD = .1056814+01	RECEIVED POWER = .1004177+01	EQ. NOISE = .1002175+01	HIT = F
CELL NO. 29	THRESHOLD = .1056814+01	RECEIVED POWER = .1022170+01	EQ. NOISE = .1005606+01	HIT = F
CELL NO. 30	THRESHOLD = .1056814+01	RECEIVED POWER = .1110832+01	EQ. NOISE = .1006012+01	HIT = T
CELL NO. 30	THRESHOLD = .1231982+01	RECEIVED POWER = .1098531+01	EQ. NOISE = .9937104+00	HIT = F

START SCANNING NEARBY CELLS

CELL NO. 1	THRESHOLD = .1231982+01	RECEIVED POWER = .1025719+01	EQ. NOISE = .1005437+01	HIT = F
CELL NO. 2	THRESHOLD = .1231982+01	RECEIVED POWER = .1036280+01	EQ. NOISE = .1005487+01	HIT = F
CELL NO. 3	THRESHOLD = .1231982+01	RECEIVED POWER = .1003129+01	EQ. NOISE = .9957135+00	HIT = F
CELL NO. 4	THRESHOLD = .1231982+01	RECEIVED POWER = .1007516+01	EQ. NOISE = .1004474+01	HIT = F
CELL NO. 5	THRESHOLD = .1231982+01	RECEIVED POWER = .9973872+00	EQ. NOISE = .9962059+00	HIT = F
CELL NO. 6	THRESHOLD = .1231982+01	RECEIVED POWER = .1005677+01	EQ. NOISE = .9959659+00	HIT = F

START SCANNING SIDELINE CELLS

CELL NO. 1	THRESHOLD = .1231982+01	RECEIVED POWER = .1004001+01	EQ. NOISE = .1002292+01	HIT = F
CELL NO. 2	THRESHOLD = .1231982+01	RECEIVED POWER = .1003590+01	EQ. NOISE = .1002174+01	HIT = F
CELL NO. 3	THRESHOLD = .1231982+01	RECEIVED POWER = .1004970+01	EQ. NOISE = .1003437+01	HIT = F
CELL NO. 4	THRESHOLD = .1231982+01	RECEIVED POWER = .1001559+01	EQ. NOISE = .1000409+01	HIT = F
CELL NO. 5	THRESHOLD = .1231982+01	RECEIVED POWER = .9965565+00	EQ. NOISE = .9946271+00	HIT = F
CELL NO. 6	THRESHOLD = .1231982+01	RECEIVED POWER = .9919622+00	EQ. NOISE = .9969185+00	HIT = F
CELL NO. 7	THRESHOLD = .1231982+01	RECEIVED POWER = .1005577+01	EQ. NOISE = .1003031+01	HIT = F
CELL NO. 8	THRESHOLD = .1231982+01	RECEIVED POWER = .1006219+01	EQ. NOISE = .1005324+01	HIT = F
CELL NO. 9	THRESHOLD = .1231982+01	RECEIVED POWER = .9968157+00	EQ. NOISE = .9956781+00	HIT = F

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CELL NO. 10	THRESHOLD = .1231982+01	RECEIVED POWER = .1005656+01	EQ. NOISE = .1003080+01	HIT = F
CELL NO. 11	THRESHOLD = .1231982+01	RECEIVED POWER = .1005727+01	EQ. NOISE = .1003675+01	HIT = F

VERIFICATION OF A HIT IN THE NORMAL PATH

CELL NO. 30	THRESHOLD = .1056814+01	RECEIVED POWER = .1103800+01	EQ. NOISE = .9989797+00	HIT = T

(NORMAL SCANNING) DETECTED IN THE 30TH CELL
DISTANCE (SATELLITE,BORESIGHT) = .1786547+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
ACQUISITION TIME = .1529875+02 SECONDS

(XTDRSS,YTDRSS) = (.6450336-02, .6569242-01) IN THE 25TH CELL

START SCANNING - NORMAL PATH

CELL NO. 1	THRESHOLD = .1056814+01	RECEIVED POWER = .9944397+00	EQ. NOISE = .9942294+00	HIT = F
CELL NO. 2	THRESHOLD = .1056814+01	RECEIVED POWER = .1007831+01	EQ. NOISE = .1005770+01	HIT = F
CELL NO. 3	THRESHOLD = .1056814+01	RECEIVED POWER = .9967382+00	EQ. NOISE = .9950313+00	HIT = F
CELL NO. 4	THRESHOLD = .1056814+01	RECEIVED POWER = .9952282+00	EQ. NOISE = .9987396+00	HIT = F
CELL NO. 5	THRESHOLD = .1056814+01	RECEIVED POWER = .9957960+00	EQ. NOISE = .9957065+00	HIT = F
CELL NO. 6	THRESHOLD = .1056814+01	RECEIVED POWER = .9990430+00	EQ. NOISE = .9990330+00	HIT = F
CELL NO. 7	THRESHOLD = .1056814+01	RECEIVED POWER = .1005604+01	EQ. NOISE = .1005260+01	HIT = F
CELL NO. 8	THRESHOLD = .1056814+01	RECEIVED POWER = .1003794+01	EQ. NOISE = .1003126+01	HIT = F
CELL NO. 9	THRESHOLD = .1056814+01	RECEIVED POWER = .9967475+00	EQ. NOISE = .9955036+00	HIT = F
CELL NO. 10	THRESHOLD = .1056814+01	RECEIVED POWER = .1012719+01	EQ. NOISE = .1003110+01	HIT = F
CELL NO. 11	THRESHOLD = .1056814+01	RECEIVED POWER = .9954061+00	EQ. NOISE = .9942271+00	HIT = F
CELL NO. 12	THRESHOLD = .1056814+01	RECEIVED POWER = .1005160+01	EQ. NOISE = .1005140+01	HIT = F
CELL NO. 13	THRESHOLD = .1056814+01	RECEIVED POWER = .9958450+00	EQ. NOISE = .9958140+00	HIT = F
CELL NO. 14	THRESHOLD = .1056814+01	RECEIVED POWER = .9965752+00	EQ. NOISE = .9944313+00	HIT = F
CELL NO. 15	THRESHOLD = .1056814+01	RECEIVED POWER = .9965591+00	EQ. NOISE = .9985321+00	HIT = F
CELL NO. 16	THRESHOLD = .1056814+01	RECEIVED POWER = .9990149+00	EQ. NOISE = .9989152+00	HIT = F
CELL NO. 17	THRESHOLD = .1056814+01	RECEIVED POWER = .1005020+01	EQ. NOISE = .1004045+01	HIT = F
CELL NO. 18	THRESHOLD = .1056814+01	RECEIVED POWER = .9952739+00	EQ. NOISE = .9952393+00	HIT = F
CELL NO. 19	THRESHOLD = .1056814+01	RECEIVED POWER = .1006026+01	EQ. NOISE = .1005665+01	HIT = F
CELL NO. 20	THRESHOLD = .1056814+01	RECEIVED POWER = .1002458+01	EQ. NOISE = .1002619+01	HIT = F
CELL NO. 21	THRESHOLD = .1056814+01	RECEIVED POWER = .9979093+00	EQ. NOISE = .9961646+00	HIT = F
CELL NO. 22	THRESHOLD = .1056814+01	RECEIVED POWER = .9954563+00	EQ. NOISE = .9944677+00	HIT = F
CELL NO. 23	THRESHOLD = .1056814+01	RECEIVED POWER = .1059704+01	EQ. NOISE = .9965621+00	HIT = T
CELL NO. 25	THRESHOLD = .1231982+01	RECEIVED POWER = .1103079+01	EQ. NOISE = .9999367+00	HIT = F

START SCANNING NEARBY CELLS

CELL NO. 1	THRESHOLD = .1231982+01	RECEIVED POWER = .1001340+01	EQ. NOISE = .1000371+01	HIT = F
CELL NO. 2	THRESHOLD = .1231982+01	RECEIVED POWER = .1000176+01	EQ. NOISE = .9975221+00	HIT = F
CELL NO. 3	THRESHOLD = .1231982+01	RECEIVED POWER = .1031798+01	EQ. NOISE = .9958181+00	HIT = F
CELL NO. 4	THRESHOLD = .1231982+01	RECEIVED POWER = .1035634+01	EQ. NOISE = .1004107+01	HIT = F
CELL NO. 5	THRESHOLD = .1231982+01	RECEIVED POWER = .1014875+01	EQ. NOISE = .9950652+00	HIT = F
CELL NO. 6	THRESHOLD = .1231982+01	RECEIVED POWER = .9950091+00	EQ. NOISE = .9943590+00	HIT = F

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START SCANNING SIDELOBE CELLS

CELL NO.  1    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9957183+00   EQ. NOISE =   .9940793+00   HIT =  F
CELL NO.  2    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1005474+01   EQ. NOISE =   .1003657+01   HIT =  F
CELL NO.  3    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9964236+00   EQ. NOISE =   .9943641+00   HIT =  F
CELL NO.  4    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1004486+01   EQ. NOISE =   .1002732+01   HIT =  F
CELL NO.  5    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1001319+01   EQ. NOISE =   .9999606+00   HIT =  F
CELL NO.  6    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9994398+00   EQ. NOISE =   .9981019+00   HIT =  F
CELL NO.  7    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1006558+01   EQ. NOISE =   .1005102+01   HIT =  F
CELL NO.  8    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1003641+01   EQ. NOISE =   .1001271+01   HIT =  F
CELL NO.  9    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1006112+01   EQ. NOISE =   .1004655+01   HIT =  F
CELL NO. 10    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9963265+00   EQ. NOISE =   .9946682+00   HIT =  F
CELL NO. 11    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9994604+00   EQ. NOISE =   .9983380+00   HIT =  F

VERIFICATION OF A HIT IN THE NORMAL PATH

CELL NO. 23    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1101446+01   EQ. NOISE =   .9983039+00   HIT =  T


(NORMAL SCANNING)     DETECTED IN THE  23TH CELL
DISTANCE (SATELLITE,BORESIGHT) =    .1903175+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
                ACQUISITION TIME =    .1337578+02  SECONDS


(XTDRSS,YTDRSS) = (  .1703849-01, -.7263459-02 )     IN THE   7TH CELL

START SCANNING  -  NORMAL PATH

CELL NO.  1    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1037985+01   EQ. NOISE =   .1005628+01   HIT =  F
CELL NO.  2    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1005407+01   EQ. NOISE =   .1003312+01   HIT =  F
CELL NO.  3    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1007127+01   EQ. NOISE =   .1005510+01   HIT =  F
CELL NO.  4    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1007516+01   EQ. NOISE =   .1005657+01   HIT =  F
CELL NO.  5    THRESHOLD =   .1056814+01   RECEIVED POWER =  .9959425+00   EQ. NOISE =   .9950683+00   HIT =  F
CELL NO.  6    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1051711+01   EQ. NOISE =   .9959696+00   HIT =  F
CELL NO.  7    THRESHOLD =   .1056814+01   RECEIVED POWER =  .1076462+01   EQ. NOISE =   .9937604+00   HIT =  T
CELL NO.  7    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1076579+01   EQ. NOISE =   .9938067+00   HIT =  F

START SCANNING NEARBY CELLS

CELL NO.  1    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9986669+00   EQ. NOISE =   .9985780+00   HIT =  F
CELL NO.  2    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1002990+01   EQ. NOISE =   .1002541+01   HIT =  F
CELL NO.  3    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1015596+01   EQ. NOISE =   .1004635+01   HIT =  F
CELL NO.  4    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1027074+01   EQ. NOISE =   .9941171+00   HIT =  F
CELL NO.  5    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1053057+01   EQ. NOISE =   .9977760+00   HIT =  F
CELL NO.  6    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1001117+01   EQ. NOISE =   .9988765+00   HIT =  F

START SCANNING SIDELOBE CELLS

CELL NO.  1    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1000393+01   EQ. NOISE =   .1003600+01   HIT =  F
CELL NO.  2    THRESHOLD =   .1231982+01   RECEIVED POWER =  .9984207+00   EQ. NOISE =   .9902621+00   HIT =  F
CELL NO.  3    THRESHOLD =   .1231982+01   RECEIVED POWER =  .1001603+01   EQ. NOISE =   .1001627+01   HIT =  F
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CELL NO.  4   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9953587+00   EQ. NOISE =  .9942220+00   HIT =  F
CELL NO.  5   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006150+01   EQ. NOISE =  .1004093+01   HIT =  F
CELL NO.  6   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006725+01   EQ. NOISE =  .1005167+01   HIT =  F
CELL NO.  7   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9961698+00   EQ. NOISE =  .9953710+00   HIT =  F
CELL NO.  8   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9999866+00   EQ. NOISE =  .9994795+00   HIT =  F
CELL NO.  9   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9958120+00   EQ. NOISE =  .9951589+00   HIT =  F
CELL NO. 10   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006954+01   EQ. NOISE =  .1005673+01   HIT =  F
CELL NO. 11   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1007792+01   EQ. NOISE =  .1005768+01   HIT =  F

VERIFICATION OF A HIT IN THE NORMAL PATH

CELL NO.  7   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1076690+01   EQ. NOISE =  .9940684+00   HIT =  T


(NORMAL SCANNING)    DETECTED IN THE   7TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .3065623+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
               ACQUISITION TIME =   .9041400+01  SECONDS


(XTORSS,YTORSS) = ( -.7855088-01, -.3708831-01 )    IN THE  51TH CELL


START SCANNING  -  NORMAL PATH

CELL NO.  1   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1004448+01   EQ. NOISE =  .1004039+01   HIT =  F
CELL NO.  2   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9972701+00   EQ. NOISE =  .9971675+00   HIT =  F
CELL NO.  3   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9962001+00   EQ. NOISE =  .9962601+00   HIT =  F
CELL NO.  4   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1000982+01   EQ. NOISE =  .1000744+01   HIT =  F
CELL NO.  5   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1001577+01   EQ. NOISE =  .1001220+01   HIT =  F
CELL NO.  6   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9997696+00   EQ. NOISE =  .9997264+00   HIT =  F
CELL NO.  7   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9983497+00   EQ. NOISE =  .9982780+00   HIT =  F
CELL NO.  8   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9948472+00   EQ. NOISE =  .9947652+00   HIT =  F
CELL NO.  9   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9971754+00   EQ. NOISE =  .9970645+00   HIT =  F
CELL NO. 10   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1002210+01   EQ. NOISE =  .1002177+01   HIT =  F
CELL NO. 11   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9953752+00   EQ. NOISE =  .9952640+00   HIT =  F
CELL NO. 12   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1004238+01   EQ. NOISE =  .1003759+01   HIT =  F
CELL NO. 13   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1004790+01   EQ. NOISE =  .1002690+01   HIT =  F
CELL NO. 14   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1005971+01   EQ. NOISE =  .1003010+01   HIT =  F
CELL NO. 15   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1000213+01   EQ. NOISE =  .9996037+00   HIT =  F
CELL NO. 16   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9969633+00   EQ. NOISE =  .9966002+00   HIT =  F
CELL NO. 17   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9996142+00   EQ. NOISE =  .9994347+00   HIT =  F
CELL NO. 18   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9965051+00   EQ. NOISE =  .9945651+00   HIT =  F
CELL NO. 19   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1004947+01   EQ. NOISE =  .1004660+01   HIT =  F
CELL NO. 20   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1001989+01   EQ. NOISE =  .1001917+01   HIT =  F
CELL NO. 21   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1004250+01   EQ. NOISE =  .1004225+01   HIT =  F
CELL NO. 22   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9951254+00   EQ. NOISE =  .9950680+00   HIT =  F
CELL NO. 23   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9993253+00   EQ. NOISE =  .9992494+00   HIT =  F
CELL NO. 24   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9975972+00   EQ. NOISE =  .9975724+00   HIT =  F
CELL NO. 25   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9971950+00   EQ. NOISE =  .9971690+00   HIT =  F
CELL NO. 26   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1000180+01   EQ. NOISE =  .1000291+01   HIT =  F
CELL NO. 27   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9997899+00   EQ. NOISE =  .9997694+00   HIT =  F
CELL NO. 28   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1005082+01   EQ. NOISE =  .1004251+01   HIT =  F
CELL NO. 29   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1006881+01   EQ. NOISE =  .9966716+00   HIT =  F
CELL NO. 30   THRESHOLD =  .1056814+01   RECEIVED POWER =  .9956100+00   EQ. NOISE =  .9949610+00   HIT =  F
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CELL NO. 31   THRESHOLD = .1056814+01   RECEIVED POWER = .9959325+00   EQ. NOISE = .9944144+00   HIT =  F
CELL NO. 32   THRESHOLD = .1056814+01   RECEIVED POWER = .9947427+00   EQ. NOISE = .9942732+00   HIT =  F
CELL NO. 33   THRESHOLD = .1056814+01   RECEIVED POWER = .9964986+00   EQ. NOISE = .9964669+00   HIT =  F
CELL NO. 34   THRESHOLD = .1056814+01   RECEIVED POWER = .1005084+01   EQ. NOISE = .1005679+01   HIT =  F
CELL NO. 35   THRESHOLD = .1056814+01   RECEIVED POWER = .9944809+00   EQ. NOISE = .9943622+00   HIT =  F
CELL NO. 36   THRESHOLD = .1056814+01   RECEIVED POWER = .1005757+01   EQ. NOISE = .1005747+01   HIT =  F
CELL NO. 37   THRESHOLD = .1056814+01   RECEIVED POWER = .9943618+00   EQ. NOISE = .9943107+00   HIT =  F
CELL NO. 38   THRESHOLD = .1056814+01   RECEIVED POWER = .1002631+01   EQ. NOISE = .1002628+01   HIT =  F
CELL NO. 39   THRESHOLD = .1056814+01   RECEIVED POWER = .9943870+00   EQ. NOISE = .9943660+00   HIT =  F
CELL NO. 40   THRESHOLD = .1056814+01   RECEIVED POWER = .9945302+00   EQ. NOISE = .9945302+00   HIT =  F
CELL NO. 41   THRESHOLD = .1056814+01   RECEIVED POWER = .9957275+00   EQ. NOISE = .9957194+00   HIT =  F
CELL NO. 42   THRESHOLD = .1056814+01   RECEIVED POWER = .9942664+00   EQ. NOISE = .9942381+00   HIT =  F
CELL NO. 43   THRESHOLD = .1056814+01   RECEIVED POWER = .9942379+00   EQ. NOISE = .9942374+00   HIT =  F
CELL NO. 44   THRESHOLD = .1056814+01   RECEIVED POWER = .1005654+01   EQ. NOISE = .1005670+01   HIT =  F
CELL NO. 45   THRESHOLD = .1056814+01   RECEIVED POWER = .1004799+01   EQ. NOISE = .1004726+01   HIT =  F
CELL NO. 46   THRESHOLD = .1056814+01   RECEIVED POWER = .9952736+00   EQ. NOISE = .9950456+00   HIT =  F
CELL NO. 47   THRESHOLD = .1056814+01   RECEIVED POWER = .9949635+00   EQ. NOISE = .9946657+00   HIT =  F
CELL NO. 48   THRESHOLD = .1056814+01   RECEIVED POWER = .9972672+00   EQ. NOISE = .9971065+00   HIT =  F
CELL NO. 49   THRESHOLD = .1056814+01   RECEIVED POWER = .9960525+00   EQ. NOISE = .9942647+00   HIT =  F
CELL NO. 50   THRESHOLD = .1056814+01   RECEIVED POWER = .1033837+01   EQ. NOISE = .9940620+00   HIT =  F
CELL NO. 51   THRESHOLD = .1056814+01   RECEIVED POWER = .1093155+01   EQ. NOISE = .9965645+00   HIT =  T
CELL NO. 51   THRESHOLD = .1231982+01   RECEIVED POWER = .1102192+01   EQ. NOISE = .1005641+01   HIT =  F

START SCANNING NEARBY CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .9970598+00   EQ. NOISE = .9964417+00   HIT =  F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1006163+01   EQ. NOISE = .1003222+01   HIT =  F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1049245+01   EQ. NOISE = .1005056+01   HIT =  F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1027131+01   EQ. NOISE = .9956296+00   HIT =  F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1015229+01   EQ. NOISE = .9997646+00   HIT =  F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .9948125+00   EQ. NOISE = .9946608+00   HIT =  F

START SCANNING SIDELOBE CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1006929+01   EQ. NOISE = .1005736+01   HIT =  F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .9975047+00   EQ. NOISE = .9955517+00   HIT =  F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1006370+01   EQ. NOISE = .1004425+01   HIT =  F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1006926+01   EQ. NOISE = .1005629+01   HIT =  F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1008660+01   EQ. NOISE = .1003645+01   HIT =  F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1004325+01   EQ. NOISE = .1003304+01   HIT =  F
CELL NO.  7   THRESHOLD = .1231982+01   RECEIVED POWER = .9973531+00   EQ. NOISE = .9959025+00   HIT =  F
CELL NO.  8   THRESHOLD = .1231982+01   RECEIVED POWER = .1006911+01   EQ. NOISE = .1004056+01   HIT =  F
CELL NO.  9   THRESHOLD = .1231982+01   RECEIVED POWER = .9986052+00   EQ. NOISE = .9967042+00   HIT =  F
CELL NO. 10   THRESHOLD = .1231982+01   RECEIVED POWER = .9984129+00   EQ. NOISE = .9972390+00   HIT =  F
CELL NO. 11   THRESHOLD = .1231982+01   RECEIVED POWER = .1004926+01   EQ. NOISE = .1004277+01   HIT =  F

VERIFICATION OF A HIT IN THE NORMAL PATH

CELL NO. 51   THRESHOLD = .1056814+01   RECEIVED POWER = .1099105+01   EQ. NOISE = .1002654+01   HIT =  T


(NORMAL SCANNING)    DETECTED IN THE  51TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .2311531+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
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ORIGINAL PAGE IS
OF POOR QUALITY

ACQUISITION TIME = .2106767+02 SECONDS

(XTDRSS,YTDRSS) = (.2929696-01, .7793007-01) IN THE 42TH CELL

START SCANNING - NORMAL PATH

CELL NO. 1	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9980586+00	EQ. NOISE =	.9979551+00	HIT =	F
CELL NO. 2	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003634+01	EQ. NOISE =	.1003613+01	HIT =	F
CELL NO. 3	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9972903+00	EQ. NOISE =	.9968400+00	HIT =	F
CELL NO. 4	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9944347+00	EQ. NOISE =	.9943361+00	HIT =	F
CELL NO. 5	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003363+01	EQ. NOISE =	.1003251+01	HIT =	F
CELL NO. 6	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003803+01	EQ. NOISE =	.1003615+01	HIT =	F
CELL NO. 7	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9997013+00	EQ. NOISE =	.9993091+00	HIT =	F
CELL NO. 8	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9990520+00	EQ. NOISE =	.9978066+00	HIT =	F
CELL NO. 9	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1000960+01	EQ. NOISE =	.1000453+01	HIT =	F
CELL NO. 10	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1006455+01	EQ. NOISE =	.1004683+01	HIT =	F
CELL NO. 11	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9943449+00	EQ. NOISE =	.9942263+00	HIT =	F
CELL NO. 12	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1005386+01	EQ. NOISE =	.1005378+01	HIT =	F
CELL NO. 13	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1005799+01	EQ. NOISE =	.1005743+01	HIT =	F
CELL NO. 14	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1002662+01	EQ. NOISE =	.1002650+01	HIT =	F
CELL NO. 15	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1004505+01	EQ. NOISE =	.1004420+01	HIT =	F
CELL NO. 16	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003919+01	EQ. NOISE =	.1003658+01	HIT =	F
CELL NO. 17	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1002403+01	EQ. NOISE =	.1002380+01	HIT =	F
CELL NO. 18	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9973647+00	EQ. NOISE =	.9971841+00	HIT =	F
CELL NO. 19	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1004904+01	EQ. NOISE =	.1004763+01	HIT =	F
CELL NO. 20	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1005374+01	EQ. NOISE =	.1005220+01	HIT =	F
CELL NO. 21	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003585+01	EQ. NOISE =	.1001020+01	HIT =	F
CELL NO. 22	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1040473+01	EQ. NOISE =	.9972088+00	HIT =	F
CELL NO. 23	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1014634+01	EQ. NOISE =	.1000315+01	HIT =	F
CELL NO. 24	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1007085+01	EQ. NOISE =	.1005427+01	HIT =	F
CELL NO. 25	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9953013+00	EQ. NOISE =	.9950112+00	HIT =	F
CELL NO. 26	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003619+01	EQ. NOISE =	.1003490+01	HIT =	F
CELL NO. 27	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9958723+00	EQ. NOISE =	.9957135+00	HIT =	F
CELL NO. 28	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1003886+01	EQ. NOISE =	.1003788+01	HIT =	F
CELL NO. 29	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9963896+00	EQ. NOISE =	.9963227+00	HIT =	F
CELL NO. 30	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1004803+01	EQ. NOISE =	.1004503+01	HIT =	F
CELL NO. 31	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9995576+00	EQ. NOISE =	.9995063+00	HIT =	F
CELL NO. 32	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1001141+01	EQ. NOISE =	.1001132+01	HIT =	F
CELL NO. 33	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1005181+01	EQ. NOISE =	.1005178+01	HIT =	F
CELL NO. 34	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9943625+00	EQ. NOISE =	.9943577+00	HIT =	F
CELL NO. 35	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9942701+00	EQ. NOISE =	.9942316+00	HIT =	F
CELL NO. 36	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9964160+00	EQ. NOISE =	.9962401+00	HIT =	F
CELL NO. 37	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1005099+01	EQ. NOISE =	.1005097+01	HIT =	F
CELL NO. 38	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1002160+01	EQ. NOISE =	.1001871+01	HIT =	F
CELL NO. 39	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1004263+01	EQ. NOISE =	.1004207+01	HIT =	F
CELL NO. 40	THRESHOLD =	.1056814+01	RECEIVED POWER =	.9948662+00	EQ. NOISE =	.9946881+00	HIT =	F
CELL NO. 41	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1026159+01	EQ. NOISE =	.1000151+01	HIT =	F
CELL NO. 42	THRESHOLD =	.1056814+01	RECEIVED POWER =	.1092203+01	EQ. NOISE =	.9959603+00	HIT =	T
CELL NO. 42	THRESHOLD =	.1231982+01	RECEIVED POWER =	.1098516+01	EQ. NOISE =	.1002594+01	HIT =	F

START SCANNING NEARBY CELLS

CELL NO. 1	THRESHOLD =	.1231982+01	RECEIVED POWER =	.1022822+01	EQ. NOISE =	.9968137+00	HIT =	F

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CELL NO.  2   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006427+01   EQ. NOISE =   .9953141+00   HIT =  F
CELL NO.  3   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9946449+00   EQ. NOISE =   .9944409+00   HIT =  F
CELL NO.  4   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9977947+00   EQ. NOISE =   .9967667+00   HIT =  F
CELL NO.  5   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1010375+01   EQ. NOISE =   .1005772+01   HIT =  F
CELL NO.  6   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1045963+01   EQ. NOISE =   .1004891+01   HIT =  F

START SCANNING SIDELOBE CELLS

CELL NO.  1   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9984669+00   EQ. NOISE =   .9970677+00   HIT =  F
CELL NO.  2   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1001497+01   EQ. NOISE =   .9995295+00   HIT =  F
CELL NO.  3   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1003108+01   EQ. NOISE =   .1001188+01   HIT =  F
CELL NO.  4   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006753+01   EQ. NOISE =   .1005627+01   HIT =  F
CELL NO.  5   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1001248+01   EQ. NOISE =   .1000627+01   HIT =  F
CELL NO.  6   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1005567+01   EQ. NOISE =   .1004685+01   HIT =  F
CELL NO.  7   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1007196+01   EQ. NOISE =   .1005496+01   HIT =  F
CELL NO.  8   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9963380+00   EQ. NOISE =   .9942826+00   HIT =  F
CELL NO.  9   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1003218+01   EQ. NOISE =   .1001606+01   HIT =  F
CELL NO. 10   THRESHOLD =  .1231982+01   RECEIVED POWER =  .9981696+00   EQ. NOISE =   .9970684+00   HIT =  F
CELL NO. 11   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1006622+01   EQ. NOISE =   .1005668+01   HIT =  F

VERIFICATION OF A HIT IN THE NORMAL PATH

CELL NO. 42   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1091178+01   EQ. NOISE =   .9949549+00   HIT =  T

(NORMAL SCANNING)    DETECTED IN THE  42TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .2336655+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
               ACQUISITION TIME =   .1859528+02  SECONDS


NUMBER OF SATELLITE POSITIONS GENERATED:            5
STANDARD DEVIATION:                                 .2500000+01

CARRIER-TO-NOISE RATIO:                             .6000000+02 DB-HZ
ACQUISITION AVERAGE TIME:                           .1547578+02 S
STANDARD DEVIATION:                                 .1863793+01 S
PROBABILITY OF DETECTION:                           .1000000+01
PROBABILITY OF DETECTION (SL. VAR.):                .0000000
PROBABILITY OF MISS:                                .0000000
PROBABILITY OF FALSE ALARM (IN THE SIMULATION):     .0000000


(XTDRSS,YTDRSS) = (  .2972895-01, -.2477371-01 )    IN THE  18TH CELL

START SCANNING - NORMAL PATH

CELL NO.  1   THRESHOLD =  .1056814+01   RECEIVED POWER =  .1113836+01   EQ. NOISE =   .9986626+00   HIT =  T
CELL NO.  1   THRESHOLD =  .1231982+01   RECEIVED POWER =  .1115467+01   EQ. NOISE =   .1000294+01   HIT =  F

START SCANNING NEARBY CELLS
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CELL NO. 1   THRESHOLD = .1231982+01   RECEIVED POWER = .1728553+01   EQ. NOISE = .9913820+00   HIT = T

VERIFICATION OF A HIT WITH THRESHOLD TH2 IN THE CELL NO. 1
CELL NO. 1   THRESHOLD = .1231982+01   RECEIVED POWER = .1728146+01   EQ. NOISE = .9909348+00   HIT = T


(NORMAL SCANNING)    DETECTED IN THE   7TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .7638220+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
             ACQUISITION TIME =   .1100000+01  SECONDS


(XTDRSS,YTDRSS) = (  .5145452-01, -.4069500-01 )    IN THE  35TH CELL

START SCANNING  -  NORMAL PATH

CELL NO. 1   THRESHOLD = .1056814+01   RECEIVED POWER = .1022829+01   EQ. NOISE = .1004341+01   HIT = F
CELL NO. 2   THRESHOLD = .1056814+01   RECEIVED POWER = .1043272+01   EQ. NOISE = .9942146+00   HIT = F
CELL NO. 3   THRESHOLD = .1056814+01   RECEIVED POWER = .9962220+00   EQ. NOISE = .9962091+00   HIT = F
CELL NO. 4   THRESHOLD = .1056814+01   RECEIVED POWER = .9982686+00   EQ. NOISE = .9958771+00   HIT = F
CELL NO. 5   THRESHOLD = .1056814+01   RECEIVED POWER = .1027099+01   EQ. NOISE = .1002695+01   HIT = F
CELL NO. 6   THRESHOLD = .1056814+01   RECEIVED POWER = .1207795+01   EQ. NOISE = .1002665+01   HIT = T
CELL NO. 6   THRESHOLD = .1231982+01   RECEIVED POWER = .1211380+01   EQ. NOISE = .1005450+01   HIT = F

START SCANNING NEARBY CELLS

CELL NO. 1   THRESHOLD = .1231982+01   RECEIVED POWER = .1843327+01   EQ. NOISE = .9940682+00   HIT = T

VERIFICATION OF A HIT WITH THRESHOLD TH2 IN THE CELL NO. 1
CELL NO. 1   THRESHOLD = .1231982+01   RECEIVED POWER = .1858381+01   EQ. NOISE = .1009112+01   HIT = T


(NORMAL SCANNING)    DETECTED IN THE  18TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .7494704+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
             ACQUISITION TIME =   .2768778+01  SECONDS


(XTDRSS,YTDRSS) = ( -.4016849-01,  .4022257-01 )    IN THE  26TH CELL

START SCANNING  -  NORMAL PATH

CELL NO. 1   THRESHOLD = .1056814+01   RECEIVED POWER = .1023704+01   EQ. NOISE = .1002397+01   HIT = F
CELL NO. 2   THRESHOLD = .1056814+01   RECEIVED POWER = .1040832+01   EQ. NOISE = .1005250+01   HIT = F
CELL NO. 3   THRESHOLD = .1056814+01   RECEIVED POWER = .1010094+01   EQ. NOISE = .1005761+01   HIT = F
CELL NO. 4   THRESHOLD = .1056814+01   RECEIVED POWER = .1195212+01   EQ. NOISE = .9932751+00   HIT = T
CELL NO. 4   THRESHOLD = .1231982+01   RECEIVED POWER = .1198944+01   EQ. NOISE = .9970670+00   HIT = F

START SCANNING NEARBY CELLS
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CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1026970+01   EQ. NOISE =  .1005660+01   HIT =  F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1193091+01   EQ. NOISE =  .9956858+00   HIT =  F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1211718+01   EQ. NOISE =  .9944626+00   HIT =  F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1175515+01   EQ. NOISE =  .1003538+01   HIT =  F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1087056+01   EQ. NOISE =  .9965718+00   HIT =  F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1015022+01   EQ. NOISE =  .1005640+01   HIT =  F

START SCANNING SIDELOBE CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1159191+01   EQ. NOISE =  .1004362+01   HIT =  F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1024842+01   EQ. NOISE =  .9963519+00   HIT =  F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1023189+01   EQ. NOISE =  .9976041+00   HIT =  F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .9960020+00   EQ. NOISE =  .9951295+00   HIT =  F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1006314+01   EQ. NOISE =  .1005761+01   HIT =  F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1017571+01   EQ. NOISE =  .9965125+00   HIT =  F
CELL NO.  7   THRESHOLD = .1231982+01   RECEIVED POWER = .1031952+01   EQ. NOISE =  .9954390+00   HIT =  F
CELL NO.  8   THRESHOLD = .1231982+01   RECEIVED POWER = .1116057+01   EQ. NOISE =  .9969025+00   HIT =  F
CELL NO.  9   THRESHOLD = .1231982+01   RECEIVED POWER = .1107847+01   EQ. NOISE =  .1003992+01   HIT =  F
CELL NO. 10   THRESHOLD = .1231982+01   RECEIVED POWER = .1130155+02   EQ. NOISE =  .1026797+01   HIT =  T
CELL NO. 11   THRESHOLD = .1130155+02   RECEIVED POWER = .4684649+01   EQ. NOISE =  .9923030+00   HIT =  F

VERIFICATION OF A HIT WITH THRESHOLD TH2 IN THE CELL NO. 10
CELL NO. 10   THRESHOLD = .1231982+01   RECEIVED POWER = .1125699+02   EQ. NOISE =  .9822343+00   HIT =  T

(SIDELOBE VARIATION  ) DETECTED IN THE  11TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .1929775+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
              ACQUISITION TIME =   .7373733+01  SECONDS

(XIDRSS,YIDRSS) = ( -.1691523-02, -.3991819-01 )   IN THE  16TH CELL

START SCANNING  -  NORMAL PATH

CELL NO.  1   THRESHOLD = .1056814+01   RECEIVED POWER = .1038965+01   EQ. NOISE =  .9957600+00   HIT =  F
CELL NO.  2   THRESHOLD = .1056814+01   RECEIVED POWER = .1064412+01   EQ. NOISE =  .9953704+00   HIT =  T
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1069331+01   EQ. NOISE =  .1000290+01   HIT =  F

START SCANNING NEARBY CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1010767+01   EQ. NOISE =  .1004114+01   HIT =  F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1054815+01   EQ. NOISE =  .1005604+01   HIT =  F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1005484+01   EQ. NOISE =  .9943950+00   HIT =  F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1086111+01   EQ. NOISE =  .1002450+01   HIT =  F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1157123+01   EQ. NOISE =  .9985374+00   HIT =  F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1081655+01   EQ. NOISE =  .9961021+00   HIT =  F

START SCANNING SIDELOBE CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1006109+01   EQ. NOISE =  .1005211+01   HIT =  F
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CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1085388+01   EQ. NOISE = .1005477+01   HIT = F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .7032383+01   EQ. NOISE = .9791045+00   HIT = T
CELL NO.  4   THRESHOLD = .7032383+01   RECEIVED POWER = .4160836+01   EQ. NOISE = .1009890+01   HIT = F

VERIFICATION OF A HIT WITH THRESHOLD TH2 IN THE CELL NO.  3
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .7067150+01   EQ. NOISE = .1013871+01   HIT = T

(SIDELOBE VARIATION  ) DETECTED IN THE   5TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .4143377+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
            ACQUISITION TIME =   .4221220+01  SECONDS

(XTDRSS,YTDRSS) = (  .2517179-01,  .7252498-01 )    IN THE  42TH CELL

START SCANNING  -  NORMAL PATH

CELL NO.  1   THRESHOLD = .1056814+01   RECEIVED POWER = .1035955+01   EQ. NOISE = .9948069+00   HIT = F
CELL NO.  2   THRESHOLD = .1056814+01   RECEIVED POWER = .1082917+01   EQ. NOISE = .1005429+01   HIT = T
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1076380+01   EQ. NOISE = .9988031+00   HIT = F

START SCANNING NEARBY CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1092502+01   EQ. NOISE = .1006251+01   HIT = F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .1151801+01   EQ. NOISE = .9964462+00   HIT = F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1100727+01   EQ. NOISE = .1001715+01   HIT = F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1006210+01   EQ. NOISE = .9988417+00   HIT = F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .1042544+01   EQ. NOISE = .9939782+00   HIT = F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1015700+01   EQ. NOISE = .1005684+01   HIT = F

START SCANNING SIDELOBE CELLS

CELL NO.  1   THRESHOLD = .1231982+01   RECEIVED POWER = .1035924+01   EQ. NOISE = .9972430+00   HIT = F
CELL NO.  2   THRESHOLD = .1231982+01   RECEIVED POWER = .9977590+00   EQ. NOISE = .9960610+00   HIT = F
CELL NO.  3   THRESHOLD = .1231982+01   RECEIVED POWER = .1019086+01   EQ. NOISE = .1003458+01   HIT = F
CELL NO.  4   THRESHOLD = .1231982+01   RECEIVED POWER = .1016583+01   EQ. NOISE = .1002037+01   HIT = F
CELL NO.  5   THRESHOLD = .1231982+01   RECEIVED POWER = .9996817+00   EQ. NOISE = .9996561+00   HIT = F
CELL NO.  6   THRESHOLD = .1231982+01   RECEIVED POWER = .1042388+01   EQ. NOISE = .9940690+00   HIT = F
CELL NO.  7   THRESHOLD = .1231982+01   RECEIVED POWER = .1054146+01   EQ. NOISE = .9964074+00   HIT = F
CELL NO.  8   THRESHOLD = .1231982+01   RECEIVED POWER = .1057802+01   EQ. NOISE = .1006048+01   HIT = F
CELL NO.  9   THRESHOLD = .1231982+01   RECEIVED POWER = .9818087+01   EQ. NOISE = .9987424+00   HIT = T
CELL NO. 10   THRESHOLD = .9818087+01   RECEIVED POWER = .1851426+01   EQ. NOISE = .9904050+00   HIT = F

VERIFICATION OF A HIT WITH THRESHOLD TH2 IN THE CELL NO.  9
CELL NO.  9   THRESHOLD = .1231982+01   RECEIVED POWER = .9839320+01   EQ. NOISE = .1019091+01   HIT = T

(SIDELOBE VARIATION  ) DETECTED IN THE  22TH CELL
DISTANCE (SATELLITE,BORESIGHT) =   .2781226+02% OF DISTANCE BETWEEN BORESIGHT AND FIRST NULL
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ACQUISITION TIME =  .5970993+01  SECONDS

NUMBER OF SATELLITE POSITIONS GENERATED:          5
STANDARD DEVIATION:                               .2500000+01

CARRIER-TO-NOISE RATIO:                           .6000000+02 DB-HZ
ACQUISITION AVERAGE TIME:                         .4073195+01 S
STANDARD DEVIATION:                               .1103123+01 S
PROBABILITY OF DETECTION:                         .1000000+01
PROBABILITY OF DETECTION (SL. VAR.):              .6000000+00
PROBABILITY OF MISS:                              .0000000
PROBABILITY OF FALSE ALARM (IN THE SIMULATION):   .0000000

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SUMMARY

This document presents the results pertaining to the trade-off analysis and performance of the Ku-Band Shuttle antenna pointing and signal acquisition system. The study was performed assuming the existance of various antenna scanning trajectories and various signal acquisition algorithms. The square, hexagonal and spiral trajectories were investigated assuming the TDRS postulated uncertainty region and a flexible statistical model for the location of the TDRS within the uncertainty volume. The scanning trajectories, Shuttle/TDRS signal parameters and dynamics and three signal acquisition algorithms were integrated into a hardware simulation discussed herein and documented in detail in Volume IV. The hardware simulation is quite flexible in that it allows one to evaluate signal acquisition performance for an arbitrary (programmable) antenna pattern, a large range of C/N_0's, various TDRS/Shuttle a priori uncertainty distributions and three distinct signal search algorithms.

Based upon the data made available during this contract period, certain Ku-Band forward link signal threshold characteristics were studied. The antenna pointing and acquisition threshold is found to be less than 60 dB-Hz with an acquisition time dependent on the antenna scan procedure and acquisition algorithm implemented. Various techniques are discussed in this report and a computer program is presented from which these can be evaluated. It appears that there will be no problem in meeting the system

spec even in light of the uncertainty associated with the possibilities of antenna sidelobe acquisition. The details are provided herein. Assuming a single channel monopulse system and a 30 MHz IF bandwidth, a monopulse tracking loop bandwidth of one Hz, the monopulse tracking jitter is 0.11 degrees at C/N_0 = 54 dB-Hz. The Costas loop arm filter bandwidths can be chosen to be ten times the data rate such that no false-lock problem occurs during carrier acquisition. Assuming loop bandwidth of B_L = 3 kHz, the loop jitter is 10 degrees at C/N_0 = 60.4 dB-Hz. Acquisition can be accomplished in less than 10 seconds.

For the purpose of antenna scanning analysis, a reference coordinate system, whose z-axis is in line with the center axis of a specified uncertainty cone of the TDRS position, is chosen for the relative relation between the TDRS and the Shuttle antenna. The scan path of the Shuttle antenna can be projected onto the (x,y) plane of the coordinate system; while the uncertainty cone of the TDRS position can be described by a circle in the (x,y) plane. The uncertainty in the position of the TDRS is modeled by a truncated Gaussian probability density p(x,y) with uncertainty parameters $\sigma_x^2 = \sigma_y^2 = \sigma^2$. By changing the value of this variance parameter, the model is sufficiently general to include a uniform distribution of TDRS position uncertainty ($\sigma_p=\infty$) to one which specifies the position with probability one ($\sigma_p=0$).

In the study of antenna scanning three types of trajectories are proposed and evaluated in terms of average scan time and the structure of coverage over the uncertainty cone of the TDRS position. The analysis technique used for finding average scan time is discussed and an illustration of the technique for a specific type of scanning trajectories and motion of the Shuttle antenna is given. The results show that the spiral trajectories is in general better than the other two trajectories, especially for a constant velocity along a trajectory, since the path of a spiral trajectory (from the center of uncertainty cone to its edge) can be shorter than the other two.

From the Ku-band system specifications, it has been recognized that the variation of the received signal level at the Shuttle (due to TDRS EIRP path loss and antenna pointing loss variations) varies as much as 23 dB. If the antenna sidelobes are not sufficiently suppressed, a potential problem called sidelobe acquisition may cause the degradation in system performance. Therefore in this tradeoff analysis study, three different acquisition strategies are proposed and evaluated. The first acquisition strategy may be used for the case where the sidelobe acquisition does not impose a problem to the system. The other two strategies are primarily designed to avoid the sidelobe acquisition (especially the first sidelobe).

In this study, we assume that the first sidelobe of the Shuttle antenna is 17.5 dB suppression from the main lobe of the antenna so that we can study the effectiveness of the acquisition algorithm proposed. Surely, one should note that the sidelobe acquisition can be overcome by tapering down the sidelobes of the Shuttle antenna below 23 dB. However, it has been found that with one particular acquisition algorithm studied, a strong sidelobe of the antenna can speed spatial acquisition significantly.

The scan schemes and acquisition algorithms are all integrated by a computer simulation program. This software package, discussed herein, provides a useful tool for predicting the performance of the Ku-band antenna pointing system. Various options are available for users to do tradeoff studies on system parameters in designing an acquisition system. The software package has been tested on UNIVAC 1100 Series computers and verified with analytical results.