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DIGITIZING PLOTTING PROCEDURE FOR MICROWAVE LANDING SYSTEM FLIGHT TEST AIRBORNE AND GROUND TRACKER MERGED DATA PLOTS

by

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TECHNICAL CENTER
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ABSTRACT

This program was written to apply tolerance limits to Microwave Landing System (MLS) flight test airborne and ground tracker merged data plots. It will be used by project engineers for post flight analysis and determination of acceptable data. A program flow chart, a program listing, and sample plots are presented in the Appendix.

Project No. 076-320-110

Key Words

MLS
GDU'S
UDU'S
Calcomp plot

PURPOSE

The purpose of the plotting technique revision was to significantly increase the efficiency and ease by which tolerances are plotted onto original Calcomp plots for Microwave Landing System (MLS) test flight data by project personnel.

BACKGROUND

Previously, tolerances were plotted with the Hewlett-Packard System 9854B and accompanying H.P. 9872A plotter onto Calcomp plots only after the following 3 steps were taken:

Step 1. Locate and plot on a clean sheet of paper, the axes by which the computer will plot the tolerances.

Step 2. Carefully align the plot to be processed so that it's axes coincide with those of Step 1.

Step 3. Run the program to plot the tolerances.

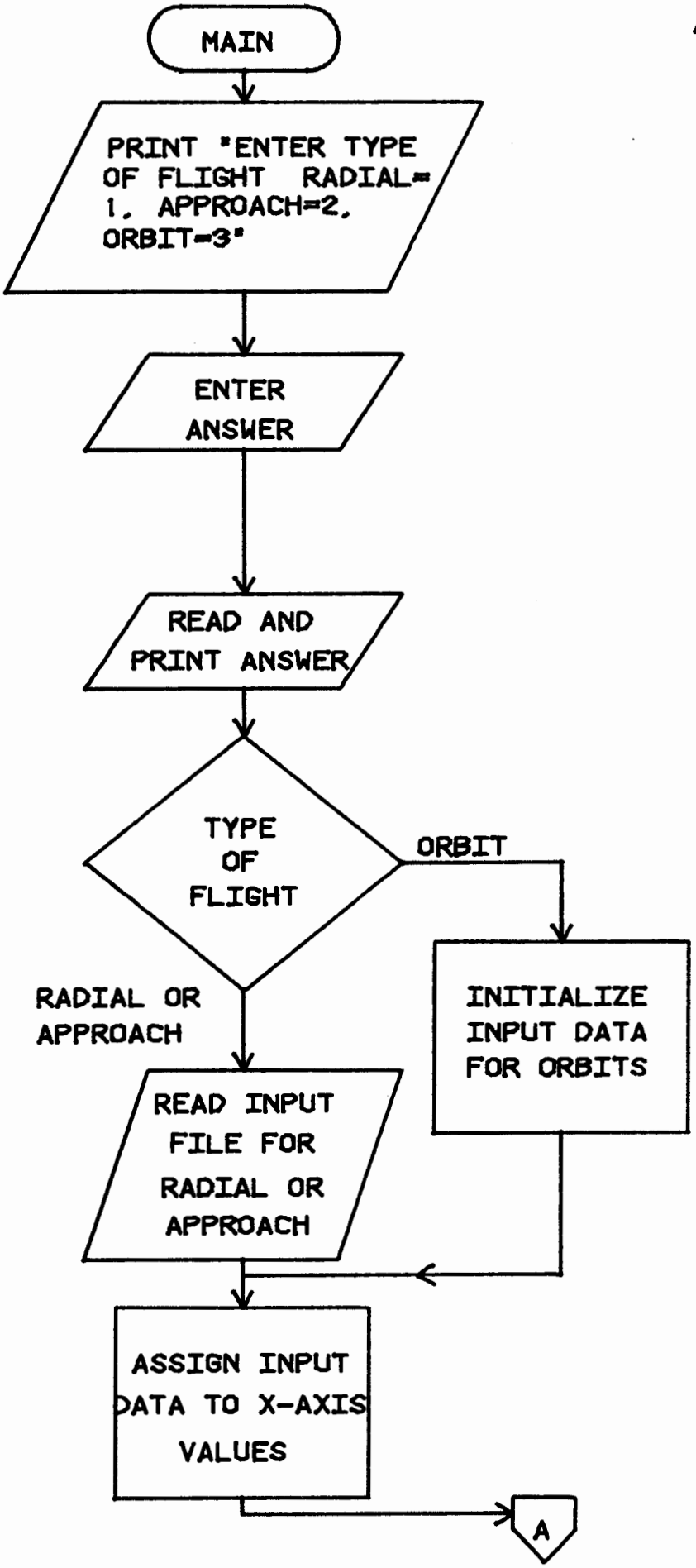
Typically, Step 2 took approximately 1 to 1½ minutes to perfectly align the two sets of axes. For example, to process any given flight data that had roughly 10 runs (40 plots) associated with it, the time it took to plot the tolerances was around one hour. This time factor, together with the fact that the condition of the paper with the axes generated in Step 1, gradually diminished as the plotting process continued, led to the search for a better, more accurate, and more efficient plotting technique.

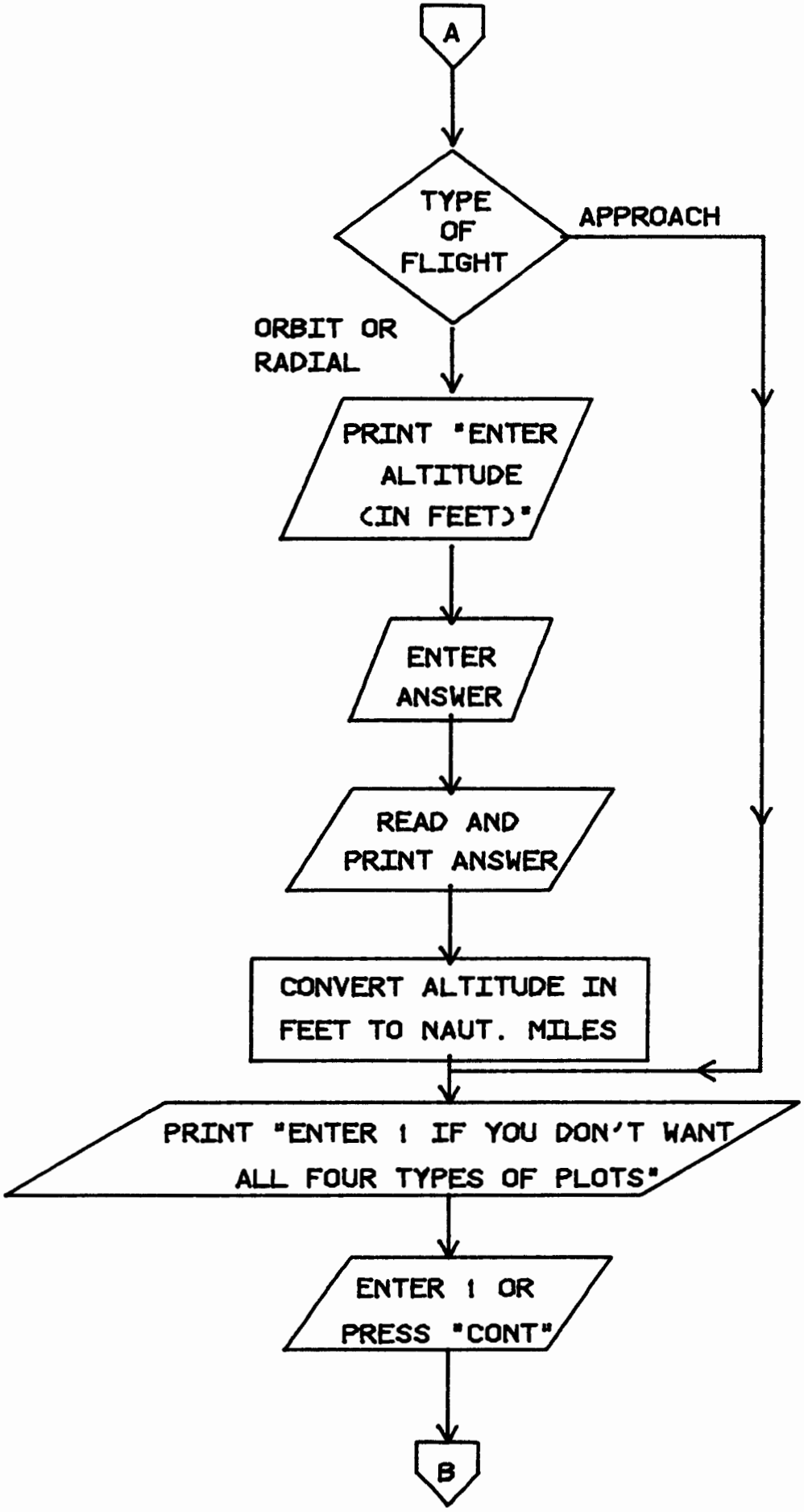
DISCUSSION

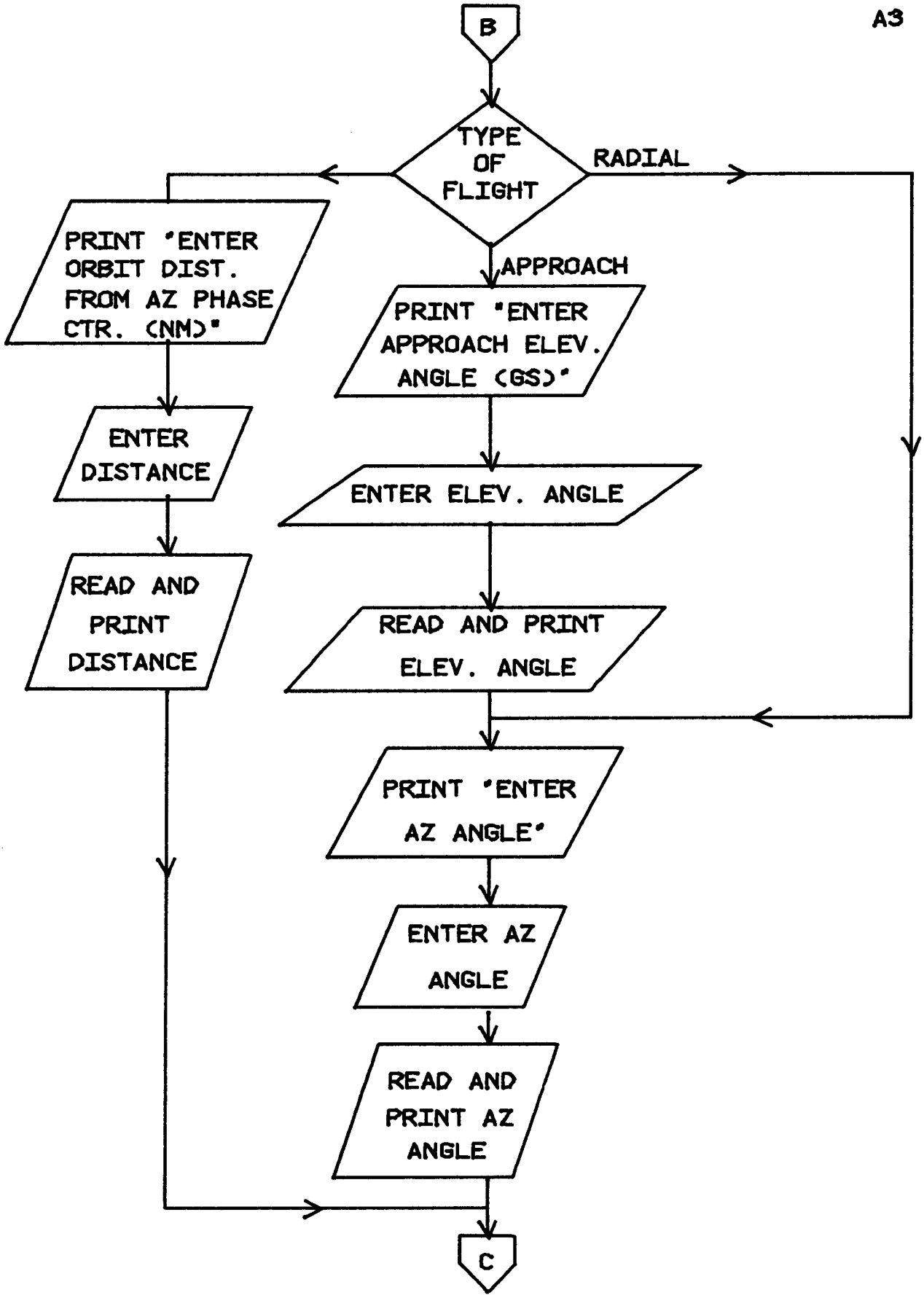
The main benefit of this technique revision is to orient the Calcomp plot in any position on the H.P. plotter, thus eliminating the need to align the plot relative to the plotting surface, and still retain sufficient accuracy. Consequently, there was a need to devise a way to rotate and translate the plot relative to a known point (0,0) on the plotter. This was best solved by performing all plotting in Graphic Defined Units (GDU's) as opposed to User Defined Units (UDU's). In this way, the coordinates of the points to be plotted can be found with respect to a known, unchangeable position.

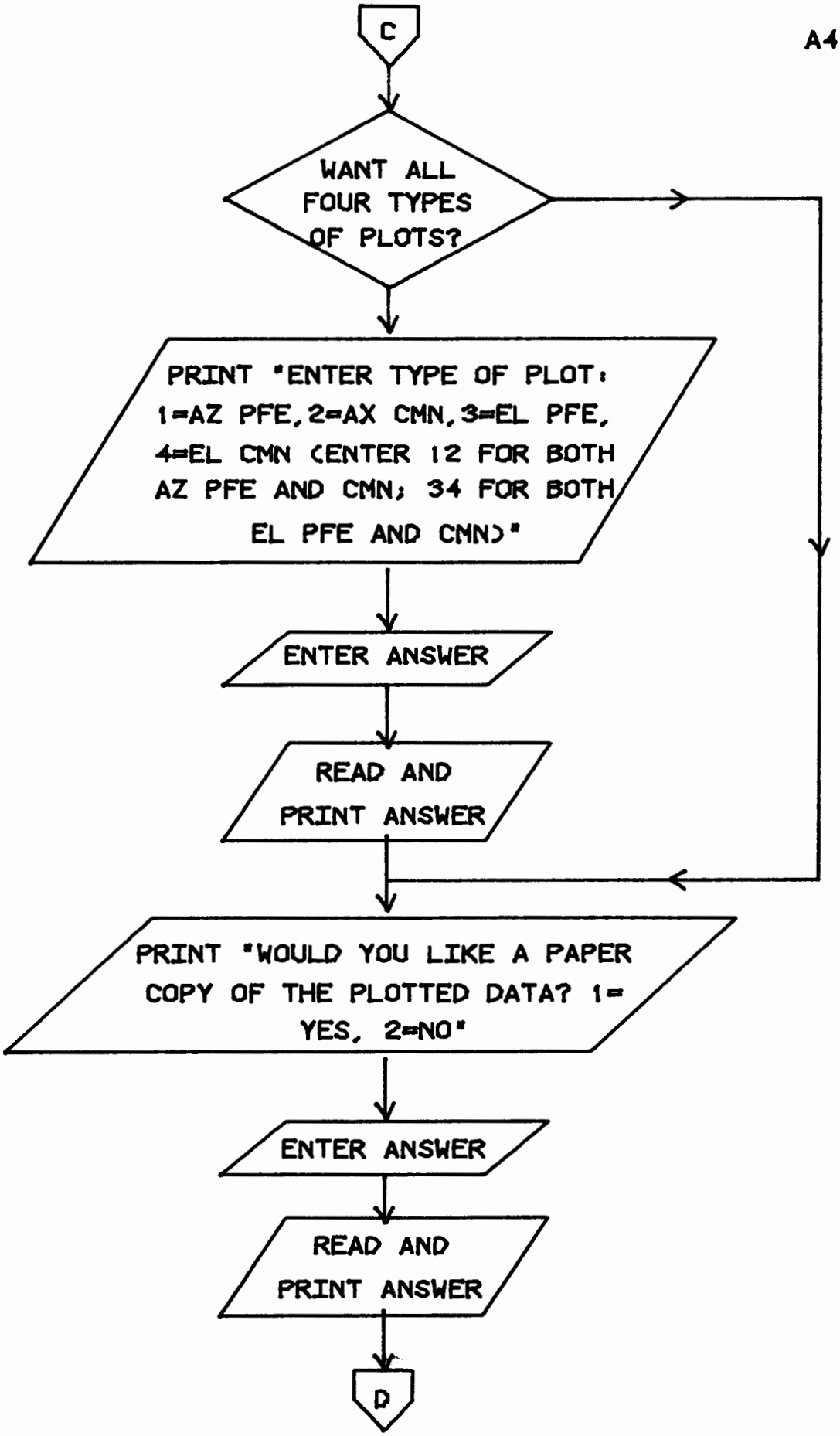
By digitizing the top of the Y axis, the bottom of the Y axis, and the end of the X axis in GDU's, a correction factor in GDU's per UDU for each axis is calculated. The angle of rotation and the distance in X and Y from the plotter's (0,0) point (lower left-hand corner) are also found. The coordinates of the Calcomp plots' rotated and translated origin are then computed. At this point, the previously calculated coordinates of the tolerances in UDU's are converted to GDU's, rotated by the angle of rotation, and translated to their respective positions relative to the new origin. The program then plots the revised tolerances and asks the user to prepare the next plot.

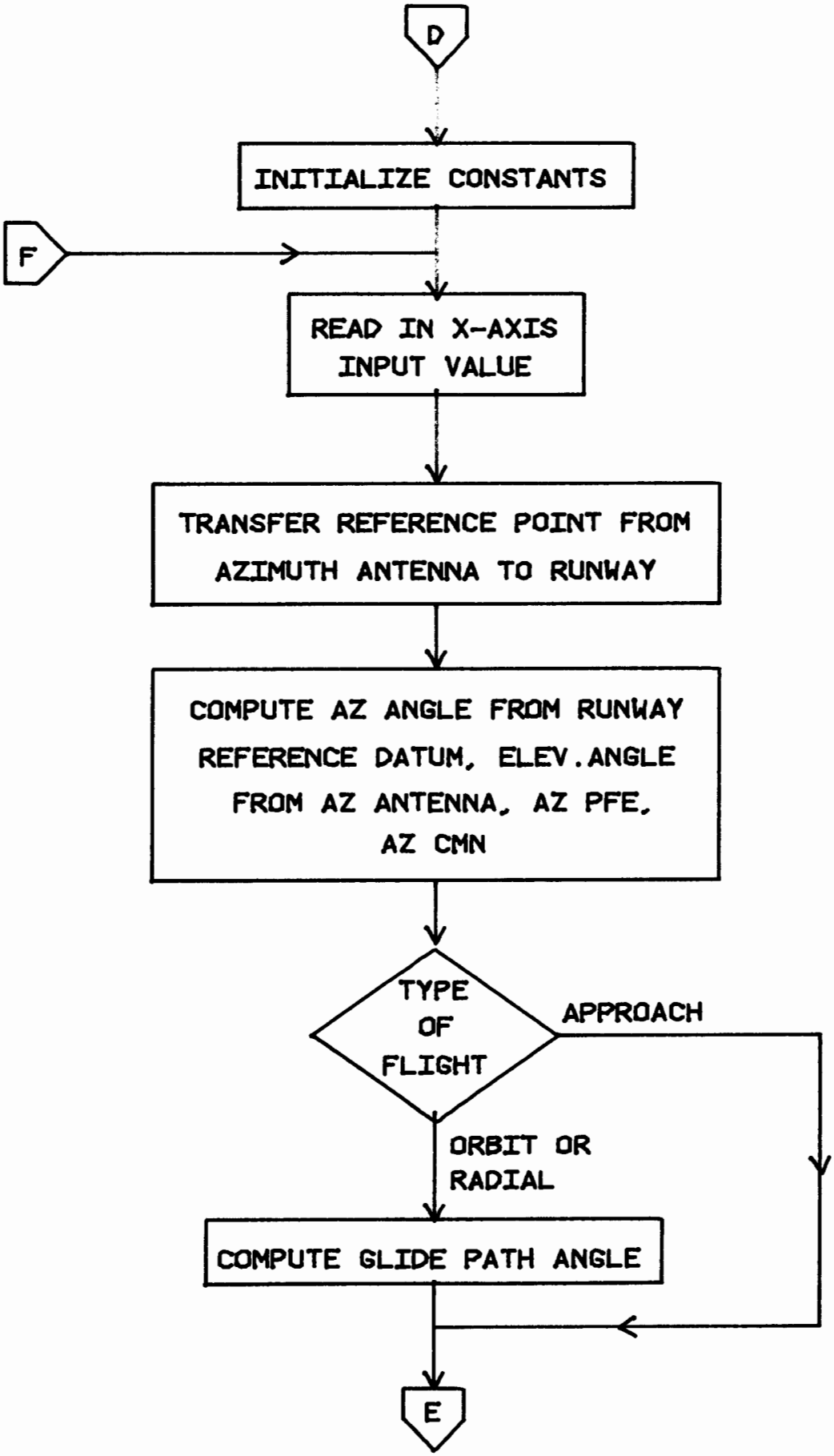
This procedure is just as accurate as the previous one while reducing the time needed to process plots by eliminating the need to align the papers. The time required to process any given series of runs is reduced in half using the new technique.

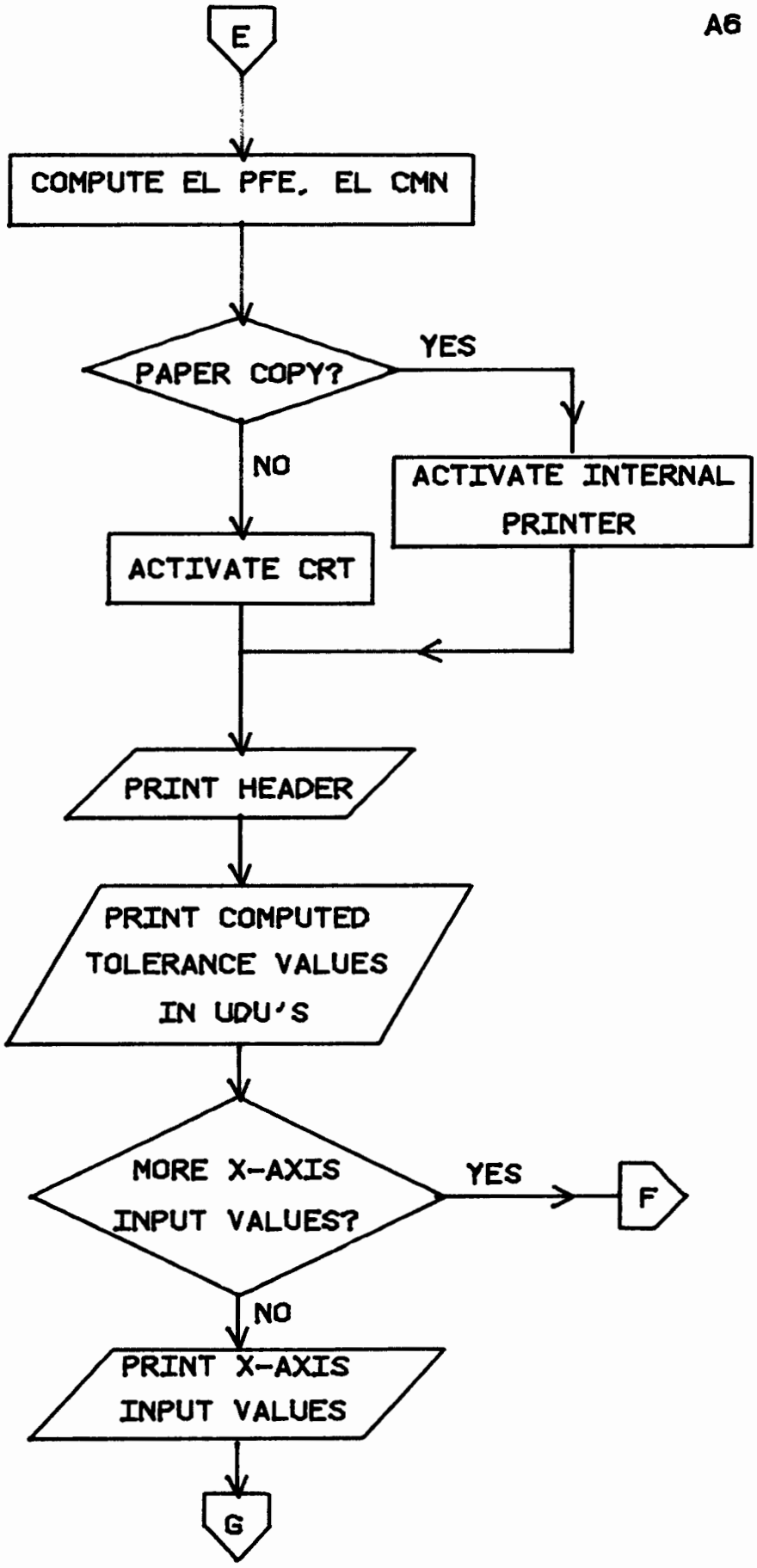

MAIN
PRINT "ENTER TYPE OF FLIGHT RADIAL=1, APPROACH=2, ORBIT=3"
ENTER ANSWER
READ AND PRINT ANSWER
TYPE OF FLIGHT
ORBIT
RADIAL OR APPROACH
INITIALIZE INPUT DATA FOR ORBITS
READ INPUT FILE FOR RADIAL OR APPROACH
ASSIGN INPUT DATA TO X-AXIS VALUES
A

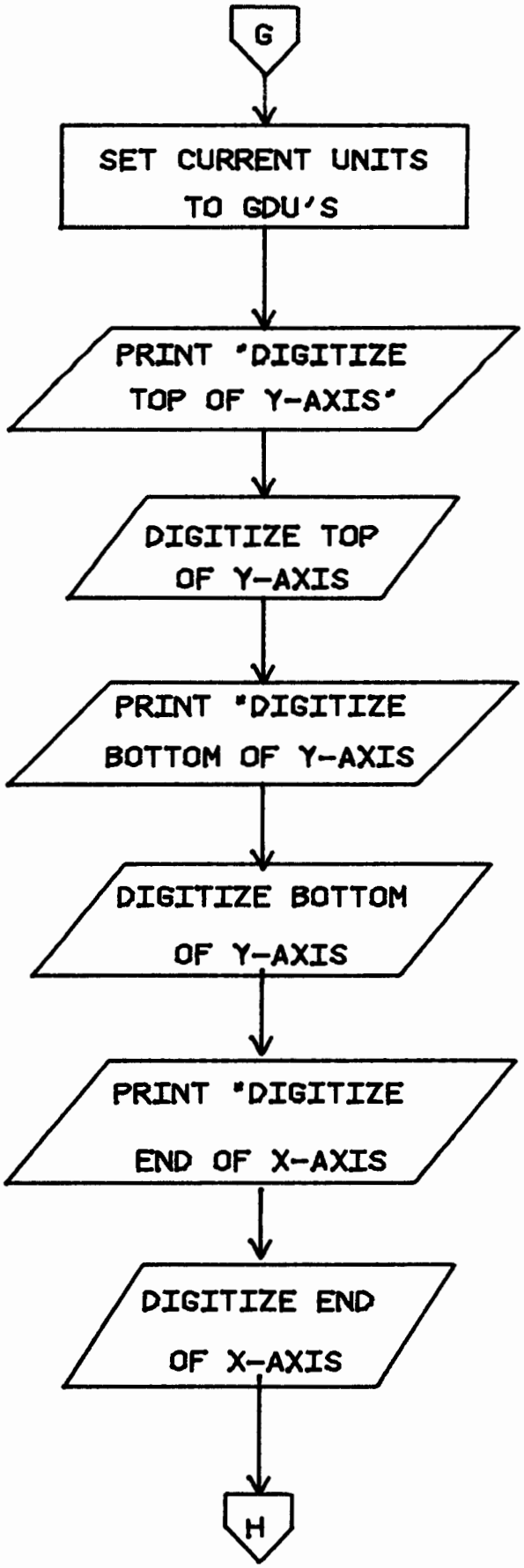

A
TYPE OF FLIGHT
APPROACH
ORBIT OR RADIAL
PRINT "ENTER ALTITUDE (IN FEET)"
ENTER ANSWER
READ AND PRINT ANSWER
CONVERT ALTITUDE IN FEET TO NAUT. MILES
PRINT "ENTER 1 IF YOU DON'T WANT ALL FOUR TYPES OF PLOTS"
ENTER 1 OR PRESS "CONT"
B

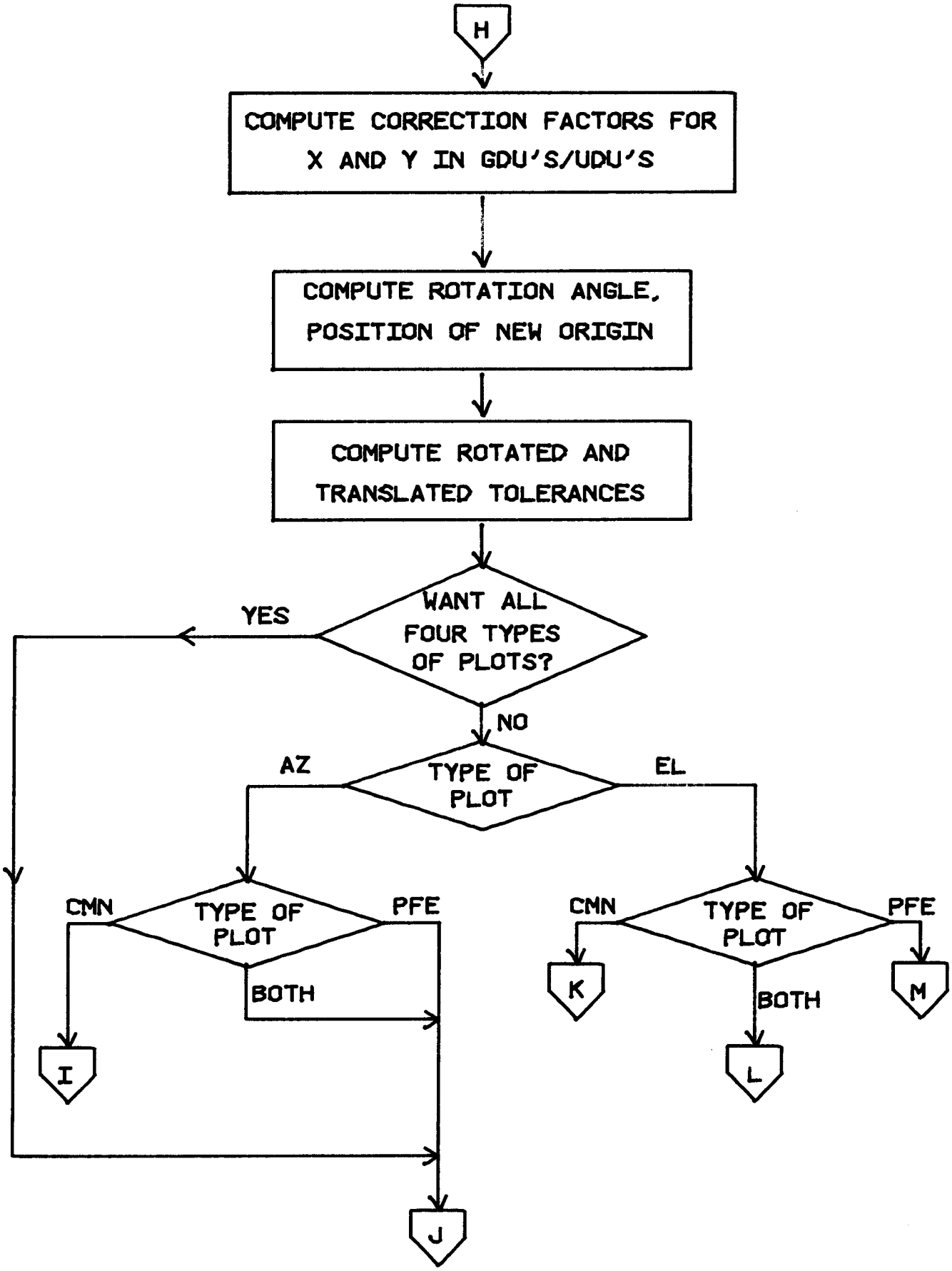

B
TYPE OF FLIGHT
RADIAL
APPROACH
PRINT "ENTER ORBIT DIST. FROM AZ PHASE CTR. (NM)"
ENTER DISTANCE
READ AND PRINT DISTANCE
PRINT "ENTER APPROACH ELEV. ANGLE (GS)"
ENTER ELEV. ANGLE
READ AND PRINT ELEV. ANGLE
PRINT "ENTER AZ ANGLE"
ENTER AZ ANGLE
READ AND PRINT AZ ANGLE
C

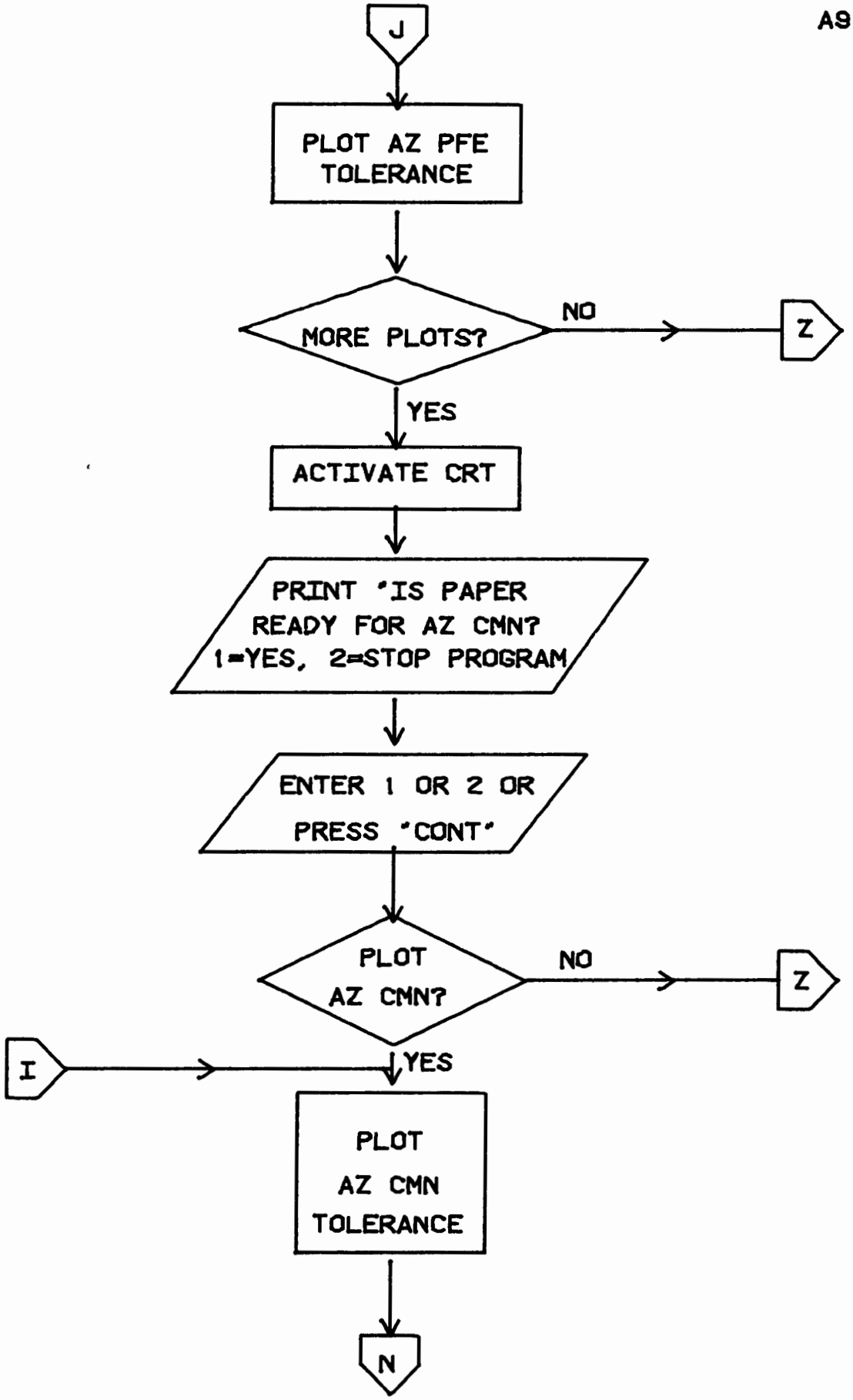

C
WANT ALL FOUR TYPES OF PLOTS?
PRINT "ENTER TYPE OF PLOT: 1=AZ PFE, 2=AX CMN, 3=EL PFE, 4=EL CMN (ENTER 12 FOR BOTH AZ PFE AND CMN; 34 FOR BOTH EL PFE AND CMN)"
ENTER ANSWER
READ AND PRINT ANSWER
PRINT "WOULD YOU LIKE A PAPER COPY OF THE PLOTTED DATA? 1= YES, 2=NO"
ENTER ANSWER
READ AND PRINT ANSWER
D

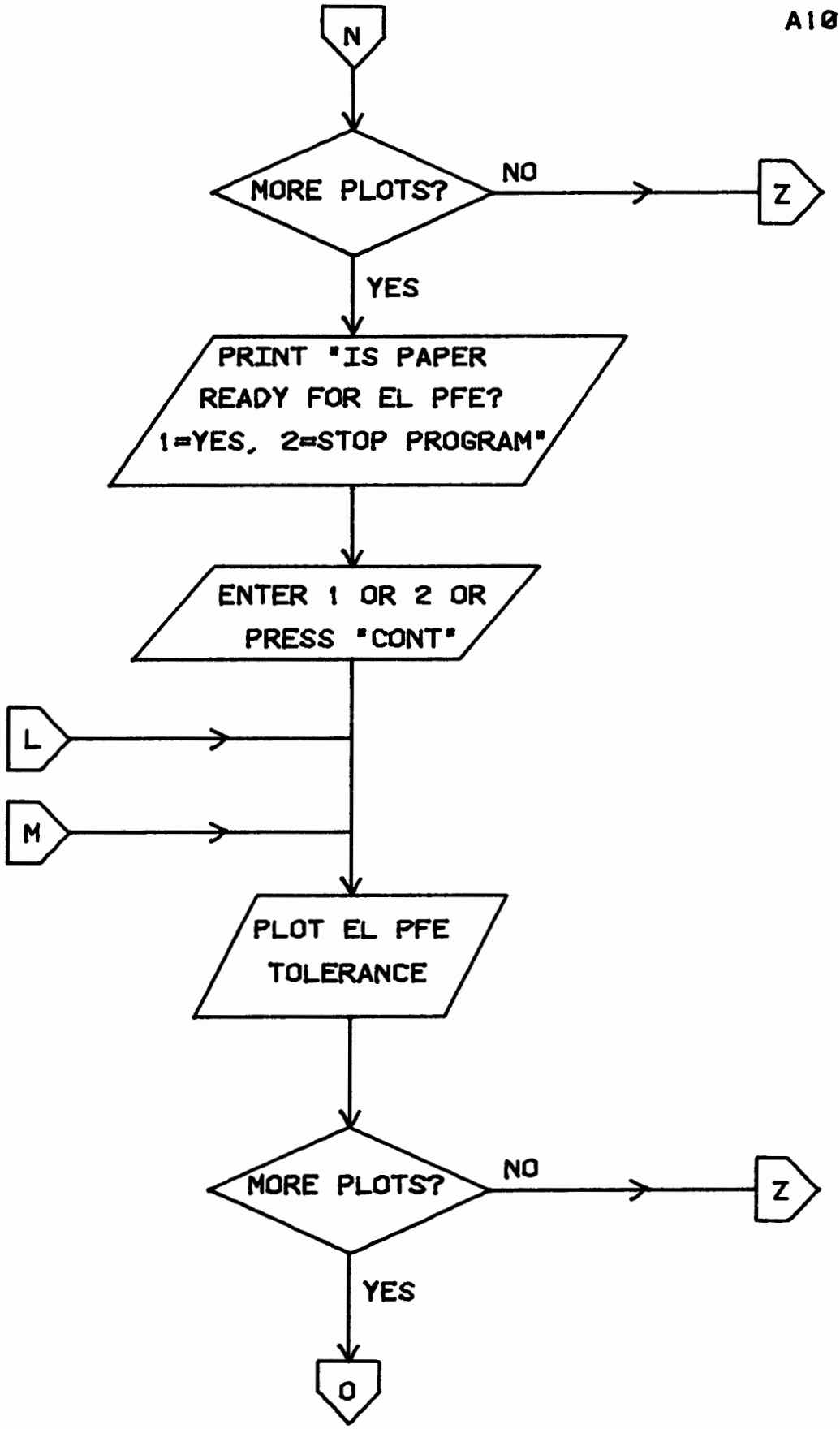

D
INITIALIZE CONSTANTS
F
READ IN X-AXIS INPUT VALUE
TRANSFER REFERENCE POINT FROM AZIMUTH ANTENNA TO RUNWAY
COMPUTE AZ ANGLE FROM RUNWAY REFERENCE DATUM, ELEV.ANGLE FROM AZ ANTENNA, AZ PFE, AZ CMN
TYPE OF FLIGHT
APPROACH
ORBIT OR RADIAL
COMPUTE GLIDE PATH ANGLE
E

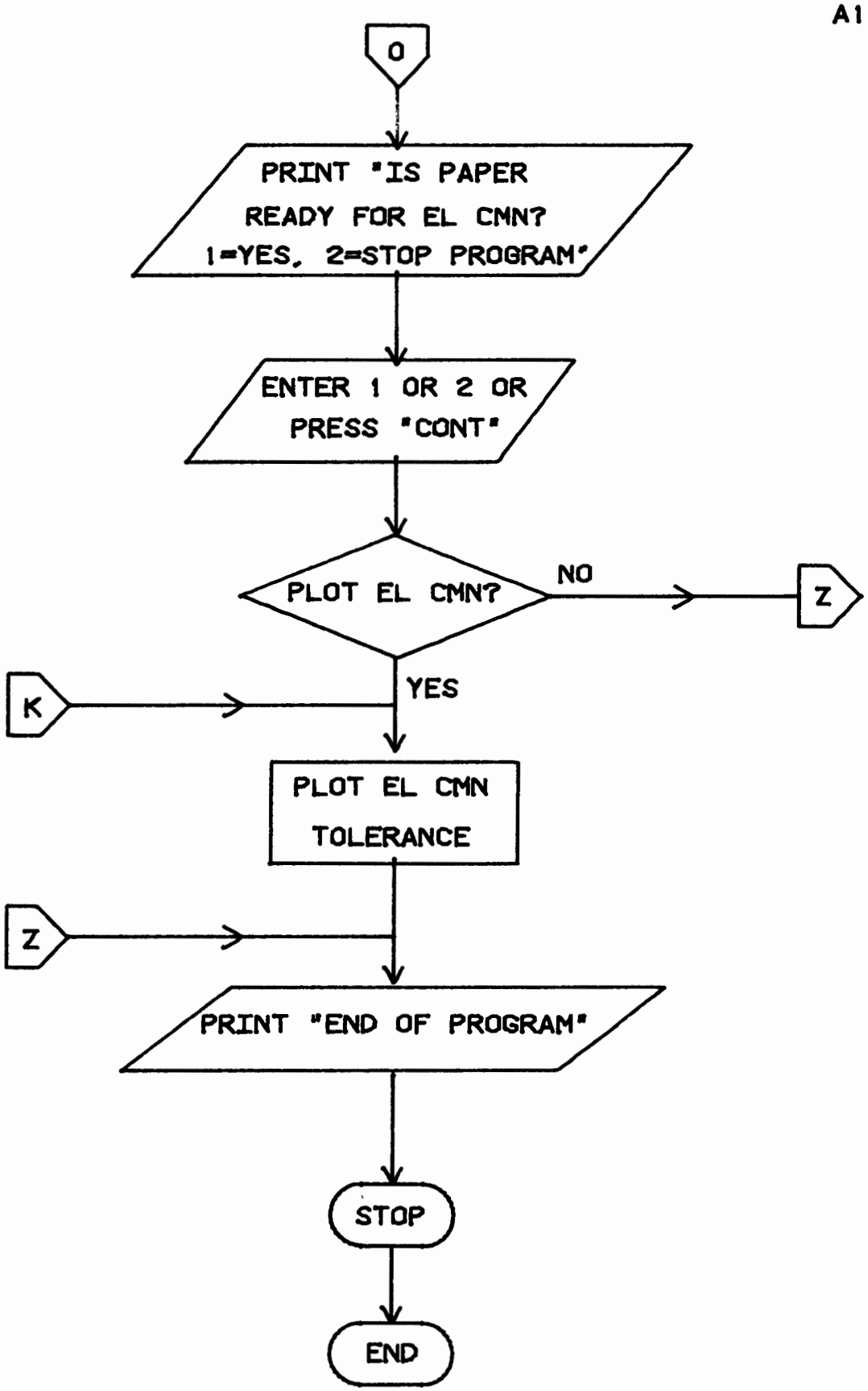

E
COMPUTE EL PFE, EL CMN
PAPER COPY?
YES
NO
ACTIVATE INTERNAL PRINTER
ACTIVATE CRT
PRINT HEADER
PRINT COMPUTED TOLERANCE VALUES IN UDU'S
MORE X-AXIS INPUT VALUES?
YES
F
NO
PRINT X-AXIS INPUT VALUES
G


G
SET CURRENT UNITS TO GDU'S
PRINT 'DIGITIZE TOP OF Y-AXIS'
DIGITIZE TOP OF Y-AXIS
PRINT 'DIGITIZE BOTTOM OF Y-AXIS
DIGITIZE BOTTOM OF Y-AXIS
PRINT 'DIGITIZE END OF X-AXIS
DIGITIZE END OF X-AXIS
H


H
COMPUTE CORRECTION FACTORS FOR X AND Y IN GDU'S/UDU'S
COMPUTE ROTATION ANGLE, POSITION OF NEW ORIGIN
COMPUTE ROTATED AND TRANSLATED TOLERANCES
WANT ALL FOUR TYPES OF PLOTS?
YES
NO
TYPE OF PLOT
AZ
EL
TYPE OF PLOT
CMN
PFE
BOTH
I
J
TYPE OF PLOT
CMN
PFE
BOTH
K
L
M


J
PLOT AZ PFE TOLERANCE
MORE PLOTS?
NO
Z
YES
ACTIVATE CRT
PRINT 'IS PAPER READY FOR AZ CMN? 1=YES, 2=STOP PROGRAM
ENTER 1 OR 2 OR PRESS 'CONT'
PLOT AZ CMN?
NO
Z
I
YES
PLOT AZ CMN TOLERANCE
N


N
MORE PLOTS?
NO
Z
YES
PRINT "IS PAPER
READY FOR EL PFE?
1=YES, 2=STOP PROGRAM"
ENTER 1 OR 2 OR
PRESS "CONT"
L
M
PLOT EL PFE
TOLERANCE
MORE PLOTS?
NO
Z
YES
O


0
PRINT "IS PAPER READY FOR EL CMN? 1=YES, 2=STOP PROGRAM"
ENTER 1 OR 2 OR PRESS "CONT"
PLOT EL CMN?
NO
Z
YES
K
PLOT EL CMN TOLERANCE
Z
PRINT "END OF PROGRAM"
STOP
END

```
10    !        ****************** "ROTDCA" ******************
20    ! ****************************************************************
30    ! ^^^ PLOTTING TOLERANCES ONTO DISPLACED AND ROTATED AXES ^^^
40    ! *** PROGRAM "ROTDCA" PLOTS MLS PFE AND CMN TOLERANCES FOR AZ AND EL
50    ! *** FOR WASHINGTON NATIONAL AIRPORT. ***
60    ! *** WRITTEN BY B. HENDRICK ON 1/28/82 ***
70    ! ****************************************************************
80    !
90    ! FILE "WASH" HOLDS DATA FOR DISTANCES FROM AZ PHASE CENTER FOR RADIALS
100   ! AND FILE "DSTORE" HOLDS THE ROUTINE TO ALTER THIS DATA
110   !
120   ! FILE "DIST2" HOLDS DATA FOR DISTANCES FROM AZ PHASE CENTER FOR APPROACHE
S
130   ! AND FILE "DSTOR" HOLDS THE ROUTINE TO ALTER THIS DATA
140   !
150   !
160   OPTION BASE 1
170   DIM Psi(3)
180   DIM D(25)
190   PLOTTER IS 7,5,"9872A"
200   PRINTER IS 16          !                ENABLES THE CRT
210    PRINT "ENTER TYPE OF FLIGHT: RADIAL=1, APPROACH=2, ORBIT=3"
220   INPUT L
230    PRINT L,LIN(1)
240 IF L=2 THEN 290
250 IF L=3 THEN 320
260   ASSIGN #1 TO "WASH"
270   S=25
280    GOTO 360
290   ASSIGN #1 TO "DIST2"
300   S=10
310    GOTO 360
320   Psi(1)=-10
330   Psi(2)=0  ! SET AZ TRACKER VALUES FOR ORBIT ONLY
340   Psi(3)=10
350    GOTO 390
360  FOR B=1 TO S
370   READ #1;D(B)
380  NEXT B
390 IF L=2 THEN 440
400    PRINT "ENTER ALTITUDE (IN FEET)"
410   INPUT Alt1
420    PRINT Alt1,LIN(1)
430   Alt=Alt1/6076                  ! CONVERTS FEET TO NM
440    PRINT "ENTER 1 IF YOU DON'T WANT ALL FOUR TYPES OF PLOTS"
450   INPUT No
460    PRINT No,LIN(1)
470 IF L=1 THEN 520                  ! RADIAL
480 IF L=3 THEN 560                  ! ORBIT
490    PRINT "ENTER APPROACH ELEVATION ANGLE (GLIDE PATH)"
500   INPUT Phi
510    PRINT Phi,LIN(1)
520    PRINT "ENTER AZ ANGLE"
530   INPUT Psi
540    PRINT Psi,LIN(1)
550     GOTO 610
560    PRINT "ENTER ORBIT DIST FROM AZ PHASE CENTER(NM)"
570   INPUT L1
580    PRINT L1,LIN(1)
590 IF L=3 THEN H=3
600    GOTO 630
610 IF L=1 THEN H=25
620 IF L=2 THEN H=10
630 IF No=0 THEN 680
640    PRINT "ENTER TYPE OF PLOT:1=AZ PFE, 2=AZ CMN, 3=EL PFE, 4=EL CMN,(ENTER 1
2 FOR BOTH AZ PFE AND CMN, 34 FOR BOTH EL PFE AND CMN)"
```

```
650   INPUT K3
660    PRINT K3,LIN(1)
670     GOTO 690
680    K3=1
690    PRINT "PAPER COPY? 1=YES"
700    INPUT K2
710    PRINT K2,LIN(1)
720    IF K2<>1 THEN 800
730    PRINTER IS 0
740    PRINT "AZ PFE","AZ CMN","EL PFE","EL CMN",LIN(3)
750 !
760 !
770 !                TOLERANCE CALCULATIONS:
780 !
790 !
800   Add=0
810   X=4954/6076 !DIST FROM AZ ANTENNA TO A POINT ON RWY OPPOSITE EL ANTENNA
820   X1=5212/6076 ! DIST FROM AZ ANTENNA TO THRESHOLD
830   X2=.22
840   X3=.133
850   X4=.05
860   X5=.1
870   X6=.5
880   DIM A(25,4)
890   DEG
900   !
910   ! TRANSFER OF REFERENCE POINT FROM AZ ANTENNA TO RWY
920   !
930   FOR B=1 TO H
940    IF L=3 THEN 980 ! SKIP IF ORBIT
950    Y=D(B)*SIN(Psi)
960    X7=D(B)*COS(Psi)-X
970     GOTO 1000
980    Y=L1*SIN(Psi(B))
990    X7=L1*COS(Psi(B))
1000   Z=Y/X7
1010   Theta=ATN(Z) !THETA= AZ ANGLE FROM RWY REFERENCE DATUM
1020  !
1030  !      $$$$$$$   AZ TOLERANCES   $$$$$$$
1040  !
1050 IF L=2 THEN 1130
1060 IF L=1 THEN 1090
1070  Z1=Alt/L1
1080   GOTO 1100
1090  Z1=Alt/D(B)
1100  Phi1=ATN(Z1)       !Phi1=EL ANGLE FROM AZ ANTENNA
1110 IF Phi1<9 THEN 1130
1120   GOTO 1140
1130  Phi1=9
1140  IF Phi1>20 THEN 1670
1150  !
1160  !       PFE CALCULATIONS
1170  !
1180 IF L=3 THEN 1210
1190  Dfeaz=1+(D(B)-X1)/20
1200   GOTO 1220
1210  Dfeaz=1+(L1-X1)/20
1220  Afeaz=1+ABS(.5*Theta/40)
1230  Efeaz=1+(Phi1-9)/11
1240  Pfeaz=X2*Dfeaz*Afeaz*Efeaz !     **** AZ PFE ****
1250  !
1260  !      CMN CALCULATIONS
1270  !
1280  IF L=3 THEN 1310
1290  Dmnaz=1+.3*(D(B)-X1)/10
1300   GOTO 1320
```

```
1310  Dmnaz=1+.3*(L1-X1)/10
1320  Amnaz=1+ABS(.3*Theta/40)
1330  Cmnaz=X5*Dmnaz*Amnaz        !      **** AZ CMN ****
1340  !
1350  !      $$$$$$$   EL TOLERANCES   $$$$$$$
1360  !
1370 IF L=2 THEN 1440
1380 IF L=1 THEN 1410
1390  Z1=Alt/(L1-X)
1400   GOTO 1430
1410  E=D(B)-X
1420  Z1=Alt/E
1430  Phi=ATN(Z1)
1440 IF Phi<6 THEN 1460 ! Phi=GLIDE PATH ANGLE
1450   GOTO 1470
1460  Phi=6
1470  !
1480  !       PFE CALCULATIONS
1490  !
1500 IF L=3 THEN 1530
1510  Dfeel=1+X6*(D(B)-X1)/20
1520   GOTO 1540
1530  Dfeel=1+X6*(L1-X1)/20
1540  Efeel=1+(Phi-6)/9
1550  Pfeel=X3*Dfeel*Efeel*Amnaz !        **** EL PFE ****
1560  !
1570  !      CMN CALCULATIONS
1580  !
1590  Cmnel=X4*Dmnaz*Amnaz*Efeel !        **** EL CMN ****
1600  !
1610  A(B,1)=Pfeaz
1620  A(B,2)=Cmnaz
1630  A(B,3)=Pfeel
1640  A(B,4)=Cmnel
1650  !
1660   PRINT A(B,1),A(B,2),A(B,3),A(B,4)
1670  NEXT B
1680 IF L=3 THEN 1720
1690    PRINT "DIST VALUES(INPUT)"
1700    MAT PRINT D
1710     GOTO 1750
1720    PRINT "AZ ANGLE VALUES(INPUT)"
1730    MAT PRINT Psi
1740    !
1750    !            *****  SET UP PLOTTER  *****
1760    !
1770  SETGU
1780  PRINT "DIGITIZE TOP OF Y AXIS"
1790  POINTER 11,100
1800  DIGITIZE X1,Y1
1810  PRINT
1820  PRINT "DIGITIZE BOTTOM OF Y AXIS"
1830  POINTER 11,5
1840  DIGITIZE X2,Y2
1850  PRINT
1860  PRINT "DIGITIZE END OF X AXIS"
1870  POINTER 115,5
1880  DIGITIZE X3,Y3
1890  Xdis=X3-X2
1900  Ydis=Y1-Y2
1910 IF L=3 THEN Xgupuu=Xdis/20
1920 IF L<>3 THEN Xgupuu=Xdis/10
1930  Ygupuu=Ydis/.90
1940  DEG
1950  Rot=ATN((X1-X2)/(Y1-Y2))
1960  IF L=3 THEN X0=(X1+X3)/2
```

```
1970  IF L=3 THEN Y0=(Y1+Y3)/2
1980  IF L<>3 THEN X0=(X1+X2)/2
1990  IF L<>3 THEN Y0=(Y1+Y2)/2
2000  LOCATE 0,120,0,100
2010  !
2020  !
2030  ! ******PLOTTING OF TOLERANCES *******
2040  !
2050  !
2060 FOR W=2 TO 3
2070 FOR B=1 TO H
2080  IF L<>3 THEN Xer=D(B)*Xgupuu
2090  IF L=3 THEN Xer=Psi(B)*Xgupuu
2100  Y1er=A(B,1)*Ygupuu*(-1)^W
2110  Y2er=A(B,2)*Ygupuu*(-1)^W
2120  Y3er=A(B,3)*Ygupuu*(-1)^W
2130  Y4er=A(B,4)*Ygupuu*(-1)^W
2140  X1r=Xer*COS(Rot)+Y1er*SIN(Rot)
2150  X2r=Xer*COS(Rot)+Y2er*SIN(Rot)
2160  X3r=Xer*COS(Rot)+Y3er*SIN(Rot)
2170  X4r=Xer*COS(Rot)+Y4er*SIN(Rot)
2180  Y1r=Y1er*COS(Rot)-Xer*SIN(Rot)
2190  Y2r=Y2er*COS(Rot)-Xer*SIN(Rot)
2200  Y3r=Y3er*COS(Rot)-Xer*SIN(Rot)
2210  Y4r=Y4er*COS(Rot)-Xer*SIN(Rot)
2220  X1new=X1r+X0
2230  X2new=X2r+X0
2240  X3new=X3r+X0
2250  X4new=X4r+X0
2260  Y1new=Y1r+Y0
2270  Y2new=Y2r+Y0
2280  Y3new=Y3r+Y0
2290  Y4new=Y4r+Y0
2300 IF K3=34 THEN 2430
2310 IF K3=12 THEN 2340
2320 IF K3>1 THEN 2370
2330   LINE TYPE 1
2340 IF (A(B,1)<=.45) AND (A(B,1)<>0) THEN PLOT X1new,Y1new!  PLOTS AZ PFE
2350    GOTO 2480
2360 IF K3=12 THEN 2380
2370 IF K3>2 THEN 2410
2380   LINE TYPE 5
2390 IF (A(B,2)<=.45) AND (A(B,2)<>0) THEN PLOT X2new,Y2new!  PLOTS AZ CMN
2400    GOTO 2480
2410 IF K3=34 THEN 2430
2420 IF K3>3 THEN 2460
2430   LINE TYPE 1
2440 IF (A(B,3)<=.45) AND (A(B,3)<>0) THEN PLOT X3new,Y3new!  PLOTS EL PFE
2450    GOTO 2480
2460   LINE TYPE 5
2470 IF (A(B,4)<=.45) AND (A(B,4)<>0) THEN PLOT X4new,Y4new!  PLOTS EL CMN
2480  NEXT B
2490   PENUP
2500  NEXT W
2510   PENUP
2520 IF K3=12 THEN 2630
2530 IF K3=34 THEN 2760
2540  !
2550  ! ****** CONTINUE PLOTTING WITH SAME DATA *******
2560  !          +++ ADVANCE TO NEXT PLOT +++
2570  !
2580 IF No=1 THEN 2820
2590 IF (No=0) AND (K3=1) THEN 2630
2600 IF (No=0) AND (K3=2) THEN 2700
2610 IF (No=0) AND (K3=3) THEN 2760
2620 IF (No=0) AND (K3=4) THEN 2820
```

```
2630   PRINTER IS 16
2640   PRINT "IS PAPER READY FOR AZ CMN PLOT(FILT 2)?    2=STOP PROGRAM"
2650   BEEP
2660  INPUT Cont1
2670 IF Cont1=2 THEN 2820
2680   K3=2
2690    GOTO 1750
2700   PRINT "IS PAPER READY FOR EL PFE PLOT(FILT 1)?    2=STOP PROGRAM"
2710   BEEP
2720  INPUT Cont2
2730 IF Cont2=2 THEN 2820
2740   K3=3
2750    GOTO 1750
2760   PRINT "IS PAPER READY FOR EL CMN PLOT(FILT 2)?    2=STOP PROGRAM"
2770   BEEP
2780  INPUT Cont3
2790 IF Cont3=2 THEN 2820
2800   K3=4
2810    GOTO 1750
2820   PRINT "END OF PROGRAM"
2830   BEEP
2840 STOP
2850  END
```

** QUESTIONS AND ANSWERS FOR A 6 DEGREE APPROACH **

PLOTS ONE THROUGH FOUR ARE THE RESULTS OF PLOTTING THE DATA BELOW

ENTER TYPE OF FLIGHT: RADIAL=1, APPROACH=2, ORBIT=3
2

ENTER 1 IF YOU DON'T WANT ALL FOUR TYPES OF PLOTS
0

ENTER APPROACH ELEVATION ANGLE (GLIDE PATH)
6

ENTER AZ ANGLE
0

PAPER COPY? 1=YES
1

AZ PFE	AZ CMN	EL PFE	EL CMN
.222664186965	.100726596445	.133805311061	5.03632982225E-02
.232564186965	.103426596445	.136797811061	5.17132982225E-02
.243564186965	.106426596445	.140122811061	5.32132982225E-02
.254564186965	.109426596445	.143447811061	5.47132982225E-02
.265564186965	.112426596445	.146772811061	5.62132982225E-02
.276564186965	.115426596445	.150097811061	5.77132982225E-02
.287564186965	.118426596445	.153422811061	5.92132982225E-02
.298564186965	.121426596445	.156747811061	6.07132982225E-02
.309564186965	.124426596445	.160072811061	6.22132982225E-02
.320564186965	.127426596445	.163397811061	6.37132982225E-02

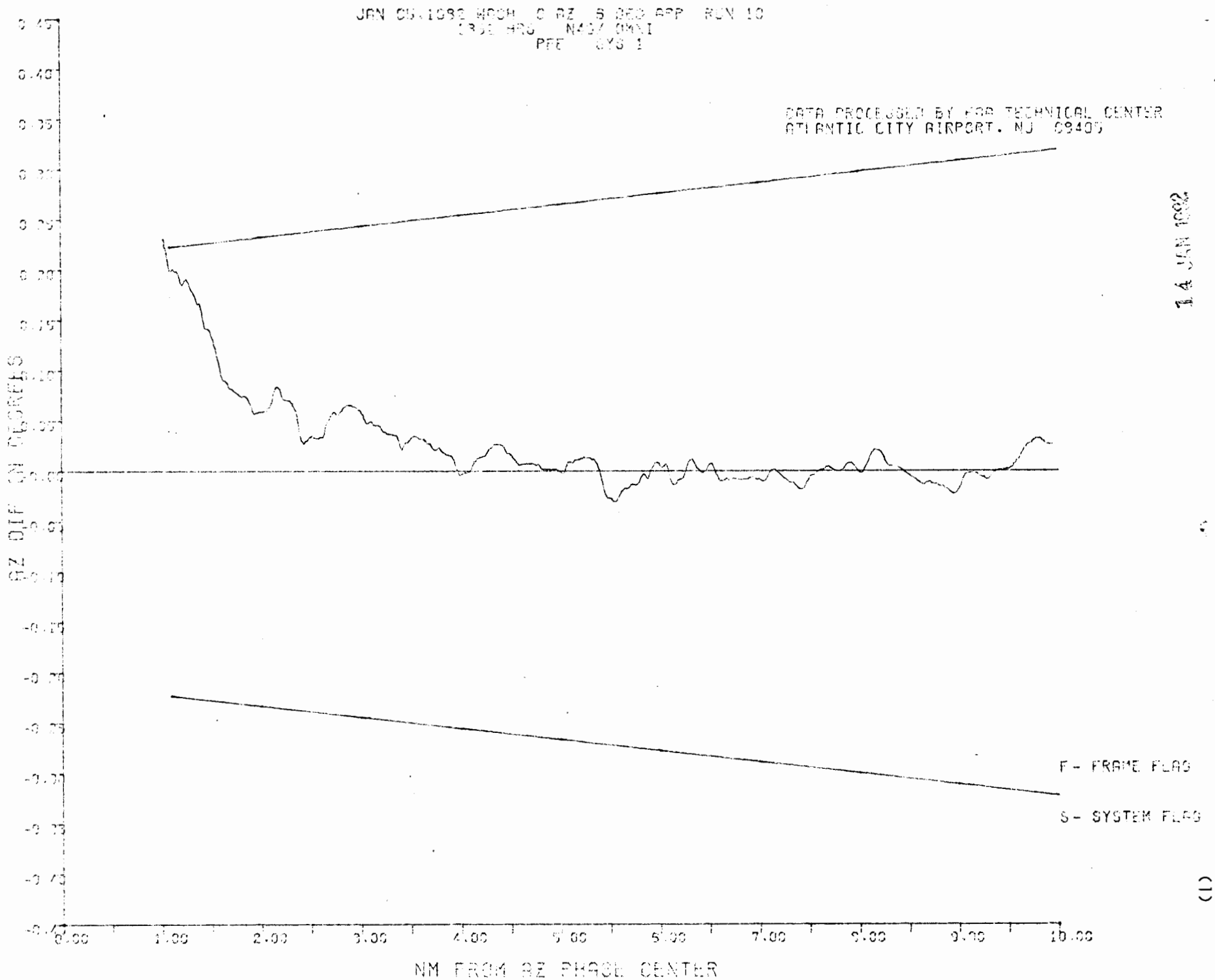
DIST VALUES(INPUT)

1.1	2	3	4
5	6	7	8
9	10	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0			

DIGITIZE TOP OF Y AXIS

DIGITIZE BOTTOM OF Y AXIS

DIGITIZE END OF X AXIS


JAN 05,1982 WASH C AZ 5 DEG APP RUN 10
PFE SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
AZ DIF IN DEGREES
NM FROM AZ PHASE CENTER
F - FRAME FLAG
S - SYSTEM FLAG
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

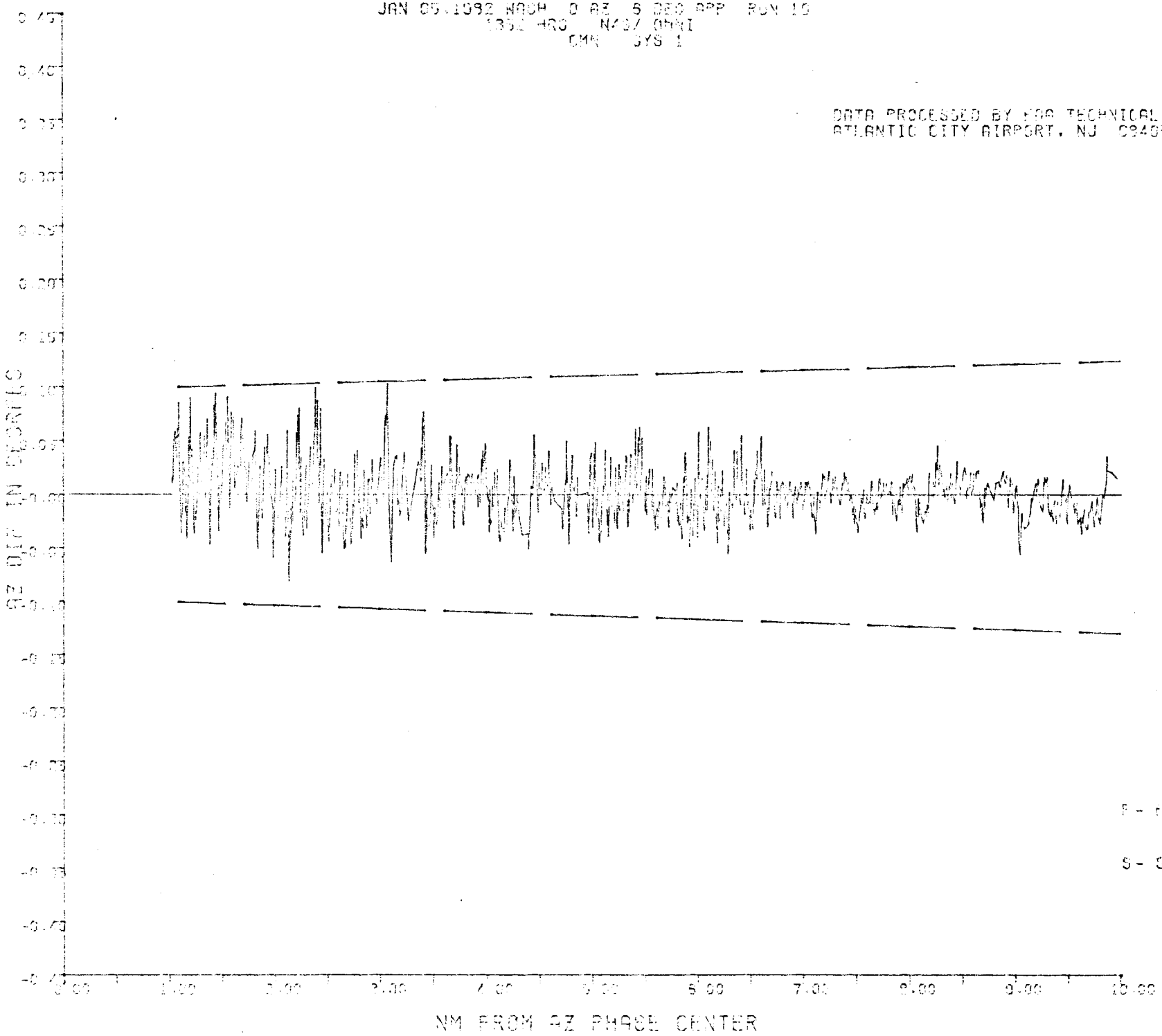
14 JAN 1982

(1)

JAN 05.1982 WASH 0 AZ 5 DEG APP RUN 19
1351 HRS N437 OMNI
CMR SYS 1

DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405

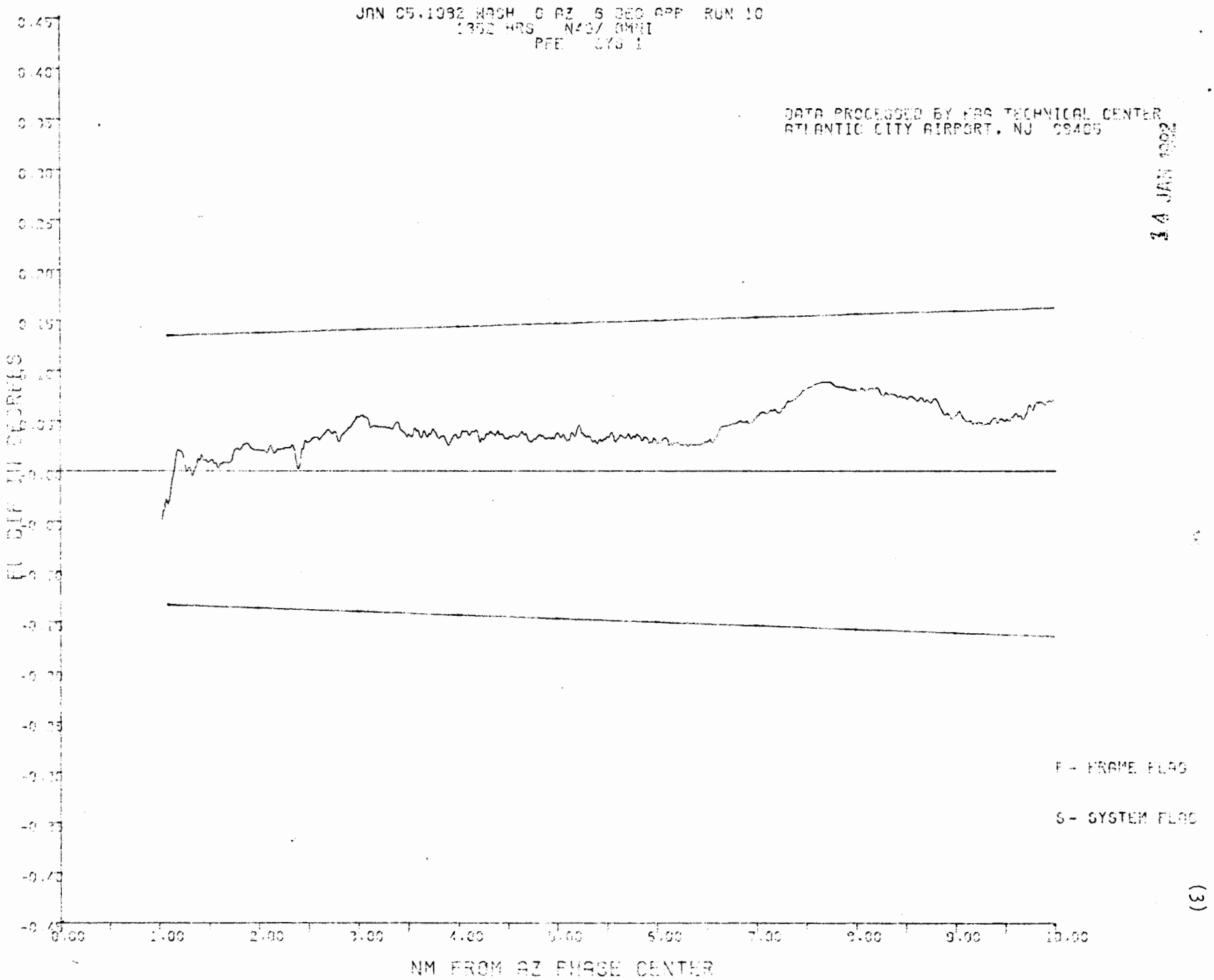
14 JAN 1982



P - PROBE FLAG

S - SYSTEM FLAG

(2)

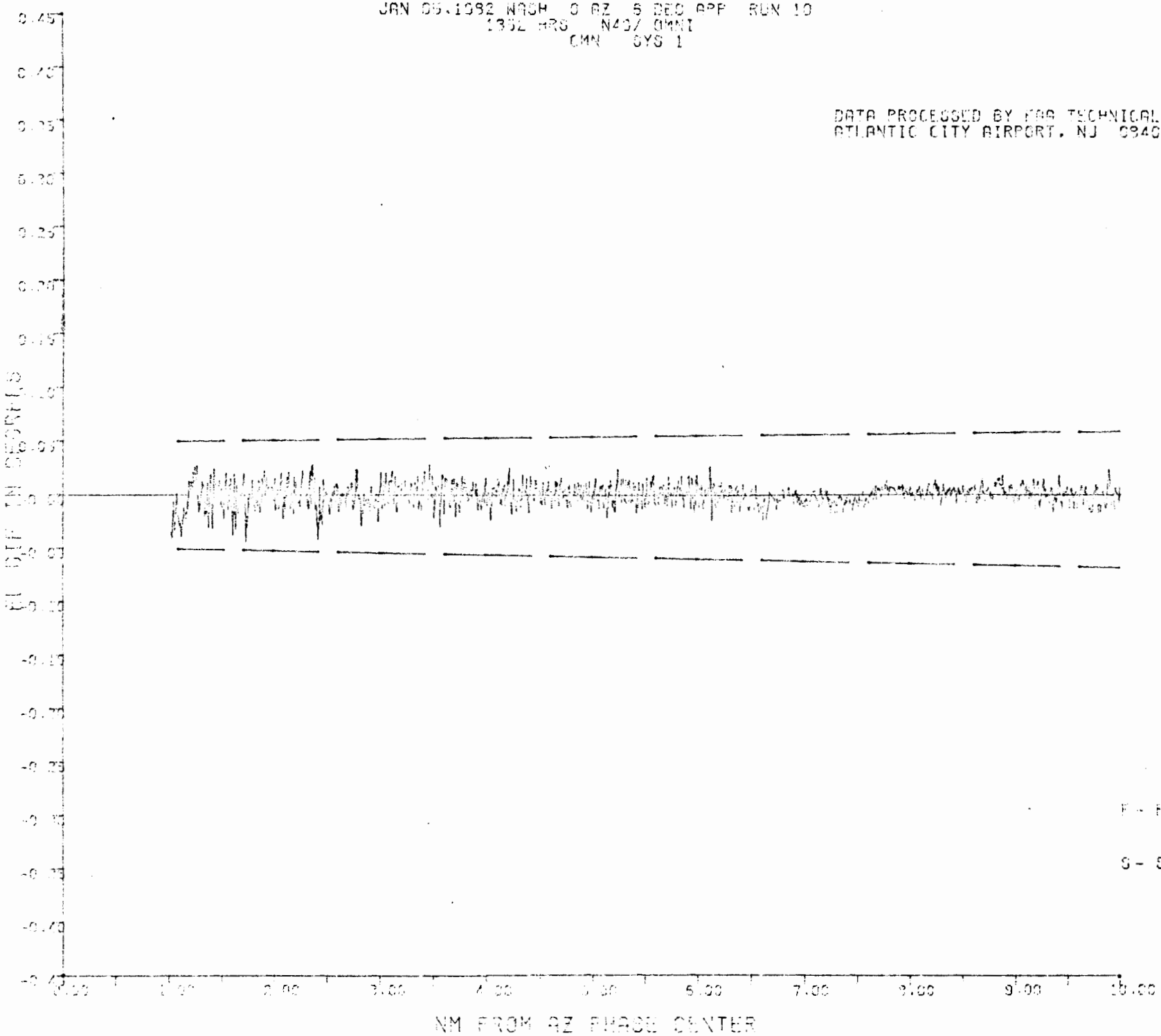

JAN 05,1982 WASH 0 AZ 6 DEG APP RUN 10
1352 HRS N43/ OMNI
PFE SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
14 JAN 1982
F - FRAME FLAG
S - SYSTEM FLAG
NM FROM AZ PHASE CENTER
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00

(3)

JAN 05,1982 WASH 0 RZ 5 DEG BPF RUN 10
1352 HRS N40/ OMNI
CMN SYS 1

DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405

14 JAN 1982



F - FRAME FLAG

S - SYSTEM FLAG

(4)

** QUESTIONS AND ANSWERS FOR A 4000′ ORBIT **

PLOTS FIVE THROUGH EIGHT ARE THE RESULTS OF PLOTTING THE DATA BELOW

ENTER TYPE OF FLIGHT: RADIAL=1, APPROACH=2, ORBIT=3
3

ENTER ALTITUDE (IN FEET)
4000

ENTER 1 IF YOU DON′T WANT ALL FOUR TYPES OF PLOTS
0

ENTER ORBIT DIST FROM AZ PHASE CENTER(NM)
7

PAPER COPY? 1=YES
1

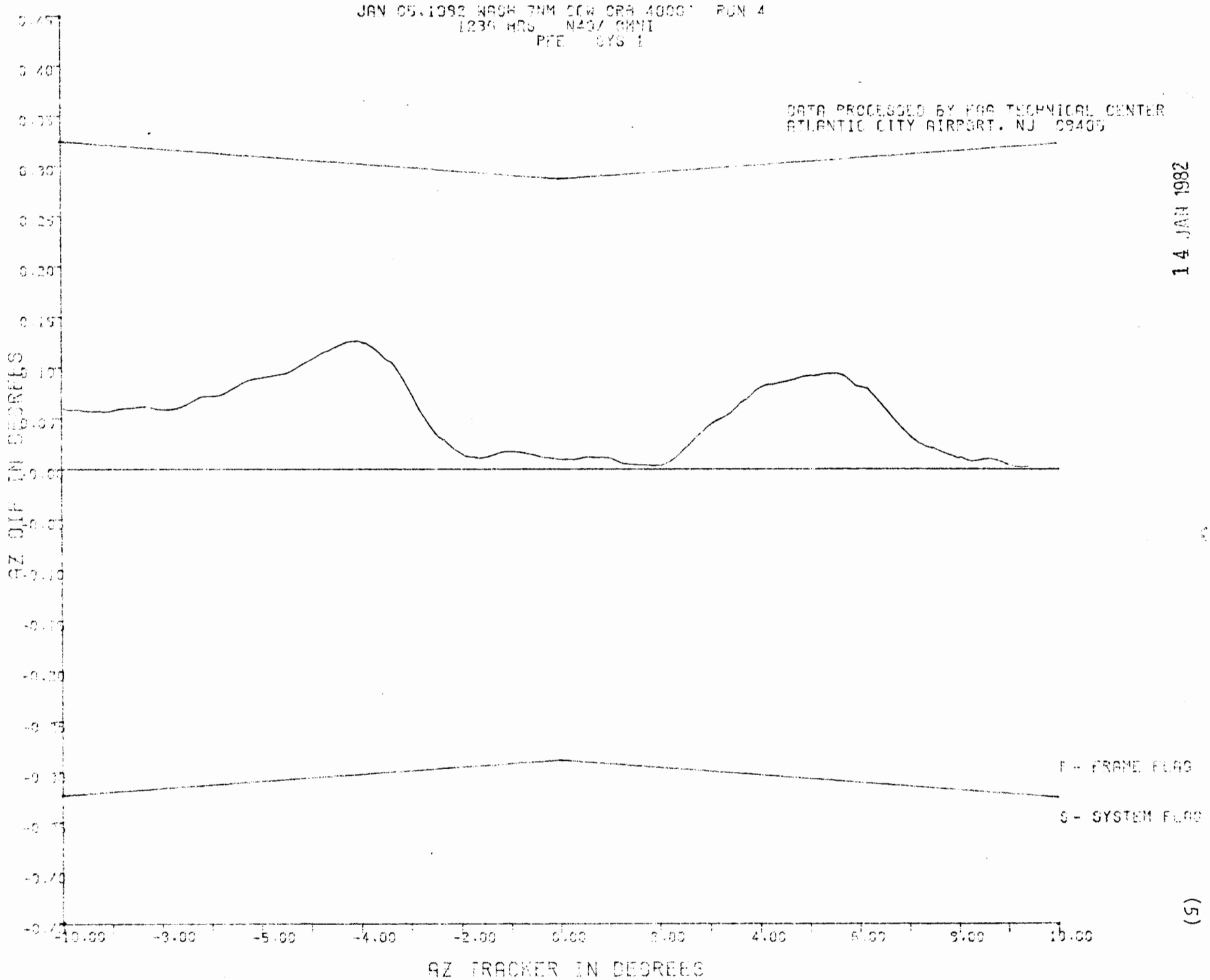
AZ PFE	AZ CMN	EL PFE	EL CMN
.323509710336	.127308591178	.166321983994	6.41917141988E-02
.287564186965	.118426596445	.154718124646	5.97182251850E-02
.323509710336	.127308591178	.166321983994	6.41917141988E-02

AZ ANGLE VALUES(INPUT)
-10 0 10

DIGITIZE TOP OF Y AXIS

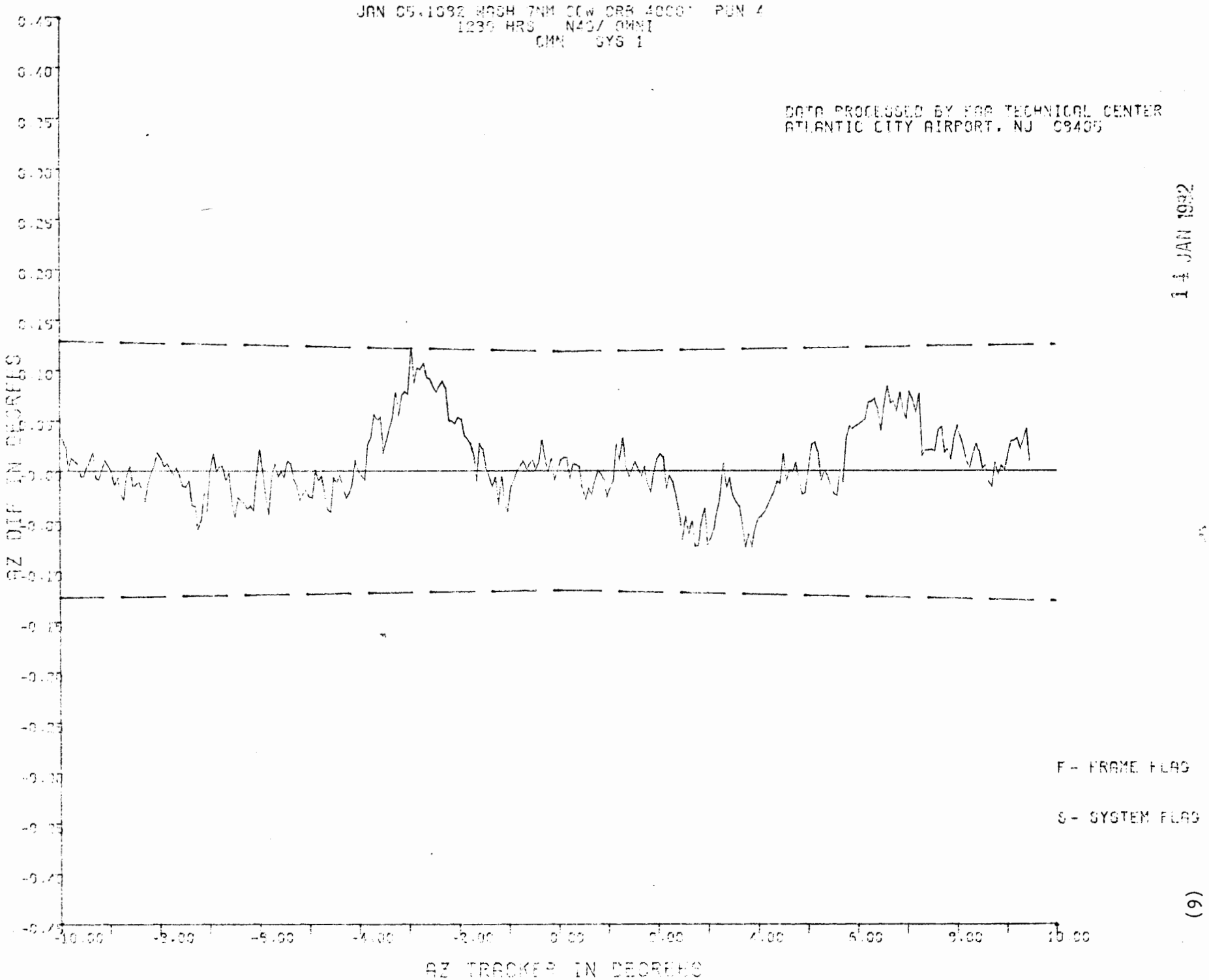
DIGITIZE BOTTOM OF Y AXIS

DIGITIZE END OF X AXIS


JAN 05,1982 WASH 7NM CCW CRB 4000' RUN 4
1236 HRS N40/ OMNI
PFE SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00

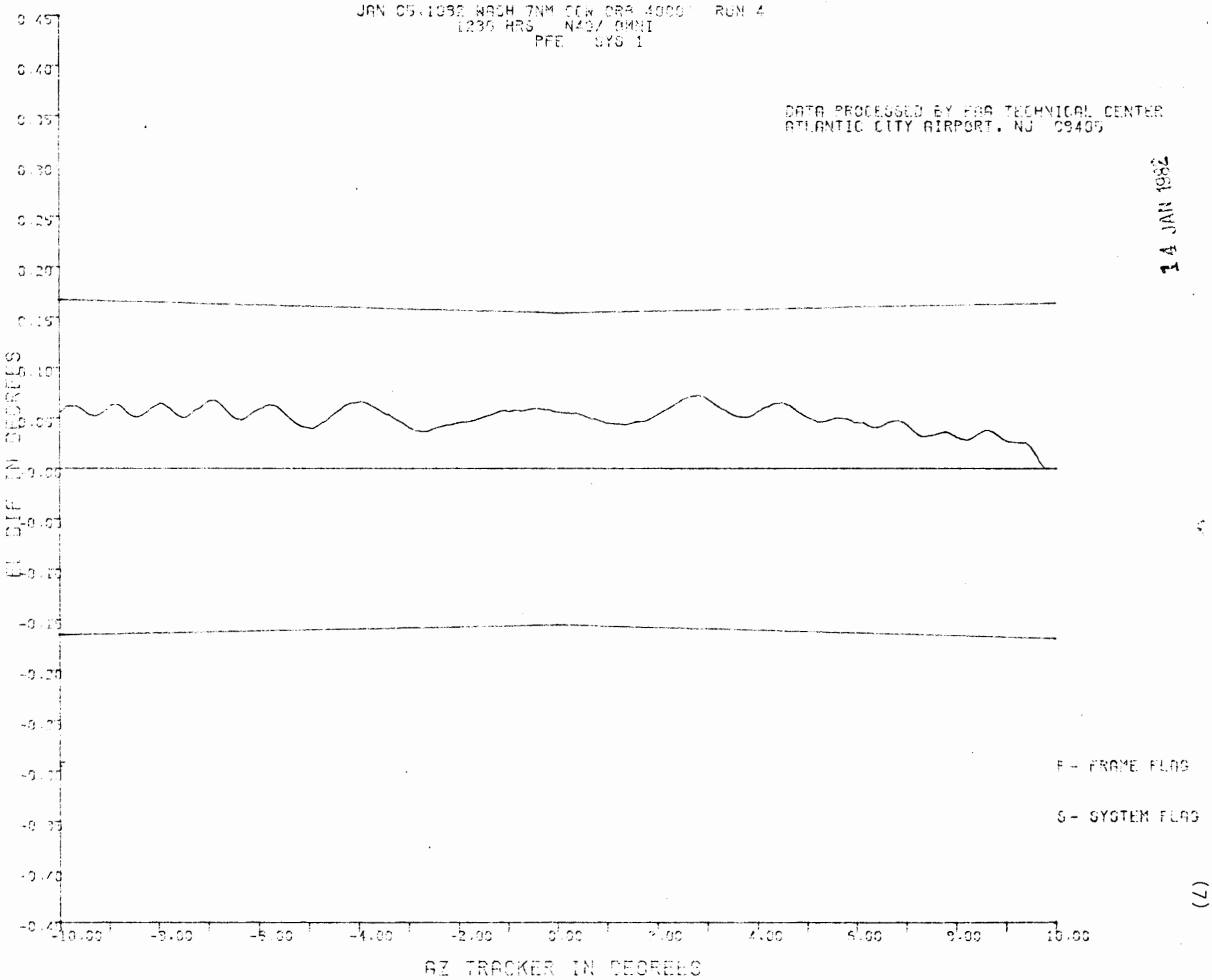
14 JAN 1982

(5)

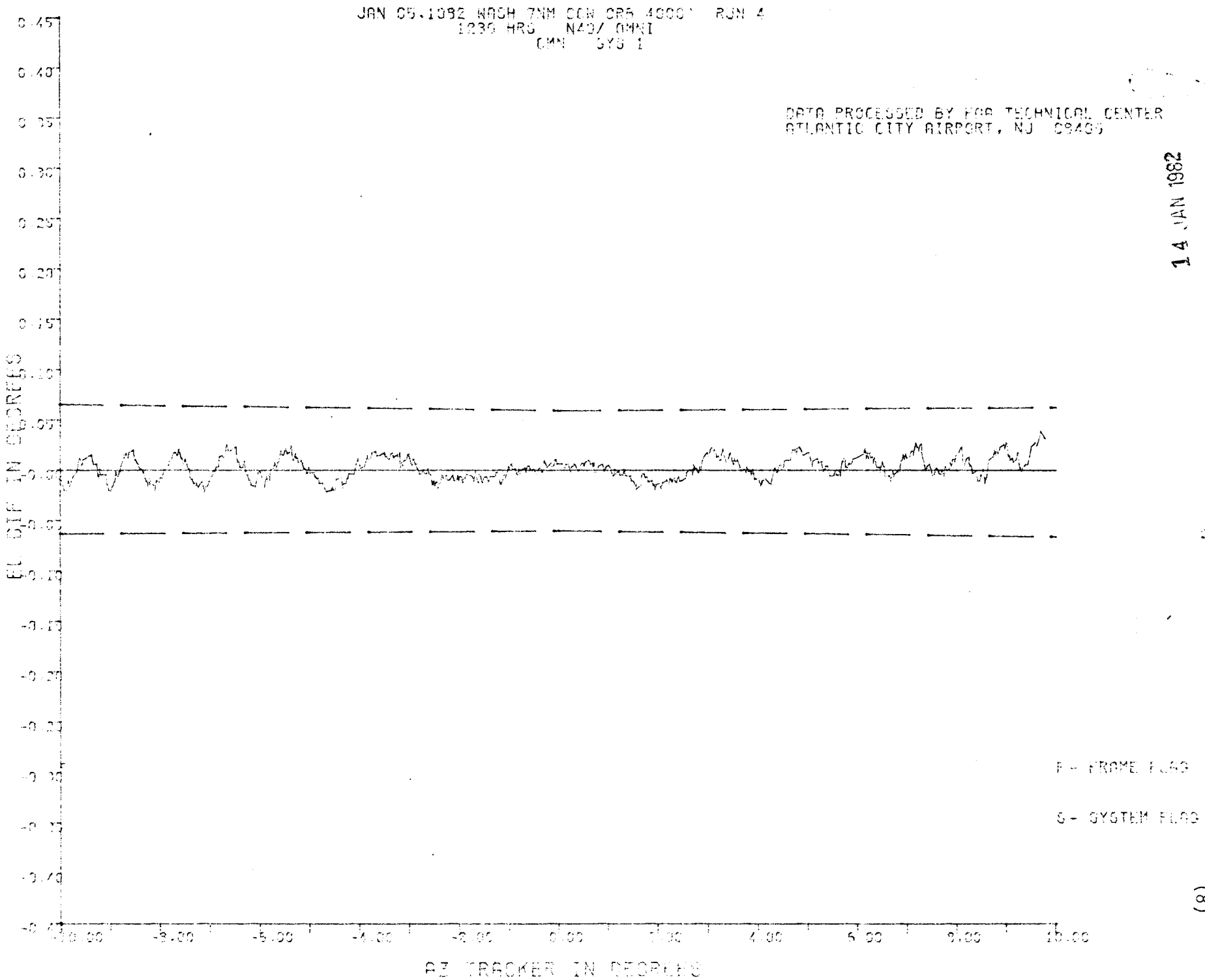

JAN 05,1982 WASH 7NM CCW ORB 4000' RUN 4
1230 HRS N40/ OMNI
CMN SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
AZ DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

14 JAN 1982

(9)


JAN 05,1982 WASH 7NM CCW ORB 4000' RUN 4
1230 HRS N43/ OMNI
PFE SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
14 JAN 1982
EL DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
-0.30
-0.35
-0.40
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00

(7)


JAN 05,1982 WASH 7NM CCW CR5 4000' RUN 4
1230 HRS N43/ OMNI
OMN SYS 1
DATA PROCESSED BY FAA TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NJ 08405
14 JAN 1982
EL DIF IN DEGREES
AZ TRACKER IN DEGREES
F - FRAME FLAG
S - SYSTEM FLAG

(8)