TASK FINAL REPORT

on

SEASAT B ORBIT SYNTHESIS
(Report No. BCL-OA-TFR-76-7)

by

F. G. Rea and J. M. Warmke

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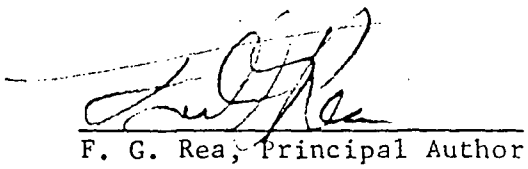
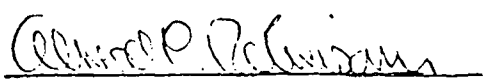


F. G. Rea, Principal Author



Approved by: A. C. Robinson,
Project Manager

BATTELLE
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

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INTRODUCTION

The objective of Task 8 was to apply Battelle's Interactive Graphics Orbit Selection (IGOS) computer program to the synthesis and analysis of specific SEASAT orbits. The quick response capability of IGOS facilitates a close communication between mission planners and the needs of the user community. For this reason, technical direction of the effort was performed by the Jet Propulsion Laboratory (JPL).

SUMMARY

Technical effort consisted of three phases: additions were made to Battelle's Interactive Graphics Orbit Selection (IGOS) program, IGOS was exercised via telephone lines from JPL, and candidate SEASAT orbits were analyzed by Battelle.

The additions to the program enable clear understanding of the implications of a specific orbit to the diverse desires of the SEASAT user community.

If the proper terminal hardware can be arranged at JPL, direct exercise of the code is preferable to exercise by Battelle with mail delivery of the output.

BACKGROUND

IGOS is an interactive graphics program accessible via remote graphics terminals and telephone line connection to Battelle's computer. The program has been structured to facilitate its use by analysts with a minimum of IGOS specific training.

The program was developed by Battelle's Columbus Laboratories (BCL) for the Marshall Space Flight Center (MSFC) under contract NAS8-26491. The program, as originally developed, was oriented primarily toward orbit synthesis. The original output was limited to an altitude/inclination circular orbit design space on which the analysts can indicate those orbits which do not satisfy specific mission requirements.* The original version of IGOS has been delivered to MSFC and to the Goddard Space Flight Center (GSFC).**

Additional MSFC funding was received in January 1976, to expand IGOS orbit analysis capabilities. This effort was conducted concurrently with Task 8. The expanded version of the program includes the capability to generate maps of selected portions of the Earth and plot orbit swath patterns on them. This capability is extremely valuable to the mission analyst who needs to clearly communicate, to the user community, the coverage of specific candidate orbits.

TECHNICAL DISCUSSION

Technical effort on Task 8 was divided into the following phases: IGOS modification, IGOS exercise by JPL, and SEASAT/IGOS exercise by Battelle. Each phase is described separately in the following paragraphs.

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* Rea, F. G., "Final Report on Vehicle Systems and Payload Requirements Evaluation", Battelle's Columbus Laboratories, Contract NAS8-26491 (December 1975); and Rea, F. G., "Preliminary Mission Planning Using Interactive Graphics", Paper No. AAS75-051 presented at AAS/AIAA Astrodynamics Specialists Conference, Nassau, July 28-30, 1976.

** Pittenger, J. L., and Rea, F. G., "The Interactive Graphics Orbit Selection Program Description and Users Guide", Battelle's Columbus Laboratories, Contract NAS7-786 (Task 13), Report No. IGOS-TM-76-1 (May 26, 1976).

IGOS Modifications

The IGOS program is described in the two appendices included with this report. Appendix A gives a sample IGOS session with copies of the output and description of the dialog. Appendix B is a full IGOS users manual. Page B-11 is a summary of each command, with references to the page numbers giving a full description of the command. Page B-48 is an alphabetic index to the full manual including instructions for accessing the Battelle computer and other general information. The manual is republished periodically to reflect recent modifications and additions. Care should be taken to ensure that a correct version of the manual is being used.

Task 8 effort began by reviewing the expanded IGOS capability and evaluating its applicability to interfacing with the SEASAT user community. While the mapping feature developed by MSFC is a significant feature, maps of orbit swath over a long time period are very difficult to interpret. Also, SEASAT application requires consideration of sensor swaths of specified widths which are not nadir centered. Finally, in addition to the ocean coverage for data acquisition, the communication with specific tracking sites is a concern in SEASAT orbit evaluation.

Task 8 effort was therefore used to develop the IGOS commands shown in Table 1.

TABLE 1. IGOS COMMANDS DEVELOPED UNDER TASK 8

Command	Description	Sample Use*	P Instructions*
SETSWT	Defines a sensor ground swath	A-3	B-21
SHWSWT	Shows sensor ground swaths	--	B-22
SWATH	Selects a ground swath	--	B-23
STPLNG	Produces an orbit longitude step plot	A-27, 29	B-24
STPTOD	Produces an orbit time-of-day plot	A-31	B-25
TRKSIT	Draws tracking site masks	A-39	B-43
CHGSIT	Adds or changes tracking site date	--	B-44
SHWSIT	Shows tracking site data	A-37	B-45

* Page numbers of Appendices A or B.

IGOS Exercise by JPL

JPL has a large number of Tektronix terminals (4002 and 4014) suitable for exercising IGOS at Battelle via FTS telephone lines. However, most of these terminals do not have either authority to access outside (of JPL) phone lines, or a hard copy unit. JPL personnel were successful in exercising IGOS on terminals without hard copy and have become familiar with its command structure and output. However, without a hard copy unit, the output cannot be reproduced for dissemination to the user community. Administrative action has been undertaken at JPL to gain access to the necessary terminal/hard copy/phone line combination. In the meantime, BCL was directed to perform extensive IGOS exercises and mail the output to JPL.

SEASAT/IGOS Exercise by Battelle

Order JPL direction, Battelle conducted several exercises, each of which produced several hundred IGOS plots. These plots resulted from combinations such as those shown in Table 2.

TABLE 2. SEASAT/IGOS EXERCISE

Plot Type	Orbits	Swaths	Time Periods	Sun Angle	Longitude	Latitude	Total
Mercator map of ground trace	8	1	3	1	-	-	24
STPLNG plot	8	4	1	2	3	-	192
Polar projections	8	3	3	1	-	-	72
STPTOD plots	3	4	1	1	1	3	36
TOTAL PLOTS							314

Each exercise produced copious output for presentation to the user community, and for evaluation of the acceptability of the candidate orbits. However, each exercise also identified several other potential candidate orbits which seemed likely to reduce the less desirable features of the previous set. This led to the definition of the next exercise.

CONCLUSIONS AND RECOMMENDATIONS

The Task 8 funded modifications to IGOS provide the necessary graphical output to effectively communicate the implications of candidate orbits to the SEASAT user community.

The exercise of the program by Battelle and the mailing at large numbers of plots to JPL is feasible but cumbersome. This approach leads to iterative exercise with large numbers (hundreds) of plots. A closer relationship between IGOS, the analyst, and the user is extremely desirable.

Further effort in this area is recommended in one of the following modes:

(1) Access to the proper terminal hardware at JPL and exercise by JPL personnel in close communication with the user community, or

(2) Increased funding of BCL with BCL personnel communicating directly with the users.

Either mode will take full advantage of the efficiency and convenience inherent in the interactive graphics approach of IGOS.

APPENDIX A

SAMPLE IGOS TERMINAL SESSION

APPENDIX A

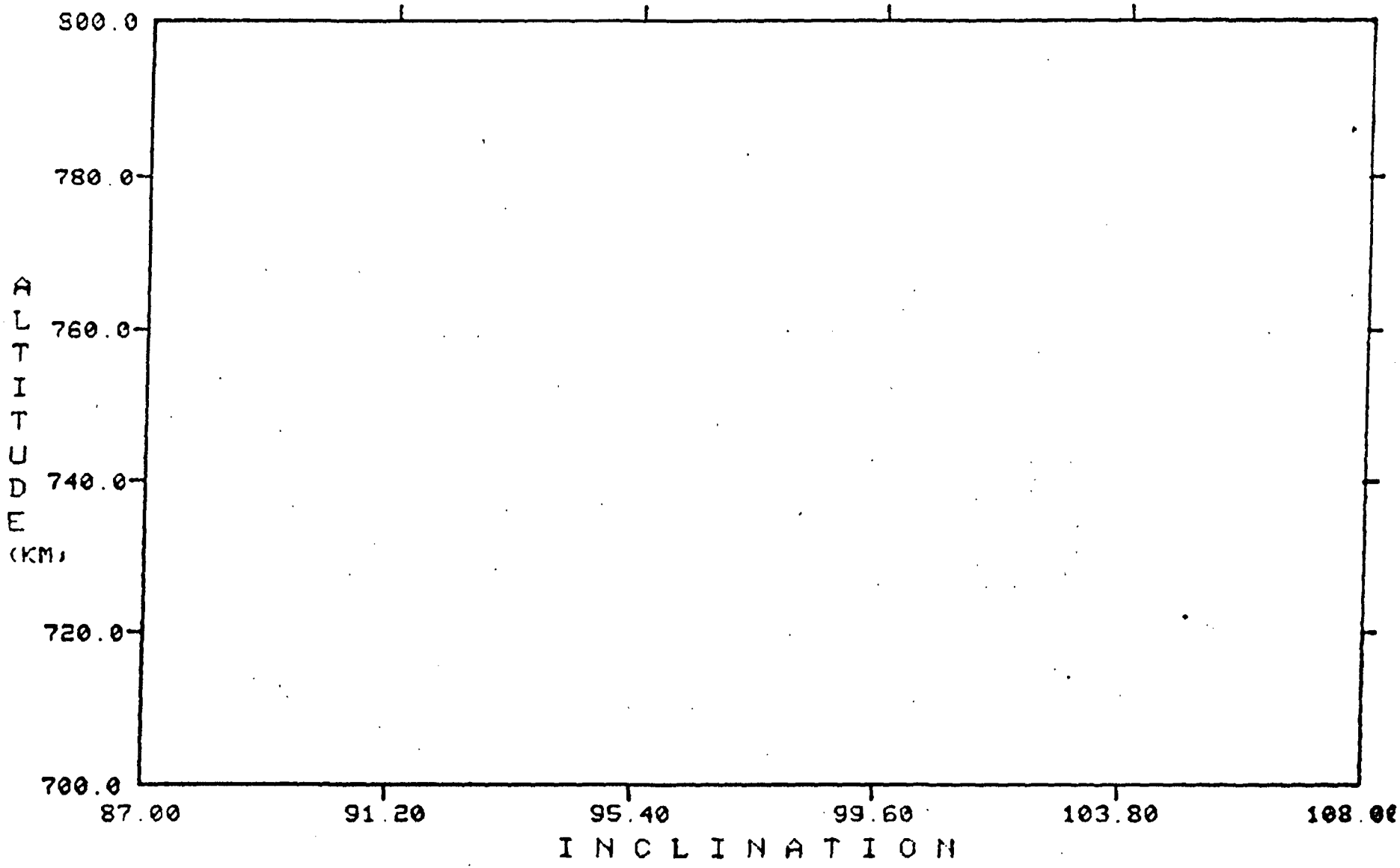
SAMPLE IGOS TERMINAL SESSION

The capabilities of the Interactive Graphics Orbit Selection program are illustrated by the following sample terminal session. The work session includes most of the commands available to the analyst for evaluating satellite Earth coverage and tracking requirements for any orbit and sensor ground swath of interest. The displays shown were taken directly from the terminal screen. To distinguish user entries from program generated output, all analyst entries appear in boxes on the displays. A short narrative accompanies each terminal display to describe the IGOS commands entered by the analyst and the illustrated computer responses. For a more detailed explanation of the IGOS commands, i.e., command descriptions, argument values, and options not demonstrated in this sample work session, reference should be made to the IGOS User's Manual.

After successful terminal identification and program access, the work session begins with the welcome, the date and the time. The first program inquiry is about the subtitle to appear on all IGOS plots generated during the session (i.e., IGOS SAMPLE WORK SESSION). The first command, UNITS, specifies that the units on all lineal input and output data is kilometers. To define the initiation of all orbits during the session, a "LAUNCH" from WTR is requested for the default time of midnight GMT on January 1. Two satellite sensor ground swaths, single and double, are defined with the command, SETSWT, for reference later in the session. The satellite sensor ground swath, single, views all surface areas located 230 to 330 km to one side of the subsatellite center line. Double is an asymmetric ground swath which observes all surface locations 150 to 500 km to one side of the subsatellite center line and 200 to 450 km on the opposite side. An orbit selection plot request for altitudes ranging from 700 to 800 km and inclinations ranging from 87.0 to 108.0 degrees initiates orbit investigations.

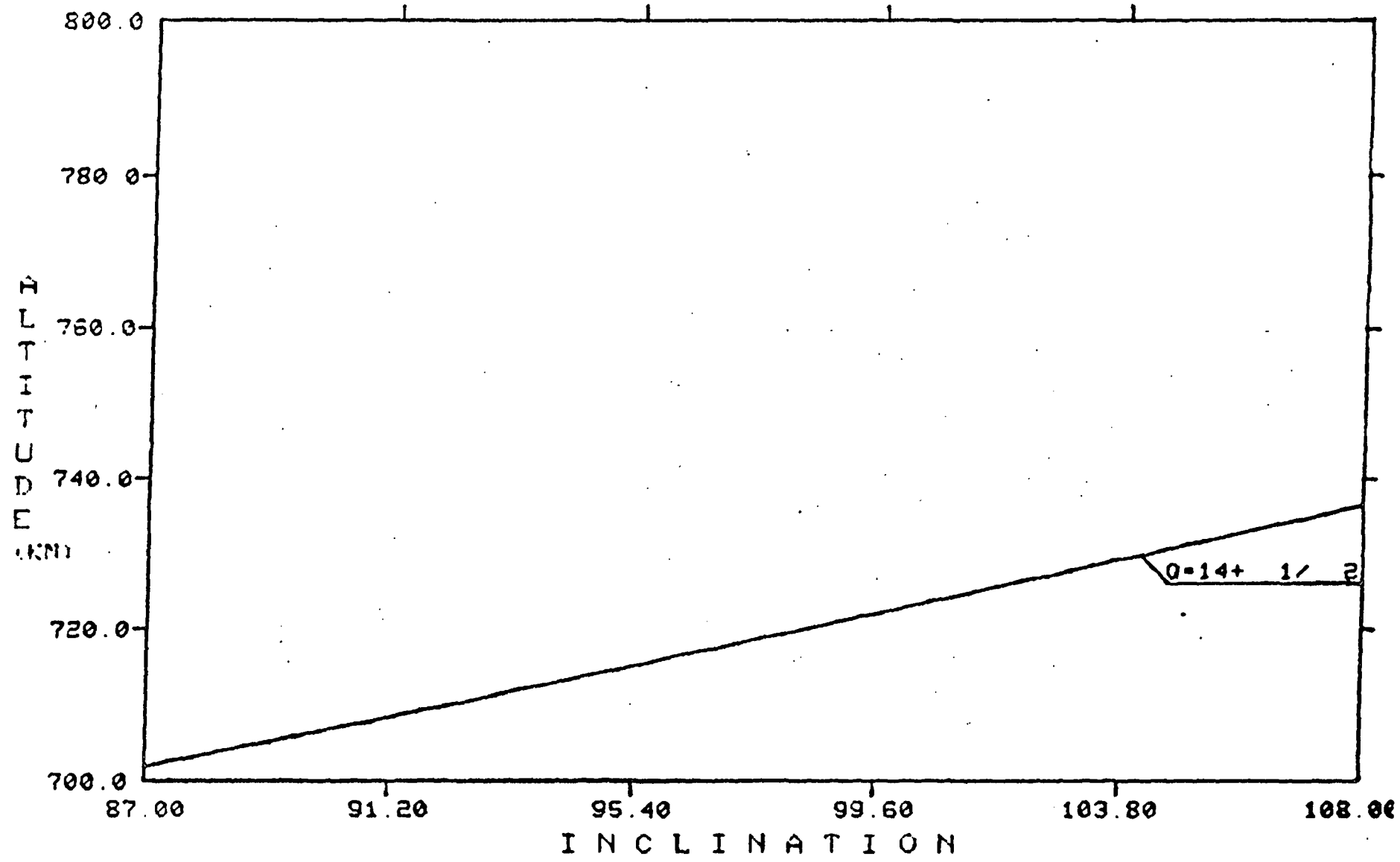
```
WELCOME TO I G O S
SESSION=OC 23 76       092906
ENTER CURVE COMMENTS--          IGOS SAMPLE WORK SESSION
EX.TIME,   0.20


--      UNITS,KM,KM
UNITS, INPUT=KM, OUTPUT=KM
EX.TIME,   0.23
--      LAUNCH,WTR

LAUNCH FROM WTR
                              16.00 LOCAL TIME

     LONGITUDE=    -120.60,LATITUDE=      34.00
     AZIMUTH LIMITS=     170.00 TO     302.00
     LAUNCH AT      .0 DAYS,     .00 HRS.(    .E+00          SEC.)
EX.TIME,   0.30
--      SETSWT,SINGLE,230,330,0,0
NEW SWATH
     SINGLE
        2.066-    2.964 DEGREES (    230.0-    330.0 KM)
EX.TIME,   0.37
--      SETSWT,DOUBLE,-500,-150,200,450
NEW SWATH
     DOUBLE
       -4.492-   -1.347 DEGREES (   -500.0-   -150.0 KM)
        1.797-    4.042 DEGREES (    200.0-    450.0 KM)
EX.TIME,   0.42
--      ORBSEL,700,800,87,108
```

An orbit design space is created with the axis shown generated from the ORBSEL request on page A-3.



IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 1

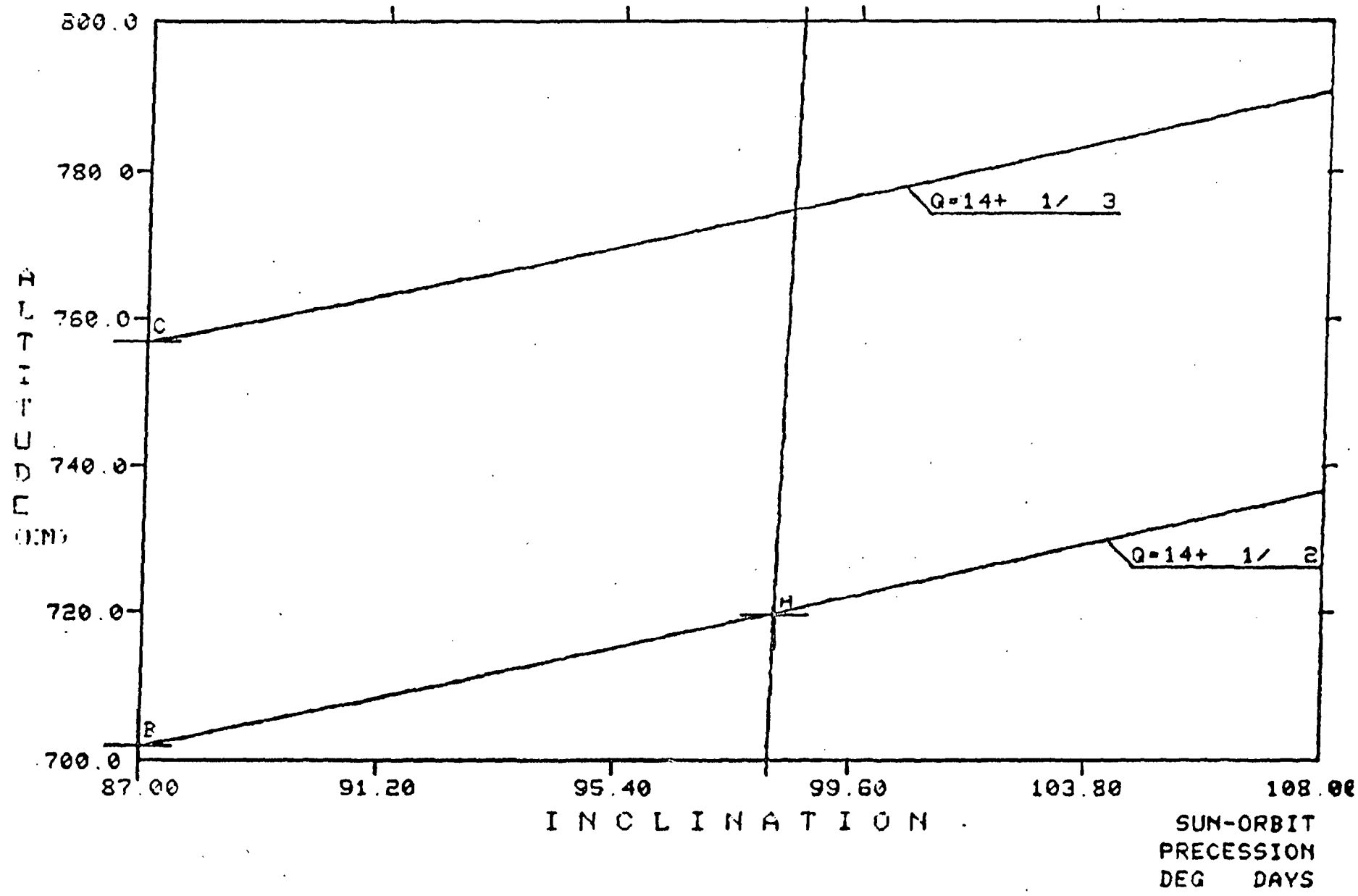
Using QPLT, a request is made for the contours of orbits on the display with a Q that can be expressed in the form integer + 5/10. The program responds with the curve for orbits with a Q of 14-1/2.



-- QPLT.5.10

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 1

Superimposed on the display created on page A-7 is the Sun synchronous line and a curve for the orbits characterized by a Q of 14-1/3. A "MARK" is done three times to define three orbits for reference later in the session. Mark A identifies a Sun synchronous orbit with a Q of 14-1/2. Mark B is an orbit inclined 87 degrees with a Q of 14-1/2. Mark C is an 87-degree inclined orbit with a Q of 14-1/3. Using SELECT, orbit B is chosen for further investigation.



[redacted]

IGOS SAMPLE WORK SESSION
06/23.76 032906 NO. 1

In response to the selection of Orbit B on page A-9, altitude, inclination and launch data are printed. Additional data for orbit B are requested with the ORBDEF command.

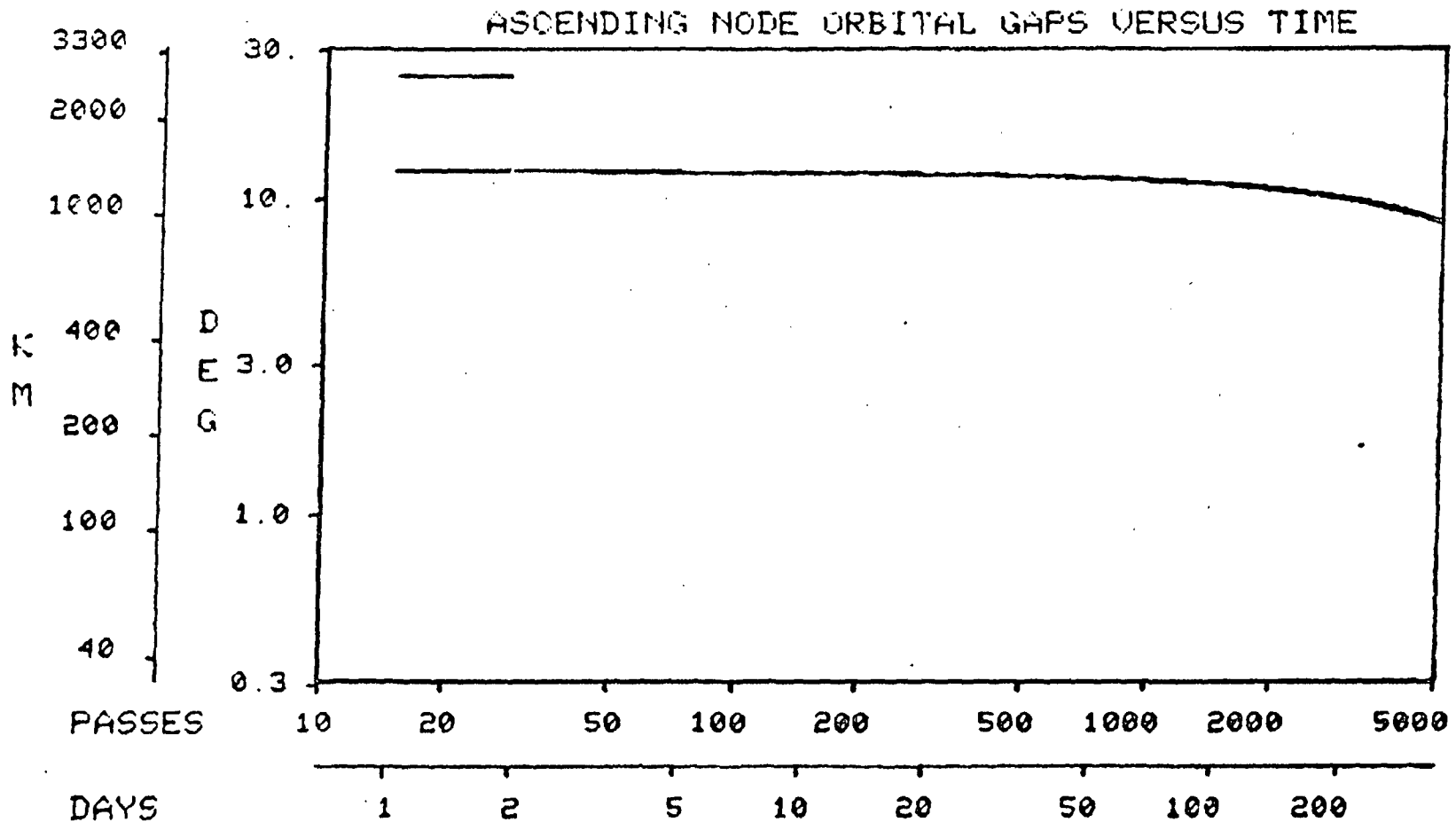
```
MARK=8 ON 06/23/76      092906 NO. 1 IGOS SAMPLE WORK SESSION

  701 9KM CIRCULAR, INCLINATION= 86.99 DEG.
LAUNCH AT          .0(   0D 0H 0M 0S OR    .E+00          SEC.) FROM 00 GMT JANUARY 1

FOR MORE INFO ENTER ORBDEF COMMAND
EX TIME    1.00
--      ORBDEF
```

The data request on page A-11, combined with an ORBSHW command, produces a full page of orbital information on B. Additional data include Q, nodal and apsidal periods, relative motions of the node with respect to the Sun, Earth, and perigee, and a plot of the orbital gaps between ascending nodes for coverage purposes. The ascending node orbital gap plot indicates that a satellite in Orbit B views all possible surface area it sees in the first two days. This is due to the Q of about 14-1/2. Orbit coverage study proceeds with a GNDTRK request for a plot of the Earth's surface for all longitudes and a latitude range of -80 to 80 degrees.

LAUNCH DELTA-V= 24569.3 F/S, AZIMUTH= 179.3 WITH .00 DEG. PLANE CHANGE
MARK 18 701.944(KM), INC.= 86.99, FROM WTR . AT 0D 0H 0M 0S
SUN ANGLE=180.0 SENSOR = -614.8 TO 614.8 (KM)

PERIOD(MIN).:KEPLERIAN= 98.8138, NODAL= 98.9427, APSIDAL= 98.8784 Q=14.4995444

RELATIVE MOTION	NODE-INERTIAL	NODE-EARTH	NODE-SUN	PERIGEE-NODE
DEG/NODAL PERIOD	-0.02496	-24.82837	0.0927	-0.23427
DEG/DAY	-0.36328	-361.34889	1.3489	-3.40951

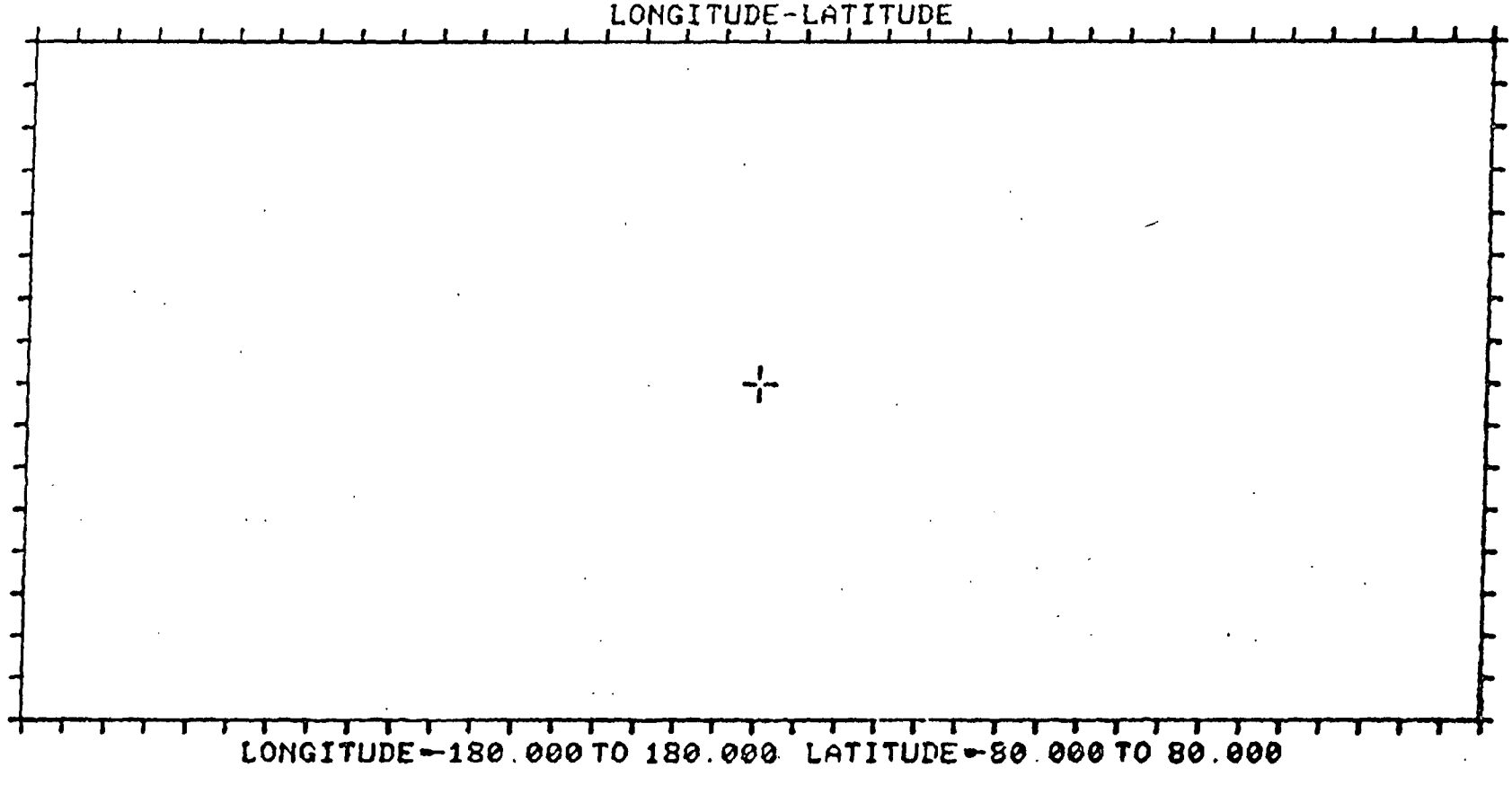


-- ORBSHW

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 2

The ground track display is shown for the GNDTRK request on page A-13. The default longitude-latitude projection is to be used for all plotting on this display. Intervals of 10 degrees are indicated on the axes. Note that the current orbit and sensor ground swath references appear at the top.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR . AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

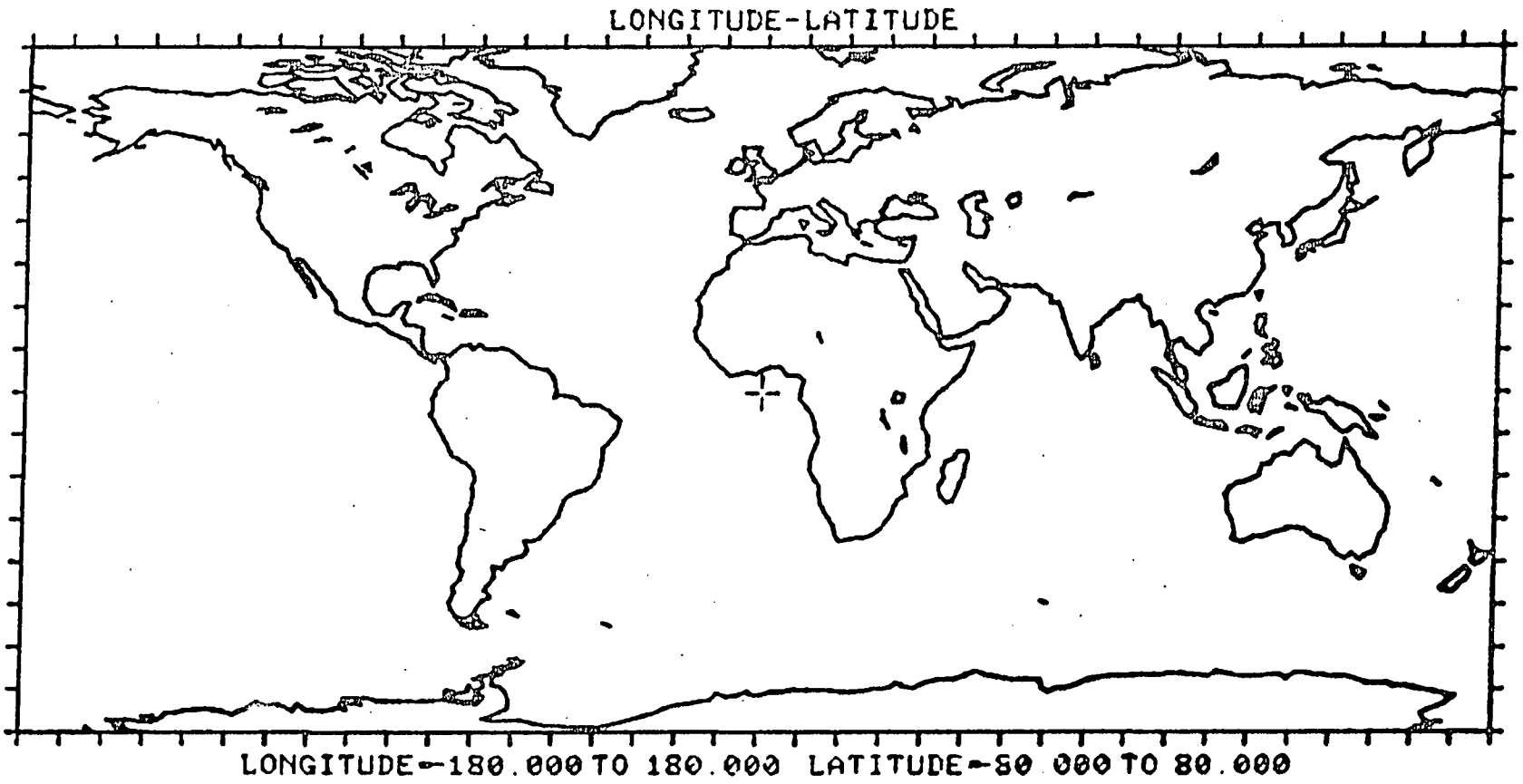
100 200 300 400 500 600 700 800 900

REQUESTED PASSES

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 3

Superimposed on the display created on page A-15 by the MAP command is a projection of the Earth.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

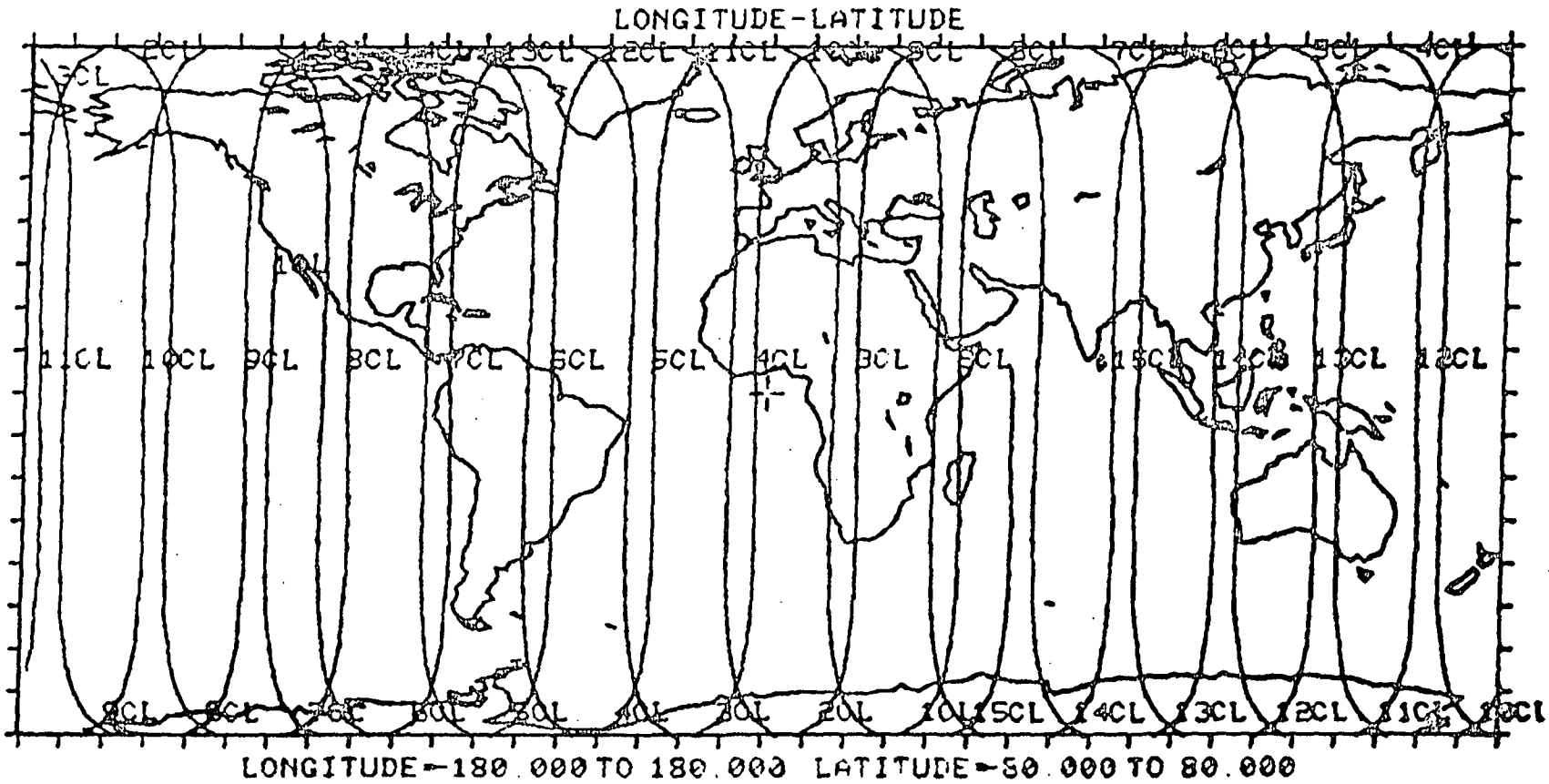
REQUESTED PASSES

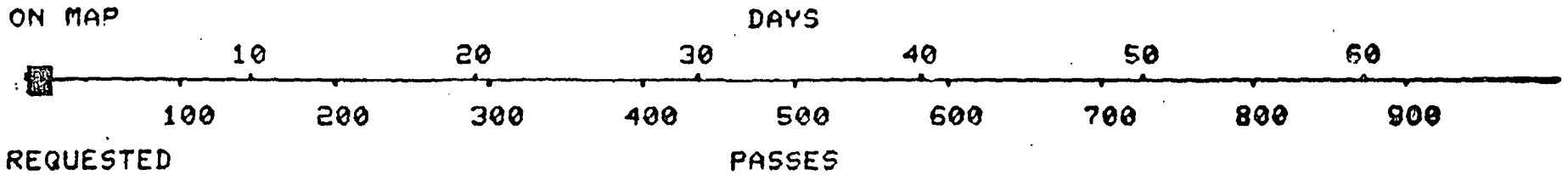
-- MAP

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 3

To examine Orbit B's behavior, a PASS request is made to plot the subsatellite center line on orbital passes 1 through 15 to show approximately one day's coverage. The origin of the first pass reflects the WTR launch selected on page A-3.

MARK 1B 701.944(KM). INC.= 86.99. FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



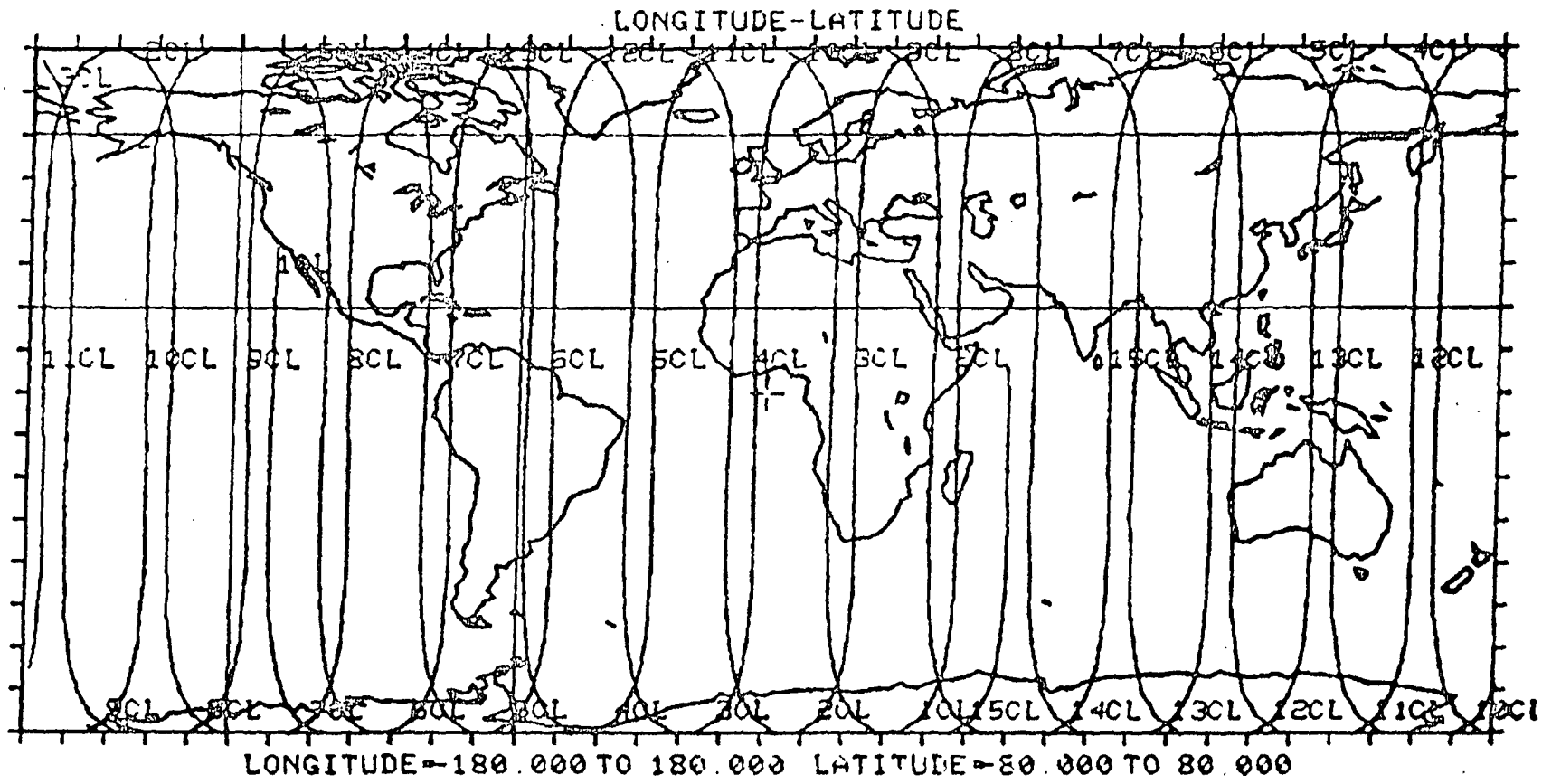


-- MABS.1.15.1

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 3

A "ZOOM" is done for a more detailed look at longitudes -130 to -60 degrees and 20 to 60 degrees latitude. Note the boxed in area on the display.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

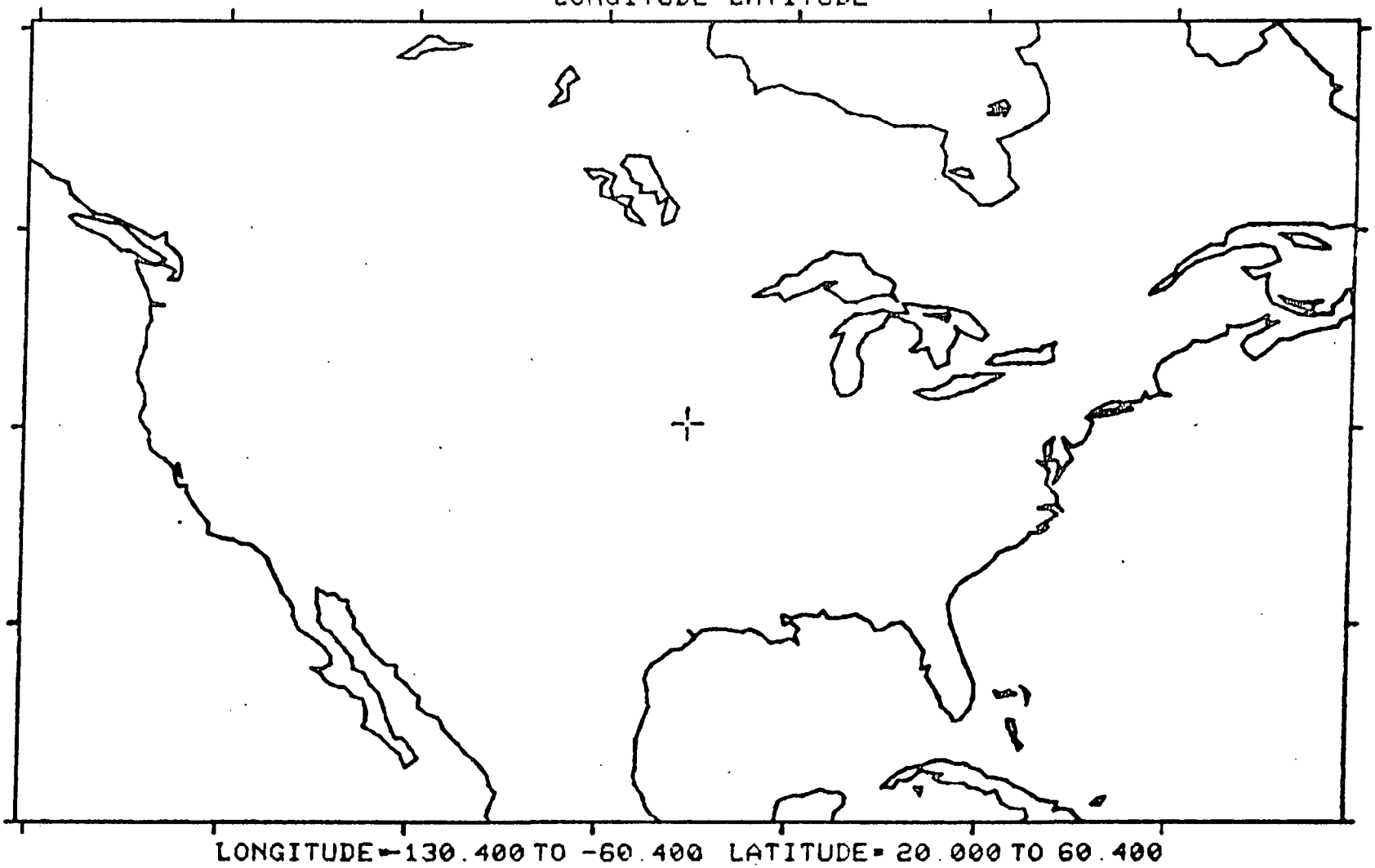
REQUESTED PASSES

PAGE 8888.1.15.1

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 3

The result of the ZOOM request on page A-21 is a magnified plot of the United States.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

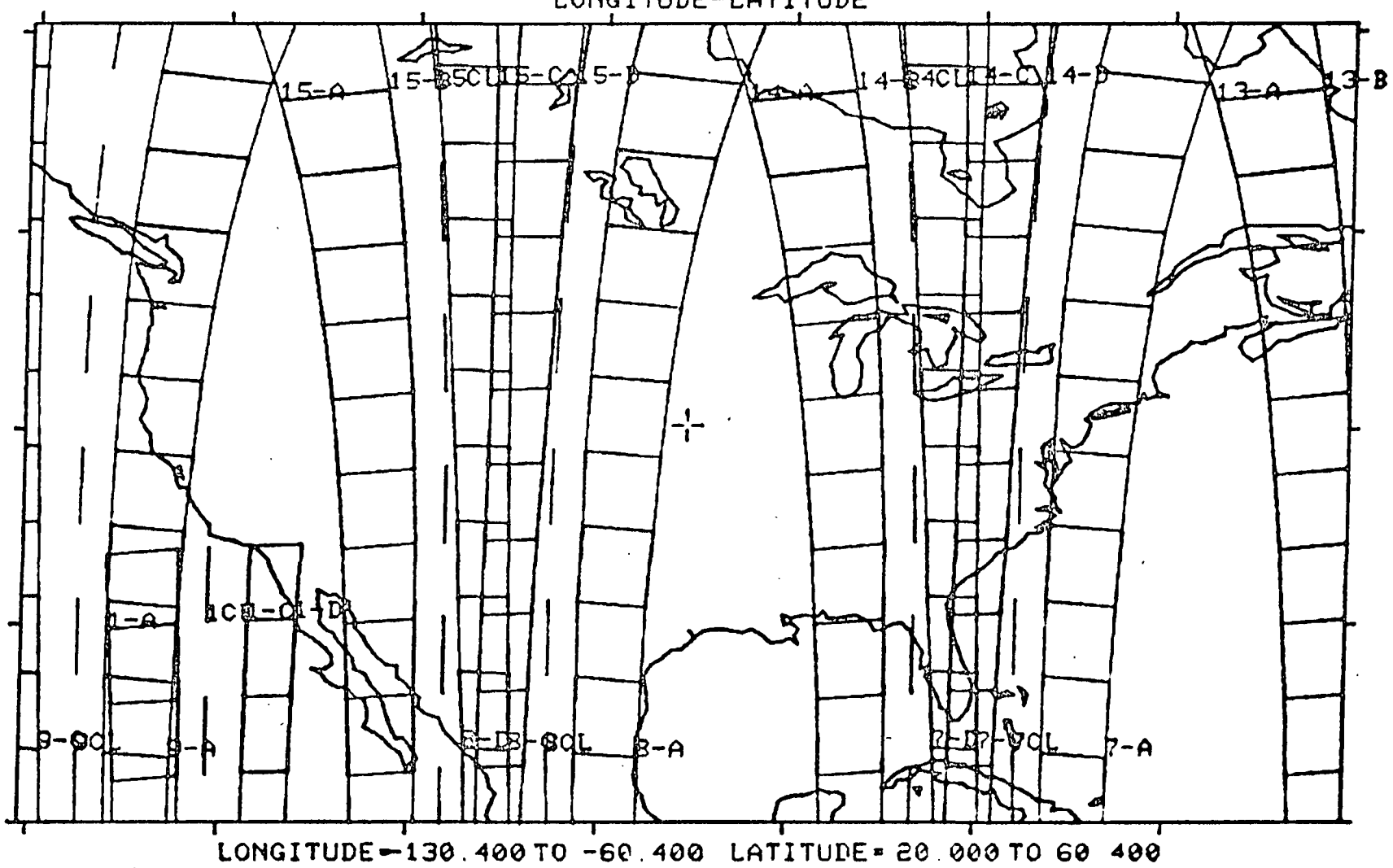
REQUESTED PASSES

-- MAP

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 4

A PASS command is used to superimpose on the map of page A-23 one-day coverage for the United States, orbital passes 1 through 15, from Orbit B with the sensor ground swath, Double. The dashed line indicates the subsatellite center line and the cross-hatched bands to either side of the center line are the surface areas viewed by the satellite. The asymmetry of the sensor's ground swath is evident in this presentation. One can conclude from this display that full United States coverage is not possible in one day from Orbit B using the sensor, Double. The Q of 14.5 implies the satellite will repeat this coverage pattern every two days.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

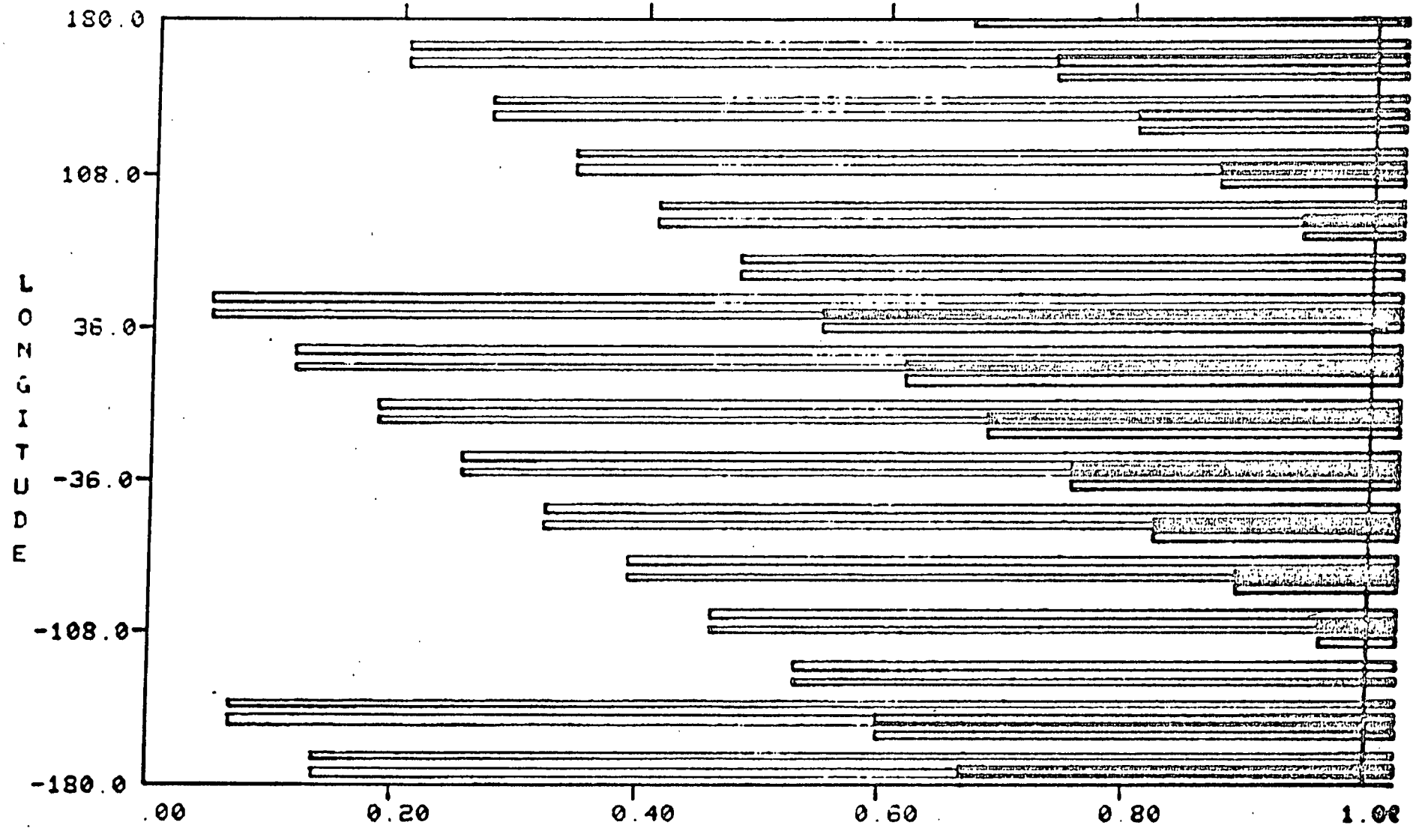
REQUESTED PASSES

-- MABS.1.15.7

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO 4

The longitude viewed versus time from launch plot (STPLNG) is an alternate graphical presentation of coverage data. The example shown illustrates the LNGB plot option. The latitude of interest requested, 40 degrees, is the middle of the latitude range for the display on page A-25. The plot specifies first-day coverage of all longitudes when viewed at 40 degrees latitude. Note the double longitude bands present due to the definition of the sensor, DOUBLE. With the LNGB option, full coverage of the longitude range can be determined from the right vertical axis. Full coverage does not occur in one day.

MARK 1E 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)

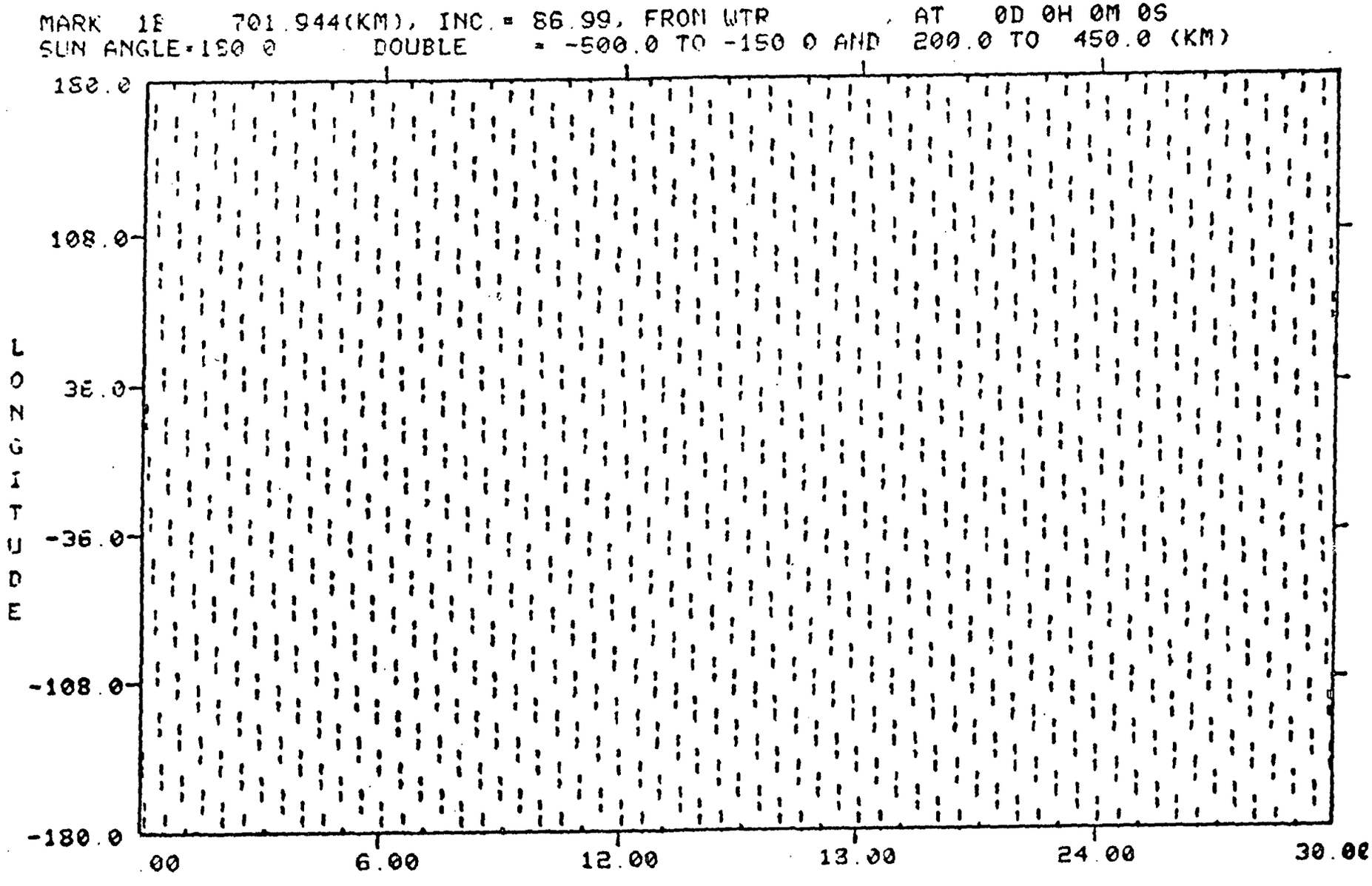


LATITUDE 40.0

SWATH AT THIS LATITUDE = 457.1, 457.1, 326.0, 326.0 (KM)

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 5

The STPLNG plot is given for one month's coverage at 40 degrees latitude with the LNG plot option. Careful examination of the figure indicates that the satellite coverage pattern repeats every two days. Recall that Q is 14.5 for Orbit B. If full Earth coverage is desired, a sensor with a wider ground swath is necessary for Orbit B.

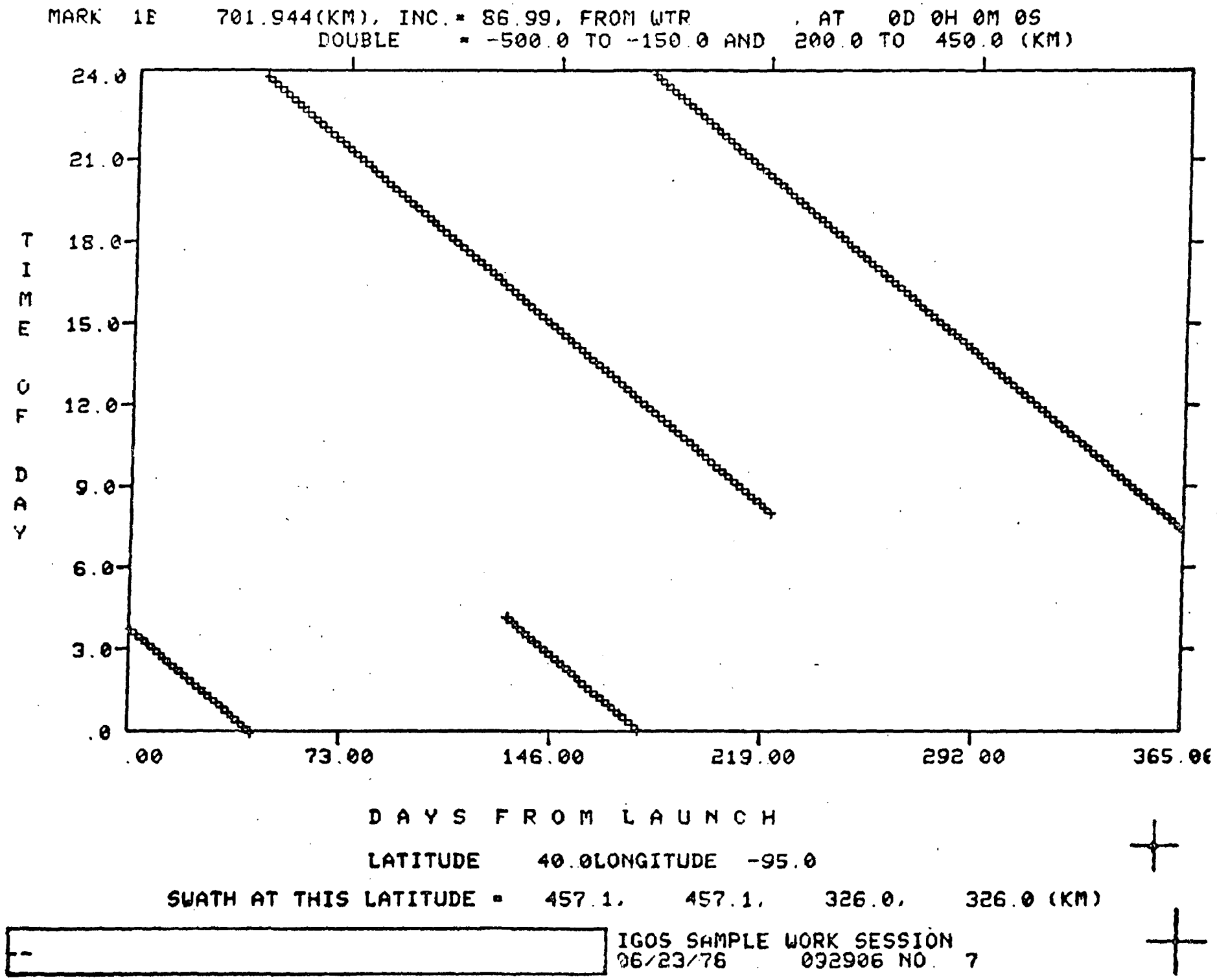


LATITUDE 40.0

SWATH AT THIS LATITUDE = 457.1, 457.1, 326.0, 326.0 (KM)

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 6

A time of day plot (STPTOD) is requested for 40 degrees latitude and -95 degrees longitude and one year coverage. Daily satellite observations occur throughout the year, and during the period of approximately 5 to 7 months after launch, the location is viewed twice a day.


MARK 1E 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
DOUBLE = -500.0 TO -150.0 AND 200.0 TO 450.0 (KM)
24.0
21.0
18.0
15.0
12.0
9.0
6.0
3.0
.0
TIME OF DAY
.00
73.00
146.00
219.00
292.00
365.00
DAYS FROM LAUNCH
LATITUDE 40.0LONGITUDE -95.0
SWATH AT THIS LATITUDE = 457.1, 457.1, 326.0, 326.0 (KM)
IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 7

This is an example of the GNDTRK and MAP commands to see the Northern Hemisphere above 50 degrees latitude using the north polar projection.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 SINGLE = 230.0 TO 330.0 (KM)

LONGITUDE=-180.000 TO 180.000 LATITUDE= 50.000 TO 90.000

ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

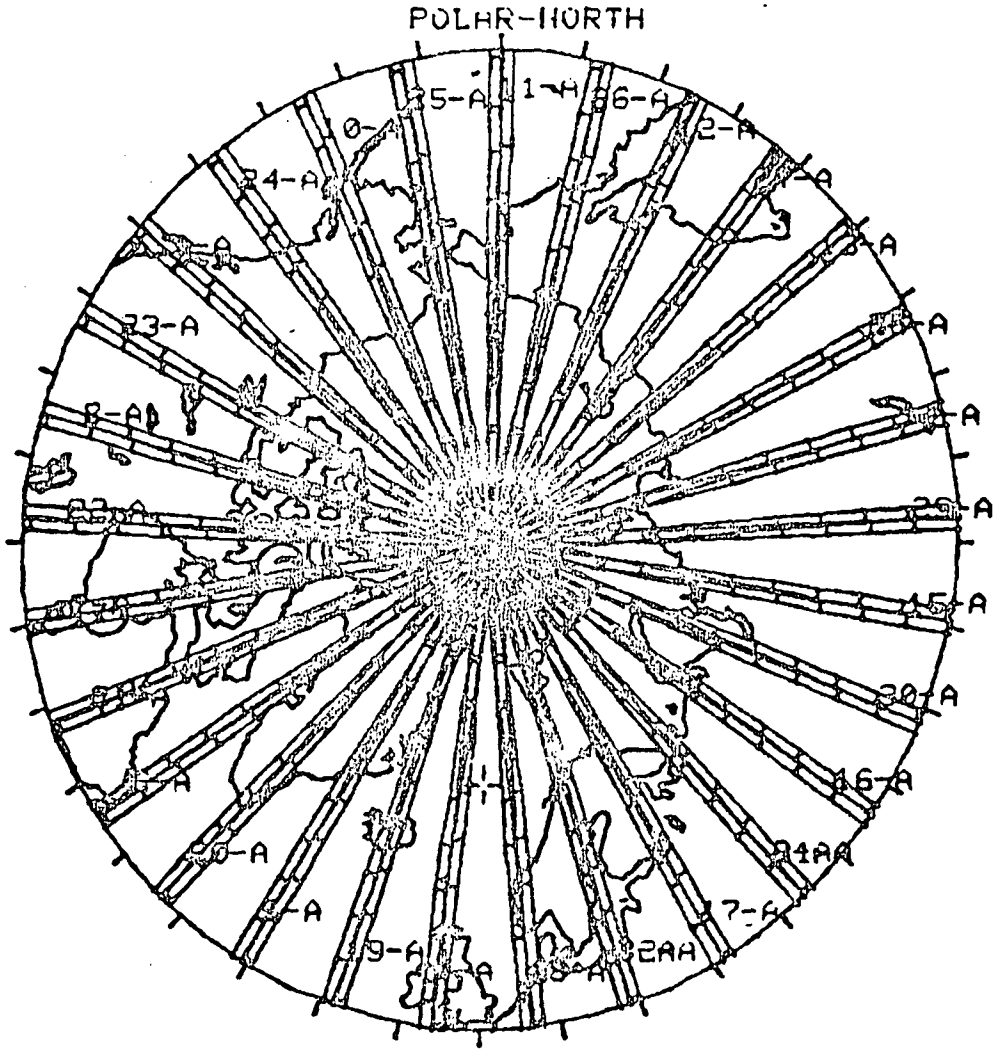
REQUESTED PASSES

-- MAP

IGOS SAMPLE WORK SESSION
06/23/76 032906 NO. 8

A 702-km circular orbit inclined 87 degrees is the current orbit being investigated. Thirty-two orbital passes, about two days coverage, are superimposed on the map display on page A-33 with the PASS command. The satellite sensor ground swath, SINGLE, views the surface areas indicated, which are located 230 to 330 km to one side of the subsatellite center line. This orbit and sensor swath combination achieves excellent North Pole coverage.

MARK 15 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE=180.0 SINGLE = 230.0 TO 330.0 (KM)



LONGITUDE=-180.000 TO 180.000 LATITUDE= 50.000 TO 90.000

ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

REQUESTED PASSES

RABS.1.32.6

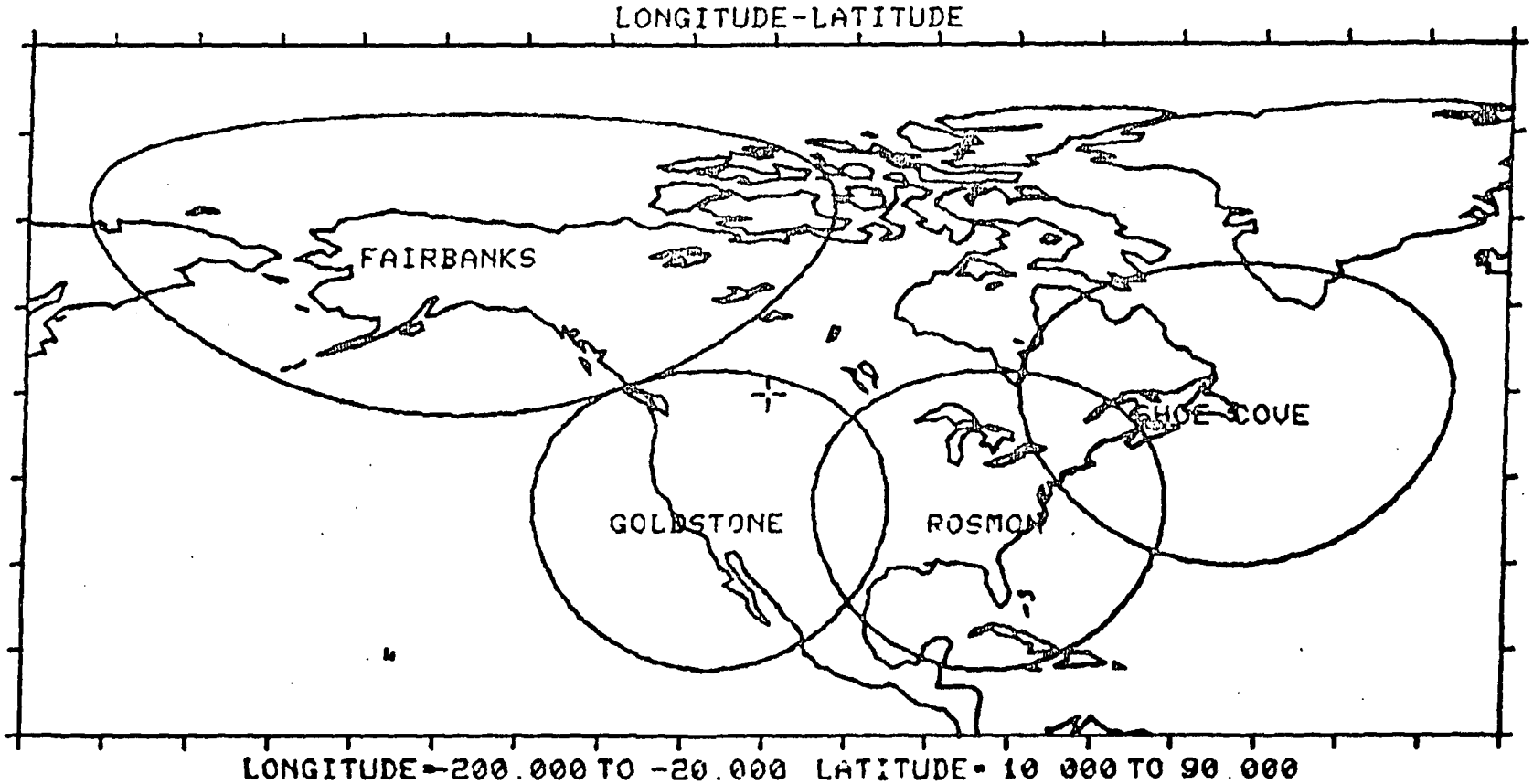
IGOS SAMPLE WORK SESSION
05/23/76 032806 NO. 8

A SHWSIT request is used here to list the tracking sites defined in Class 1. Before plotting the Class 1 sites on page A-41, the argument labels and current values for the command TRKSIT are summoned to refresh the memory using the LIST command. The command SUNANG is used to impose a daylight requirement on all Earth observation displays during the remainder of the work session. The GNDTRK request for longitudes -200 to -20 degrees and 10 to 90 degrees latitude will plot an appropriate region on the Earth's surface containing the Class 1 tracking sites.

```
    CLASS  1 TRACKING SITES

                LONG          LAT.      MIN.ELE.    ALT.(KM)  ALT(KM)=  701.9
FAIRBANKS     -147.533       64 967       10.0        0 320   RAD(DEG)=  17.47
GOLDSTONE     -116.883       35.333       10.0        0.930   RAD(DEG)=  17.46
  ROSMON       -82.883       35.200       10.0        0.860   RAD(DEG)=  17.47
SHUE COVE      -53.000       47.500       10.0         .000   RAD(DEG)=  17.48
EX.TIME, 37.21
--      LIST,TRKSIT
ARGUMENT                  VALUE          UNITS          RANGE
(1) CODE1                  .E+00                        1.0000E+00 TO  1.0000E+01
(2) CODE2                  .E+00                        1.0000E+00 TO  1.0000E+01
(3) CODE3                  .E+00                        1.0000E+00 TO  1.0000E+01
(4) CODE4                  .E+00                        1.0000E+00 TO  1.0000E+01


EX TIME, 37.27
--      SUNANG,90
SUN ANGLE=  90.00
EX.TIME, 37.30
--      GNDTRK,-200,-20,10,90,200,LL
```

Superimposed on the map generated by the GNDTRK command on page A-37 and MAP, is the range of each site in Class 1 by the command TRKSIT.

MARK 1B 701.944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE= 90.0 SINGLE = 230.0 TO 330.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

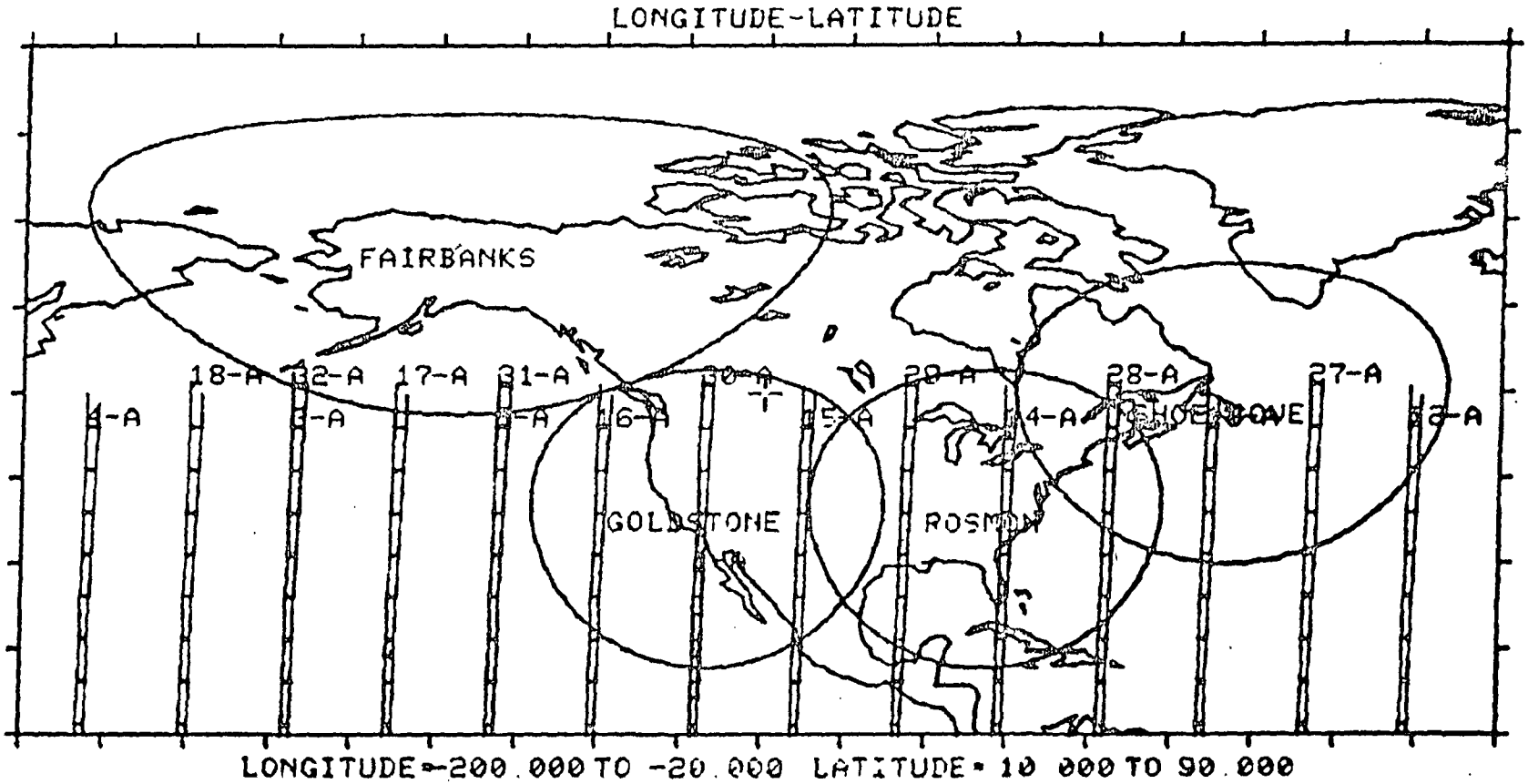
REQUESTED PASSES

-- MARSIT.1

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO. 9

Orbital passes for a two-day period are added to the display on page A-39 with a PASS request, under a 90-degree Sun angle requirement. With a 90-degree Sun angle, only the daylight areas of orbital passes are plotted. Therefore, daylight monitoring occurs primarily at the Goldstone and Rosmon sites.

MARK 1B 701 944(KM), INC.= 86.99, FROM WTR , AT 0D 0H 0M 0S
SUN ANGLE= 90.0 SINGLE = 230.0 TO 330.0 (KM)



ON MAP DAYS

10 20 30 40 50 60

100 200 300 400 500 600 700 800 900

REQUESTED PASSES

RAMSIT.32.6

IGOS SAMPLE WORK SESSION
06/23/76 092906 NO 9

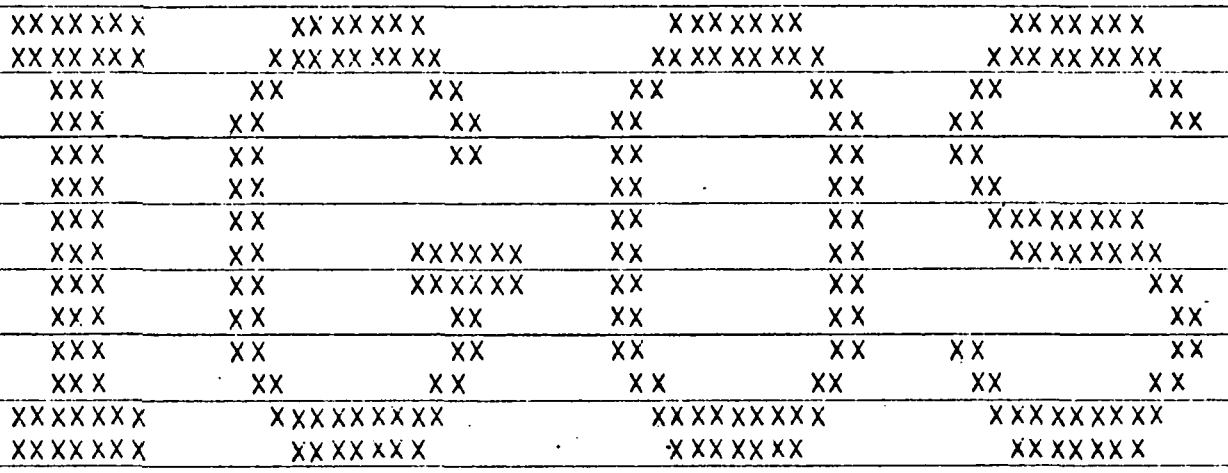
The command END terminates the sample work session with IGOS. Before control returns to the computer's operating system, the last program inquiry asks if a copy of the work session's activity file is to be sent to the central site. LOGOUT must be used to end the user's communication with Battelle's operating system. The result is a listing of computer statistics for the session.

```
DO YOU WANT BATTELLE TO RECEIVE A COPY OF THE DAYFILE(Y/N)? -- N
 EXIT
COMMAND- LOGOUT
CP            49.038  SEC.
IO             3.905  SEC.
CM             8.120  SEC.
SS            62.000  SEC.
CH             92320  CHARS.
CONNECT TIME     0 HRS.    40 MIN.
 06/23/76  LOGGED OUT AT 10.08.03.
      <
```

APPENDIX B

IGOS USERS MANUAL

BANNER IGUS MANUAL 06/23/76 PAGE 1



INTERACTIVE GRAPHICS

ORBIT SELECTION

BATTELLE COLUMBUS LABORATORIES

NASA/MSFC NASA/GSFC NASA/HEADQUARTERS JPL/SEASAT

IGOS IS AN INTERACTIVE GRAPHICS PROGRAM AVAILABLE TO REMOTE USERS VIA 1200 BAUD BELL OR FTS TELEPHONE LINES. THE PROGRAM IS DESIGNED AS AN AID TO PRELIMINARY EARTH ORBIT MISSION DESIGN.

IGOS GENERATES ORBIT SELECTION PLOTS WHICH IDENTIFY THOSE ORBITS WHICH SATISFY MISSION REQUIREMENTS SPECIFIED BY THE USER.

ORBIT ANALYSIS COMMANDS MAY THEN BE USED TO DISPLAY THE DETAILS OF PARTICULAR ORBITS SELECTED FROM THE ORBIT SELECTION PLOT, OR ORBITS ARBITRARILY DEFINED BY THE USER.

ALL FEATURES HAVE BEEN DESIGNED TO INCLUDE INTERNALLY STORED DATA AND EFFICIENT CALCULATIONS. WHILE THIS HAS NECESSITATED SOME MATHEMATICAL APPROXIMATIONS, IT PERMITS RAPID EVALUATION OF MISSION ALTERNATIVES. IGOS IS, THEREFORE, AN AUTOMATED HANDBOOK FOR PRELIMINARY MISSION ANALYSIS AND NOT A SUBSTITUTE FOR DETAILED FINAL ANALYSIS.

THIS USERS MANUAL DESCRIBES ACCESS TO THE IGOS PROGRAM, IGOS OPERATION, AND THE DETAILS OF EACH IGOS COMMAND.

AN ALPHABETIC INDEX IS INCLUDED ON THE LAST PAGE OF THIS MANUAL.

THE BATTELLE INTERACTIVE COMPUTER SYSTEM MAY BE ACCESSED BY 1200 BAUD TELEPHONE LINES AT THE FOLLOWING NUMBERS,

BELL
(AREA CODE 614) 421-7280

FTS
941-8045, ASK BATTELLE OPERATOR FOR EXTENSION 1176
OR
943-6600, ASK FTS OPERATOR FOR 421-7280,

WHEN A STEADY AUDIO TONE IS HEARD PLACE THE CALLING DATA SET IN THE DATA MODE, THE TERMINAL WILL THEN DISPLAY THE BATTELLE COMPUTER REQUEST TO LOGIN, RESPOND BY TYPING LOGIN (CARRIAGE RETURN), THE COMPUTER WILL THEN REQUEST YOUR USER NAME AND PASS WORD FOR ACCESS TO THE SYSTEM, WHEN SUCCESSFUL LOGIN IS COMPLETE THE SYSTEM WILL RESPOND WITH COMMAND-,

EXAMPLE LOGIN-

```
BATTELLE INTERCOM  4,5
DATE  04/09/76
TIME  14,40,28

PLEASE LOGIN
LOGIN (CR)
ENTER USER NAME-JANICE (CR)
********** ENTER PASSWORD-
04/09/76   LOGGED IN AT  14,41,53
           WITH USER-ID FV
           EQUIP/PORT 76/005
COMMAND-
```

IF NO AUDIO TONE IS HEARD, SEE HELP LATER IN THE MANUAL,
AFTER LOGGING IN PROCEED TO BEGIN FOR FURTHER INSTRUCTIONS,

AFTER LOGIN THE IGOS PROGRAM IS OBTAINED BY TYPING-

```
ATTACH,PROFIL,ID=IGOS  (CR)
```

THE OPERATING SYSTEM WILL RESPOND WITH COMMAND- TO BEGIN IGOS EXECUTION ENTER-

```
BEGIN,IGOS  (CR)
```

(CR) INDICATES STRIKING THE CARRIAGE RETURN KEY, A (CR) TRANSMITS ALL COMMANDS AS DISPLAYED ON THE SCREEN TO THE COMPUTER, PRIOR TO (CR) TYPING ERRORS MAY BE CORRECTED BY USING THE BACKSPACE KEY AND OVERTYPING THE ERRONEOUS CHARACTERS AND COMPLETING THE ENTRY,

IGOS EXECUTION HAS BEGUN WHEN THE COMPUTER ASKS-

```
WHAT KIND OF TERMINAL ARE YOU USING?
```

ENTER THE APPROPRIATE CODE AND (CR) FOR TERMINAL IDENTIFICATION,

CODE =	NONE	IF TERMINAL =	NONE
	COMP		COMPUTEK
	T4002		TEKTRONIX 4002
	T4012		TEKTRONIX 4012
	T4014		TEKTRONIX 4014

AFTER SUCCESSFUL TERMINAL IDENTIFICATION THE COMPUTER RESPONDS WITH-

```
WELCOME TO I G O S
SESSION=**/**/**      ******      (THE DATE IS **/**/** AND ******
ENTER CURVE COMMENTS--            IS THE TIME IN HR MIN SEC)
```

ANY REMARKS ENTERED WILL APPEAR AS A SUBTITLE ON ALL IGOS PLOTS GENERATED DURING THE SESSION, THE COMPUTER IS READY FOR THE FIRST IGOS COMMAND AFTER IT RESPONDS WITH

```
EX,TIME ****
--
```

-- INDICATES THE PROGRAM IS WAITING FOR THE NEXT COMMAND, ON SOME TERMINALS AN AUDIO TONE (BEEP) IS ALSO PRODUCED, FOR A LIST OF ALL CURRENT IGOS COMMANDS ENTER LIST,ALL, THE LIST GROUPS THE COMMANDS BY IGOS MODES,

FOR INSTRUCTIONS ON ENTERING A COMMAND ENTER COMMAND?
FOR A DISCUSSION OF IGOS MODES ENTER MODES?
FOR A DISCUSSION OF THE PAGE WARNING ENTER PAGE?
FOR A DISCUSSION OF ERROR MESSAGES ENTER ERRORS?

IF THE AUDIO TONE IS NOT HEARD, THE BATTELLE COMPUTER MAY BE MOMENTARILY UNAVAILABLE, A RECORDED STATUS MESSAGE MAY BE HEARD BY DIALING

BELL
(AREA CODE 614) 424-6666

FTS
943-6600, ASK FTS OPERATOR FOR 424-6666

HELP WITH IGOS MAY BE OBTAINED BY CALLING BATTELLE

BELL
(AREA CODE 614) 424-6424

FTS
941-8045

ASK BATTELLE OPERATOR FOR

FRED REA	EXT,1119
JANICE WARMKE	EXT,3228
JERRY PITTENGER	EXT,2212 OR 3298
DAVE NIPPERT	EXT,2602

IGOS COMMANDS ARE USED TO INITIATE PROGRAM FEATURES AND SUPPLY OR CHANGE DATA ASSOCIATED WITH THAT FEATURE. COMMANDS ARE ENTERED IN THE FORM

NAME,ARG1,ARG2,--,ARGN EXAMPLE-ORBSEL,100,250,10,110

THE NAME SPECIFIES THE COMMAND AND THE ARGUMENTS DEFINE THE DATA. THE ARGUMENT VALUES ARE RETAINED AND WILL BE USED IN FUTURE EXECUTIONS OF THE COMMAND. IF ONLY A FEW ARGUMENTS ARE TO BE CHANGED NULL OR BLANK FIELDS MAY BE USED TO SKIP ARGUMENTS. AN ALPHABETIC CODE IS ALSO ASSOCIATED WITH EACH COMMAND ARGUMENT. FOR EXAMPLE THE CODES FOR THE ORBSEL ARGUMENTS ARE HMIN,HMAX,DIMIN,DIMAX. TO AVOID HAVING TO ENTER MANY BLANK FIELDS THE FORM CODE,VALUE OR CODE=VALUE CAN BE USED. FOR EXAMPLE THE FOLLOWING ARE EQUIVALENT

```
ORBSEL, , ,30,90
ORBSEL,,,30,90
ORBSEL,DIMIN=30,DIMAX,90
ORBSEL,DIMAX,90,DIMIN,30
ORBSEL,DIMIN,30,90
```

THE NUMERICAL VALUES OF THE ARGUMENTS MUST BE ENTERED IN A FLOATING POINT FORMAT WITH THE DECIMAL POINT OPTIONAL. THE EXPONENTIAL FORMAT IS NOT ACCEPTABLE.

EXAMPLES

VALID			INVALID		
100	100,	100.00	1,E2	1,0E02	0,1E3
,01	-,01	1000000	1,E-2	-1,E-2	1,E6

FOR A LIST OF THE ARGUMENT CODES, CURRENT VALUES, UNITS, AND ALLOWABLE RANGE OF DATA FOR ANY COMMAND ENTER LIST,COMMAND EXAMPLE-LIST,ORBSEL

FOR A DISCUSSION OF ANY COMMAND ENTER THE COMMAND FOLLOWED BY A ?. FOR EXAMPLE ORBSEL?

IGOS MODE DESCRIBES THE TYPE OF INFORMATION ON THE SCREEN. EXAMPLES ARE DIALOG, ORBSEL AND GNDTRK. THE DIALOG MODE IS USED FOR DIALOG BETWEEN THE PROGRAM AND THE USER. WHILE IN THE DIALOG MODE ERROR MESSAGES WILL BE DISPLAYED. THE OTHER MODES ASSUME A PLOT IS BEING GENERATED AND ERROR MESSAGES ARE NOT DISPLAYED. THE DIALOG MODE IS INITIATED BY ENTERING ANY COMMAND ASSOCIATED WITH THAT MODE OR BY REQUESTING A TEACH (?) MESSAGE. THE OTHER MODES ARE INITIATED BY ENTERING A COMMAND OF THE SAME NAME. COMMANDS ASSOCIATED WITH THESE MODES WILL NOT BE EXECUTED UNLESS THE MODE HAS BEEN INITIATED. WHEN A COMMAND IS ENTERED THAT WILL INITIATE A MODE A PAGE WARNING IS ISSUED PRIOR TO ERASING THE SCREEN. FOR A DISCUSSION OF THE PAGE WARNING ENTER PAGE?

IGOS MODES=	DIALOG	ORBSEL	GNDTRK	ORBDEF	STPLNG
	SELECT	STPTOD			

THE PAGE WARNING IS ISSUED TO PERMIT THE USER TO OBTAIN A COPY OF THE SCREEN PRIOR TO ITS ERASURE BY THE PROGRAM. TO CONTINUE WITH THE ERASURE ENTER A BLANK. IF A NON BLANK ENTRY IS MADE THE COMMAND REQUIRING THE ERASURE WILL BE DELETED AND A NEW COMMAND REQUESTED.

THE FOLLOWING ERRORS ARE DETECTED BY IGOS

INVALID COMMAND	THE COMMAND IS NOT IN THE IGOS COMMAND LIST
NOT WITH XXXXX	THE COMMAND IS NOT VALID WITH MODE XXXXX
TOO MANY FIELDS	THE NUMBER OF ARGUMENTS GIVEN EXCEEDS THE NUMBER DEFINED FOR THAT COMMAND
XXXX TOO LARGE	THE VALUE OF XXXX IS ABOVE THE VALID RANGE
XXXX TOO SMALL	THE VALUE OF XXXX IS BELOW THE VALID RANGE
XXXX-INVALID	THE CODE XXXX IS NOT DEFINED FOR THIS COMMAND

LIST,ALL WILL DISPLAY THE MODE REQUIREMENTS.

LIST,COMMAND WILL DISPLAY THE ARGUMENT CODES, THEIR CURRENT VALUES, UNITS, AND VALID RANGES.

EACH OF THE FOLLOWING IGOS COMMANDS IS DISCUSSED IN DETAIL ON THE PAGES INDICATED.

UNITS-DEFINES INPUT AND OUTPUT UNITS (NM OR KM)

THE INPUT UNITS OPTION CONTROLS INTERPRETATION OF THE ARGUMENT VALUES PERTAINING TO LINEAL QUANTITIES, THE INPUT OPTION MAY BE CHANGED DURING AN EXERCISE TO FACILITATE EXTRACTING DATA FROM SOURCES WITH INCOMPATITIBLE UNITS.

THE OUTPUT UNITS OPTION MAY BE USED TO EXPRESS THE RESULTS IN THE DESIRED UNITS.

COMMAND UNITS IS VALID IN ALL MODES.

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) INPUT	NM	ALPHABETIC
(2) OUTPUT	NM	ALPHABETIC

ORBSEL-ORBIT SELECTION

THE ORBIT SELECTION PLOT USES THE SCREEN AS A DESIGN SPACE. ORBITS ARE PRESUMED TO BE CIRCULAR WITH THE HORIZONTAL AXIS REPRESENTING INCLINATION AND THE VERTICAL AXIS REPRESENTING ALTITUDE. ANY POINT ON THE PLOT IS A PARTICULAR CIRCULAR ORBIT. VARIOUS COMMANDS MAY BE USED TO INDICATE THOSE ORBITS WHICH DO NOT MEET THE MISSION DESIGN REQUIREMENTS.

THE ARGUMENTS ARE
- HMIN= THE MINIMUM ALTITUDE
- HMAX= THE MAXIMUM ALTITUDE
- DIMIN= THE MINIMUM INCLINATION
- DIMAX= THE MAXIMUM INCLINATION

COMMAND ORBSEL IS VALID IN ALL MODES. IT WILL ERASE THE SCREEN AND INITIATE A ORBSEL PLOT. THE FOLLOWING COMMANDS MAY THEN BE USED TO ENHANCE THE PLOT.

VEH	PLD	QPLT	HC	LABEL	
SUN	RAD	HR	DECAY	ZOOM	MARK
COV					

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) HMIN	1.0000E+02 NM, 1.8520E+02 KM	.E+00 TO 1.0000E+20
(2) HMAX	2.5000E+02 NM, 4.6300E+02 KM	.E+00 TO 1.0000E+20
(3) DIMIN	1.0000E+01 DEG	.E+00 TO 1.8000E+02
(4) DIMAX	1.1000E+02 DEG	.E+00 TO 1.8000E+02

RESET-RESETS ALL DATA TO DEFAULT VALUES

COMMAND RESET IS VALID IN ALL MODES.

NO ARGUMENTS

END-ENDS IGOS EXECUTION AND RETURNS CONTROL TO OPERATING SYSTEM

BEFORE CONTROL RETURNS TO THE OPERATING SYSTEM, THE COMPUTER ASKS-

DO YOU WANT BATTELLE TO RECEIVE A COPY OF THE DAYFILE(Y/N)?--

A Y RESPONSE (YES) AUTOMATICALLY ROUTES A COPY OF THE ACTIVITY FILE TO BATTELLE, N RESULTS IN NO DAYFILE, NOW THE OPERATING SYSTEM HAS CONTROL.

COMMAND END IS VALID IN ALL MODES,

NO ARGUMENTS

TABLE-PRINTS TABLES OF IGOS RESULTS (NO LONGER SUPPORTED)

COMMAND TABLE IS VALID IN ALL MODES.

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) IT1	,E+00	,E+00 TO 1,0000E+01
(2) IT2	,E+00	,E+00 TO 1,0000E+01

GNDTRK-GROUND TRACK DISPLAY

THE GROUND TRACK PLOT IS A MAP OF A PORTION OF THE EARTHS SURFACE, THE ARGUMENTS DEFINE THE REGION OF INTEREST, THE RESOLUTION OF THE WORLD MAP THAT MAY BE ADDED TO THE PLOT, AND THE PLOT PROJECTION,

LNG1,LNG2= THE LONGITUDE RANGE
LAT1,LAT2= THE LATITUDE RANGE
FINE= THE DISTANCE BETWEEN THE CLOSEST MAP POINTS TO BE PLOTTED DIVIDED INTO THE MAP WIDTH FINE=0 WILL SKIP ALL MAP POINTS AND SAVE EXECUTION TIME.
PRJ= THE PROJECTION OPTION
THE PROJECTION OPTIONS ARE
LL=LATITUDE-LONGITUDE
M=MERCATOR
PN=POLAR ABOUT THE NORTH POLE
PS=POLAR ABOUT THE SOUTH POLE

FOR EXAMPLE -180,180,-90,90,100,LL WILL PRODUCE A LNG-LAT PLOT OF THE ENTIRE EARTH WITH A REASONABLE NUMBER OF POINTS ON THE MAP.

IF ORBIT GROUND TRACKS ARE TO BE PLOTTED USING THE PASS COMMAND THE COMMAND ORBDEF MUST BE ENTERED PRIOR TO THE COMMAND GNDTRK.

COMMAND GNDTRK IS VALID IN ALL MODES, IT WILL ERASE THE SCREEN AND INITIATE A GNDTRK PLOT, THE FOLLOWING COMMANDS MAY THEN BE USED TO ENHANCE THE PLOT, MAP PASS ZOOM TRKSIT

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) LNG1	-1,8000E+02 DEG	-3,6000E+02 TO 1,8000E+02
(2) LNG2	1,8000E+02 DEG	-1,8000E+02 TO 3,6000E+02
(3) LAT1	-8,0000E+01 DEG	-9,0000E+01 TO 9,0000E+01
(4) LAT2	8,0000E+01 DEG	-9,0000E+01 TO 9,0000E+01
(5) FINE	1,0000E+02	,E+00 TO 1,0000E+03
(6) PRJ	LL ALPHABETIC	

SENSOR-DEFINES DATA FOR THE IGOS SENSOR MODEL

THE IGOS SENSOR MODEL COMPUTES A NADIR CENTERED CIRCLE OF GROUND AREA VIEWED BASED ON THE MOST RESTRICTIVE OF THE FOLLOWING LIMITATIONS DEFINED BY THE ARGUMENTS,

RNG= MAXIMUM SLANT RANGE (NM OR KM)
ELE= MINIMUM ELEVATION ABOVE THE HORIZON (DEGREE)
FOV= MAXIMUM SENSOR FIELD OF VIEW (HALF CONE ANGLE -DEGREE)
ARES/LRES= MINIMUM RESOLUTION (APPARENT ANGLE/ SURFACE DISTANCE)
(DEGREE / NM OR KM)

FOR EXAMPLE 1200,40,40,,1,10 ESTABLISHES A SENSOR MODEL FOR THE MOST RESTRICTIVE OF A 1200 NM MAXIMUM SLANT RANGE, A 40 DEGREE MINIMUM ELEVATION ABOVE THE HORIZON, A 40 DEGREE MAXIMUM HALF CONE ANGLE FOR THE SENSOR FIELD OF VIEW, AND A MINIMUM RESOLUTION OF ,1 DEGREE APPARENT ANGLE EQUALS 10 NM IN SURFACE DISTANCE,

THE CIRCLE SIZE VARIES WITH ORBIT ALTITUDE, TO BYPASS THE SENSOR MODEL AND REQUEST USE OF A SPECIFIC SWATH WIDTH USE THE COMMAND SWATH, SEE SWATH FOR HOW TO ENTER AN ARBITRARY SWATH WIDTH,

COMMAND SENSOR IS VALID IN ALL MODES,

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) RNG	1,2000E+03 NM, 2,2224E+03 KM	1,0000E-20 TO 1,0000E+20
(2) ELE	4,0000E+01 DEG	1,0000E-20 TO 1,0000E+20
(3) FOV	4,0000E+01 DEG	1,0000E-20 TO 1,0000E+20
(4) ARES	1,0000E-01 DEG	1,0000E-20 TO 1,0000E+20
(5) LRES	1,0000E+01 NM, 1,8520E+01 KM	1,0000E-20 TO 1,0000E+20

ORBDEF-ORBIT DEFINITION

AN ORBIT IS DEFINED BY ENTERING THE FOLLOWING 6 ORBITAL ELEMENTS

1 APOGEE
2 PERIGEE
3 INCLINATION
4 LONGITUDE OF ASCENDING NODE
5 ARGUMENT OF PERIGEE
6 TIME OF PERIGEE (RELATIVE TO 00 GMT JAN1)

THE TIME OF PERIGEE IS ENTERED IN DAYS,HOURS,MINUTES,SECONDS AS A SINGLE DECIMAL NUMBER, FOR EXAMPLE, 43 DAYS, 13 HOURS, 55 MINUTES, AND 0 SECONDS WOULD BE ENTERED AS 43135500,

THE LAUNCH COMMAND MAY BE USED PRIOR TO ORBDEF TO AVOID CUMBERSOME ENTRY OF THE LAST THREE ORBITAL ELEMENTS, THEY ARE THEN COMPUTED TO PLACE THE PERIGEE DIRECTLY OVER THE LAUNCH SITE AT LAUNCH TIME,

AFTER ENTERING ORBDEF FURTHER STUDY OF THE ORBIT MAY BE MADE WITH THE COMMANDS STPLNG, STPTOD, GNDTRK, OR ORBSHW,

COMMAND ORBDEF IS VALID IN ALL MODES, IT WILL ERASE THE SCREEN AND INITIATE A ORBDEF PLOT, THE FOLLOWING COMMANDS MAY THEN BE USED TO ENHANCE THE PLOT, ORBSHW

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) APG	1,5000E+02 NM, 2,7780E+02 KM	,E+00 TO 1,0000E+20
(2) PER	1,5000E+02 NM, 2,7780E+02 KM	,E+00 TO 1,0000E+20
(3) INC	2,8500E+01 DEG	,E+00 TO 1,8000E+02
(4) LON	,E+00 DEG	-3,6000E+02 TO 3,6000E+02
(5) ARP	,E+00 DEG	-3,6000E+02 TO 3,6000E+02
(6) TOP	,E+00 DHMS	-1,0000E+20 TO 1,0000E+20

SUNANG-DEFINES SUN ANGLE REQUIREMENT

THE SUN ANGLE IS THE ANGLE BETWEEN THE EARTH-SUN AND EARTH-SATELLITE VECTORS, WHEN THE SUB-SATELLITE POINT IS AT LOCAL NOON THE SUN ANGLE IS ZERO, AT LOCAL MIDNIGHT THE ANGLE IS 180.

THE VALUE LIMITS THE LOCAL LIGHTING CONDITIONS FOR PORTIONS OF THE EARTH CONSIDERED VIEWED IN THE OUTPUT FROM THE PASS, STPLNG AND STPTOD COMMANDS.

COMMAND SUNANG IS VALID IN ALL MODES.

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) ANG	1.8000E+02 DEG	1.0000E+00 TO 1.8000E+02

SETSWT-DEFINES SENSOR GROUND SWATH DATA

THE SWATH IS DEFINED BY ENTERING AN ALPHABETIC NAME AND TWO OR FOUR DISTANCES RELATIVE TO THE SUB-SATELLITE CENTER LINE (NEGATIVE=LEFT), EACH PAIR OF DISTANCES DEFINES THE START AND STOP OF A SWATH, FOR EXAMPLE

SETSWT,SINGLE,-100,100,0,0 DEFINES A SWATH NAMED SINGLE WHICH EXTENDS 100 NM OR KM ON EITHER SIDE OF THE CENTER LINE,

SETSWT,DOUBLE,-700,-300,400,800 DEFINES A SWATH NAMED DOUBLE WHICH EXTENDS FROM 300 TO 700 ON THE LEFT AND FROM 400 TO 800 ON THE RIGHT,

THE SWATH NAME AND GROUND SWATH DATA ARE SAVED FOR LATER REFERENCE, UP TO TEN SENSOR GROUND SWATHS MAY BE DEFINED, REFERENCE TO A PARTICULAR SENSOR MAY BE MADE USING THE COMMAND SWATH,

THE UNITS (NM OR KM) ARE DETERMINED BY THE SELECTED UNITS OPTION,

WHEN USED WITH AN ELLIPTICAL ORBIT THE SWATH IS ASSUMED PROPORTIONAL TO THE ALTITUDE WITH THE DEFINED VALUES AT THE AVERAGE ALTITUDE,

THE NAME SENSOR IS RESERVED FOR THE IGOS SENSOR MODEL AND THE ARGUMENT VALUES WILL BE IGNORED,

TO UPDATE GROUND SWATH DATA RE-ENTER THE APPROPRIATE SENSOR NAME FOLLOWED BY THE NEW DATA IN A SECOND SETSWT COMMAND,

COMMAND SETSWT IS VALID IN ALL MODES,

ARGUMENT	DEFAULT VALUE AND UNITS				VALID RANGE
(1) NAME			ALPHABETIC		
(2) X1	,E+00	NM,	,E+00	KM	-1,0000E+20 TO 1,0000E+20
(3) X2	,E+00	NM,	,E+00	KM	-1,0000E+20 TO 1,0000E+20
(4) X3	,E+00	NM,	,E+00	KM	-1,0000E+20 TO 1,0000E+20
(5) X4	,E+00	NM,	,E+00	KM	-1,0000E+20 TO 1,0000E+20

SHWSWT-SHOWS SENSOR GROUND SWATH DATA

THE COMMAND SHWSWT LISTS THE SENSOR GROUND SWATH DATA FOR ALL SWATHS THAT MAY BE REFERENCED USING THE COMMAND SWATH, EACH SWATH WAS PREVIOUSLY DEFINED WITH THE COMMAND SETSWT,

COMMAND SHWSWT IS VALID IN ALL MODES,

NO ARGUMENTS

SWATH-SELECTS A GROUND SWATH

THE COMMAND SWATH IS USED TO REFERENCE A PARTICULAR SENSOR GROUND SWATH FOR PROGRAM USE, SWATH REQUIRES PRIOR USE OF THE COMMANDS SET-SWT AND ORBDEF,

THE FIRST ARGUMENT IS THE ALPHABETIC NAME OF THE GROUND SENSOR SWATH SELECTED, A LIST OF AVAILABLE SENSOR GROUND SWATHS MAY BE OBTAINED USING THE COMMAND SHWSWT, THE NAME SENSOR WILL FORCE USE OF THE IGOS SENSOR MODEL,

THE SECOND ARGUMENT DEFINES OR CHANGES THE SUN ANGLE REQUIREMENT, THE ANGLE BETWEEN THE EARTH-SUN AND EARTH-SATELLITE VECTORS IN DEGREES, FOR MORE INFORMATION, SEE THE COMMAND SUNANG, SUN ANGLE IS OPTIONAL,

EXAMPLE-

SWATH,SINGLE,70 REQUESTS THE SENSOR GROUND SWATH, SINGLE, AND A 70 DEGREE SUNANGLE REQUIREMENT,

SWATH ALSO PRODUCES OUTPUT TO IDENTIFY THE GROUND SENSOR SWATH SELECTED,

COMMAND SWATH IS VALID IN ALL MODES,

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) NAME	SENSOR ALPHABETIC	
(2) SUNANG	1,8000E+02 DEG	1,0000E+00 TO 1,8000E+02

STPLNG-PRODUCES THE ORBIT STEP LONGITUDE COVERAGE PLOT

A LONGITUDE COVERAGE PLOT IS A GRAPH OF SATELLITE COVERAGE OF A PARTICULAR RANGE OF LONGITUDES AT A SPECIFIC LATITUDE VERSUS TIME IN DAYS FROM LAUNCH. THE ARGUMENTS DEFINE THE REGION OF INTEREST. THREE GRAPHICAL REPRESENTATIONS ARE AVAILABLE THRU THE PLOT OPTION.

DAY1,DAY2= TIME PERIOD (DAYS FROM LAUNCH)
LNG1,LNG2= THE LONGITUDE RANGE (DEGREES)
LAT= LATITUDE (DEGREES)
LY= THE PLOT OPTION
THE PLOT OPTIONS ARE-
LONG= PLOTS LONGITUDE COVERAGE VERSUS TIME
LNG= PLOTS LONG OPTION AND CUMULATIVE LONGITUDE COVERAGE LINE FOR DEFINED TIME PERIOD,
LNGB= PLOTS LONG AND LNG OPTIONS USING A BAR GRAPH REPRESENTATION

FOR EXAMPLE-
STPLNG,10,40,-50,120,0,LONG WILL PRODUCE A SATELLITE COVERAGE PLOT FOR DAY 10 THRU DAY 40 AFTER LAUNCH OF LONGITUDES -50 TO 120 DEGREES AT THE EQUATOR

THE COMMAND ORBDEF MUST BE ENTERED PRIOR TO THE COMMAND STPLNG TO DEFINE THE SATELLITE ORBIT.

AFTER THE AXES ARE DRAWN AND PERIODICALLY THROUGHOUT THE PLOTING, THE COMPUTER WILL PAUSE. TYPE A BLANK AND A RETURN TO CONTINUE. A NON-BLANK WILL TERMINATE THE PLOT AND ASK FOR A NEW COMMAND.

COMMAND STPLNG IS VALID IN ALL MODES. IT WILL ERASE THE SCREEN AND INITIATE A STPLNG PLOT. THE FOLLOWING COMMANDS MAY THEN BE USED TO ENHANCE THE PLOT. ZOOM

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) DAY1	1,0000E+00 DAYS	,E+00 TO 1,0000E+20
(2) DAY2	1,1000E+01 DAYS	,E+00 TO 1,0000E+20
(3) LNG1	,E+00 DEG	-3,6000E+02 TO 3,6000E+02
(4) LNG2	3,6000E+02 DEG	-3,6000E+02 TO 3,6000E+02
(5) LAT	,E+00 DEG	-9,0000E+01 TO 9,0000E+01
(6) LY	LONG ALPHABETIC	

STPTOD-PRODUCES THE ORBIT STEP TIME OF DAY COVERAGE PLOT

A TIME OF DAY COVERAGE PLOT IS A GRAPH OF LOCAL TIME OF DAY SATELLITE COVERAGE OF A PARTICULAR LONGITUDE AND LATITUDE VERSUS TIME IN DAYS FROM LAUNCH, THE ARGUMENTS DEFINE THE LOCATION AND TIMES OF INTEREST,

DAY1,DAY2= TIME PERIOD (DAYS FROM LAUNCH)
TOD1,TOD2= LOCAL TIME OF DAY RANGE (HOURS 0-24)
EXAMPLE TOD1=3,TOD2=17 IS 3 AM TO 5 PM
LNG= LONGITUDE (DEGREES)
LAT= LATITUDE (DEGREES)

FOR EXAMPLE-
STPTOD,1,366,6,18,-82,28 WILL PRODUCE A PLOT OF SATELLITE COVERAGE FOR ABOUT A YEAR (DAYS 1 THRU 366 AFTER LAUNCH) DURING THE HOURS 6 AM TO 6 PM OF -82 DEGREES LONGITUDE AND 28 DEGREES LATITUDE

THE COMMAND ORBDEF MUST BE ENTERED PRIOR TO THE COMMAND STPTOD TO DEFINE THE SATELLITE ORBIT,

AFTER THE AXES ARE DRAWN AND PERIODICALLY THROUGHOUT THE PLOTING, THE COMPUTER WILL PAUSE, TYPE A BLANK AND A RETURN TO CONTINUE, A NON-BLANK WILL TERMINATE THE PLOT AND ASK FOR A NEW COMMAND,

COMMAND STPTOD IS VALID IN ALL MODES, IT WILL ERASE THE SCREEN AND INITIATE A STPTOD PLOT, THE FOLLOWING COMMANDS MAY THEN BE USED TO ENHANCE THE PLOT, ZOOM

ARGUMENT	DEFAULT VALUE AND UNITS		VALID RANGE		
(1) DAY1	,E+00	DAYS	,E+00	TO	1,0000E+20
(2) DAY2	1,1000E+01	DAYS	,E+00	TO	1,0000E+20
(3) TOD1	,E+00	HRS	,E+00	TO	2,4000E+01
(4) TOD2	2,4000E+01	HRS	,E+00	TO	2,4000E+01
(5) LNG	,E+00	DEG	-3,6000E+02	TO	3,6000E+02
(6) LAT	,E+00	DEG	-9,0000E+01	TO	9,0000E+01

LIST-LISTS THE IGOS COMMANDS AND THEIR ARGUMENTS

THE COMMAND LIST,NAME WILL LIST THE ARGUMENTS, CURRENT VALUES, UNITS, AND VALID RANGES OF THE COMMAND NAMED.

LIST,ALL WILL PRODUCE A PAGE LISTING THE IGOS COMMANDS GROUPED BY SCREEN MODE.

COMMAND LIST IS VALID IN ALL MODES.

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) COMAND	ALL	ALPHABETIC

LAUNCH-DEFINES THE LAUNCH SITE FOR BEGINNING AN ORBIT

LAUNCH DEFINES THE LAUNCH SITE AND TIME TO DEFINE THE ORBIT LONG, OF NODES, ARGUMENT OF PERIGEE, AND TIME OF PERIGEE,

LAUNCH SITE OPTIONS ARE

ETR=EASTERN TEST RANGE
WTR=WESTERN TEST RANGE
WAL-N=WALLOPS ISLAND(NORTHERN AZIMUTHS)
WAL-S=WALLOPS ISLAND(SOUTHERN AZIMUTHS)
SAN MARC=SAN MARCO ISLAND

TIME IS ENTERED IN DAYS OF THE YEAR AND GMT HOURS,

EXAMPLE-LAUNCH,WTR,15,22

THIS IS A LAUNCH FROM WTR ON JAN 15 AT 22 HOURS GMT,

COMMAND LAUNCH IS VALID IN ALL MODES,

ARGUMENT	DEFAULT VALUE	AND UNITS	VALID RANGE
(1) LSITE	NONE	ALPHABETIC	
(2) DAY	,E+00	DAYS	,E+00 TO 3,6600E+02
(3) TIME	,E+00	HRS	,E+00 TO 2,4000E+01

VEH-SELECTS AN EXPENDABLE LAUNCH VEHICLE

THIS COMMAND GENERATES AN INTERNALLY STORED TABLE OF PAYLOAD WEIGHT VERSUS ALTITUDE AND INCLINATION FOR THE SPECIFIED VEHICLE, THE VEHICLE NAME AND THE RANGE OF WEIGHTS FOR THE CURRENT ORBSEL PLOT ARE DISPLAYED IN THE UPPER LEFT CORNER OF THE PLOT, EQUI-PAYLOAD CONTOURS MAY THEN BE ADDED TO THE PLOT USING THE COMMAND PLD,

THE VEHICLE IS SELECTED BY THE FOLLOWING CODES AS THE FIRST ARGUMENT,

1=SCOUT-D
2=DELTA-2910
3=DELTA-2610
4=DELTA-2310
5=SCOUT-F

THE REMAINING 5 ARGUMENTS ARE USED TO SPECIFY THE LAUNCH SITES, IF THE ARGUMENTS ARE ALL BLANK THE CALCULATIONS WILL BE MADE ASSUMING A LAUNCH FROM THE SITE NORMALLY USED BY THE VEHICLE WHICH PRODUCES THE GREATEST PAYLOAD TO EACH ORBIT, IF ANY SITE IS SPECIFIED, ONLY THOSE SITES ARE CONSIDERED,

THE FOLLOWING SITES MAY BE SPECIFIED,

ETR=EASTERN TEST RANGE
WTR=WESTERN TEST RANGE
WAL-N=WALLOPS ISLAND(NORTHERN AZIMUTHS)
WAL-S=WALLOPS ISLAND(SOUTHERN AZIMUTHS)
SAN MARC=SAN MARCO ISLAND

BLANKS MUST BE ENTERED BY TYPING THE WORD BLANK, (IGOS SKIPS BLANKS)

EXAMPLE-VEH,2,BLANK,BLANK,BLANK,BLANK WILL ASSUME A DELTA FROM EITHER ETR OR WTR,

EXAMPLE-VEH,1,WAL-N,WAL-S,WTR WILL ASSUME A SCOUT BUT WILL ELIMINATE SAN MARCO LAUNCHES,

COMMAND VEH IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) IV	1,0000E+00	1,0000E+00 TO 1,0000E+20
(2) LS1	ALPHABETIC	
(3) LS2	ALPHABETIC	
(4) LS3	ALPHABETIC	
(5) LS4	ALPHABETIC	
(6) LS5	ALPHABETIC	

PLD-DRAWS A LAUNCH VEHICLE PAYLOAD CONTOUR

THIS COMMAND WILL DRAW A CONTOUR OF THOSE ORBITS TO WHICH THE SPECIFIED VEHICLE CAN DELIVER A PARTICULAR PAYLOAD WEIGHT.

NO PLOT WILL BE PRODUCED IF THE ARGUMENT VALUE IS BEYOND THE VEHICLE CAPABILITY OR IF NO VEHICLE HAS BEEN SPECIFIED FOR THE CURRENT ORBSEL PLOT.

COMMAND PLD IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) PLD	,E+00 LBS	,E+00 TO 1.0000E+20

QPLT-DRAWS THE CONTOURS OF A SPECIFIED ORBIT Q

Q IS THE RATIO OF SATELLITE MEAN ANGULAR RATE TO THE ORBIT PLANE ANGULAR RATE RELATIVE TO THE EARTH, Q IS USUALLY EXPRESSED IN THE FOLLOWING FORM

$$Q = I + N1/N2$$

WHERE I, N1, AND N2 ARE INTEGERS, THE FIRST TWO QPLT ARGUMENTS ARE N1 AND N2, AN ORBIT WILL REPEAT OBSERVATIONS OF THE SAME EARTH SITES EVERY N2 DAYS OR I*N2+N1 PASSES, THE THIRD QPLT ARGUMENT, GAP, IS PROVIDED TO ALLOW SPECIFICATION OF A SMALL GAP DISTANCE, IF GAP IS NON-ZERO, THE Q PLOTTED WILL REPRESENT ORBITS WHICH MISS AN EXACT REPEAT BY THE GAP DISTANCE,

QPLT WILL DRAW CONTOURS OF EQUAL Q FOR ALL VALUES OF I WHICH FALL ON THE CURRENT ORBSEL PLOT, IF A NON-INTEGER N1 IS SPECIFIED ALL VALUES WHICH ARE PRIME TO N2 WILL ALSO BE PLOTTED,

EXAMPLE-QPLT,27,81,0 WILL PLOT LOCII OF I+1/3
QPLT,,1,4,0 WILL PLOT LOCII OF I+1/4, I+3/4
QPLT,1,2,20 WILL PLOT LOCII OF Q FOR 2 DAY REPETITION WITHIN 20 NM

COMMAND QPLT IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS		VALID RANGE
(1) NP	,E+00	PASSES	,E+00 TO 1,0000E+20
(2) ND	,E+00	DAYS	,E+00 TO 1,0000E+20
(3) GAP	,E+00 NM,	,E+00 KM	-1,0000E+20 TO 1,0000E+20

LABEL-PERMITS TYPING INFORMATION ON THE SCREEN (TEKTRONIX ONLY)

THE COMMAND WILL CAUSE THE CROSS HAIRS TO APPEAR ON THE SCREEN. THESE MAY BE MOVED USING THE TERMINAL THUMB WHEELS TO POSITION THEIR INTERSECTION AT THE LOCATION OF THE DESIRED LABEL. A BLANK SHOULD THEN BE TRANSMITTED. THE CHARACTER CURSOR WILL THEN APPEAR AND THE KEY BOARD USED TO TYPE ONTO THE SCREEN. WHEN A CARRIAGE RETURN IS TRANSMITTED THE CROSS HAIRS WILL REAPPEAR, THEY MAY BE REPOSITIONED FOR ADDITIONAL LABELING, OR MOVED TO THE BOTTOM OF THE PLOT TO END THE LABELING PROCESS.

COMMAND LABEL IS VALID IN MODES ORBSEL

NO ARGUMENTS

SUN-DRAWS SUN SYNCHRONUS CONTOURS

THREE DASHED LINES ARE DRAWN, THEY REPRESENT ORBITS WHOSE SUN-ORBIT PRECESSION RATE ARE -OMEGA, ZERO, AND +OMEGA,

OMEGA IS THE ANGULAR RATE (DEGREES/DAY) GIVEN BY THE ARGUMENTS,

EXAMPLE-SUN,1,30 WILL DRAW THE-1/30,0, AND +1/30 DEGREES/DAY LINES,

COMMAND SUN IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS		VALID RANGE	
(1) DEG	,E+00	DEG	,E+00 TO	1,0000E+20
(2) DAYS	,E+00	DAYS	,E+00 TO	1,0000E+20

RAD-DRAWS THE OUTLINE OF THOSE ORBITS WHICH HAVE EXCESS RADIATION

THE COMMAND RAD OUTLINES THOSE ORBITS ON THE ORBSEL PLOT WITH EXCESSIVE RADIATION EXPOSURE. THE ARGUMENTS DEFINE THE RADIATION SPECIFICATIONS AS FOLLOWS-

CMAL = DENSITY OF ALUMINUM SHIELD (GM/CM2)
FLUM = MAXIMUM FLUENCE
DAYS = NUMBER OF DAYS FOR ALLOWABLE FLUENCE

DUE TO THE SIZE OF THE NUMBER, FLUM IS ENTERED AS FOLLOWS-
XX,XXEYY IS ENTERED AS XX,XX*100,YY-2
12,40E12 IS ENTERED AS 1240,10
11,71E13 IS ENTERED AS 1171,11

THE OUTLINED AREAS MAY BE CROSS HATCHED USING THE HR COMMAND,

COMMAND RAD IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) CMAL	1,0000E-02 GM/CM2	1,0000E-20 TO 1,0000E+20
(2) FLUM	5,1200E+00	1,0000E-20 TO 1,0000E+20
(3) DAYS	3,0000E+01 DAYS	1,0000E-20 TO 1,0000E+20

HR-DRAWS VERTICAL HATCHES IN THE EXCESS RADIATION OUTLINES

THE OUTLINES GENERATED BY THE RAD COMMAND ARE STORED AS 51 DISCRETE ALTITUDE STRIPS, CROSS HATCHES ARE LINES DRAWN AT THE 51 ALTITUDES, THE ARGUMENTS CONTROL WHICH ALTITUDES WILL BE HATCHED.

EXAMPLE- HR,1,1 WILL HATCH EVERY ALTITUDE STARTING AT THE FIRST,

HR,4,3 WILL HATCH EVERY THIRD ALTITUDE STARTING WITH THE FOURTH

COMMAND HR IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) START	1.0000E+00 LINES	1.0000E+00 TO 1.0000E+01
(2) STEP	1.0000E+00 LINES	1.0000E+00 TO 1.0000E+01

DECAY-PLOTS THE ORBIT DECAY AND LAUNCH VEHICLE INJECTION ERRORS

COMMAND DECAY PRODUCES ORBIT DECAY AND LAUNCH VEHICLE INJECTION DISPERSIONS (SCOUT ONLY) ON THE ORBSEL PLOT,

THE ARGUMENTS ARE-

ALT = ALTITUDE OF INJECTION (NM OR KM)
DI = INCLINATION OF INJECTION (DEGREES)
BC = BALLISTIC COEFFICIENT (KG/M2)
LYR = LAUNCH YEAR (EXAMPLE-1976)
YRS = TIME IN YEARS FOR DECAY

EXAMPLE- DECAY,160,,35.5,220,,1977.2

COMMAND DECAY IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) ALT	1.7500E+02 NM, 3.2410E+02 KM	.E+00 TO 1.0000E+20
(2) DI	3.7000E+01 DEG	.E+00 TO 1.8000E+02
(3) BC	2.2000E+02 KG/M2	1.0000E-20 TO 1.0000E+20
(4) LYR	1.9760E+03 CAL YR	1.0000E-20 TO 1.0000E+20
(5) YRS	1.0000E+00 YRS	1.0000E-20 TO 1.0000E+20

ZOOM-USES THE CURSOR TO ZOOM IN ON A PLOT REGION (TEKTRONIX ONLY)

THE CROSS HAIRS ARE USED TO DEFINE A PORTION OF THE PLOT FOR EXPANSION TO ACHIEVE BETTER CLARITY,

1, THE CROSS HAIRS WILL APPEAR ON THE SCREEN, POSITION THEM WITH THEIR INTERSECTION AT A CORNER OF THE DESIRED REGION,

2, TRANSMIT A BLANK

3, THE PROGRAM WILL DRAW A PAIR OF LINES AT THE CROSS HAIR LOCATIONS,

4, REPOSITION THE CROSS HAIRS WITH THEIR INTERSECTION AT THE OPPOSITE CORNER OF THE DESIRED REGION,

5, TRANSMIT A BLANK

6, THE PROGRAM WILL DRAW A SECOND PAIR OF LINES, THE DESIGNATED AREA IS NOW OUTLINED ON THE PLOT,

7, A PAGE WARNING IS ISSUED, IF DESIRED, A COPY OF THE PLOT, WITH THE DESIGNATED AREA OUTLINED, MAY BE OBTAINED,

8, TRANSMIT A BLANK

9, THE EXPANDED PLOT WILL BE INITIATED BY THE PROGRAM,

COMMAND ZOOM IS VALID IN MODES ORBSEL GNDTRK STPLNG STPTOD

NO ARGUMENTS

MARK-MARKS WITH THE CURSOR A POINT FOR LATER REFERENCE(TEKTRONIX ONLY)

THE COMMAND MARK WILL CAUSE THE CROSS HAIRS TO APPEAR ON THE SCREEN, THEY MAY THEN BE POSITIONED WITH THEIR INTERSECTION AT THE DESIRED ORBIT (POINT) ON THE ORBSEL PLOT. A BLANK IS THEN TRANSMITTED, THE PROGRAM WILL DRAW A CROSS AT THE INTERSECTION AND ASSIGN A LETTER TO THE MARK. LATER REFERENCE MAY BE MADE TO THESE ORBITS USING THE COMMAND SELECT.

UP TO FIFTEEN MARKS MAY BE MADE ON ORBSEL PLOTS DURING ONE IGOS SESSION (A THROUGH O). THEIR COORDINATES ARE SAVED UNTIL PROGRAM TERMINATION.

DUE TO THE FINITE RESOLUTION OF THE TERMINAL SCREEN, MORE PRECISE MARKS MAY BE MADE BY EXPANDING THE ORBSEL PLOT SCALES, USING THE ZOOM COMMAND, PRIOR TO MAKING THE MARKS.

COMMAND MARK IS VALID IN MODES ORBSEL

NO ARGUMENTS

SELECT-SELECTS A PREDEFINED MARK

SELECT REQUIRES PRIOR USE OF THE COMMAND MARK, (MARK READS THE POSITION OF CROSSHAIRS ON AN ORBSEL PLOT TO DEFINE AND LABEL AN ORBIT--SEE MARK) SELECT CHOOSES AN ORBIT DEFINED BY THE MARK COMMAND ON THE MOST RECENT ORBSEL PLOT FOR FURTHER ANALYSIS, THE COMMAND ENTERS THE APPROPRIATE ALTITUDE AND INCLINATION OF THE ORBIT SELECTED IN THE ARGUMENT LIST FOR THE COMMAND ORBDEF, THIS AVOIDS HAVING TO READ THE COORDINATES ON THE ORBSEL PLOT AND TYPE THEM AS ARGUMENTS WITH ORBDEF.

EXAMPLE- SELECT,A CAUSES THE ALTITUDE AND INCLINATION ASSOCIATED WITH THE ORBIT LABELED A BY MARK ON THE MOST RECENT ORBSEL PLOT TO BE ENTERED AS ORBDEF ARGUMENTS,

SELECT ALSO PRODUCES OUTPUT TO IDENTIFY THE ORBSEL PLOT AND THE MARK SELECTED,

THE ARGUMENT TOL IS NOT USED,

COMMAND SELECT IS VALID IN ALL MODES, IT WILL ERASE THE SCREEN AND INITIATE A SELECT PLOT,

ARGUMENT	DEFAULT VALUE AND UNITS		VALID RANGE
(1) MARK	A	ALPHABETIC	
(2) TOL	,E+00	DHMS	-1,0000E+20 TO 1,0000E+20

COV-THE IGOS COVERAGE MODEL TO NOTE ORBITS WITH INSUFFICIENT COVERAGE

THE COVERAGE MODEL OUTLINES THOSE ORBITS ON THE ORBSEL PLOT WHICH DO NOT VIEW ALL POINTS IN THE LATITUDE RANGE, LAT1,-LAT2, AT LEAST ONCE IN THE SPECIFIED NUMBER OF DAYS. VIEWING IS DEFINED BY THE IGOS SENSOR MODEL WHOSE DATA IS ENTERED WITH THE COMMAND SENSOR. AN ARGUMENT, NSATS, IS PROVIDED TO SPECIFY THE NUMBER OF SATELLITES. FOR MULTIPLE SATELLITES IT IS ASSUMED THAT THE ORBIT PLANES ARE POSITIONED SO THAT THE GROUND SWATH LIE EXACTLY ADJACENT.

EXAMPLE-COV,0,60,30 WILL OUTLINE THOSE ORBITS THAT DO NOT VIEW ALL PORTIONS OF THE EARTH BETWEEN LATS 0 AND 60 DEGREES AT LEAST ONCE EVERY 30 DAYS.

THE OUTLINED AREAS MAY BE CROSS HATCHED USING THE HC COMMAND.

COMMAND COV IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) LAT1	3.5000E+01 DEG	-9.0000E+01 TO 9.0000E+01
(2) LAT2	3.5000E+01 DEG	-9.0000E+01 TO 9.0000E+01
(3) DAYS	3.0000E+01 DAYS	1.0000E-20 TO 1.0000E+20
(4) NSATS	1.0000E+00 NO.	-1.0000E+01 TO 1.0000E+01

HC-CROSS HATCHES THE FORBIDDEN ORBITS IN THE COVERAGE PLOT

THE OUTLINES GENERATED BY THE COV COMMAND ARE STORED AS 51 DISCRETE ALTITUDE STRIPS, CROSS HATCHES ARE LINES DRAWN AT THE 51 ALTITUDES,

THE ARGUMENTS CONTROL WHICH ALTITUDES WILL BE HATCHED,

EXAMPLE-HC,1,1 WILL HATCH EVERY ALTITUDE STARTING AT THE FIRST,

EXAMPLE-HC,2,3 WILL HATCH EVERY THIRD ALTITUDE STARTING WITH THE 2ND,

COMMAND HC IS VALID IN MODES ORBSEL

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) START	1,0000E+00 LINES	1,0000E+00 TO 1,0000E+01
(2) STEP	1,0000E+00 LINES	1,0000E+00 TO 1,0000E+01

MAP-DRAWS AN EARTH MAP BACKGROUND

THE MAP DATA CONSIST OF 10000 DATA POINTS, WHEN THE GNDTRK COMMAND IS GIVEN A SUBSET OF THE DATA IS COPIED TO A SCRATCH FILE, THE SCRATCH FILE CONSISTS OF THOSE POINTS WHICH LIE ON THE PORTION OF THE EARTH BEING DISPLAYED, AND FURTHER APART THAN A MINIMUM DISTANCE, THE MINIMUM DISTANCE IS THE WIDTH OF THE PLOT DIVIDED BY THE FINENESS, IF THE FINENESS WAS SET TO ZERO NO SCRATCH FILE IS WRITTEN AND NO MAPS CAN BE DRAWN,

COMMAND MAP IS VALID IN MODES GNDTRK

NO ARGUMENTS

PASS-DRAWS ORBIT PASSES ON THE GROUND TRACK PLOT

THE ARGUMENTS ARE USED TO CONTROL WHICH PASSES AND HOW THE SWATH IS PLOTTED,

EXAMPLE-PASS,1,3,7

THIS WILL DRAW PASSES 1,2, AND 3 WITH A TYPE 7 SWATH PLOT, THE FIRST PASS BEGINS AT LAUNCH AND ENDS WITH THE FIRST ASCENDING EQUATORIAL CROSSING, SEVERAL PASS PLOTS MAY BE SUPERIMPOSED, FOR EXAMPLE PASS,1,5,7 AND PASS,6,10,7 WILL GIVE THE SAME PLOT AS PASS,1,10,7

THE SWATH CODES ARE

1=SOLID CENTERLINE ONLY
2=SWATH EDGES ONLY
3=EDGES AND DASHED CENTERLINE
4=CROSS HATCHES ONLY
5=CROSS HATCHES AND DASHED CENTERLINE
6=CROSS HATCHES AND EDGES
7=CROSS HATCHES+EDGES+DASHED CENTERLINE

IF A SUN ANGLE LESS THAN 180 DEG, HAS BEEN SPECIFIED, ONLY THE PORTION OF THE SWATH WITH ADEQUATE ILLUMINATION WILL BE PLOTTED,

COMMAND PASS IS VALID IN MODES GNDTRK

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) FIRST	1.0000E+00 PASSES	-1.0000E+03 TO 1.0000E+04
(2) LAST	1.0000E+00 PASSES	-1.0000E+03 TO 1.0000E+04
(3) CODE	2.0000E+00	1.0000E+00 TO 7.0000E+00

TRKSIT-DRAWS THE TRACKING SITE MASKS ON THE GROUND TRACK PLOT

THE TRACKING SITE MASKS ARE CIRCLES WITH RADII COMPUTED FROM THE ORBIT AVERAGE (SMA) ALTITUDE, THE SITE ALTITUDE, AND THE MINIMUM ELEVATION ANGLE ABOVE THE LOCAL HORIZON.

THE SITES ARE GROUPED BY CLASSES. ALL SITES WITHIN A CLASS ARE PLOTTED AT THE SAME TIME. UP TO FOUR CLASSES MAY BE PLOTTED WITH EACH TRKSIT COMMAND.

EXAMPLE-TRKSIT,2 PLOTS ALL CLASS 2 SITES

EXAMPLE-TRKSIT,4,3,1 PLOTS CLASS 1,3, AND 4 SITES,
TRKSIT-DRAWS CLASSES OF TRACKING SITE MASKS ON THE GROUND TRACK PLOT

COMMAND TRKSIT IS VALID IN MODES GNDTRK

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) CODE1	,E+00	1,0000E+00 TO 1.0000E+01
(2) CODE2	,E+00	1,0000E+00 TO 1.0000E+01
(3) CODE3	,E+00	1,0000E+00 TO 1.0000E+01
(4) CODE4	,E+00	1,0000E+00 TO 1.0000E+01

CHGSIT-TO ADD TRACKING SITE DATA OR CHANGE EXISTING SITE DATA

THE FIRST ARGUMENT IS A SITE NAME, IF THE NAME MATCHES AN EXISTING SITE NAME THE COMMAND WILL CHANGE THE DATA ASSOCIATED WITH THAT SITE, IF THE NAME DOES NOT MATCH THAT OF AN EXISTING SITE, A NEW SITE IS CREATED WITH DATA PROVIDED IN THE ARGUMENT LIST,

WHEN THE DATA FOR AN EXISTING SITE IS TO BE CHANGED, ZERO ARGUMENTS WILL CAUSE THE CORRESPONDING DATA TO REMAIN UNCHANGED,

EXAMPLE-CHGSIT,FAIRBANKS,3,0,0,20,0 WILL CHANGE FAIRBANKS TO A CLASS 3 SITE WITH A MINIMUM ELEVATION ANGLE OF 20 DEG, THE LAT,LONG AND ALT WILL NOT BE CHANGED,

COMMAND CHGSIT IS VALID IN ALL MODES,

ARGUMENT	DEFAULT VALUE AND UNITS		VALID RANGE
(1) NAME	ALPHABETIC		
(2) CODE	,E+00	,E+00	TO 1,0000E+01
(3) LNG	,E+00 DEG	-3,6000E+02	TO 3,6000E+02
(4) LAT	,E+00 DEG	-9,0000E+01	TO 9,0000E+01
(5) ELE	,E+00 DEG	,E+00	TO 9,0000E+01
(6) ALT	,E+00 NM,	,E+00 KM	-1,0000E+20 TO 1,0000E+20

SHWSIT-SHOWS THE DATA FOR A CLASS OF TRACKING SITES

THE SHWSIT COMMAND LISTS THE TRACKING SITE DATA FOR ALL SITES IN THE CLASS SPECIFIED BY THE ARGUMENT.

COMMAND SHWSIT IS VALID IN ALL MODES.

ARGUMENT	DEFAULT VALUE AND UNITS	VALID RANGE
(1) CODE	.E+00	1.0000E+00 TO 1.0000E+01

ORBSHW-PRODUCES THE NODAL GAP PATTERN ON THE ORBIT DEFINITION PLOT

THE COMMAND ORBSHW PROVIDES THE FOLLOWING ADDITIONAL ORBIT INFORMATION ON THE ORBDEF PRESENTATION-

1, RELATIVE MOTION OF THE NODE WRT EARTH, WRT SUN AND INERTIAL IN DEGREES/NODAL PERIOD AND DEGREES/DAY

2, RELATIVE MOTION OF PERIGEE WRT NODE IN DEGREES/NODAL PERIOD AND DEGREES/DAY,

3, PLOT OF DISTANCE BETWEEN ASCENDING NODES VERSUS TIME, DISTANCE IS MEASURED IN NM OR KM AND DEGREES AND TIME IS IN DAYS AND ORBITAL PASSES,

COMMAND ORBSHW IS VALID IN MODES ORBDEF

NO ARGUMENTS

NO TEACH MESSAGE IS AVAILABLE FOR THESE COMMANDS

MANUAL 1 ARGUMENTS