[redacted]

577

VOYAGER 1 AND 2
SATURN IRIS MERGED DATA

77-084A-03B
77-076A-03B

VOYAGER 2
NEPTUNE-IRIS REDUCED DATA RCD
77-076A-03D

REQ. AGENT	RAND NO.	ACQ. AGENT
RLR		PSB

VOYAGER 2

NEPTUNE-IRIS REDUCED DATA RCD

77-076A-03D

This data set catalog consists of 3 tapes. The tapes are 6250 bpi, 9-track, multifiled, binary, created on the VAX. The D and C numbers, time spans, and number of files are as follows:

#D	#C	FILES	TIME SPANS
D-82873	C-29230	21	08/17/89 - 08/23/89
D-82874	C-29231	21	08/22/89 - 08/28/89
D-82875	C-29232	21	08/27/89 - 09/06/89

NASA

D-693-92-1

VOYAGER INFRARED INTERFEROMETER SPECTROMETER AND RADIOMETER (IRIS)

DOCUMENTATION FOR REDUCED DATA RECORDS (RDR) FOR THE NEPTUNIAN SYSTEM

J.C. PEARL, C.M. STAUB, J.S. TINGLEY, L. HERATH & L.A. MAYO

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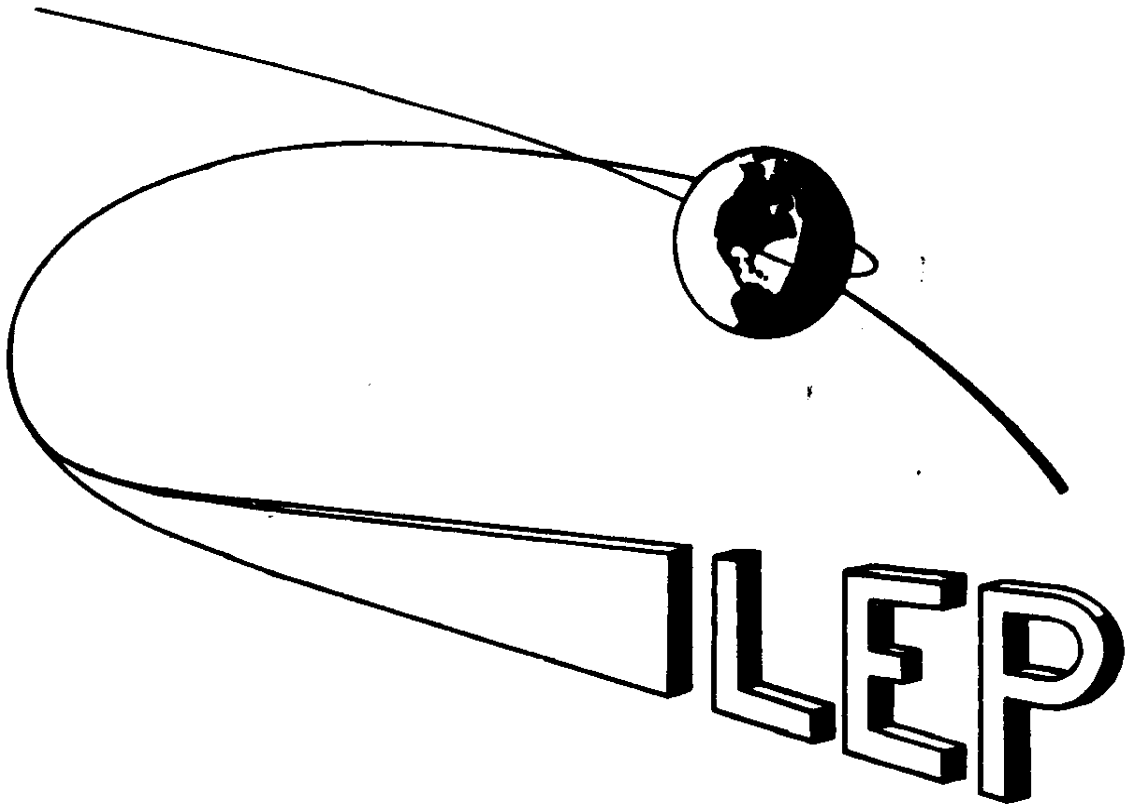
LABORATORY FOR EXTRATERRESTRIAL PHYSICS



National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

APPENDIX C

IRIS RDR FILE SUMMARY

VOYAGER 2 NEPTUNE FILE SUMMARY

FILE	RECS.	FDSC RANGE	POINTING INFORMATION	TIME RELATIVE TO PERIAPSIS	TAPE
NRDR1.DAT	10720	11140.18-11232.28	FINAL/09226	-8d 7h 58m 28s	NIRIS1
		11232.29	NONE		
		11232.30-11282.57	FINAL/09236	TO	
		11282.58-11283.00	NONE		
		11283.01-11320.18	FINAL/09236	-2d 7h 58m 28s	
NRDR2.DAT	8655	11320.15-11340.22	FINAL/09236	-2d 8h 0m 52s	NIRIS2
		11340.23	PREDICT/00136		
		11340.24-11374.57	FINAL/09237		
		11374.58	PEDICT/00136		
		11374.59-11392.47	FINAL/09516		
		11392.48-11392.50	NONE		
		11392.51-11393.25	FINAL/09516	TO	
		11393.26-11393.28	NONE		
		11393.29-11398.04	FINAL/09516		
		11398.05-11398.07	NONE		
		11398.08-11441.13	FINAL/09516		
		11441.14-11460.22	FINAL/09526		
		11460.23	PREDICT/00121		
		11460.24-11470.15	FINAL/09527	+2d 15h 59m 7s	
NRDR3.DAT	17884	11470.15-11487.24	FINAL/09527	+2d 15h 59m 7s	NIRIS3
		11487.25-11487.27	NONE		
		11487.28-11501.39	FINAL/09527		
		11501.40-11501.42	NONE		
		11501.43-11531.12	FINAL/09527	TO	
		11531.13	PREDICT/00121		
		11531.14-11726.55	FINAL/09716		
		11726.56-11726.58	NONE		
		11726.59-11769.52	FINAL/09716	+12d 15h 40m 41s	

APPENDIX D

REDUCED DATA RECORD (RDR) TAPE DESCRIPTION AND FORMAT

GENERAL DESCRIPTION OF DATABASE TAPES

The Voyager 2 Neptune IRIS database is contained on three magnetic tapes which are available from the National Space Science Data Center (NSSDC). Each tape includes a file of reduced data records (RDR's) covering time spans roughly equal to pre-encounter, near encounter, and post-encounter (see Appendix C). Each tape also includes files of related deep space averages, related noise equivalent spectral radiances (NESR), and pre- and post-encounter target plate calibration spectra.

The format of each tape is as follows:

Volume label=NIRIS1, NIRIS2, or NIRIS3
Tracks=9, Density=6250 bpi, ANSI standard labels
Fixed-length, blocked records
Record length=4096 bytes, Blocksize=4096 bytes
VAX/VMS binary (unformatted) records

Each reduced data record (RDR) file contains complete IRIS records (header and data) in ascending FDSC order. The first 500 bytes of each record are the header information, which is a mixture of full-word floating point values, full and half-word integers, and individual bytes. The remaining 3596 bytes are radiance data as a function of wavenumber and are full-word floating point values. A full-word in this context equals 4 bytes, or 32 bits. Refer to Table D-1 for a complete field description. The following illustrates an IRIS RDR record:

<----------4096 bytes---------->
<----------1024 words---------->
<----------HEADER------><----------RADIANCE VALUES---------->
<----------500 bytes----><----------3596 bytes---------->
<----------125 words----><----------899 words----------><

The files on each Voyager 2 Neptune IRIS database tape were created on a VAX computer (made by Digital Equipment Corporation). To view the directory of any RDR tape using a VAX, do the following:

1. $ ALLOCATE [device] ('device' is a tape drive specification, e.g., MSA0:)

2. Physically mount the tape on the drive and put it on-line.
3. $ MOUNT/BLOCKSIZE=4096 [device] [volume label]
4. $ DIRECTORY [device]

The files on the database tapes are sequentially organized. You could simply copy them to disk using the VMS COPY command:

5. $ COPY [input-file-spec] [output-file-spec]

For example: $ COPY MSA0:NRDR2.DAT SYS$NEPTUNE:ENCNTR_NEAR.RDR

Note that the RDR files are large, so be sure you have enough disk space. The blocking factor for files on the RDR tapes compared to files on disk for a VAX system is 8:1 (4096 bytes:512 bytes), therefore, multiply the file size on tape by eight to see how much disk space will be required. The DIRECTORY/SIZE command enables you to check the size of the files on tape.

CREATING INDEXED FILES

A more preferable way of storing the files on disk is to create them using indexed organization. This allows you to rapidly access records by keying on the Flight Data System Count (FDSC) which is unique to each record. Word 75 at byte offset 297-300 in the header is the FDSC multiplied by 100 (e.g., 11390.16 = 1139016) and is used as the index, or primary key. To create indexed files on disk from sequential files on tape, mount the tape as in steps 1-3 above and then run the following example FORTRAN program:

```
      PROGRAM MAIN
      PARAMETER (NWORDS=1024)
      REAL REC(NWORDS)
      CHARACTER*80 INFNAME,OUTFNAME
      INFNAME = '[input-file-spec]'  ! e.g., MSA0:NRDR1.DAT
      OPEN(1,FILE=INFNAME,STATUS='OLD',READONLY,
     A    FORM='UNFORMATTED',BLOCKSIZE=4096)
      OUTFNAME = '[output-file-spec]'  ! e.g., SYS$NEPTUNE:ENCNTR_PRE.RDR
      OPEN(2,FILE=OUTFNAME,STATUS='NEW',FORM='UNFORMATTED',
     A    ACCESS='KEYED',RECORDTYPE='FIXED',RECL=NWORDS,
     B    ORGANIZATION='INDEXED',KEY=(297:300:INTEGER))
100   READ(1,END=999) REC
      WRITE(2) REC
      GO TO 100
999   END
```

When creating indexed files on disk from sequential files on tape, additional space beyond the 8:1 blocking factor is needed for the indexing structure. Here are the space requirements (in 512 byte blocks) for the three database files:

NRDR1.DAT;1	94431
NRDR2.DAT;1	76467
NRDR3.DAT;1	158952

If you're short on disk space, you could copy part of the files by selecting records based on FDSC. See below on how to extract the FDSC.

ACCESSING HEADER AND DATA INFORMATION

After the indexed RDR file is created on disk, you can access the header and radiance information from each record by using something similar to the following FORTRAN code:

```
      PROGRAM MAIN
      PARAMETER (NPTS = 899)
      CHARACTER*80 FNAME
      DOUBLE PRECISION FDSC1,WN(NPTS),WN1,DWN
      REAL*4 REC(1024),HEADER(125),RAD(NPTS)
      INTEGER*4 IFWORD(125)
      INTEGER*2 IHWORD(250)
      LOGICAL*1 BYTES(500)
      EQUIVALENCE (REC,HEADER,IFWORD,IHWORD,BYTES),
     A    (REC(126),RAD)
      FNAME = '[input-file-spec]'  ! e.g., SYS$NEPTUNE:ENCNTR_POST.RDR
      OPEN(1,FILE=FNAME,STATUS='OLD',
     A    ACCESS='KEYED',FORM='UNFORMATTED')
      FDSC1 = [starting FDSC]  ! e.g., 11487.28
      IFDSC = IDINT(FDSC1 * 100.0D0)
      READ(1,KEYGE=IFDSC) REC  ! reads first record by index
100   READ(1,END=999) REC      ! reads remaining records sequentially
      GO TO 100
999   END
```

Each field in the header can then be referenced by referring to Table D-1 and finding its corresponding offset within one of the appropriate arrays (HEADER, IFWORD, IHWORD, or BYTES) according to its type and length.

COMMONLY REFERENCED FIELDS

1. Wavenumber

Because only radiances are stored in the data portion of the record (i.e., there is no associated frequency), the corresponding wavenumber must be calculated. This can be accomplished with the help of two header fields:

Field #144 (bytes 477-480) Wavenumber at first data point
Field #145 (bytes 481-484) Wavenumber spacing between data points

Adding to the above FORTRAN code, you can build a wavenumber table:

```
      WN1 = DBLE(HEADER(120))
      DWN = DBLE(HEADER(121))
      DO 200 N=1,NPTS
200   WN(N) = WN1 + DFLOAT(N-1)*DWN
```

2. Flight Data System Count (FDSC)

The decimal FDSC for each record can be computed as follows:

```
DOUBLE PRECISION FDSC
FDSC = DFLOAT(IFWORD(5)*100 + IFWORD(6)) * 0.01D0
```

3. Q Points

The decimal latitudes and longitudes of all the Q points (IRIS field of view (FOV) descriptors) for both line counts 350 and 750 can be calculated as follows: The data are stored in the record as packed INTEGER*4 values in the format AAA^AABBB^BB where AAAAA is the latitude (-90.00 to +90.00) and BBBBB is the longitude (000.00 to 360.00). ^ represents the implied decimal point.

For example, the Q5 (FOV center) latitude and longitude for line count 350 is computed in this manner:

```
REAL*4 Q5LAT,Q5LON
Q5LAT = FLOAT(IFWORD(114)/100000) * 0.01
Q5LON = FLOAT(MOD(IABS(IFWORD(114)),100000)) * 0.01
```

READING THE DATABASE ON ANOTHER COMPUTER SYSTEM (OTHER THAN VAX)

Because the database tapes are written with ANSI standard labels, you should be able to read them using your machine's appropriate control statements. However, you will have to perform a bit conversion on the data in order to properly represent the header and data items in each record within the architecture of your particular machine.

For an IBM computer you should include the following Data Definition (DD) statement in your JCL to read the main database files on each tape:

```
//stepname.ddname DD UNIT=devicetype,DISP=OLD,LABEL=(7,AL,,IN),
// DCB=(RECFM=FB,LRECL=4096,BLKSIZE=4096,DEN=4),VOL=SER=volume label
```

The contents of an RDR record are described in Table D1. The column headings are:

Column 1:	Field Number	a consecutive numbering of field quantities for reference.
Column 2:	Byte Location	contains the relative byte number of each word in the header
Column 3:	Format	contains the FORTRAN descriptor for the format of each word, e.g., R*4 = floating point four byte variable.
Column 4:	FI-SEDR Word	contains the origin of the navigation data from the fixed instrument SEDR data. Note: None of these data were placed into the IRIS header.
Column 5:	SP-SEDR Word	contains the origin of the navigation data from the Scan Platform SEDR data. These words are referenced in Appendix E.
Column 6:	Description	a description of the field quantities.

The abbreviations used in Table D1:

HK = Housekeeping.

IFM = Interferogram

PB = Picture Body. The body (planet or satellite) that the IRIS instrument is pointing at at the time of observation.

CB = Central Body. The planetary body at the center of the planet-moon system (e.g., Jupiter, Saturn).

Q5 = Intercept point of center of IRIS field of view with surface of target body. If the instrument is pointed off the limb (emission angle greater than 90 degrees), the Q5 data "looks good", but in fact is not.

S/C = Spacecraft.

ASD = Angular Semi-Diameter. The angle subtended in degrees at the spacecraft by the radius of the disc of the observed body.

Neptune Coordinate System 3: A coordinate system of reference which rotates at the same rate as Neptune's magnetic field (16 hours, 11 minutes).

The arrangement of the IRIS field of view is illustrated in Appendix E.

Table D1. RDR Record Content

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
1	1-4	I*4			Tape Creation Date (Y MM DD) (Jupiter & Saturn Only)
2	5-6	I*2			Record Type: Always 3
3	7-8	I*2			Calibration File Serial # (Jupiter & Saturn Only)
4	9-10	I*2			Source EDR Tape # -N = Preliminary +N = Final
5	11-12	I*2			Source Fixed Instrument SEDR Tape # (Tape Not Merged) 0 = None -N = Predict +N = Actual
6	13-14	I*2			Source Footprint SEDR Tape # 0 = None -N = Predict +N = Actual
7	15-16	I*2			# of Records in Average - Always 1
8	17-20	I*4			Starting FDSC Mod 2^{16}
9	21-24	I*4			Starting FDSC Mod 60
10	25-28	I*4			Ending FDSC Mod 2^{16} (Always = Field 8)
11	29-32	I*4			Ending FDSC Mod 60 (Always = Field 9)
12	33-34	I*2			Spacecraft ID 1 = Voyager 1 2 = Voyager 2
13	35-36	I*2			Data Mode from EDR Header: (10 = GS3 etc.)
14	37-38	I*2			Playback Flag 0 = Real Time 1 = Playback
15	39-40	I*2			Earth Received Time: Year
16	41-42	I*2			Earth Received Time: Day
17	43-44	I*2			Earth Received Time: Hour
18	45-46	I*2			Earth Received Time: Minutes

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
19	47-48	I*2			Earth Received Time: Seconds
20	49-50	I*2			Data Source as in EDR (1 = Real Time etc.) (No Data Present)
21	51-52	I*2			Golay Encoded Flag 0 = No, 1 = Yes (No Data Present)
22	53-54	I*2			Phase Angle Serial # for Symmetrization
23	55-56	I*2			Spacecraft Event Time: Year
24	57-58	I*2			Spacecraft Event Time: Day
25	59-60	I*2			Spacecraft Event Time: Hour
26	61-62	I*2			Spacecraft Event Time: Minute
27	63-64	I*2			Spacecraft Event Time: Second
28	65-66	I*2			Scet Flag (Always 1) 0 = Input by NORT File 1 = Input by EDR Proc
29	67-68	I*2			DSN Configuration 8 Bits (Low Order) as in EDR
30	69-70	I*2			DSN Station # 8 Bits (Low Order) as in EDR
31	71-72	I*2			Estimated Bit Error Count from EDR
32	73-74	I*2			
33	75-76	I*2			DQSW Sums over 10 Groups for
34	77-78	I*2			Bits 4, 3, 1, 0 (see EDR DQSW)
35	79-80	I*2			
36	81-82	I*2			# of Minor Frames, Golay Corrected
37	83-84	I*2			# of Minor Frames Containing Missing Data
38	85-86	I*2			Reject Code: 0 = OK 1 = Too Many Spikes 2 = Missing Data 3 = Zero Peak 4 = No IFM Present 5 = Problem with Symmetrization
39	87-88	I*2			# of Spikes, Corrected
40	89-90	I*2			Golay Bit Error Summation from EDR
41	91-92	I*2			Radiometer Data Present 0 = No, 1 = Yes (No Data Present)

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
42	93-96	R*4			Integrated Radiometer from HK (Watts)
43	97-100	R*4			IR detector temperature
44	100-104	R*4			Radiometer temperature
45	105-108	R*4			Beam splitter temperature
46	109-112	R*4			Michelson motor temperature
47	113-116	R*4			Radiating surface temperature
48	117-120	R*4			Primary mirror center temperature
49	121-124	R*4			Primary mirror edge temperature
50	125-128	R*4			Secondary mirror temperature
51	129-132	R*4			Electronics box temperature
52	133	L*1			Lock 1st Group HK LHK1 and LHK2 Logical
53	134	L*1			Lock 2nd Group HK LHK3 and LHK4 Logical
54	135	L*1			Neon Delay Lock ND1 and ND2 or ND3 or ND4 Logical
55	136	L*1			Motor Position Lock Control (No data present)
56	137-140	R*4			
57	141-144	R*4			
58	145-148	R*4			
59	149-152	R*4			8 Radiometer Samples Normal Gain(Watts)
60	153-156	R*4			(-1 when radiometer < 0)
61	157-160	R*4			
62	161-164	R*4			
63	165-168	R*4			
64	169-172	R*4			
65	173-176	R*4			
66	177-180	R*4			
67	181-184	R*4			8 Radiometer Samples High Gain (Watts)
68	185-188	R*4			(-1 when radiometer < 0)
69	189-192	R*4			
70	193-196	R*4			
71	197-200	R*4			
72	201-204	R*4			Maximum of 8 Neon Samples (Volts) (No data present)
73	205-208	R*4			Maximum of 8 Neon Samples (Volts) (No data present)

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
74	209-212	R*4			Average Residual Square Difference of Phase (No data for Uranus)
75	213-216	R*4			Average 22 Micron Brightness Temperature (400-500 cm^{-1}) (Jupiter & Saturn Only)
76	217-220	R*4			Average 5 Micron Brightness Temperature (2000-2050 cm^{-1}) (Jupiter & Saturn Only)
77	221-224	R*4			Near IR Radiance (Voy. I - Not Used) (Voy. II Jupiter only: Integrated Radiance 3600-3800 cm^{-1})
78	225	L*1			
79	226	L*1			
80	227	L*1			HK Present 4 Groups
81	228	L*1			
82	229-230	I*2			Spare (not used)
83	231-232	I*2			
84	233-234	I*2			EDR Subheader Without Spares
85	235-236	I*2			
86	237-240	R*4			X
87	241-244	R*4			Y
88	245-248	R*4			Z Cartesian State of Spacecraft (No data present)
89	249-252	R*4			X
90	253-256	R*4			Y
91	257-260	R*4			Z
92	261-264	R*4			X
93	265-268	R*4			Y Cartesian State of Spacecraft (no data present)
94	269-272	R*4			Z CB Centered, CB Mean Orbit and Prime
95	273-276	R*4			X Meridian in Sun Direction
96	277-280	R*4			Y
97	281-284	R*4			Z
98	285-288	R*4	157		Latitude of Spacecraft (No data present)
99	289-292	R*4	158		Longitude of Spacecraft (System I) (No data present)
100	293-296	R*4	159		Longitude of Spacecraft (System III) (No data present)

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
101	297-300	I*4			Index (FDSC in integer form)
102	301-314	R*4			Spare
103	315-316	I*2			Deep space flag (1 = yes; record used in calibration. Neptune only)
104	317-320	I*4		2	CB Id. (-N when looking at rings)
105	321-324	R*4		36	Range CB -> Sun (km)
106	325-328	R*4	176	40	Range S/C -> CB (km)
107	329-332	R*4	184		Angle a CB - Sun - S/C (Deg) (No data present)
108	333-336	R*4	186		Angle a Sun - CB - S/C (Deg) (No data present)
109	337-340	I*4	239	14	Time Relative to Periapsis
110	341-344	I*4		2	PB ID (IF PB is CB, PB = 0)
111	345-348	R*4		37	Range, PB -> Sun
112	349-352	R*4		40	Range, S/C -> CB
113	353-356	R*4		41	Range, S/C -> PB
114	357-360	R*4		71	Range, S/C -> PB Tangency Point
115	361-364	R*4		42	S/C Altitude Above PB
116	365-368	R*4		43	PB Sub Solar Pt. Latitude
117	369-372	R*4		44	PB Sub Solar Pt. Longitude (For Jupiter, add 360 to negative values)
118	373-376	R*4		45	PB Sub-S/C Pt. Lat.
119	377-380	R*4		46	PB Sub-S/C Pt. Long. (For Jupiter, add 360 to negative values)
120	381-384	R*4		47	S/C Phase angle
121	385-388	R*4		48	PB ASD
122	389-392	R*4		70	Optic Axis (Negative values occur when FOV off CB)
123	393-396	R*4		74	Solar Zenith Angle for Q5 Point
124	397-400	R*4		75	Emission Angle for PB Q5 Point
125	401-404	R*4		76	Phase Angle for PB Q5 Point
126	405-408	R*4		77	Sun Azimuth Angle for PB Q5 Point
127	409-412	R*4		82	Local Time for PB Q5 Point (in degrees)
128	413-416	R*4			CB Lat. of PB (No data present)
129	417-420	R*4			CB Long. of PB (Jup. Sys. I) (No data present)

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
130	421-424	R*4			CB Long. of PB (Jup. Sys. III) (No data present)
131	425-428	R*4			X
132	429-432	R*4			Y Cartesian State of PB (No data present)
133	433-436	R*4			Z
134	437-440	I*4		145/146	Q1 Lat. & Long., System 3, for Line Count 350
135	441-444	I*4		147/148	Q2 Lat. & Long., System 3, for Line Count 350
136	445-448	I*4		149/150	Q3 Lat. & Long., System 3, for Line Count 350
137	449-452	I*4		151/152	Q4 Lat. & Long., System 3, for Line Count 350
138	453-456	I*4		72/73	Q5 Lat. & Long., System 3, for Line Count 350 The Q5 point is the center point for the IRIS field of view
139	457-460	I*4		153/154	Q6 Lat. & Long., System 3, for Line Count 350
140	461-464	I*4		155/156	Q7 Lat. & Long., System 3, for Line Count 350
141	465-468	I*4		157/158	Q8 Lat. & Long., System 3, for Line Count 350
142	469-472	I*4		159/160	Q9 Lat. & Long., System 3, for Line Count 350
143	473-476	R*4			Integrated Radiance Across Spectrum (175. to 2500 cm -1) (Jupiter & Saturn Only)
144	477-480	R*4			Wave # at First Data Point (Always 150.175 cm^{-1})
145	481-484	R*4			Wave # Spacing between Data Points
146	485-486	I*4			# of Data Points in Radiance array
147	487-488	I*2			Scan Platform in Motion Flag (Not Reliable)
148	489-492	I*4			Q5 Lat. & Long., System 3, for Line Count 750
149	493-496	R*4			Emission Angle for Line Count 750
150	497-500				Spare
151	501	R*4			Radiance Array ($W/cm^2/sr/cm^{-1}$) (Each radiance value is 4 bytes long)

B34514-0004
DLO=C
HCK=D

X-693-82-30

Voyager Infrared Interferometer Spectrometer and Radiometer (IRIS) - Documentation for Reduced Data Records (RDR) for the Saturnian System

R. A. Hanel, J. C. Pearl,
and L. A. Mayo

NOVEMBER 1982

NASA
National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

Voyager Infrared Interferometer Spectrometer and Radiometer (IRIS) - Documentation for Reduced Data Records (RDR) for the Saturnian System

September 1982

Goddard Space Flight Center
Greenbelt, MD 20771

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1. INTRODUCTION

On August 20 and September 5, 1977, the two Voyager spacecraft were launched from the Eastern Test Range. Voyager 1 passed Saturn on November 12, 1980 and Voyager 2 on August 26, 1981. Both spacecraft carried infrared instruments, known as IRIS, which contain a Michelson interferometer for the infrared (4-55 μm) and a single channel radiometer for the visible and near infrared (0.33-2 μm). Large numbers of spectra and radiometer data were recorded and are now available to the scientific community.

The purpose of this document is to provide the information necessary for use of the IRIS data in scientific investigations and to document the final calibrated infrared data contained in the reduced data records (RDR) of the IRIS data base. Included below are sections on the instrument, data processing and calibration, trajectory information, RDR tape format, and general information on the selection of spectra from the RDR magnetic tapes.

The magnetic tapes contain the calibrated thermal emission spectra, radiometer output, housekeeping data, and the navigation and pointing information. The tapes, called reduced data records (RDR), are available to the scientific community through the National Space Science Data Center, GSFC, Greenbelt, MD 20771. The 15 RDR tapes for Voyager 1 contain 54,681 records, and the 11 tapes for Voyager 2 contain 37,670 records.

For additional information or for further clarification, the appropriate contacts are:

Dr. R. A. Hanel, P.I.
Goddard Space Flight Center
Code 690
Greenbelt, MD 20771 301-344-8528

Mr. V. G. Kunde, Co.I.
Goddard Space Flight Center
Code 693
Greenbelt, MD 20771 301-344-5593

Dr. J. C. Pearl, Co.I.
Goddard Space Flight Center
Code 693
Greenbelt, MD 20771 301-344-5979

For specific programming and tape format assistance, the appropriate contact is:

Mr. L. A. Mayo
Goddard Space Flight Center
Greenbelt, MD 20771

301-344-8533

2. INSTRUMENT DESCRIPTION

The Voyager infrared investigation uses a Michelson interferometer with 4.3 cm^{-1} spectral resolution in the 180-2500 cm^{-1} (4-55 μm) range and a single-channel radiometer for the visible and near infrared, 5000-30000 cm^{-1} (.33-2 μm). Both devices share a Cassegrain telescope with a 50 cm diameter primary mirror and a 0.25° field of view. A description of the instrument has been published (Hanel, et al., Applied Optics, 19, 1391, 1980). Table 1 summarizes parameters of the Voyager IRIS.

The on-board calibration of the interferometer uses deep space, which is for this purpose considered a blackbody of zero degrees, and the internal instrument temperature (200°K) as reference points. The radiometer is calibrated by occasionally viewing a diffuser plate of known radiometric properties to reflect sunlight into the instrument. In addition to the instrument paper, a detailed description of the calibration concept of the interferometer and radiometer, including the spectral response of the radiometer and the diffusor plate, is contained in R. Hanel et al., JGR 86, 8705 (1981). Reprints of this paper and of the instrument paper are available on request. Other publications of interest are R. Hanel et al., Science 212, 192 (1981) and R. Hanel et al., Science 215, 544 (1982).

For reference the noise equivalent spectral radiance (NESR) (the radiance level yielding unity signal-to-noise for a single spectrum) on a linear scale is shown in Fig. 1 for Voyager 1 and in Fig. 2 for Voyager 2. The NESR on a logarithmic scale is shown in Figs. 3 and 4 for Voyagers 1 and 2, respectively.

3. DATA REDUCTION AND CALIBRATION

3.1 Interferometer

The reduction of the IRIS data was divided into two major steps. The first consisted of symmetrizing the interferograms to correct for the fact that they are not sampled at zero path difference and to remove the asymmetry due to residual dispersion in the beamsplitter and compensator. Deep space

Table 1. Parameters of the Voyager Infrared Instrument (IRIS) at Saturn

Spectral Range		
Interferometer		180-2000 cm^{-1} (5-55mm)
Radiometer		5000-30000 cm^{-1} (0.33-2mm)
Spectral resolution of interferometer (apodized)		4.3 cm^{-1}
Field of view		
Telescope		0.25° diameter
Interferometer		4.28° diameter
Aperture: (including obscuration)		
Telescope		2026 cm^2
Interferometer		8.56 cm^2
Noise equivalent spectral radiance	at 500 cm^{-1}	5 x 10^{-9} W cm^{-2} sr^{-1}/cm^{-1}
	at 2000 cm^{-1}	2 x 10^{-8} W cm^{-2} sr^{-1}/cm^{-1}
Operating temperature, optics		200 ± 0.5 K
Temperature stability		± 0.1 K/day
Interferogram time		45.6 sec
Mirror travel		0.158 cm
Mirror velocity		3.51 x 10^{-3} cm sec^{-1}
Reference wavelength		0.58525 mm
Data Band		1.26-14.04 Hz
Words per interferogram		3648
Data word rate		80 words sec^{-1}
Analog-to-digital converter		13 bits
Word length after digital filtering		14 bits
Data bit rate		1120 bits sec^{-1}
Weight		18.4 kg
Power dissipation (average)		14.0 W

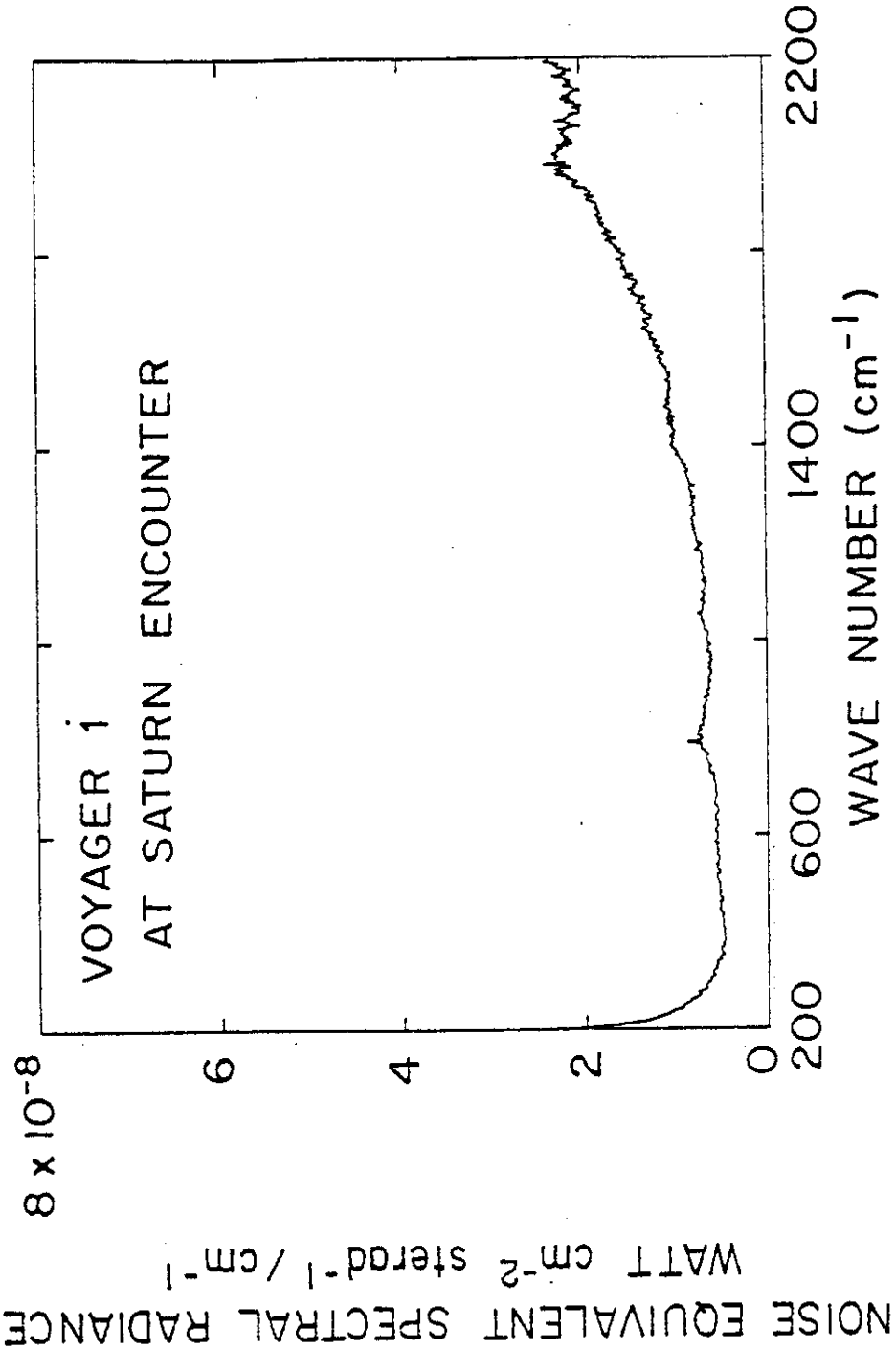


Figure 1. Noise Equivalent Spectral Radiance (NESR) of Voyager 1 versus wavenumber is computed for a single spectrum from a large number of deep space spectra recorded near Saturn.

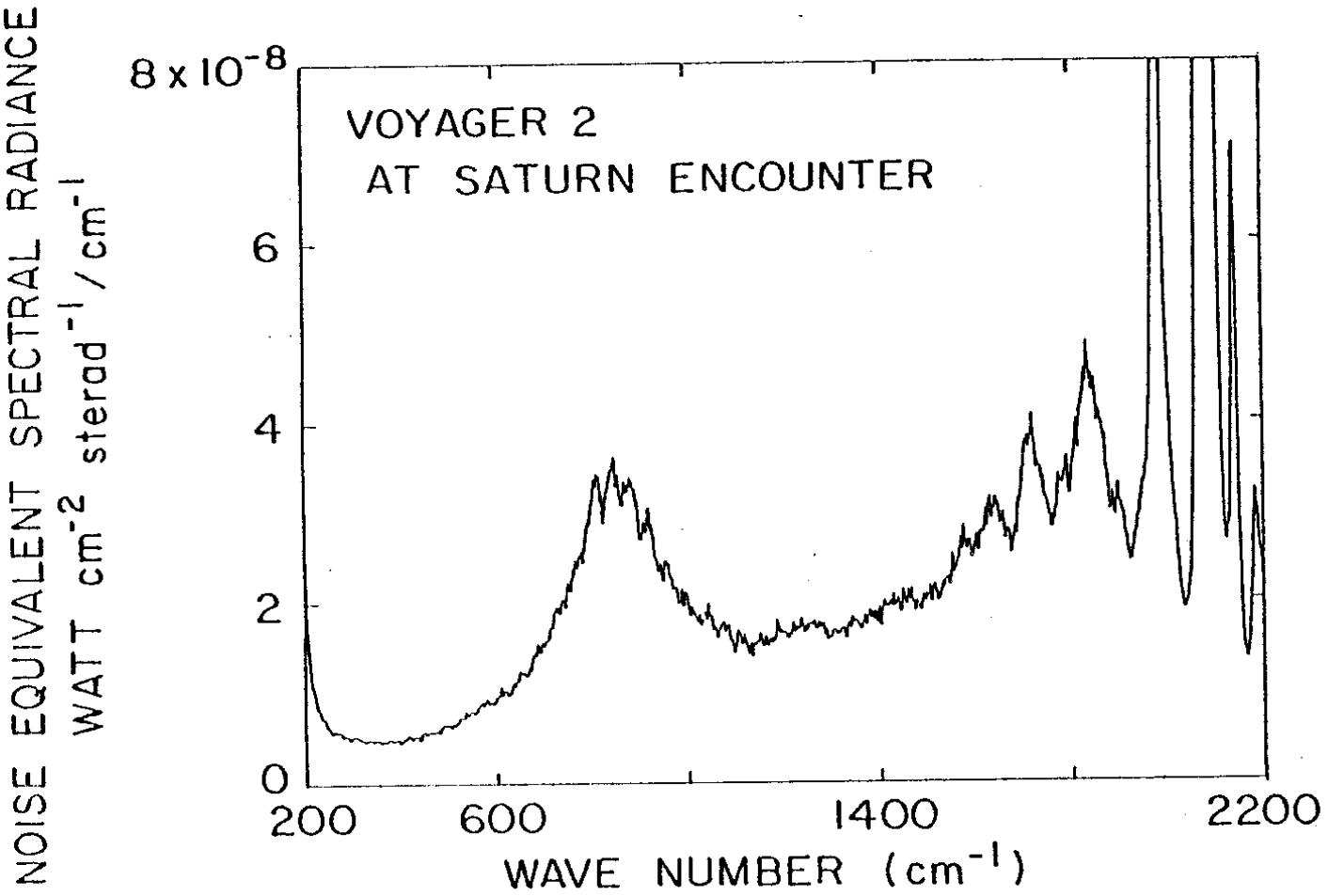


Figure 2. The same information as in Figure 1, however, computed for Voyager 2 IRIS.

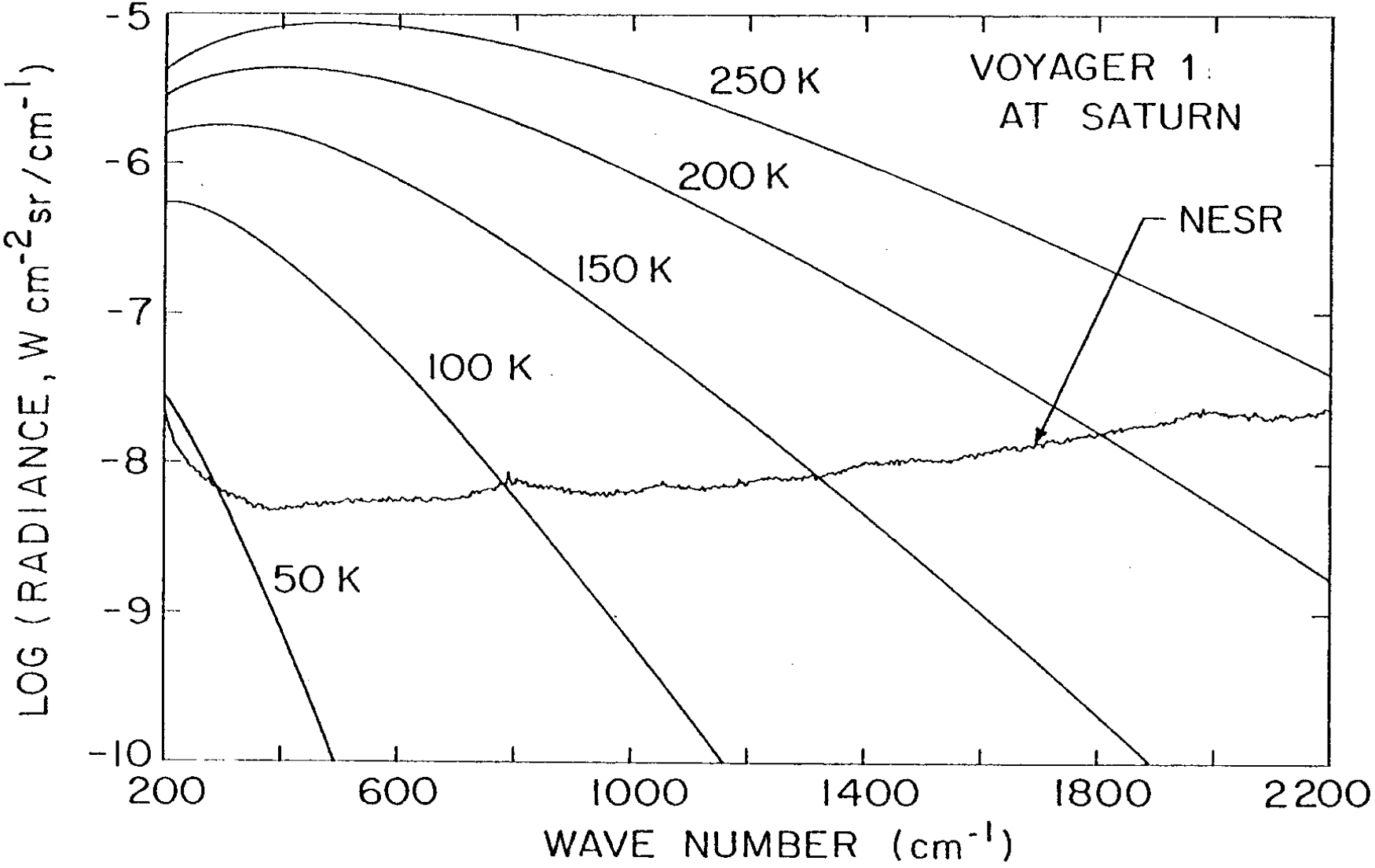


Figure 3. Noise Equivalent Spectral Radiance (NESR) of Voyager 1 on a logarithmic scale versus wavenumber. The spectral radiances of blackbodies at several temperatures are shown for comparison. Averaging of spectra reduces the NESR of the average spectrum by the square root of the number of spectra contained in the average.

calibration data were then selected from the symmetrized interferograms to calculate the spectral response. The second step consisted of apodizing and cosine-transforming the symmetrized interferograms, and calibrating them with the spectral response. The observed power spectrum C can be written as

$$C(n) = r(n)\ (B_i(n) - B_T(n))$$

where n is wavenumber, r is the spectral response, B_i is the instrument radiance at the instrument temperature (200K) and B_T is the target radiance. While observing deep space, the instrument emission B_i corresponds to a blackbody of 200K since all elements of the instrument are carefully controlled at this temperature.

The overall goal of the calibration effort was to minimize systematic errors so that many spectra can be averaged. To achieve this, the phase angles used to symmetrize each interferogram must be reasonably accurate even through regions of the spectrum where the signal to noise ratio in an individual spectrum is too low to obtain a reliable value. This is necessary in order to recover the proper signal amplitude even under low signal-to-noise conditions. This problem was solved by using a reference phase angle spectrum obtained by averaging the complex power spectra. The individual interferograms were then symmetrized using this reference phase angle spectrum after adjusting it to allow for differences in sampling between the individual and the reference phase spectrum. This difference in phase angle is linear, and was determined by a least squares fit to the phase difference at low frequencies.

A second requirement for reducing systematic errors was to derive an accurate spectral amplitude response. Since the instrument radiance at 200K enters the calibration as a large background signal, a very small change in the spectral response will yield systematic errors in the calibration proportional to blackbody radiation at 200K. Figs. 3 and 4 are radiance plots with the Voyager 1 and 2 NESR superimposed, respectively. To reduce the systematic calibration errors to the level of the NESR, the spectral response must be stable to .1% at 400 cm^{-1}. If it is not stable to this value, it should be updated frequently enough to minimize this potential systematic

error. Furthermore, Figs. 3 and 4 show that the deep space calibration will not allow calibration past about 1500 cm^{-1}.

A means of estimating the daily response changes at high wavenumbers was required. The ratio of the response for two different time periods was examined. For Voyager 1 the ratio is proportional to (sin (An))/An as expected for a change in optical alignment. Smoothing of the numerator and denominator could also be used to increase the signal to noise ratio. A high quality spectral response could therefore be adjusted to a different time period by scaling the response by the smooth ratio with the ratio extrapolated by the sin (An)/An fit. The average response functions for Voyager 1 and 2 are shown in Figs. 5 and 6, respectively.

Calibrations for the daily response changes consisted of first averaging all calibration data to obtain a spectral response below 1500 cm^{-1}. This response spectrum was adjusted by the smooth ratio technique to match the response at the time of the target plate calibration. Each daily calibration average was then used to scale the master response by using the smooth ratio with a (sin (An))/An extrapolation of the ratio above 1300 cm^{-1}. Each daily response was assigned a time value corresponding to the average time of all the individual spectra in the response calculation. Individual spectra were then calibrated using a linear interpolation within the time dependent spectral response.

The above method was quite successful except during observations where the sun angle on the instrument changed significantly. With the sun illuminating the primary mirror the heat distribution changes. The heater controllers make the necessary adjustments with only a slight ($.1^{\circ}$ or $.2^{\circ}$) change in temperature. The effect on the instrument is a change in the power spectrum that is much larger than that due to the temperature change above. The change corresponds to about a 1% change in the spectral response. The time periods containing these changes occur at "SUNCAL's" when the sun is 20° off axis and at the various encounters where the scan platform slews to many angles to view Saturn and its satellites. At encounter the response was updated more frequently to remove some of these errors. The time constant for

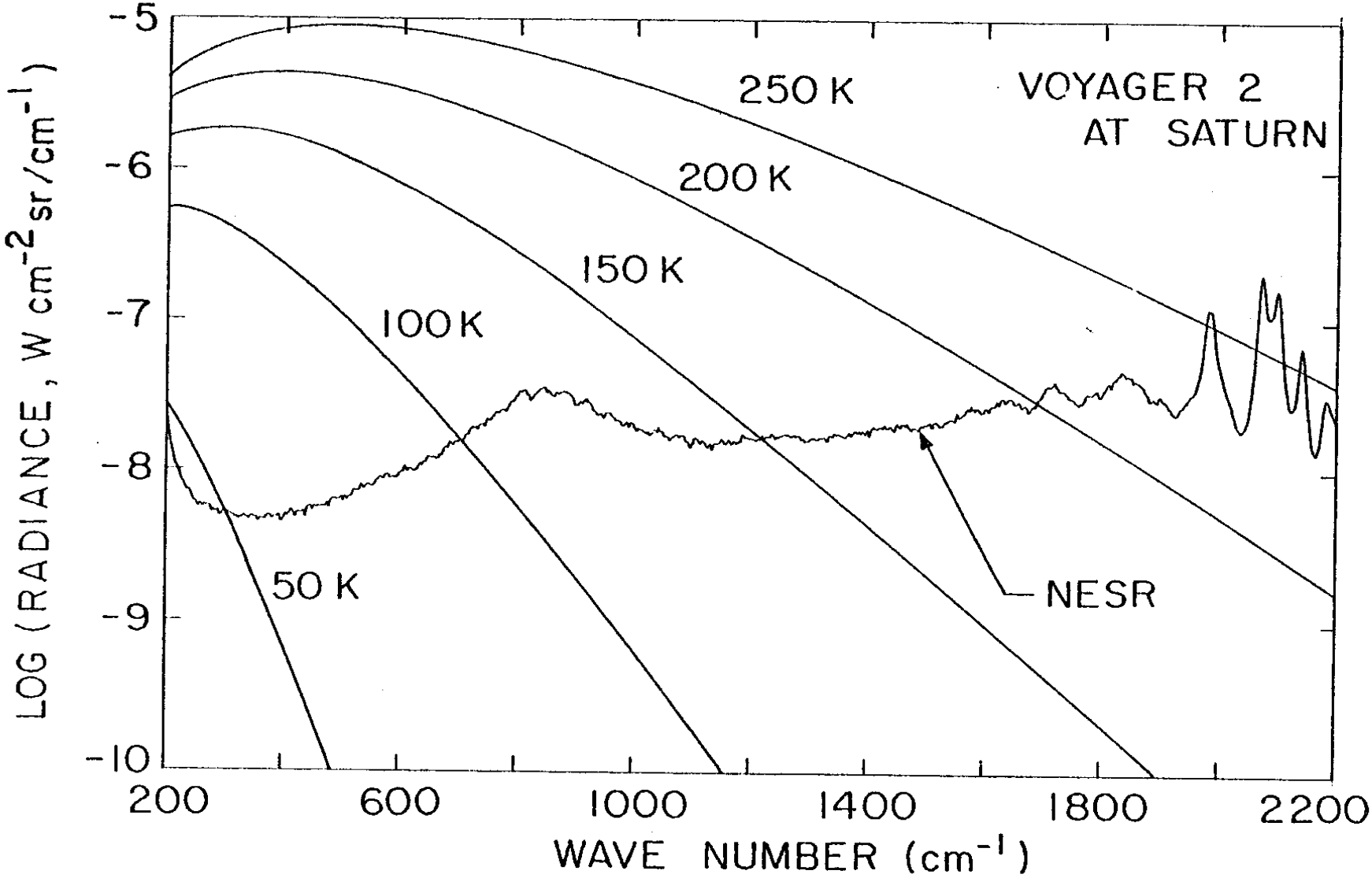


Figure 4. The same information as in Figure 3, however, computed for Voyager 2 IRIS.

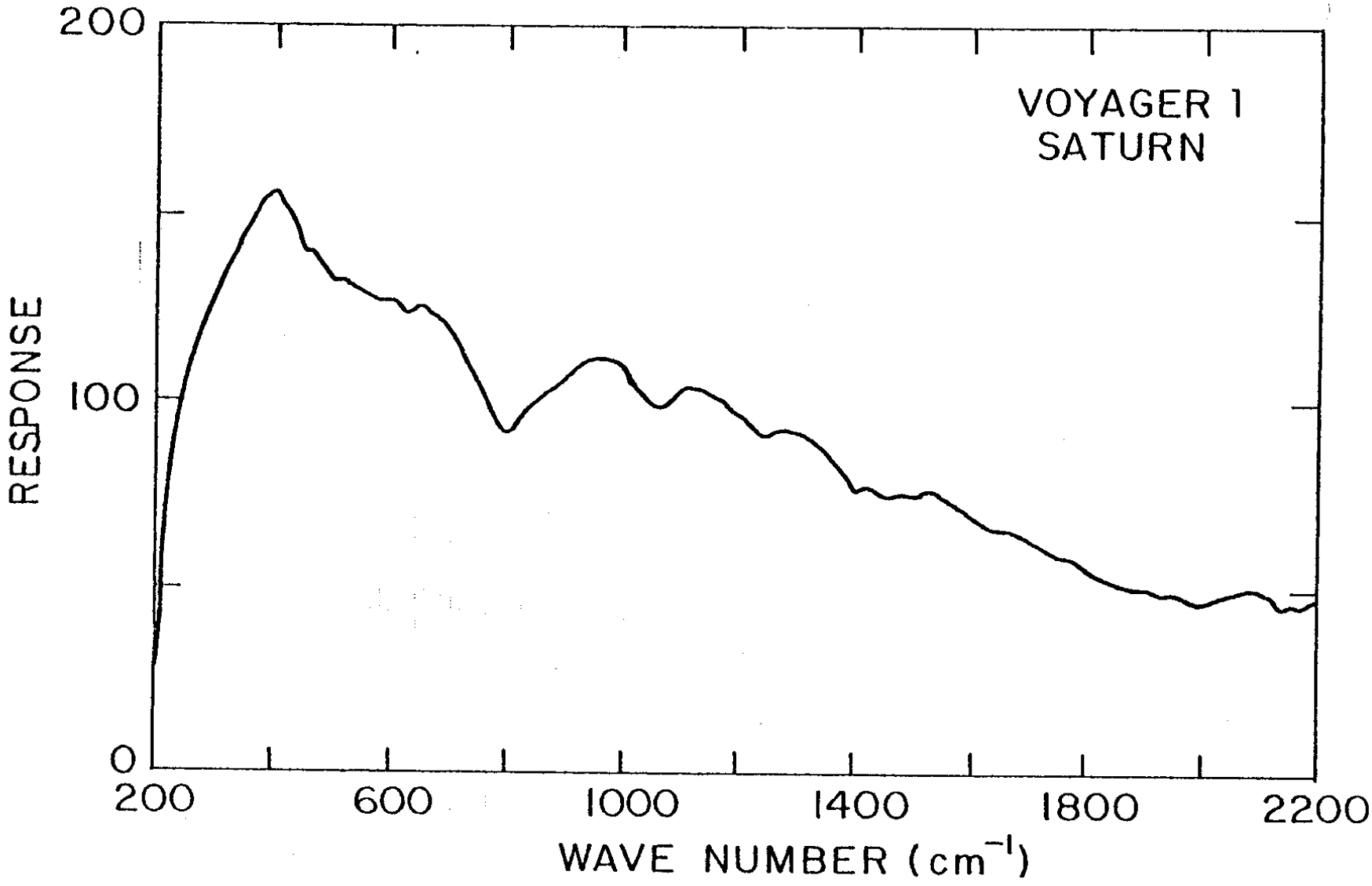


Figure 5. Spectral response of Voyager 1 IRIS versus wavenumber.

recovery from the change in sun angle is on the order of an hour. Errors will exist during and after SUNCAL's.

For the user, the best check on calibration is to select deep space spectra near the desired observation if they exist. If systematic errors are present during this time, they will appear in the calibrated deep space spectra as a small wavenumber dependent offset to be subtracted from the desired spectra. Such offsets have been found to be very slowly varying functions of wavenumber. Thus, a low order smoothing function (of no higher order than ν^2) can be fitted to the data before subtraction to prevent introduction of extraneous noise into the corrected spectra.

Voyager 2 calibration progressed in a similar manner except the response ratio could not be extrapolated in the same manner as Voyager 1. Voyager 2 has a misalignment component with a null near 800 cm^{-1}. As the misalignment increases the null moves to lower wavenumbers. This produces an "S" shape in the response ratios. The ratio above about 1600 cm^{-1} appears to be relatively constant. As seen in Fig. 6 the Voyager 2 instrument contained channel spectra. This limited the amount of smoothing used in the response ratio. It was assumed that the channel spectra were entirely in the spectral response. This assumption is good to first order, but low order components at higher wavenumbers will become significant relative to the signal strengths above 1500 cm^{-1}.

The sun angle calibration problem was corrected in a few critical time periods by using correction factors related to the change in the secondary mirror temperature. This temperature was found to have the best correlation with the observed change in response. (The primary mirror temperature was also used as a guide, though it has a relatively long thermal time constant.)

Some interferometer data have been lost due to the effect of slews. A slew on or off a warm target will cause a significant change in the IR signal and cause a hump in the interferogram. If this hump is too large it will be interpreted during processing as many data errors, and the interferogram will be rejected. Broad, low level "humps" will have only low frequency components which lie outside the spectral bandwidth, and are therefore generally no problem.

3.2 Radiometer

Three sets of radiometer data are available with each IRIS frame: mean intensity integrated over the 45 second duration of the interferogram; and normal and high (X8) gain samples, taken every 6 seconds throughout the frame. The radiometer system has a time constant of ~3 seconds; sample #3 is taken about 2 seconds after the interferogram peak; sample #7 is taken about 3 seconds after closure of the imaging system (ISS) shutter. Various IRIS and ISS events are summarized in terms of the imaging frame linecount in Table 2.

Table 2. IRIS and ISS Events

Event	ISS linecount
ISS frame start	0
IRIS frame start	167
IRIS interferogram start	179
IRIS radiometer samples	217, 317, ... 717, and 017, 117 of following frame
IRIS pointing information #1	350
IRIS interferogram peak	375 ± 5
IRIS pointing information #2	750
ISS shutter close	767
ISS frame end	800 (48 seconds)

The radiometer data contained in the Reduced Data Records (RDRs) are only partially calibrated. The integrated radiometer and the 8 sample high and normal gain radiometer data are all presented in the data records as watts at the detector. This allows for detector response, electrical gains, and the difference between the sampled radiometer and the integrated value. A steady signal will yield identical watts at the detector in the 8 sample high and normal gain values and the integrated value within the resolution of each measurement, assuming the high gain channel does not saturate. The total transmission function of the optical elements in front of the radiometers together with some spectral knowledge of the observed signal within this

bandwidth is necessary for further calibrations. The integrated radiometer offers the best resolution without saturation but requires that the target remain stable in the field of view for an entire frame. The paper "Albedo, Internal Heat, and Energy Balance of Jupiter" by R. Hanel, et al., JGR, 86 8705 (1981) contains a detailed description of the radiometer calibration.

4. TRAJECTORY OVERVIEW AND MISSION PHASES

The Voyager 1 (JST) and Voyager 2 (JSX) missions have been overviewed by Kohlhase and Penzo (Sp. Sci. Rev., 21, 77, 1977). Characteristics of the JST and JSX trajectories are shown in Figs. 7 through 10. A time vs. range summary is given in Appendix A.

Each Voyager flight between Earth and Saturn was divided into phases. Further definition of these phases may be found in the VOYAGER 1 AND 2 SATURN SCIENCE LINK DICTIONARY INDEX (JPL Voyager-IOM-JD-80-5, Voyager IOM, 81-13, JPL, Pasadena, CA).

The sequences of scientific observations for each Voyager experiment for each phase were carried out through a series of well-defined science links. The science links for IRIS are also defined in the VOYAGER 1 AND 2 SATURN SCIENCE LINK DICTIONARY INDEX. The IRIS links and their time periods are summarized in Appendix B.

5. REDUCED DATA RECORD (RDR) TAPE GENERATION

5.1 Data Processing Procedure

The IRIS information was received from JPL in the form of three types of magnetic tapes:

(1) Experimenter Data Record (EDR) tapes containing the raw telemetry and engineering data,

(2) Fixed Instrument Supplementary Experimenter Data Record (FI-SEDR) tapes containing spacecraft navigation data, and

Table 3 Saturn satellite data.

Satellite	Diameter (km)	Distance (km)	Distance (R_S)*	Period (hours)	Closest approach (km)	
					Voyager 1	Voyager 2
1980S28	30†	137,300†	2.276†	14.446†	219,000	287,000
1980S27	220†	139,400†	2.310†	14.712†	300,000	247,000
1980S26	200†	141,700†	2.349†	15.085†	270,000	107,000
1980S3	90 × 40†	151,422†	2.510†	16.664†	121,000	147,000
1980S1	100 × 90†	151,472†	2.511†	16.672†	297,000	223,000
Mimas	390†	188,224	3.120	23.139	88,440	309,990
Enceladus	500†	240,192	3.981	33.356	202,040	87,140
Tethys	1,050†	296,563	4.916	45.762	415,670	93,000
1980S6	~160	378,600†	6.275†	65.738†	230,000	270,000
Dione	1,120†	379,074	6.283	66.133	161,520	502,250
Rhea	1,530†	527,828	8.749	108.660	73,980	645,280
Titan	5,140†	1,221,432	20.246	382.504	6,490	665,960
Hyperion	290†	1,502,275	24.901	521.743	880,440	470,840
Iapetus	1,440†	3,559,400	58.999	1901.820	2,470,000	909,070
Phoebe	~160	10,583,200	175.422	9755.679	13,537,000	1,473,000

*Here 1 R_S is defined as 60,330 km (37,490 miles). †From Voyager 1 data in this issue; distances and periods are for 1 October 1980. The remaining entries were provided by the Voyager navigation team.

E. C. Stone, E. D. Miner, Science Vol. 212, 10 April 1981

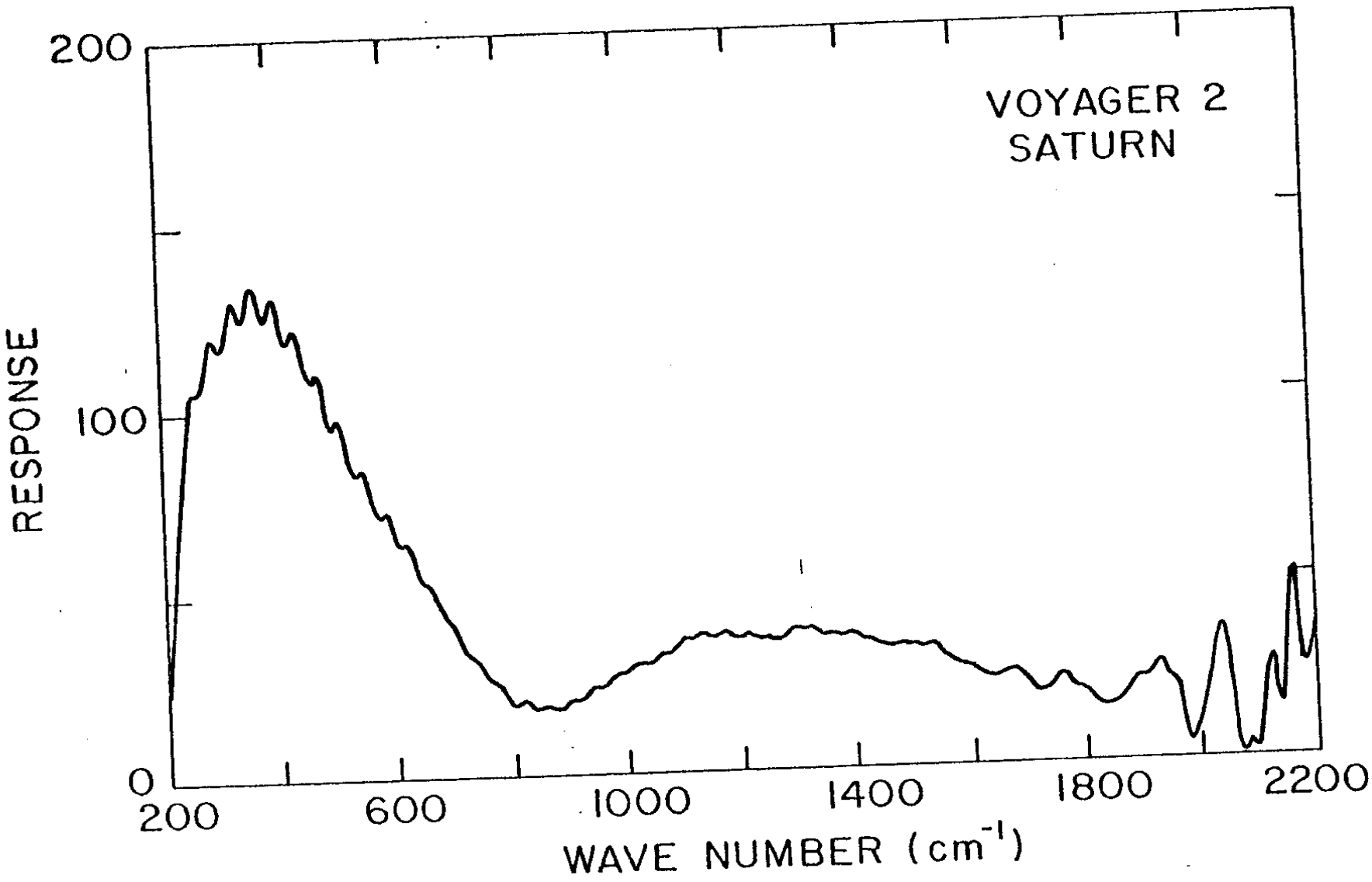


Figure 6. Spectral response of Voyager 2 IRIS versus wavenumber. The "channel spectrum" is due to insufficient tilt between the beamsplitter substrate and the compensating plate.

VOYAGER 1 ENCOUNTER WITH SATURNIAN SYSTEM

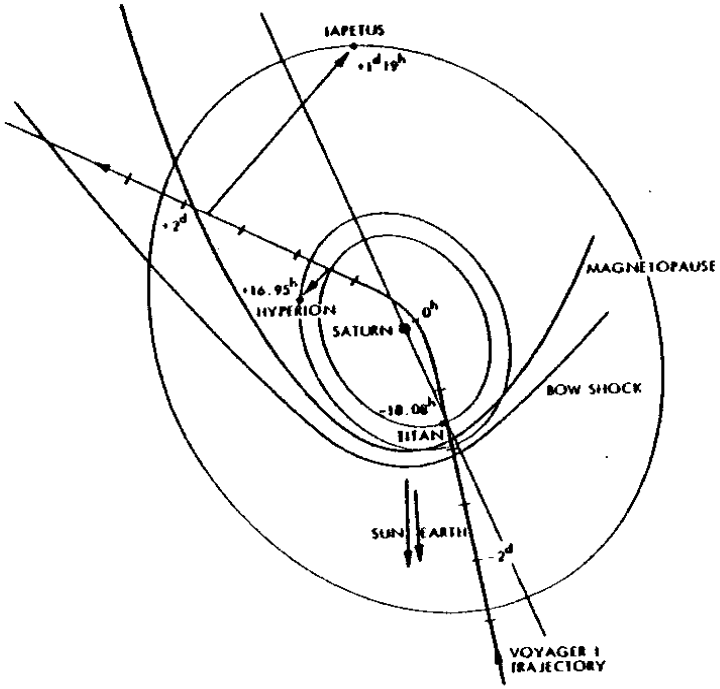


FIGURE 7

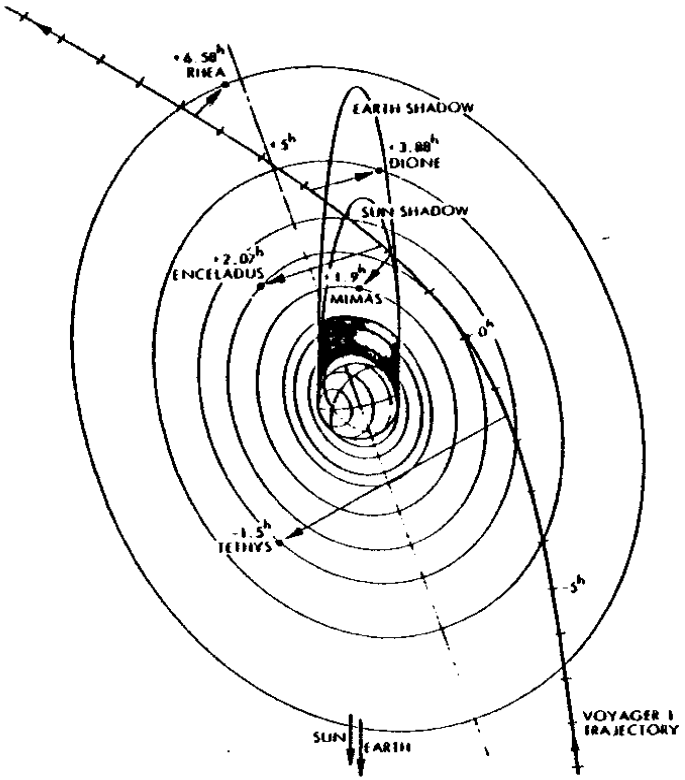


FIGURE 8

E. C. Stone, E. D. Miner, Science Vol. 212, 10 April 1981

(3) Scan Platform Supplementary Experimenter Data Record (SP-SEDR) tapes containing instrument pointing data.

The procedure used to process each EDR tape is illustrated in Fig. 11. The details for the symmetrization of the interferogram (IFM), the Fourier transformation, and the calibration for each record are contained in Section 3. The details of the merging procedure are described in Section 5.2.

Each IRIS RDR tape contains IRIS records in ascending FDSC order (the FDSC is the Flight Data System Count). The "decimal" portion of each count is modulo 60; except for occasional resets, there are exactly seventy-five decimal counts per hour. Appendix C contains the RDR tape summary by FDSC. Appendix D contains a detailed description of the physical tape format and the word content of each RDR. Example FORTRAN programs are included to illustrate the way in which specific data elements can be accessed or calculated.

5.2 Merge Procedure

After the EDR tapes have been processed into Calibrated Spectra Record (CSR) tapes, it is necessary to merge the navigation/pointing data into the header of each CSR to produce the Reduced Data Records (RDR's). Fig. 12 illustrates this merge procedure. (The term SEDR is used to mean both FI-SEDR and SP-SEDR, since the procedure is identical in both cases.)

The SEDR tapes were generated by JPL at either 48 second (one per observation) or 24 second (two per observation) intervals. The 48 second SEDR's correspond to imaging experiment readout line-count 350 (near the peak of the IFM). The 24 second SEDR's correspond to line-counts 350 and 750 (one second before shuttering of the Voyager cameras). In cases where 24 second SEDRs are available, it is possible to estimate the displacement of the field of view during an IRIS frame. Such displacements arise from spacecraft motion and, occasionally, from slews. This motion can be determined from the differences between the Q5 (center of field-of-view) latitude/longitude values and/or the emission angle values of the two SEDR records for the frame; these data are included in the header record (see Table 2). Where only 48 second SEDR data are available the linecount 750 values are set equal to the values at linecount 350.

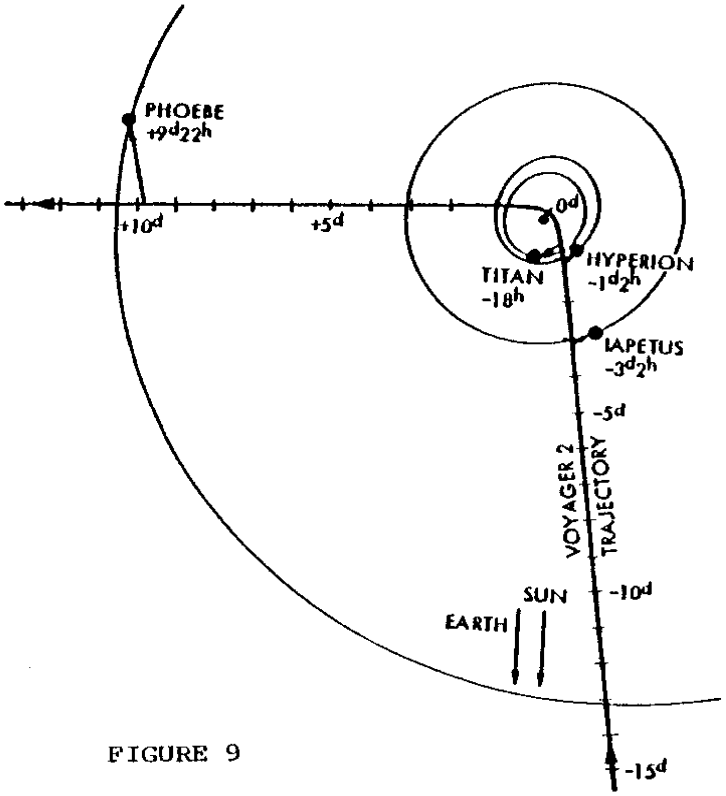


FIGURE 9

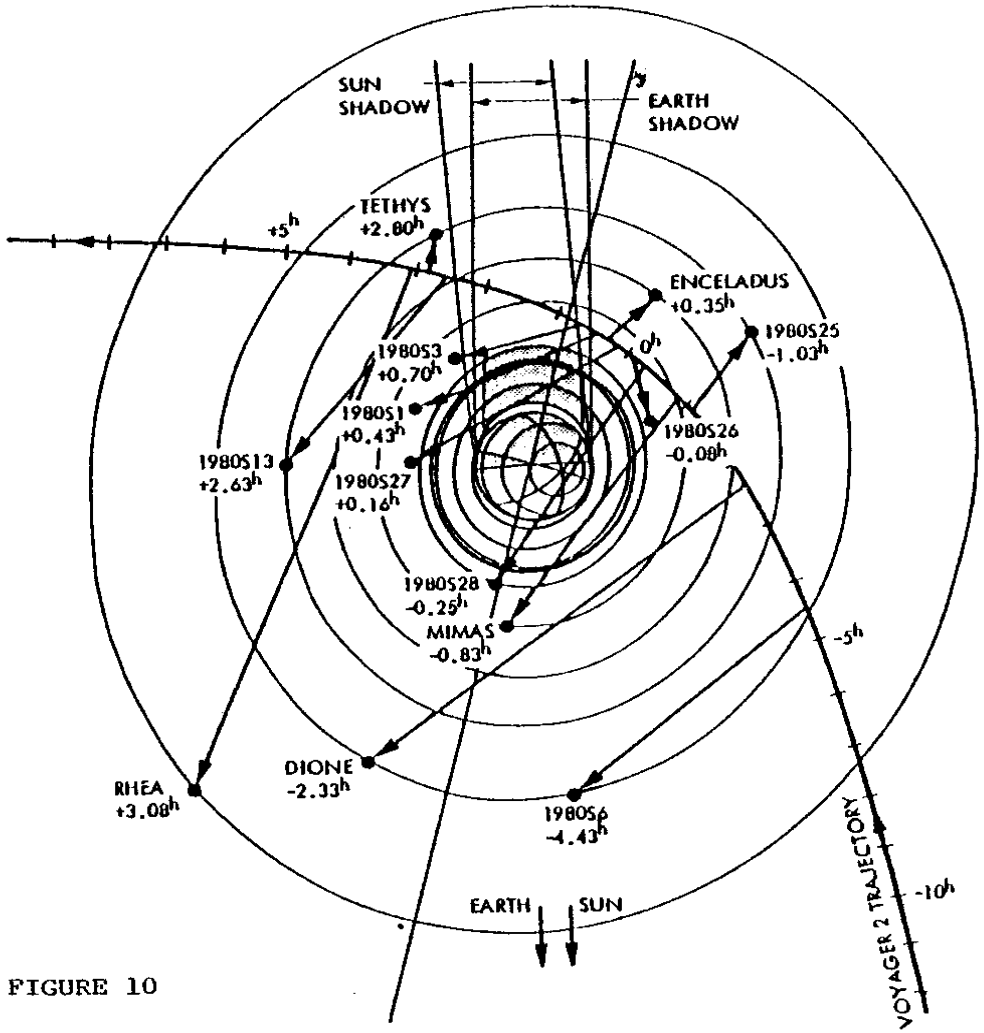


FIGURE 10

Fig. 9(left). Voyager 2 path through the Saturn system shown in the plane of the spacecraft trajectory. The projected orbits of Phoebe, Iapetus, Hyperion, and Titan are shown along with the positions of these satellites at the times (labeled) when Voyager 2 was closest to them. Time ticks along the trajectory mark Voyager's position at 1-day intervals. Fig. 10(right). Voyager 2 path through the orbits of the inner satellites of Saturn. The orbits of Mimas through Rhea are shown projected into the plane of the spacecraft trajectory. Positions of all of the satellites are shown at the times (labeled) when Voyager 2 was closest to them. The limits in the plane of the spacecraft trajectory of the sun and Earth "shadows" are shown. Time ticks mark Voyager's position at 1-hour intervals.

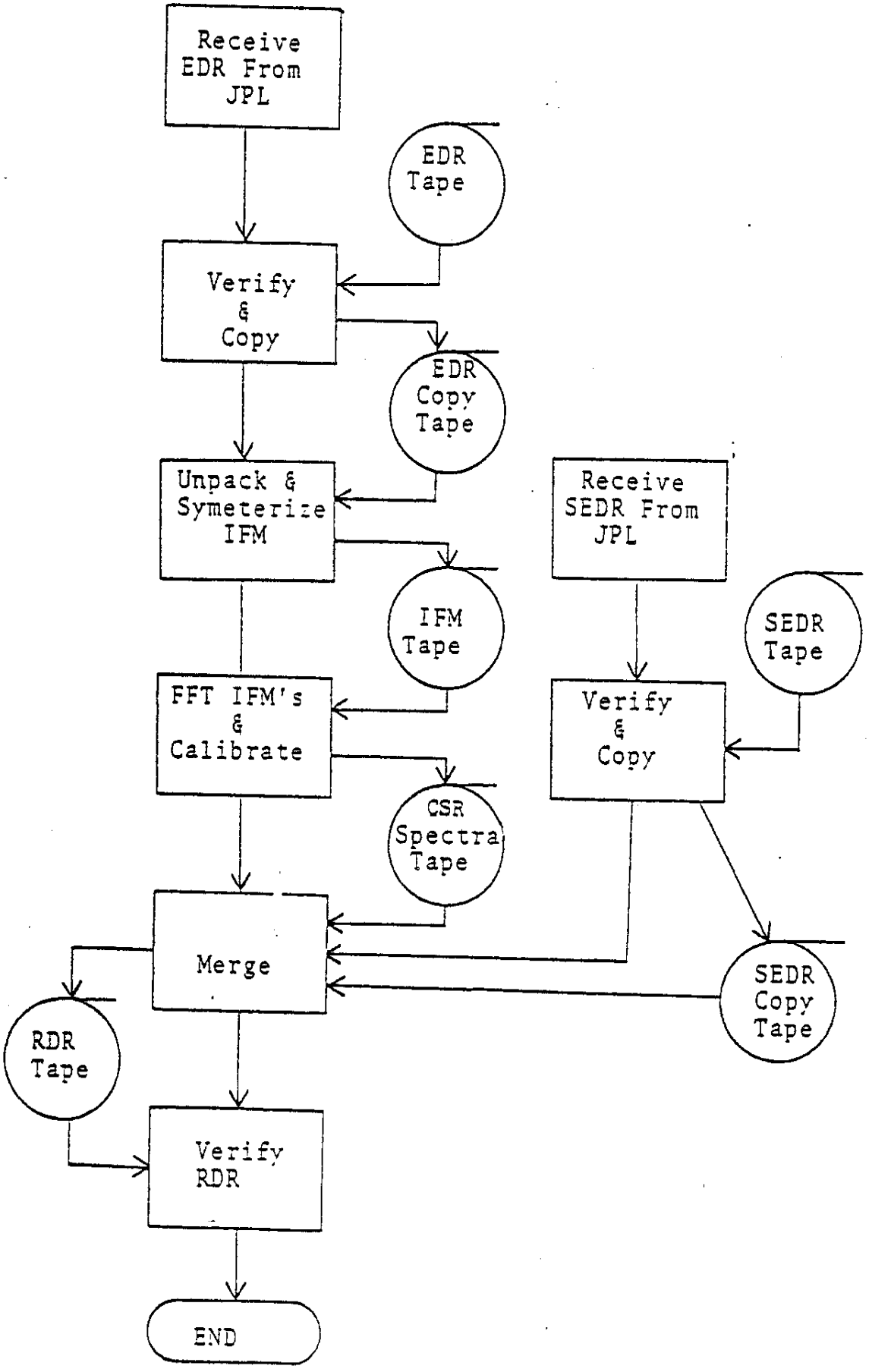


Figure 11. IRIS Data Processing Procedure Flow-Chart.

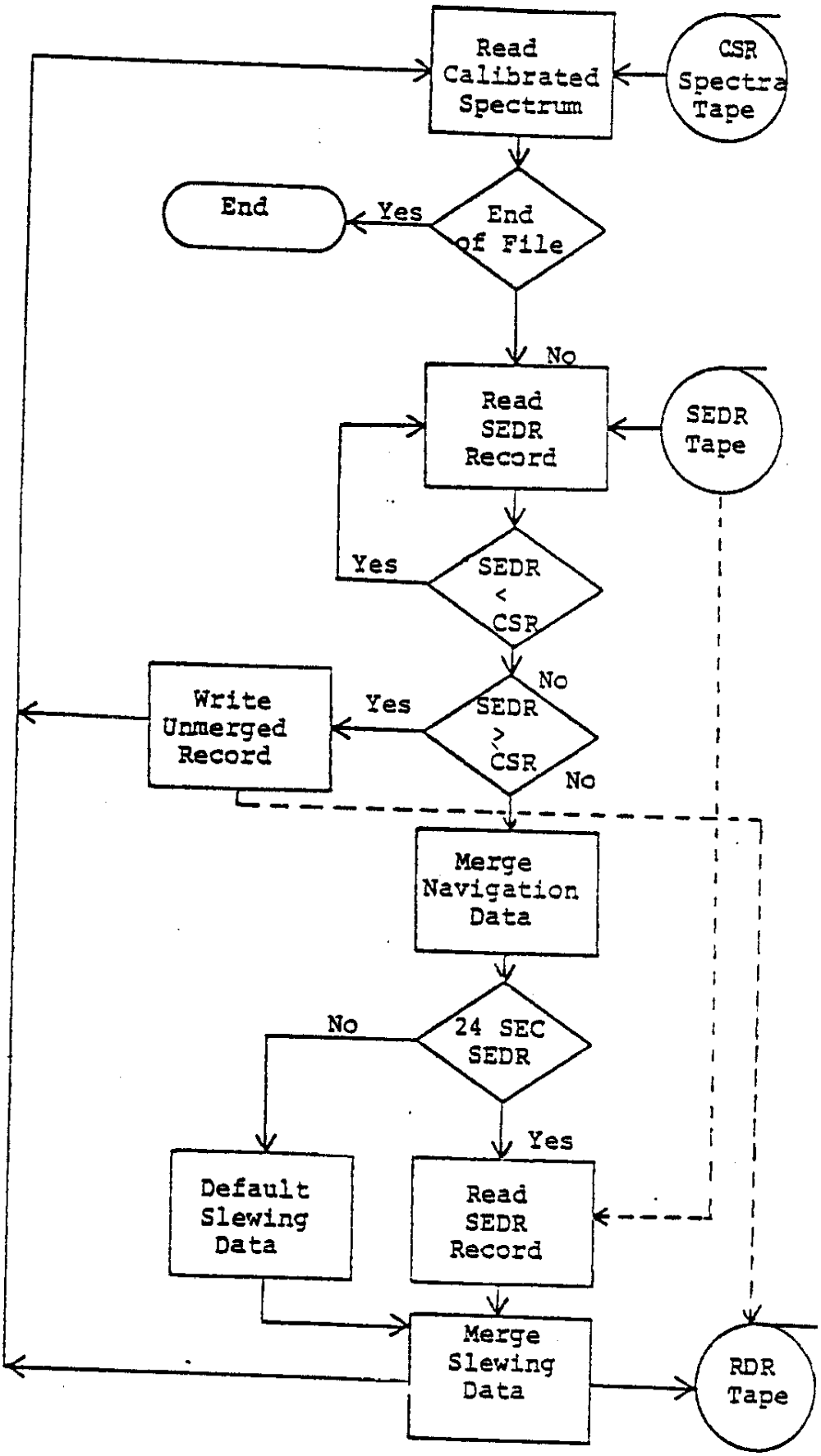


Figure 12. IRIS Merge Procedure Flow-Chart.

6. GENERAL INFORMATION FOR DATA USERS

6.1 Key IRIS RDR Field #'s

For the convenience of the user, some of the IRIS RDR fields most often used are summarized in Table 2. The Q5 point is at the center of the 0.25° (diameter) circular IRIS field of view (FOV).

Table 4. Key IRIS RDR Field #'s

	RDR Field #	Bytes	Format	Description
	8	17-20	I*4	FDSC MOD 2^{16}
	9	21-24	I*4	FDSC MOD 2^{60}
	38	85-86	I*2	Interferometer data quality code
	43	97-100	R*4	Instrument temperature (K)
	74	209-212	R*4	Phase angle quality
	107	341-344	I*4	PB* identification
	110	353-356	R*4	Range, S/C to PB
	120	393-396	R*4	Solar elevation angle for PB Q5 point
linecount 350 (ifm peak)	121	397-400	R*4	Emission angle for PB Q5 point
	124	409-412	R*4	Local time for PB Q5 point
or	135	453-456	I*4	**Magnetic field oriented latitude and longitude for PB Q5 point.
linecount 750 (ISS shutter close)	145	489-492	R*4	Emission angle for PB Q5 point
	146	493-496	I*4	**Magnetic field oriented latitude and longitude for PB Q5 point
	2916	11537-11540	R*4	Ring Q5 point radius from center of Saturn (km)
	2917	11541-11544	R*4	Ring Q5 point local hour angle (deg)

The complete description of the RDR words is given in Appendix D. Examples of program coding for identifying some individual RDR field quantities are also given in Appendix D.

*PB = picture body

**M.D. Desch, M. L. Kaiser, GRL, 8, No. 3, pp 253-256, March 1981.

6.2 Data Quality Criteria

Several levels of quality indicators should be considered before acceptance of an RDR for data analysis:

a) interferometer data quality - RDR field #38 is coded as follows, depending on the quality of the interferogram;

0 = good

1 = too many spikes in IFM

2 = missing data in IFM

3 = zero peak in IFM

4 = no IFM data, but radiometer data are available

Only Code 0 indicates that the interferogram is useable.

b) smear - During non-IRIS science links the scan platform may slew considerably during an IRIS 48 second frame. This slewing can be detected by noting differences in the latitude/longitude of the Q5 points (center of the field-of-view) and the emission angles, at line counts 350 and 750 (see Table 2), or by variations in the sampled radiometer values during a frame. The 24 second pointing information is available for days 214-321 for Voyager I and for days 234-240 for Voyager II. In most cases (see section 5.2), this information is stored in the header portion of each RDR.

When selecting data for spectral analysis, care should be taken to insure that observations with pronounced smear are not included. However, since the total infrared energy and very low resolution spectral data are recorded in a brief time surrounding the interferogram peak, even when smear occurs, this information can be associated with the pointing information at the 24 second point, as can radiometer sample #3.

c) phase angle fit - RDR field #74, the average residual square difference of the phase angle fit, should always be checked. A high value indicates a poor fit which is probably caused by a bad data value near the central peak of the interferogram. For Voyager 1 this value should be less than 10^{-4}, and for Voyager 2 it should be less than 10^{-3}.

d) Instrument temperature - RDR field #43, the instrument temperature, should be checked. This temperature should be within .1 or .2° of 200K. If it is not the spectrum can be corrected by:

$$I' = I - B(T_i) + B(200.)$$

where I' is the corrected target radiance, I is the listed target radiance found in RDR field numbers 149-2907, $B(T_i)$ is the Planck function at the temperature found in RDR item 43, and B(200) is the Planck function at 200K.

6.3 Pointing Accuracy and Precision

The pointing information provided by JPL in the SEDRs is derived from knowledge of the spacecraft position (determined from trajectory analysis), the spacecraft orientation (as indicated by sun and star sensor data and by displacements within the limit cycle), and the articulation of the scan platform on which the instruments are mounted; when inadequate data are available (due to transmission loss, for example) predicted values for pointing information are used. The quoted 3σ pointing uncertainty is 0.15° (to be compared with the 0.125° radius of the IRIS FOV). On occasion, greater accuracy than this may be required, e.g., determining whether a feature comparable in size to the IRIS footprint lies within the IRIS FOV. In such cases, it is best to refer directly to images obtained simultaneously with the IRIS data, using the pointing changes between the 24 second SEDR values to correct for spatial drift between the times of interferogram peaks and the shuttering of the images.*

The pointing data are evaluated for the IRIS field of view, which is slightly offset from the center of the ISS frames. Relative to the center of the narrow angle frame, the IRIS Q5 point offsets are as follows. Voyager 1:

---

*Images are not read out during the frames in which they are shuttered. When a single image is made during a frame, its assigned FDSC is one "decimal" count (module 60) greater than the FDSC of that frame. When both cameras are shuttered simultaneously (in the imaging modes BOTSIM and BSIMAN), the narrow angle image of the pair is read out first (with FDSC augmented by 0.01), and the wide angle image is read out second (with FDSC augmented by 0.02). IRIS FDSCs are not augmented.

+0.020° elevation (37 pixels to the right), +0.024° azimuth (45 lines down); Voyager 2: +0.016° elevation (30 pixels to the right), -0.009° azimuth (17 lines up).

Several sets of observations have been investigated to provide a check of the quoted pointing uncertainty. The intersection point (Q5) of the IRIS optic axis with various bodies was determined independently of the SEDRs by using images. For Saturn (Table 5) a projected view of the planet was calculated and matched to an image in which enough of the limb was visible to provide a reference. The latitude was estimated by the position of the center of the image on the projected view. The emission angle was then calculated using the latitude and the distance of the center of the picture from the central meridian of the projection. A control net of surface features (M. E. Davies, private communication) was used in determining pointing positions on Rhea (Table 6). The resulting absolute pointing error is estimated to be about 0.01°, or slightly less than 10% of the angular radius of the IRIS FOV. The absolute angular offset for the Rhea observations is also displayed in Figure 13; in addition to a random scatter of the points, different systematic offsets are apparent for the two links.

Table 5. Selected Pointing Checks for Saturn

Link	IRIS FDSC	Footprint Q5 (from SEDR at linecount 750)		Image center	
		Lat.	Emiss. Angle	Lat.	Emiss. Angle
N/S Map					
	34898:18	-37.1	41.5	-42	49.1
	34899:34	-7.3	19.3	-10	20.3
	34898:46	-13.4	22.6	-17	26.7
	34899:02	-30.2	33.6	-32	33.3
	34899:18	-34.3	38.8	-38	45
	34898:30	-56.5	60.8	-61	68.1
VPRET					
	34900:50	-26.5	31.5	-34	49.1
	34902:27	-26.5	39.4	-28	35.4
RP 2x2					
	34936:53	-53.1	57.7	-56.5	59.8
	34937:00	-53.8	55.1	-56.0	58.3

Table 6. Selected Pointing Checks for Rhea

Link	IRIS FDSC	Footprint Q5 (from SEDR at linecount 750)	Footprint Q5 (from image)	Absolute angular offset of SEDR Q5 from actual Q5 (cf $3\sigma=0.15^\circ$)
V5STMOS I				
	34950.06	(-18.0,297.6)	(7,333)	0.17°
	950.08	(-20.3,310.5)	(6,333)	0.16
	950.10	(-30.7,3.6)	(-5,18)	0.18
	950.12	(-24.1,3.5)	(-2,23)	0.19
	950.14	(-26.7,4.5)	(-5,23)	0.17
	950.18	(-22.4,60.1)	(-5,87)(limb)	0.18
	950.20	(-16.8,44.3)	(-2,80)	0.18
	950.22	(12.7,39.7)	(30,78)	0.19
	950.24	(11.3,42.5)	(25,80)	0.18
	950.28	(9.4,4.1)	(29,25)	0.19
	950.30	(10.0,9.1)	(30,28)	0.18
	950.32	(16.8,2.7)	(29,25)	0.17
	950.34	(2.7,329.6)	(30,342)	0.20
	950.36	(7.3,326.0)	(24,347)	0.17
	950.38	(11.7,321.5)	(35,335)	0.19
	950.46	(58.4,7.7)	(74,112)	0.20
V5STMOS II				
	34952.24	(36.7,21.3)	(39,21)	0.02
	952.28	(26.0,47.6)	(24,47)	0.03
	952.52	(49.1,330.8)	(50,332)	0.01
	952.56	(67.7,44.3)	(68,44)	0.00
	952.58	(76.2,146.8)	(77,115)	0.07
	953.00	(47.8,72.6)	(43,68)	0.04
	953.02	(61.3,114.9)	(59,102)	0.06
	953.06	(22.1,95.9)	(11,89)	0.07

6.4 Known RDR Peculiarities

Despite all attempts to establish a clean, contiguous data base, some discontinuities and errors remain. Some of the known peculiarities and inconsistencies are:

1) A few FDSC counts are missing both interferometer and radiometer data and contain only the scan platform information.

2) There are time periods where a few FDS counts are missing entirely. This is due primarily to data truncation between the end of one tape and the beginning of the next, and/or no scan platform data for that observation.

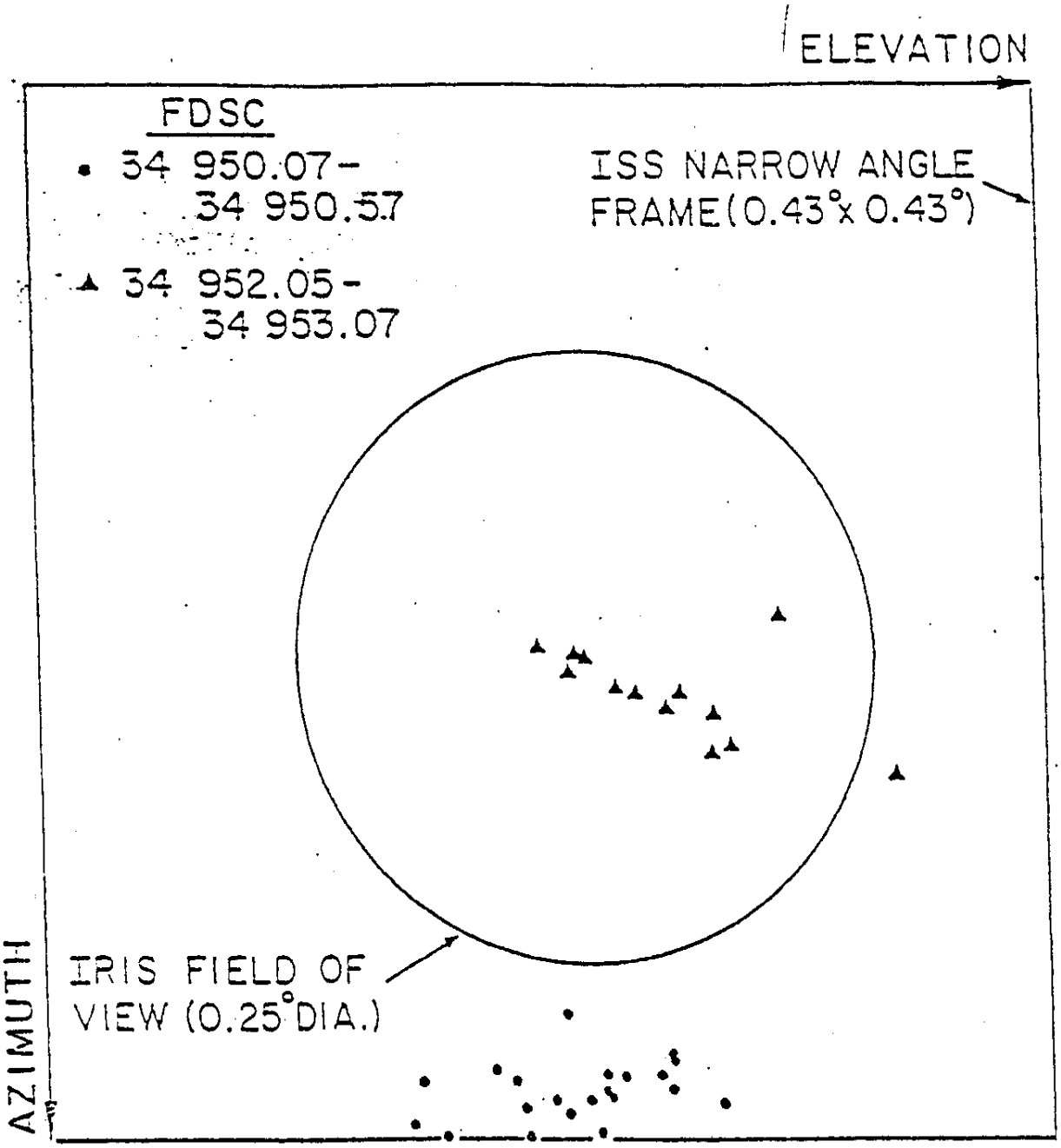


Fig. 13. SEDR pointing offsets during two Voyager 1 Rhea mosaics. Triangles and dots are Q5 pointing positions taken from SEDR; actual Q5 position is at center of IRIS field of view, which is slightly offset from the center of the narrow angle frame.

Several observations which fell off the limb are included, although no pointing data are indicated in Table 6.

3) The Voyagers 1 and 2 spacecraft photographed many satellites previously unobserved. Most of these new bodies are listed with identifying names from the footprint data tapes. Two that are not identified are:

A) S10 34930.28 - 34930.36
34936.08 - 34936.11

B) S12 34939.25 - 34939.27

4) All spectra on the data base are given a 2 character descriptor indicating the body being observed, e.g., SA for Saturn, RH for Rhea. Observations of deep space, however, are coded with the descriptor of the body being observed closest to the deep space observation time.

6.5 Apodization Function

The apodization function used was the Hamming function

$$A.F. = .54 + .46 \cos \frac{\pi \sigma}{L}$$

where L is the total optical path difference from center, thus producing a two-sided interferogram of 2L, and σ is the displacement from zero path difference. For Voyager IRIS, L = .23176 cm.

The corresponding instrument function in the frequency domain is

$$I.F. = \frac{\sin (\pi X)}{\pi X} + \frac{.46}{.54 \pi} \frac{X \sin (\pi X)}{1-X^2}$$

where X is the relative displacement from the center wave number of interest

$$X = \Delta\nu / (1/2L).$$

APPENDIX A

TIME VS. RANGE SUMMARY

The parameters listed in the time summaries are:

Scet:	Spacecraft event time.
Relative Time:	Time relative to that of closest approach to Saturn.
FDSC:	Flight Data System count; there are seventy-five counts per hour.
Range (10^6 km):	Range from spacecraft to center of Saturn in km.
Range (R_S):	Range from spacecraft to center of Saturn scaled to the equatorial radius of Saturn (R_S).
ASD:	Angular semidiameter of Saturn as viewed from the spacecraft, in degrees.
1/F:	Spatial resolution parameter = 1/(Spacecraft to picture body distance)/(Picture body diameter * IRIS field of view)

Voyager 1 Time Summary
(Saturn)

Scet	Relative Time (Day)	Relative Time (Hrs.)	FDSC	Range (10^6 km)	Range (R_s)*	ASD	1/F
277.23	-40	-960	33744.01	53.301	883.490	6.485E-02	0.519
287.23	-30	-720	34044.01	40.087	664.462	8.623E-02	0.690
292.23	-25	-600	34194.01	33.480	554.948	1.032E-01	0.826
297.23	-20	-480	34394.01	26.873	445.430	1.286E-01	1.029
302.23	-15	-360	34494.01	20.270	335.985	1.705E-01	1.364
307.23	-10	-240	34644.01	13.659	226.405	2.531E-01	2.025
308.23	-9	-216	34674.01	12.333	204.426	2.803E-01	2.242
309.23	-8	-192	34704.01	11.004	182.397	3.141E-01	2.513
310.23	-7	-168	34734.01	9.674	160.351	3.573E-01	2.859
311.23	-6	-144	34764.01	8.340	138.240	4.145E-01	3.316
312.23	-5	-120	34794.01	7.001	116.045	4.937E-01	3.950
313.23	-4	-96	34824.01	5.657	93.768	6.111E-01	4.888
314.23	-3	-72	34854.01	4.310	71.440	8.020E-01	6.416
315.23	-2	-48	34884.01	2.949	48.881	1.172E+00	9.377
316.05	-1.75	-42	34891.31	2.601	43.113	1.329E+00	10.632
316.11	-1.50	-36	34899.01	2.255	37.378	1.533E+00	12.263
316.17	-1.25	-30	34906.31	1.932	32.024	1.789E+00	14.313
316.23	-1.00	-24	34914.01	1.596	26.455	2.166E+00	17.327
317.05	- .75	-18	34921.31	1.196	19.824	2.891E+00	23.122
317.11	- .5	-12	34929.01	0.720	11.934	4.807E+00	38.407
317.17	- .25	-6	34936.31	0.319	5.288	1.090E+01	86.688
317.23	0.0	0	34944.01	0.184	3.050	1.914E+01	150.290
318.05	+ .25	+6	34951.31	0.340	5.636	1.022E+01	81.334
318.11	+ .50	+12	34959.01	0.835	13.841	4.143E+00	33.118
318.17	+ .75	+18	34966.31	1.198	19.857	2.887E+00	23.083
318.23	+1.00	+24	34974.01	1.554	25.758	2.225E+00	17.795
319.05	+1.25	+30	34981.31	1.905	31.576	1.815E+00	14.516
319.11	+1.50	+36	34989.01	2.254	37.361	1.534E+00	12.269
318.17	+1.75	+42	34996.31	2.599	43.080	1.330E+00	10.640
319.23	+2	+48	35004.01	2.943	48.782	1.175E+00	9.396
320.23	+3	+72	35034.01	4.303	71.324	8.033E-01	6.427
321.23	+4	+96	35064.01	5.448	90.303	6.345E-01	5.076
322.23	+5	+120	35094.01	6.987	115.813	4.947E-01	3.958
323.23	+6	+144	35124.01	8.319	137.892	4.155E-01	3.324
324.23	+7	+168	35154.01	9.648	159.920	3.583E.01	2.866
325.23	+8	+192	35184.01	10.895	180.590	3.173E-01	2.538
326.23	+9	+216	35214.01	12.297	203.829	2.811E-01	2.249
327.23	+10	+240	35244.01	13.619	225.742	2.538E-01	2.031
332.23	+15	+360	35394.01	20.428	338.604	1.692E-01	1.354
337.23	+20	+480	35544.01	27.238	451.484	1.269E-01	1.015
342.23	+25	+600	35694.01	34.047	564.346	1.015E-01	0.812
347.23	+30	+720	35844.01	40.857	677.225	8.460E-02	0.677
357.23	+40	+960	36144.01	54.476	902.967	6.345E-02	0.508

*Radius of Saturn used in these calculations is equatorial radius (60,330 km). For comparison, Polar radius = 54,538 km.

Voyager 1 Time Summary
(Titan)

Scet	Relative Time (Day)	Relative Time (Hrs.)	FDSC	Range (10^6 km)	Range (R_T)*	ASD	1/F
307.23	-10	-240	34644.01	14.8	5.7 E3	.0099	.08
308.23	-9	-216	34674.01	13.6	5.3 E3	.011	.09
309.23	-8	-192	34704.01	12.2	4.7 E3	.012	.10
310.23	-7	-168	34734.01	10.6	4.1 E3	.014	.11
311.23	-6	-144	34764.01	8.9	3.5 E3	.017	.13
312.23	-5	-120	34794.01	7.1	2.8 E3	.021	.17
313.23	-4	-96	34824.01	5.4	2.1 E3	.028	.22
314.23	-3	-72	34854.01	3.6	1.4 E3	.041	.33
315.23	-2	-48	34884.01	1.9	7.4 E2	.077	.62
316.05	-1.75	-42	34891.31	1.5	5.8 E2	.098	.79
316.11	-1.50	-36	34899.01	1.1	4.3 E2	.13	1.06
316.17	-1.25	-30	34906.31	0.74	2.9 E2	.20	1.59
316.23	-1.00	-24	34914.01	0.37	1.4 E2	.40	3.18
317.05	- .75	-18	34921.31	0.06	2.2 E1	2.46	19.63
317.11	- .50	-12	34929.01	.38	1.5 E2	.40	3.18
317.17	- .25	-6	34936.31	.78	3.0 E2	.19	1.51
317.23	0	0	34944.01	1.2	4.7 E2	.12	0.98
318.05	+ .25	+6	34951.31	1.6	6.2 E2	.091	0.73
318.11	+ .50	+12	34959.01	2.0	7.8 E2	.073	0.58
318.17	+ .75	+18	34966.31	2.4	9.3 E2	.062	0.50
318.23	+1.00	+24	34974.01	2.7	1.1 E3	.054	0.44
319.05	+1.25	+30	34981.31	3.0	1.2 E3	.048	0.39
319.11	+1.50	+36	34989.01	3.4	1.3 E3	.044	0.35
319.17	+1.75	+42	34996.31	3.7	1.4 E3	.040	0.32
319.23	+2.00	+48	35004.01	4.0	1.6 E3	.037	0.30
320.23	+3	+72	35034.01	5.1	2.0 E3	.029	0.23
321.23	+4	+96	35064.01	6.1	2.4 E3	.024	0.19
322.23	+5	+120	35094.01	7.0	2.7 E3	.021	0.17

*R_T (Radius of Titan) = 2570 km

Voyager 2 Time Summary
(Saturn)

Scet	Relative Time (Day)	Relative Time (Hrs.)	FDSC	Range (10^6 km)	Range (R_s)*	ASD	1/F
198.03	-40	-960	42805.37	38.289	634.660	9.028E-02	.722
208.03	-30	-720	43105.37	28.929	479.513	1.195E-01	.956
213.03	-25	-600	43255.37	24.318	403.083	1.421E-01	1.137
218.03	-20	-480	43405.37	19.610	325.046	1.763E-01	1.410
223.03	-15	-360	43555.37	14.887	246.759	2.322E-01	1.858
228.03	-10	-240	43705.37	10.147	168.192	3.407E-01	2.725
229.03	-9	-216	43735.37	9.195	152.412	3.759E-01	3.007
230.03	-8	-192	43765.37	8.239	136.566	4.196E-01	3.356
231.03	-7	-168	43795.37	7.279	120.653	4.749E-01	3.799
232.03	-6	-144	43825.37	6.314	104.658	5.475E-01	4.380
233.03	-5	-120	43855.37	5.342	88.546	6.471E-01	5.177
234.03	-4	-96	43005.37	4.361	72.286	7.927E-01	6.341
235.03	-3	-72	43915.37	3.366	55.793	1.027E+00	8.216
236.03	-2	-48	43945.37	2.348	38.919	1.472E+00	11.777
236.09	-1.75	-42	43953.07	2.088	34.610	1.656E+00	13.244
236.15	-1.50	-36	43960.37	1.825	30.250	1.894E+00	15.153
236.21	-1.25	-30	43968.07	1.566	25.957	2.208E+00	17.659
237.03	-1.00	-24	43975.37	1.283	21.266	2.695E+00	21.554
237.09	-0.75	-18	43983.07	1.004	16.642	3.445E+00	27.543
237.15	-0.50	-12	43990.37	0.712	11.802	4.861E+00	38.839
237.21	-0.25	-6	43998.07	0.406	6.730	8.546E+00	68.112
238.03	0.00	0	44005.37	0.161	2.669	2.054E+01	171.760
238.09	+ .25	+6	44013.07	0.406	6.730	8.546E+00	68.112
238.15	+ .50	+12	44020.37	0.712	11.802	4.861E+00	38.839
238.21	+ .75	+18	44028.07	1.004	16.642	3.445E+00	27.543
239.03	+1.00	+24	44035.37	1.284	21.283	2.693E+00	21.537
239.09	+1.25	+30	44043.07	1.557	25.808	2.221E+00	17.761
239.15	+1.50	+36	44050.37	1.825	30.250	1.894E+00	15.153
239.21	+1.75	+42	44058.07	2.088	34.610	1.656E+00	13.244
240.03	+2.00	+48	44065.37	2.349	38.936	1.472E+00	11.772
241.03	+3.0	+72	44095.37	3.366	55.793	1.027E+00	8.216
242.03	+4.0	+96	44125.37	4.362	72.302	7.925E-01	6.340
243.03	+5.0	+120	44155.37	5.343	88.563	6.470E-01	5.176
244.03	+6.0	+144	44185.37	6.315	104.674	5.474E-01	4.379
245.03	+7.0	+168	44215.37	7.280	120.670	4.748E-01	3.799
246.03	+8.0	+192	44245.37	8.240	136.582	4.195E-01	3.356
247.03	+9.0	+216	44275.37	9.196	152.428	3.759E-01	3.007
248.03	+10.0	+240	44305.37	10.148	168.208	3.406E-01	2.725
253.03	+15.0	+360	44455.37	14.888	246.776	2.322E-01	1.857
258.03	+20.0	+480	44605.37	19.611	325.062	1.763E-01	1.410
263.03	+25.0	+600	44755.37	24.319	403.100	1.421E-01	1.137
268.03	+30.0	+720	44905.37	28.930	479.529	1.195E-01	0.956
278.03	+40.0	+960	45205.37	38.290	634.676	9.028E-02	0.722

Voyager 2 Time Summary
(Titan)

Scet	Relative Time (Day)	Relative Time (Hrs.)	FDSC	Range (10^6 km)	Range (R_T)*	ASD	1/F
228.03	-10	-240	43705.37	11.0	4.2 E3	1.3 E-2	.11
229.03	-9	-216	43735.37	10.3	4.0 E3	1.4 E-2	.11
230.03	-8	-192	43765.37	9.4	3.7 E3	1.6 E-2	.13
231.03	-7	-168	43795.37	8.4	3.3 E3	1.8 E-2	.14
232.03	-6	-144	43825.37	7.2	2.8 E3	2.0 E-2	.16
233.03	-5	-120	43855.37	5.9	2.3 E3	2.5 E-2	.20
234.03	-4	-96	43885.37	4.6	1.8 E3	3.3 E-2	.26
235.03	-3	-72	43915.37	3.1	1.2 E3	4.8 E-2	.38
236.03	-2	-48	43945.37	1.8	7.0 E2	8.2 E-2	.65
236.09	-1.75	-42	43953.07	1.5	5.8 E2	9.8 E-2	.79
236.15	-1.50	-36	43960.37	1.2	4.7 E2	1.2 E-1	.98
236.21	-1.25	-30	43968.07	0.9	3.5 E2	1.6 E-1	1.31
237.03	-1.00	-24	43975.37	0.7	2.7 E2	2.1 E-1	1.68
237.09	- .75	-18	43983.07	0.6	2.3 E2	2.5 E-1	1.96
237.15	- .50	-12	43990.37	0.7	2.7 E2	2.1 E-1	1.60
237.21	- .25	-6	43998.07	0.9	3.5 E2	1.6 E-1	1.31
238.03	0	0	44005.37	1.1	4.3 E2	1.3 E-1	1.07
238.09	+ .25	+6	44013.07	1.4	5.4 E2	1.1 E-1	0.84
238.15	+ .50	+12	44020.37	1.6	6.2 E2	9.2 E-2	0.74
238.21	+ .75	+18	44028.07	1.8	7.0 E2	8.2 E-2	0.65
239.03	+1.00	+24	44035.37	2.0	7.8 E2	7.4 E-2	0.59
239.09	+1.25	+30	44043.07	2.2	8.6 E2	6.7 E-2	0.54
239.15	+1.50	+36	44050.37	2.5	9.7 E2	5.8 E-2	0.47
239.21	+1.75	+42	44058.07	2.7	1.1 E3	5.5 E-2	0.44
240.03	+2	+48	44065.37	2.9	1.1 E3	5.1 E-2	0.41
241.03	+3	+72	44095.37	3.8	1.5 E3	3.9 E-2	0.31
242.03	+4	+96	44125.37	4.7	1.8 E3	3.1 E-2	0.25
243.03	+5	+120	44155.37	5.5	2.1 E3	2.7 E-2	0.21

APPENDIX B

IRIS SCIENCE LINKS

VOYAGER 1 LOAD SUMMARY

OBSERVATORY PHASE

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
Load A501					
RHSUN	$-81^d23^h54^m$ 236/01:10	$-81^d23^h02^m$ 236/02:01	32484:04 32484:42	Deep Space (sun +1.7° elev.)	
			32484:43 32485:02	Sun	
			32485:02 32485:08	Deep Space (sun +1.7° elev.)	
Load A502					
RHSUN	$-59^d06^h49^m$ 258/18:19	$-59^d05^h56^m$ 258/19:12	33165:28 33166:07	Deep Space (sun +1.7° elev.)	
			33166:07 33166:27	Sun	
			33166:27 33166:35	Deep Space (sun +1.7° elev.)	
RHSUN	$-34^d00^h44^m$ 284/00:26	$-33^d23^h51^m$ 284/01:20	33923:05 33923:44	Deep Space (sun +1.7° elev.)	
			33923:44 33924:04	Sun	
			33924:04 33924:12	Deep Space (sun +1.7° elev.)	
Load A503					
RCFOH	$-33^d02^h08^m$ 284/23:10	$-33^d02^h07^m$ 284/23:11	33951:30 33951:31	IRIS off IRIS Flash-off heater on	
RCFOH	$-22^d02^h07^m$ 295/23:01	$-22^d02^h06^m$ 295/23:02	34281:18	IRIS Flash-off heater off	
RCFOH	$-21^d11^h55^m$ 296/13:13	$-21^d11^h54^m$ 296/13:14	34299:04 34299:05	Replacement heater off IRIS on	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RHSUN	$-19^d11^h26^m$ 298/13:44	$-19^d10^h30^m$ 298/14:40	34359.42 34360.22	Deep Space (Sun +1.7° Elev.)	
			34360.22 34360.42	Sun	
			34360.42 34360.52	Deep Space (Sun +1.7° Elev.)	
RCAL	-19:09:29.0 298/15:42	-19:01:27.6 298/23:43	34362.09 34372.11	8^h3^m long	
	-19:09:27.6 298/15:	-19:08:30.4 298/16:40	34362.09 34363.22	First part of RCAL, not recorded	
	-19:08:30.4 298/16:40	-19:01:22.0 298/23:49	34363.22 34372.18	Record RCAL	
	-19:08:27.2 298/16:41		34363.23	XTWT low	
	-19:07:39.9 298/17:31	-19:04:59.6 298/20:11	34364.25 34367.46	RPIRC (IRCOMP on Saturn)	
	-19:04:59.6 298/20:11	-19:04:53.9 298/20:17	34367.46 34367.53	Slew to Target Plate	
	-19:04:53.9 298/20:17	-19:01:20.8 298/23:43	34367.53 34372.11	Sit on Target Plate	
	-19:01:27.2 298/23:41		34372.08	XTWT High	
	-19:01:27.2 298/23:41	-19:01:22.4 298/23:45	34372.08 34372.13	XTWT Warmup	
RCAL (Playbacks)	-17:14:37.0 300/10:33	-17:13:51 300/11:19	34415.44 34416.41	Playback 1	
	-17:08:28.4 300/16:42	-17:07:23 300/17:47	34423.25 34424.46	Playback 2	
	-17:06:24 300/18:46	-17:05:25 300/19:46	34426.00 34427.14	Playback 3	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	$-19^d\ 7^h39.9^m$ 298/17:31	$-19^d04^h59.6^m$ 298/20:11	34364:25 34367:46	Center of Saturn IRIS-centered during RCAL	
PPIRC (Saturn)	-19 01 21 298/23:49	-18 23 30 299/01:41	34372:18 34374:38	Planet heat balance	
RPAXS/RPIRC (Saturn)	-18 19 55 299/05:15	-18 19 06 299/06:05	34379:06 34380:08	Center of Saturn IRIS-centered	NA-VI, CL, BL, GR, UV, OR
VPGLOB/RPIRC (Saturn movie)	-18 19 05 299/06:05	-17 20 48 300/04:23	34380:08 34408:01	Center of Saturn ISS centered	NA, CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-17 19 51 300/05:20	-17 18 33 300/06:37	34409:11 34410:49	Center of Saturn IRIS centered	CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-16 21 17 301/03:53	-16 19:24 301/05:46	34437.23 34439:45	Center of Saturn ISS centered	NA-CL, VI, BL, OR, GR, UV
RPIRC (Saturn)	-16 11 53 301/13:17	-16 11 24 301/13:47	34449:08 34449:46	Center of Saturn for IRIS	
RPAXS/RPIRC (Saturn)	-15 20 34 302/04:37	-15 19 19 302/05:51	34468.18 34469:51	Center of Saturn IRIS centered	CL, VI, BL, OR, GR, UV

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPAXS/RPIRC (Saturn)	$-14^d19^h56^m$ 303/05:14 ERT	$-14^d18^h35^m$ 303/06:35	34499:04 34500:46	Center of Saturn IRIS centered	NA-CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-13 21 19 304/03:51	-13 20 37 304/04:33	34527:20 34528:14	Center of Saturn IRIS centered	NA-CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-12 20 22 305/04:49	-12 19 39 305/05:32	34558:32 34559:27	Center of Saturn, IRIS centered	NA-CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-11 19 40 306/05:31	-11 18 56 306/06:14	34589:25 34590:20	Center of Saturn IRIS centered	NA-CL, VI, BL, OR, GR, UV
RPAXS/RPIRC (Saturn)	-10 21 41 307/03:30	-10 20 26 307/04:45	34616:54 34618:28	Center of Saturn IRIS centered	NA-CL, VI, BL, OR, GR, UV

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VP2X2 (Saturn)	$-9^d23^h09^m$ 308/02:01	$-9^d20^h49^m$ 308/04:21	34645:03 34647:59	2X2 mosaic IRIS centered on Saturn for readout. First 19^m at first ISS position.	NA-GR, BL, VI WA-BL, VI, OR, CH_4
RPAXS/RPIRC (Saturn)	-9 20 48 308/04:22	-9 19 02 308/06:09	34647:59 34650:13	Center of Saturn IRIS centered. Last 45 frames are RPIRC	NA-OR, GR, UV BL WA-BL, VI, OR, CH_4
VP2A3 (Saturn)	-9 16 43 308/08:27	-9 15 43 308/09:26	34653:05 34654:20	2X2 mosaic, IRIS centered on Saturn for readout	NA-OR, GR, BL, VI, CL WA-NA, UV, CH_4, CL
VP2B3 (Saturn)	-9 08 39 308/16:31	-9 07 31 308/17:39	34663:11 34664:36	2x2 mosaic, IRIS centered on Saturn for readout	NA-OR, GR, BL, VI, CL WA-NA, UV, CH_4, CL
RPAXS/RPIRC (Saturn)	-8 20 05 309/05:06	-8 19 08 309/06:02	34678:54 34680:05	Center of Saturn IRIS centered	NA-OR, GR, UV, BL, WA-BL, VI, OR, CH_4
RPIRC (Saturn)	-7 22 36 310/02:34	-7 21 44 310/03:26	34705:44 34706:50	Lat = +35° Long = sub s/c	
RPAXS/RPIRC (Saturn)	-7 21 34 310/03:37	-7 20 44 310/04:26	34707:02 34708:05	Center of Saturn IRIS centered	NA-OR, GR, UV, BL WA-BL, VI, OR, CH_4
RPAXS/RPIRC (Saturn)	-6 20 48 311/04:21	-6 19 54 311/05:16	34737:59 34739:07	Center of Saturn IRIS centered	NA-OR, GR, UV, BL WA-BL, VI, OR, CH_4
RPIRC (Saturn)	-6 17 50 311/07:20	-6 17 26 311/07:46	34741:42 34742:15	Lat = +35° Long = sub s/c	NA-GR, BL WA-BL
RPIRC (Saturn)	-6 10 58 311/14:12	-6 10 38 311/14:33	34750:17 34750:43	Lat = +35° Long = sub s/c	NA, BL, VI WA-BL
VP2B3 (Saturn)	-6 04 34 311/20:36	-6 03 32 311/21:44	34758:17 34759:42	2x2 mosaic, IRIS centered on Saturn for readout	NA-OR, GR, BL, VI, CL WA-NA, UV, CH_4, CL

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VPMOS (Saturn)	$-6^d00^h20^m$ 312/00:47	$-5^d23^h28^m$ 312/01:40	34763:31 34764:37	2X2 mosaic, IRIS centered on Saturn	NA-LB, GR WA-BL, VI, OR CH_4
VPAMOS (Saturn)	-5 16 24 312/08:44	-5 15 11 312/09:57	34773:27 34774:58	2X2 mosaic, IRIS centered on Saturn for readout	NA-OR, GR WA-BL, VI, OR, CH_4
RPIRC (Saturn)	-4 19 05 313/06:03	-4 18 52 313/06:16	34800:05 34800:22	Lat = +40° Long = Sub S/C	NA-BL, GR WA-BL, VI
RPIRC (Saturn)	-4 18 40 313/06:27	-4 18 16 313/06:51	34800:35 34801:06	Lat = +40° Long = Sub S/C	NA-BL, VI WA-BL, VI
VPBMOS (Saturn)	-4 07 15 313/17:52	-4 06 08 313/18:59	34814:52 34816:16	2X2 mosaic, IRIS centered on Saturn for readout	NA-BL, GR WA-BL, VI, OR, CH_4
VPAMOS (Saturn)	-4 01 47 313/23:21	-4 00 05 314/01:02	34821:43 34823:50	2X2 mosaic, IRIS centered on Saturn	NA-OR, GR WA-BL, VI, OR, CH_4
RPIRC (Saturn)	-3 23 27 314/01:40	-3 23 08 314/02:00	34824:37 34825:02	Lat = +40° Long = Sub S/C	NA-VI WA-CH_4, VI
RPIRC (Saturn)	-3 22 49 314/02:19	-3 21 26 314/03:41	34825:25 34827:09	Lat = +40° Long = Sub S/C	NA-BL, VI WA-GR, VI
RPIRC (Saturn)	-3 20 17 314/04:51	End of load 314/05:31	34828:35 34829:26		

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RSPAC (Deep Space)	$-3^d19^h27^m$ 314/05:43	$-3^d19^h06^m$ 314/06:04	34829:41 34830:08	Targeted to EL/AZ EL = 169.08° AZ = 230.77°	
RPIRC (Saturn)	-3 18 52 314/06:18 ERT	-3 18 01 314/07:09 ERT	34830:25 34831:29	Lat/Sub S/C Long Lat = +36°, Drift	
VTXLONG (Titan)	-3 15 58 314/09:13	-3 15 39 314/09:31	34834:04 34834:27	Center of Titan Drift	NA-UV, VI, BL, CL, OR, GR WA-CH_4
RPIRC (Saturn)	-3 14 02 314/11:08	-3 12 51 314/12:19	34836:28 34837:55	Lat/Sub S/C Long Lat = 36°, Drift	NA-VI, GR WA-BL, OR, GR, VI
VTSHORT (Titan)	-3 11 57 314/13:13	-3 11 36 314/13:34	34839:03 34839:30	Center of Titan Drift	NA-CL, BL, OR, VI, GR, UV: WA-CH_4
RPIRC (Saturn)	-3 09 53 314/15:12	-3 08 46 314/16:30	34841:32 34843:10	After last VPBMOS Position	NA-VI WA-GR
VTXLONG (Titan)	-3 07 53 314/17:18	-3 07 31 314/17:39	34844:09 34844:37	Center of Titan Drift	NA-UV, VI, BL, CL, OR, GR WA-CH_4
RPE/W (Saturn map)	-3 05 31 314/19:39	-3 01 38 314/23:32	34847:06 34851:58	9x10, 3 ifgm/pt 9 in E/W direction	NA-GR, WA-GR, VI, OR, BL
VTSHORT (Titan)	-3 01 35 314/23:35	03 01 17 314/23:53	34852:01 34852:24	Center of titan Drift	NA-UV, VI, BL, CL, OR, GR WA-CH_4
RPIRC (Saturn)	-2 23 46 315/01:19	-2 23 35 315/01:36	34854:11 34854:32	After last VPAMOS position	NA-BL WA-GR
RPE/W (Saturn map)	-2 22 38 315/02:32	-2 18 47 315/06:24	34855:42 34860:32	9x10, 3 ifgm/pt 9 in E/W direction	WA-GR, VI, OR, BL NA-GR
RPIRC (Saturn)	-2 18 46 315/06:25	-2 18 27 315/06:44	34860:33 34860:56	At first position in VPAMOS	NA-CL, GR WA-VI
VTSHORT (Titan)	-2 17 31 315/07:39	-2 17 13 315/07:57	34862:06 34862:29	Center of Titan Drift	NA-UV, VI, BL, CL OR, GR, WA-CH_4
RPE/W (Saturn map)	-2 15 54 315/09:16	-2 11 56 315/13:15	34864:08 34869:06	9x10, 3 ifgm/pt 9 in E/W direction	NA-GR, WA-GR, VI, BL, OR
VTXLONG (Titan)	-2 11 08 315/14:02	-2 10 49 315/14:21	34870:05 34870:30	Center of Titan Drift	NA-UV, VI, BL, CL, OR, GR WA-CH_4

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RP7C0 (West limb)	$-2^d10^h05^m$ 315/15:06	$-2^d09^h04^m$ 315/16:06	34871:24 34872:40	Lat/Viewing Angle Lat = 15°, VW = -40° Drift is in South-east direction approx. 1/2 an FOV	NA-GR, VI, BL, OR WA-BL, VI, OR, CH_4, GR
RP7C0 (Center)	-2 08 56 315/16:15 ERT	-2 07 58 315/17:13 ERT	34872:50 34874:03	Lat/Sub S/C long Lat = 15°, Drift is in southeast direction approx. 1/2 an FOV	NA-GR, VI, BL,OR WA-VI, BL, GR
RP7C0 (East limb)	-2 07 58 315/17:13	-2 07 02 315/18:09	34874:03 34875:13	Lat/Viewing Angle Lat = 15°, VW = 48° Drift is in South-east direction approx. 1/2 an FOV	NA-GR, VI, BL, OR, WA-BL, VI, GR, OR, CH_4
VTITAN (Titan)	-2 06 59 315/18:12	-2 06 40 315/18:30	34875:17 34875:41	Center of Titan	NA-VI, OR, GR, BL, UV WA-CH_4
RP7C0 (South Pole	-2 06 38 315/18:32	-2 05 32 315/19:39	34875:43 34877:06	Lat/Sub S/C Long Lat = -43°, Drift is in Southeast direction approx. 1/2 an FOV	NA-GR, VI, BL, OR, UV WA-BL, VI, OR, CH4
RP7C0 (North Pole)	-2 04 31 315/20:40	-2 03 27 315/21:44	34878:22 34879:42	Lat/Sub S/C Long Lat = 55°, 1x11 scan 7 ifgm/pt	NA-GR, VI, BL WA-BL, VI, OR, CH_4
RP7C0 (Left Ansa)	-2 03 13 315/21:57	-2 02 31 315/22:42	34879:59 34880:51	B-ring, 1x3 scan 20 ifgm/pt	NA-CL, VI, BL, GR
RP7C0 (Left Ansa)	-2 02 25 315/22:45	-2 01 22 315/23:48	34880:59 34882:18	B-ring, 1x4 scan 20 ifgm/pt	NA-CL, VI, BL, OR, GR, UV WA-BL, CL, VI, OR, GR
VT12EX (Titan)	-2 00 54 316/00:15	-2 00 11 316/01:00	34882:53 34883:47	Center of Titan	NA-BL, OR, UV, CL, VI, GR WA-OR, CH_4
RP7C0 (Right Ansa)	-1 23 53 316/01:18	-1 23 05 316/02:05	34884:09 34885:09	B-ring, 1x3 scan 20 ifgm/pt	NA-CL, WA-BL, VI, OR
VT4NA (Titan)	-1 22 53 316/02:17	-1 22 27 316/02:43	34885:24 34885:56	Center of Titan	NA-BL, OR, GR, VI, WA-VI
RPMAS (S[illegible] map)	-1 21 56 316/03:14	-1 11 17 316/13:53	34886:35 34899:54	Many nested scans, 1x11 1 ifgm/pt	WA-BL, OR, VI, GR

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VTW2x2 (Titan)	-1 10 14 316/14:57	-1 09 28 316/15:43	34901:12 34902:11	2x2, with IRIS at center for TV read-out	NA-BL, CL, C WA-CH_4, VI, OR
VTW2x2 (Titan)	-1 08 14 316/16:56	-1 07 16 316/17:40	34903:43 34904:37	2x2, with IRIS at center for TV read-out	NA-VI, GR, BL WA-CH4, OR, VI
VTW2x2 (Titan)	-1 06 33 316/18:38	-1 05 44 316/19:27	34905:49 34906:51	2x2, with IRIS at center for TV read-out	NA-CL, BL, OR WA-CH_4, OR, VI
VTW2x2 (Titan)	-1 04 39 316/20:31	-1 03 44 316/21:26	34908:11 34909:20	2x2, with IRIS at center for TV read-out	NA-VI, UV, BL WA-CH_4, OR, VI
RPLAT (Saturn)	-1 03 37 316/21:33	-1 03 10 316/22:00	34909:28 34910:03	3x10 mosaic, 1 ifgm/ pt. Center of mosaic at Lat/Sub S/C Long Lat = +20°	NA-GR, WA-BL, VI, GR, OR, CH_4

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
REFERENCE STAR IS MIAPLACIDUS					
VTMOS1 (RTIRC) (Titan)	$-1^{d}01^{h}53^{m}$ 316/23:17	$-23^{h}58^{m}$ 317/01:12	34911:39 34914:03	Titan, 3x3, 4 color mosaic 32 departure slews for IRIS centering	NA-CL, VI, OR, GR
V4S4N (Dione)	-23 56 316/01:14	-23 45 317/01:25	34914:05 34914:19	Center of Dione, 1x4 scan, 4 ifgm/pt.	NA-VI, BL, OR, UV
V2S3N (Enceladus)	-23 44 317:01:26	-23 35 317:01:35	34914:20 34914:31	Center of Enceladus 1x3 scan, 4 ifgm/pt.	NA-CL, OR, UV
OPNAV (Mimas)	-23 34 317/01:36	-23 28 317/01:42	34914:32 34914:40	RA/DEC targeting one WA for spinaxis measurement	NA-Clear WA-CL
OPNAV V5S1N (Rhea)	-23 27 317/01:43	-23 15 317/01:56	34914:41 34914:57	RA/DEC targeting	NA-Clear (2)
OPNAV (Titan)	-23 12 317/01:58	-23 06 317/02:05	34915:00 34915:08	RA/DEC targeting (One increm. slew)	WA-Clear
UTBLM1 (Titan)	-23 05 317/02:05	-22 04 317/02:06	34915:09 34915:25	VLO scan across Titan (.005°/sec slewing)	NA, VI, GR, WA-CH_4 BL VI, OR, CL
RTCOM (South Limb-Titan)	-22 04 317/03:07	-21 36 317/03:35	34916:25 34917:01	Lat/Sub S/C Long Lat = -35° 1x8 scan, 4 ifgm./pt.	NA-CL, BL, GR, WA-VI, OR, CH_4
RTCOM (West Limb-	-21 35 317/03:35	-21 09 317/04:01	34917:01 34917:34	Lat/Viewing angle Lat = 7.5° VW = -43° 1x7 scan 5 ifgm./pt.	NA-VI, BL, OR, GR, UV (1/2 edit)
VTMOS2 (Titan)	-21 09 317/04:02	-20 37 317/04:33	34917:34 34918:14	20 narrow angle frames	NA-CL, VI. WA-BL, GR, OR
UTBLM2 (Titan)	-20 36 317/04:35	-20 00 317/05:10	34918:15 34919:00	VLO scan across Titan (.005°/sec slewing)	WA-CL, VI, OR, CH_4
RTCOM (East limb) (Titan)	-20 00 317/05:11	-19 35 317/05:36	34919:00 34919:32	Lat/Viewing angle Lat = 7.27° VW = 57° 1x11 scan, 3 ifgm./pt.	NA-CL WA-VI, OR, CH_4
RTCOM (North pole) (Titan) Pa[illegible]	-19 34 317/05:36	-19 21 317/05:49	34919:32 34919:49	Lat/Sub S/C Long. Lat = 70°, 2X8 Mosaic, 1 ifgm/pt	NA-Clear
VTMOS3	-19 20 317/05:50	-19 09 317/06:01	34919:49 34920:04	7 NA Grames	NA-CL

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RTCOM (North pole) (Titan) Part II	$-0^h19^d09^m$ 317/05:02	-18^h55^m 317/06:15	34920:04 34920:21	Lat/Sub S/C long Lat = 70°, 3x5 Mosaic, 1 ifgm/pt.	NA-CL WA-BL, OR
RTSAT (Titan)	-18 55 317/06:16	-18 21 317/06:49	34920:21 34921:04	Lat/Sub S/C Long Lat = 80° SDEL = 1.35° SDAZ = -.07° 4 Mosaics, 3 ifgm./pt.	WA-Clear
UTOCC (Ingress)	-18 19 317/06:52	-17 55 317/07:15	34921:07 34921:37	Sun occ. entrance S/C doing Gyro drift turns for Radio Science	
**********TITAN MOVEABLE BLOCK********** (LINKS CAN MOVE $\pm 3.2^m$)			(-18h13m	to -17^h15^m)	
Titan Closest Approach	-18 04 48s			C/A is 6969 km	
VTPHASE	-18 03	-18 2	34921:27 34921:28	WA recorded	WA-VI
SUNOCC INGRESS	-17 59 27.5s				
EARTHOCC INGRESS	-17 58 16.9				
SUNOCC EGRESS	-17 48 45				
EARTHOCC EGRESS	-17 46 05				
UTOCC (Egress)	-17 54	-17 11	34921:37 34922:31	Sun occ. exit	
RTWOC (South Pole - Titan)	-17 04	-16 47	34922:40 34923:02	Mosaic during 7.2^m Mini-ASCAL, ten frames drift at end. Lat = -50°	
**********END TITAN MOVEABLE BLOCK**********					
RTWOC (North pole - Titan)	-16 46 317/08:25	-16 20 317/08:50	34923:02 34923:34	2 mosaics, 1 ifgm./pt. Data rate change during first few frames	None - playback
UTROR (N/S scan - Titan)	-16 20 317/08:50	-16 00 317/09:11	34923:34 34924:01	1x27 scan, 1ifgm./pt.,	
UTROR (E/W scan - Titan)	-15 59 317/09:12	-15 47 317/09:23	34924:01 34924:16	1x15 scan, 1 ifgm./pt., starts off Titan	
RTWOC (East limb-Titan	-15 47 317/09:24	-15 25 317/09:45	34924:16 34924:44	1x10 scan, 3 ifgm./pt. Lat = -7°	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
UTHOR (Titan)	$-0^d15^h25^m$ 317/09:45	-15^h18^m 317/09:52	34924:44 34924:52	VLO slew off east Limb	
RTWOC (UVS N. Pole scan-Titan)	-15 18 317/09:52	-15 08 317/10:02	34924:53 34925:05	1x12 scan, 1 ifgm/ pt., starts off Titan	
RTWOC (S. Pole, Titan)	-15 08 317/10:02	-14 57 317/10:13	34925:05 34925:19	Lat =-50°, 1x7 scan, 2 ifgm/pt., spread in longitude	
V4S1N (Dione)	-14 54 317/10:16	-14 51 317/10:19	34925:22 34925:26	Center of Dione	NA-Clear
V6S1N OPNAV (Rhea)	-14 51 317/10:20	-14 37 317/10:33	34925:27 34925:44	Center of Rhea	NA-BL, CL
R5RHE V6S5N (Rhea)	-14 37 317/10:34	-14 16 317/10:54	34925:44 34926:10	Center of Rhea 1x13 scan, 2 ifgm./pt.	NA-GR, VI, OR, UV, CL WA-CL
V3S1N (Tethys)	-14 14 317/10:57	-14 10 317/11:01	34926:13 34926:18	Center of Tethys, Centered for IRIS	NA-CL
VPRET (Saturn)	-14 09 317/11:01	-13 45 317/11:25	34926:18 34926:49	Lat = 23°, Long = 338° 2x2 Mosaic, 7 ifgm./pt.	NA-GR WA-VI, GR, OR, BL
UPHASE (Saturn)	-13 45 317/11:26	-13 16 317/11:54	34926:49 34927:25	1x30 scan, 1 ifgm./ pt. Starts off Saturn above rings	NA-VI, GR, WA-VI, GR, OR
RPEDE (Saturn)	-13 16 317/11:55	-12 56 317/12:15	34927:25 34927:51	Lat = -4°, Long = 315.5° 2x12 mosaic, 1 ifgm/pt. tracks occ point	NA-CL WA, GR, OR, BL
UPHASE (Saturn)	-12 55 317/12:16	-12 31 317/12:40	34927:51 34928:22	1x30 scan, 1 ifgm./ pt., goes off Saturn below rings	NA, GR, WA-BL VI, GR, OR, CH_4
VPHASE (Saturn)	-12 30 317/12:41	-12 01 317/12:45	34928:23 34928:29	Lat/Viewing Angle Lat = 0°, VW = -90° Increm. slew	NA-CL, VI WA-VI, GR, OR, CH_4
			34928:44	Lat/Viewing Angle Lat = -40°, VW = -90°	NA-CL, VI
			34928:51	Lat/Viewing angle Lat = -80°, VW = 90°	NA-CL, VI
			34928:59	End VPHASE	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
V1S6N (Mimas)	$-0^d12^h00^m$ 317/13:11	-11^h42^m 317/13:29	34929:00 34929:23	1x6 scan, 4 ifgm./ pt. centered for IRIS	NA-VI, GR, OR, UV, CL, BL WA-CL
RRCRI (C-Ring)	-11 40 317/13:30	-11 20 317/13:51	34929:25 34929:51	Saturn Radius/Hour Angle SR = 1.33 HA = 289.5 1x12 scan, 2 ifgm./ pt.	NA-CL WA-CL, VI, GR
V2S1N (Enceladus	-11 16 317/13:54	-11 20 317/13:55	34929:55 34929:56	Drift	NA-Clear WA-Clear
V4S6N R4DIO (Dione)	-11 12 317/13:59	-10 50 317/14:21	34930:01 34930:28	Center of Dione 1x6 scan, 4 ifgm./ pt., IRIS centered	NA-BL, VI, OR, GR, UV, CL WA-CL
V1ONEW (S10 satellite)	-10 48 317/14:23	-10 44 317/14:27	34930:30 34930:36	Center of S10	NA-CL
V1S1N (Mimas)	-10 42 317/14:29	-10 40 317/14:30	34930:38 34930:40	Center of Mimas	NA-CL
VRWSCN (Rings)	-10 40 317/14:31	- 9 56 317/15:14	34930:40 34931:35	7 unique positions	NA-CL WA-BL, VI, GR
V2S5N R2D2 (Encleladus)	-9 55 317/15:16	- 9 39 317/15:32	34931:37 34931:57	1x9 scan, 2 ifgm./ pt. IRIS centered	NA-VI, BL, OR UV, CL, WA-CL
V1S6N (Mimas)	-9 37 317/15:34	-9 17 317/15:53	34931:59 34932:24	Center of Mimas 1x6 Scan, 4 ifgm./ pt., IRIS centered	NA-VI, BL, OR, GR, UV, CL
RRCRI (C-Ring)	-9 15 317/15:55	-8 37 317/16:33	34932:26 34933:14	Saturn Radius/Hour Angle SR = 1.36, HA = 292° Mosaic, 2 ifgm./pt.	WA, VI, GR
VPSHAD (Ring Shadow on Saturn)	-8 36 317/16:34	-8 24 317/16:47	34933:15 34933:31	Ring shadow on Saturn 5 positions	NA-CL WA-BL, VI, OR
V4S1N (Dione)	-8 21 317/16:49	-8 18 317/16:53	34933:33 34933:38	Center of Dione IRIS centered	NA-Clear
V2S1N (Enceladus)	-8 15 317/16:56	-8 14 317/16:57	34933:42 34933:43	Center of Enceladus	NA-Clear WA-Clear
V1S1N R1MIM (Mimas)	-8 12 317/16:58	-8 04 317/17:06	34933:45 34933:55	Center of Mimas 1x6 scan 1 ifgm./ pt., IRIS centered	NA-Clear WA-Clear
V1 SSN (A-Ring)	-8 04 317/17:08	-7 31 317/17:40	34933:56 34934:36	1x11 scan, 4 ifgm./ pt., scan across A-Ring	NA-Clear

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RRPHA (B-Ring)	$-0^d7^h31^m$ 317/17:40	-7^h29^m 317/17:42	34934:37 34934:39	Sit in B-Ring	
VRNGSN (C-Ring)	-7 28 317/17:42	-6 59 317/18:12	34934:40 35935:17	1x11 scan, 4 ifgm./pt. Scan across C-Ring	NA-Clear
VRNGSCN (Ring limb mosaic)	-6 58 317/18:12	-6 24 317/18:47	34935:17 34936:01	Mosaic, 2 ifgm./pt. scan along Saturn's limb with rings in FOV	NA-Clear
RRPHA (A & B Ring)	-6 22 317/18:49	-6 15 317/18:53	34936:03 34936:05 34936:08	Opposite Ansa from VRNGSN. B-Ring first then A-Ring. RS = 1.75, 2.1	WA-CL
VTONEW (S10 Satellite)	-6 18 317/18:53	-6 16 317/18:55	34936:08 34936:11	Center of S10	NA-CL
VTSSN (Mimas)	-6 14 317/18:56	-6 00 317/19:11	34936:12 34936:31	Center of Mimas Mosaic, 2 ifgm/pt IRIS centered	NA-VI, BL, OR, UV, CL
VPHASE (Saturn)	-5 58 317/19:14	-5 47 317/19:24	34936:33 34936:47	Lat/Viewing Angle Lat = 0°, -40°, -68°; VW = -90°	NA-VI WA-VI
RP2x2 (Saturn)	-5 46 317/19:24	-5 36 317/19:35	34936:47 34937:01	Lat/Long Lat = -52° Long = 270° 2x2 Mosaic, 3 ifgm./pt.	NA-CL WA-VI, GR
V3SSN (Tethys)	-5 34 317/19:37	-5 19 317/19:52	34937:03 34937:22	Center of Tethys Mosaic, 2 ifgm./pt. IRIS centered	NA-CL, VI, GR, UV
RRCCO (C-Ring)	-5 17 317/19:53	-4 51 317/20:20	34937:23 34937:57	2x3 Mosaic plus one position 3 ifgm./pt.	WA-CL
VTSSN (Mimas)	-4 49 317/20:22	-4 34 317/20:37	34937:59 34938:18	Center of Mimas Mosaic, 2 ifgm/pt IRIS centered	NA-VI, BL, OR, UV, CL
RPFEA (Saturn)	-4 31 317/20:40	-3 35 317/20:41	34938:21	Lat/Long Lat = - °, Long = 270°	NA-CL, WA-GR
			34938:27	Lat/Viewing Angle Lat = -70°, VW = -76° 1x9 scan, 2 ifgm./pt.	NA-CL WA-GR, VI

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
			34938:44	Lat/Viewing Angle Lat = -88° VW = 76° 1x10 scan, 2ifgm/ pt.	NA-CL WA-GR, VI
			34939:05 34939:24	Lat/Viewing Angle Lat = -70°, VW = -54°	NA-CL WA-GR, VI
			34939:24	1x10 scan, 2 ifgm/pt	
V12NEW (Dione Trojan) (S12)	$-0^d3^h40^m$ 317/21:31	-3^h39^m 317/21:32	34939:25 34939:27	Center of Dione Trojan	NA-CL
RSECL (Rhea)	-3 37 317/21:33	-3 16 317/21:54	34939:28 34939:55	Center of Rhea 1x23 scan, 1 ifgm/ pt. Pre-eclispse entry	NA-CL WA-CL
VRENCKE (Encke Division)	-3 13 317/21:57	-2 55 317/22:16	34939:59 34940:21	Saturn Radius/Hour angle. SR = 2.34 HA = 234.62	WA-CL WA, CL
RRPHA (B-ring)	-2 54 317/22:16	-2 50 317/22:21	34940:22 34940:28	Saturn Radius = 1.75	NA-CL
V1S2N R1MIM (Mimas)	-2 47 317/22:24	-2 40 317/22:30	34940:32 34940:40	1x7 scan, 1 ifgm./ pt., IRIS centered	NA-CL (2)
UPBLM	-2 39 317/22:32	-2 04 317/23:07	34940:42 34941:26	2 drifts across Saturn's bright limb. Lat (1) = 10.5°, Lat (2) = 11.0°	NA-CL WA-OR, BL, GR,
VRCASS (Casini Division)	-2 02 317/23:09	-1 50 317/23:21	34941:28 34941:42	Mosaic in Casini Division	NA-CL WA-BL
RRPHA (B-ring)	-1 49 317/23:21	-1 47 317/23:23	34941:43 34941:46	Sit in B-ring	None
RPIRN (Saturn)	-1 47 317/23:24	-1 25 317/23:45	34941:47 34942:13	1x23 scan, 1 ifgm/ pt scan across South pole, Starting Lat = -60°	WA-CLear
V10NEW (S10 Satellite)	-1 24 317/23:46	-1 20 317/23:51	34942:15 34942:21	Center of S10	NA-CL
V11NEW (S11 satellite)	-1 18 317/23:52	-0 57 318/00:13	34942:22 34942:49	2x3 mosaic, 4 ifgm/ pt	NA-CL, GR
UP*OCC (Iota Hercules)	-0 56 318/00:14	-0 28 318/00:42	34942:50 34943:23	Drift, star occ.	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RHECL (Rhea)	$-0^d0^h27^m$ 318/00:44	-0 04 318/01:06	34943:26 34943:55	Center of Rhea 3x8 Mosaic, 1 ifgm./pt.	
VPHASE (Saturn)	-0 02 317/01:09	+0 00 318/01:11	34943:58 34944:01	Lat/Viewing Angle Lat = -45°,	WA-VI
VIMOS (Mimas)	+0 0 02 317/01:16	+0 27 318/01:38	34944:03 34944:35	1x2 3-color Mosaic with 6 scan departures for IRIS	NA-VI, GR, CL WA-CL
VPHASE	+0 30 318/01:40	+0 35 318/01:45	34944:37 34944:43	Lat/Viewing Angle Lat = -46°, -54°	WA-VI
RRCOLD (C-Ring)	+0 36 318/01:46	+0 39 318/01:50	34944:45 34944:50	Saturn Radius = 1.4 Drift in dark	WA-CL
V4S2N R4DIO (Dione)	+0 43 318/01:53	+0 52 318/02:03	34944:53 34945:04	Mosaic, 2 ifgm/pt	NA-CL

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
BEGIN A552	+0^{h}55^m		34945:09		
FSMAN (roll)	+0 56 318/02:06 EAT	+1^{h}19^m 318/02:28 EAT	34945:10 34945:38	Roll to align for UVS sun occultation entrance	
VRHIPHA (C-ring)	+1 20 318/02:28	+1 22 318/02:32	34945:39 34945:42	Saturn Radius = 1.45 Hour angle = 285°	WA-CL
WPGS4 (PWS)	+1 22 318/02:32	+1 24 318/02:33	34945:42 34945:44	Record 1 PWS high rate frame	
UPHOCC (Sun occ. entrance)	+1 32 318/02:41	+2 13 318/03:24	34945:53 34946:47	UVS off axis port on sun	
VRDSCAT (D-ring)	+2 14 318/03:25	+2 16 318/03:26	34946:48 34946:49	D-ring forward scattering	WA-Clear
VRESCAT (E-ring)	+2 17 318/03:27	+2 20 318/03:31	34946:51 34946:55	E-ring forward scattering. Saturn radius = 3.97	WA-Clear (Long exposure)
RRCCO (C-ring)	+2 22 318/03:32	+2 32 318/03:43	34946:57 34947:11	Targeting: R_s/Hour angle R_s=1.40^s, HA = 304° 1x8 scan, 2 ifgm/pt	
RRCAS (Casini Div.)	+2 33 318/03:44	+2 38 318/03:49	34947:11 34947:18	Targeting: R_s/Hour angle R_s=2.03^s, HA= 7.0° 1x8 scan, 1 ifgm/pt	
UPDRK (Saturn)	+2 42 318/03:53	+2 45 318/03:56	34947:23 34947:26	Saturn dark side with occ. port	
UPHOCC (sun occ. exit)	+2 45 318/03:56	+3 11 318/04:22	34947:26 34948:00	UVS off axis port on sun	
RROCC (Ring occult.)	+3 11 318/04:22	+3 16 318/04:27	34948:00 34948:06	Target: sun ring-occultation calib.	
VRHIPHA (A-ring)	+3 17 318/04:28	+3 18 318/04:29	34948:07 34948:08	Saturn Radius = 2.1 Hour Angle = 290°	WA-CL
V4STMOS (Dione)	+3 19 318/04:30	+3 39 318/04:49	34948:00 34948:34	Dione high resolution mosaic	NA-CL, VI, GR
APWGS4 (PRA and PWS)	+3 39 318/04:49	+3 42 318/04:52	34948:34 34948:37	2 PRA and 1 PWS frames	
VPHASE (Saturn Limb)	+3 41 318/04:51	+3 47 318/04:58	34948:36 34948:44	Lat = -40°, -52° centered on limb	WA-VI
RROCC (Ring occ.)	+3 48 318/04:59	+4 06 318/05:17	34948:45 34949:09	Ring occultaion using off-axis port	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
URCRS (Ring plane crossing)	+4h07m 318/05:18 ERT	+4h29m 318/05:40 ERT	34949:09 34949:37	3 scans, 1x9, 1 ifgm/pt, scan across rings	
VRSCRS (Ring plane crossing)	+4 30 318/05:41	+4 40 318/05:51	34949:38 34949:51	Image ring edge	WA-CL
Ring plane crossing	+4 34 318/05:45		34949:42		
VESTMOS I (Rhea)	+4 45 318/05:56	+5 33 318/06:44	34949:56 34950:57	3-color global mosaic	NA-CL, VI, GR WA-BL, VI, OR
USHYD (Rhea)	+5 34 318/06:45	+5 58 318/07:09	34950:58 34951:28	During XRSCAT and ASCAL S/C is moving	
Roll to Alhena	+5 58 318/07:09	+6 16 318/07:27	34951:28 34951:51	New reference star - Alhena	
VESIN (Iapetus)	+6 17 318/07:28	+6 20 318/07:31	34951:52 34951:56		NA-CL
VESTMOS II (Rhea)	+6 25 318/07:35	+7 18 318/08:28	34952:01 34953:07	Global mosaic, Image motion compensation last half	NA-CL WA-BL, VI, OR
RSDRK (Rhea)	+7 17 318/08:28	+7 20 318/08:32	34953:07 34953:12	2 points on dark Side of Rhea	
FSMAN (to Vega)	+7 20 318/08:32	+7 40 318/08:53	34953:12 34953:38		
WPGS4 (PWS)	+7 41 318/08:53	+7 45 318/08:55	34953:38 34953:41	1 PWS frame	
VTDEBRIS (Titan)	+7 47 318/08:56	+7 53 318/09:05	34953:41 34953:53	Titan debris search	NA-CL (Long exposure)
VRHIPHA (A-ring)	+7 54 318/09:05	+7 57 318/09:08	34953:54 34953:57	Saturn Radius = 2.12 Hour Angle = 110°	WA-CL
RRING (A-ring)	+7 54 318/09:08	+8 23 318/09:34	34953:57 34954:30	Slew starts 34953;39 Targeting: R_S/Hour angle R_S=2.1^S, HA= 22°^{S}, 3x3 mosaic 3 ifgm/pt	WA-CL
PPOPA (Saturn) (West limb)	+8 24 318/09:34	+8 56 318/10:07	34954:30 34955:11	Target: Lat/Viewing angle Lat=13° VW=-72.5° 2x10 mosaic, 2 ifgm/pt, 2nd Lat=+20°	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPOPA (Saturn) (Center)	+8h57m 318/10:08 ERT	+9h29m 318/10:40 ERT	34955:11 34955:52	Lat/Sub. S/C pt. Lat=13° 2x10 mosaic 2 ifgm/pt 2nd lat = +20°	
RPOPA (Saturn (East limb)	+9 29 318/10:40	+9 57 318/11:08	34955:52 34956:28	Lat/Viewing angle Lat = 13° VW=70° 2x6 mosaic 3 ifgm/pt 2nd Lat = +20°	WA-BL, OR
VRNGSCN (Rings)	+9 58 318/11:09	+10 47 318/12:07	34956:28 34957:41		VI, GR, WA-CL,
WPGS4 (PWS)	+10 57 318/12:03	+10 58 318/12:04	34957:36 34957:37	1 frame PWS high rate data	
RRING (C-ring)	+11 00 318/12:08	+11 11 318/12:21	34957:41 34957:59	Saturn Radius/Hour Angle SR = 1.4, HA = 25°	WA-CL
UPROR (Saturn)	+11 11 318/12:22	+11 54 318/13:05	34958:00 34958:54	2 scans 1x26, 1 ifgm/pt	
RPMOS (Saturn)	+11 55 318/13:05	+12 17 318/13:28	34958:54 34959:22	1x27 scan Lat = +10°, then goes north	
RPOPA (Saturn) (West limb)	+12 17 318/13:28	+12 43 318/13:54	34959:22 34959:55	Lat/Viewing angle Lat = 13°, VW = -69° 2x4 mosaic 4 ifgm/pt 2nd Lat = +20°	
RPOPA (Saturn) (Center)	+12 44 318/13:54	+13 09 318/14:20	34959:55 34960:28	Lat/Sub S/C Long Lat = 13° 2x4 mosaic 4 ifgm/pt 2nd Lat = +20°	
RPOPA (Saturn)	+13 10 318/14:21	+13 40 318/14:50	34960:28 34961:05	Lat/Viewing angle Lat=13°, VW 69° 2x4 mosaic 4 ifgm/pt 2nd Lat = +20°	BL
UPROR (Saturn)	+13 40 318/14:51	+14 22 318/15:33	34961:05 34961:59	2 scans, 1x26, 1 ifgm/pt	
VRETRNG (Rings)	+14 23 318/15:34	+14 55 318/16:06	34961:59 34962:40	Scan starting at SR = 1.4, ending at SR = 2.1	NA-CL WA-BL, CL, VI, OR, GR
WPGS4 (PWS)	+15 00 318/16:11	+15 01 318/16:12	34962:45 34962:46	1 frame PWS	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RRPHA (A & B rings)	+14^{h}56^m 318/16:07 ERT	+15^{h}16^m 318/16:20 ERT	34962:21 34962:58	R_s/Hour angle R_s=2.15, HA=315° one increm. slew	WA-CL
RRPHA (A & B rings)	+15 10 318/16:21	+15 16 318/16:27	34962:58 34963:06	R_s/Hour angle R_s=1.75, HA=129°	WA-BL, BL
RSRHE (Rhea)	+15 17 318/16:28	+15 31 318/16:42	34963:07 34963:25	1x8 scan 2 figm/pt	NA-CL, VI, BL, OR
RPMOS (Saturn) (North pole)	+15 33 318/16:44	+16 07 318/17:18	34963:27 34964:09	1x7 scan, 3 ifgm/pt, at north pole	NA-CL, GR, UV, VI, BL OR WA-CL, VI, GR, OR, BL
UPROR (Saturn)	+16 07 318/17:18	+16 54 318/18:05	34964:10 34965:09	2 scans, 1x26 1 ifgm/pt	NA-CL WA-CL
WPGS4 (PWS)	+16 54 318/18:05	+16 56 318/18:07	34965:09 34965:11	1 PWS frame	
VTPHASE (Titan)	+16 56 318/18:06	+17 02 318/18:13	34965:10 34965:19		NA-VI, GR
VPRETMOS (Saturn)	+17 03 318/18:14	+18 07 318/19:18	34965:20 34966:40	6x12 retargetable mosaic, 7 ifgm/pt	NA-GR WA-VI, GR, OR, CH_4
RPMOS (Saturn) (East Limb)	+18 08 318/19:18	+18 42 318/19:53	34966:40 34967:24	Lat/Viewing angle Lat=70°, VW = 65° 1x7 scan, 5 ifgm/pt	NA-CL, GR, UV, VI, OR WA-CL, VI, GR, OR, BL
WPGS4 (PWS)	+18 43 318/19:54	+18 44 318/19:55	34967:25 34967:26	1 PWS frame	
UPROR (Saturn)	+18 45 318/19:54	+19 33 318/20:44	34967:25 34968:28		
RPMOS (Saturn) (West limb)	+19 34 318/20:45	+20 03 318/21:13	34968:28 34969:04	Lat/Viewing angle Lat=70°, VW=-65° 1x5 scan, 7 ifgm/pt	
RPMOS (Saturn) (North pt., not North Pole)	+20 03 318/21:13	+20 32 318/21:43	34969:04 34969:41	Lat/Sub S/C Long Lat=70°	
RPMOS (Saturn) (Mid-latitude mosaic)	+20 32 318/21:43	+21 12 218/22:40	34969:41 34970:51	7x7 mosaic 1 ifgm/pt, sit 20 frames at last point	
WPGS4	+21 12 318/22:30	+21 21 318/22:31	34970:40 34970:41		

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
REFERENCE STAR IS VEGA					
Titan Slew	+21^{h}29^m 318/22:39		34970:52	Center of Titan for UVS	
FSMAN (Rolls and yaws)	+21 36 318/22:46	+23^{h}28^m 319/00:40	34971:00 34973:21	2 rolls 2 yaws	
WPGS4 (PWS)	+23 35 319/00:45	+23 36 319/00:46	34973:29 34973:31	1 frame	
VRETRNG (Rings)	+23 33 319/00:43	+23 51 319/01:01	34973:27 34973:39 34973:48	IRIS on A-ring IRIS straddling Casini Division touching Saturn	NA-Clear WA,CL
VRETRNG (Rings)	+23 51 319/01:01	+1^{d}00^{h}15^m 319/01:24	34973:49 34974:18	1x5 scan along A-ring, 6 ifgm/pt	NA-CL WA-OR, BL, GR, CL
RRPHA (A ring)	+1^{d}00 15 319/01:25	+1 00 22 319/01:32	34974:19 34974:28	R_s/Hour angle R_s = 2.1, HA = 135°	WA-CL, GR
VPRETMOS (Saturn)	+1 00 22 319/01:32	+1 00 43 319/01:53	34974:28 34974:53	2x2 mosaic, centered at Lat = 5°, Long = 280°	NA-GR WA-BL, VI, OR, CH_4
VPRETMOS (Saturn)	+1 00 43 319/01:53	+1 01 08 319/02:18	34974:54 34975:24	2x2 mosaic, centered at Lat = 5°, Long = 280°	NA-GR WA-BL, VI, OR, CH_4
OPNAV DIONE	+1 01 09 319/02:19	+1 01 21 319/02:30	34975:26 34975:41	Targeted RA/DEC	NA-CL
OPNAV RHEA	+1 01 22 319/02:32	+1 01 31 319/02:40	34975:42 34975:53	Targeted RA/DEC	NA-CL
WPGS4 (PWS)	+1 01 33 319/02:43	+1 01 35 319/02:45	34975:57 34975:59		
RSAPE VESGN (Iapetus)	+1 01 39 319/02:49	+1 01 13 319/04:23	34976:04 34978:01	2 mosaics, 1st is 4, ifgm/pt; 2nd is 1 ifgm/pt. IRIS centered	NA-OR, GR, UV, VI, BL, CL
RPAXS (Dark rings)	+1 03 15 319/04:25	+1 03 48 319/04:58	34978:04 34978:45	2 PRA and 1 PWS frames, scan in dark rings, 18 pts, 2 ifgm/pt. 5 frames deep space off A-Ring	
RPRET (Saturn)	+1 03 50 319/05:00	+1 04 31 319/05:41	34978:47 34979:38	1x13 scan, 4 ifgm/pt., west to east scan Lat = +13°	WA-VI, CL

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPRET (Saturn)	+1 d 04 h 31 m 319/05:41	+1 d 05 h 13 m 319/06:23	34979:39 34980:31	1x13 scan, 4 ifgm/ pt, west to east scan Lat = +20°	
RPRET (Saturn)	+1 05 14 319/06:24	+1 05 55 319/07:05	34980:33 34981:24	1x13 scan, 4 ifgm/ west to east scan Lat = 30°	
WPGS4 (PWS)	+1 05 55 319/07:05	+1 05 56 319/07:06	34981:24 34981:26		
RPN/S (N/S Map)	+1 05 58 319/07:08	+1 16 31 319/17:37	34981:28 34988:03 34994:35	Nested scans, 1x15 followed by 1x13, repeat 14 times nested scans, 1x12 only, repeat 32 times	
WPGS4 (PWS)	+1 16 28 319/17:39	+1 16 30 319/17:40	34994:36 34994:38		
VRNGMS (rings)	+1 16 31 319/17:41	+2 00 46 319/01:56	34994:39 35004:57	Narrow angle mosaic of entire illuminated ring plane	NA-CL WA-VI, GR, OR, BL, CL
VGSTLON (Iapetus)	+2 00 48 320/01:58	+2 01 24 320/02:35	35005:00 35005:45	Mosaic, 9 positions, 4 ifgm/pt, IRIS centered	NA-VI, BL, OR, UV, CL WA-CL
RPAXS (Saturn)	+2 01 30 320/02:40	+2 02 04 320/3:14	35005:51 35006:34	2 PRA and 1 PWS frames Saturn integration, Lat = +40°	
UPROR (Saturn)	+2 02 04 320/03:14	+2 02 56 320/04:06	35006:35 35007:39	2 VLO scans across Saturn's North pole in dark	
RP7CO (in light) (Left, B-ring)	+2 02 57 320/04:07	+2 04 06 320/04:41	35007:41 35008:23	Saturn Radius/Hour Angle SR = 1.73 HA = 309° in lighted B-ring, drift	WA-BL, CL, GR,
RP7CO (in dark) (Left, B ring)	+ 2 03 31 320/04:41	+2 04 06 320/05:16	35008:24 35009:07	Saturn Radius/Hour angle SR= 1.73 HA = 343° In dark B-Ring, drift	WA-BL, CL, GR
RP7CO (right, B-ring)	+2 04 16 320/05:26	+2 04 34 320/05:44	35009:20 35009:42	Saturn Radius/Hour Angle SR = 1.73, HA = 140°, drift	NA-CL, WA-CL
RP7CO (right, B-ring)	+2 05 32 320/06:42	+2 06 20 320/07:30	35010:55 35011:55	Saturn Radius/Hour Angle SR = 1.73 HA = 140°, 7X4 scan, 18 ifgm/pt.	NA-BL, OR, VI, CL WA-BL, GR, CL

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RP7CO (Saturn-N. Pole	$+2^d06^h21^m$ 320/07:31	$+2^d07^h10^m$ 320/08:20	35011:56 35012:57	Lat/Sub S/C Long Lat = 77°, 1x3 scan, 30 ifgm/pt	WA-GR
RP7CO (Saturn-N. Pole	+2 08 10 320/09:20	+2 08 27 320/09:38	35014:13 35014:34	Lat/Sub S/C long Lat = 71.78°, 1x3 scan, 10 ifgm/pt	
RP7CO (Saturn-S. pole	+2 08 28 320/09:38	+2 09 27 320/10:38	35014:35 35015:49	Lat/Sub S/C Long, Lat = -23.45° 1x7 scan, 12 ifgm/pt	NA-CL WA-BL, CL, VI, OR, GR
RP7CO (Saturn-west limb)	+2 09 28 320/10:38	+2 09 47 320/10:47	35015:50 35016:14	Lat/Viewing Angle, lat = 11.2, VW = -51.30° 1x3 scan, 12 ifgm/pt	
RP7CO (Saturn-west limb)	+2 10 46 320/11:56	+2 11 33 320/12:43	35017:27 35018:26	Lat/Viewing angle Lat = 9.92°, VW = -54.76°, 1x5 scan 12 ifgm/pt	NA-CL WA-CL
RP7CO (Saturn-Center)	+2 11 33 320/12:44	+2 12 05 320/13:15	35018:27 35019:07	Lat/Sub S/C long, Lat = 12.9, 1x4 scan, 12 ifgm/pt	NA-CL WA-BL
RPE/W (E/W Map)	+2 12 06 320/13:16	+2 15 49 320/16:59	35019:07 35023:46	Center of planet with offsets 9x10 mosaic, 3 ifgm/pt	NA-GR, WA-BL, CH_4 VI, OR
WPSS4 (PWS)	+2 15 51 320/17:01	+2 15 52 320/17:02	35023:49 35023:51	1 frame PWS	
RP7CO (Saturn-center)	+2 15 50 320/17:00	+2 16 18 320/17:28	35023:47 35024:22	Lat/Sub S/C Long Lat = 12.64°, drift	
RP7CO (Saturn-east limb)	+2 16 18 320/17:28	+2 17 23 320/18:33	35024:23 35025:43	Lat/Viewing Angle Lat = 32°, VW = 35.52°, 1x7 scan, 12 ifgm/pt	NA-BL, VI, GR WA-BL, VI, OR, CH_4
WESTLON (Iapetus)	+2 18 13 320/19:23	+2 18 50 320/20:00	35026:46 35027:33	Center of Iapetus centered for IRIS Drift	NA-VI, BL, OR GR, UV, CL, WA-CL
RPE/W (E/W Map)	+2 18 54 320/20:04	+2 22 39 320/23:49	35027:37 35032:18	Center of Planet, with offsets 9x10 mosaic 3 ifgm/pt	NA-GR WA-GR, BL, CH_4, VI, OR
TPHASE (Titan)	+2 22 40 320/23:49	+2 22 52 321/00:02	35032:20 35032:35	Center of Titan centered for IRIS drift	NA-VI, GR

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPAXS (Saturn)	$+3^d01^h08^m$ 321/02:18	$+3^d01^h40^m$ 321/02:50	35035:25 35036:06	2 PRA and 1 PWS frames, Saturn integration, Lat = +45°	
RPE/W (E/W Map)	$+3^d01^h41^m$ 321/02:51	+3 05 20 321/06:30	35036:06 35040:40	Center of planet, with offsets 9x10 mosaic 3 ifgm/pt	NA-GR WA, BL, CH_4
V8STLON	+3 05 23 321/06:33	+3 06 02 321/07:12	35040:44 35041:32	Center of Iapetus Centered for IRIS drift	NA-BL, OR, GR, UV, CL, VI WA-CL
V8STLON (Iapetus)	+4 01 36 322/02:46	+4 02 16 322/03:26	35066:01 35066:50	Center of Iapetus centered for IRIS drift	NA-VI, BL, OR, UV, CL WA-CL
RPAXS (Saturn)	+4 02 19 322/03:29	+4 02 56 322/04:06	35066:54 35067:40	2 PRA and 1 PWS Frames, Saturn integation, Lat = +45°	
RPAXS (Saturn)	+5 01 34 323/02:44	+5 02 09 323/03:19	35095:58 35096:42	2 PRA and 1 PWS frames, Saturn integration, Lat = +39°	
RPAXS (Saturn)	+6 01 32 324/02:42	+6 02 09 324/03:18	35125:55 35126:41	2 PRA and 1 PWS frames, Saturn integration, Lat = +39°	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VPMOS	$6^d09^h18^m07^s$	$6^d22^h45^m57^s$	35135:38 35152:28	2x2's w/scan departures in North Hemisphere	NA-CL, VI, GR, BL WA-CL, GR, BL
RPAXS	6 22 46 17	6 23 37 09	35152:28 35153:32	+45° Lat	NA-VI, GR, BL WA-BL, CL, BR
VPMOS	7 06 37 42	7 20 05 57	35162:17 35179:08	+45° Lat w/scan departures	NA-VI, GR, BL WA-BL, CL, BR
RPAXS	7 20 06 16	7 20 44 21	35179:08 35179:56	+45° Lat	
VPMOS	8 03 20 50	8 19 22 18	35188:11 35208:13	+45° Lat W/ departures	NA-CL, VI, GR, BL WA-BL, CL, GR
RPAXS	8 19 22 18	8 20 13 09	35208:13 35209:17	Center of planet	
RPIRC	9 11 03 00	9 14 21 09	35227:49 35231:57	+45° Lat	
RPIRC	10 10 40 44	10 11 31 33	35258:25	+45° Lat	
RCAL (RPIRC)	11 05 58 35	11 09 33 09	35281:28 35286:57	+45° Lat	
RCAL (Adj. Deep Space)	11 09 39 56	11 10 33 09	35286:05 35287:12		
RCAL (Target Plate)	11 10 39 25	11 14 13 09	35287:19 35291:47		
RPAXS	11 14 22 52	11 18 32 21	35291:59 35297:11	+45° Lat	
RPAXP	12 05 18 24	12 12 16 21	35310:38 35319:21	Center	
RPAXP	13 07 48 00	13 12 17 09	35343:45 35349:22	Center	
RPAXP	14 07 24 49	14 12 03 33	35373:16 35379:05	Center	
RPAXP	15 07 11 17	15 11 58 45	35402:59 35408:59	Center	
RSPAC	16 07 04 19	16 08 25 09	35432:50 35434:32	Center	
RHSUN	16 08 26 13	16 09 23 09	35434:33 35435:44	With off axis port	
RPAXP	16 09 24 12	16 11 54 45	35435:45 35438:54	Center	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPAXP	$17^d07^h02^m30^s$	$17^d11^h49^m57^s$	35462:48 35468:48	Center	
RPAXP	18 06 57 42	18 11 47 33	35492:42 35498:46	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR, WA-CL
RPAXP	19 07 04 07	19 11 39 33	35522:50 35528:35	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR WA-CL
RPAXP	20 07 29 44	20 11 34 45	35553:22 35558:29	Center	
RPAXP	21 06 55 20	21 11 29 57	35582:39 35588:23	Center	
RPAXP	22 06 50 32	22 11 29 57	35612:33 35618:23	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR NA-CL
RHSUN	23 06 56 56	23 07 53 09	35642:41 35643:52	With off axis port	
RPAXP	23 07 56 03	23 11 25 09	35643:55 35648:17	Center has VPMOOZ following: IRIS centered	NA-VI, BL, GR NA-CL
RPAXP	24 06 41 44	24 11 21 09	35672:22 35678:12	Center has VPMOOZ folloinwg; IRIS centered	NA-VI, BL, GR, NA-CL
RPAXP	25 06 37 44	25 11 16 21	35702:17 35708:06	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR, NA-CL
RPAXP	26 06 32 56	26 11 11 33	35732:11	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR, NA-CL
RPAXP	27 06 28 08	27 11 06 45	35762:05 35767:54	Center has VPMOOZ following; IRIS centered	NA-VI, BL, GR, NA-CL
RHSUN	28 06 37 51	28 07 33 09	35792:17 35793:27	Uses off axis Chablis	
RPAXP	28 07 44 29	28 11 02 45	35793:41 35797:43	Center has VPMOOZ following; IRIS centered	
RPAXP	29 11 01 56	29 12 05 09	35827:47 35829:07	Center. Has VPMOOZ following; IRIS centered	NA-VI, BL, GR, WA-CL
RPAXP	31 10 52 21	31 11 55 33	35887:39 35888:55	Center. Has VPMOOZ following; IRIS centered	NA-VI, BL, GR WA-CL

ASSI OBSERVATIONS - SCIENCE OBJECTIVES
[Listed in Chronological Order]

VTMOS1/RTIRC VTMOS2 VTMOS3	-Titan imaging mosaic/IRIS composition study. -High resolution imaging with global coverage ranging from entire illuminated disk to specified regions. -Mapping of Titan's atmosphere (and possibly the surface) to provide information for photometric and morphological studies.
RTIRC:	-IRIS obtains composition, atmospheric dynamics and temperature information.
V4S4N	-High resolution longitude coverage of Dione.
V2S3N	-High resolution longitude coverage of Enceladus.
V5S1N	-High resolution longitude coverage of Rhea.
OPNAVs	-Optical navigation frames of satellites to provide accurate ephemeris data .
UTBLM1/2	-UVS-Titan bright limb observation. -Study of the hydrogen distribution around Titan to determine its escape pattern. -Measures altitude profile of Titan's atmospheric constituents. -Includes support imaging.
RTCOM	-IRIS-Titan limb and polar study. -Data will provide load composition, high altitude temperature information and vertical distribution of minor constituents. -RTCOM covers the south limb, west limb, east limb, north pole. -Combined with RTWOC - local hour angle coverage for atmospheric wave investigation; covers north and south pole.
RTSAT	-UVS obtains north pole measurements. -IRIS atmospheric scans tangent to Titan's limb. (i) Determination of the vertical extent of the atmosphere, and (ii) Determination of the relative mixing ratios of trace constituents.
UTOCC Ingress Egress	-UVS Titan-Sun occultation measurement. -Obtains altitude profile of Titan's atmosphere and its constituents. -Includes support imaging.
VTPHASE	-ISS-Titan phase angle study to define and determine specific particle characteristics of Titan's atmosphere such as: (i) Aerosol-to-methane mixing ratio as a function of height. (ii) Spatial variation of particle properties. (iii) Height above the surface of the stratospheric layer. (iv) Variation of aerosol number density within altitude.

VRNGSCN/RRPHA	-Narrow-angle ring imaging. -High resolution radial scans across the west ring ansa and across the rings at Saturn's sub-spacecraft longitude. -Observations of the unilluminated ring ansa provides the opportunity to search for surface in homogeneities. -Sub-spacecraft scan provides transmission of Saturn's "light" through the rings. -IRIS obtains ring phase angle data.
RRPHA	-IRIS ring phase angle coverage. -Data will assist evaluation of ring opacity and rotation states of relatively large ring particles.
V1SSN	-High resolution longitude coverage of Mimas.
RP2X2	IRIS high resolution Saturn 2x2 mosaic.
V3SSN	-High resolution longitude coverage of Tethys.
RRCCO	-IRIS C-ring colling study via a circumferential ring scan at high emission angles to detect particle sizes in the 01-1 cm range.
RPFEA	-IRIS planetary feature mosaic. -Obtains high resolution coverage at both the poles and the equatorial region. -Integration on 3 points, 2 of which are at the same emission angle, 2 of which are at the same latitude.
V12NEW	-Longitude coverage of S12-2 Dione-Trojan satellite.
VRENCKE	-Radial scan across Encke's Division. -High resolution imaging of the F-ring, A-ring edge, and of the area in and around Encke's Division. -IRIS obtains RRPHA data.
UPBLM	-UVS-Saturn bright limb observation. -Measures the altitude profile of atmospheric constituents through airglow emissions.
VRCASS	-Radial scan across Cassini's Division. -High-resolution imaging of the area in and around Cassini's Division on the unilluminated side of the ring plane. -Search for ring surface in homogeneities. -Multi-color wide angle coverage of the area. -IRIS obtains RRPHA data.
RPIRN	-IRIS terminator-study via the south polar region scan.
V11NEW	-Longitude coverage of "S-11", the other of the co-orbiting satellites.
UP*OCC	-UVS-Saturn/Star occultation measurement. -Maps CH_4 density versus altitude on Saturn. -Drift covers region from 3000 km off the bright limb to 1000 km on the planet.
RSECL	-IRIS-Rhea eclipse observations. -Obtain data on thermophysical properties as well as layer thickness of the satellite.
V1MOS	-High-resolution multi-spectral coverage of Mimas.
RRCOLD	-IRIS measurement of C-ring in the dark.

IRIS obtains RTIRC data

UTROR	-UVS-Titan auroral search.
V4S1N	-High resolution longitude coverage of Dione.
V5S1N	-High resolution longitude coverage of Rhea.
R5RHE	-IRIS-Rhea phase angle and composition measurements.
V5S5N	-High resolution longitude coverage of Rhea.
VPRET	-ISS retargetable mosaics.
	-Observations of specific regions on Saturn's desk of dynamic, colorimetric and/or morphological interest.
UPHASE	-UVS-Saturn phase angle coverage.
	-Determination of hydrogen and helium abundance, mixing, ratio, and temperature.
RPEOE	-IRIS obtains data on Earth occultation exit point. Used to determine atmospheric composition by comparing with IRIS temperature profile.
VPHASE	-Saturn-phase angle coverage.
	-Study of specific emission particle characteristics of Saturn's atmosphere.
	-Aerosol-to-methane mixing ratio as a function of height in the atmosphere .
	-Spatial variation of particle properties, height above the surface of stratospheric aerosol layer, variation of aerosol number density with altitude.
V1S6N	-High-resolution longitude coverage of Mimas.
RRCR1	-IRIS integration in the C-ring to determine ring composition opacity, temperature and particle size (if in 10u range).
	-Phase angle study with focus on high emission angles.
	-Optical density studies.
V2S1N	-High resolution longitude coverage of Enceladus.
V4S6N	-High resolution longitude coverage of Dione.
R4DIO	-IRIS phase angle/composition study of Dione.
V1ONEW	-Longitude coverage of "S-10", one of the co-orbital satellites.
V1S1N	-High resolution longitude coverage of Mimas.
VRWSN	-Wide-angle ring scan.
	-WA multi-color imaging to provide photometric and exposure information about the unilluminated rings.
V2S6N	-High resolution longitude coverage of Enceladus.
R2D2	-IRIS composition/phase angle coverage of Enceladus.
V1S6N	-High resolution longitude coverage of Mimas.
VPSHAD	-Saturn imaging through ring shadow.
	-Determination of optical transmission characteristics of the ring.
	-Observation of atmospheric disturbances caused by the outline of the shadow.
V4S1N	-High resolution longitude coverage of Dione.
V2S1N	-High resolution longitude coverage of Enceladus.
V1S1N	-High resolution longitude coverage of Mimas.
R1MIM	-IRIS phase angle/composition study of Mimas.

A552 OBSERVATIONS - SCIENCE GOALS
[Listed in Chronological Order]

FSMAN	-Fields and particles maneuver. -Acquires information on plasma flow and particle fluxes in the directions other than normally viewed by the fixed body fields and particle instruments. -Roll only.
VRHIPHA	-Imaging of rings at high phase angles to characterize particle size.
WPGS4	-1' high rate data for PWS. -Permits acquisition of high-frequency and high time resolution data not ordinarily obtained via the low rate data.
UPHOCC	-UVS-Sun occultation measurements. -Identification of major atmospheric constituents and their altitude profiles.
VRDSCAT	-To ascertain existence of D-ring by looking for forward scatterings by small particles in those regions.
VRESCAT	-Same as VRDSCAT, only in the E-ring region.
RRCCD	-Studies C-ring cooling via a circumferential ring scan at high emission angles to detect particle sizes in 01-1cm range.
RRCAS	-Provides data on absorption in the Cassini Division via north-south scans. -Observes Cassini's division using the planet as a warm background.
UPDRK	-UVS-darkside observations of Saturn. -Search for aurora and investigation of Pioneer 11 observations of enhanced polar emission.
RROCC	-IRIS-Sun/ring occultation calibration.
V4STMOS	-High-resolution multi-spectral coverage of Dione.
APWGS	-Cyclic combining 2' high-rate data for PRA and 1' high-rate data for PWS. -Provides high frequency and high time resolution data not obtained via low-rate data.
VPHASE	-Saturn Phase/Emission angle observation. -Study of specific particle characteristics of Saturn's atmosphere. -Aerosol-to-methane mixing ratio as a function of height in the atmosphere. -Spatial variation of particle properties height above the surface of stratospheric aerosol layer, variation of aerosol number density with altitude.
URCPS	-UVS-ring plane crossing observation. -Measurement of hydrogen distribution by using shadow of planet and shadow of rings as emission boundaries.
VRCPS	-Search for optically thin ring off the edge of the F-ring during ring-plane crossing in a region unable to be explored via ground-based observation.
V5STMOSI/II	-High-resolution multi-spectral coverage of Rhea. -Mosaic utilizes image motion compensation to reduce smear.
USHYD	-UVS search for hydrogen near Rhea.
V8S1N	-High-resolution longitude coverage of Iapetus.
R5DRK	-IRIS integration on dark side of Rhea.

VTDEBRIS	-ISS search for Titan-ring/debris.
RPOPA	-IRIS opacity measurements. -Observation of the thermal structure and vertical distribution in both local time and across a belt/zone interface. -Covers west/east limbs and center of Saturn.
VRNGSCN	-High-resolution radial scans across the west ring ansa and across the rings at Saturn's sub-spacecraft longitude. -Observations of unilluminated ring ansa provides the opportunity to search for surface inhomogeneities. -Sub-spacecraft scan provides transmission of Saturn's "light" through the rings.
UPROR	-UVS-Saturn auroral search. -Measurements of air glow emission from polar regions; and north/south symmetry. -Determination of altitude profile of emitting species and excitation mechanisms.
VRETRNG	-ISS "retargetable" ring observations. -High resolution imaging of the illuminated ring plane within the orbit of Mimas. -Regions selected on the basis of dynamic, colorimetric, and/or morphological interest. -Provides opportunity to search for inner satellites.
RRPHA	-IRIS ring phase angle coverage. -Data to assist in the evaluation of ring opacity and rotation states of relatively large particles.
RSRHE	-IRIS-Rhea phase angle/composition measurements.
RPMOS	-IRIS high resolution planetary equatorial mosaics. -Observes variations in latitude and emission angles on the north polar region.
VTPHASE	-ISS phase angle observations of Titan. -To define and determine specific particle characteristics of Titan's atmosphere such as: i) aerosol-to-methane mixing ration as a function of height. ii) Spatial variation of particle properties. iii) Height above the surface of the stratospheric layer. iv) Variation of aerosol number density within altitude.
VPRETMOS	-ISS retargetable planetary mosaics. -Observations of specific regions on Saturn's disk of dynamic, colorimetric and/or morphological interest.

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM
Voyager-LH-81-13

May 14, 1981

TO: IRIS Team

FROM: Linda Horn

SUBJECT: VOYAGER 2 SATURN ENCOUNTER LINK LISTS AND PLOTS

This package includes link lists for the CCS loads pertinent to IRIS and graphics for loads B525, B551, and B571. These loads cover the time period which includes the inbound north/south map and the outbound north/south map.

These designs will be the subject of discussions at the IRIS Team meeting scheduled for Tuesday, May 26, at the Goddard Space Flight Center in Dr. Rudolf Hanel's office. An agenda is attached for your information.

Please critically review these designs and return comments to me by the end of June. I hope you like what you see!

LH:kb
Attachments
cc: B. Conrath
D. Cruikshank
M. Flasar
R. Hanel
S. Kumar
V. Kunde
J. Pearl
J. Pirraglia
B. Samuelson
P. Schenk

B503

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RCFOH	$-37^{d}21^{h}28^{m}$	$-37^{d}21^{h}27^{m}$	42863:41	Flash-off heater off	
	200/07:12	200/07:13	42868:42	Replacement heater on	
RCFOH	-37:07:29	-27:07:28	42886:16	Replacement heater off	
	200/21:16	200:21:17	42886:17	IRIS on	
		B521			
RCFOH	-24:22:40	-22:22:40	43257:19	IRIS off	
	213/06:09	213/06:10	43257:20	Flash-off heater on	
		B523			
RCFOH	-14:17:04	-14:17:03	43564:18	Flash-off heater off	
	223/11:45	223/11:46	43564:19	Replacement Heater on	
RCFOH (IRIS on)	-14:07:25	-14:07:24	43576:23	Replacement heater off	
	223/21:25	223:21:26	43576:24	IRIS on	
RHSUN (SUNCAL)	-13:23:44	-13:22:51	43585:58	Near Sun, Sun +1.7° Elev.	
	224/05:06	224/05:59	43586:37	IRIS on Sun	
			43586:56	Near Sun, Sun +1.7° Elev.	
			43587:05	End SUNCAL	
RPIRC (Saturn)	-13:22:37	-13:19:22	43587:21	On Saturn, above rings	none
	224/06:12	224/09:27	43591:26		
RCAL (Warm, dark target plate)	-13:19:05	-13:15:34	43591:47	EL=101.58, AZ=-3.23	
	224/09:44	224/13:15	43596:10	On dark target plate	

5/26/81

B525 (2nd Load in FE-2)

Load Summary:

1. Boundaries: Start $-3^d\ 20^h\ 31^m\ 04^s$
   81-234/06:53:35

   End $-15^h\ 41^m\ 28^m$
   81-237/11:43:11

   Duration is $3^d\ 4^h\ 50^m$

2. Reference Star: From start of load to $-1^d\ 11^h\ 57^m\ 37^s$ - Canopus
   From $-1^d\ 11^h 57^m 37^s$ to end of load - Miaplacidus

3. Saturn, satellite and ring observations plus a manuever form the basis of B525. Significant events of B525 include a ring spoke movie (13^h duration), the North/South Map (1 rotation) and a -340° roll (FSMAN1). Titan closest approach is also in this load at $-17^h 30m$ at a range of 665,000 km.

Potential Sequence Change Requests:

1. Add a scan call to each of the RR7CO observations to maintain pointing in each of the targeted rings.

2. Modify replacement strip No. 1 to fill gore in N/S Map. (This work has already been done by the SSD.)

3. Retarget IRIS's lone retargetable observation ($-19^h\ 19^m$).

AVAILABLE WORDS FOR UPDATE: 155

Observ longer than 20 min

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	$-3^d07^h57^m$	$-3^d7^h38^m$	43905:42 43906:06	Center of Saturn	None
RP7CO (Saturn-West Limb)	-3:00:52	-2:23:52	43914:33 43915:49	LAT/Viewing Angle Lat=15°, VW=-50°	NA,WA
RP7CO (Saturn-Center)	-2:21:01	-2:19:47	43919:22 43920:54	Lat/Sub S/C Long Lat=10°	NA, WA
RP7CO (Saturn-East Limb)	-2:19:47	-2:18:47	43920:54 43922:10	Lat/Viewing Angle Lat=15°, VW=50°	NA, WA
RP7CO (Saturn-South Pole)	-2:18:46	-2:17:46	43922:10 43923:26	Lat/Sub S/C Long Lat=-40°	NA, WA
RP7CO (Saturn-North Pole)	-2:17:45	-2:16:45	43923:26 43924:42	Lat/Sub S/C Long Lat=65°	NA, WA
RR7CO (B-Ring)	-2:12:11	-2:11:01	43930:25 43931:52	Saturn Radius/Hour Angle SR=1.7, LHA=101°	NA, WA
RR7CO (A-Ring)	-2:10:41	-2:09:34	43932:16 43933:41	Saturn Radius/Hour Angle SR=2.15 LHA=101°	NA, WA
RR7CO (C-Ring)	-2:08:13	-2:07:04	43935:21 43936:48	Saturn Radius/Hour Angle SR=1.4 LHA=101°	
RPN/S (Saturn Replacement Strip #1)	-2:00:04	-1:23:16	43945:33 43946:33	Lat/Sub S/C Long Lat=80°	WA
RPN/S (Saturn-Replacement Strip#2)	-1:20:39	-1:19:55	43949:49 43950:45	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn-Part 1)	-1:19:09	-1:13:20	43951:42 43958:59	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn Part 2)	-1:12:37	-1:09:51	43959:52 43963:20	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn Part 3)	-1:09:14	-1:07:18	43964:05 43966:31	Lat/Sub S/C Long Lat= 80°	WA

Voyager 1

Days	FDSC Start	FDSC Finish	Tape Id.	File #	# of Records
296-296	34299.00	34311.59	VGR301	1	733
296-297	34312.00	34341.59	"	2	1799
297-298	34342.00	34372.59	VGR302	1	1852
298-299	34373.00	34401.59	"	2	1856
299-300	34402.00	34431.59	VGR303	1	1792
300-301	34432.00	34461.59	"	2	1798
301-302	34462.00	34491.59	VGR304	1	1754
302-303	34492.00	34521.59	"	2	1657
303-304	34522.00	34551.59	VGR305	1	1797
304-305	34552.00	34581.59	"	2	1786
305-306	34582.00	34611.59	VGR306	1	1789
306-307	34612.00	34641.59	"	2	1781
307-308	34642.00	34671.59	VGR307	1	1790
308-309	34672.00	34701.59	"	2	1738
309-310	34702.00	34731.59	VGR308	1	1782
310-311	34732.00	34761.59	"	2	1773
311-312	34762.00	34792.59	VGR309	1	1543
312-313	34793.00	34821.59	"	2	1575
313-314	34822.00	34851.59	VGR310	1	1786
314-315	34852.00	34881.59	"	2	1798
315-316	34882.00	34911.59	VGR311	1	1785
316-317	34912.00	34941.59	"	2	1668
317-318	34942.00	34945.11	VGR312	1	160
318-318	34945.12	34970.58	"	2	1344
318-319	34971.00	35001.59	VGR313	1	1716
319-320	35002.00	35032.79	"	2	1828
320-321	35033.00	35062.59	VGR314	1	1793
321-322	35063.00	35091.59	"	2	1735
322-323	35092.00	35122.59	VGR315	1	1839

Voyager 2

Days	FDSC Start	Finish	Tape Id.	File #	# of Records
225-227	43639.00	43700.59	VGR401	1	3666
227-229	43701.00	43759.59	VGR402	1	3530
229-231	43760.00	43820.59	VGR403	1	3446
231-232	43821.00	43848.59	VGR404	1	1642
232-233	43849.00	43875.59	VGR404	2	1605
233-235	43876.00	43931.59	VGR405	1	3345
235-237	43932.00	43991.59	VGR406	1	3461
237-239	43992.00	44058.57	VGR407	1	3539
239-242	44059.00	44125.59	VGR408	1	3967
242-244	44126.00	44208.59	VGR409	1	4904
244-246	44209.00	44268.59	VGR410	1	3562
246-247	44269.00	44284.07	VGR411	1	903

APPENDIX D

REDUCED DATA RECORD (RDR) TAPE DESCRIPTION AND FORMAT

Each standard magnetic tape contains complete IRIS records (header and data) in ascending FDSC order. All records can be read using a standard IBM FORTRAN unformatted READ statement:

```
DIMENSION RECORD(2894)
READ (1) RECORD
```

The first 500 bytes of each record are the header information, which is a mix of full-word real values, full and half-word integers, and individual bytes. The remaining 11,076 bytes are radiance data as a function of wavenumber, and are all full-word, real values.* A full-word is four bytes (32 bits).

The following illustrates graphically an IRIS RDR record:

```
<-----------------------------11,576 Bytes---------------------------->

<---500 Bytes--->|<-------------11,076 Bytes---------------------------->

<---125 Words--->|<------------ 2,769 Words---------------------------->

<----Header----->|<------------Radiance Values------------------------->
                          (in ascending wave number order)
```

*NOTE: Positional data for ring pointing were added at the end of each record and occupy bytes 11505 - 11576. The radiances written over to accommodate this data contained radiances far below the noise level (at $\sim$ 4000 cm^{-1}) to be useful.

The physical tape description and corresponding IBM JCL is given in Table D1.

Table D1. RDR Tape Description

		IBM JCL
Tracks:	9	Unit = 9TRACK
Density:	6250 BPI	Den = 4
Label:	No Label	Label = (,NL)
Parity:	Odd	
Record Format:	Blocked, Variable Length*	RECFM = VBS
Record Size:	11,580 Bytes**	LRECL = 11580
Block Size:	11,584 Bytes***	BLKSIZE = 11584

*Although the record format specifies variable length records, all records on a tape are the same length (record size). VBS format was used to conform to IBM FORTRAN unformatted READ/WRITE requirements.

**Includes standard IBM 4 byte segment descriptor word.

***Includes standard IBM 4 byte block descriptor word.

The contents of an RDR record are described in Table D2. The column headings are:

Column 1:	Field Number	a consecutive numbering of field quantities for reference.
Column 2:	Byte Location	contains the relative byte number of each word in the header
Column 3:	Format	contains the FORTRAN descriptor for the format of each word, e.g., R*4 = real four byte variable.
Column 4:	FI-SEDR Word	contains the origin of the navigation data from the fixed instrument SEDR data. NOTE: None of these data was placed into the IRIS header.
Column 5:	SP-SEDR Word	contains the origin of the navigation data from the Scan Platform SEDR data. These words are referenced in Appendix E.
Column 6:	Description	a description of the field quantities.

The abbreviations used in Table D2:

HK = Housekeeping.

IFM = Interferogram

PB = Picture Body. The body (planet or satellite) that the IRIS instrument is pointing at at the time of observation.

CB = Central Body. The planetary body at the center of the planet-moon system (i.e., Jupiter, Saturn).

Q5 = Defines intercept point of center of IRIS field of view with surface of target body. If the instrument is pointed off the limb (emission angle greater than 90 degrees), the Q5 data "looks good", but in fact is not.

S/C = Spacecraft.

ASD = Angular Semi-Diameter. The angle subtended in degrees at the spacecraft by the radius of the disc of the observed body.

Saturnian Coordinate System 1: A coordinate system of reference which rotates at the same rate as Saturn's magnetic field.

The arrangement of the IRIS field of view is illustrated in Appendix E.

Table D2. RDR Record Contents

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
1	1-4	I*4			Tape Creation Date (YY MM DD)
2	5-6	I*2			Record Type: Always 3
3	7-8	I*2			Calibration File Serial #
4	9-10	I*2			Source EDR Tape # -N = Preliminary +N = Final
5	11-12	I*2			Source Fixed Instrument SEDR Tape # 0 = None -N = Predict +N = Actual
6	13-14	I*2			Source Footprint SEDR Tape # 0 = None -N = Predict +N = Actual
7	15-16	I*2			# of Records in Average - Always 1
8	17-20	I*4			Starting FDSC Mod 2^{16}
9	21-24	I*4			Starting FDSC Mod 60
10	25-28	I*4			Ending FDSC Mod 2^{16} (Always = Field 8)
11	29-32	I*4			Ending FDSC Mod 60 (Always = Field 9)
12	33-34	I*2			Spacecraft ID 1 = Voyager 1 2 = Voyager 2
13	35-36	I*2			Data Mode from EDR Header: (10 = GS3 etc.)
14	37-38	I*2			Playback Flag 0 = Real Time 1 = Playback
15	39-40	I*2			Earth Received Time: Year
16	41-42	I*2			Earth Received Time: Day
17	43-44	I*2			Earth Received Time: Hour
18	45-46	I*2			Earth Received Time: Minutes
19	47-48	I*2			Earth Received Time: Seconds
20	49-50	I*2			Data Source as in EDR (1 = Real Time etc.)

21	51-52	I*2	Golay Encoded Flag 0 = No 1 = Yes
22	53-54	I*2	Phase Angle Serial # for Symmetrization
23	55-56	I*2	Spacecraft Event Time: Year
24	57-58	I*2	Spacecraft Event Time: Day
25	59-60	I*2	Spacecraft Event Time: Hour
26	61-62	I*2	Spacecraft Event Time: Minute
27	63-64	I*2	Spacecraft Event Time: Second
28	65-66	I*2	0 = Input by NORT File 1 = Input by EDR Proc (Scet Flag)
29	67-68	I*2	DSN Configuration 8 Bits (Low Order) as in EDR
30	69-70	I*2	DSN Station # 8 Bits (Low Order) as in EDR
31	71-72	I*2	Estimated Bit Error Count from EDR
32	73-74	I*2	
33	75-76	I*2	DQSW Sums over 10 Groups for
34	77-78	I*2	Bits 4, 3, 1, 0 (See EDR DQSW)
35	79-80	I*2	
36	81-82	I*2	# of Minor Frames, Golay Corrected
37	83-84	I*2	# of Minor Frames Containing Missing Data
38	85-86	I*2	Reject Code: 0 = OK 1 = Too Many Spikes 2 = Missing Data 3 = Zero Peak 4 = No IFM Present
39	87-88	I*2	# of Spikes, Corrected
40	89-90	I*2	Golay Bit Error Summation from EDR
41	91-92	I*2	Radiometer Data Present 0 = No 1 = Yes
42	93-96	R*4	Integrated Radiometer from HK (Watts)
43	97-100	R*4	
44	100-104	R*4	
45	105-108	R*4	
46	109-112	R*4	
47	113-116	R*4	Averages over HK Groups of
48	117-120	R*4	9 Temperature Channels
49	121-124	R*4	

50	125-128	R*4	
51	129-132	R*4	
52	133	L*1	Lock 1st Group HK LHK1 and LHK2 Logical and
53	134	L*1	Lock 2nd Group HK LHK3 and LHK4 Logical and
54	135	L*1	Neon Delay Lock ND1 or ND2 or ND3 or ND4 Logical or
55	136	L*1	Motor Position Lock Control MP1 or MP2 or MP3 or MP4 Logical or
56	137-140	R*4	
57	141-144	R*4	
58	145-148	R*4	8 Radiometer Samples Normal Gain (Watts)
59	149-152	R*4	
60	153-156	R*4	
61	157-160	R*4	
62	161-164	R*4	
63	165-168	R*4	
64	169-172	R*4	
65	173-176	R*4	
66	177-180	R*4	
67	181-184	R*4	8 Radiometer Samples High Gain (Watts)
68	185-188	R*4	
69	189-192	R*4	
70	193-196	R*4	
71	197-200	R*4	
72	201-204	R*4	Maximum of 8 Neon Samples (Volts)
73	205-208	R*4	Minimum of 8 Neon Samples (Volts)
74	209-212	R*4	Average Residual Square Difference of Phase Fit
75	213-216	R*4	Average 22 Micron Brightness Temperature (400-500 cm^{-1})
76	217-220	R*4	Average 5 Micron Brightness Temperature (2000-2050 cm^{-1})
77	221-224	R*4	Near IR Radiance (Voy. I - Not Used) (Voy. II - Integrated Radiance 3600-3800 cm^{-1})
78	225	L*1	
79	226	L*1	

80	227	L*1			HK Present 4 Groups
81	228	L*1			
82	231-232	I*2			
83	233-234	I*2			EDR Subheader Without Spares
84	235-236	I*2			
85	237-240	R*4			X
86	241-244	R*4			Y
87	245-248	R*4			Z Cartesian State of Spacecraft
88	249-252	R*4			$\dot{X}$ Relative to Saturnian Magnetic Field
89	253-256	R*4			$\dot{Y}$
90	257-260	R*4			$\dot{Z}$
91	261-264	R*4			X
92	265-268	R*4			Y Cartesian State of Spacecraft
93	269-272	R*4			Z Saturn Centered, Saturn Mean Orbit and Prime
94	273-276	R*4			$\dot{X}$ Meridian in Sun Direction
95	277-280	R*4			$\dot{Y}$
96	281-284	R*4			$\dot{Z}$
97	285-288	R*4	157		Saturn Latitude of Spacecraft
98	289-292	R*4	158		Saturn Longitude of Spacecraft
99	293-296	R*4	159		
100	297-316	R*4			Spare
101	317-320	R*4		2	CB Id.
102	321-324	R*4		36	Range CB → Sun (km)
103	325-328	R*4	176	40	Range S/C → CB (km)
104	329-332	R*4	184		Angle α CB - Sun - S/C (Deg)
105	333-336	R*4	186		Angle α Sun - CB - S/C (Deg)
106	337-340	R*4	239		Time Relative to Periapsis
107	341-344	R*4		2	PB Id. IF PB is CB, PB = 0
108	345-348	R*4		37	Range, PB → Sun
109	349-352	R*4		40	Range, S/C → CB
110	353-356	R*4		41	Range, S/C → PB
111	357-360	R*4		71	Range, S/C → PB Tangency Point
112	361-364	R*4		42	S/C Altitude Above PB
113	365-368	R*4		43	PB Sub Solar Pt. Latitude
114	369-372	R*4		44	PB Sub Solar Pt. Longitude
115	373-376	R*4		45	PB Sub-S/C Pt. Lat.

116	377-380	R*4
117	381-384	R*4
118	385-388	R*4
119	389-392	R*4
120	393-396	R*4
121	397-400	R*4
122	401-404	R*4
123	405-408	R*4
124	409-412	R*4
125	413-416	R*4
126	417-420	R*4
127	421-424	R*4
128	425-428	R*4
129	429-432	R*4
130	433-436	R*4
131	437-440	I*4
132	441-444	I*4
133	445-448	I*4
134	449-452	I*4
135	453-456	I*4
136	457-460	I*4
137	461-464	I*4
138	465-468	I*4
139	469-472	I*4
140	473-476	R*4
141	477-480	R*4
142	481-484	R*4
143	489-486	I*2
144	487-488	I*2
145	489-492	R*4

46	PB Sub-S/C Pt. Long.
47	S/C Phase α
48	PB ASD
70	Optic Axis
74	Solar Elevation Angle for Q5 Point
75	Emission Angle for PB Q5 Point
76	Phase Angle for PB Q5 Point
77	Sun Azimuth Angle for PB Q5 Point
82	Local Time (hr) for PB Q5 Point
	CB Lat. of PB
	CB Long. of PB (Jup. Sys. I)
	CB Long. of PB (Jup. Sys. III)
	X
	Y Cartesian State of PB
	Z Relative to Saturnian Magnetic Field
145/146	Q1 Lat. & Long., System 3, for Line Count 350
147/148	Q2 Lat. & Long., System 3, for Line Count 350
149/150	Q3 Lat. & Long., System 3, for Line Count 350
151/152	Q4 Lat. & Long., System 3, for Line Count 350
72/73	Q5 Lat. & Long., System 3, for Line Count 350 The Q5 point is the center point for the IRIS field of view
153/154	Q6 Lat. & Long., System 3, for Line Count 350
155/156	Q7 Lat. & Long., System 3, for Line Count 350
157/158	Q8 Lat. & Long., System 3, for Line Count 350
159/160	Q9 Lat. & Long., System 3, for Line Count 350
	Integrated Radiance Across Spectrum (175. to 2500 cm^{-1})
	Wave # at First Data Point, (Always 150.18 cm^{-1})
	Wave # Spacing between Data Points, (Always 1.39051 cm^{-1})
	# of Data Points, (Always 2769)
	Scan Platform in Motion Flag - Not Used
	Emission Angle for Line Count 750

146	493-496	I*4	Q5 Lat. & Long., System 3, for Line Count 750
147	497-500		Spare
148	501-504	R*4	Radiance Value of First Data Point ($W/cm^2/sr/cm^{-1}$
149	505-508	R*4	Radiance Value of Second Data Point (Always at 151.57 cm^{-1})
.	.	.	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
2907	11501-11504	R*4	Radiance Value of Last Data Point (Always at 3975.47 cm^{-1})
2908	11505-11508	R*4	Q1 Range from Saturn Center of Q1 Point on Saturn Rings (km) for Linecount 350
2909	11509-11512	.	Q1 Saturn Rings Intercept Q1 Point Local Hour Angle for Count 350
2910	11513-11516	.	Q2
2911	11517-11520	.	Q2
2912	11521-11524	.	Q3
2913	11525-11528	.	Q3
2914	11529-11532	.	Q4
2915	11533-11536	.	Q4
2916	11537-11540	.	Q5
2917	11541-11544	.	Q5 The Q5 Point is the Center Point for the IRIS Field of View
2918	11545-11548	.	Q6
2919	11549-11552	.	Q6
2920	11553-11556	.	Q7
2921	11557-11560	.	Q7
2922	11561-11564	.	Q8
2923	11565-11568	.	Q8
2924	11569-11572	.	Q9
2925	11573-11576	R*4	Q9

The following example depicts one way to identify individual RDR field quantities:

```
      LOGICAL*1 BYTE
      INTEGER*2 I2VAL
      INTEGER*4 I4VAL
      REAL*4 RECORD, RAD, HEADER
      DIMENSION RECORD(2894), BYTE(500), I2VAL(250), I4VAL(125),
     A          HEADER(125), RAD(2769)
      EQUIVALENCE (RECORD(1), HEADER(1)),
     A          (HEADER(1), BYTE(1), I2VAL(1), I4VAL(1)),
     B          (RECORD(126), RAD(1))
```

Each data element can then be addressed simply by using the variable name associated with its type.

Since radiances only are stored in the data portion of the record (i.e., no associated wavenumber), the corresponding wavenumber must be computed using the 3 header fields:

REAL*4	Field #141	Starting Wave No. (Word #120)
REAL*4	Field #142	Wave No. Spacing (Word #121)
INTEGER*2	Field #143	No. of Data Points (Half-Word #243)

The following is one way to calculate and store these values for use with their corresponding radiances, using the above data definition statements to head the program:

```
      DIMENSION WAVE (2769)
      WAVE(1) = RECORD(120)
      DWN = RECORD(121)
      N = I2VAL(243)
      DO 100  I = 2,N
      WAVE (I) = FLOAT (I-1) *DWN + WAVE(1)
  100 CONTINUE
```

[The number of data points (N) will always be 2769.]

The decimal FDSC can be calculated in the following manner (it is recommended that FDSC be a double precision variable).

```
REAL*8 FDSC
FDSC = DFLOAT (I4VAL(5)*100 + I4VAL(6)) * 0.01D0
```

The decimal latitudes and longitudes of all the Q points (IRIS FOV descriptors) for both line counts 350 and 750 can be calculated as follows. The data are stored in the record as packed integers (I*4) ... $AAA_{\Lambda}AA$ $BBB_{\Lambda}BB$ where AAAAA is the latitude (-90.00 to +90.00) and BBBBB is the longitude (0.0 to 360.00) and '$_{\Lambda}$' represents the implied decimal point.

Example Q5 latitude and longitude calculation for line count 350.

```
REAL*4    Q5LAT, Q5LON
Q5LAT  =  FLOAT (I4VAL(114)/100000) * 0.01
Q5LON  =  FLOAT (MOD(IABS(I4VAL(114)),100000)) * 0.01
```

APPENDIX E

SUPPLEMENTARY EXPERIMENTER DATA RECORD (SEDR) DESCRIPTION

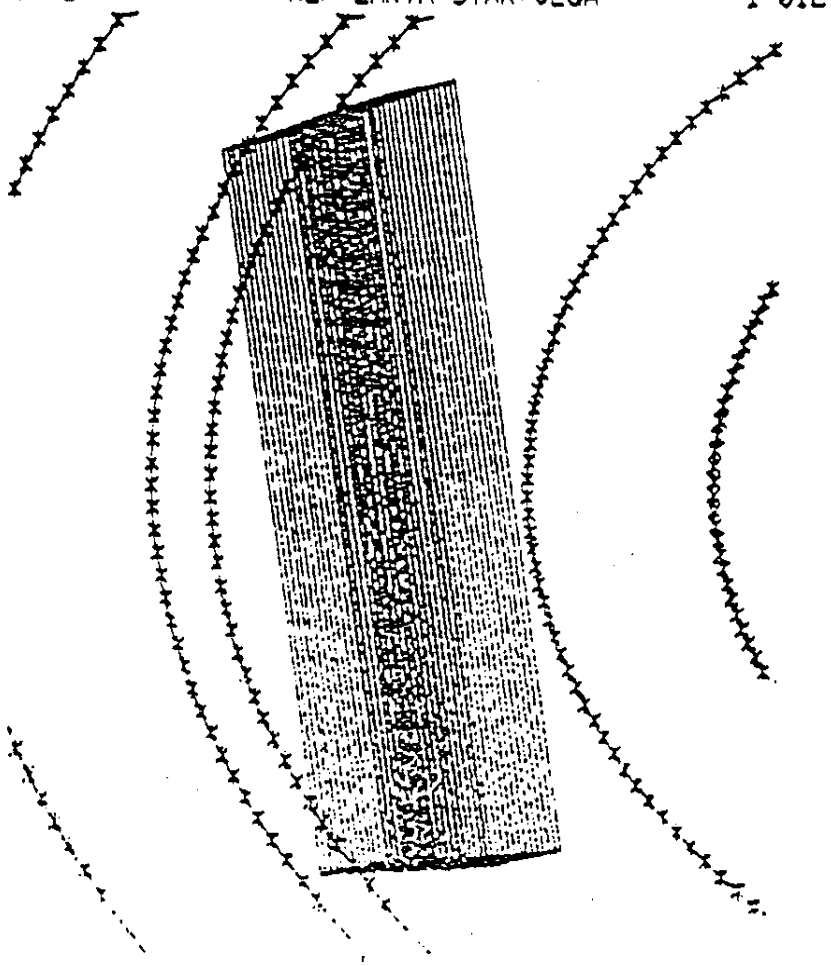
(1c)

SHOWS

5 HR DRIFT

PLTOBS012 08/28 09:43
TIME!** 2/18: 0: 9 0 MIDVUE=3 2 000 SATS DESIGN D124 P=0
/SU 0:12 SISBDU SATURN/ REF=EARTH STAR=VEGA 1 012

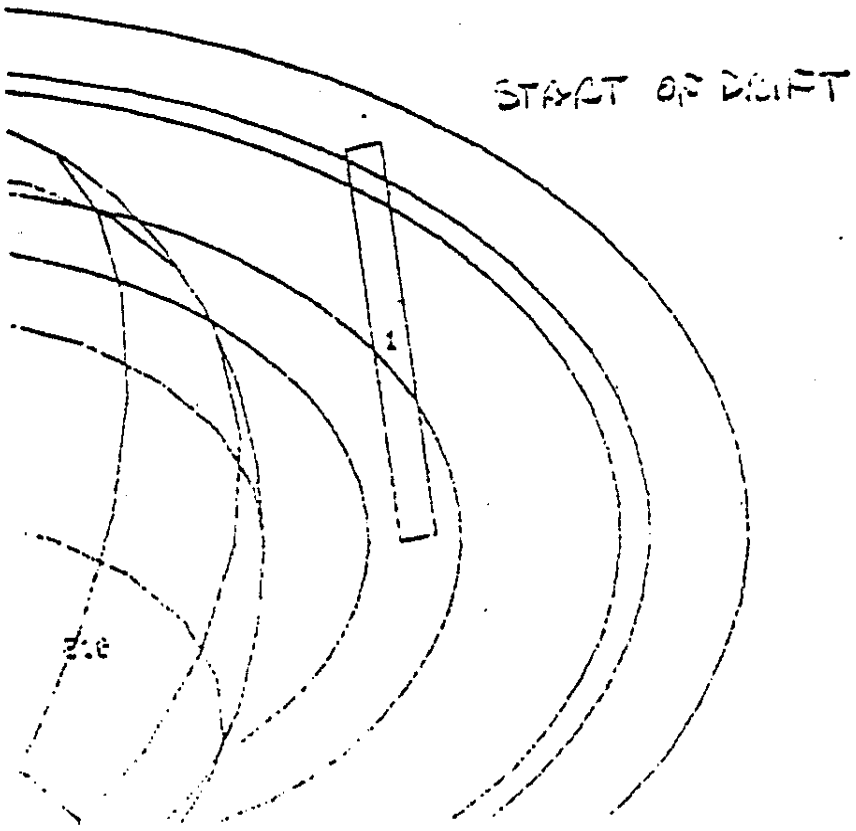
C	HHMMSS	ELFF	AZFF
1	180000	9468	20958
2	181000	9468	20958
3	182000	9468	20958
4	183000	9468	20958
5	184000	9468	20958
6	185000	9468	20958
7	190000	9468	20958
8	191000	9468	20958
9	192000	9468	20958
10	193000	9468	20958
11	194000	9468	20958
12	195000	9468	20958
13	200000	9468	20958
14	201000	9468	20958
15	202000	9468	20958
16	203000	9468	20958
17	204000	9468	20958
18	205000	9468	20958
19	210000	9468	20958
20	211000	9468	20958
21	212000	9468	20958
22	213000	9468	20958
23	214000	9468	20958
24	215000	9468	20958
25	220000	9468	20958
26	221000	9468	20958
27	222000	9468	20958
28	223000	9468	20958
29	224000	9468	20958
30	225000	9468	20958
31	230000	9468	20958



(POSITION SLIGHTLY OFF)

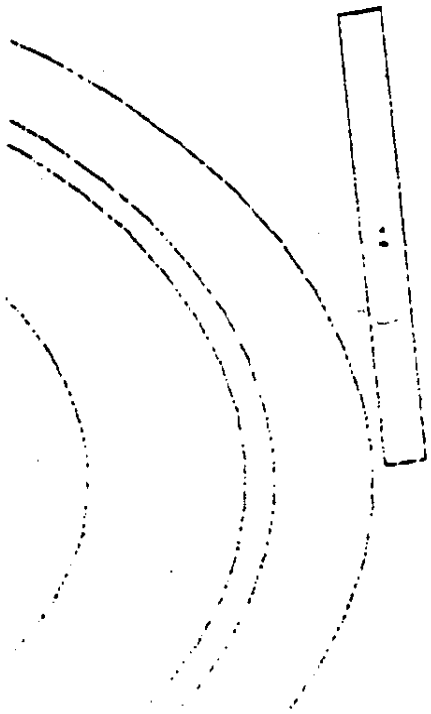
(2

PLTOBS012 08/28 10:53
TIME:+ 3/ 0: 0: 0 MIDVUE-3 1 000 SATS DESIGN D124
JEL 0:12 SISBDW SATURN/ REF-EARTH STAR-VEGA 1 012
O HHMMSS ELFF AZFF
: 0 3168 20948



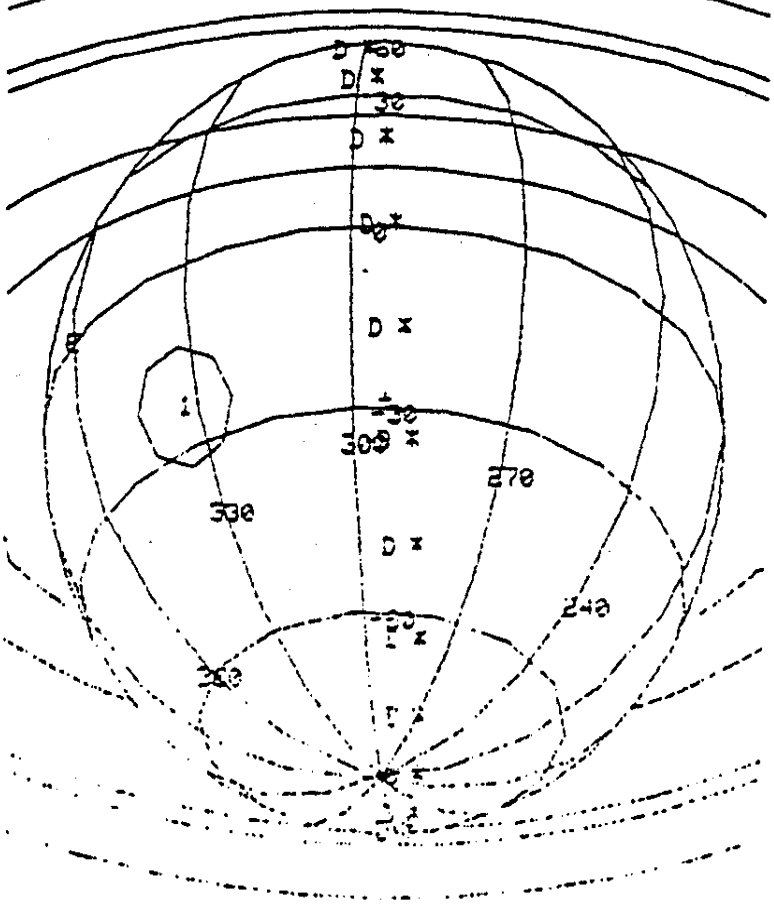
2E

[illegible]89012 08/28 10:55
[illegible] 3/12 0 0 MIDVUE-3 1 000 SATS DESIGN D124
[illegible] 0 12 SISBDW SATURN/ REF-EARTH STAR-VEGA 2 012
[illegible] ELFF AZFF
[illegible] 9162 20948



END OF DRIFT

PLTOBS012 08/28 11:09
TIMEI=+ 3/12: 0: .0 MIDVUE=0 .S000 SATS DESIGN D124
JSU 0 1 SISBDU SATURN/ REF=EARTH STAR=VEGA 1 012
HHMMSS ELFF AZFF
1 120000 9430 20948

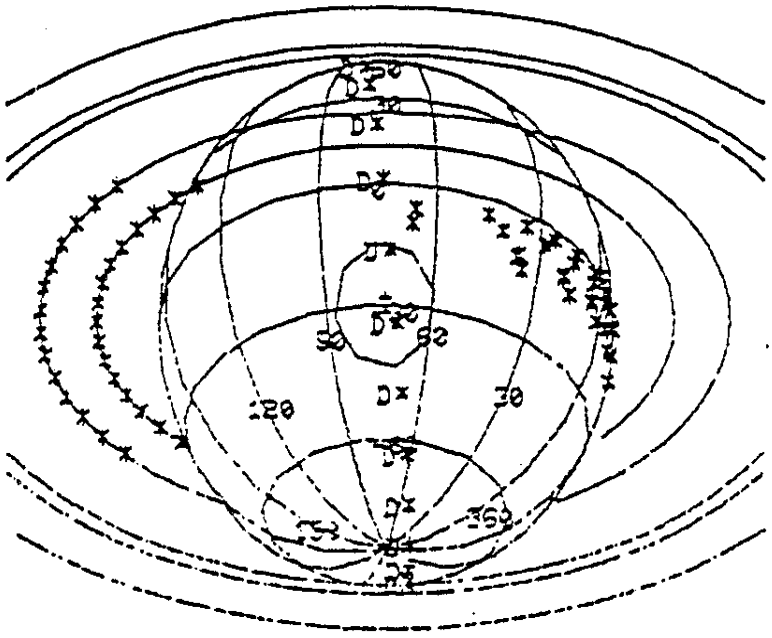


```
     ...012 08/28 11·10
...      5  0  0   0 MIDUUE=0   9000   SATS          DESIGN D124
         1  SISBDW SATURN/               REF=EARTH STAR=VEGA          1 012
         ELFF  AZFF
         9430 20948
```

END
POSITION

4w

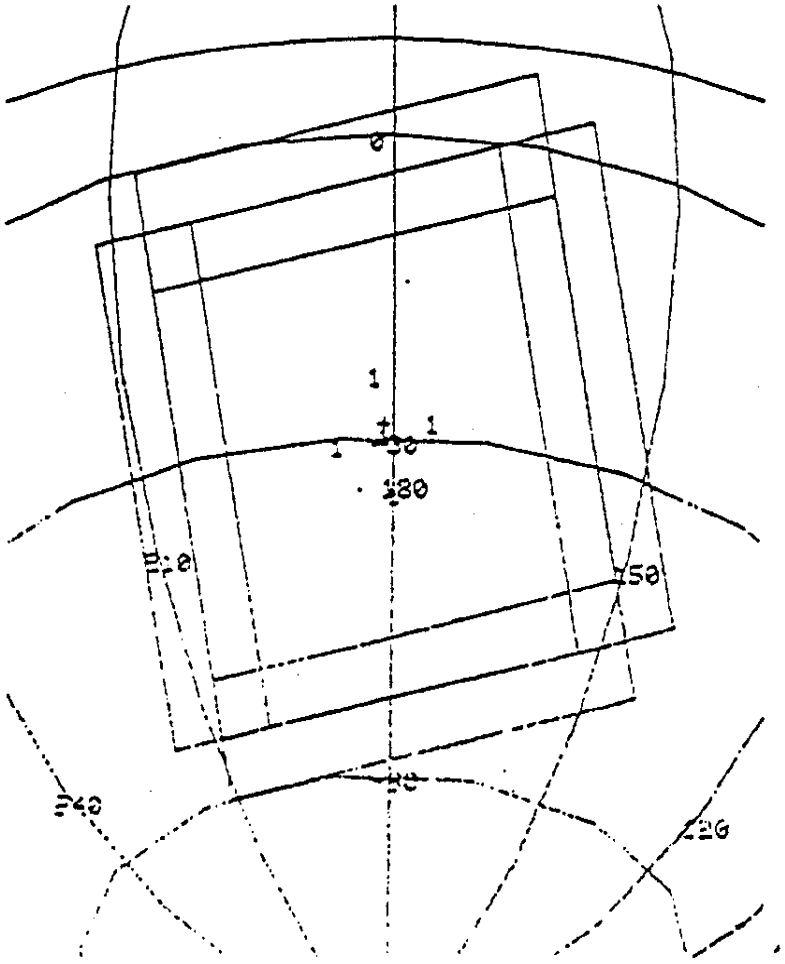
PLTOB9012 08/28 09:54
TIME1=+ 5/18 0 .0 MIDVUE=3 .6000 SATS DESIGN D124
JBU 0 1 SISBDW SATURN/ REF=EARTH STAR=VEGA 1 012
O HHMMSS ELFF AZFF
1 180000 9530 20948
[illegible]



4

PLTOBS012 08/28 11:33
TIMEI-+ 5/14 0 .0 MIDVUE-0 1.500 SATS DESIGN D124
OBS 0 1 SISBDW SATURN/ REF-EARTH STAR-VEGA 1 012

	HHMMSS	ELFF	AZFF
1	140000	9523	20947
1	140000	9528	20947
1	140000	9518	20947
1	140002	9523	20952
1	140000	9523	20942



ATTITUDE CONTROL MOTION (NA)

APPENDIX C

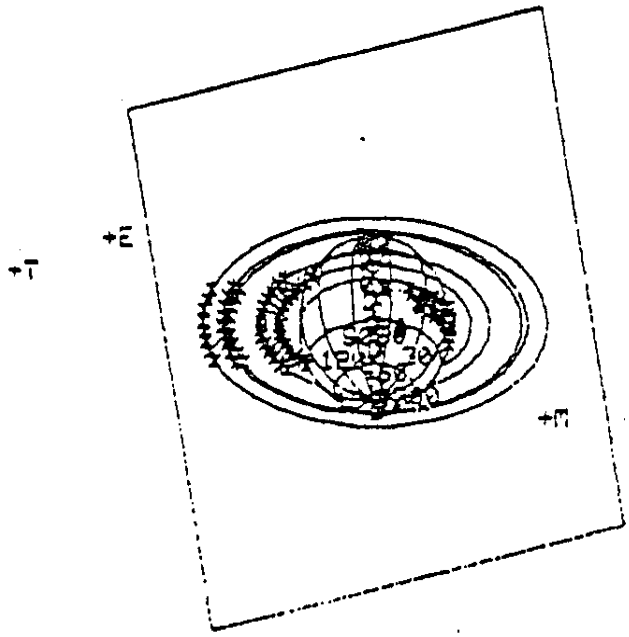
VOYAGER 1 AND 2 RDR TAPE SUMMARY

FDSC COUNT - TAPE ID

4b

PLTOBS012 08/28 09:59
TIME1=+ 5/18: 0: 0 MIDVUE=3 2000 SATS DESIGN D124
[illegible] 0: 2 SISBDW SATURN/ REF=EARTH STAR=VEGA 1 012
[illegible] HHMMSS ELFF AZFF
1 180000 9530 20948

CENTER OF VRMOV

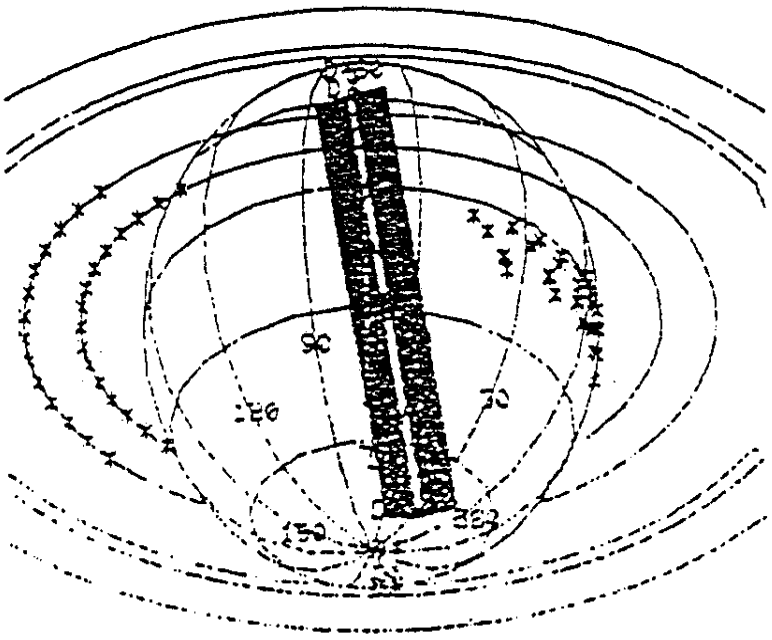


(AC)

[illegible]5012 08/28 09:51
[illegible] 5/14 0 9 0 MIDVUE=3 6000 SATS DESIGN D124 P=0
[illegible] 0 12 SISBDU SATURN/ REF=EARTH STAR=VEGA 1 012

	[illegible]	ELFF	AZFF
1	140009	9522	20947
2	141009	9522	20947
3	142009	9522	20947
4	143009	9522	20947
5	144009	9522	20947
6	145009	9522	20947
7	150009	9522	20947
8	151009	9522	20947
9	152009	9522	20947
10	153009	9522	20947
11	154009	9522	20947
12	155009	9522	20947
13	160009	9522	20947
14	[illegible]	9522	20947
15	[illegible]	9522	20947
16	[illegible]	9522	20947
17	[illegible]	9522	20947
18	[illegible]	9522	20947
19	[illegible]	9522	20947
20	[illegible]	9522	20947
21	[illegible]	9522	20947
22	[illegible]	9522	20947
23	[illegible]	9522	20947
24	[illegible]	9522	20947
25	[illegible]	9522	20947
26	[illegible]	9522	20947
27	[illegible]	9522	20947
28	[illegible]	9522	20947
29	[illegible]	9522	20947
30	[illegible]	9522	20947
31	[illegible]	9522	20947

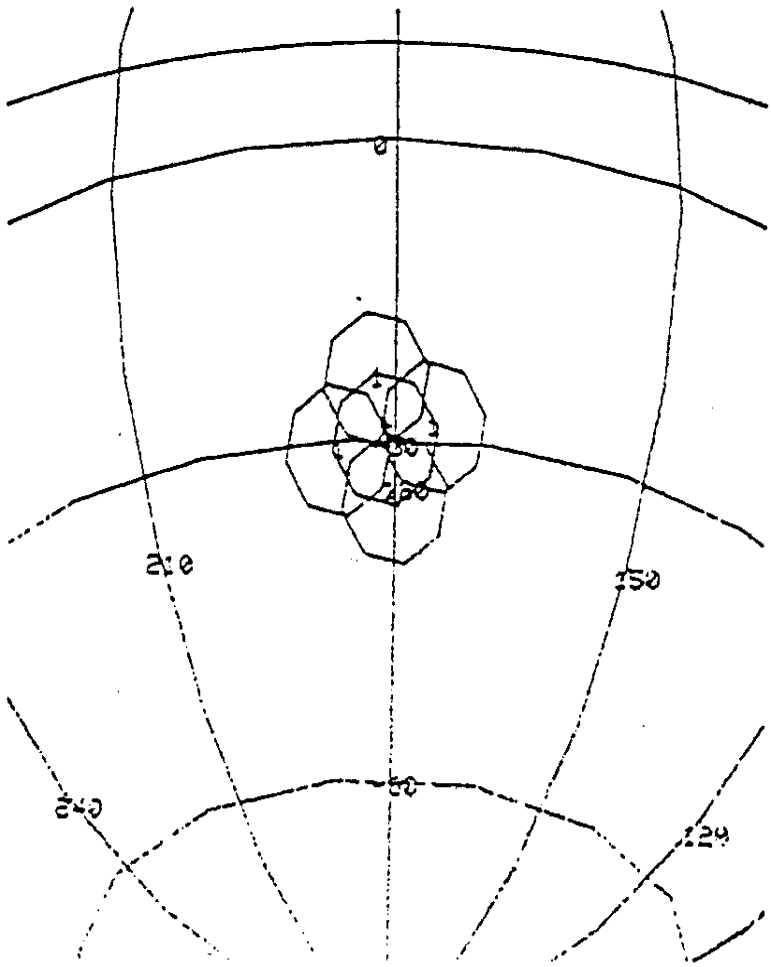
JUST BEFORE CENTER OF VRMOV



4d

PLTOB9012 08/28 11:33
TIMEI=+ 5/14: 0: 0
JSU 0: 1 SISBDW
0 HHMMSS ELFF AZFF
1 140000 9523 20947
1 140000 9528 20947
1 140000 9518 20947
1 140000 9523 20952
1 140000 9523 20942

MIDVUE=0 1.500 SATS DESIGN D124
SATURN/ REF=EARTH STAR=VEGA 1 012

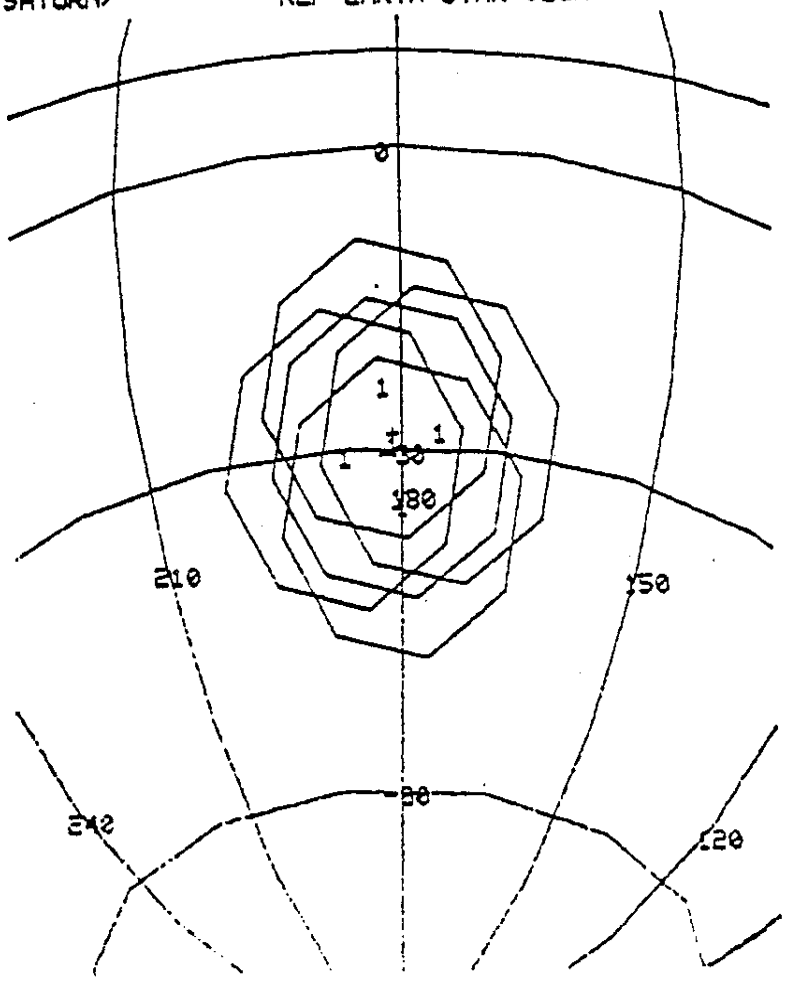


[illegible] Attitude control motion (PPS)

4-C

PLTOBS012 08/28 11:33
TIMEI++ 5/14 0 .0 MIDVUE=0 1.500 SATS DESIGN D124
JSU 0 1 SISBDW SATURN/ REF=EARTH STAR=VEGA 1 012

C	HHMMSS	ELFF	AZFF
1	140000	9523	20947
1	140000	9528	20947
1	140000	9518	20947
1	140000	9523	20952
1	140000	9523	20942



ATTITUDE CONTROL
MOTION
(ACS)

PROPOSED R/T SLEWS IN B571 V2 Saturn

~44 090

① SLEW TO EL = 94.36, AZ = 209.84 ASAP (COMMAND OUT ~ 1PM PDT)
- PROVIDES UVS DRIFT THROUGH PART OF RING (SHADOWED PORTION
- WIDE ANGLE COVERS MOST OF RINGS
- 6 HOURS OF DRIFT. approx 8 hrs here

~44100 (44 097.12 SLEW?) (44 099.41 SLEW?)

② SLEW TO EL = 91.36 (COMMAND OUT ~ 7PM PDT)
- RING COVERAGE FOR ALL
- PPS(?) DRIFT FROM INNER EDGE B RING TO F RING.
- 12 HOURS OF DRIFT.

~44112 (44110.53 SLEW?) LOOKS AS THOUGH GOING ONTO η (ΔPEAK = 125 dn

③ SLEW TO EL = 93.98 (COMMAND OUT ~ 7AM PDT SATURDAY)
- PLANET COVERAGE FOR ALL.
- PPS, UVS, IRIS DRIFT ACROSS PLANET
- 24 HOURS OF DRIFT.

~44142 (44141.44 SLEW TO COLDER TARGET)

④ SLEW TO EL = 94.98 (COMMAND OUT ~ 7AM PDT SUNDAY)
- VRMOV COVERAGE FOR ALL, RPEOE FOR IRIS
- UV SLIT PROBABLY INCLUDES -80° LAT
- 48 HOURS OF DRIFT.

~44202

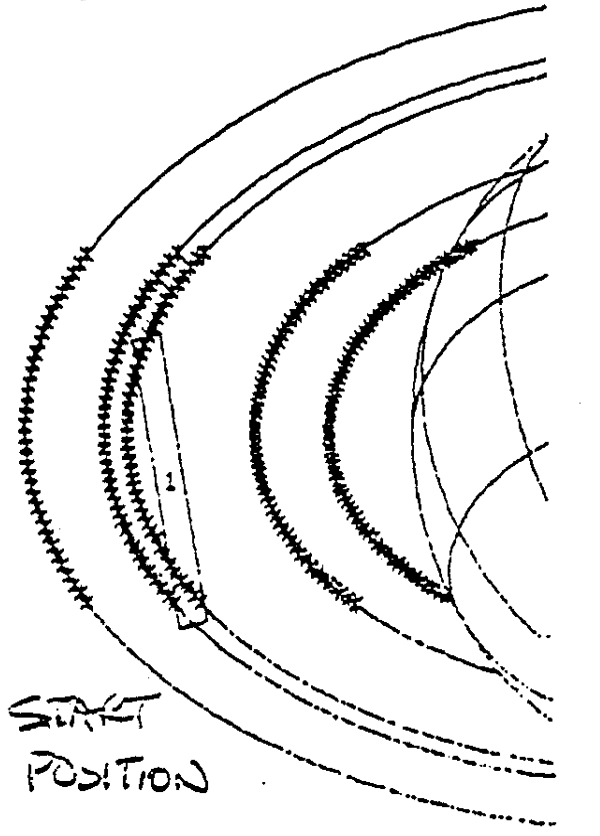
⑤ SLEW TO EL = ? FOR TIME PERIOD FROM END OF B571 TO PHOEBE MOVIE FOR PLANET COVERAGE.

EDM. 28 AUG 1981
NOON

(1a)

+3:00

PLTOBS012 08/28 10:05
TIMEI-+ 2/18 0 0 MIDVUE-3 8000 SATS DESIGN D124
0 12 SISBDW SATURN/ REF-EARTH STAR-VEGA 1 012
HHMMSS ELFF AZFF
1 180000 3468 20948



1st picture Eve of Aug 28 ~5:30 PDT
(ie SIC ~4 PM) 44 000.

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPAXS (Saturn)	$+7^d17^h16^m$	$+17^d18^h37^m$	44237:13 44238:55	Lat=-45°, Long= sub S/C	None
RPIRC (Saturn)	+8 11 07	+8 13 25	44259:32 44262:25	Lat = -45°, Long= sub S/C	WA (1)
RPAXS (Saturn)	+8 18 03	+8 20 15	44268:12 44270:57	" "	None
RPAXS (Saturn)	+9 20 34	+9 22 25	44301:20 44303:40	" "	None
RPIRC (Saturn)	+10 16 28	+10 20 56	44326:13 44331:48	" "	None
RPIRC (Saturn)	+10 21 06	+11 05 12	44332:01 44342:08	" "	None
RSPAC (Deep Space)	+11 05 16	+11 06 12	44342:13 44343:23	EL=120°, AZ=-3.23° Deep space just off target plate	None
RCAL (Warm, Dark Target Plate)	+11 06 13	+11 11 09	44343:24 44349:34	EL=101.58°, AZ=-3.23°	None
VPLIT (Saturn)	+11 12 59	+11 23 12	44351:51 44364:39	Imaging of Lit part of Saturn. IRIS goes to Lat=-45°, Long=Sub S/C during ISS readout.	Many NA & WA
RPIRC (Saturn)	+12 06 46	+12 13 00	44374:05 44381:54	Lat=-45°, Long=Sub S/C	None
VPLIT (Saturn)	+12 13 01	+12 23 22	44381:54 44394:51	Imaging of Lit part of Saturn. IRIS goes to Lat=45°, Sub S/C long during ISS readout	Many NA & WA
RPIRC (Saturn)	+13 18 00	+13 19 41	44418:07 44420:14		None
VPLIT (Saturn)	+13 19 44	+14 02 04	44420:19 44428:14	Imaging of Lit part of Saturn. IRIS goes to Lat=-45°, Long=Sub S/C, during ISS readout	Many NA & WA
RPIRC (Saturn)	+14 02 04	+14 14 12	44428:14 44443:24		None
VPLIT (Saturn)	+14 14 12	+15 00 20	44443:24 44456:03	Same as previous VPLIT	

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	+15 00 20	+15 03 26	44456:03 44459:56		None
RPIRC (Saturn)	+15 10 38	+15 12 36	44468:55 44471:23		
VPLIT (Saturn)	+15 12 42	+15 22 48	44471:31 44484:08	Imaging of Lit part of Saturn. IRIS goes to Lat=-45°, Long=Sub S/C, during ISS readout.	Many NA & WA
RPAXS (Saturn)	+15 22 58	+16 00 03	44484:20 44485:42	Lat=-45°, Long=Sub S/C	None
RHSUN (Suncal)	+16 07 40	+16 08 33	44495:13 44495:52 44496:12 44496:20	Near Sun, Sun +1.7° Elev. IRIS on Sun Near Sun, Sun +1.7° Elev. End Suncal	
RPIRC (Saturn)	+16 08 37	+16 14 00	44496:24 44503:08		
VPLIT (Saturn)	+16 14 05	+17 00 11	44503:15 44515:52	(Same as previous VPLIT)	Many NA & WA
RPIRC (Saturn)	+17 05 55	+17 12 50	44523:01 44531:41	Lat=-45°, Long=Sub S/C	None
RPIRC (Saturn)	+18 01 46	+18 05 25	44547:51 44552:25		
RPIRC (Saturn)	+18 11 14	+18 12 56	44559:40 44561:47		
RPIRC (Saturn)	+19 07 29	+19 12 35	44584:59 44591:22	Center of Saturn	None
RPIRC (Saturn)	+20 07 20	+20 12 51	44614:47 44621:42	Center of Saturn	None
RPIRC (Saturn)	+21 07 15	+21 12 48	44644:41 44651:48	Center of Saturn	None
RPIRC (Saturn)	+22 07 20	+22 12 32	44674:47 44681:19	Center of Saturn	None
RHSUN (SunCal)	+23 07 07	+23 08 00	44704:32 44705:11 44705:31 44705:39	Near Sun, Sun +1.7° IRIS on Sun Near Sun, Sun +1.7° End Suncal	Elev None Elev.
RPIRC (Saturn)	+23 08 04	+23 12 19	44705:43 44711:02	Center of Saturn	None

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	+24 07 04	+24 12 37	44734:27 44741:25	Center of Saturn	None
RPIRC (Saturn)	+25 07 07	+25 12 34	44764:31 44771:21	Center of Saturn	None
RPIRC (Saturn)	+26 07 06	+26 12 28	44794:30 44801:14	Center of Saturn	None
RPIRC (Saturn)	+27 06 58	+27 12 17	44824:20 44831:00	Center of Saturn Saturn size comparable to IRIS field of view	None
RPIRC (Saturn)	+28 07 00	+28 12 21	44854:23 44861:05	Center of Saturn Saturn size comparable to IRIS FOV.	None
RPIRC (Saturn)	+29 06 48	+29 12 18	44884:08 44891:01	Center of Saturn Saturn size comparable to IRIS FOV	None
RHSUN (Suncal)	+30 06 53	+30 07 46	44914:14 44914:53 44915:13 44915:21	Near Sun, Sun +1.7° Elev. IRIS on Sun Near Sun, Sun +1.7° Elev. End Suncal	
RPIRC (Saturn)	+30 07 49	+33 13 00	44915:25	Center of Saturn	

The following pointing was proposed to substitute for post encounter period ~ 44090 to ~ 44202 after the scan platform, on which the IRIS instrument is mounted, failed to slew properly in azimuth when emerging from post encounter Saturn occultation.

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RSPAC (Deep Space)	$1^d03^h43^m$	$1^d03^h48^m$	44040:16 44040:24	PPS background	none
PROPHT (Rings)	1:03:52	1:05:25	44040:28 44042:04 44042:25	Saturn Radius/ Local Hour Angle SR=2.36° LHA=160° 3 FC/PT end 1 FC/PT end	NA,WA
V5RHEA (Rhea)	1:05:26	1:05:44	44042:25 44042:48	Center of Planet	NA, WA
RPN/S (Saturn Part 1)	1:05:45	1:10:51	44042:49 44049:12	Lat/Hour Angle Lat=17°, LHA=80° One frame in C-Ring while on Saturn every 29 frames 1x13 scan 1x11 scan Nested scans 1FC/PT	NA, WA
RPN/S (Saturn-Part 2)	1:10:51	1:16:44	44049:12 44056:34	Lat/Hour Angle Lat=5°, LHA=80° 1x11 Scan 1x8 Scan Nested Scans 1 FC/PT	
VTITAN (TITAN)	1:18:01	1:18:20	44058:09 44058:33		NA
RPMOS (Saturn-South Pole)	1:18:21	1:21:28	44058:34 44062:28	Drift on South Pole Lat/Sub S/C Long Lat=-88°	NA,WA
VPRET (Saturn)	1:22:57	1:23:24	44064:19 44064:54	N/S Retargetable scan Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA, WA
VPRET (Saturn)	1:23:25	1:23:59	44064:54 44065:37	N/S Retargetable Scan Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA, WA
RSPAC (Deep Space)	2:01:53	2:03:15	44068:00 44069:40	During FSMAN6 manuever	none
RR7C0 (C-Ring)	2:04:22	2:05:29	44071:06 44072:30	Saturn Radius/Hour Angle SR=1.39 LHA=165° 28 FC/PT	NA, WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RR7CO (A-Ring)	2:05:30	2:06:40	44072:30 44073:58	Saturn Radius/Hour Angle SR=2.15 LHA=165° 28 FC/PT	NA, WA
RR7CO (B-Ring)	2:07:36	2:08:49	44075:08 44076:40	Saturn Radius/Hour Angle SR=1.76, LHA=165° 28 FC/PT	NA, WA
VTITAN (TITAN)	2:08:50	2:09:10	44076:41 44077:07		NA
RP7CO (Saturn-South Pole)	2:09:11	2:10:20	44077:07 44078:33	Lat/Sub S/C Long Lat=-82° Drift	NA, WA
RP7CO (Saturn East Limb)	2:10:20	2:11:46	44078:33 44080:21	Lat/Viewing Angle Lat=-4°, VW=52.5° Drift	NA, WA
RP7CO (Saturn center	2:12:57	2:14:13	44081:49 44083:25	Lat/Sub S/C Long Lat=-2° Drift	NA, WA
RP7CO (Saturn-West Limb)	2:15:04	2:16:16	44084:28 44085:58	Lat/Viewing Angle Lat=-4°, VW=-52.5° Drift	None
VPRET (Saturn)	2:16:16	2:16:35	44085:58 44086:22	N/S Retargetable Scan Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA/WA
VPRET (Saturn)	3:02:34	3:03:01	44098:50 44099:25	N/S Retargetable Scan Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA/WA
RPIRC (Saturn)	3:03:01	3:04:42	44099:25 44101:31	Lat/Hour Angle Lat=-57°, LHA=75° Drift	None
RPIRC (Saturn)	3:04:42	3:06:52	44101:31 44104:13	Lat/Hour Angle Lat=-57°, LHA=75° Drift	None
VTITAN (TITAN)	3:06:52	3:07:12	44104:13 44104:38		NA

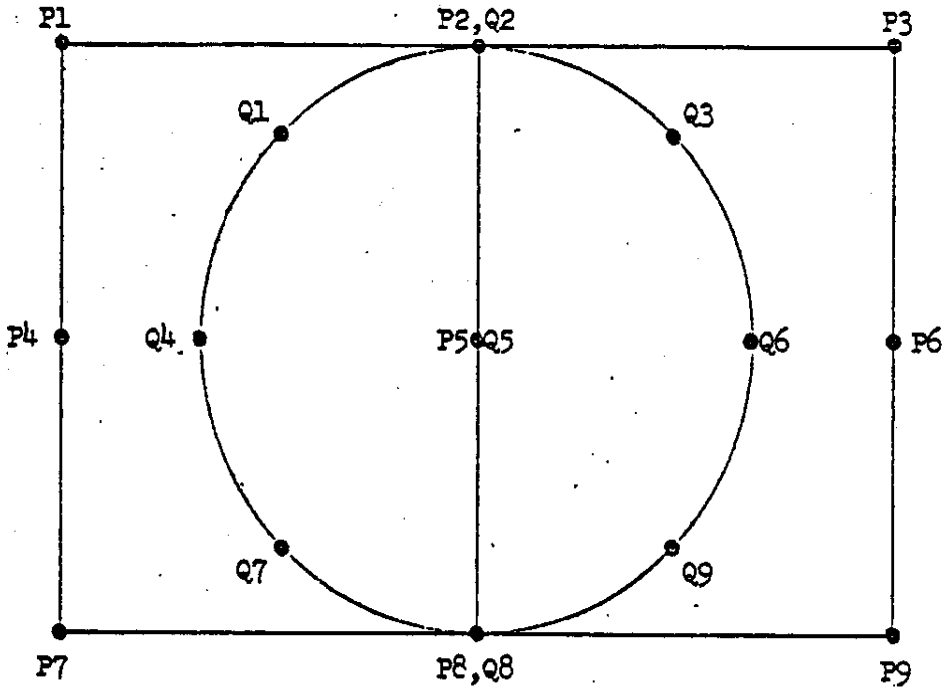
LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VPRET (Saturn)	3:07:12	3:07:43	44104:38 44105:17	N/S Retargetable Scan Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA, WA
RPIRC (Saturn)	3:07:43	3:08:56	44105:17 44106:48	Lat/Hour Angle Lat=-57°, LHA=75° Drift	
RPIRC (Saturn)	3:09:43	3:12:22	44107:47 44111:06	Lat/Hour Angle Lat=-57°, LHA=75° Drift	None
RPIRC (Saturn)	3:12:37	3:14:20	44111:24 44113:33	Lat/Hour Angle Lat=-57°, LHA=75° Drift	None
RPIRC (Saturn)	3:15:14	3:17:24	44114:40 44117:24	Lat/Hour Angle Lat=-57°,LHA=75°	None
VPRET (Saturn)	3:17:25	3:17:47	44117:24 44117:52	N/S Retargetable Lat/Hour Angle Lat=0°, LHA=120° 3 FC/PT	NA, WA
VPRET (Saturn)	3:18:02	3:18:28	44118:10 44118:43	N/S Retargetable Scan Lat/Hour Angle Lat=0° LHA-120° 3 FC/PT	NA, WA
RPIRC (Saturn)	3:19:19	3:20:22	44119:47 44121:06	Lat/Hour Angle Lat=-57°, LHA=75°	None
RPIRC (Saturn)	4:04:06	4:05:00	44130:45 44131:53	Lat/Sub S/C Long Lat=-45°	None
RPIRC (Saturn)	4:06:03	4:06:55	44133:12 44134:17	Lat/Sub S/C Long Lat=-45°	None
VTITAN (Titan)	4:10:04	4:10:25	44138:12 44138:39		NA
RPIRC (Saturn)	4:13:41	4:14:53	44142:44 44144:15	Lat/Sub S/C Long Lat=-45°	None
RPIRC (Saturn)	5:5:21	5:12:48	44162:20 44171:43	Lat/Sub S/C Long Lat=-45° During VRMOV	WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	5:12:52	6:01:58	44171:43 44186:06	Lat/Sub S/C Long Lat=-45° During VRMOV	WA
RPIRC (Saturn)	6:02:49	6:04:56	44189:09 44191:48	Lat/Sub S/C Long Lat=-45°	None
RPIRC (Saturn)	6:04:56	6:15:47	44191:48 44205:22	Lat/Sub S/C Long Lat=-45°	WA

Attachment D

Scan Platform Instrument
SEDR FOV Definitions

The Following figure illustrates the geometry of the field-of-view (FOV) that will be modelled for each scan platform instrument on the SEDR.



Instrument	FOV Definition
ISS (All Images)	Rectangle (P1, P3, P5, P7 & P9)
IRIS (Far Encounter)	Point (Q5)
IRIS (Near Encounter)	Circle (Q1 - Q9)
UVS (All Images)	Line (P2, P5, P8)
PPS (All Images)	Point (P5)

ATTACHMENT E

EME50 -TO- ECL50
Transformation Metrix

IRIS Instrument Peculiar Block

WORD	DESCRIPTION	UNITS	TYPE
1 - 2	Planetodetic Latitude and Longitude of Q1 Point	Deg	E
3 - 4	Planetodetic Latitude and Longitude of Q2 Point	Deg	E
5 - 6	Planetodetic Latitude and Longitude of Q3 Point	Deg	E
7 - 8	Planetodetic Latitude and Longitude of Q4 Point	Deg	E
9 - 10	Planetodetic Latitude and Longitude of Q6 Point	Deg	E
11 - 12	Planetodetic Latitude and Longitude of Q7 Point	Deg	E
13 - 14	Planetodetic Latitude and Longitude of Q8 Point	Deg	E
15 - 16	Planetodetic Latitude and Longitude of Q9 Point	Deg	E
17 - 18 *	Range from Saturn center and hour angle of Q1 point on Saturn Rings	km/deg	E
19 - 20 *	Range from Saturn center and hour angle of Q2 point on Saturn Rings	km/deg	E
21 - 22 *	Range from Saturn center and hour angle of Q3 point on Saturn Rings	km/deg	E
23 - 24 *	Range from Saturn center and hour angle of Q4 point on Saturn Rings	km/deg	E
25 - 26 *	Range from Saturn center and hour angle of Q6 point on Saturn Rings	km/deg	E
27 - 28 *	Range from Saturn center and hour angle of Q7 point on Saturn Rings	km/deg	E
29 - 30 *	Range from Saturn center and hour angle of Q8 point on Saturn Rings	km/deg	E
31 - 32 *	Range from Saturn center and hour angle of Q9 point on Saturn Rings	km/deg	E
33 - 60	Spares		

* Ring calculations are done only in the Saturian system and are done all through the Saturn period regardless of whether the rings are in view or not.

IRIS Instrument Peculiar Block Format

Notes:

1) The arrangement of the Q points is given in Attachment 6. The periphery Q points (Q1-Q4 and Q6-Q9) define the IRIS .25 degree field-of-view (FOV) and are placed nominally 45 degrees apart. The Q5 point defines the IRIS optic axis and all associated geometry for this point is given in the common block format.

2) The IRIS Instrument Peculiar Block will only be produced in the near encounter periods of the mission. The instrument peculiar block will be generated whenever twice the picture body angular semi-diameter equals or exceeds the IRIS angular FOV (.25 degree).

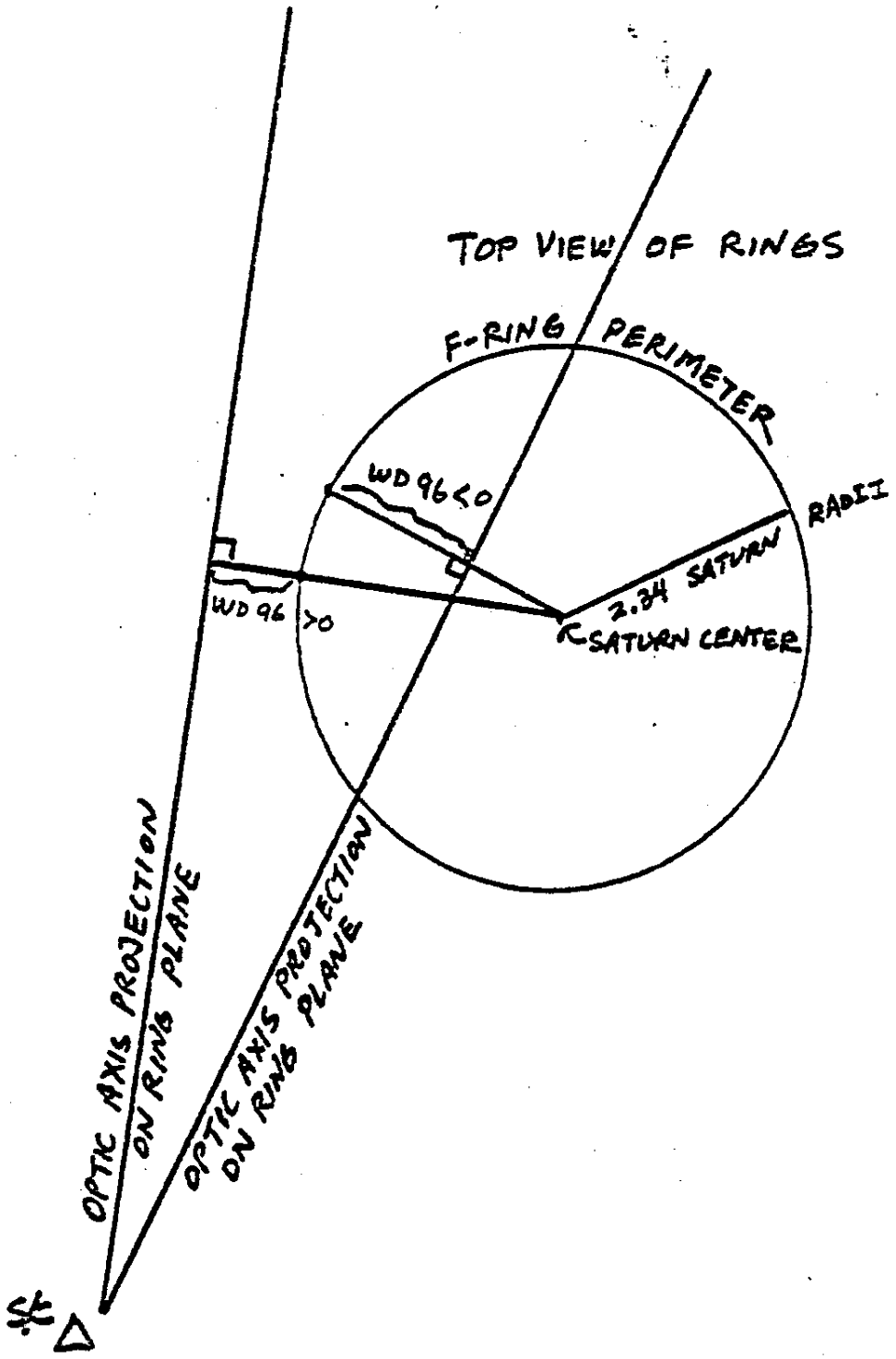


FIGURE 9 SEDR WORD 96

ATTACHMENT D

IRIS Instrument Peculiar
Block Format

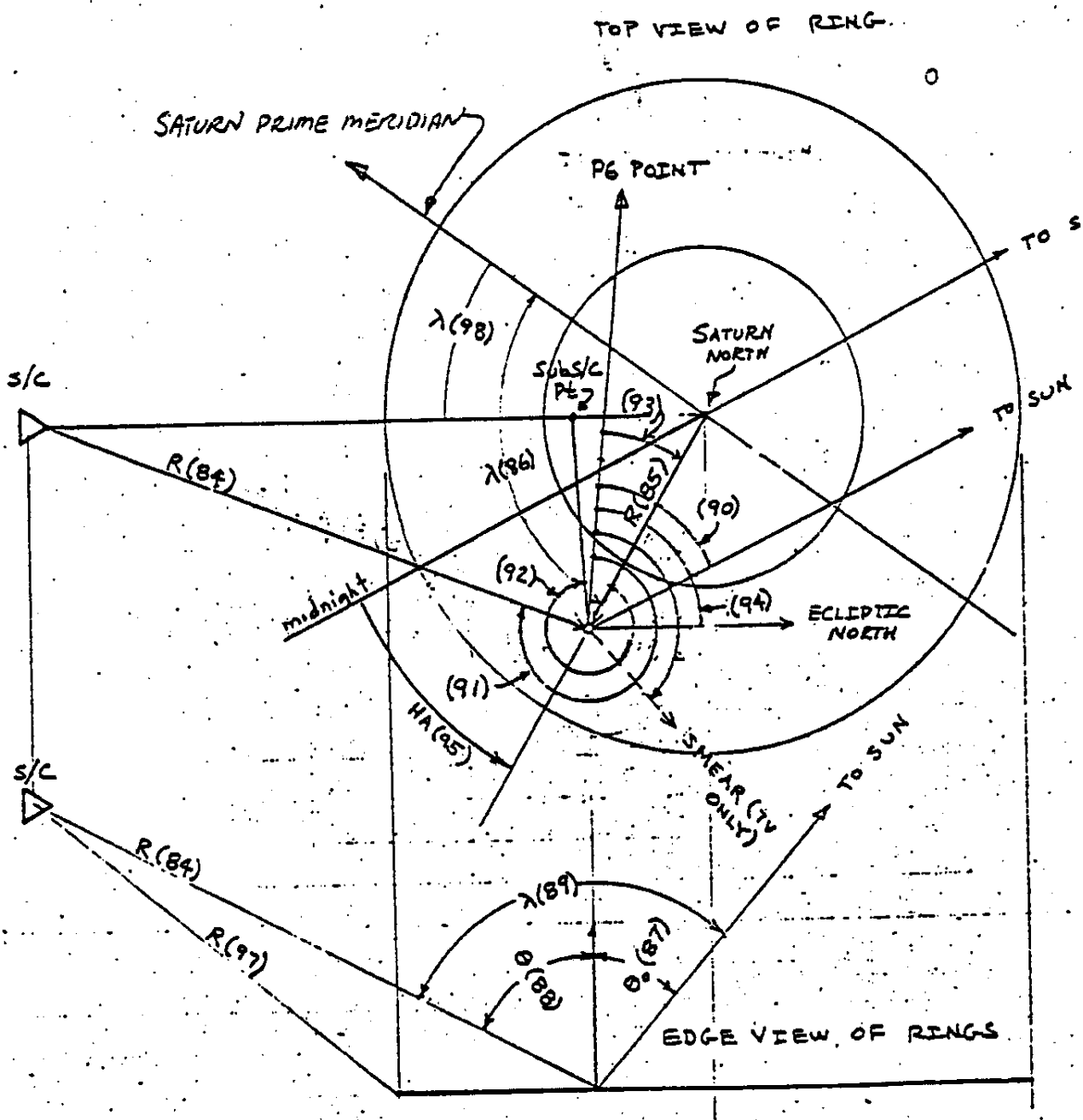


FIGURE 7 SATURN RING GEOMETRY

Attachment C

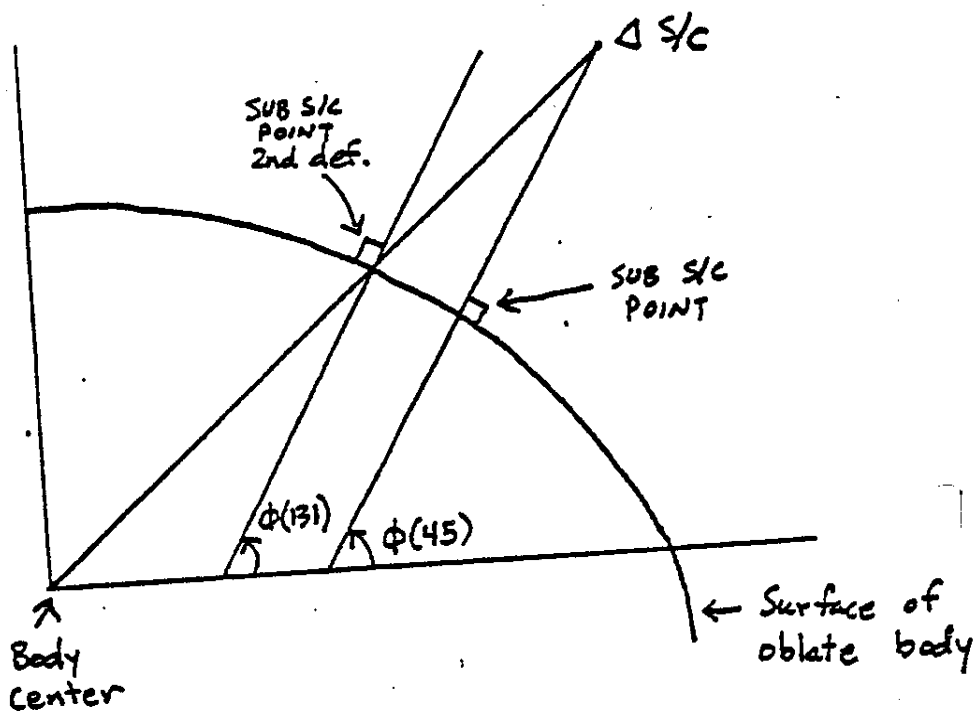
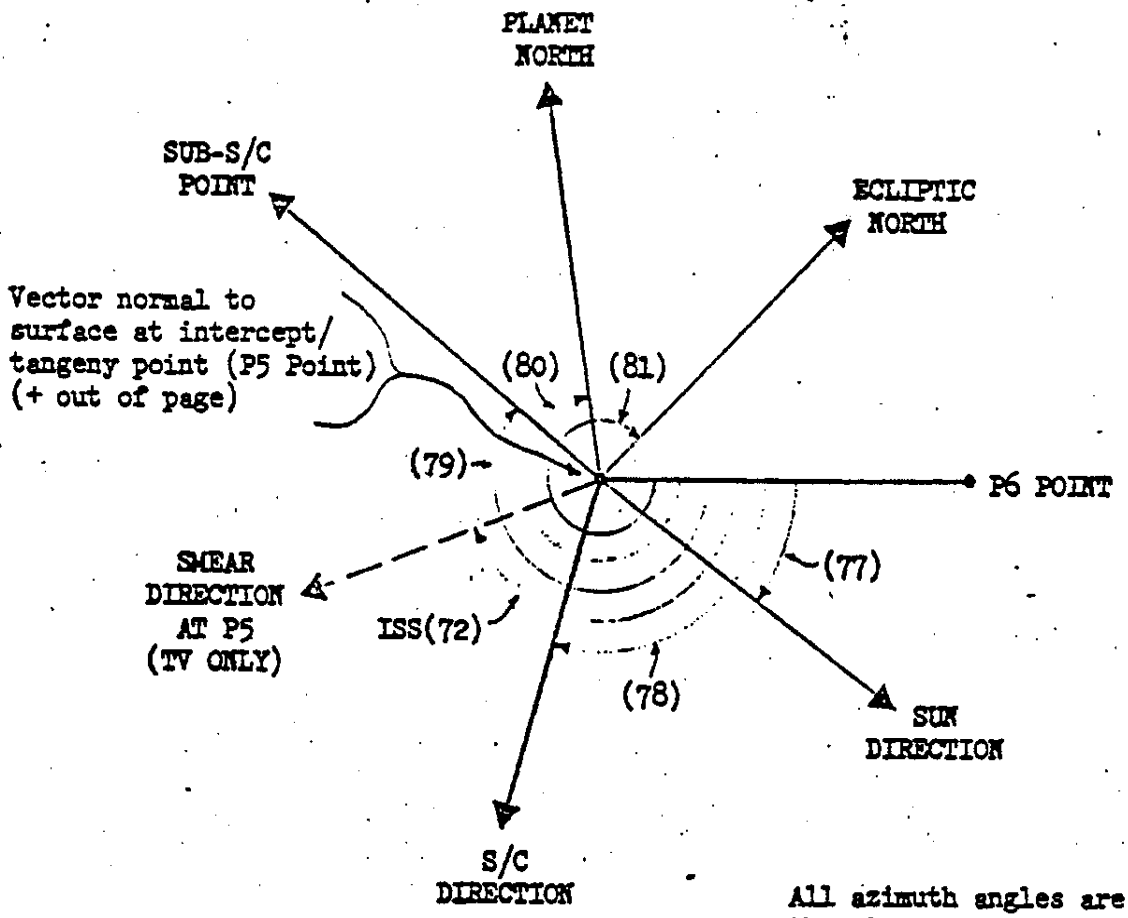


FIGURE 8 - PLANETODETIC LATITUDE
OF SUBSPACECRAFT POINT BY SECONDARY DEFINITION



All azimuth angles are measured in the clockwise direction about the vector normal to the surface at the intercept/tangency point in the plane tangent to the surface at that point. All of the angles are measured from the P5-P6 vector.

FIGURE 6 AZIMUTH ANGLES

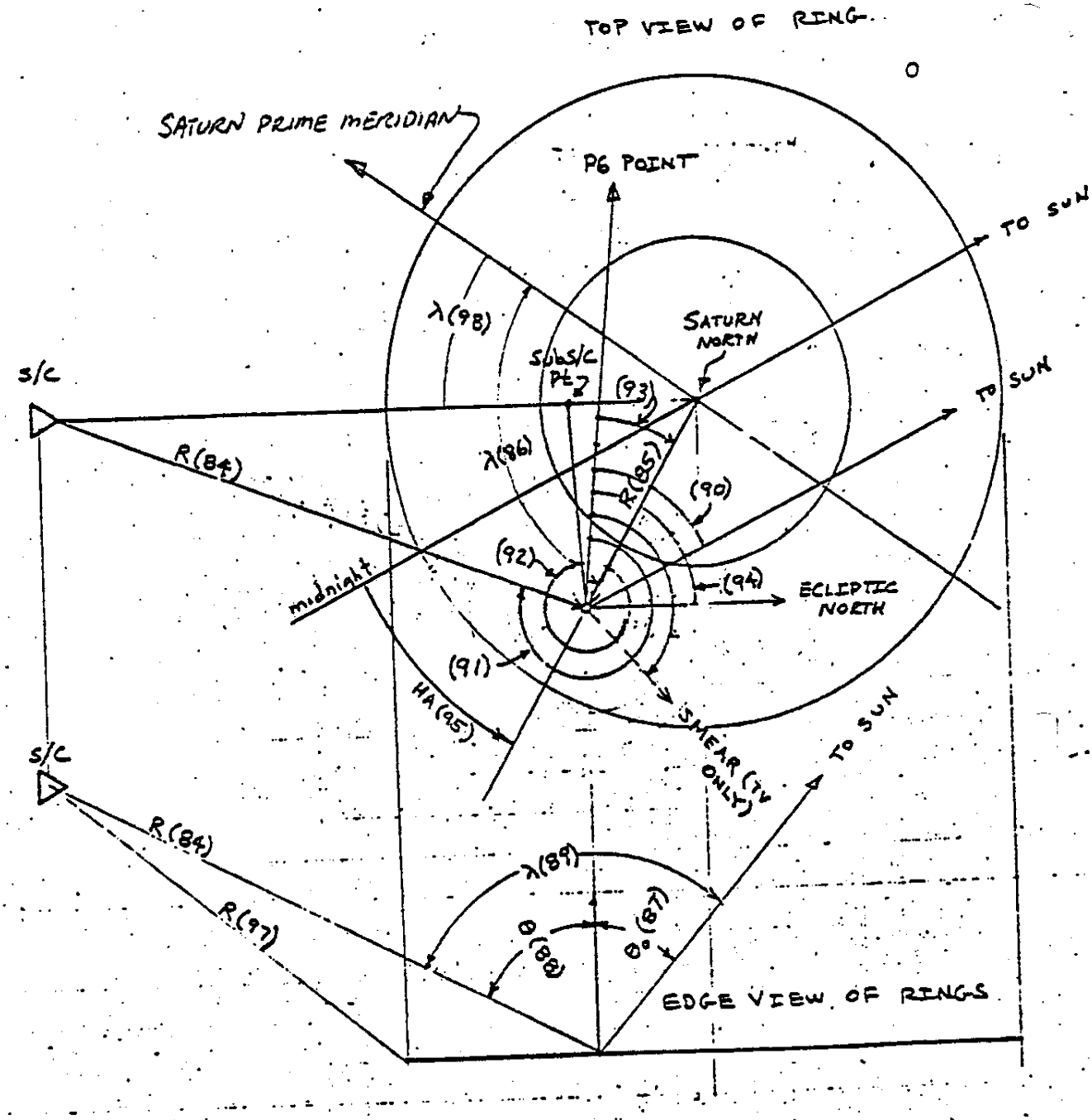


FIGURE 7 SATURN RING GEOMETRY

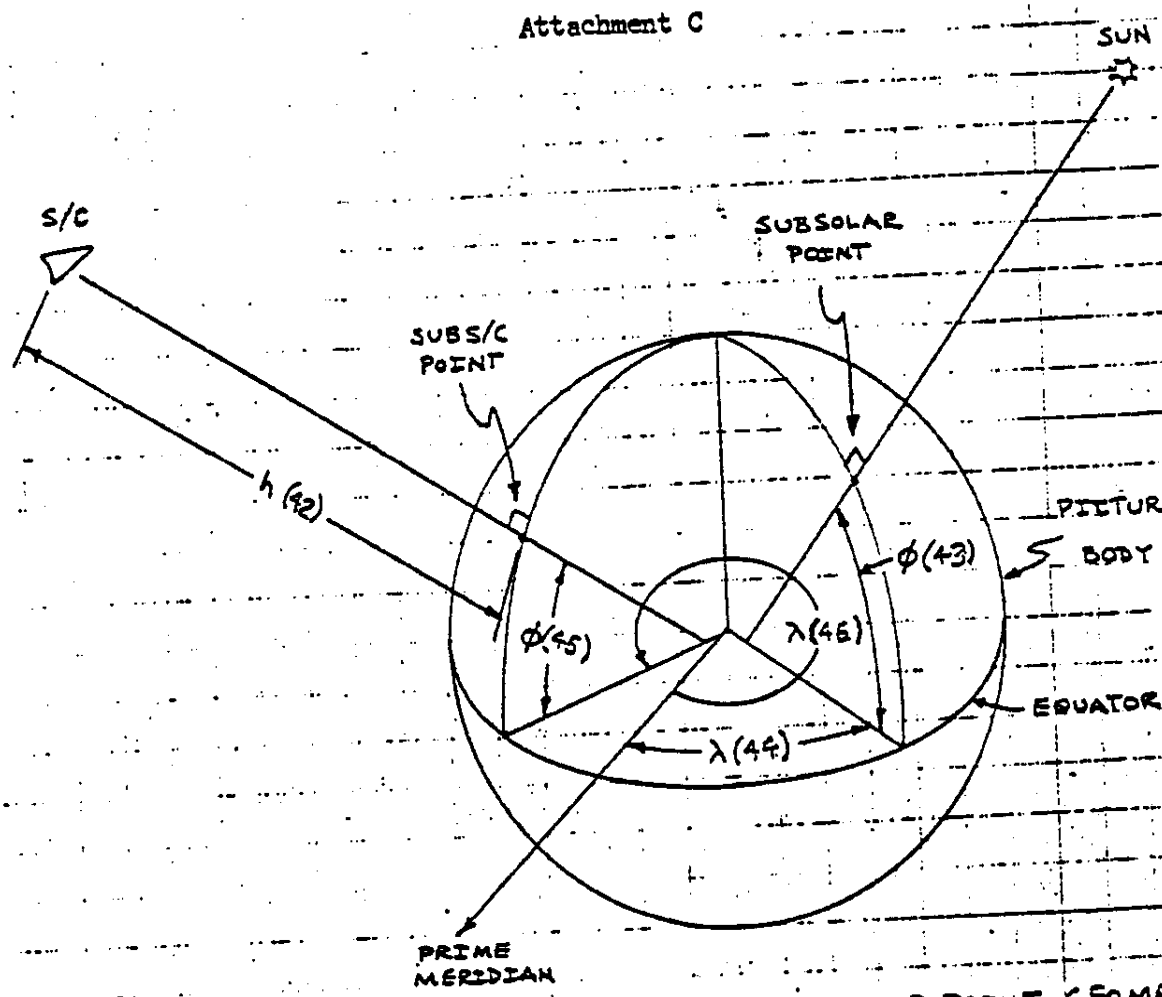


FIGURE 2 SUB S/C - SUB SOLAR POINT GEOMETRY

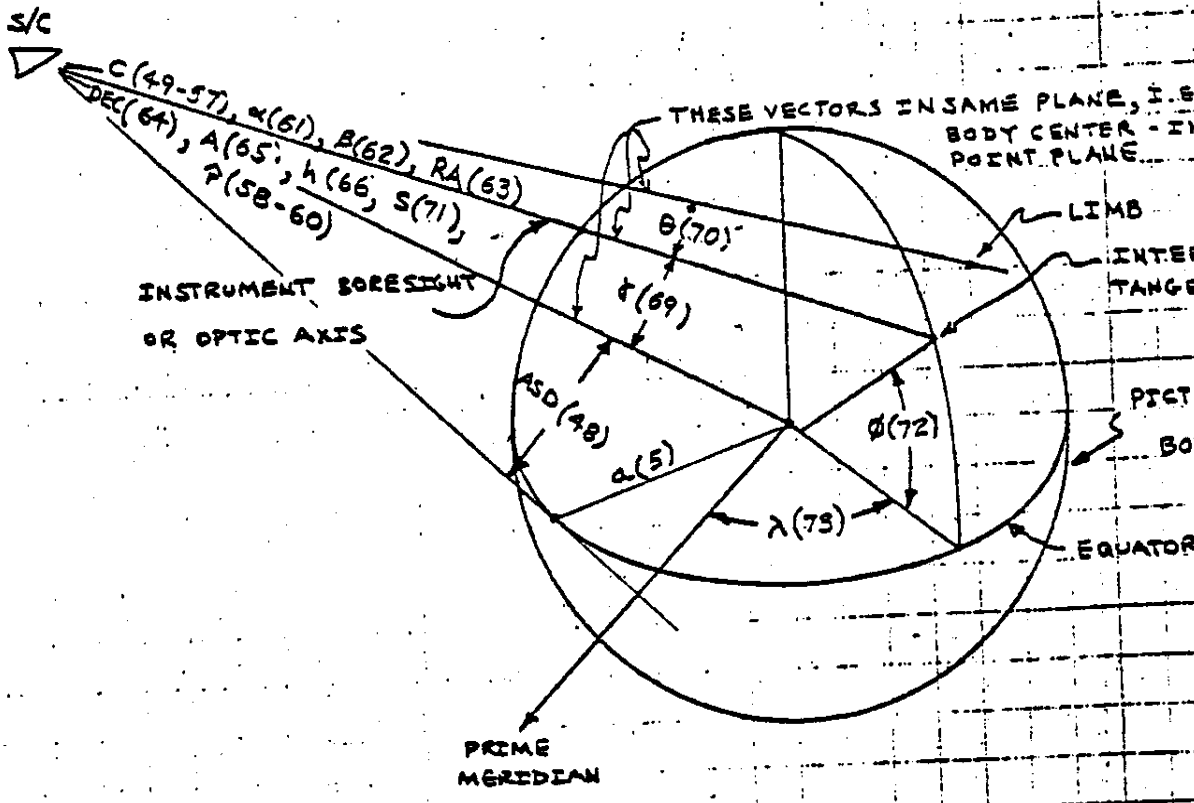


FIGURE 3 - GENERAL OPTIC AXIS GEOMETRY

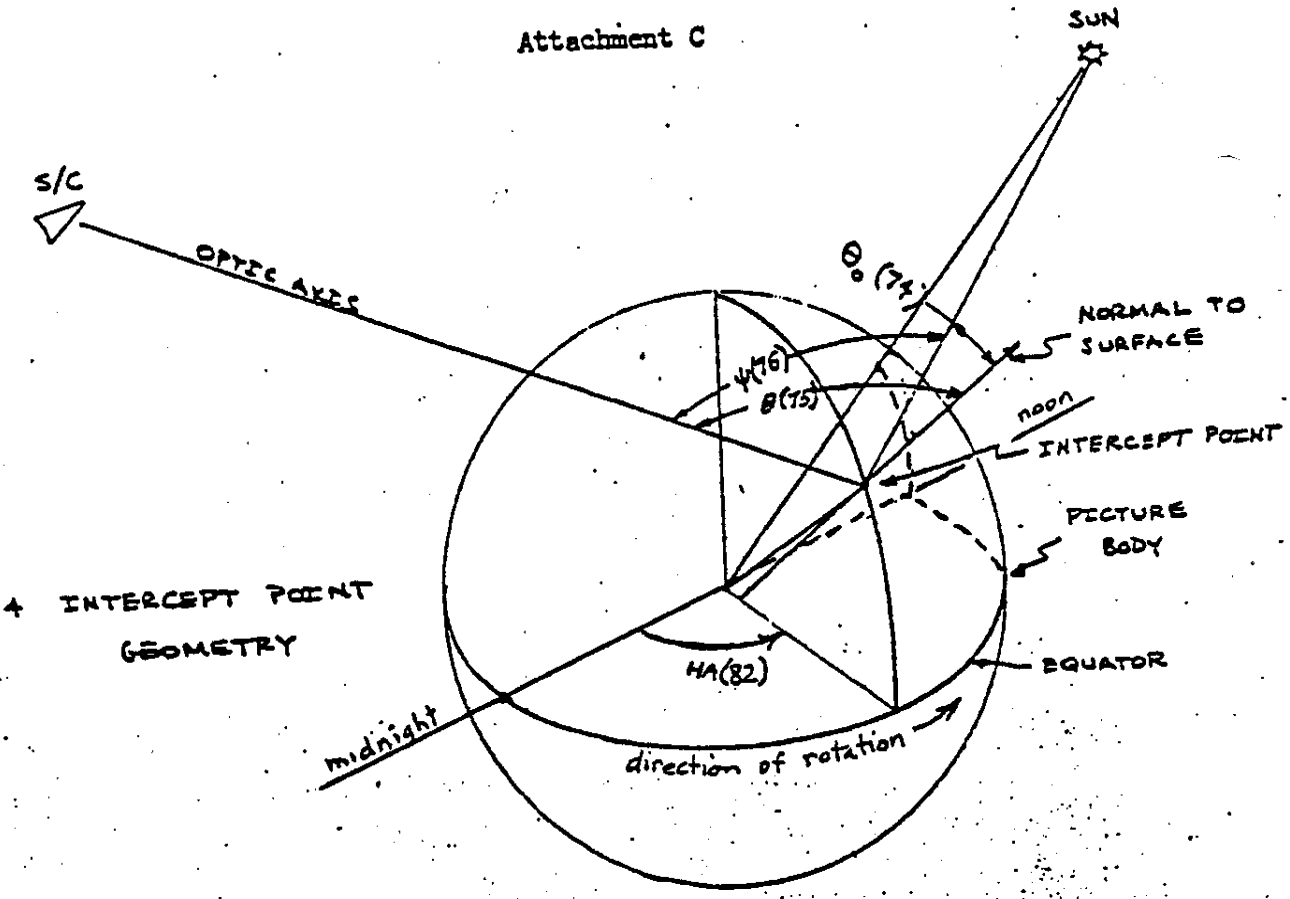


FIGURE 4 INTERCEPT POINT GEOMETRY

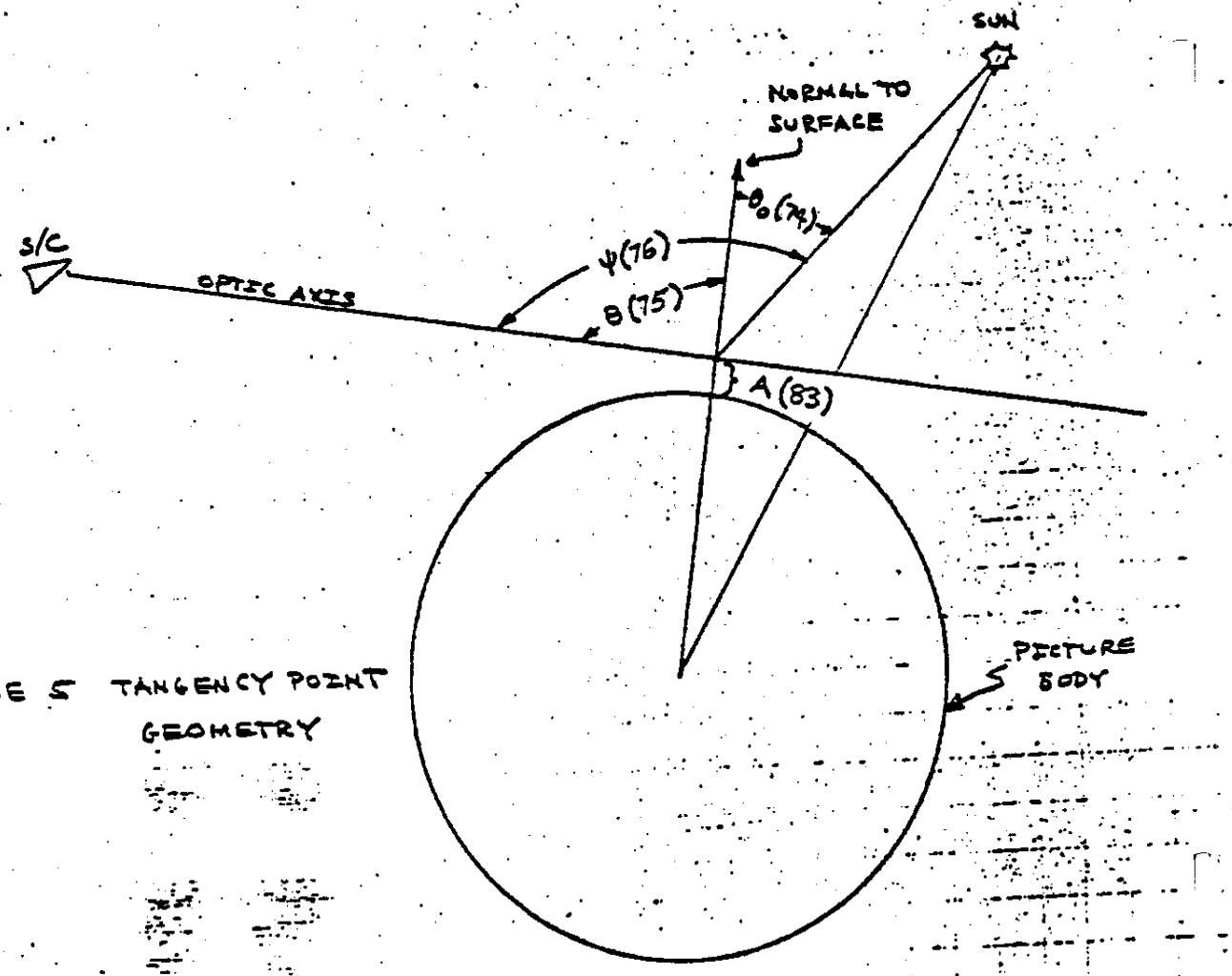


FIGURE 5 TANGENCY POINT GEOMETRY

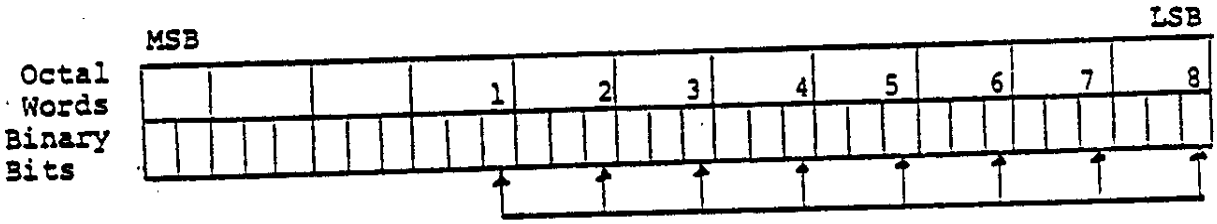
Attachment C

TELEMETRY USE CODE

Table C-2

OCTAL NUMBER POSITION - LEFT TO RIGHT	DESCRIPTION
1 *	Pitch Limit Cycle Position
2 *	Yaw Limit Cycle Position
3 *	Roll Limit Cycle Position
4	Scan Platform Elevation
5	Scan Platform Azimuth
6	Pitch Limit Cycle Rate
7	Yaw Limit Cycle Rate
8	Roll Limit Cycle Rate

* always zero if no limit cycle correction is applied.



When these bits are set telemetry is used.
When they are not set predicts are used.
All other bits are zero.

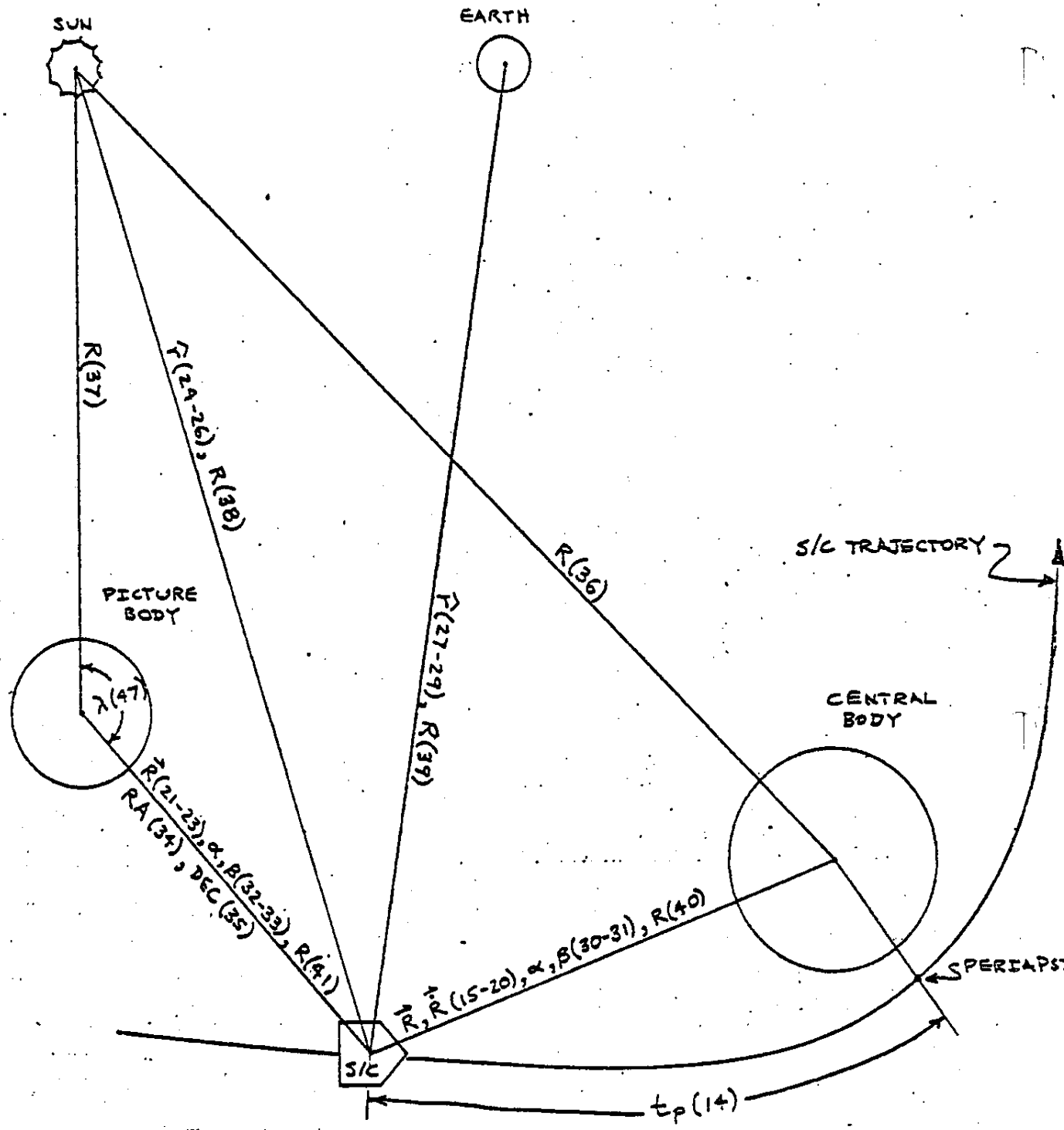


FIGURE 1 GENERAL SOLAR SYSTEM GEOMETRY

Attachment C

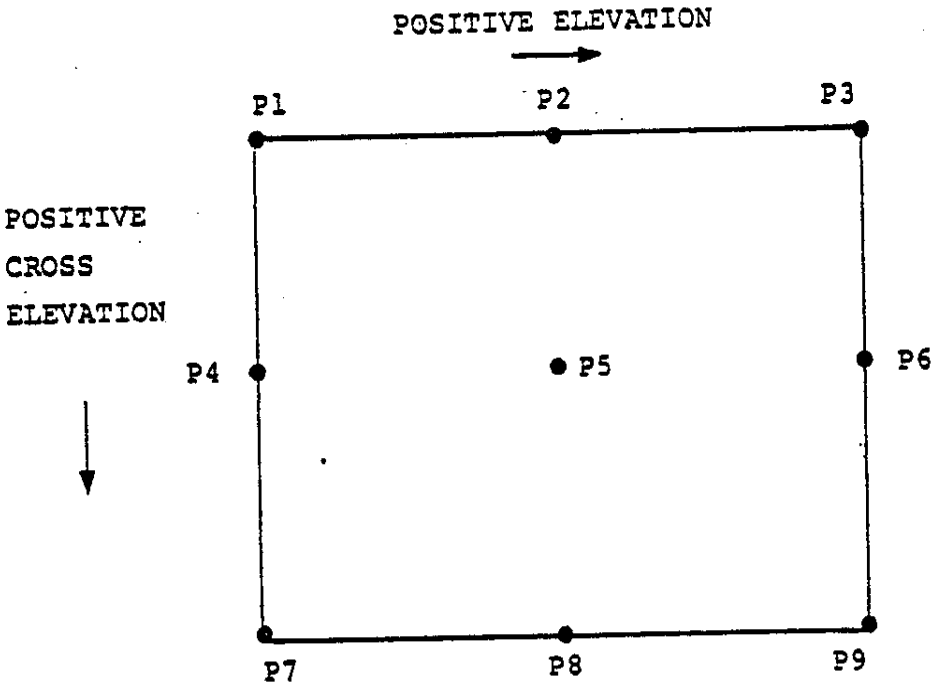
Picture Body/Central Body Identification

A 3 digit integer is used to identify the picture and central bodies in WORD 2 of each SEDR logical record (footprint). This quantity is present in each logical record due to the possibility of more than one picture body being represented on a given SEDR file. The identifier takes the following form: SSP, where SS refers to the satellite number if the picture body is a satellite, and P refers to the planet number. The planet number refers to one of the nine major planets in the solar system in order of distance from the sun. If no satellite number is specified, the picture body for the SEDR record is the planet. Also, the planet number always refers to the SEDR central body. The following table gives the picture body/central body possibilities for Jupiter and Saturn.

PICTURE BODY		CENTRAL BODY		SSP (SEDR WORD 2)
NAME	NO. (SS)	NAME	NO. (P)	
Earth	0	Earth	3	3
Moon	1	Earth	3	13
Jupiter	0	Jupiter	5	5
Io	1	Jupiter	5	15
Europa	2	Jupiter	5	25
Ganymede	3	Jupiter	5	35
Callisto	4	Jupiter	5	45
Amalthea	5	Jupiter	5	55
Hestia	6	Jupiter	5	65
Hera	7	Jupiter	5	75
Poseidon	8	Jupiter	5	85
Hades	9	Jupiter	5	95
Demeter	10	Jupiter	5	105
Pan	11	Jupiter	5	115
Adrastea	12	Jupiter	5	125
Saturn	0	Saturn	6	6
Janus	1	Saturn	6	16
Mimas	2	Saturn	6	26
Enceladus	3	Saturn	6	36
Tethys	4	Saturn	6	46
Dione	5	Saturn	6	56
Rhea	6	Saturn	6	66
Titan	7	Saturn	6	76
Hyperion	8	Saturn	6	86
Iapetus	9	Saturn	6	96
Phoebe	10	Saturn	6	106
A1640 (S10)	51	Saturn	6	516
B1640 (S11)	52	Saturn	6	526
Dione-B	54	Saturn	6	546

TABLE C-1

Attachment B



The above is based on the ISS FOV. See Attachment D for the FOV of the other instruments.

TABLE B-1 OFFSET ANGLE CONVENTIONS AS VIEWED BY THE INSTRUMENT

Attachment C

Scan Platform Instrument
SEDR Common Block Format

The figures which follow the common block format present graphically some of the SEDR parameters which appear in the format. It is hoped that these figures will aid the reader to better understand what each SEDR quantity represents to avoid confusion in the future and to help in present discussions and negotiations of the SEDR contents. Note that the symbols on each figure have a number in parenthesis appended which indicates the word number in the common block format to which it corresponds.

Scan Platform Instrument SEDR Common Block Format

WORD	DESCRIPTION	UNITS	TYPE
1	Experiment/Instrument Identification (ISSN, ISSW, IRIS, PPS, UVSA, UVSØ)	N/A	C
2	Picture Body/Central Body Identification	see Table C-1	I
3	SCE GMT Year of Measurement Time	Years, AD	I
4	SCE GMT Day-of Measurement Time	Day of year	I
5	SCE GMT Hour of Measurement Time	Hour of day	I
6	SCE GMT Minute of Measurement Time	Minute of hour	I
7	SCE GMT Second of Measurement Time	Second of minute	I
8	SCE GMT Millisecond of Measurement Time	Msec of second	I
9	FDSC MOD16 Count Value at Measurement Time	Binary Counts	I
10	FDSC MOD60 Count Value at Measurement Time	Binary Counts	I
11	Picture Body Rotational Rate	Deg/day	E
12	Picture Body Flattening ($f = \frac{a-b}{b}$, a = semi-major axis, b = semi-minor axis)	Dim	E
13	Picture Body Semi-Major Axis or Equatorial Radius	Km	E
14	Time to(-)/from(+) Central Body Periapsis	Sec	E
15-20	Cartesian Position and Velocity of S/C, Central Body Centered, Earth Mean Equator and Equinox of 1950.0	Km Km/sec	E
21-23	Cartesian Position of Picture Body, S/C Centered, Earth Mean Equator and Equinox of 1950.0	Km	E
24-26	Cartesian Unit Vector of Sun Direction, S/C Centered, Earth Mean Equator and Equinox of 1950.0	Dim	E
27-29	Cartesian Unit Vector of Earth Direction, S/C Centered, Earth Mean Equator and Equinox of 1950.0	Dim	E

Scan Platform Instrument Common Block Format

WORD	DESCRIPTION	UNITS	TYPE
30-31	Celestial Clock and Cone Angles of the Central Body	Deg	E
32-33	Celestial Clock and Cone Angles of the Picture Body	Deg	E
34-35	Right Ascension and Declination of the Picture Body, S/C Centered Earth Mean Equator and Equinox of 1950.0	Deg	E
36	Range Central Body - Sun	Km	E
37	Range Picture Body - Sun	Km	E
38	Range S/C - Sun	Km	E
39	Range S/C - Earth	Km	E
40	Range S/C - Central Body	Km	E
41	Range S/C - Picture Body	Km	E
42	S/C Altitude above the Picture Body (Normal to Surface)	Km	E
43-44	Picture Body Subsolar Point Planetodetic Latitude and Longitude	Deg	E
45-46	Picture Body Sub-S/C Point Planetodetic Latitude and Longitude	Deg	E
47	S/C Phase Angle (S/C - Picture Body Center - Sun Angle)	Deg	E
48	Angular Semi-Diameter of the Picture Body Equatorial Plane	Deg	E
49-57	Transformation Matrix - Instrument Coordinate System -To- Earth Mean Equator and Equinox of 1950.0 (C-Matrix)	Dim	E
58-60	Cartesian Unit Vector of Instrument Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox 1950.0	Dim	E
61-62	Celestial Clock and Cone Angles of the Instrument Optic Axis	Deg	E
63-64	Right Ascension and Declination of the Instrument Optic Axis, S/C Centered, Earth Mean Equator and Equinox of 1950.0	Deg	E

Scan Platform Instrument Common Block Format

WORD	DESCRIPTION	UNITS	TYPE
65-67 *	Azimuth, Elevation, and Twist Angles of the Scan Platform Primary Pointing Vector (L Vector or ISSNA Optic Axis)	Deg	E
68	Scan Platform in Motion Bit (= 0, Platform not moving; = 1, Platform moving;	Dim	I
69	Angle Instrument Optic Axis - S/C to Picture Body Center Vector	Deg	E
70	Angle Instrument Optic Axis - S/C to Picture Body Limb in the same plane as defined by above angle (WORD 69)	Deg	E
71	Range S/C - Picture Body Intercept/Tangency Point (Slant Range)	Km	E
72-73	Picture Body Intercept/Tangency Point Planetodetic Latitude and Longitude	Deg	E
74	Picture Body Intercept/Tangency Point Solar Incidence Angle	Deg	E
75	Picture Body Intercept/Tangency Point S/C Emission Angle	Deg	E
76	Picture Body Intercept/Tangency Point Phase Angle	Deg	E
77	Azimuth Angle in the Plane Tangent to the Surface at the Picture Body Intercept/Tangency Point from P5-P6 Vector to P5-Sun Direction in the Clockwise Direction	Deg	E
78	Azimuth Angle in the Plane Tangent to the Surface at the Picture Body Intercept/Tangency Point from P5-P6 Vector to P5-S/C Direction in the Clockwise Direction	Deg	E
79	Azimuth Angle in the Plane Tangent to the Surface at the Picture Body Intercept/Tangency Point from P5-P6 Vector to P5-SubS/C Point Direction in the Clockwise Direction	Deg	E
80	Azimuth Angle in the Plane Tangent to the Surface at the Picture Body Intercept/Tangency Point from P5-P6 Vector to P5-Picture Body North Direction in the Clockwise Direction	Deg	E
81	Azimuth Angle in the Plane Tangent to the Surface at the Picture Body Intercept/Tangency Point from P5-P6 Vector to P5-Ecliptic North Direction in the Clockwise Direction	Deg	E
82	Picture Body Intercept/Tangency Point Local Hour Angle	Deg	E
83	Point of Closest Approach (PCA) Altitude of Optic Axis (Positive for Tangency, Negative for Intercept)	Km	E
84	Range S/C - Saturn Rings Intercept ** Point	Km	E
85	Range Saturn Center - Saturn Rings Intercept ** Point	Km	E

* Twist Angle is always zero.

** Ring intercept is ring plane intercept

Scan Platform Instrument Common Block Format

WORD	DESCRIPTION	UNITS	TYPE
86	Longitude of Saturn Rings Intercept** point as projected on Saturn	Deg	E
87	Saturn Rings Intercept** Point Solar Incidence Angle	Deg	E
88	Saturn Rings Intercept** Point S/C Emission Angle	Deg	E
89	Saturn Rings Intercept** Point Phase Angle	Deg	E
90	Azimuth Angle in the Ring Plane at the Intercept** Point from P5-P6 Vector to P5-Sun Direction in the Clockwise Direction	Deg	E
91	Azimuth Angle in the Ring Plane at the Intercept** Point from P5-P6 Vector to P5-S/C Direction in the Clockwise Direction	Deg	E
92	Azimuth Angle in the Ring Plane at the Intercept** Point from P5-P6 Vector to P5-SubS/C Point Direction in the Clockwise Direction	Deg	E
93	Azimuth Angle in the Ring Plane at the Intercept** Point from P5-P6 Vector to P5-Saturn North (Center) in the Clockwise Direction	Deg	E
94	Azimuth Angle in the Ring Plane at the Intercept** Point from P5-P6 Vector to P5-Ecliptic North Direction in the Clockwise Direction	Deg	E
95	Saturn Rings Intercept** Point Local Hour Angle	Deg	E
96	Tangency point distance to the F-ring (2.34 Saturn radii) on the projection of the optic axis on the ring plane. Positive for outside F-ring, negative for inside. See Figure 9.	Km	E
97	Range S/C - Closest Point of Saturn Rings on F-ring (2.34 Saturn radii)	Km	E
98	Longitude of Closest Point of Saturn Rings, as projected on Saturn	Deg	E
99-100*	Planetodetic Latitude and Longitude of Io (Titan) Shadow on Jupiter (Saturn) Surface	Deg	E
101-102*	Planetodetic Latitude and Longitude of Europa Shadow on Jupiter Surface	Deg	E
103-104*	Planetodetic Latitude and Longitude of Ganymede Shadow on Jupiter Surface	Deg	E
105-106*	Planetodetic Latitude and Longitude of Callisto Shadow on Jupiter Surface	Deg	E
107	Angle Jupiter System II Prime Meridian Minus Jupiter System I Prime Meridian	Deg	E

* Latitudes set to 200 degrees and longitudes to zero when not computed

** Ring intercept is ring plane intercept

Scan Platform Instrument Common Block Format

WORD	DESCRIPTION	UNITS	TYPE
108	Angle Jupiter System III (1965.0) Prime Meridian Minus Jupiter System I Prime Meridian	Deg	E
109-117	Transformation Matrix - Picture Body Equator and Prime Meridian of Date To Earth Mean Equator and Equinox of 1950.0 (XMEM) (Not valid for S10, S11, Dione-B)	Dim	E
118-126	Transformation Matrix - Picture Body Equator and Equinox of Date To Earth Mean Equator and Equinox of 1950.0 (XMEM) (Not valid for S10, S11, Dioné-B)	Dim	E
127-129	Pitch, Yaw and Roll Limit Cycle Angles about the S/C Axes which have been applied to the Instrument Optic Axis Pointing Vector	Deg	E
130	Telemetry Use Code * 0 = Telemetry is not used or Predict is used. 1 = Telemetry is used	N/A	Octal
131	Planetodetic latitude of subspacecraft point by secondary definition. See Attachment C, Figure 8.	Deg	E
132-~~136~~ 144	Spares		

* Refer to Attachment C, Table C-2, for breakdown of telemetry code.

Attachment B

Scan Platform Instrument SEDR Header Record Format

WORD	DESCRIPTION	UNITS	TYPE
1	Project Identification	'MJS '	C
2	File Identification	'SEDR'	C
3	Spacecraft Identification (0 = Flt 2, 1 = Flt 1, 2 = PTM, 4 = Sim 1, 5 = Sim 2)	Dim	E
4-5	SEDR Identification (Tape Number)	NA	C
6	SEDR File Generation Date	MMDDYY	I
7	SEDR File Generation Time	HHMMSS	I
8-9	LIBPOG Identification (Tape Number)	NA	C
10	LIBPOG File Generation Date	MMDDYY	I
11	LIBPOG File Generation Time	HHMMSS	I
12	IPPS File Generation Date	MMDDYY	I
13	IPPS File Generation Time	HHMMSS	I
14-16	*Elevation, Cross-Elevation and Rotation Offset Angles of the ISSWA Optic Axis from the ISSNA Optic Axis	Deg	E
17-19	*Elevation, Cross-Elevation and Rotation Offset Angles of the PPS Optic Axis from the ISSNA Optic Axis	Deg	E
20-22	*Elevation, Cross-Elevation and Rotation Offset Angles of the IRIS Optic Axis from the ISSNA Optic Axis	Deg	E
23-25	*Elevation, Cross-Elevation and Rotation Offset Angles of the UVS Airglow Optic Axis from the ISSNA Optic Axis	Deg	E
26-28	*Elevation, Cross-Elevation and Rotation Offset Angles of the UVS Occultation Optic Axis from the ISSNA Optic Axis	Deg	E
29-45	Spares		
	*Figure on following page presents the offset angle conventions		

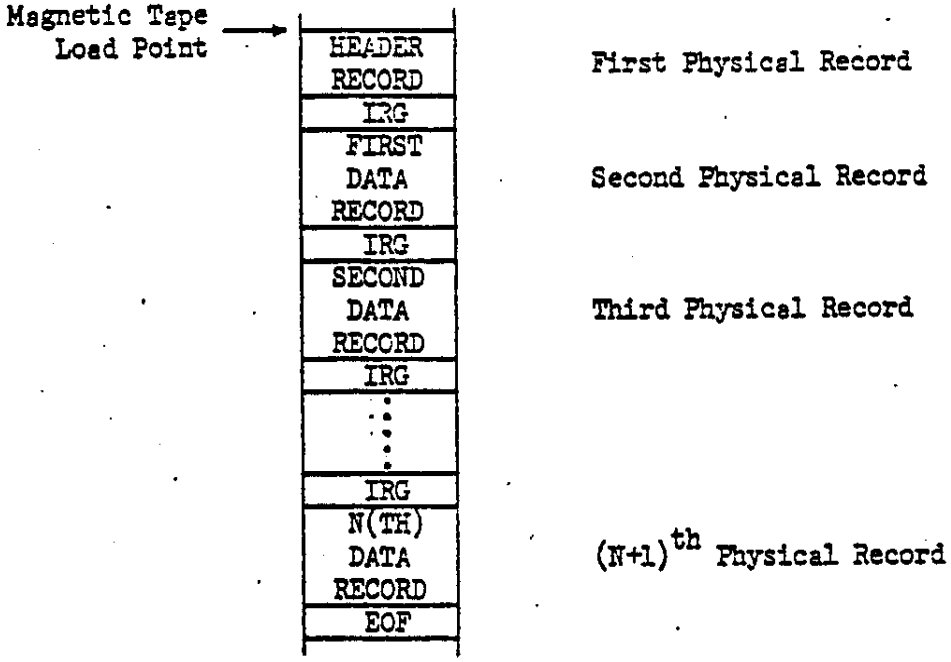
ATTACHMENT C

Scan Platform Instrument
SEDR Common Block Format

Scan Platform Instrument

SEDR File Layout

Each scan platform instrument SEDR file shall be contained on a single magnetic tape and shall be comprised of a file header record, n data records and an End-of-File (EOF) mark. The format of how the SEDR file resides on the magnetic tape is presented in the figure below.



The header record and all data records are separate complete physical records separated by inter-record gaps (IRG). Each data record is equivalent to a logical record, i. e., each data record contains a complete set of SEDR parameters. The set of parameters will always contain a common block of data (SEDR Common Block) and may also contain an instrument peculiar block (SEDR Instrument Peculiar Block). If only a common block is required for this instrument, the physical record size in words for each data record will be identical to the size of the common block. If, however, both the common and peculiar blocks are required, the physical record size is determined by the sum of the common and peculiar block sizes. The following list indicates instrument type versus block requirements.

Instrument	Block Requirements
ISS	Common and Peculiar
UVS	Common and Peculiar
PPS	Common
IRIS	Common and Peculiar

ATTACHMENT B

Scan Platform Instrument
SEDR Header Record Format

JPL	Jet Propulsion Laboratory
Km	Kilometers
Km/sec	Kilometers per second
LIBPOG	Library Planetary Observation Geometry Module of POINTER
LJSF	Left Justified Space Filled
MMDDYY	Month-Day=Year
MOD	Modulo
Msec	Milliseconds
PCA	Point of Closest Approach
PI	Principle Investigator
POINTER	Planetary Observation Instrument Targeting and Encounter Reconnaissance Program
PPS	Photopolarimeter Subsystem
PTM	Proof Test Model
Rad/sec	Radians per second
SCE	Spacecraft Event Time
Sec	Seconds
SEDR	Supplementary Experiment Data Record
SEDRGEN	Supplementary Experiment Data Record Generation Program
Sim	Simulation Math Model
S/C	Spacecraft
UVS	Ultraviolet Spectrometer Subsystem

ATTACHMENT A

Scan Platform Instrument
SEDR File Layout

FRACTION — contains the significant digits of the quantity with the binary point located to the left of bit 8.

The following algarithm could be used to evaluate floating point quantities from the format:

$$VALUE_{10} = (1 - 2*SIGN) * (FRACTION_{10}) * 16_{10} ** (CHAR_{10} - 64_{10})$$

RECORDING METHOD

UNIVAC 1100 System Library Routine, IOW (binary read/write routine)

DETAILED INTERFACE DEFINITION/FORMAT

The SEDRGEN Program will write a 9-track magnetic tape for the IRIS PI containing data intended to supplement his EDR data. The SEDR will not contain any duplication of data already present on the EDR except for certain timing values which are needed to correlate the EDR and SEDR data. The attachments to this document describe the structure and content of the IRIS SEDR.

Attachment A	Scan Platform Instrument SEDR File Layout
Attachment B	Scan Platform Instrument SEDR Header Record Format
Attachment C	Scan Platform Instrument SEDR Common Block Format
Attachment D	IRIS Instrument Peculiar Block Format
Attachment E	EME50 -TO- ECL50 Transformation Matrix

DEFINITION OF TERMS

Celestial Clock and Cone Angles	Clock and cone angles centered at the S/C with respect to the Sun - S/C - Canopus (ABC) reference system.
Central Body	The celestial body controlling the Trajectory of the S/C. Earth, Jupiter and Saturn are the only possible central bodies.
C-Matrix	The C-Matrix defines the instrument coordinate system (L,M,N system) in EME50 coordinates. The matrix therefore can be used to transform instrument coordinates to EME50 corrdinates. The matrix can also be considered to be 3 EME50 unit vectors where the first three elements define the instrument M axis, the second three define the instrument N axis and the last three define the instrument L (optic axis) axis.
Longitude Systems	The longitude angles given on the SEDR for the planets and satellites will conform to the International Astronomical Union (IAU) conventions. All longitude angles pertaining to Jupiter will be given relative to the System I Prime Meridian. The SEDR will also contain conversion or rotation angles such that longitudes can also be obtained relative to the System II and System III Prime Meridians. This document will not attempt to define all the longitude systems of the planets and satellites that

will be represented on the SEDR. However, reference to documentation which contains descriptions of the Jupiter and Saturn systems are given below:

Jupiter System I - Explanatory Supplement to the Ephemeris or JPL Technical Report 32-1508, dated January 15, 1971 (available upon request).

Jupiter System II - Same as Jupiter System I.

Jupiter System III - The SEDR uses System III (1965.0)

Saturn System - JPL Technical Report 32-1508, dated January 15, 1971 (available upon request).

Picture Body — The celestial object under observation. The following picture bodies are possible: Earth, Moon, Jupiter, all Jovian satellites, Saturn, all Saturnian satellites and Saturn rings. Earth, Moon and all satellites of Jupiter and Saturn will be represented as spheres. Both Jupiter and Saturn will be represented as oblate spheroids. Saturn Rings will be modelled as a circular ring in the Saturnian equatorial plane.

GLOSSARY

BPI	Bits Per Inch
C	Character Quantity
Deg	Degrees
Dim	Dimensionless
E	Floating Point Quantity
FDSC	Flight Data Subsystem Count
FOV	Field-Of-View
GMT	Greenwich Mean Time
HHMMSS	Hours-Minutes-Seconds
I	Integer Quantity
IAU	International Astronomical Union
IPPS	Instrument Pointing Program Set
IRG	Inter-Record Gap
IRIS	Infrared Interferometer Spectrometer and Radiometer Subsystem
ISS	Imaging Science Subsystem

The abbreviations used in Table D2:

HK = Housekeeping.

IFM = Interferogram

PB = Picture Body. The body (planet or satellite) that the IRIS instrument is pointing at at the time of observation.

CB = Central Body. The planetary body at the center of the planet-moon system (i.e., Jupiter, Saturn).

Q5 = Defines intercept point of center of IRIS field of view with surface of target body. If the instrument is pointed off the limb (emission angle greater than 90 degrees), the Q5 data "looks good", but in fact is not.

S/C = Spacecraft.

ASD = Angular Semi-Diameter. The angle subtended in degrees at the spacecraft by the radius of the disc of the observed body.

Saturnian Coordinate System 1: A coordinate system of reference which rotates at the same rate as Saturn's magnetic field.

The arrangement of the IRIS field of view is illustrated in Appendix E.

Table D2. RDR Record Contents

RDR FIELD NO.	BYTE LOCATION	FORMAT WORD	FI-SEDR WORD	SP-SEDR WORD	DESCRIPTION
1	1-4	I*4			Tape Creation Date (YY MM DD)
2	5-6	I*2			Record Type: Always 3
3	7-8	I*2			Calibration File Serial #
4	9-10	I*2			Source EDR Tape # -N = Preliminary +N = Final
5	11-12	I*2			Source Fixed Instrument SEDR Tape # 0 = None -N = Predict +N = Actual
6	13-14	I*2			Source Footprint SEDR Tape # 0 = None -N = Predict +N = Actual
7	15-16	I*2			# of Records in Average - Always 1
8	17-20	I*4			Starting FDSC Mod 2^{16}
9	21-24	I*4			Starting FDSC Mod 60
10	25-28	I*4			Ending FDSC Mod 2^{16} (Always = Field 8)
11	29-32	I*4			Ending FDSC Mod 60 (Always = Field 9)
12	33-34	I*2			Spacecraft ID 1 = Voyager 1 2 = Voyager 2
13	35-36	I*2			Data Mode from EDR Header: (10 = GS3 etc.)
14	37-38	I*2			Playback Flag 0 = Real Time 1 = Playback
15	39-40	I*2			Earth Received Time: Year
16	41-42	I*2			Earth Received Time: Day
17	43-44	I*2			Earth Received Time: Hour
18	45-46	I*2			Earth Received Time: Minutes
19	47-48	I*2			Earth Received Time: Seconds
20	49-50	I*2			Data Source as in EDR (1 = Real Time etc.)

21	51-52	I*2	Golay Encoded Flag 0 = No 1 = Yes
22	53-54	I*2	Phase Angle Serial # for Symmetrization
23	55-56	I*2	Spacecraft Event Time: Year
24	57-58	I*2	Spacecraft Event Time: Day
25	59-60	I*2	Spacecraft Event Time: Hour
26	61-62	I*2	Spacecraft Event Time: Minute
27	63-64	I*2	Spacecraft Event Time: Second
28	65-66	I*2	0 = Input by NORT File 1 = Input by EDR Proc (Scet Flag)
29	67-68	I*2	DSN Configuration 8 Bits (Low Order) as in EDR
30	69-70	I*2	DSN Station # 8 Bits (Low Order) as in EDR
31	71-72	I*2	Estimated Bit Error Count from EDR
32	73-74	I*2	DQSW Sums over 10 Groups for Bits 4, 3, 1, 0 (See EDR DQSW)
33	75-76	I*2	
34	77-78	I*2	
35	79-80	I*2	
36	81-82	I*2	# of Minor Frames, Golay Corrected
37	83-84	I*2	# of Minor Frames Containing Missing Data
38	85-86	I*2	Reject Code: 0 = OK 1 = Too Many Spikes 2 = Missing Data 3 = Zero Peak 4 = No IFM Present
39	87-88	I*2	# of Spikes, Corrected
40	89-90	I*2	Golay Bit Error Summation from EDR
41	91-92	I*2	Radiometer Data Present 0 = No 1 = Yes
42	93-96	R*4	Integrated Radiometer from HK (Watts)
43	97-100	R*4	
44	100-104	R*4	
45	105-108	R*4	
46	109-112	R*4	
47	113-116	R*4	Averages over HK Groups of 9 Temperature Channels
48	117-120	R*4	
49	121-124	R*4	

50	125-128	R*4	
51	129-132	R*4	
52	133	L*1	Lock 1st Group HK LHK1 and LHK2 Logical and
53	134	L*1	Lock 2nd Group HK LHK3 and LHK4 Logical and
54	135	L*1	Neon Delay Lock ND1 or ND2 or ND3 or ND4 Logical or
55	136	L*1	Motor Position Lock Control MP1 or MP2 or MP3 or MP4 Logical or
56	137-140	R*4	
57	141-144	R*4	
58	145-148	R*4	
59	149-152	R*4	8 Radiometer Samples Normal Gain (Watts)
60	153-156	R*4	
61	157-160	R*4	
62	161-164	R*4	
63	165-168	R*4	
64	169-172	R*4	
65	173-176	R*4	
66	177-180	R*4	
67	181-184	R*4	8 Radiometer Samples High Gain (Watts)
68	185-188	R*4	
69	189-192	R*4	
70	193-196	R*4	
71	197-200	R*4	
72	201-204	R*4	Maximum of 8 Neon Samples (Volts)
73	205-208	R*4	Minimum of 8 Neon Samples (Volts)
74	209-212	R*4	Average Residual Square Difference of Phase Fit
75	213-216	R*4	Average 22 Micron Brightness Temperature (400-500 cm^{-1})
76	217-220	R*4	Average 5 Micron Brightness Temperature (2000-2050 cm^{-1})
77	221-224	R*4	Near IR Radiance (Voy. I - Not Used) (Voy. II - Integrated Radiance 3600-3800 cm^{-1})
78	225	L*1	
79	226	L*1	

80	227	L*1			HK Present 4 Groups
81	228	L*1			
82	231-232	I*2			
83	233-234	I*2			EDR Subheader Without Spares
84	235-236	I*2			
85	237-240	R*4			X
86	241-244	R*4			Y
87	245-248	R*4			Z Cartesian State of Spacecraft
88	249-252	R*4			$\dot{X}$ Relative to Saturnian Magnetic Field
89	253-256	R*4			$\dot{Y}$
90	257-260	R*4			$\dot{Z}$
91	261-264	R*4			X
92	265-268	R*4			Y Cartesian State of Spacecraft
93	269-272	R*4			Z Saturn Centered, Saturn Mean Orbit and Prime
94	273-276	R*4			$\dot{X}$ Meridian in Sun Direction
95	277-280	R*4			$\dot{Y}$
96	281-284	R*4			$\dot{Z}$
97	285-288	R*4	157		Saturn Latitude of Spacecraft
98	289-292	R*4	158		Saturn Longitude of Spacecraft
99	293-296	R*4	159		
100	297-316	R*4			Spare
101	317-320	R*4		2	CB Id.
102	321-324	R*4		36	Range CB → Sun (km)
103	325-328	R*4	176	40	Range S/C → CB (km)
104	329-332	R*4	184		Angle α CB - Sun - S/C (Deg)
105	333-336	R*4	186		Angle α Sun - CB - S/C (Deg)
106	337-340	R*4	239		Time Relative to Periapsis
107	341-344	R*4		2	PB Id. IF PB is CB, PB = 0
108	345-348	R*4		37	Range, PB → Sun
109	349-352	R*4		40	Range, S/C → CB
110	353-356	R*4		41	Range, S/C → PB
111	357-360	R*4		71	Range, S/C → PB Tangency Point
112	361-364	R*4		42	S/C Altitude Above PB
113	365-368	R*4		43	PB Sub Solar Pt. Latitude
114	369-372	R*4		44	PB Sub Solar Pt. Longitude
115	373-376	R*4		45	PB Sub-S/C Pt. Lat.

116	377-380	R*4	46	PB Sub-S/C Pt. Long.
117	381-384	R*4	47	S/C Phase α
118	385-388	R*4	48	PB ASD
119	389-392	R*4	70	Optic Axis
120	393-396	R*4	74	Solar Elevation Angle for Q5 Point
121	397-400	R*4	75	Emission Angle for PB Q5 Point
122	401-404	R*4	76	Phase Angle for PB Q5 Point
123	405-408	R*4	77	Sun Azimuth Angle for PB Q5 Point
124	409-412	R*4	82	Local Time (hr) for PB Q5 Point
125	413-416	R*4		CB Lat. of PB
126	417-420	R*4		CB Long. of PB (Jup. Sys. I)
127	421-424	R*4		CB Long. of PB (Jup. Sys. III)
128	425-428	R*4		X
129	429-432	R*4		Y Cartesian State of PB
130	433-436	R*4		Z Relative to Saturnian Magnetic Field
131	437-440	I*4	145/146	Q1 Lat. & Long., System 3, for Line Count 350
132	441-444	I*4	147/148	Q2 Lat. & Long., System 3, for Line Count 350
133	445-448	I*4	149/150	Q3 Lat. & Long., System 3, for Line Count 350
134	449-452	I*4	151/152	Q4 Lat. & Long., System 3, for Line Count 35
135	453-456	I*4	72/73	Q5 Lat. & Long., System 3, for Line Count 350 The Q5 point is the center point for the IRIS field of view
136	457-460	I*4	153/154	Q6 Lat. & Long., System 3, for Line Count 350
137	461-464	I*4	155/156	Q7 Lat. & Long., System 3, for Line Count 350
138	465-468	I*4	157/158	Q8 Lat. & Long., System 3, for Line Count 350
139	469-472	I*4	159/160	Q9 Lat. & Long., System 3, for Line Count 350
140	473-476	R*4		Integrated Radiance Across Spectrum (175. to 2500 cm^{-1})
141	477-480	R*4		Wave # at First Data Point, (Always 150.18 cm^{-1})
142	481-484	R*4		Wave # Spacing between Data Points, (Always 1.39051 cm^{-1})
143	489-486	I*2		# of Data Points, (Always 2769)
144	487-488	I*2		Scan Platform in Motion Flag - Not Used
145	489-492	R*4		Emission Angle for Line Count 750

146	493-496	I*4	Q5 Lat. & Long., System 3, for Line Count 750
147	497-500		Spare
148	501-504	R*4	Radiance Value of First Data Point ($W/cm^2/sr/cm^{-1}$)
149	505-508	R*4	Radiance Value of Second Data Point (Always at 151.57 cm^{-1})
.	.	.	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
.	.	.	
2907	11501-11504	R*4	Radiance Value of Last Data Point (Always at 3975.47 cm^{-1})
2908	11505-11508	R*4	Q1 Range from Saturn Center of Q1 Point on Saturn Rings (km) for Linecount 350
2909	11509-11512	.	Q1 Saturn Rings Intercept Q1 Point Local Hour Angle for Count 350
2910	11513-11516	.	Q2
2911	11517-11520	.	Q2
2912	11521-11524	.	Q3
2913	11525-11528	.	Q3
2914	11529-11532	.	Q4
2915	11533-11536	.	Q4
2916	11537-11540	.	Q5
2917	11541-11544	.	Q5 The Q5 Point is the Center Point for the IRIS Field of View
2918	11545-11548	.	Q6
2919	11549-11552	.	Q6
2920	11553-11556	.	Q7
2921	11557-11560	.	Q7
2922	11561-11564	.	Q8
2923	11565-11568	.	Q8
2924	11569-11572	.	Q9
2925	11573-11576	R*4	Q9

The following example depicts one way to identify individual RDR field quantities:

```
      LOGICAL*1 BYTE
      INTEGER*2 I2VAL
      INTEGER*4 I4VAL
      REAL*4 RECORD, RAD, HEADER
      DIMENSION RECORD(2894), BYTE(500), I2VAL(250), I4VAL(125),
     A          HEADER(125), RAD(2769)
      EQUIVALENCE (RECORD(1), HEADER(1)),
     A           (HEADER(1), BYTE(1), I2VAL(1), I4VAL(1)),
     B           (RECORD(126), RAD(1))
```

Each data element can then be addressed simply by using the variable name associated with its type.

Since radiances only are stored in the data portion of the record (i.e., no associated wavenumber), the corresponding wavenumber must be computed using the 3 header fields:

REAL*4	Field #141	Starting Wave No. (Word #120)
REAL*4	Field #142	Wave No. Spacing (Word #121)
INTEGER*2	Field #143	No. of Data Points (Half-Word #243)

The following is one way to calculate and store these values for use with their corresponding radiances, using the above data definition statements to head the program:

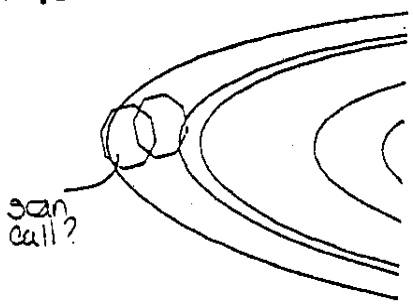
```
      DIMENSION WAVE (2769)
      WAVE(1) = RECORD(120)
      DWN = RECORD(121)
      N = I2VAL(243)
      DO 100  I = 2,N
      WAVE (I) = FLOAT (I-1) *DWN + WAVE(1)
  100 CONTINUE
```

[The number of data points (N) will always be 2769.]

B525 IRIS RING OBSERVATIONS

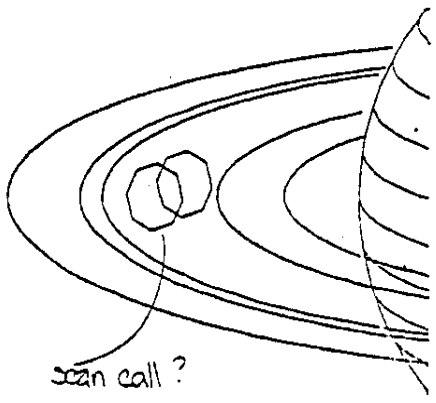
Word count is tight

-2d 10h 41m



RR7C0 (1h8m)
A RING

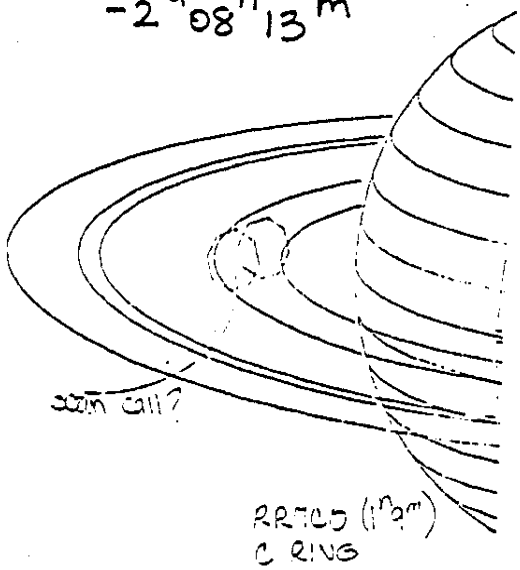
-2d 12h 10m



RR7C0 (1h9m)
B Ring

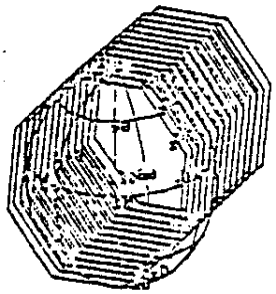
Printing of
coloring in

-2d 08h 13m



RR7C0 (1h9m)
C RING

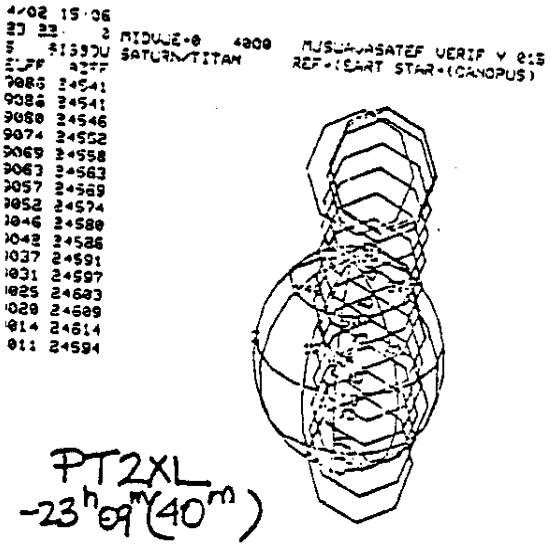
IRIS TITAN RIDE-ALONGS



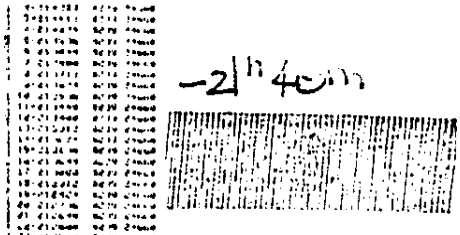
$-1^d 12^h$
($\sim 20^m$)

VTITAN

PTCRV
$-1^d 2^h 18^m (1^h 18^m)$



PT2XL
$-23^h 09^m (40^m)$

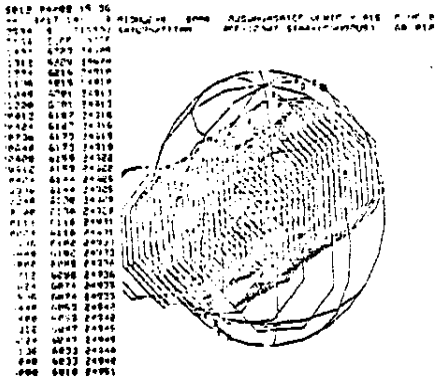


$-2^h 40^m$

TARGETED TO IRIS FOV

UTDRFT ($\sim 52^m$)
2 scans across TITAN

PT1105
$-17^h 14^m (40^m)$

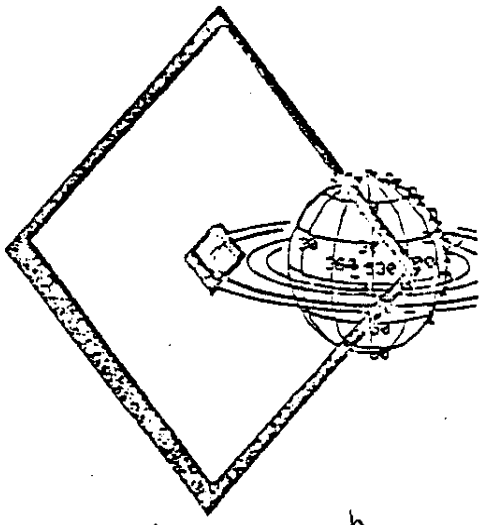


B525 REPRESENTATIVE ISS OBSERVATIONS

VRSPOK

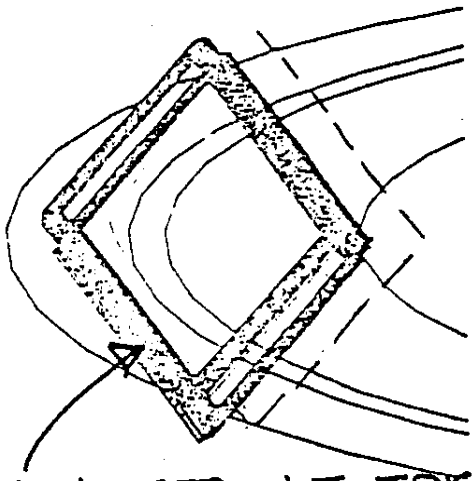
[illegible] 3/16 31 34 0 MIDUJE+3 3000 MUSUAVASATEF VERIF Y 015 P=0
[illegible] 42374 59 [illegible] SATURN/ REF=(EART STAR=(CAHOPUS) 3 012

[illegible]	[illegible]	[illegible]
1-163174	16880	23961
2-162912	16880	23952
3-162646	16880	23952
4-162422	16880	23952
5-162153	16880	23952
6-161934	16880	23952
7-161710	16880	23952
8-161446	16880	23952
9-161222	16880	23952
10-160958	16880	23952
11-160734	16880	23952
12-160510	16877	23944
13-160246	16877	23944
14-160022	16877	23944
15-155758	16877	23944
16-155534	16877	23944
17-155310	16877	23944
18-155046	16877	23944
19-154822	16877	23944
20-154558	16877	23944
21-154334	16877	23944
22-154110	16874	23935
23-153846	16874	23935
24-153622	16874	23935
25-153358	16874	23935
26-153134	16874	23935
27-152910	16874	23935
28-152646	16874	23935
29-152422	16874	23935
30-152158	16874	23935
31-151934	16874	23935



START: $-3^d\ 16\frac{1}{2}^h$ (13^h TOTAL)

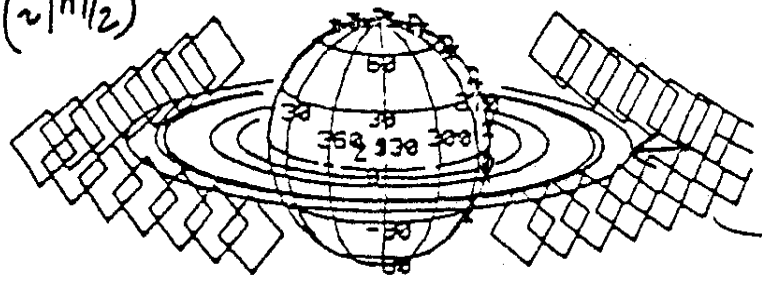
[illegible] 1 800 MUSUAVASATEF VERIF Y 015 P=0
[illegible] REF=(EART STAR=(CAHOPUS) 7 0



CENTERED AT IRIS POINT (1.75 R_S in "B" RING

VSATSH (THRU-OUT LOAD) ($\sim 1^h\ 1/2$)

satellite search



imaging wanted [illegible]

NARROWS

4. Add scan call @ RPTSO
order:
Ring A
C optically thin
B already in

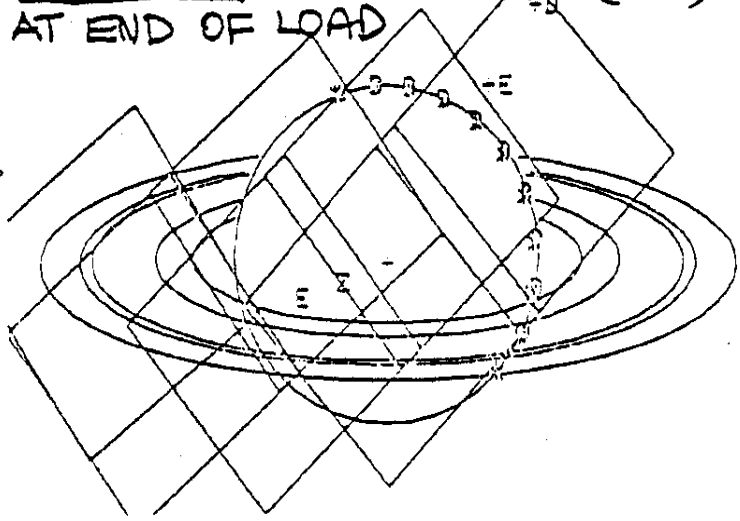
1. Reverse retrograde 3/4 FOV

2. Move RPTSO to 1D, 3D, 25th lat sub on the limb
[illegible]

3. —> [illegible]

4. Center B, [illegible]

VPRET 1 (W/A ONLY) (20^m)
AT END OF LOAD



LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPIRC (Saturn)	$-3^d07^h57^m$	$-3^d7^h38^m$	43905:42 43906:06	Center of Saturn	None
RP7CO (Saturn-West Limb)	-3:00:52	-2:23:52	43914:33 43915:49	LAT/Viewing Angle Lat=15°, VW=-50°	NA,WA
RP7CO (Saturn-Center)	-2:21:01	-2:19:47	43919:22 43920:54	Lat/Sub S/C Long Lat=10°	NA, WA
RP7CO (Saturn-East Limb)	-2:19:47	-2:18:47	43920:54 43922:10	Lat/Viewing Angle Lat=15°, VW=50°	NA, WA
RP7CO (Saturn-South Pole)	-2:18:46	-2:17:46	43922:10 43923:26	Lat/Sub S/C Long Lat=-40°	NA, WA
RP7CO (Saturn-North Pole)	-2:17:45	-2:16:45	43923:26 43924:42	Lat/Sub S/C Long Lat=65°	NA, WA
RR7CO (B-Ring)	-2:12:11	-2:11:01	43930:25 43931:52	Saturn Radius/Hour Angle SR=1.7, LHA=101°	NA, WA
RR7CO (A-Ring)	-2:10:41	-2:09:34	43932:16 43933:41	Saturn Radius/Hour Angle SR=2.15 LHA=101°	NA, WA
RR7CO (C-Ring)	-2:08:13	-2:07:04	43935:21 43936:48	Saturn Radius/Hour Angle SR=1.4 LHA=101°	
RPN/S (Saturn Replacement Strip #1)	-2:00:04	-1:23:16	43945:33 43946:33	Lat/Sub S/C Long Lat=80°	WA
RPN/S (Saturn-Replacement Strip#2)	-1:20:39	-1:19:55	43949:49 43950:45	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn-Part 1)	-1:19:09	-1:13:20	43951:42 43958:59	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn Part 2)	-1:12:37	-1:09:51	43959:52 43963:20	Lat/Sub S/C Long Lat= 80°	WA
RPN/S (Saturn Part 3)	-1:09:14	-1:07:18	43964:05 43966:31	Lat/Sub S/C Long Lat= 80°	WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VTIX3 (Titan)	-1:06:39	-1:06:19	43967:19 43967:45	ISS Mosaic of Titan	NA, WA
UTDRFT (Titan)	-1:02:18	-1:01:09	43972:45 43974:12	Titan drift, start at center of Titan	NA, WA
PT2XL (Titan)	-23:10	-22:49	43976:40 43977:07	Scan across Titan	NA, WA
UTDRFT (Titan)	-21:48	-20:51	43978:23 43979:35	Titan drift, start at center of Titan	NA
PTCRV (Titan)	-20:50	-20:30	43979:35 43980:01	Scan across Titan	NA, WA
RPRET (Saturn)	-19:20	-18:28	43981:28 43982:34	North Pole, scan to track Saturn	NA, WA
PTMOS (Titan)	-17:14	-16:32	43984:05 43984:58	Scan across Titan	NA, WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
V2S1N (Enceladus)	-15^h38^m	-15^h34^m	43986:05 43986:10	Center of body for ISS	NA/WA
UPDLBL (Saturn)	-15^h31^m	-14:38	43986:12 43987:20	Scans around Limb of Saturn as S/C rolls about Saturn center	None
UPDLBL (Saturn)	-14:33	-13:47	43987:26 43988:23	South to north scan starting at -10° Lat	None
V3S1N (Tethys)	-13:44	-13:18	43988:27 43989:00	Center of body for ISS	NA/WA
V2S5N (Enceladus)	-13:14	-13:00	43989:04 43989:22	Center of body for ISS scan every 4 framecounts	5 NA
VRDYN (Rings)	-12:59	-12:12	43989:23 43990:22	Ring Dynamics measurements	NA/WA
RPEOI (Saturn)	-12:11	-11:58	43990:23 43990:40	Lat=36.11°, Long=173.39° 4x4 Mosaic, 1 frame count/ point	WA
PTCRV (Titan)	-11:56	-11:35	43990:42 43991:08	Center of body for IRIS	NA/WA
VPRET (Saturn)	-11:33	-11:11	43991:10 43991:38	North/South retargetable scan 1 framecount/point	WA
PPCLDS (Saturn)	-11:11	-10:48	43991:38 43992:07	Several points at 3.5° Lat. First point is for background, it is in deep space.	WA
V2S1N (Enceladus)	-10:47	-10:46	43992:08 43992:10	Center of body for ISS	NA
V3S5N (Tethys)	-10:44	-10:28	43992:11 43992:32	Center of body for ISS	NA
VPRET (Saturn)	-10:26	-10:09	43992:33 43992:56	North/South retargetable scan 1 framecount/point	WA
VRDYN (Rings)	-10:08	-10:01	43992:57 43993:06	Ring dynamics R_S=1.44,1.95	NA/WA
V2S4N (Enceladus)	-9:59	-9:46	43993:07 43993:24	Center of body for ISS	NA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VRGSCN (Rings)	-9:45	-7:53	43993:26 43995:48	Radial Ring Scan Starts R_c=2.34, 2 framecounts/point	NA/WA
V2S1N (Enceladus)	-7:51	-7:50	43995:48 43995:50	Center of body for ISS	NA
V3S1N (Tethys)	-7:49	-7:46	43995:51 43995:55	Center of body for ISS	NA
V4S1N (Dione)	-7:43	-7:40	43995:57 43996:02	Center of body for ISS	NA
V5S2N (Rhea)	-7:39	-7:34	43996:02 43996:10	Center of body for ISS	NA
PPCLDS (Saturn)	-7:33	-7:14	43996:11 43996:35	Several points at 3.5° Lat. First point is for background, it is in deep space.	WA
UP*OCC (Star Occ-Saturn)	-7:13	-6:38	43996:36 43997:20	UVS Stellar Occultation	None
V2S4N (Enceladus)	-6:35	-6:24	43997:23 43997:37	Center of body for ISS. Scan every 4 framecounts	NA
VXXNEW (New Satellite)	-6:22	-6:10	43997:39 43997:55	New Satellite Imaging	NA
PTCRV (Titan)	-6:07	-5:58	43997:58 43998:09	Center of body for IRIS. Scan every 1 framecount	NA
VRDYN (Rings)	-5:56	-5:14	43998:11 43999:04	Ring Dynamics	NA/WA
V2S1N (Enceladus)	-5:12	-5:07	43999:06 43999:13	Center of body for ISS	NA
VPOLE1 (Saturn)	-5:06	-4:54	43999:14 43999:29	North/South scan, goes with VPOLE 2 to give contiguous coverage for IRIS	WA
VRDYN (Rings)	-4:53	-4:34	43999:30 43999:54	Ring Dynamics	NA/WA
VPOLE 2 (Saturn)	-4:33	-4:19	43999:56 44000:13	North/South scan goes with VPOLE1 to give contiguous coverage for IRIS	WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
PPCLDS (Saturn)	-4:18	-3:59	44000:14 44000:38	Several points at 3.5° Lat. First point is for background, it is in deep space.	NA
V2S5N (Enceladus)	-3:57	-3:50	44000:39 44000:50	Center of body for ISS	NA
UP*OCC PROCC (Stellar Occult.)	-3:48	-1:23	44000:51 44003:53	Saturn and ring occultations OC-1 data rate, radiometer data only	None
V3S3N (Tethys)	-1:21	-1:13	44003:55 44004:06	Pre-eclipse entrance Center of body for ISS, scan every 4 framecounts	NA/WA
V2MOS1 (Enceladus)	-1:11	-0:49	44004:08 44004:35	Mosaic of Enceladus IRIS data on center of Enceladus during ISS readout.	NA/WA
R3ECL (Tethys)	-0:46	-0:44	44004:38 44004:42	In Dark Center of body for IRIS	None
FSMAN (Roll)	-0:44	-0:32	44004:42 44004:56		
VXXNEW (New satellite)	-0:32	-0:30	44004:56 44004:58	New satellite imaging	NA/WA
VRDYN (Rings)	-0:30	-0:15	44004:59 44005:18	Ring Dynamics	NA/WA
FSMAN (Roll)	-0:15	+0:01	44005:18 44005:38		
R3ECL (Tethys)	+0:01	+0:17	44005:38 44005:58	Satellite in dark Center of body for IRIS	None
V2MOS2 (Enceladus)	+0:21	+0:27	44006:03 44006:10	1X2 mosaic	NA
UPHOCC (Sun Occult. Ingress)	+0:30	+0:47	44006:14 44006:35	UVS Sun occult. entrance	None

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VRXING (Rings)	+0:49	+0:59	44006:39 44006:51	Ring Plane crossing	WA
R3ECL (Tethys)	+1:04	+1:16	44006:57 44007:11	Post-eclipse heating scan every frame-count	None
V3MOS1 (Tethys)	+1:16	+1:37	44007:12 44007:37	3x3 Mosaic go to center of body for IRIS during ISS readout	NA/WA
PROPHT (Rings)	+1:39	+1:47	44007:40 44007:51	Ring scan starting at 1.95 R_S scan every 2 frame counts	WA
VRDRK (Rings)	+1:48	+2:04	44007:52 44008:13	Dark side of rings 4 WA during occul-tation.	WA
UPHOCC (Sun occult.	+2:08	+2:36	44008:17 44008:52	Sun occultation exit	None
V2MOS3 (Enceladus)	+2:40	+2:44	44008:57 44009:01	Center of brightness for ISS	NA
V3MOS2 (Tethys)	+2:49	+2:57	44009:08 44009:18	1x3 mosaic of south pole	NA
VRDYN (Rings)	+2:59	+3:36	44009:21 44010:06	Ring Dynamics	WA
R2ECL (Enceladus)	+3:39	+3:52	44010:11 44010:27	Body in dark Scan every frame count for IRIS	None
PPCLDS (Saturn)	+3:56	+4:11	44010:32 44010:51	Several points at 3.5° Lat. Includes background point	WA
FSMAN (Roll)	+4:11	+4:27	44010:51 44011:11	Acquire Vega	WA
UPOLE (Saturn)	+4:29	+5:33	44011:13 44012:33	Look for aurora	None
VRDYN (Rings)	+5:35	+6:05	44012:36 44013:13	Ring Dynamics	NA/WA
R3TET (Tethys)	+6:06	+6:19	44013:15 44013:30	Center of body for IRIS scan every framecount	NA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
PPCLD (Saturn)	+6:20	+6:36	44013:32 44013:52	Several points at 3.5° Lat. Includes background point.	WA
RPOPA (Saturn)	+6:37	+7:05	44013:54 44014:27	Lat/Viewing Angle Lat=-30.8°, VW=76°	WA
	+7:05	+7:27	44014:27 40014:55	Lat/Viewing Angle Lat=-22.8°, VW=76°	NOne
RPOPA (Saturn)	+7:27	+8:13	44014:56 44015:35	Lat/Sub S/C Long Lat=-22.8°	None
			44015:35 44015:53	Lat/Sub S/C Long Lat=-30.8°	None
V1S2N (Mimas)	+8:15	+8:20	44015:55 44016:02	Center of body for ISS	NA
UPSHAD (Saturn)	+8:20	+8:40	44016:02 44016:27	Scan of ring Shadow on Saturn	None
VRGSCN (Rings)	+8:40	+10:09	44016:27 44018:18	Start at R_s=1.2 28 positions, move every 4 framecounts	NA/WA
VRDYN (Rings)	+10:11	+10:32	44018:20 44018:47	Ring Dynamics	NA/WA
PPCLD (Saturn)	+10:33	+10:53	44018:49 44019:13	Several points at 3.5° Lat. Includes background point	WA
PROPHT (Rings)	+10:54	+11:08	44019:14 44019:32	Start at R_s=1.4	NA/WA
R2D2 (Enceladus)	+11:10	+11:16	44019:34 44019:42	Center of body for IRIS	
UPART (Saturn)	+11:18	+12:10	44019:44 44020:49	Starts at center of Saturn, scans towards limb. 13 framecounts per position	None
RPEOE RPOPA (Saturn)	+12:10	+12:35	44020:50 44021:23	Earth occult. egress Lat/Sub S/C Long Lat= -30.8°	None
	+12:35	+12:59	44021:23 44021:51	Lat/Sub S/C Long Sat=-22.8°	None

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
RPOPA (Saturn)	+13:00	+13:25	44021:52 44022:25	Lat/Viewing Angle Lat=-30.8°. VW=72°	None
	+13:25	+13:49	44022:25 44022:35	Lat/VW Lat=-22.8°, VW=72°	None
PTCRV (Titan)	+13:50	+14:14	44022:55 44023:24	Center of body for IRIS, scan every framecount	NA/WA
R2D2 (Enceladus)	+14:16	+14:47	44023:27 44024:05	Center of body for IRIS, scan every framecount	NA
VRDYN (Rings)	+14:49	+15:11	44024:08 44024:36	Ring Dynamics	NA/WA
PPLONG (Saturn)	+15:12		44024:36 44027:03	Longitudal scan at constant lighting angle Initial Lat= 0°, scan south, 2 framecounts per position	NA/WA
PROPHT (Rings)	+17:10	+17:32	44027:04 44027:32	Radial scan of rings	NA/WA
R3TET (Tethys)	+17:33	+17:44	44027:33 44027:46	Center of body for IRIS, scan every 3 framecounts	NA
V7S1N (Hyperion)	+17:46	+17:47	44027:49 44027:50	Center of body for ISS	NA/WA
VRDYN (Rings)	+17:49	+18:25	44027:53 44028:38	Ring Dynamics	NA/WA
RRCIR (C-Ring)	+18:26	+18:52	44028:40 44029:11	C-Ring Circumferential scan 12 points from rings in shadow to lighted rings on planet, scan every 3 framecounts	NA/WA
	+18:52	+19:01	44029:11 44029:23	3 points in C-Ring, on Saturn	WA
	+19:01	+19:26	44029:23 44029:54	11 points in C-Ring from Saturn's limb to space	NA/WA

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
Quiet Time			44029:56 44030:06	QT at 1st RRDCO position.	
RRDCO (Rings)	+19:27	+20:17	44030:06 44030:58	Radial Ring Scans from outside A to inside C-Ring	
				1) 26 points scan lighted rings, overlap 50% 2 frame-counts per position	NA/WA
	+20:17	+20:39	44030:58 44031:24	2)26 points, scan rings in dark, just above shadow 1 frame count per position	
	+20:39	+22:46	44031:25 44032:17	3) 26 points, scan rings in dark, above scan #2,2 framecounts per position.	None
	+21:20	+22:40	44032:17 44033:57	4) 26 points, scan rings in dark above scan #3, 4 frame-counts per position	None
	+22:46	+23:10	44034:05 44034:34	5) 14 points, no overlap, scan lighted rings at same position as #1 2 framecounts per position	NA/WA
PPCLD (Saturn)	+23:12	+23:36	44034:37 44035:07	positions at 3.5° Lat Includes back-ground point.	WA
VRETRG (Rings)	+23:36	+1:00:17	44035:07 44035:58	Ring retargetable	NA/WA
V1 & 2 NW (Mimas & Enceladus)			44035:59 44036:05	2 satellites in same frame	NA/WA
UPROR (Saturn)	+1:00:23	+1:01:17	44036:06 44037:13	Scan for aurora on Saturn's dark side	None
VRDYN (Rings)	+1:01:18	+1:01:31	44037:14 44037:30	Ring dynamics	NA
P8PHA (Iapetus)	+1:01:33	+1:01:53	44037:33 44037:59	Center of body for ISS	NA
RPMOS (Saturn)	+1:01:56	+1:03:32	44038:01 44040:02	4 points on south pole.	WA

SOFTWARE INTERFACE SPECIFICATION

SIS 4-7008-1, Rev. C

Fixed Instrument SEDR

21 October 1980

APPROVALS

GENERATING PROGRAM

SEDRGEN

Cognizant Engineer _____ 1/13/81
JAMES F. SCHMIDLING

Cognizant Programmer _____ 1/13/81
JAMES F. SCHMIDLING

PRINCIPAL INVESTIGATOR

CONCURRENCE

_____ 10/21/80
HARRY W. WOO

CONCURRENCES

Data Records System Engineer _____ 10/23/80
NEIL N. TOY

Ground Data System Engineer _____ 10/23/80
ROBERT G. POLANSKY

Software System Engineer _____ 10/25/80
ROBERT E. HILL

Number: 4-7008-1, Rev C
Date: 21 October 1980

SOFTWARE INTERFACE SPECIFICATION

GENERATING PROGRAM:	SEDRGEN	USER PROGRAM:	Fixed Instrument PI SEDR Processors
COMPUTER SYSTEM:	UNIVAC 1100	COMPUTER SYSTEM:	

PURPOSE OF INTERFACE

To provide the fixed or direct sensing instrument Principal Investigators with the prevailing navigation and orientation conditions when their scientific data were obtained.

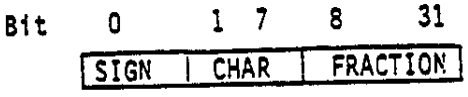
INTERFACE DEVICE

Magnetic tape of seven or nine tracks written at a tape density of 800 BPI using odd lateral parity. The tape will contain a single file termed "Fixed Instrument SEDR File".

DATA CODE

The Fixed Instrument SEDR will be composed of 32-bit words which contain character, integer and floating point quantities. All character data will be Left Justified Space Filled (LJSF) in the standard IBM 360 EBCDIC code. All integer quantities will be in the 2's complement form. The floating point words will be in the standard IBM 360 format which is given below. In general, the tape will appear as if it had been written on an IBM 360.

IBM 360 Floating Point Word Format



Where,

SIGN — indicates the sign of the quantity represented by the floating point word. If SIGN = 0, the quantity is positive. If SIGN = 1, the quantity is negative.

CHAR	indicates the location of the hexidecimal point of the FRACTION portion of the word. This value is normalized to a hexidecimal value of 40 such that CHAR - 40 (hexidecimal arithmetic) locates the hexidecimal point to the right when positive and to the left when negative. The CHAR can also be considered as a decimal scale factor which the FRACTION when evaluated as a decimal number must be multiplied by to properly evaluate the quantity. Under this scheme, the normalized value is 64 (decimal) and the scale factor is the (CHAR - 64)th power of 16.
FRACTION	contains the significant digits of the quantity with the hexidecimal point located to the left of bit 8.

The following algorithm could be used to evaluate floating point quantities from this format:

$$VALUE_{10} = (1 - 2 * SIGN_{10}) * (FRACTION_{10}) * 16_{10} ** (CHAR_{10} - 64_{10})$$

RECORDING METHOD

UNIVAC 1100 System Library Routine, IOW (binary read/write routine)

DETAILED INTERFACE DEFINITION/FORMAT

The SEDRGEN Program will write a nine (9) track magnetic tape for the CRS, PRA, PLS, MAG, LECP, RSS, IRIS, PPS and UVS PIs and a seven (7) track magnetic tape for the PWS PI. All words will be 32 bits in length and all physical records except for the header record will contain the same number of words for any single SEDR. The following attachments to this document describe the structure and content of the Fixed Instrument SEDR File.

Attachment A	Fixed Instrument SEDR File Layout
Attachment B	Fixed Instrument SEDR Header Record Format
Attachment C	Navigation Data Block Format for Launch Period
Attachment D	Navigation Data Block Format for Cruise Periods
Attachment E	Navigation Data Block Format for Jupiter Encounter
Attachment F	Navigation Data Block Format for Saturn Encounter
Attachment G	Pointing Vector Data Block Format

DEFINITION OF TERMS

Cartesian State	Cartesian position and velocity components in the following order: X-position, Y-position, Z-position, X-velocity, Y-velocity, and Z-velocity.

Celestial Clock and Cone Angles	Clock and cone angles centered at the S/C with respect to the Sun - S/C - Canopus (ASC) reference system.
Equinox	Refers to the vernal equinox, i.e., for the planets the vernal equinox is defined as the axis from the center of the planet to the ascending node of the planet's orbit through the planet's equatorial plane.
Jupiter System I Prime Meridian	This prime meridian system is identified with the rotation of the visible features in the Jovian equatorial zone. The exact definition of this system can be found in the Explanatory Supplement to the Astronomical Ephemeris and The American Ephemeris and Nautical Almanac (Explanatory Supplement to the Ephemeris). JPL Technical Report (TR) 32-1508, dated January 15, 1971 which can be made available upon request, also contains the definition.
Jupiter System III Prime Meridian	This prime meridian system is identified with the rotation of radio emissions from Jupiter. This rotation probably corresponds to the rotation of the Jovian inner core which is associated with the planet's magnetic field. The SEDR uses Jupiter System III (1965.0).
Saturn Prime Meridian	This system is a JPL defined system which assumes a constant rotational rate of the prime meridian and a zero hour angle of the equinox at the epoch of 1950, January 1.0. The exact definition of this system can be found in JPL Technical Report 32-1508, dated January 15, 1971 which is available upon request.
Longitudes	The longitude conventions will conform to the IAU standards which specify positive west longitudes for both Jupiter and Saturn.

GLOSSARY

BPI	Bits per Inch
C	Character Quantity
CRS	Cosmic Ray Subsystem
deg	degrees
dim	dimensionless
DPTRAJ	Double Precision Trajectory Program
E	Floating Point Quantity
FDSC	Flight Data Subsystem Count
FIP	Fixed Instrument Pointing
GMT	Grenwich Mean Time
HET	High Energy Telescope
HHMMSS	Hours-Minutes-Seconds
HGA	High Gain Antenna
I	Integer Quantity
IAU	International Astronomical Union
IRG	Inter-Record Gap
IRIS	Infrared Interferometer Spectrometer and Radiometer Subsystem
JPL	Jet Propulsion Laboratory
km	kilometers
km/sec	kilometers per second
LECP	Low Energy Charged Particle Subsystem
LET	Low Energy Telescope
LJSF	Left Justified Space Filled
MAG	Magnetometer Subsystem
MMDDYY	Month-Day-Year
MOD	Modulo
msec	milliseconds
PI	Principal Investigator
PLS	Plasma Subsystem
PPS	Photopolarimeter Subsystem
PRA	Planetary Radio Astronomy Subsystem
PWS	Plasma Wave Subsystem
RSS	Radio Science Subsystem
SCE	Spacecraft Event Time

GLOSSARY (Continued)

sec	Seconds
SEDR	Supplementary Experiment Data Record
SEDRGEN	Supplementary Experiment Data Record Generation Program
S/C	Spacecraft
TET	The Electron Telescope
UVS	Ultraviolet Spectrometer Subsystem

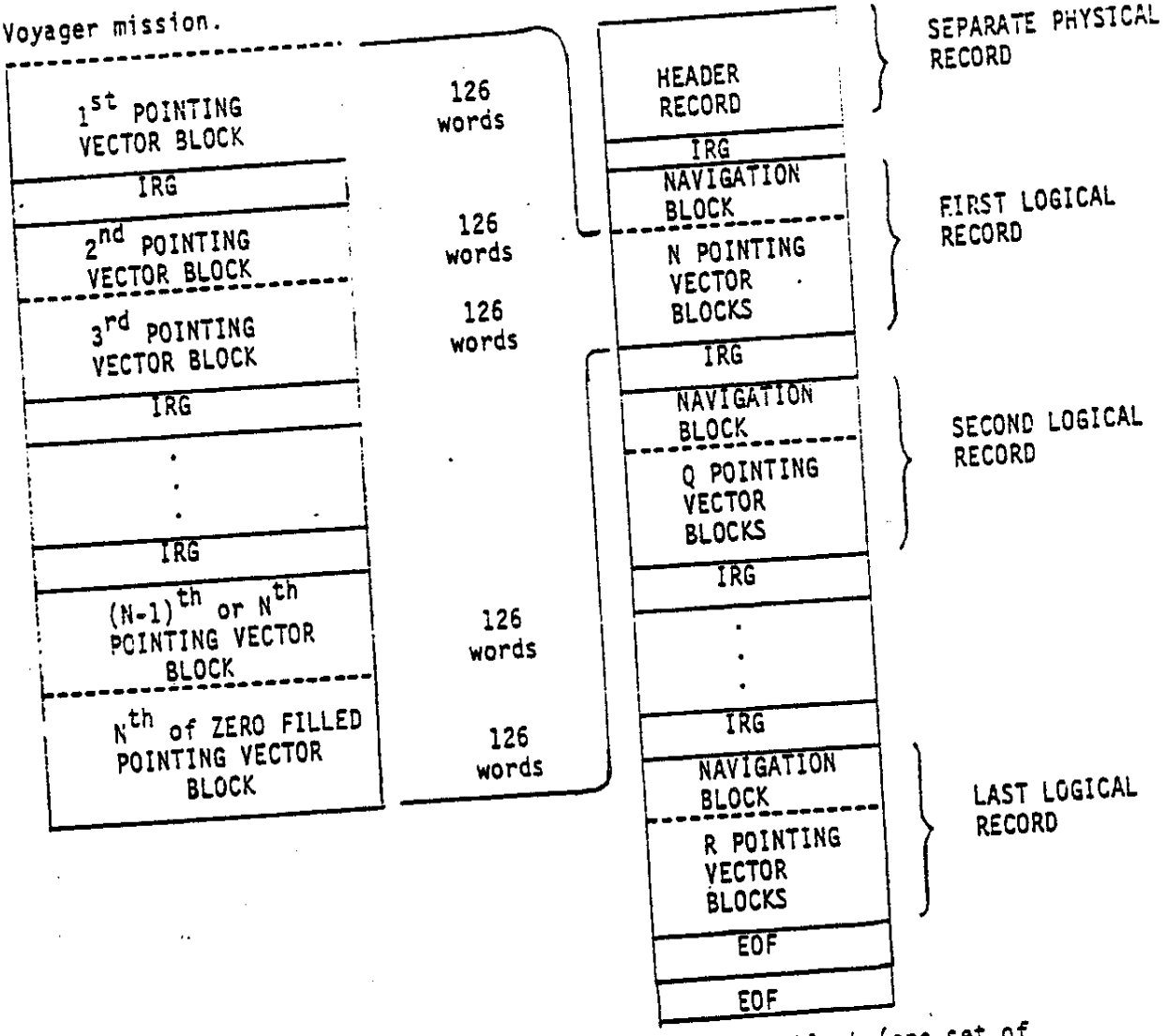
ATTACHMENT A

Fixed Instrument SEDR
File Layout

ATTACHMENT A

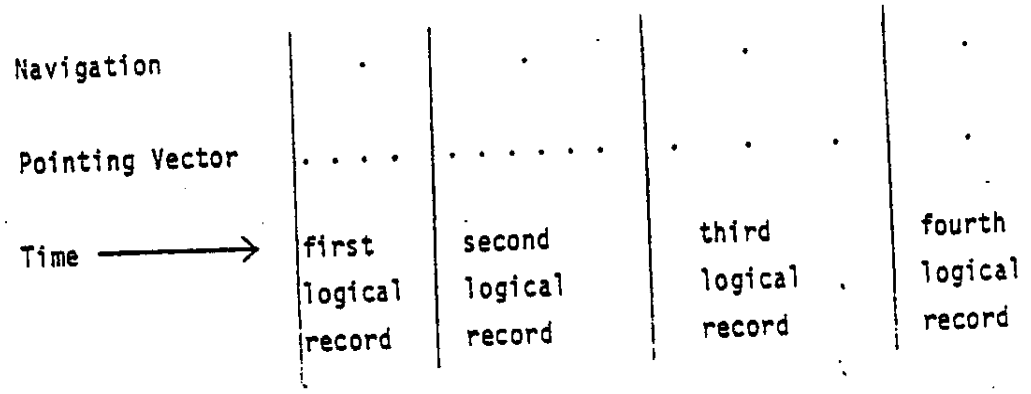
Fixed Instrument SEDR
File Layout

The following SEDR file (tape) layout represents the common file structure that will be supplied to fixed instrument Principal Investigators (PIs) of the Voyager mission.



Each logical record will contain one navigation data block (one set of navigation data effective at a particular time) and all pointing vector data blocks associated with it. This association is determined by time such that the times of the pointing vector blocks in any logical record are closer to that logical record's navigation block time than any other navigation block time on the SEDR. The following figure illustrates how SEDR logical records

would be formed given an arbitrary set of navigation and pointing vector times. Note that the navigation block is always the first data in the logical record even though some of the pointing vector blocks may have earlier times. However, the navigation and pointing vector blocks taken as individual sets will always be in increasing time order.



Each logical record will be composed of an integral number of physical records. Also, each physical record will contain an integral number of 126 word logical blocks. The number of these blocks for each physical record will be determined from the size of the navigation data block and one pointing vector block. For launch, cruise, and Saturn encounter, the navigation data block occupies one logical block while the Jupiter encounter navigation block requires two logical blocks. The pointing vector block is mission phase independent and always occupies one logical block. Therefore, the physical record size for launch, cruise, and Saturn encounter is 2 logical blocks or 252 words while Jupiter encounter requires 3 logical blocks or 378 words. When multiple pointing vector blocks exist in a logical record, these data are filled into as many additional physical records as are required to contain the logical record. Each pointing vector block will contain a continuation bit which indicates if that pointing vector block is the last block in the logical record. If the last physical record is not evenly filled with pointing vector blocks, the remainder of the record will be zero filled. The lefthand portion of the file format presented at the start of this attachment illustrates the physical record - logical record structure/relationship for the launch, cruise, or Saturn encounter format. The Jupiter encounter format would be similar except that the physical records would contain three 126 word blocks instead of two.

ATTACHMENT B

Fixed Instrument SEDR
Header Record Format

ATTACHMENT B

Fixed Instrument SEDR Header Record Format

WORD	DESCRIPTION	UNITS	TYPE
1	Project Identification	'VOY 77'	C
2	File Identification	'SEDR'	C
3	S/C Identification 0 = Flt 2, 1 = Flt 1,.2 = PTM, 4 = Sim 1, 5 = Sim 2, Others = Unused	dim	I
4-5	SEDR Tape Identification	see page 12	C
6	SEDR File Generation Date	MMDDYY	I
7	SEDR File Generation Time	HHMMSS	I
8-9	Pointing Vector (FIP) Tape Identification	JPL Facility Number	C
10	FIP File Generation Data	MMDDYY	I
11	FIP File Generation Time	HHMMSS	I
12-13	Navigation (DPTRAJ Save Tape) Tape Identification	JPL Facility Number	C
14-15	Navigation Data Block Identification, i.e., Launch, Cruise, Jupiter or Saturn	'LAUNCH' 'CRUISE' 'JUPITE' 'SATURN'	C

ATTACHMENT B

Fixed Instrument SEDR Header Record Format

WORD	DESCRIPTION	UNITS	TYPE
16-19	Same as 12-15 for Second DPTRAJ Save Tape		
20-23	Same as 12-15 for Third DPTRAJ Save Tape		
24-27	Same as 12-15 for Fourth DPTRAJ Save Tape		
28-45	Spares		

SEDR TAPE IDENTIFICATION

Each SEDR tape is labelled with an eight character alphanumeric identifier which indicates the SEDR type, the experiment/instrument identification, the spacecraft identification and the mission phase. The identifier has the following general form:

A B B I J J K K

A — indicates the SEDR type. A = S, indicates a fixed instrument SEDR and A = F, indicates a scan platform or footprint SEDR.

BB — indicates the experiment/instrument identification according to the following list:

BB	Experiment/Instrument
CR	Cosmic Ray
IR	Infrared Interferometer Spectrometer
LE	Low Energy Charged Particles
MA	Magnetometer
PL	Plasma
PP	Photopolarimeter
PR	Planetary Radio Astronomy
PW	Plasma Wave
RS	Radio Science
UV	Ultra Violet Spectrometer

I — indicates the spacecraft identification. I = 0 is for the FLT-2 spacecraft and I = 1 is for the FLT-1 spacecraft.

JJ — indicates the mission phase according to the following list:

JJ	Mission Phase
00-09	Unused
10-19	Launch
20-29	Earth to Jupiter Cruise
30-39	Jupiter Encounter
40-49	Jupiter to Saturn Cruise
50-59	Saturn Encounter
60-69	Post Saturn or Saturn to Uranus Cruise
70-79	Uranus Encounter
80-89	Post Uranus or Uranus to Neptune Cruise
90-99	Neptune Encounter

KK Indicates the SEDR serial number within each mission phase.

ATTACHMENT C

Navigation Data Block Format
for Launch Period

ATTACHMENT C

Navigation Data Block Format for Launch Period

WORD	DESCRIPTION	UNITS	TYPE
1	SCE GMT Year of Navigation Data Block	years, AD	I
2	SCE GMT Day of Navigation Data Block	day of year	I
3	SCE GMT Hour of Navigation Data Block	hour of day	I
4	SCE GMT Minute of Navigation Data Block	minute o hour	I
5	SCE GMT Second of Navigation Data Block	second of minut	I
6	SCE GMT Millisecond (msec) of Navigation Data Block	msec of second	I
7-12	Cartesian State of S/C, Earth Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
13-18	Cartesian State of S/C, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
19-24	Cartesian State of S/C, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
25-30	Cartesian State of S/C, Saturn Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
31-36	Cartesian State of Earth, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E

ATTACHMENT C

Navigation Data Block Format for Launch Period

WORD	DESCRIPTION	UNITS	TYPE
37-42	Cartesian State of Jupiter, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
43-48	Cartesian State of Saturn, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
49	Range Earth - S/C	km	E
50	Range Earth - Sun	km	E
51	Range Sun - S/C	km	E
52	Range Jupiter - S/C	km	E
53	Range Saturn - S/C	km	E
54	Range Sun - Jupiter	km	E
55	Range Sun - Saturn	km	E
56	Angle Earth - Sun - S/C	deg	E
57	Angle Sun - S/C - Earth (Celestial Cone Angle of Earth)	deg	E

ATTACHMENT C

Navigation Data Block Format for Launch Period

WORD	DESCRIPTION	UNITS	TYPE
58	Angle Sun - Earth - S/C	deg	E
59	Angle Jupiter - Sun - S/C	deg	E
60	Angle Sun - S/C - Jupiter (Celestial Cone Angle of Jupiter)	deg	E
61	Angle Sun - Jupiter - S/C	deg	E
62	Angle Saturn - Sun - S/C	deg	E
63	Angle Sun - S/C - Saturn (Celestial Cone Angle of Saturn)	deg	E
64	Angle Sun - Saturn - S/C	deg	E
65	Celestial Clock Angle of Earth	deg	E
66	Celestial Clock Angle of Jupiter	deg	E
67	Celestial Clock Angle of Saturn	deg	E
68-69	Right Ascension and Declination of S/C, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E

ATTACHMENT C

Navigation Data Block Format for Launch Period

WORD	DESCRIPTION	UNITS	TYPE
70-71	Right Ascension and Declination of Sun, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
72-73	Right Ascension and Declination of Jupiter, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
74-75	Right Ascension and Declination of Saturn, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
76-77	Right Ascension and Declination of S/C, Jupiter Centered Jupiter True Equinox and Equator of Date	deg	E
78-79	Right Ascension and Declination of Sun, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
80-81	Right Ascension and Declination of Earth, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
82-83	Right Ascension and Declination of Io, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
84-85	Right Ascension and Declination of S/C, Saturn Centered, Saturn Mean Equinox and Equator of 1950.0	deg	E
86-87	Spares		
88-89	Spares		
90-91	Celestial Latitude and Longitude of S/C, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E

ATTACHMENT C

Navigation Data Block Format for Launch Period

WORD	DESCRIPTION	UNITS	TYPE
92-93	Celestial Latitude and Longitude of Earth, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
94-95	Celestial Latitude and Longitude of Jupiter, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
96-97	Celestial Latitude and Longitude of Saturn, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
98-99	Right Ascension and Declination of S/C, Sun Centered, Sun True Equinox and Equator of Date	deg	E
100-101	Right Ascension and Declination of Earth, Sun Centered, Sun True Equinox and Equator of Date	deg	E
102-103	Right Ascension and Declination of Jupiter, Sun Centered, Sun True Equinox and Equator of Date	deg	E
104-105	Right Ascension and Declination of Saturn, Sun Centered, Sun True Equinox and Equator of Date	deg	E
106	Hour Angle of Jupiter System III Prime Meridian, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
107-126	Spares		

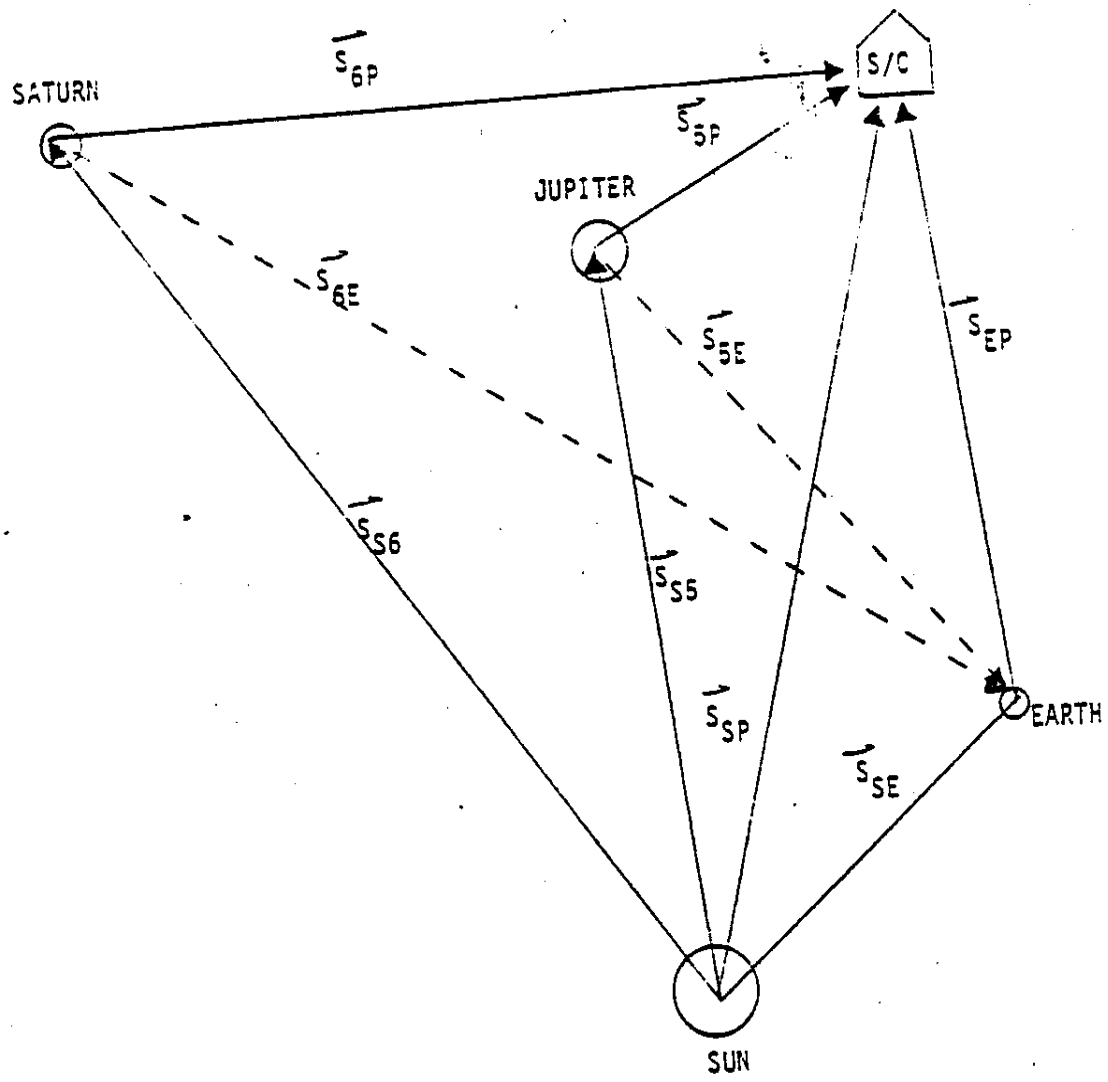


Figure C-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Launch SEDR State Vectors

Nomenclature ⟶ $\vec{S}$ refers to State Vector (Position and Velocity Components) with the subscripts AB, where, A is the reference or "From" body and B is the "To" body. The following body definitions are used; S-Sun, P-S/C or Probe, E-Earth, 5-Jupiter and 6-Saturn.

Note that the Earth State with respect to Jupiter and Saturn ($\vec{S}_{5E}$ and $\vec{S}_{6E}$ - dashed vectors in Figure) will not be provided. These states can be simply derived, if desired, by the PI by vector subtraction of the Sun to Earth State ($\vec{S}_{SE}$) and the Sun to Jupiter and the Sun to Saturn States ($\vec{S}_{S5}$ and $\vec{S}_{S6}$).

ATTACHMENT D

Navigation Data Block Format
for Cruise Periods

ATTACHMENT D

Navigation Data Block Format for Cruise Periods

WORD	DESCRIPTION	UNITS	TYPE
1	SCE GMT Year of Navigation Data Block	years, AD	I
2	SCE GMT Day of Navigation Data Block	day of year	I
3	SCE GMT Hour of Navigation Data Block	hour of day	I
4	SCE GMT Minute of Navigation Data Block	minute o hour	I
5	SCE GMT Second of Navigation Data Block	second o minute	I
6	SCE GMT Millisecond (msec) of Navigation Data Block	msec of second	I
7-12	Cartesian State of S/C, Earth Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
13-18	Cartesian State of S/C, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
19-24	Cartesian State of S/C, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
25-30	Cartesian State of S/C, Saturn Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
31-36	Cartesian State of Earth, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E

ATTACHMENT D

Navigation Data Block Format for Cruise Periods

WORD	DESCRIPTION	UNITS	TYPE
37-42	Cartesian State of Jupiter, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
43-48	Cartesian State of Saturn, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
49	Range Earth - S/C	km	E
50	Range Earth - Sun	km	E
51	Range Sun - S/C	km	E
52	Range Jupiter - S/C	km	E
53	Range Saturn - S/C	km	E
54	Range Sun - Jupiter	km	E
55	Range Sun - Saturn	km	E
56	Angle Earth - Sun - S/C	deg	E
57	Angle Sun - S/C - Earth (Celestial Cone Angle of Earth)	deg	E

ATTACHMENT D

Navigation Data Block Format for Cruise Periods

WORD	DESCRIPTION	UNITS	TYPE
58	Angle Sun - Earth - S/C	deg	E
59	Angle Jupiter - Sun - S/C	deg	E
60	Angle Sun - S/C - Jupiter (Celestial Cone Angle of Jupiter)	deg	E
61	Angle Sun - Jupiter - S/C	deg	E
62	Angle Saturn - Sun - S/C	deg	E
63	Angle Sun - S/C - Saturn (Celestial Cone Angle of Saturn)	deg	E
64	Angle Sun - Saturn - S/C	deg	E
65	Celestial Clock Angle of Earth	deg	E
66	Celestial Clock Angle of Jupiter	deg	E
67	Celestial Clock Angle of Saturn	deg	E
68-69	Right Ascension and Declination of S/C, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E

ATTACHMENT D

Navigation Data Block Format for Cruise Periods

WORD	DESCRIPTION	UNITS	TYPE
70-71	Right Ascension and Declination of Sun, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
72-73	Right Ascension and Declination of Jupiter, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
74-75	Right Ascension and Declination of Saturn, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
76-77	Right Ascension and Declination of S/C, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
78-79	Right Ascension and Declination of Sun, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
80-81	Right Ascension and Declination of Earth, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
82-83	Right Ascension and Declination of Io, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
84-85	Right Ascension and Declination of S/C, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
86-87	Right Ascension and Declination of Sun, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
88-89	Right Ascension and Declination of Earth, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
90-91	Celestial Latitude and Longitude of S/C, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E

ATTACHMENT D

Navigation Data Block Format for Cruise Periods

WORD	DESCRIPTION	UNITS	TYPE
92-93	Celestial Latitude and Longitude of Earth, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
94-95	Celestial Latitude and Longitude of Jupiter, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
96-97	Celestial Latitude and Longitude of Saturn, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
98-99	Right Ascension and Declination of S/C, Sun Centered, Sun True Equinox and Equator of Date	deg	E
100-101	Right Ascension and Declination of Earth, Sun Centered, Sun True Equinox and Equator of Date	deg	E
102-103	Right Ascension and Declination of Jupiter, Sun Centered, Sun True Equinox and Equator of Date	deg	E
104-105	Right Ascension and Declination of Saturn, Sun Centered, Sun True Equinox and Equator of Date	deg	E
106	Hour Angle of Jupiter System III Prime Meridian, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
107-126	Spares		

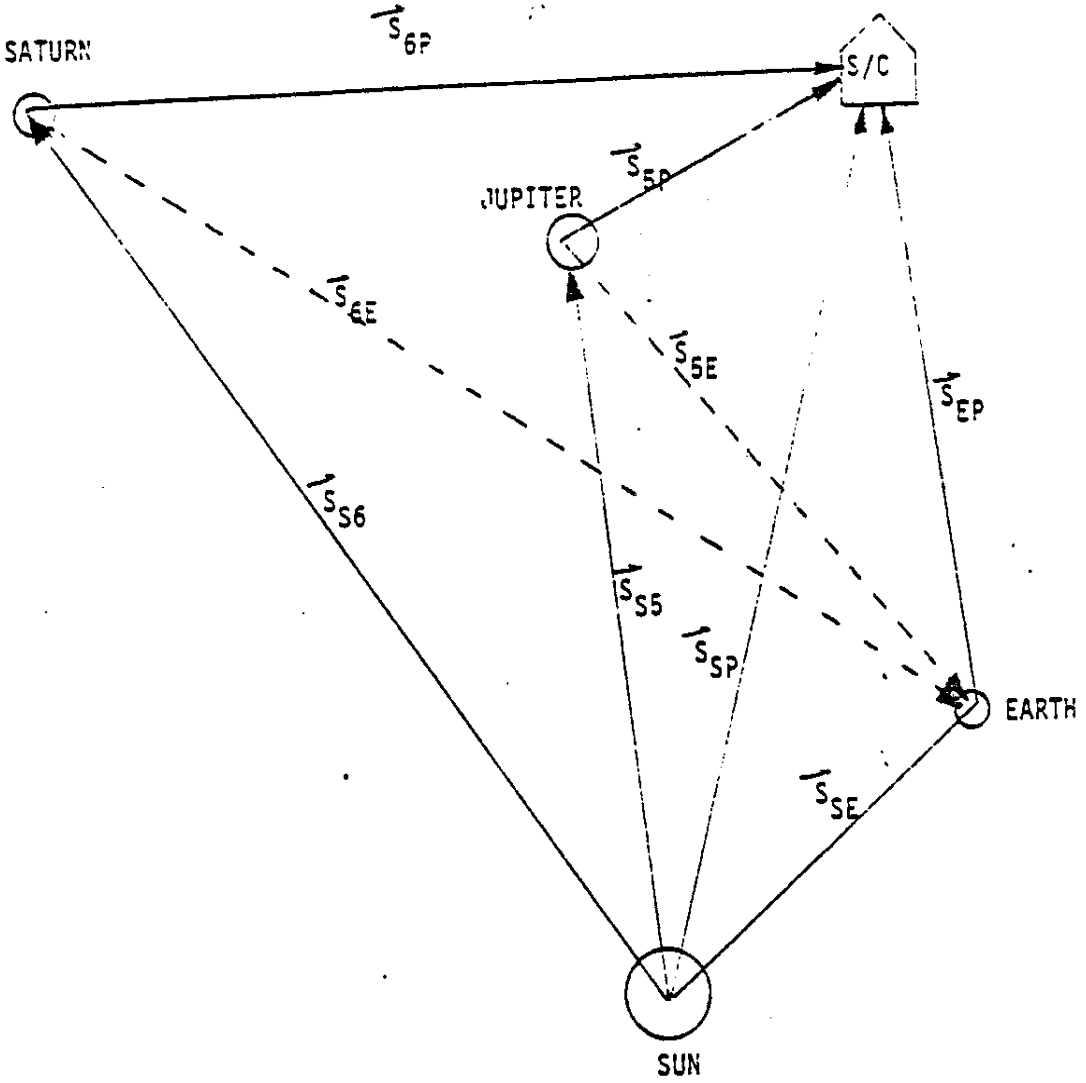


Figure D-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Cruise SEDR State Vectors

Nomenclature ⟶ $\vec{S}$ refers to State Vector (Position and Velocity Components) with the subscripts AB, where, A is the reference or "From" body and B is the "To" body. The following body definitions are used; S-Sun, P-S/C or Probe, E-Earth, 5-Jupiter and 6-Saturn

Note that the Earth State with respect to Jupiter and Saturn ($\vec{S}_{5E}$ and $\vec{S}_{6E}$ - dashed vectors in Figure) will not be provided. These states can be simply derived, if desired, by the PI by vector subtraction of the Sun to Earth State ($\vec{S}_{SE}$) and the Sun to Jupiter and the Sun to Saturn States ($\vec{S}_{S5}$ and $\vec{S}_{S6}$).

ATTACHMENT E

Navigation Data Block Format
for Jupiter Encounter

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
1	SCE GMT Year of Navigation Data Block	years, AD	I
2	SCE GMT Day of Navigation Data Block	day of year	I
3	SCE GMT Hour of Navigation Data Block	hour of day	I
4	SCE GMT Minute of Navigation Data Block	minute of hour	I
5	SCE GMT Second of Navigation Data Block	second of minut	I
6	SCE GMT Millisecond (msec) of Navigation Data Block	msec of second	I
7-12	Cartesian State of S/C, Earth Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
13-18	Cartesian State of S/C, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
19-24	Cartesian State of S/C, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
25-30	Cartesian State of S/C, Io Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
31-36	Cartesian State of S/C, Europa Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
37-42	Cartesian State of S/C, Ganymede Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
43-48	Cartesian State of S/C, Callisto Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
49-54	Cartesian State of Earth, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
55-60	Cartesian State of Jupiter, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
61-66	Cartesian State of Earth, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
67-72	Cartesian State of Io, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
73-78	Cartesian State of Europa, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
79-84	Cartesian State of Ganymede, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
85-90	Cartesian State of Callisto, Jupiter Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
91-96	Cartesian State of S/C, Jupiter Centered, Jupiter Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
97-102	Cartesian State of Io, Jupiter Centered, Jupiter Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
103-108	Cartesian State of Europa, Jupiter Centered, Jupiter Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
109-114	Cartesian State of Ganymede, Jupiter Centered, Jupiter Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
115-120	Cartesian State of Callisto, Jupiter Centered, Jupiter Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
121-126	Cartesian State of S/C, Jupiter Centered, Jupiter System I True Prime Meridian and Equator of Date	km km/sec	E
127-129	Cartesian Position of Io, Jupiter Centered, Jupiter System I True Prime Meridian and Equator of Date	km	E
130-132	Cartesian Position of Europa, Jupiter Centered, Jupiter System I True Prime Meridian and Equator of Date	km	E
133-135	Cartesian Position of Ganymede, Jupiter Centered, Jupiter System I True Prime Meridian and Equator of Date	km	E
136-138	Cartesian Position of Callisto, Jupiter Centered, Jupiter System I True Prime Meridian and Equator of Date	km	E
139-144	Cartesian State of S/C, Jupiter Centered, Jupiter System III True Prime Meridian and Equator of Date	km km/sec	E
145-147	Cartesian Position of Io, Jupiter Centered, Jupiter System III True Prime Meridian and Equator of Date	km	E
148-150	Cartesian Position of Europa, Jupiter Centered, Jupiter System III True Prime Meridian and Equator of Date	km	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
151-153	Cartesian Position of Ganymede, Jupiter Centered, Jupiter System III True Prime Meridian and Equator of Date	km	E
154-156	Cartesian Position of Callisto, Jupiter Centered, Jupiter System III True Prime Meridian and Equator of Date	km	E
157-159	Jupiter Latitude, System I Longitude and System III Longitude of S/C	deg	E
160-162	Jupiter Latitude, System I Longitude and System III Longitude of Io	deg	E
163-165	Jupiter Latitude, System I Longitude and System III Longitude of Europa	deg	E
166-168	Jupiter Latitude, System I Longitude and System III Longitude of Ganymede	deg	E
169-171	Jupiter Latitude, System I Longitude and System III Longitude of Callisto	deg	E
172	Range Earth - S/C	km	E
173	Range Sun - S/C	km	E
174	Range Sun - Earth	km	E
175	Range Sun - Jupiter	km	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
176	Range Jupiter - S/C	km	E
177	Range Jupiter - Io	km	E
178	Range Jupiter - Europa	km	E
179	Range Jupiter - Ganymede	km	E
180	Range Jupiter - Callisto	km	E
181	Angle Earth - Sun - S/C	deg	E
182	Angle Sun - S/C - Earth (Celestial Cone Angle of Earth)	deg	E
183	Angle Sun - Earth - S/C	deg	E
184	Angle Jupiter - Sun - S/C	deg	E
185	Angle Sun - S/C - Jupiter (Celestial Cone Angle of Jupiter)	deg	E
186	Angle Sun - Jupiter - S/C	deg	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
187	Celestial Clock Angle of Earth	deg	E
188	Celestial Clock Angle of Jupiter	deg	E
189-190	Celestial Clock and Cone Angles of Io	deg	E
191-192	Celestial Clock and Cone Angles of Europa	deg	E
193-194	Celestial Clock and Cone Angles of Ganymede	deg	E
195-196	Celestial Clock and Cone Angles of Callisto	deg	E
197-198	Right Ascension and Declination of S/C, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
199-200	Right Ascension and Declination of Sun, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
201-202	Right Ascension and Declination of Jupiter, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
203-204	Right Ascension and Declination of S/C, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
205-206	Right Ascension and Declination of Sun, Jupiter Centered, Jupiter True Equinox and Equator of Date.	deg	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
207-208	Right Ascension and Declination of Io, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
209-210	Right Ascension and Declination of Europa, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
211-212	Right Ascension and Declination of Ganymede, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
213-214	Right Ascension and Declination of Callisto, Jupiter Centered, Jupiter True Equinox and Equator of Date	deg	E
215-216	Celestial Latitude and Longitude of S/C, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
217-218	Celestial Latitude and Longitude of Earth, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
219-220	Celestial Latitude and Longitude of Jupiter, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
221-226	Cartesian State of S/C, Jupiter Magnetic Dipole Centered, Jupiter Magnetic Meridian and Equator of Date	km km/sec	E
227-232	Cartesian State of Io, Jupiter Magnetic Dipole Centered, Jupiter Magnetic Meridian and Equator of Date	km	E
233	Range Jupiter Magnetic Dipole - S/C	km	E
234	Range Jupiter Magnetic Dipole - Io	km	E

ATTACHMENT E

Navigation Data Block Format for Jupiter Encounter

WORD	DESCRIPTION	UNITS	TYPE
235-236	Latitude and Longitude of S/C, Jupiter Magnetic Dipole Centered, Jupiter Magnetic Meridian and Equator of Date	deg	E
237-238	Latitude and Longitude of Io, Jupiter Magnetic Dipole Centered, Jupiter Magnetic Meridian and Equator of Date	deg	E
239	Time to (-) / From (+) Jupiter Periapsis Passage	sec	E
240-252	Spares		

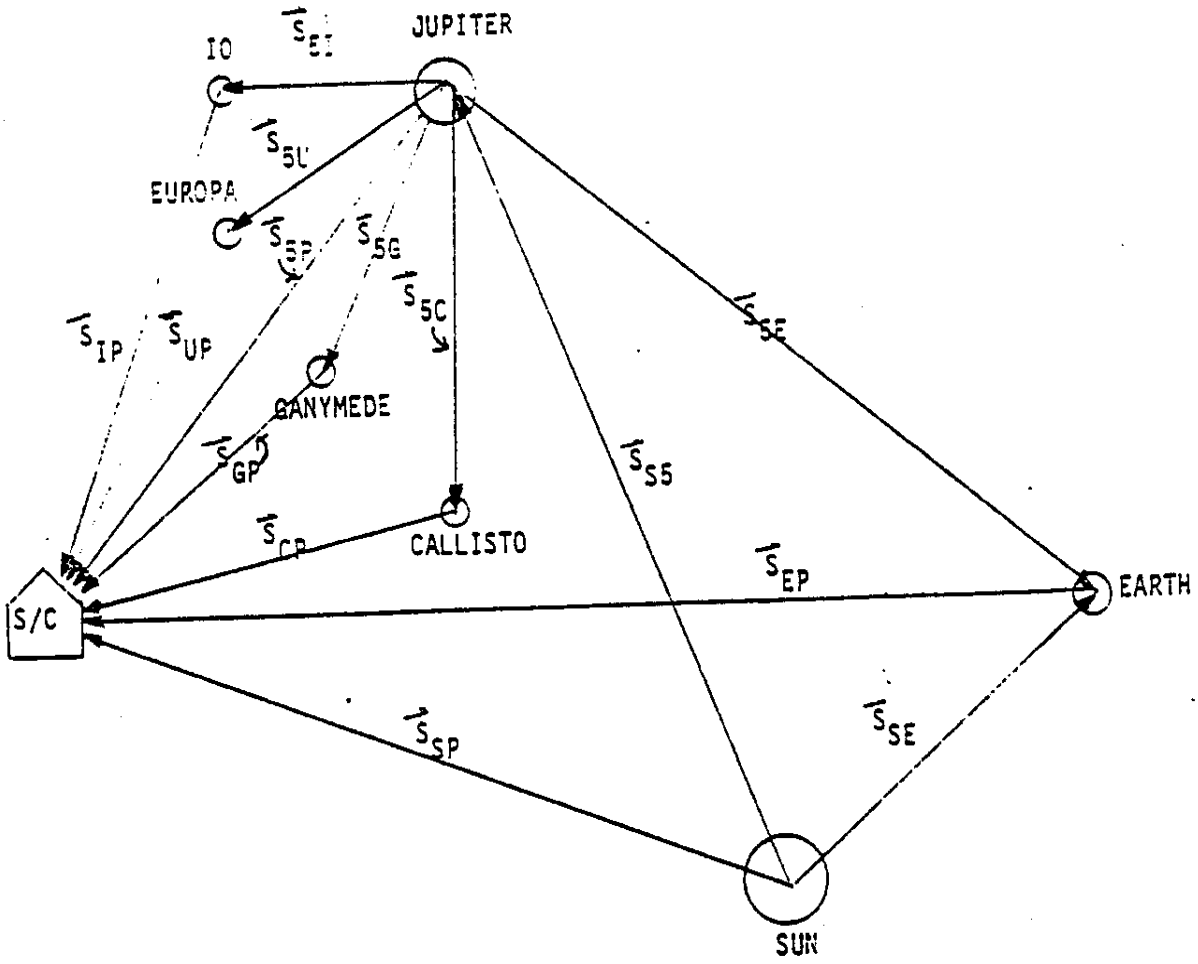


Figure E-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Jupiter Encounter State Vectors

Nomenclature $\vec{S}$ refers to State Vector (Position and Velocity Components) with the subscripts AB, where A is the reference or "From" body and B is the "To" body. The following body definitions are used: S-Sun, P-S/C or Probe, E-Earth, 5-Jupiter, I-IO, U-Europa, G-Ganymede, C-Callisto.

ATTACHMENT F

Navigation Data Block Format
for Saturn Encounter

ATTACHMENT F

Navigation Data Block Format for Saturn Encounter

WORD	DESCRIPTION	UNITS	TYPE
1	SCE GMT Year of Navigation Data Block	years, AD	I
2	SCE GMT Day of Navigation Data Block	day of year	I
3	SCE GMT Hour of Navigation Data Block	hour of day	I
4	SCE GMT Minute of Navigation Data Block	minute of hour	I
5	SCE GMT Second of Navigation Data Block	second o minute	I
6	SCE GMT Millisecond (msec) of Navigation Data Block	msec of second	I
7-12	Cartesian State of S/C, Earth Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
13-18	Cartesian State of S/C, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
19-24	Cartesian State of S/C, Saturn Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
25-30	Cartesian State of S/C, Titan Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
31-36	Cartesian State of Earth, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E

ATTACHMENT F

Navigation Data Block Format for Saturn Encounter

WORD	DESCRIPTION	UNITS	TYPE
37-42	Cartesian State of Saturn, Sun Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
43-48	Cartesian State of Earth, Saturn Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
49-54	Cartesian State of Titan, Saturn Centered, Earth Mean Ecliptic and Equinox of 1950.0	km km/sec	E
55-60	Cartesian State of S/C, Saturn Centered, Saturn Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
61-66	Cartesian State of Titan, Saturn Centered, Saturn Mean Orbit and Prime Meridian in Sun Direction	km km/sec	E
67-72	Cartesian State of S/C, Saturn Centered, Saturn True Prime Meridian and Equator of Date	km km/sec	E
73-75	Cartesian Position of Titan, Saturn Centered, Saturn True Prime Meridian and Equator of Date	km	E
76-77	Saturn Latitude and Longitude of S/C	deg	E
78-79	Saturn Latitude and Longitude of Titan	deg	E
80	Range Earth - S/C	km	E
81	Range Earth - Sun	km	E

ATTACHMENT F

Navigation Data Block Format for Saturn Encounter

WORD	DESCRIPTION	UNITS	TYPE
82	Range Sun - S/C	km	E
83	Range Saturn - S/C	km	E
84	Range Titan - S/C	km	E
85	Range Sun - Saturn	km	E
86	Range Saturn - Titan	km	E
87	Angle Earth - Sun - S/C	deg	E
88	Angle Sun - S/C - Earth (Celestial Cone Angle of Earth)	deg	E
89	Angle Sun - Earth - S/C	deg	E
90	Angle Saturn - Sun - S/C	deg	E
91	Angle Sun - S/C - Saturn (Celestial Cone Angle of Saturn)	deg	E
92	Angle Sun - Saturn - S/C	deg	E

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
41-42	Celestial Clock and Cone Angles of the CRS TET Boresight	deg	E
43-45	Cartesian Unit Vector of the CRS TET Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
46-47	Celestial Clock and Cone Angles of the CRS HET 1 Boresight	deg	E
48-50	Cartesian Unit Vector of the CRS HET 1 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
51-52	Celestial Clock and Cone Angles of the CRS HET 21* Boresight	deg	E
53-55	Cartesian Unit Vector of the CRS HET 21 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
56-57	Celestial Clock and Cone Angles of the CRS HET 22* Boresight	deg	E
58-60	Cartesian Unit Vector of the CRS HET 22 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
61-62	Celestial Clock and Cone Angles of the LECP Axis of Rotation	deg	E
63-65	Cartesian Unit Vector of the LECP Axis of Rotation, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
66-67	Celestial Clock and Cone Angles of the PLS Axis of Symmetry	deg	E

* HET 2, Positions 1 and 2, i.e HET 21 and HET 22.

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
12-14	Cartesian Unit Vector of the S/C X-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
15-17	Cartesian Unit Vector of the S/C Y-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
18-20	Cartesian Unit Vector of the S/C Z-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
21-22	Celestial Clock and Cone Angles of CRS LET C Boresight	deg	E
23-25	Cartesian Unit Vector of the CRS LET C Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
26-27	Celestial Clock and Cone Angles of the CRS LET A Boresight	deg	E
28-30	Cartesian Unit Vector of the CRS LET A Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
31-32	Celestial Clock and Cone Angles of the CRS LET D Boresight	deg	E
33-35	Cartesian Unit Vector of the CRS LET D Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
36-37	Celestial Clock and Cone Angles of the CRS LET B Boresight	deg	E
38-40	Cartesian Unit Vector of the CRS LET B Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E

ATTACHMENT F

Navigation Data Block Format for Saturn Encounter

WORD	DESCRIPTION	UNITS	TYPE
93	Celestial Clock Angle of Earth	deg	E
94	Celestial Clock Angle of Saturn	deg	E
95-96	Celestial Clock and Cone Angles of Titan	deg	E
97-98	Right Ascension and Declination of S/C, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
99-100	Right Ascension and Declination of Sun, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
101-102	Right Ascension and Declination of Saturn, Earth Centered, Earth Mean Equator and Equinox of 1950.0	deg	E
103-104	Right Ascension and Declination of S/C, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
105-106	Right Ascension and Declination of Sun, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
107-108	Right Ascension and Declination of Titan, Saturn Centered, Saturn True Equinox and Equator of Date	deg	E
109-110	Celestial Latitude and Longitude of S/C, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
111-112	Celestial Latitude and Longitude of Earth, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E

ATTACHMENT F

Navigation Data Block Format for Saturn Encounter

WORD	DESCRIPTION	UNITS	TYPE
113-114	Celestial Latitude and Longitude of Saturn, Sun Centered, Earth True Equinox and Ecliptic of Date	deg	E
115	Time To (-) / From (+) Saturn Periapsis Passage	sec	E
116-126	Spares		

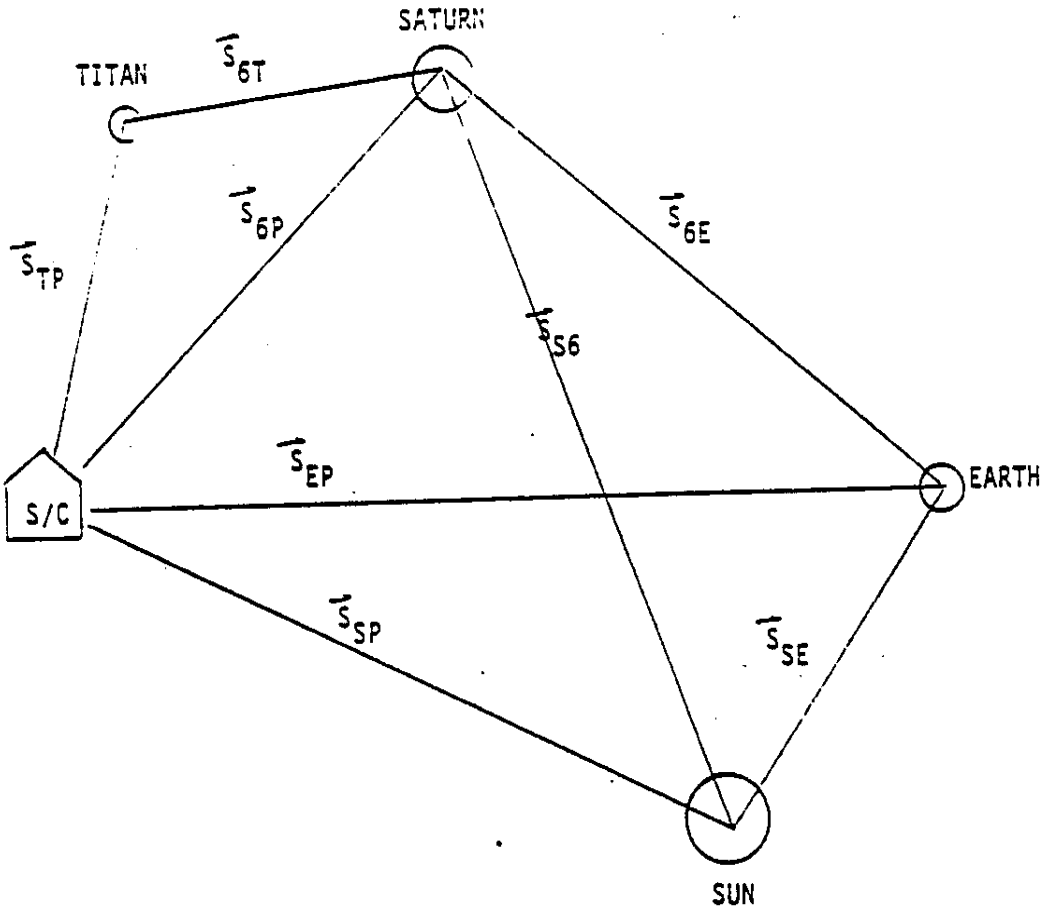


Figure F-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Saturn Encounter State Vectors

Nomenclature $\vec{S}$ referes to State Vector (Position and Velocity Components) with the subscripts AB, where A is the reference or "From" body and B is the "To" body. The following body definitions are used: S-Sun, P-S/C or Probe, E-Earth, 6-Saturn, T-Titan.

ATTACHMENT G

Pointing Vector Data
Block Format

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
1	SCE GMT Year of Pointing Vector Data Block	years, AD	I
2	SCE GMT Day of Pointing Vector Data Block	day of year	I
3	SCE GMT Hour of Pointing Vector Data Block	hour of day	I
4	SCE GMT Minute of Pointing Vector Data Block	minute of hour	I
5	SCE GMT Second of Pointing Vector Data Block	second of minute	I
6	SCE GMT Millisecond (msec) of Pointing Vector Data Block	msec of second	I
7	FDSC MOD16 Count Value of Pointing Vector Data Block	binary counts	I
8	FDSC MOD60 Count Value of Pointing Vector Data Block	binary counts	I
9	Pitch Limit Cycle Angle (Rotation about the S/C X-Axis with the positive direction determined by the right hand rule)	deg	E
10	Yaw Limit Cycle Angle (Rotation about the S/C Y-Axis with the Positive direction determined by the right hand rule)	deg	E
11	Roll Limit Cycle Angle (Rotation about the S/C Z-Axis with the positive direction determined by the right hand rule)	deg	E

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
12-14	Cartesian Unit Vector of the S/C X-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
15-17	Cartesian Unit Vector of the S/C Y-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
18-20	Cartesian Unit Vector of the S/C Z-Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
21-22	Celestial Clock and Cone Angles of CRS LET C Boresight	deg	E
23-25	Cartesian Unit Vector of the CRS LET C Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
26-27	Celestial Clock and Cone Angles of the CRS LET A Boresight	deg	E
28-30	Cartesian Unit Vector of the CRS LET A Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
31-32	Celestial Clock and Cone Angles of the CRS LET D Boresight	deg	E
33-35	Cartesian Unit Vector of the CRS LET D Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
36-37	Celestial Clock and Cone Angles of the CRS LET B Boresight	deg	E
38-40	Cartesian Unit Vector of the CRS LET B Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
41-42	Celestial Clock and Cone Angles of the CRS TET Boresight	deg	E
43-45	Cartesian Unit Vector of the CRS TET Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
46-47	Celestial Clock and Cone Angles of the CRS HET 1 Boresight	deg	E
48-50	Cartesian Unit Vector of the CRS HET 1 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
51-52	Celestial Clock and Cone Angles of the CRS HET 21* Boresight	deg	E
53-55	Cartesian Unit Vector of the CRS HET 21 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
56-57	Celestial Clock and Cone Angles of the CRS HET 22* Boresight	deg	E
58-60	Cartesian Unit Vector of the CRS HET 22 Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
61-62	Celestial Clock and Cone Angles of the LECP Axis of Rotation	deg	E
63-65	Cartesian Unit Vector of the LECP Axis of Rotation, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
66-67	Celestial Clock and Cone Angles of the PLS Axis of Symmetry	deg	E

* HET 2, Positions 1 and 2, i.e., HET 21 and HET 22.

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
68-70	Cartesian Unit Vector of the PLS Axis of Symmetry, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0.	dim	E
71-72	Celestial Clock and Cone of the PLS Laterial Detector Boresight	deg	E
73-75	Cartesian Unit Vector of the PLS Laterial Detector Boresight, S/C Centered, Earth Mean Ecliptic And Equinox of 1950.0	dim	E
76-77	Celestial Clock and Cone Angles of the HGA Boresight	deg	E
78-80	Cartesian Unit Vector of the HGA Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
81-82	Celestial Clock and Cone Angles of the PPS Optic Axis	deg	E
83-85	Cartesian Unit Vector of the PPS Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
86-87	Celestial Clock and Cone Angles of the UVS Airglow Optic Axis	deg	E
88-90	Cartesian Unit Vector of the UVS Airglow Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
91-92	Celestial Clock and Cone Angles of the UVS Occultation Optic Axis	deg	E
93-95	Cartesian Unit Vector of the UVS Occultation Optic Axis, S/C Centered Earth Mean Ecliptic and Equinox of 1950.0	dim	E

ATTACHMENT G

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
68-70	Cartesian Unit Vector of the PLS Axis of Symmetry, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0.	dim	E
71-72	Celestial Clock and Cone of the PLS Laterial Detector Boresight	deg	E
73-75	Cartesian Unit Vector of the PLS Laterial Detector Boresight, S/C Centered, Earth Mean Ecliptic And Equinox of 1950.0	dim	E
76-77	Celestial Clock and Cone Angles of the HGA Boresight	deg	E
78-80	Cartesian Unit Vector of the HGA Boresight, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
81-82	Celestial Clock and Cone Angles of the PPS Optic Axis	deg	E
83-85	Cartesian Unit Vector of the PPS Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
86-87	Celestial Clock and Cone Angles of the UVS Airglow Optic Axis	deg	E
88-90	Cartesian Unit Vector of the UVS Airglow Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
91-92	Celestial Clock and Cone Angles of the UVS Occultation Optic Axis	deg	E
93-95	Cartesian Unit Vector of the UVS Occultation Optic Axis, S/C Centered Earth Mean Ecliptic and Equinox of 1950.0	dim	E

Pointing Vector Data Block Format

WORD	DESCRIPTION	UNITS	TYPE
96-97	Celestial Clock and Cone Angles of the IRIS Optic Axis	deg	E
98-100	Cartesian Unit Vector of the IRIS Optic Axis, S/C Centered, Earth Mean Ecliptic and Equinox of 1950.0	dim	E
101	Continuation Bit: = 1, another pointing vector block follows = 0, last pointing vector block in this logical record	dim	I
102	Scan Platform Azimuth Angle	deg	E
103	Scan Platform Elevation Angle	deg	E
104	Telemetry Use Code (Octal)* 0 = telemetry is NOT used or predict is used 1 = telemetry is used	NA	Octal
105-126	Spares		

* Refer to Table G-2 for breakdown of telemetry code.

TABLE G-1

Nominal S/C Clock and Cone Angles
of the Fixed Instrument Boresights

BORESIGHT	S/C CLOCK AND CONE ANGLES*	
	CLOCK (deg)	CONE (deg)
CRS LET A	305	115
CRS LET B	236	53
CRS LET C	125	65
CRS LET D	10	48
CRS TET	305	115
CRS HET 1	338	60
CRS HET 21	104	78
CRS HET 22	104	140
LECP Axis of Rotation	200	90
PLS Axis of Symmetry	---	0
PLS Lateral Detector	262	90
HGA	---	0

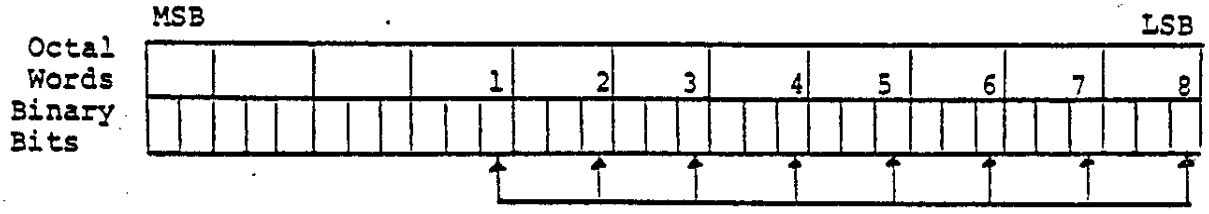
*S/C clock and cone angles are not to be confused with celestial clock and cone angles. The S/C clock/cone system uses the HGA boresight and the Canopus Tracker optic axis as references while the celestial clock/cone system uses the Sun and Canopus.

Table G-2

TELEMETRY USE CODE

OCTAL NUMBER POSITION - LEFT TO RIGHT	DESCRIPTION
1 *	Pitch Limit Cycle Position
2 *	Yaw Limit Cycle Position
3 *	Roll Limit Cycle Position
4	Scan Platform Elevation
5	Scan Platform Azimuth
6	Pitch Limit Cycle Rate
7	Yaw Limit Cycle Rate
8	Roll Limit Cycle Rate

* always zero if no limit cycle correction is applied.



When these bits are set telemetry is used.
When they are not set predicts are used.
All other bits are zero.

RIGHT ASCENSION AND DECLINATION ALGORITHM

The PI may wish to compute S/C centered right ascension and declination angles of his boresight or optic axis relative to the Earth Mean Equator and Equinox of 1950.0 (EME50). To obtain these angles the following two step algorithm is offered.

Step 1. Rotate ECL50 Unit Vector to EME50 Unit Vector

The instrument boresight or optic axis unit vector is available from the SEDR relative to the Earth Mean Ecliptic and Equinox of 1950.0 (ECL50). This unit vector must be rotated through the mean obliquity of the ecliptic (angle between the ecliptic and equatorial planes) at 1950.0 to obtain the EME50 unit vector. The following transformation matrix will accomplish the required rotation.

$$T \begin{matrix} \text{ECL50} \\ \downarrow \\ \text{EME50} \end{matrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\bar{\epsilon}_o & -\sin\bar{\epsilon}_o \\ 0 & \sin\bar{\epsilon}_o & \cos\bar{\epsilon}_o \end{bmatrix}$$

Where $\bar{\epsilon}_o$ is the mean obliquity of the ecliptic at 1950.0 and $\bar{\epsilon}_o = 23.445789^o$. The following example illustrates the proper use of this matrix.

$$\vec{U}_{EME50} = T \begin{matrix} \text{ECL50} \\ \downarrow \\ \text{EME50} \end{matrix} * \vec{U}_{ECL50}$$

Where $\vec{U}_{EME50}$ and $\vec{U}_{ECL50}$ are the EME50 and ECL50 unit vectors, respectively, and $T \begin{matrix} \text{ECL50} \\ \downarrow \\ \text{EME50} \end{matrix}$ is the transformation matrix.

Step 2. Compute the Right Ascension and Declination Angles

Once the unit vector has been transformed to EME50 coordinates, the right ascension and declination angles can be computed by using the following equations:

$$\alpha = \mathrm{Tan}^{-1} \left(y_{EME50} / x_{EME50} \right)$$

$$\delta = \mathrm{Sin}^{-1} \left(z_{EME50} \right)$$

Where α is the right ascension angle, δ is the declination angle and x_{EME50}, y_{EME50} and z_{EME50} are the x, y and z components of the EME50 unit vector.

LINK NAME	START TIME	END TIME	FDS CNT	TARGETING	SUPPORT IMAGING
VT1X3 (Titan)	-1:06:39	-1:06:19	43967:19 43967:45	ISS Mosaic of Titan	NA, WA
UTDRFT (Titan)	-1:02:18	-1:01:09	43972:45 43974:12	Titan drift, start at center of Titan	NA, WA
PT2XL (Titan)	-23:10	-22:49	43976:40 43977:07	Scan across Titan	NA, WA
UTDRFT (Titan)	-21:48	-20:51	43978:23 43979:35	Titan drift, start at center of Titan	NA
PTCRV (Titan)	-20:50	-20:30	43979:35 43980:01	Scan across Titan	NA, WA
RPRET (Saturn)	-19:20	-18:28	43981:28 43982:34	North Pole, scan to track Saturn	NA, WA
PTMOS (Titan)	-17:14	-16:32	43984:05 43984:58	Scan across Titan	NA, WA

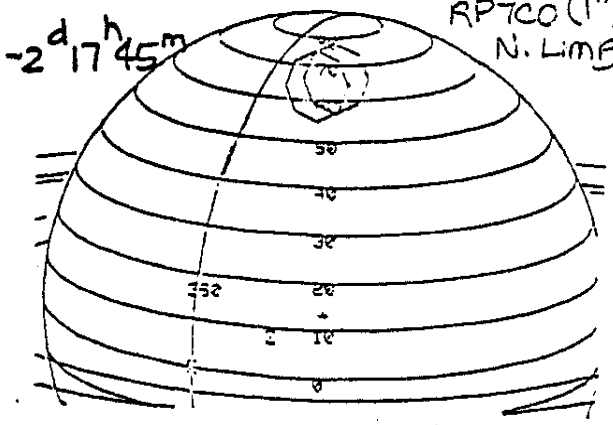
B525 IRIS LIMB INTEGRATION

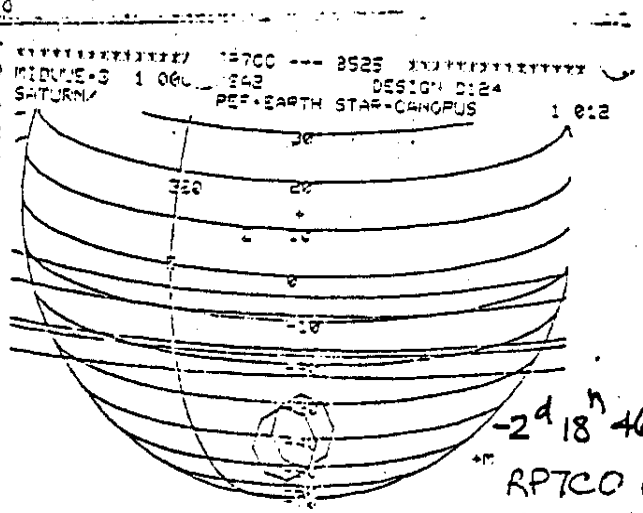
[Move to pole]

Only with pole integration time, [illegible] retargetable

RP7CO (1^h)
N. LIMB

$-2^d 17^h 45^m$

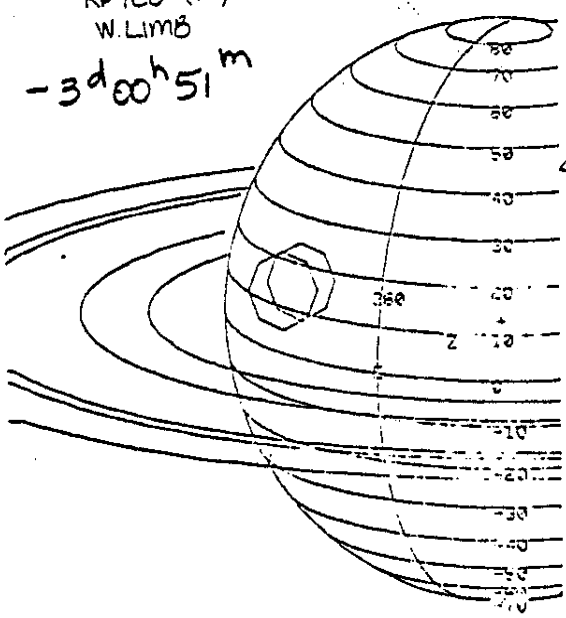




$-2^d 18^h 46^m$
RP7CO (1^h)
S. LIMB

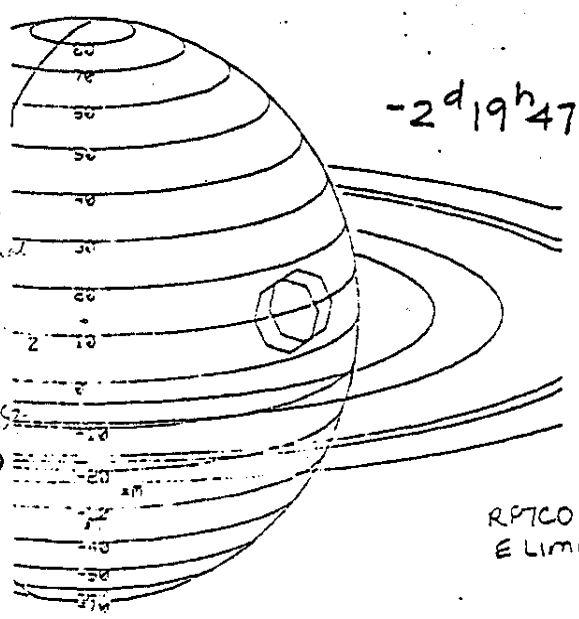
RP7CO (1^h)
W. LIMB

$-3^d 00^h 51^m$



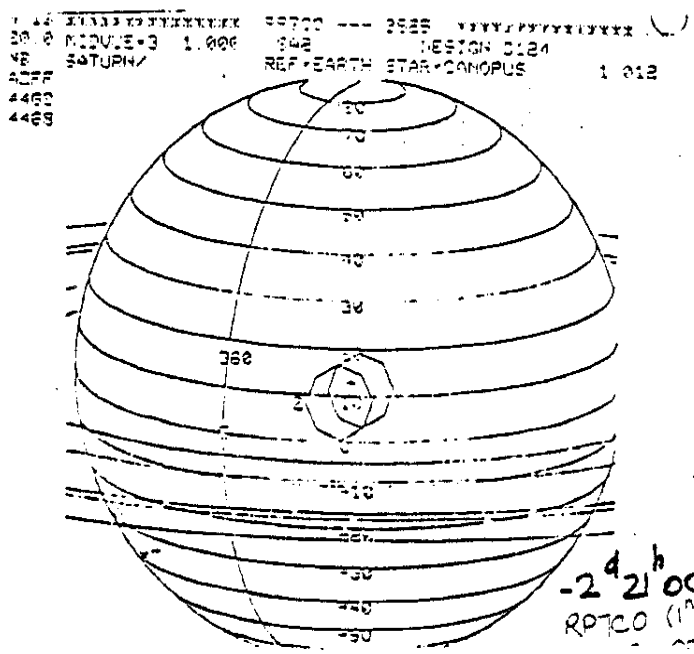
To average over thermal structure

start low and work up highs resolution at end



$-2^d 19^h 47^m$

RP7CO
E LIMB (1^h)



$-2^d 21^h 00^m$
RP7CO ($1^h 13^m$)

DUMP OF DD-8287B
START: 8/17/89
STOP: 8/23/89

DOY = 229

YR = 89

DUMP OF TAPE MT1

INPUT TAPE MT1 ON HT
DATA INPUT H9 NF=2 SR=2=1=1
DATA INPUT SR=2 =1=1

FILE	INPUT RECS.	DATA RECORDS INPUT	MAX. SIZE	READ ERROR SUMMARY PERM	ZERO B	SHORT	UNDEF.	INPUT RETRIES #RECS.	TOTAL#
	1		80						

FILE 2 RECORD 1 LENGTH 4096 BYTES

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(8)	51[illegible]	[illegible]	1[illegible]	9B347[illegible]92	4744[illegible]EFF	4844D42B	48449[illegible]3B	4744E1EF	4744C7F1
(12)	4744ECF4	4744BEE[illegible]	8C44[illegible]5C	[illegible]	2D343D3F	2D343D3F	2D343D3F	2D343D3F	2D343D3F
(16)	2D343D3F	2D343D3F	9934[illegible]88B	9934CF8B	9934CB8B	9934CB8B	9934CB8B	9934CE8B	9934CB8B
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(24)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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(44)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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(60)	A3[illegible]794	AE33[illegible]63	6F33[illegible]78C	8D33D[illegible]82	4F3381[illegible]	[illegible]336[illegible]B6	CD33E7CD	A9332[illegible]9BF	7E324[illegible]1D
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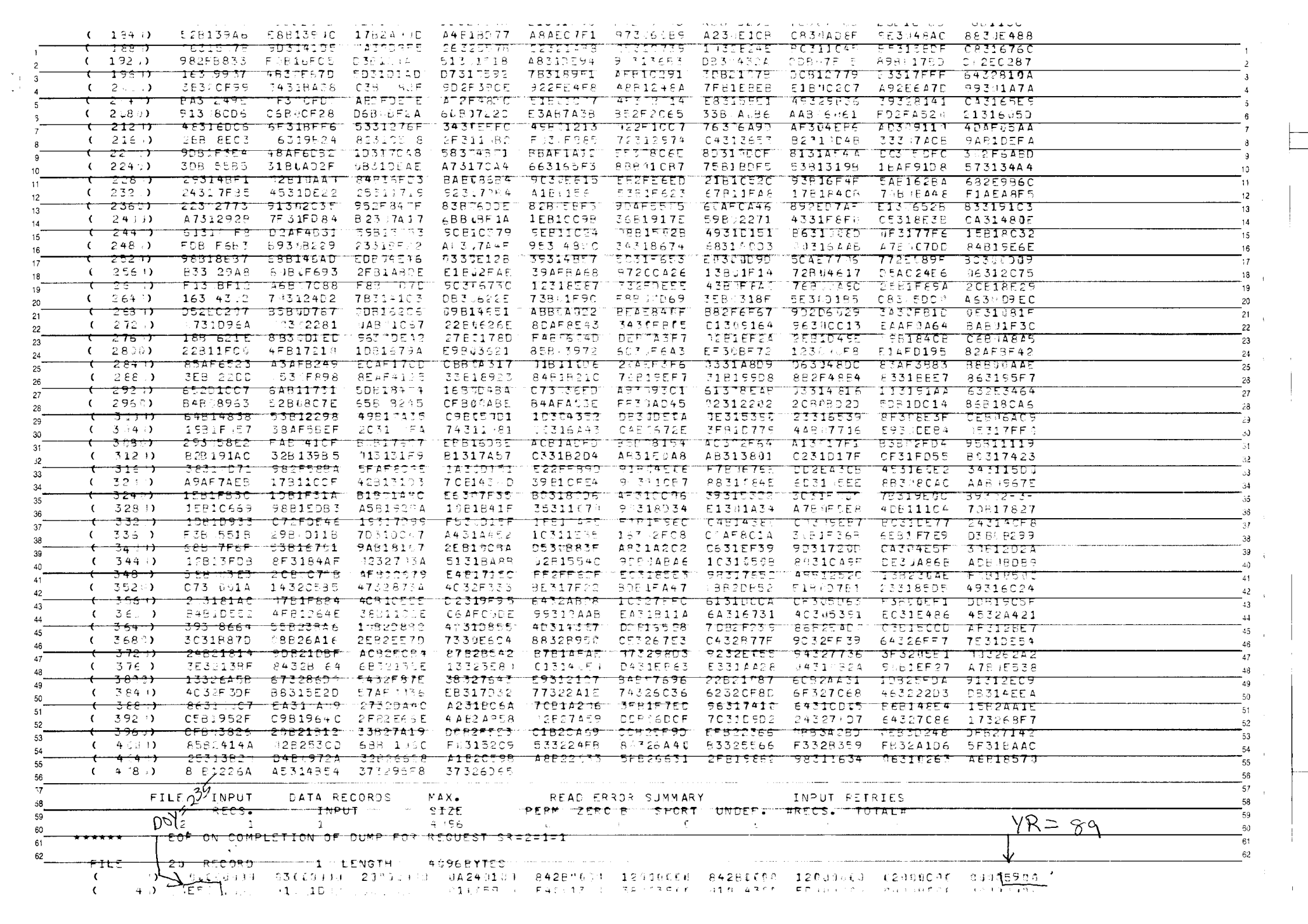

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(276)	7353	BF353 57	CC334 5A	C1338 2F	2033	EIF27 BD	4DB3 1B	CCB2 59	E731	EA321 B6
(280)	173	633 FC	CD3 9C	233C BA	7BB 32	1B3 4E	1BB3 2C	3163 82	C636 D5	8B2 F2
(284)	11B2 C5	14B338 81	1FB38 B8	DCB2 E8	A7B2 54	B33C 5B	B433 08	9533 DA	1932 4A	8353 8D
(288)	55B34 3E	9CB3 09F	8FB3 A	79B3 3E	83B3C 4D	73B38 C	D9B2 2E	9231 F4	9632 45	2232 7F
(292)	FBB 18	63E3C 8B	B8B1 EE	A433 ED	FA334 27	C 33E 3A	BA328 8E	14E31 1F	1EB3 07	3EB3 54
(296)	24B3C 5E	31B2 CD	9A32 1F	E6B2 3F	CBB3E 15	C5B3C 3E	33B3 7C	3933 7F	DE33A 4A	D3336 1D
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(308)	4F31 34	BD328 21	6733 E5	25338 E5	59E2 A	D1E28 2E	3932 11	9328 A2	3B31 B4	1D334 3E
(312)	52334 D1	3B3C 9	3684 5	45F42 AC	39B4 39	2C940 FB	DCB32 F3	9152 2	1634 4B	9D338 E5
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(320)	BB2 58	5BB31 3C	C2B38 B6	FEB38 6C	1BB47 46	D2B32 FE	CE328 28	C5336 1D	C1332 1A	1134A 1E
(324)	2134 89	F833A 71	C833C 67	F133C 98	CC338 D	7B33 65	2E33C F5	3 B2 4	A4B3A 97	74B34 E5
(328)	B52F 9A	84B28 CC	6B34 4C	25B3 F	4FB3 EB	F4B38 7	DCB34 28	47334 82	2F34C837	BA33E C2
(332)	A6B3C D5	7EB4A 55	9FB36 7A	89B2 9F	20320 C4	49329 BA	95B2 17	1EB34 1B	6A32 D2	F8334 9E
(336)	4C34C8 A	3434A 25	5633 8	4FB3C 67	C7B2C 1A	6473C AA	6633E 99	7AB28 3	7EB38 F2	47B3 3F
(340)	39B2 47	C AF 7	D7B28 74	53B3 4A	5AB3E 5F	37B24 99	4233 D5	DF32 1C	A432 D	7E328 EA
(344)	69B1 J78	4F334 C3	D333B 72	EE33D 4D	AC331 38	8D32C FA	E031 60	F5328 7C	EFB2 1E	13B47 F8
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(352)	34B4 3E	8DB33 3R	86335 3C	7E338 AE	FDB1 8B	6CB32 38	C6B33 E6	DFB3F EE	9233 3C	96B3D 6E
(356)	9EB3B 9E	3DF36 96	39732 D7	EA347 4E	7B34B C2	5333 A1	3EB3C BD	14B49 FC	7EB49 B5	84B4B 32
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(364)	313E84	CB32 7E	13B36 F1	B5324 64	B3336 24	15B32 91	7BB4D8 AB	45B4F 3	EF33A 27	9734C 9E
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(372)	F2328 4F	CD324 AD	3D338 BC	33342 8	CB349 C7	E1347 C44	2434 C7	5B48 7E	5B488 E	FD33C 1D
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(380)	2233E 1C	85B26 3	8B3E 3B	15345 4	3E338 2F	E5B2A 1B	DB333 6D	7434F 4C	6434F 28	47342 2D
(384)	534987E	F2B3A8F3	6D54E 4F	91B348 F	F833E A	9233C 69	24B24 D3	DD337 3	5F342 C	E833 8
(388)	C1B2AE7	44B42 1	41B44 3A	26B4E4 1	13B45 4	F3B3C 8C	F5B33 62	26B49 1B	1EB44 8	7334 E
(392)	943+DB5B	A8344 E	BF33889B	F783E F2	FDB3A 28	2FB38 8E	C732E 4	3A348 8B	7734 39	6C34C 1F
(396)	1C34 64	E7331 2	F533 92	7A34 AE	1E343 EC	7F348 18	8F33F 5	67B31 62	42B4286E	64B4C 9
(400)	1AB44482	CBB37862	E9334 23	99B498 F	5B43 21	B9B3486	DAB24 1D	EF328 A3	D8337 5F	56749226
(404)	4E34 C3	BDB31 8	B9B4F 3	74B46 7	1934BAC5	BC34241C	8B347 B2	7D336 71	78B3F 5	B3B3894
(408)	EFB3F 9F	3AB48 E	5FB47 F	43F4B5F						

FILE	INPUT RECS.	DATA RECORDS INPUT	MAX. SIZE	READ ERROR SUMMARY PERM	ZERO B	SHORT	UNDEF.	INPUT RETRIES #RECS.	TOTAL#
2	1 72	1 72	4 96	%	%	%	%	%	%

EOJ DUMP STOPPED AFTER FILE 2 # OF PERMANENT READ ERRORS

START TIME 6/1 /92 12:44: 4 STOP TIME 6/1 /92 12:46:45

VOYAGER 1 & 2

SATURN IRIS MERGED DATA

77-084A-03B
77-076A-03B

This data set has been restored. There were originally 15 Voyager 1 and 11 Voyager 2 Binary 9-Track, 1600 BPI tapes. There are 5 Voyager 1 and 4 Voyager 2 restored tapes. The DR tapes are 3480 cartridges and the DS tapes are 9-track, 6250 BPI. The tapes were created on an IBM 360 computer. These tapes will be replaced when the new data arrives. The DR and DS numbers along with the corresponding D numbers and the time spans are as follows:

77-084A-03B (VOYAGER 1)

DR#	DS#	D#	FILES	TIME SPAN
DR00161	DS00161	D54664	1	10/22/80 - 10/23/80
		D54665	2	10/23/80 - 10/25/80
		D54666	3	10/25/80 - 10/27/80
DR00162	DS00162	D54667	1	10/27/80 - 10/29/80
		D54668	2	10/29/80 - 10/31/80
		D54669	3	10/31/80 - 11/02/80
DR00163	DS00163	D54670	1	11/02/80 - 11/04/80
		D54671	2	11/04/80 - 11/06/80
		D54672	3	11/06/80 - 11/08/80
DR00164	DS00164	D54673	1	11/08/80 - 11/10/80
		D54674	2	11/10/80 - 11/12/80
		D54675	3	11/12/80 - 11/13/80
DR00165	DS00165	D54676	1	11/13/80 - 11/15/80
		D54677	2	11/15/80 - 11/17/80
		D54678	3	11/17/80 - 11/18/70

77-076A-03B (VOYAGER 2)

DR#	DS#	D#	FILES	TIME SPAN
DR00166	DS00166	D54679	1	08/13/81 - 08/15/81
		D54680	2	08/15/81 - 08/17/81
		D54681	3	08/17/81 - 08/19/81
DR00167	DS00167	D54682	1-2	08/19/81 - 08/21/81
		D54683	3	08/21/81 - 08/23/81
		D54684	4	08/23/81 - 08/25/81
DR00168	DS00168	D54685	1	08/25/81 - 08/27/81
		D54686	2	08/27/81 - 08/30/81
		D54687	3	08/30/81 - 09/01/81
DR00169	DS00169	D54688	1	09/01/81 - 09/03/81
		D54689	2	09/03/81 - 09/04/81

REQ. AGENT
LSM
RSH

REQ. NO.
V0173

ACQ. AGENT
RWV

VOYAGER 2

SATURN IRIS MERGED DATA

77-076A-03B

This data set consists of 11 D tapes and 14 C tapes. All of these tapes are 1600 BPI, 9TRK, BINARY, and were generated on an IBM 360 computer. Also all of these tapes have one file except for D-54682.

NOTE:

** D-54685 has been replaced due to the original being written over. This tape is 6250 BPI!!**

** D-54686 has been replaced since the original didn't contain enough data. This tape is 6250 BPI!!**

** D-54687 has been replaced since the original ran off the end of the reel while duping. This tape is also 6250 BPI!!**

The D and C numbers along with the corresponding time spans are as follows:

D#	C#	FILES	TIME SPAN
D-54679	C-23037	1	08/13/81 - 08/15/81
D-54680	C-23038	1	08/15/81 - 08/17/81
D-54681	C-23039	1	08/17/81 - 08/19/81
D-54682	C-23040	2	08/19/81 - 08/21/81
D-54683	C-23041	1	08/21/81 - 08/23/81
D-54684	C-23042	1	08/23/81 - 08/25/81
**D-54685	C-23860	1	08/25/81 - 08/27/81
	C-23861	1	08/27/81 - 08/27/81
**D-54686	C-23043	1	08/27/81 - 08/30/81
	C-23862	1	08/30/81 - 08/30/81
**D-54687	C-23044	1	08/30/81 - 09/01/81
	C-23045	1	09/01/81 - 09/01/81
D-54688	C-23046	1	09/01/81 - 09/03/81
D-54689	C-23054	1	09/03/81 - 09/04/81

REQ. AGENT	REQ. NO.	ACQ. AGENT
LSM RSH	V0173	RWV

VOYAGER 1

SATURN IRIS MERGED DATA

77-084A-03B

This data set consists of 15 D tapes, and 17 C tapes. All of these tapes are 1600 BPI, 9TRK, BINARY, and were generated on an IBM 360 computer. Also all of these tapes have one file except for D-54667.

NOTE:

** D-54667 has been replaced since the original was damaged on arrival. This tape is 6250 BPI, and has two (2) files**

The D and C numbers along with the corresponding time spans are as follows:

D#	C#	FILES	TIME SPAN
D-54664	C-23023	1	10/22/80 - 10/23/80
D-54665	C-23024	1	10/23/80 - 10/25/80
D-54666	C-23025	1	10/25/80 - 10/27/80
**D-54667	C-23844	1	10/27/80 - 10/28/80
	C-23863	1	10/28/80 - 10/29/80
D-54668	C-23026	1	10/29/80 - 10/31/80
D-54669	C-23027	1	10/31/80 - 11/02/80
D-54670	C-23028	1	11/02/80 - 11/04/80
D-54671	C-23029	1	11/04/80 - 11/06/80
	C-23030	1	11/06/80 - 11/06/80
D-54672	C-23031	1	11/06/80 - 11/08/80
D-54673	C-23032	1	11/08/80 - 11/10/80
D-54674	C-23033	1	11/10/80 - 11/12/80
D-54675	C-23034	1	11/12/80 - 11/13/80
D-54676	C-23035	1	11/13/80 - 11/15/80
D-54677	C-23036	1	11/15/80 - 11/17/80
D-54678	C-23053	1	11/17/80 - 11/18/80

VOYAGER 1

DAYS	START (FDSC)	FINISH	TAPE ID	FILE#	#RECORDS	D#
296-296	34299.00	34311.59	VGR301	1	733	D-54664
296-297	34312.00	34341.59		2	1799	
297-298	34342.00	34372.59	VGR302	1	1852	D-54665
298-299	34373.00	34401.59		2	1856	
299-300	34402.00	34431.59	VGR303	1	1792	D-54666
300-301	34432.00	34461.59		2	1798	
301-302	34462.00	34491.59	VGR304	1	1754	D-54667
302-303	34492.00	34521.59		2	1657	
303-304	34522.00	34551.59	VGR305	1	1797	D-54668
304-305	34552.00	34581.59		2	1786	
305-306	34582.00	34611.59	VGR306	1	1789	D-54669
306-307	34612.00	34641.59		2	1781	
307-308	34642.00	34671.59	VGR307	1	1790	D-54670
308-309	34672.00	34701.59		2	1788	
309-310	34702.00	34731.59	VGR308	1	1782	D-54671
310-311	34732.00	34761.59		2	1778	
311-312	34762.00	34792.59	VGR309	1	1543	D-54672
312-313	34793.00	34821.59		2	1675	
313-314	34822.00	34851.59	VGR310	1	1786	D-54673
314-315	34852.00	34881.59		2	1798	
315-316	34882.00	34911.59	VGR311	1	1785	D-54674
316-317	34912.00	34941.59		2	1668	
317-318	34942.00	34945.11	VGR312	1	160	D-54675
318-318	34945.12	34970.58		2	1344	
318-319	34971.00	35001.59	VGR313	1	1716	D-54676
319-320	35002.00	35032.79		2	1828	
320-321	35033.00	35062.59	VGR314	1	1793	D-54677
321-322	35063.00	35091.59		2	1735	
322-323	35092.00	35122.59	VGR315	1	1839	D-54678

VOYAGER 2

DAYS	START	FINISH	TAPE ID	FILE#	#RECORDS	D#
225-227	43639.00	43700.59	VGR401	1	3666	D-54679
227-229	43701.00	43759.59	VGR402	1	3530	D-54680
229-231	43760.00	43820.59	VGR403	1	3446	D-54681
231-232	43821.00	43820.59	VGR404	1	1642	D-54682
232-233	43849.00	43875.59		2	1605	
233-235	43876.00	43931.59	VGR405	1	3345	D-54683
235-237	43932.00	43991.59	VGR406	1	3461	D-54684
237-239	43992.00	44058.57	VGR407	1	3639	D-54685
239-242	44059.00	44125.59	VGR408	1	3967	D-54686
242-244	44126.00	44208.59	VGR409	1	4904	D-54687
244-246	44209.00	44268.59	VGR410	1	3562	D-54688
246-247	44269.00	44284.07	VGR411	1	903	D-54689

DUMP OF TAPE IN1

INPUT TAPE IN1 ON TB0
DATA INPUT H9 FL 1 2 2

FILE 1 RECORD 1 LENGTH 11580BYTES

(0)	2D3C0007	2D3B0100	0004C5E5	00030196	028A0000	00650001	0000869E	00000000	C000869E	00000000	
(40)	0001000A	00000E60	01A60017	0022001C	00000000	00020050	012D0016	00090020	0001008C	00860000	VOYAGER 1
(80)	00000000	00000000	00000000	00000000	10AE0000	3B4E6986	42C810B4	42C81E70	42C7FC24	42C83220	
(120)	42C7C5E0	42C7DFB4	42C75BB0	42C7CAD4	4311CCC0	01010100	3B4FA76E	3B4FA76E	3B4FA76E	3B4FA76E	77-084A-03B
(160)	3B4FA76E	3B4FA76E	3B4FA76E	3B4FA76E	3B4F5C04	3B4F5C04	3B4E3720	3B4E3720	3B4E3720	3B4E3720	
(200)	3B4E3720	3B4D123E	00000004	00000006	3CAAB918	42567E6C	42BBB144	00000000	01010101	01001DC3	D-54667 C-23844
(240)	3F000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	
(280)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	10/27/80-10/28/80
(320)	00000000	00000006	4854CE3E	4714AE01	00000000	00000000	00000000	00000000	4854CE3E	00000000	
(360)	4714AE01	47149F99	47149F4E	4139F94C	42186A27	418A4BA7	41F64AD4	41CF5613	4028CF02	401FADCA	
(400)	41349S6A	41BD2F8C	41CFD706	43115860	42B6AC90	00000000	00000000	00000000	00000000	00000000	
(440)	00000000	F30A9913	0DB8BF6C	20AE7979	77359400	0104F68A	1DBEADF5	D7442162	EEB4E821	0894416F	
(480)	3D4C0E1D	42962CCF	411F3F87	0AD1049E	0104F68A	C2DAD59C	C2286547	BC4389A0	BCAB72FB	BD11FFE3	
(520)	BD3AE539	00000000	00000000	00000000	00000000	00000000	3D1495E4	3CD8B5A7	3C6AE936	3C379596	
(560)	3C251C09	3C1B7DA8	3C1702F6	3C10D323	3BA13A30	3B9EFD40	3BA0CE10	3B5D36E0	3B44CCC0	3B7C6310	
(600)	3BA3E1E0	3B9BD770	3B9EEFF0	3B879AB0	3B74F600	3B644DE0	3B673500	3E753B00	3B7DFFA0	3B7F6D50	
(640)	3B7E37C0	3B7F5C20	3B817350	3B7F8D00	3B7A3660	3B767D10	3B76A0C0	3B7806B0	3B782DF0	3B77F220	
(680)	3B782150	3B780130	3B764450	3B740470	3B731200	3B73AA80	3B744A70	3B746FC0	3B7490F0	3B74E5D0	
(720)	3B74A550	3B7385B0	3B721810	3B70AD50	3B6F3430	3B6E52F0	3B6DC820	3B6C8F60	3B6A8C20	3B69D990	
(760)	3B6A7CB0	3B6A6940	3B68C310	3B670090	3B666D10	3B66EBA0	3B66E590	3B657CA0	3B641390	3B646FF0	
(800)	3B653F00	3B63AAC0	3B5F2E10	3B5A9BA0	3B58A160	3B592C30	3B5A46A0	3B5AADD0	3B597B80	3B568BA0	
(840)	3B53C430	3B532C60	3B576F70	3B5273B0	3B50C8A0	3B4F9BA0	3B4EC450	3B4E8C90	3B4EBFE0	3B4DB5E0	
(880)	3B4AC1E0	3B478050	3B4E3610	3B446630	3B454950	3B468F60	3B459AD0	3B420FD0	3B3E52A0	3B3C85B0	
(920)	3B3C7EA0	3B3CE5F0	3B3C9860	3B3B20A0	3B38D2C0	3B375FE0	3B379800	3B379860	3B35CCB0	3B3447D0	
(960)	3B34E590	3B35EEF0	3B367370	3B33EDD0	3B31C450	3B2F0960	3B2D0410	3B2C9120	3B2CC560	3B2CF570	
(1000)	3B2C9190	3B2C7160	3B2B83A0	3B287840	3B2C1190	3B2BDE10	3B2AF4C0	3B2AA710	3B2AB090	3B29B860	
(1040)	3B27DAE0	3B26B5D0	3B26DED0	3B277E30	3B27D560	3B27C650	3B26D700	3B24D970	3B22BA40	3B21BE40	
(1080)	3B223D80	3B2388D0	3B243BA0	3B236D30	3B21FDC0	3B213030	3B20E5C0	3B207E60	3B1FFC40	3B1F7190	
(1120)	3B1F01F0	3B1F55A0	3B2067F0	3B211D30	3B2C7810	3B1E99D0	3B1CB2E0	3B1C5700	3B1DA8B0	3B1F2650	
(1160)	3B1FE300	3B202380	3B1F9590	3B1DDAC0	3B1BE960	3B1ADCD0	3B1AA5E0	3B1ABBB0	3B1A7F10	3B19EE70	
(1200)	3B1A07A0	3B1B3630	3B1B0EA0	3B1A8860	3B180260	3B165300	3B166D50	3B178030	3B182E00	3B184000	
(1240)	3B182220	3B17CA20	3B171C00	3B167EF0	3B15FFD0	3B157A30	3B150F70	3B14E450	3B152AB0	3B160BC0	
(1280)	3B168920	3B15A900	3B1478F0	3B142C20	3B13CE40	3B12C750	3B128110	3B13B720	3B14DBE0	3B147730	
(1320)	3B13EFC0	3B11E300	3B11FAB0	3B120720	3B113850	3B10F0A0	3B1220F0	3B133780	3B12B2A0	3B119C40	
(1360)	3B112FE0	3B1108E0	3B1D5660	3B1189F0	3B126C00	3B1201F0	3B1078D0	3AF79B00	3AF73000	3AFC5F00	
(1400)	3B100A70	3AFECC00	3AF7DA00	3AF18300	3AE33300	3ACA8000	3AC16B00	3AD28700	3AE2F100	3AE69200	
(1440)	3AE97B00	3AE7BA00	3AD86700	3ACF6000	3AC29500	3AB87F00	3AC37E00	3AD5B100	3ACBDE00	3AB07900	
(1480)	3AA26600	3AA13A00	3A93D100	3AAE4400	3AB8CB00	3AFBCE00	3ABA2000	3AAEA800	3A9B9400	3A984500	
(1520)	3AA54600	3AA71600	3A97E100	3A8B0900	3A883B00	3A8C3500	3A990200	3AAE8900	3ABFF100	3ABBEF00	
(1560)	3AAC9E00	3A80D800	3A707100	3A723100	3A7DC300	3A8C9000	3A98C300	3A936000	3A746400	3A550A00	
(1600)	3A52FE00	3A633A00	3A6D5100	3A751500	3A81A000	3A896C00	3A8BC200	3A8B3C00	3A7FDD00	3A706200	
(1640)	3A6BE700	3A6AC800	3A642D00	3A62FA00	3A6AC500	3A726C00	3A720200	3A61B000	3A48D900	3A427700	
(1680)	3A51AF00	3A5EE500	3A6582D0	3A6F8C00	3A749E00	3A6C9900	3A61AD00	3A603E00	3A62FF00	3A55E400	
(1720)	3A385400	3A2DB300	3A468700	3A5EF400	3A5B1E00	3A4EB300	3A520E00	3A635900	3A743500	3A768D00	
(1760)	3A6B1800	3A5CFD00	3A61D100	3A4F5700	3A570B00	3A559F00	3A468100	3A484000	3A61AC00	3A712500	
(1800)	3A662A00	3A4DE600	3A5ACA00	3A3B6100	3A45E000	3A41A800	3A39B700	3A412D00	3A41C700	3A29B000	
(1840)	3A118700	39DD7000	3A2D9E00	3A44E100	3A5C9000	3A4E4A00	3A35CF00	3A35D300	3A417A00	3A3EBB00	
(1880)	3A2E5400	3A1FA500	3A1CE0J0	3A1F1000	3A1EA000	3A229800	3A27CF00	3A1EE800	3A138000	3A1A8800	
(1920)	3A2A4800	3A357300	3A3A7600	3A2DF200	3A149E00	39FBE000	3A22A600	3A2CCF00	3A293000	3A2E6E00	
(1960)	3A302D00	3A3EF800	3A29F000	3A10F200	39CFB000	3A1A3F00	3A234100	3A241E00	3A24CD00	3A25A800	
(2000)	3A22FE00	3A16C700	39995000	395C1000	3A217100	3A31EE00	3A1DC500	B95A9000	BA1A3200	B9F11000	
(2040)	3A1D6600	3A495E00	3A4D1300	3A33B100	3A24A600	3A24D500	3A214D00	3A18AC00	3A15A900	3A184200	
(2080)	3A1B1F00	3A1ED500	3A204200	3A195B00	3A15F200	3A24ED00	3A383000	3A3AC900	3A31B100	3A240C00	
(2120)	39FCA000	3926A000	39B58000	3A219100	3A37EC00	3A458C00	3A3F2300	3A2C6400	3A257600	3A1FAD00	
(2160)	B91C0000	BA2A8600	BA21CA00	3A235A00	3A6D0100	3A829800	3A68CA00	3A489400	3A317200	3A19D600	
(2200)	39945000	3A12CF00	3A209600	3A33B600	3A159000	B9884000	B94AA000	39EC8000	3A1BEA00	3A310900	
(2240)	3A48DA00	3A43B900	3A2D1800	3A247C00	3A201100	3A158100	3A17D200	3A257C00	3A286D00	3A209800	
(2280)	3A186500	39CAD000	39BE4000	39525000	B92F0000	3989E000	3A8F3D00	3A46DD00	3A3A4400	3A28A000	

(2320)	3A1D4400	B94CD000	BA66AE00	BA3FF100	B9DD4000	3A25E900	3A2A2500	3A185C00	3A17A000	3A187800
(2360)	392A5000	BA116600	B93DC000	3A198800	3A282B00	3A33D300	3A4AB200	3A4B1E00	3A25F700	39F5B000
(2400)	3A21A400	3A309700	3A277100	3A1C5300	39CBC000	B9833000	38920000	3A2ACE00	3A4B0700	3A47A500
(2440)	3A298C00	39F58000	3A1A5F00	3A363E00	3A2EF900	39603000	B9172000	3A1A8B00	3A354800	3A404500
(2480)	3A434600	3A4B4B00	3A3B7700	3A5FED00	3A505300	3A412300	3A37D300	3A289F00	3A1F1000	3A26A600
(2520)	3A2B0500	3A1D1F00	39C6D000	399CF000	3A134B00	3A202D00	3A2EB600	3A3AE900	3A31DA00	39D9D000
(2560)	B9F82000	B97E1000	3A112500	3A1D5500	3A1BA800	3A140900	396B8000	B9811000	B9D6E000	B976E000
(2600)	B9704000	BA172300	BA22A000	BA13AD00	39887000	3A1D6B00	3A26B100	3A1F5B00	39C0F000	3912D000
(2640)	B9183000	B9C41000	BA173400	BA170600	BA18A000	BA204900	BA1C4100	B9529000	3A162500	3A203100
(2680)	3A124800	B8DA0000	B9703000	B9714000	B9959000	B9810000	B9137000	39954000	3A14B500	39FEB000
(2720)	B9E99000	BA29BC00	BA1F6F00	3975F000	3A28B400	3A33AA00	3A2CA300	3A1C7B00	39EC3000	39F75000
(2760)	3A16BC00	39EFF000	B91E8000	B934C000	3936B000	B95F6000	BA149600	BA111100	39145000	3A167700
(2800)	3A271400	3A26A400	3A111B00	B9B3A000	BA1E9800	BA229E00	BA1A4400	B996D000	3A104E00	3A27F700
(2840)	3A2C0C00	3A2E5100	3A2B1100	3A181000	B9B3E0C0	BA1F8600	BA14F900	B9445000	393BA000	B9194000
(2880)	BA1F0000	3A26CA00	BA144C00	39A71000	3A146C00	398CE000	B95F7000	B9972000	B965A300	B9A0C600
(2920)	B9898A00	39E48900	3A241B00	3A21F060	3A13E4F0	3916DC00	BA157690	BA19C2B0	38F85000	3A24DFA0
(2960)	3A39AE40	3A2F8EA0	39A25C00	B9F37600	B964A300	39CD6900	3A1FC850	3A359870	3A304310	399F3300
(3000)	B9B9B700	3827D000	3A113270	3A28D4E0	3A4D8CF0	3A5F5310	3A4ACA90	3A2697D0	3A109930	3A136F30
(3040)	3A197950	39827F00	B9C6ED00	B9923A00	B97FC700	BA17E2C0	BA11A1B0	3A23CC20	3A16BB80	
(3080)	393B4600	B94F1500	37200000	397C1100	39302F00	38B67000	39FCCC00	3A15C4B0	397E8B00	3999CA00
(3120)	3A1F3BB0	3A21E530	398B0300	BA138590	BA218E00	BA1B5140	B9B98600	B9A00300	BA16C490	BA2081D0
(3160)	BA2537B0	BA24E730	BA15CD70	3915FA00	3A1BAB90	3A332880	3A337AB0	3A1618B0	88539000	392E6B00
(3200)	B92CE200	BA20B9D0	BA3CA460	BA3E6AB0	BA27A9C0	B9567200	3A10F620	39E01300	39291100	39327300
(3240)	39E2CF00	3A1C7780	3A283C90	3A21DF70	3937A200	BA12FDE0	B932D100	3A1692C0	39ECA100	B983BC00
(3280)	B9BA5F00	B9DF7300	BA20F110	BA2AA3A0	BA26C5E0	BA28BBF0	BA1ECD10	39ADFF00	3A30DB50	3A3C1D80
(3320)	3A34E9C0	3A156010	BA1D80D0	BA36F260	BA22F470	B94AE700	3924DE00	B9B70100	BA15A410	B9EFAB00
(3360)	B9BDE800	BA1D74E0	BA28F9A0	BA23F4C0	BA16BF20	B9C07200	396E6300	3A17A660	3A124AF0	B95CBC00
(3400)	BA1B9EA0	BA1D0F00	B9FDBEC0	B99B7B00	B96A1500	39A97D00	3A187940	39FC0200	39454B00	B8153000
(3440)	BA111AA0	BA2845C0	BA2B2CD0	BA1C1220	B9D3C9C0	B952A300	B9427600	B93A0F00	393B6300	39BC8100
(3480)	39C12A00	38241000	BA1E0400	BA430D30	BA47A700	BA25DCF0	B93AF500	38DA3000	BA1435E0	BA2CDE30
(3520)	BA3369B0	BA28EA80	BA27D7C0	BA376A10	BA374B50	BA1017C0	3A26F510	3A46B870	3A3EFA10	3A1610E0
(3560)	BA1CCDF0	BA39C5E0	BA3B37F0	BA219F30	B9278700	3A26DD00	3A3EE2E0	3A2CB060	393C9900	BA1987B0
(3600)	BA2199E0	BA1735C0	B9F6B5D0	3910EF00	39386100	39A12500	39D92700	39AB5500	39E3DB00	3A1919D0
(3640)	3A244260	3A2E66A0	3A2DC490	3A1E3570	3A124F70	3A1279F0	3A136860	3A12B0A0	39DCAA00	B91A4300
(3680)	B9B9EA00	B9682800	B9928200	BA130960	B9510900	3A16A030	3A1BB140	3A115E80	3A12C430	3A210730
(3720)	3A31E730	3A37DB50	3A27EE70	3A1ACC20	3A32B9A0	3A564320	3A4C54A0	3A16B3B0	BA1546A0	BA213AA0
(3760)	BA29F220	BA2C72F0	BA187F40	3A1D7D60	3A445A90	3A4819B0	3A1F6DD0	B9BA8F00	BA1BFEB0	B9C83C00
(3800)	39B1EA00	3A16E010	3A1FFC70	3A2AA7B0	3A28D000	3A2715F0	3A3CB4B0	3A4CEA50	3A2EBDA0	B94C0500
(3840)	BA1CD6F0	BA16EA50	B9B67D00	3A1AFBB0	3A2D9B50	3A2166E0	39A93900	B84BA000	BA1274E0	BA3A4150
(3880)	BA51CEF0	BA32E5A0	392B4600	39D32C00	BA189F50	BA3A4CF0	BA4CA4C0	BA3B8C80	BA24B800	39DE5F00
(3920)	3A370260	3A348640	3A1A6500	39188A00	BA103940	BA10A2F0	B974DC00	BA135610	BA2BC430	BA2A2990
(3960)	BA1A9080	BA1F6240	BA263980	B9E3BB00	3A156D90	3A1BB690	38C8E000	BA1587E0	B9864400	3A17DF40
(4000)	3A205480	3A3A4D90	3A4232A0	3A37E8D0	3A2A5AA0	3A31F350	3A37E980	3A216770	B9459300	BA2DC720
(4040)	BA5151B0	BA4E2AD0	BA256270	B9327D00	39AA6100	393B2600	BA2AA340	BA5CE730	BA4E5750	BA1439A0
(4080)	39BB79D0	3A124450	3A1A6720	3A1E26A0	3A1FB5A0	3A222220	39D91F00	BA1D17E0	BA3B91A0	BA3B68E0
(4120)	BA17AF60	3A255FF0	3A4B30F0	3A4559A0	3A253D40	3A114210	3A1026E0	3A1119F0	385C2000	BA1097D0
(4160)	B92C1800	39FD8800	39B93C00	39150800	39F6A200	393E4B00	BA130200	3962F600	3A35A470	3A3AFCF0
(4200)	3A1CA9E0	B97A1D00	BA320BC0	BA55E420	BA56D7A0	BA342180	B9899D00	39FE7800	397ACD00	BA1E6890
(4240)	BA49E8F0	BA4CEC40	BA1B1560	39B8D300	B9A9D2C0	BA2FA4B0	BA2ED7E0	BA1AECC0	B9BB4600	39329000
(4280)	39C04D00	3968D100	B997CF90	BA185830	B9D12300	3A167F40	3A1FC900	39353C00	B9DF9B00	B9E35700
(4320)	BA1BF6B0	BA236820	B9B90700	3A186080	3A29C970	3A2CC810	3A25D6B0	3A2003B0	3A22BEF0	3A1D7400
(4360)	39545A00	BA127850	BA124D30	39384700	3A10E5A0	39667500	392F8000	3A1BB250	3A29E220	3A185F90
(4400)	B9984E00	BA2E2ED0	BA3A4C20	BA1137C0	3A21C9F0	3A1ED390	B990C300	BA268190	BA333700	BA2E4BE0
(4440)	BA113D10	3A12B270	3A1AECE0	BA1274A0	BA53C5D0	BA481190	3A213720	3A6E6306	3A569ECB	3A208830
(4480)	39AC9C00	3938E300	B9AE3BD0	BA1D40D0	BA20C070	B9488300	3A132CC0	B9337600	BA1A4930	3933BE00
(4520)	3A24BED0	3A172BD0	B8C73000	B9486600	BA11CB30	BA35C7B0	BA553370	BA5A5640	BA406D30	BA124860
(4560)	39C66770	3965DA60	B94D8700	39963790	3A18D981	39FAB3E0	B9878100	BA2FD047	BA5FFEBF	BA5FDDF7
(4600)	BA1FFFA0	3A157AA3	3A188B8B	3A19D93E	3A1C4FBD	3921D6F0	BA121A80	B9208BC0	39CF2240	3A114B89
(4640)	3A29F5EA	3A3F852D	3A24A012	B9E52310	BA243400	BA171BF8	B83BCE00	3A1604D7	3A2DD409	3A3D67BF
(4680)	3A360FD0	3A20AAA4	3A10C7DE	396D5C50	B91ED8B0	B9155260	39CAAC00	3A2106AF	3A30A143	3A2EF57C
(4720)	3A1D8DE8	3A109BA6	39F82E10	39F40080	39B3B590	392A17E0	B9CFECA0	BA1302B4	392E7040	3A2033CE
(4760)	3A224063	3A10FFC9	398FD8A0	B9380210	BA3559EB	BA71F019	BA79CC6F	BA479D87	BA10866A	3999DD70
(4800)	3A10BFD0	3A1C3042	3A251B3E	3A14BC88	BA219325	BA3C8E05	BA279A2D	BA1520F3	B9BFE7D0	3A169E8A
(4840)	3A3CD19E	3A2A9ABB	3A17288E	3A1A7D66	3A219DA6	3A251F0F	3A2958AA	3A27815F	3A243915	3A1D226F
(4880)	B9226720	BA280EB6	BA333667	BA345A0B	BA3A50E3	BA26C7C5	39150D20	39945340	BA18206D	BA357EFF
(4920)	BA28ACF5	3A15E871	3A6457B9	3A81F0E9	3A54A1E5	39E90930	BA10CCD7	394EC020	3A376683	3A63ED5A