JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

7 April 1980

Mr. H. Domchick
Goddard Space Flight Center
Code 664
Greenbelt, Maryland 20771

Dear Mr. Domchick:

By now, you should have received the Voyager 2 SEDR Package No. 04004. This SEDR tape was prepared on the new JPL UNIVAC 1100/81 computer. Please process this tape as soon as possible and inform me on FTS Ext. 7981 if you experience any difficulties in reading the tape or processing the data.

Your cooperation in this matter is sincerely appreciated.

Very truly yours,

Denish D Pradhan

Denish D. Pradhan

DDP:pmd

Telephone (213) 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland
20771

Hal - FYI

NASA

Reply to Attn of 664

May 2, 1980

Mr. Denish D. Pradhan
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91103

Dear Mr. Pradhan:

The SEDR tape generated on your new computer system, that you asked us to try to read, has been tested. Neither our System 360 nor PDP 11/70 can read the tape in the expected format and density.

Yours truly,

ORIGINAL SIGNED BY

Gerald A. Muckel, Head
Data Management & Programming Office
Lab for High Energy Astrophysics

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

4 February 1980

Mr. Nan Lal
Goddard Space Flight Center
Code 664
Greenbelt, Maryland 20771

Dear Mr. Lal:

There have been a number of questions concerning the operation of the Data Presence Indicator (DPI) words in the header of CR-5 EDR records. Attached are two change pages for the 618-306 document, "Experiment Data Record Format Specifications", which, hopefully, will clarify the subject. DPI words are 8 bits in length and are all 1's if data is not present, all 0's if data is present. Each DPI word applies to one minor frame (MF) in the record: if there are 25 MFs in the record there will be 25 consecutive 8 bit DPI words; if there are 60 MFs, there are 60 corresponding DPI words; if 150 MFs, then there are 150 matching DPI's. Any unused DPI positions (spares) will be zero filled.

The preceding information on DPI's was obtained from the EDRPROC programmer through the DMT and was validated against the CR-5 test EDRs.

CR-5 telemetry is expected to begin at approximately 0400 GMT on 15 February. If possible, a short QEDR containing a few hours of data will be produced, validated, and expeditiously shipped that same day. If there is a delay, a longer QEDR, possibly covering a three day period will be created, validated, and shipped on Monday, 18 February. As was the case previously, these first QEDRs will serve as test EDR tapes and regular production of CR-5 EDRs will not begin until acceptability reports are received. Once approved, production of CR-5 EDRs will continue at 5 day intervals as is being done in the other cruise telemetry modes.

Please contact me at FTS 792-7959 if there are any questions or concerns.

Sincerely yours,

Harry W. Woo

Harry W. Woo

HWW:pmd

Attachments

cc: H. Domchick (GSFC)

Telephone (213) 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

Table C-9

Standard

Experiment Data Record Header

Item	Word	Bits	Description
44	14	7-0	**Data Quality Indicators** Bit 7 = Unused Bit 6 = Unused Bit 5 = Unused Bit 4 = PN Error Outside BET (0=none, 1=bit errors exceed BET) Bit 3 = PN Error Within BET (0=none, 1=bit errors) Bit 2 = Spare Bit 1 = Valid Data Flag (0=valid, 1=no data) Bit 0 = GCF Block Error (0=no, 1=yes)
45	15	31-16	DQSW for MF31-MF60
46	15	15-0	DQSW for MF61-MF90
47	16	31-16	DQSW for MF91-MF120
48	16	15-0	DQSW for MF121-150
49	17	31-16	DQSW for MF151-180
50	17	15-0	DQSW for MF181-210
51	18	31-16	DQSW for MF211-240
52	18	15-0	DQSW for MF241-270
53	19	31-16	DQSW for MF271-300
			DATA PRESENCE An 8 bit field for Data Presence Indication is supplied for each of the 25, 60, or 150 MF of the record to which this header is applied. All bits are set to zero if data is present, otherwise all bits = 1.

Table C-9

Standard

Experiment Data Record Header

Item	Word	Bits	Description
54	19	15-8	DPI for MF 1
55	19	7-0	DPI for MF 2
....	...	...	...
195	56	31-24	DPI for MF 147
196	56	23-16	DPI for MF 148
197	56	15-8	DPI for MF 149
198	56	7-0	DPI for MF 150
199	57	31-0	Spare
200	58	31-0	Spare
201	59	31-24	Spare
202	59	23-16	Spare
203	59	15-0	Spare
204	60	31-24	DRS Data Type - Numbers are in HEX. IRIS = 20 ISR = 29 CRS = 21 DCOM = 2A LECP = 22 MCNITOR = 2B MAG = 23 DCMS = 2E PLS = 24 ENGE = 2D PPS = 25 ENGS = 2C PRA = 26 PWS = 27 UVS = 28
205	60	23-0	Spare

NOTE: The number of 8-bit DPI words is equal to the number of MFs contained in the record. Unused DPI words are set to zero.

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

4 September 1980

Dr. Rochus E. Vogt
California Institute of Technology
Mail Station 330-31
Pasadena, California 91125

Dear Dr. Vogt:

With the rapid approach of Voyager 1's Saturn Encounter, I have been thinking about the delivery of science data products and the associated quality and timeliness to fully support your experiments. As you will recall, the QEDR deliveries by Voyager 2's Jupiter Encounter were down to 2 - 3 hours after the receipt of data on the ground. The data, in most cases, was of such good quality that the QEDRs qualified as final EDRs. Credit for the above performance belongs to the Data Management Team, whose members put forth a tremendous effort in work and individual initiative by far surpassing both the agreed-to delivery dates as well as our best hoped-for goals.

In preparing for the Saturn Encounters we have streamlined and improved our procedures for the production of SEDRs as well and we will do our best to give a record time performance again in the delivery of data products. As an aid for your planning, I have prepared a table showing what our commitments and goals are for the delivery of data products.

Our goal for the Saturn Encounter period is to deliver QEDRs within 7 (seven) hours after the receipt of the data on the ground. We will, however, make a special effort to provide your QEDRs during the closest approach period within 2 - 3 hours after the receipt of the data. The delivery times indicated on the attached table take into consideration computer failure, validation time and the transportation of the QEDR tapes between Laboratory facilities. In the case of Remote NORT data transmissions and SEDR deliveries, I see no problems. Should you have any questions or comments on this matter, please telephone me on FTS 792-7961.

Sincerely,

S.M. de Gyurky

SMdG:pmd

Attachment- QEDR Encounter Data Deliveries Schedule

cc: H. Domchick (NASA GSFC)
E. Franzgrote

Telephone (213) 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

VOYAGER 1

ENCOUNTER DATA DELIVERIES

DATA PRODUCT	COMMITMENT TO DELIVER (PER AGREEMENT)	SDT/DMT GOALS
SEDRs - PREDICT	S -30 Days	
SEDRs - CLOSEST APPROACH	+54 Days *	20 Days
SEDRs - ENCOUNTER PERIOD	+82 Days *	20 Days
SEDRs - CRUISE	+62 Days *	
EDR (QUICK LOOK) ENCOUNTER	+36 Hours *	7 Hours
EDRs - FINAL	+30 Days *	
Remote NORT	+04 Hours *	+2 Hours

* After receipt of data at the DSS.

Attachment
3 September 1980
S.M. de Gyurky

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Hal

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM
Voyager-NAV-80-182
23 September 1980

TO: C. H. Stembridge

FROM: A. B. Sergeyevsky ABS

SUBJECT: Astrodynamic Constants and, Specifically the Saturn Prime Meridian and Rotation Rate for Voyager-1 Saturn Encounter

This IOM is a response to your request regarding adoption of the most current Saturn longitude system III, based on recent Planetary Radio Astronomy (PRA) Voyager Data, as proposed by Ron Leppin, Goddard SFC, at the July 10, 1980 Voyager SSG Meeting. (Leppin's unnumbered handout is attached as Appendix A).

All astronomical constants used by Voyager Navigation and recommended for use throughout the Voyager Project are based on Ref (1) and additional information specifically released to the project for use throughout a specified mission segment (e.g. Saturn Encounter) by the JPL-Astronomical Constants and Ephemerides (ACE) Committee. The latest such release, "Astronomical Constants for Voyager Saturn Encounter Navigation", by George Null, IOM 314.8-231, dated 16 May 1980, is attached to this IOM as Appendix B.

The constants contained in that document have been incorporated into the ODP/DPTRAJ Encounter Lockfile: MJSNAV*GINLOCK (Navigation Team) and the POINTER Program (Sequence Team) by Donna M. Wegemer and John E. Freeman, respectively. In addition, the following definitions and revised constants have been adopted within the two above computer program families:

1. Siderial rotation rate of Saturn, System III (PRA) has been taken from Appendix A as:

   $\dot{V}$ = 810.760 000 000 000 000 D0

   degrees/day, where

   1 Day = 1 mean solar day = 86400. Sec

   (In DPTRAJ: PLANS (8) = $\dot{V}_{Saturn}$)

2. The prime meridian (P/M) of Saturn has been defined to be coincident with the Saturnian Vernal Equinox at at Epoch = Jan. 1, 0^h E.T., 1950, i.e. the prime meridian hour angle (PMHA) at above Epoch is:

$$V_o = 0.0 \text{ (Degrees)}$$

$$\left(\text{In DPTRAJ: PLANS (9)} = Vo_{Saturn}\right)$$

This choice of Epoch was necessitated by pre-existing DPTRAJ and POINTER code, which cannot be presently changed.

3. The Saturnian Vernal Equinox has been defined as the Ascending Node of Saturn's mean orbit of date at Epoch on the Saturn Equator (fixed). Both of these planes are numerically defined in Ref. (1), Table (6).

4. All Longitudes in ODP/DPTRAJ Printout and Save Tapes are defined as "EAST" Longitudes, following mathematical right-hand algorithms. Those users who require West Longitudes must obtain them using the expression:

$$\boxed{\text{(WEST LONG.)} = 360.0 - \text{(EAST LONG.)}}$$

The Science Data Team has had this correction to West-Longitude included in their SEDR output.

For users preferring to define the Saturn Prime Meridian according to the Goddard SFC proposal (Appendix A) as:

Epoch = Jan. 1, 0^h U.T, 1980

$V_{0_{80/80}}$ = 0.0 (Read: PMHA of 1980-Definition, at 1980 Epoch)

A correction to Longitude is provided, as follows (Fig.1 of Appendix C):

$$(\text{EAST LONG.})_{\substack{1980\\REF\\(Goddard)}} = (\text{EAST LONG.})_{\substack{1950\\REF\\(DPTRAJ)}} - V_{o_{80/50}}$$

Where: $V_{o_{80/50}}$, The PMHA of 1980-Definition, at 1950 EPOCH, is:

$$V_{o_{80/50}} = \Delta V_{HA} + \Delta V_{EQNX}$$

$$= 222.1995436 + 0.0048637$$

$$= 222.2044073 \quad \text{(Degrees, East)}$$

For details of the derivation of this value, refer to Appendix C.

Neither DPTRAJ nor POINTER, nor the SEDR provide corrections for Light Time between object and observer, as approximated (*) in the formula for λ_V in Appendix A. Such corrections, though important, are left to the SEDR users to evaluate, in accordance with their own needs.

An unrelated, but significant note to ODP/DPTRAJ users is, that ALL LATITUDE outputs are of PLANETO CENTRIC type (as opposed to Planetodetic or Planetographic), i.e. flattening is not considered in latitude computation.

The proofreading and checking of the analysis by Donna M. Wegemer is being gratefully acknowledged.

ABS:sg

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*Range to surface point has been assumed equal to Planetocentric S/C distance.

REFERENCE:

(1) F. M. Sturms, Jr., "Polynomial Expressions for Planetary Equators and Orbit Elements with Respect to the Mean 1950.0 Coordinate System", JPL TR 32-1508, Pasadena, Jan. 15, 1971.

APPENDIX A

DESCH } (301)-344-5884
KAISER } -7110

NOTE <ABS>: PRESENTED BY RON LEPPING, GODDARD SFC, AT VOYAGER SSG MEETING JULY 10, 1980

VOYAGER-PRA LONGITUDE SYSTEM

6/27/80

Generating Equation:

$$\boxed{\lambda_v = 810.76\ (t - t_o - 3.86\times10^{-11}\ D) - R}$$

where, λ_v = subspacecraft longitude at the time signal left planet. Like the Jupiter System III convention, λ_v increases with time as viewed by a stationary observer.

810.76 = Saturn rotation rate in degrees/day from P = 10 hr 39.4 m.

t = epoch of observation (SCET)

PRIME MERID. DEFINITION

t_o = system epoch: 0 hr U.T. on January 1, 1980. At this time the prime meridian (=0°) is coincident with Saturn's vernal equinox. (of 1980) <ABS>

D = Voyager-Saturn distance in km.

R = Voyager right ascension = angle to s/c from ascending node of Saturn's orbit on its equator.

How to compute D, R, and $t-t_o$:

D and R may be found on the SEDR cruise and encounter tapes in the following word # locations:

WORD NUMBERS (Navigation block)

Quantity	cruise tape	encounter tape
D(km)	53	83
R(deg)	84	103

$t-t_o$ is the elapsed time (to the nearest minute or so) from the system epoch of 0 hr U.T. on Jan 1, 1980 to the SCET of an observation. It may be computed by hand or from:

$$t-t_o = (wd\#2 - 1) + (wd\#3/24.) + (wd\#4/1440.) + (wd\#5/86400.)$$

where wd#2 through #5 are the SEDR word numbers on either the cruise or encounter SEDR tapes. They are:

wd#2 = elapsed days from Jan 0.0, 1980 to day dd.

wd#3 = hours into day dd

wd#4 = minutes into day dd

wd#5 = seconds into day dd

EXAMPLE: At 0hr SCET on 9 Nov 1980 (several days before V1 encounter),

$$\lambda_v = 810.76\ (313^d - (3.86\times10^{-11})(4.3\times10^6 km)) - 21.9^o$$

$$= 305.8^o$$

= sub-V1 longitude

ERROR: Present uncertainty in measured period is ± .15 ~~sec.~~ min. Over the ~6 day BS to BS Saturn encounter interval, this uncertainty translates into an accumulated error of 1.15^o. The system which uses the 10hr 14 min period will accumulate 201° of rotation error during the same interval.

REFERENCES:

Kaiser, Desch, Warwick, and Pearce -"Voyager Detection of Nonthermal Radio Emission from Saturn", Science, in press.

Desch and Kaiser -"The rotation period of Saturn's magnetic field", EOS-AGU abstract, Toronto AGU meeting, May, 1980 and paper in preparation.

APPENDIX B

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM
314.8-231
16 May 1980

TO: J. McDannell

FROM: G. Null G. W. N.

SUBJECT: Astronomical Constants for Voyager Saturn Encounter Navigation

The astronomical constants set revised according to the plans made by the Astronomical Constants and Ephemeris (ACE) committee meeting of May 2 is attached to this memo.

The changes from the 1977 constants set were:

1) A new planetary ephemeris, DE111, with new values of outer planet masses.

2) New constants for the Saturn system including:

   (a) Planet geometric radius and flattening
   (b) Gravity harmonics and planet pole direction
   (c) Satellite masses and radii
   (d) Ring dimensions and total ring mass
   (e) Satellite ephemeris
   (f) Saturn magnetic field

The choice of constants has been coordinated with Peter Doms of the Voyager Radio Science team.

The only additional changes anticipated prior to Voyager Saturn 1 encounter are the incorporation of revised DSN station locations (to be delivered by T. Moyer, 1 Aug. 80) consistent with the final DE111 planetary ephemeris (to be delivered by M. Standish, 1 July 80). Please contact me if you have any questions or suggestions for future revisions.

GWN:ac

Attachment

Distribution attached.

```
  PAGE 1.      ****  ACE COMMITTEE RECOMMENDED CONSTANTS  ISSUE- 15 MAY 80 **
SECTION 1.      ***** FUNDAMENTAL CONSTANTS *****
     SPEED OF LIGHT  C= 299792.458 KM/S
     GAUSS CONSTANT  K= 0.01720209895  AU**1.5/DAY  (EXACTLY)
SECTION 2.          ***** PLANETARY SYSTEM MASSES *****

     IT IS RECOMMENDED THAT PLANETARY AND SATELLITE MASSES BE READ
FROM THE EPHEMERIS FILES, IN ORDER THAT THERE BE NO ROUND-OFF PROBLEMS
IN CHECK-OUT OR DUPLICATION OF RUNS.
     THE SUBSEQUENT VALUES ARE TAKEN FROM JPL EPHEMERIS DE111
     METRIC VALUES FOR THE PLANETARY GM-S ARE CALCULATED AS FOLLOWS.
THE MASS OF THE SUN IS CALCULATED FROM
        GM(SUN)= (K/86400)**2 * AU**3
AND PLANETARY SYSTEM MASSES (INCLUDING THE MASS OF SATELLITES) ARE
COMPUTED IN METRIC UNITS FROM
        GM(PLANET) = GM(SUN) * (PLANET MASS/SUN MASS)
    *****CAVEAT *****
     HENCE IT IS SEEN THAT WHENEVER THE PLANETARY EPHEMERIS IS CHANGED
(USUALLY INVOLVING A CHANGE IN THE VALUE OF THE ASTRONOMICAL UNIT),
THEN ALL PLANETARY GM-S IN METRIC UNITS WILL ALSO BE ALTERED.  IT IS FOR
THIS REASON THAT WE STRONGLY RECOMMEND THAT PLANETARY GM-S BE OBTAINED
FROM THE EPHEMERIS FILES.
     THE DE111 PLANETARY SYSTEM MASSES ARE AS FOLLOWS
      GM1 = MERCURY
      GM2 = VENUS
      GM8 = EARTH + MOON
      GM4 = MARS
      GM5 = JUPITER
      GM6 = SATURN
      GM7 = URANUS
      GM8 = NEPTUNE
      GM9 = PLUTO
      GM10 = SUN
      GMM = MOON
      GM3 = EARTH
      THE PLANETARY MASSES FOR BODIES 4 THROUGH 9 INCLUDE THE
      MASSES OF THE NATURAL SATELLITES OF THAT PLANET
      THE QUANTITIES ACTUALLY USED IN ODP ARE GM VALUES IN KM**3/SEC**2

DENUM    111.     LENUM    55.

AU            149597870.652947873
EMRAT                  81.300587000
```

	GM IN AU**3/DAY**2	SUN/PLANET MASS RATIO	GM IN KM**3/SEC**2
GM1	.491254745145081176-010	6023600.000000	.220320804696054935+005
GM2	.724345620963276524-009	408523.500000	.324858765570929581+006
GM8	.899701220565351775-009	328900.530000	.403503271693468087+006
GM4	.954952894222405765-010	3098710.000000	.428282865827120481+005
GM5	.282534058144592626-006	1047.350575	.126712528804327414+009
GM6	.845943034083065932-007	3498.015760	.379393487675654884+008
GM7	.128876872313803489-007	22960.846502	.577994543472598828+007
GM8	.154749205628427619-007	19122.050229	.694028298903482395+007
GM9	.147956076186369922-011	200000037.790169	.663562074202963590+003
GMS	.295912208285591102-003	1.000000	.132712439916715653+012
GMM	.109318931171821627-010	27068706.683611	.490279943803399710+004
GM3	.888769327448169611-009	332946.017765	.398600472255434090+006

```
     SECTION 2 WILL BE REVISED BY MILES STANDISH BASED ON A FINAL
     EPHEMERIS FOR VOYAGER SATURN TO BE DELIVERED ON 1 JULY 80
```

PAGE 2

SECTION 3. ********** SATELLITE MASSES **********

--JUPITER SYSTEM---

	SATELLITE	METRIC	SIGMA	SAT/PLANET	SIGMA
1	IO	5934.	28.	468.40290D-7	2.2D-7
2	EUROPA	3196.	32.	252.27767D-7	2.5D-7
3	GANYMEDE	9885.	37.	780.27682D-7	2.9D-7
4	CALLISTO	7172.	24.	566.12497D-7	1.9D-7

(VALUES TAKEN FROM NULL PIONEER 10-11, ASTON J,VOLUME 81,1153-1161, DEC 76)

--SATURN SYSTEM---

	SATELLITE	METRIC	SIGMA	SAT/PLANET	SIGMA
1	MIMAS	2.5	.06	6.5911062D-8	1.6D-8
2	ENCELADUS	5.6	2.3	1.4764078D-7	6.1D-8
3	TETHYS	41.53	.83	1.0949145D-6	2.2D-8
4	DIONE	77.3	2.	2.0379700D-6	5.3D-8
5	RHEA	182.	30.	4.7983253D-6	7.9D-7
6	TITAN	8989.	100.	2.3698981D-4	2.6D-6
7	HYPERION	1.	---	2.6364425D-8	--
8	IAPETUS	149.	73.	3.9282993D-6	1.9D-6
9	PHOEBE	1.	---	2.6364425D-8	--
XX	RINGS	0.	38.	0.	1.D-6

VALUES FOR SATS 1-4,7 AND 8 DUNCOMBE,KLEPCZYNSKI AND SEIDELMAN FUNDAMENTALS OF COSMIC PHYSICS, VOL. 1, PP. 119-165 (1973).

SAT 5 MCLAUGHLIN AND TALBOT, MNRAS,VOL 179, 619-633(1977).

SAT 6 ANDERSON,J.D., ET AL, SCIENCE,VOL 207, 449-453,JAN 1980

HYPERION AND PHOEBE ARE ASSUMED TO HAVE LESS MASS THAN MIMAS BASED ON RELATIVE OPTICAL MAGNITUDES

RINGS G NULL, PRIVATE COMMUNICATION, 1 MAY 80(FROM PIONEER SATURN)

--URANUS SYSTEM---

	SATELLITE	METRIC	SIGMA	SAT/PLANET	SIGMA
1	MIRANDA	20.	---	.34470522D-5	---
2	ARIEL	300.	---	5.1705783D-5	---
3	UMBRIEL	100	---	2.7346362D-5	---
4	TITANIA	580.	400.	9.9964514D-5	6.9D-5
5	OBERON	100.	---	1.7235261D-5	---

(VALUES TAKEN FROM DUNHAM (MOTIONS OF SATELLITES OF URANUS(, PH.D. DISS. YALE UNIV.,1971. DUNHAM DETERMINED TITANIA MASS. OTHERS FROM FORMULA BY HARRIS.)

--NEPTUNE SYSTEM---

	SATELLITE	METRIC	SIGMA	SAT/PLANET	SIGMA
1	TRITON	21000.	11000.	3.0655556D-3	1.6D-3
2	NEREID	0.	---	--	

(SOURCE- IAU 1976)

****

* NOTE- MASS RATIOS (SATELLITE MASS/PLANET MASS) ARE ALSO GIVEN. *

* THE PLANET MASS IS DERIVED FROM PLANET-SATELLITE SYSTEM MASS LESS THE *

* MASSES (METRIC) OF THE SATELLITES. *

****

PAGE 3

SECTION 4. ********** RADII ********

-- PLANET GEOMETRIC EQUATORIAL RADII(SOURCE IAU 1976 CONSTANTS)

			FLATTENING
1	MERCURY	2439.	
2	VENUS	6052.	
3	EARTH	6378.14	
4	MARS	3397.2	
5	JUPITER	71398.	.065
6	SATURN	60330.	.096
7	URANUS	25400.	
8	NEPTUNE	24300.	
9	PLUTO	2500.	
10	SUN	696000.	
11	MOON	1736.	

****NOTE- THESE RADII ARE FOR OCCULTATIONS, ETC.

SATURN RADIUS VALUE 60330 KM SIGMA 30 KM AT 100 MILLIBARS PRESSURE FROM KLIORE,A. SUBMITTED TO JGR, 1 MAY 80(BASED ON PIONEER

SATURN FLATTENING .096 FROM PIONEER SATURN DYNAMIC FLATTENING COMPUTED FROM GRAVITYFIELD (ANDERSON AND NULL,PRIVATE COMMUN.,MAY 80)

--SATELLITE RADII (REFERENCES AT END OF SECTION)

JUPITER SYSTEM

	SATELLITE	RADIUS (KM)	SIGMA	REFERENCE
1	IO	1820.	10.	R1
2	EUROPA	1533.	27.	R2
3	GANYMEDE	2608.	32.	R2
4	CALLISTO	2445.	75.	R2
5	AMALTHEA	50.	--	R1
6	HIMALIA	80.	--	R1
7	ELARA	30.	--	R1
8	PASIPHAE	8.	--	R1
9	SINOPE	10.	--	R1
10	LYSITHEA	9.	--	R1
11	CARME	11.	--	R1
12	ANANKE	8.	--	R1
13	LEDA	2.	--	R3
14	----	--.	--	--

SATURN SYSTEM

	SATELLITE	RADIUS (KM)	SIGMA	REFERENCE
1	MIMAS	200.	--	R1
2	ENCELADUS	250.		R1
3	TETHYS	521.	57.	R5
4	DIONE	412.	74.	R5
5	RHEA	788.	43.	R5
6	TITAN	2860.	35.	R6
7	HYPERION	112.	--	R7
8	IAPETUS	797.	69.	R5
9	PHOEBE	100.	--	R1
10	JANUS	110.	--	R1

-----REFERENCES FOR SATELLITE RADII

R1. MORRISON,D., AND D. P. CRUIKSHANK 1974, SPACE SCIENCE REVIEWS VOL 15, 641-652.

R2. AKSNES, K. AND F. A. FRANKLIN 1976, ASTRON. J. VOL. 81, 461-481.

R3. KOWAL, C. T.,K. AKSNES, B. G. MARSDEN AND E. ROEMER 1975, ASTRON. J. VOL. 80, 460-464.

R4. VEVERKA, J., J. ELLIOT, AND J. GOGUEN 1975 SKY & TEL VOL 50, 356.

R5. ELLIOT,J., VERVERKA,J., AND GOGUEN,J., ICARUS,VOL26,387(1975).

R6. SMITH, P.H., SUBMITTED TO JGR,MAY 1980,(PIONEER SATURN IMAGING)

R7. CRUIKSHANK,D., ICARUS, VOL 37, 307-309(1979)

PAGE 4
SECTION 5. ****** OBLATENESS MODELS ********

--EARTH--
RADIUS = 6378.140 KM
FLATTENING F= 1/298.257
J2= 1082.63D-6
J3= -2.54D-6
J4= -1.61D-6
J5= -0.23D-6
J6= +0.54D-6
(SOURCE- IUGG 1976. ADDITIONAL HARMONICS FROM GEM MODEL)

--MOON--
RADIUS = 1738.0 KM
J2= 202.7D-6
C22= 22.3D-6
C21=S21=S22= 0.0
OBLIQUITY = 6.66534 DEGREES (INCLINATION ORBIT TO EQUATOR)
AMPLITUDE OF FREE LIBRATION = 0.0
(SOURCE- IAU)

--JUPITER--
RADIUS= 71398 KM
J2= 14733.D-6 SIGMA= 4.D-6
J4= -587.D-6 SIGMA= 7.D-6
PERIOD OF ROTATION SYS III (65) 9 H 55 M 29.711 S
RA POLE (1950.0 EQUATOR) 267.998 DEG SIGMA .016
DEC POLE (1950.0 EQUATOR) 64.504 DEG SIGMA .004
EPOCH- 1974 DECEMBER 3
(SOURCE NULL,G, ASTRON 4,,VOL 81, 1153-1161, DEC 1976)
****THESE SHOULD BE MERGED INTO COORDINATE TRANSFORMATIONS SOMETIME

--SATURN--

DYNAMIC RADIUS= 60000. KM
THE DYNAMIC RADIUS IS USED FOR OBLATENESS GRAVITY CALCULATIONS
J2 VALUE= 16465.D-6 SIGMA = 15.D-6
J4 VALUE= -970.D-6 SIGMA= 25.D-6
J6 VALUE= 80.D-6 FROM INTERIOR MODELS
J8 VALUE = -10.D-6 FROM INTERIOR MODEL
PLANET POLE WITH RESPECT TO MEAN EARTH EQUATOR AND EQUINOX OF 1950.0
RA=~~38.554 DEG~~ SIGMA = .18 DEG ~~DEC=83.316 DEG~~ SIGMA=.02 DEG
SATURN ~~SIDERIAL~~ SPIN ~~PERIOD~~ RATE VALUE = ~~10 H 39.9 M~~ SIGMA = .3 M
RING PLANE POLE IS ASSUMED TO BE SAME AS PLANET POLE
NOTE HARMONICS FROM NULL,G (PRIVATE COMMUNICATION, 1 MAY 80)
FROM PIONEER SATURN RESULTS
POLE FROM LIESKE AND TARAJI , ELEM361, EM 314.8-207, 25 APRIL 80
SPIN PERIOD OF SATURN FROM VOYAGER PLANETARY RADIO ASTRONOMY TEAM
(PRIVATE COMMUNICATION)

SATURN SPIN RATE =
$= 810.7600000000 \frac{DEG}{DAY}$

$\alpha = 38^\circ.554417326967 5803$

$\delta = 83^\circ.315867799 1923893$

A58

PAGE 5

SECTION 6. ***** COORDINATE TRANSFORMATIONS *****

AT THIS STAGE WE PROBABLY OUGHT TO CONTINUE USING THE EXPRESSIONS DERIVED BY STURMS IN JPL TR 32-1508 WITH THE FOLLOWING CORRECTION-
FOR JUPITER NODE READ 99.94335 +0.16728 T +0.00055 T**2 *******
THE ORIGINAL DOCUMENT HAS A RATE OF -0.16726 T, APPARENTLY A TYPO.
FOR FUTURE REVISION WE MIGHT DERIVE OUR OWN EXPRESSIONS FROM DE96 OR CONSIDER THE USE OF SEIDELMANN ET AL-S (ASTRON J. VOL. 79, 57-60, 1974) MEAN ELEMENTS WITH CLEMENCE (ASTRON. J. VOL. 52, 89-93, 1946) 000
****CAUTION- LOOK CAREFULLY AT SEIDELMANN-S TERMS FOR JUPITER. AT LEAST IN THE NODE THEY DIFFER FROM OURS BY ABOUT 0.2 DEGREES FOR SOME REASON.

SECTION 7. ****** EPHEMERIDES ******

PLANETARY EPHEMERIS DE111 TO BE DELIVERED BY STANDISH ET AL.
1 JULY 80
SATURN SATELLITES THEORY ELEMENT ELEM361 DELIVERED BY LIESKE AND TARAJI APRIL 25, 1980, EM314.8-207 J EKELUND TO DELIVER CHEBYCHEV FILES FOR USE BY VOYAGER NAVIGATION TEAM

SECTION 8. ***** TIME TRANSFORMATIONS *****

EPHEMERIS TIME OFFSET
DT77 = EPHEMERIS TIME MINUS INTERNATIONAL ATOMIC TIME = 32.184 SEC

NOTE- BECAUSE OF THE 1977 REVISION OF TAI SECOND, WE MAY WISH TO ALSO DEVELOP A FORMULATION FOR THE OLD TAI. IN ADDITION PLEASE NOTE THAT DT58 IS NO LONGER 1958, BUT 1977.

SECTION 9. JUPITER MAGNETIC FIELD
BASED UPON MODEL D4 (SMITH ET AL, 1975, SCIENCE VOL 188, PP 451-455)
USES SYS III (65) WITH THE FOLLOWING-

DIPOLE OFFSET VECTOR

LATITUDE	5.12 DEG
LONGITUDE	155.6 DEG
MAGNITUDE (RJ)	0.1010

MAGNETIC MOMENT VECTOR

TILT COLATITUDE	10.77 DEG
LONGITUDE	200.8 DEG
MAGNITUDE (GAUSS-RJ**3)	4.225

SECTION 10. STATION LOCATIONS

STATION	LONGITUDE (E)	Z (KM)	RS (KM)	LOCATION
11	243.1506103	3673.764	5206.340046	GOLDSTONE, PIONEER
12	243.1945377	3665.628	5212.051731	GOLDSTONE, ECHO
13	243.2051375	3660.956	5215.484580	GOLDSTONE, VENUS
14	243.1104930	3677.052	5203.996994	GOLDSTONE, 210
41	136.8875110	-3302.189	5450.203099	WOOMERA
42	148.9812947	-3674.588	5205.351556	CANBERRA
43	148.9812975	-3674.755	5205.251036	BELLIMA
51	27.6854493	-2768.744	5742.939395	JOHANNESBURG
61	355.7509964	4114.878	4862.608228	ROBLEDO
62	355.6321890	4116.901	4860.818049	CEBREROS
63	355.7520093	4115.104	4862.451240	ROBLEDO 210

SECTION 10 TO BE REVISED BY T MOYER BASED ON FINAL DELIVERY OF
STATION LOCATION SET SCHEDULED ON 1 AUGUST 80
STATION LOCATIONS ARE TO BE CONSISTENT WITH EPHEMERIS DE 111

SECTION 11 SATURN MAGNETIC FIELD
FROM PIONEER SATURN RESULTS PUBLISHED BY
SMITH, E J, ET AL, SCIENCE,VOL 207, 407-710,JAN 1980 AND
ACUNA,M - AND NESS,N F, SCIENCE,VOL 207, 444-446,JAN 1980
DIPOLE OFFSET VECTOR
MAGNITUDE=.04 SATURN RADII
LONGITUDE= NOT DETERMINED
LATITUDE=90 DEG

MAGNETIC MOMENT
TILT COLATIUDE=0. DEG
LONGITUDE= NOT DETERMINED
MAGNITUDE(GAUSS-RS**3) VALUE=.2 SIGMA=.01

SECTION 12. PLANETARY RING DIMENSIONS

SATURN SYSTEM

OUTER EDGE-D RING	72900 KM
GUERIN DIVISION	72900 KM TO 77040 KM
C RING	77040 KM TO 90000. KM
DOLLFUS DIVISION	90000. KM TO 91920. KM
B RING	91920. KM TO 117180. KM
B RING GAP	99600. KM
CASSINI DIVISION	117180. KM TO 121860. KM
GAP WITHIN CASSINI DIVISION	120000. KM
ENCKE GAP	133800. KM
A RING	121860. KM TO 137580. KM
PIONEER DIVISION	137580. KM TO 140160. KM
F RING	140160. KM TO 142260. KM

THE NAME DIVISION IS USED ONLY FOR A MAJOR SEPARATION BETWEEN
DISTICTLY DIFFERENT RINGS
SOURCE FOR RING DIMENSIONS (T. GEHRELS,PRIVATE COMMUNICATION MAY 80
FROM PIONEER SATURN IMAGING), BASED ON SATURN RADIUS = 60000 km.

NOTE RING POLE IS TAKEN TO BE SAME AS PLANET POLE BUT MUST
BE INPUT SEPARATELY IN ODP

APPENDIX C

Derivation of the hour angle at epoch 1950, Jan 1.0, 0^H E.T. for the Goddard-defined prime meridian of Saturn, System III (1980).

In order to accommodate users requesting sub-spacecraft longitudes in the Goddard (PRA) System III (1980) at Saturn, a longitude correction to be applied to DPTRAJ System III (1950) coordinates is derived in this Appendix. This correction is equivalent to the hour angle of the prime meridian (P/M) of 1980 at Epoch 1950, $V_{o_{80/50}}$.

The Goddard definition of the P/M places it coincident with the Saturnian Vernal Equinox (Ascending node of Saturn's Orbit on its equator) on Jan 1.0 (0^h U.T.), 1980.

The DPTRAJ formulation postulates the Epoch of P/M-Vernal Equinox coincidence at Jan. 1.0 (0^h E.T.), 1950. Note that the difference between the two time types used above, i.e. the uniformly increasing "Ephemeris Time" (E.T.) and the Earth Rotation-Related "Universal Time" (U.T.) is:

DUT = E.T. - U.T. = 51.2 Sec. valid throughout the year 1980.

In 1981 it probably will increase to:

DUT = 52.2 Sec., if as expected, another leap-second is decreed by the time service.

The Hour Angle of the P/M is the angle past Vernal Equinox traversed by the P/M at the time of any epoch. At planets other than Earth it is best expressed in degrees (not hours, minutes and seconds of time, because one planetary revolution is obviously not equivalent to the terrestial 24 hours of Siderial time). The usage of "Hour" in "Hour Angle" is thus only historically associated with its earthly usage in the past.

The Value of $V_{o_{80/50}}$, the desired 1950 Hour Angle, is composed of two parts:

a) The unwinding of Saturn's rotation during the interval between the two Epochs (1980 and 1950), ΔV_{Rev}, resulting in a new positive hour angle, ΔV_{ha}.

b) The motion of the Saturnian Vernal Equinox between the two Epochs, ΔV_{EQNX}. Thus (Fig.1):

$$V_{o_{80/50}} = \Delta V_{HA} + \Delta V_{EQNX}$$

The first term is easily computed, as follows:

$$\Delta T = T_{80_{UT}} - T_{50_{ET}} = JD_{80} - JD_{50} + DUT_{80}$$

$$= 2444239.5 - 2433282.5 + 51.2/86400$$

$$= 10957.0005926 \quad \text{(DAYS)}$$

$$\Delta V_{REV} = - \Delta t * \dot{V} = 10957.0005926 * 810^\circ.7600$$

$$= - 8{,}883{,}497^\circ.800045637 =$$

$$= - 24676^{REV}\ 137^\circ.80045637$$

Thus the Hour Angle of the P/M of 1980 at Epoch 1950 WRT to Vernal Equinox of 1980 is (POSITIVE EASTWARD):

$$\Delta V_{HA} = 360. - MOD_{360}\left(\Delta V_{REV}\right) = 360^\circ.0 - 137^\circ.80045637$$

$$= 222^\circ.20440727$$

The determination of the second contributor, the Nodal Motion, ΔV_{EQNX}, a small quantity, is rather computationally involved.

The secular regression of the node of Saturn's mean orbit (SMO) on the ecliptic of 1950.0 (EMO50) causes a corresponding advance of the Saturnian Vernal Equinox as can be seen from Figures 2 and 4.

To obtain the amount of this advance, provided the <u>Saturn mean equator</u> (SME) <u>Plane is fixed</u> WRT the Earth Mean Equator of 1950.0 (EME50), the following computational steps are required:

1. Inclination of Saturn Equator (SME) on Ecliptic (EMO50), I_o (Fig.3):

$$\cos I_o = \cos \bar{\epsilon}_{50} . \sin \delta_{50} - \sin \bar{\epsilon}_{50} . \cos \delta_{50} . \sin \alpha_{50}$$

Where:

$\bar{\epsilon} = 23^\circ.4457888616$ — Mean obliquity (the inclination) of Ecliptic on Earth's Equator (EMO50 on EME50, from Ref.(1), p.7, Table 3.

$\alpha_{50} = 38^\circ.41314$, $\delta_{50} = 83^\circ.31049$ — Right ascension and declination (WRT EME50) of Saturns No. Pole. From Ref (1), P.8, Table 6.

$\cos I_0 = 0.88239328$

$I_0 = 28^\circ.06757515$

2. Ecliptic Longitude of Ascending Node of Saturn Equator (SME) on Ecliptic (EM050), N_o:

$$\sin N_o = \frac{\sin N_E}{\sin I_o} \sin \left(\delta_{50} + 90^\circ\right) = 0.1939905418$$

$N_o = 180 - 11.1857589 = 168.8142401$

3. Inclination and Longitude of Ascending Node of Saturn mean orbit of date on ecliptic of 1950.0 at the two epochs:

T_{80} = Jan. 1, 0^h U.T., 1980 (Goddard Prime Meridian)

and

T_{50} = Jan. 1, 0^h E.T., 1950 (JPL Prime Meridian)

$$\Delta T = T_{80_{UT}} - T_{50_{ET}} = \left(JD_{80} - JD_{50} + DUT_{80}\right)/36525.0 =$$

$$= \left(2444239.5 - 2433282.5 + 51.2 \Big/ 86400.\right) \Big/ 36525.0 = \Big)$$

$= .2999863266$ (In Julian Centuries)

$\Delta T^2 = .0899917964$

From Definition of Saturn Mean Orbit Ref (1), p.8, Table 6:

$i_{80} = 2^\circ.49036 + .00186\ \Delta T - .00003\ \Delta T^2$

$= 2^\circ.490915275$

$i_{50} = 2^\circ.490360000$

$\Omega_{80} = 113^\circ.22015 - .25973\ \Delta T + .00002\ \Delta T^2$

$= 113^\circ.1422364$

$\Omega_{50} = 113^\circ.2201500$

4. Solve Triangle $\left[\Omega_{50} N_0 \mho_{50}\right]$ for the $\widehat{N_0 \mho_{50}}$ arc length, λ_{50} (Fig.4).

Define: $\tau = 180^\circ - I_0 = 151^\circ.93242485$

$\chi_{50} = N_0 - \Omega_{50} = 55^\circ.5940900$

$$\tan \lambda_{50} = \sin \chi_{50} \Big/ \left(\sin \tau / \tan i_{50} + \cos\tau \cdot \cos\chi_{50}\right) = .0799496909$$

$\lambda_{50} = 4^\circ.571057079$

5. Solve Triangle $\left[\Omega_{80} N_0 \mho_{80}\right]$ for the $\widehat{N_0 \mho_{80}}$ arc length, λ_{80} (Fig.4):

Define: $\chi_{80} = N_0 - \Omega_{80} = 55^\circ.6720037$

$$\tan \lambda_{80} = \sin \chi_{80} \Big/ \left(\sin \tau / \tan i_{80} + \cos \tau \cdot \cos \chi_{80}\right) = .0800351207$$

$\lambda_{80} = 4^\circ.575920726$

6. Secular advance of Saturnian vernal equinox on Saturn's equator plane:.

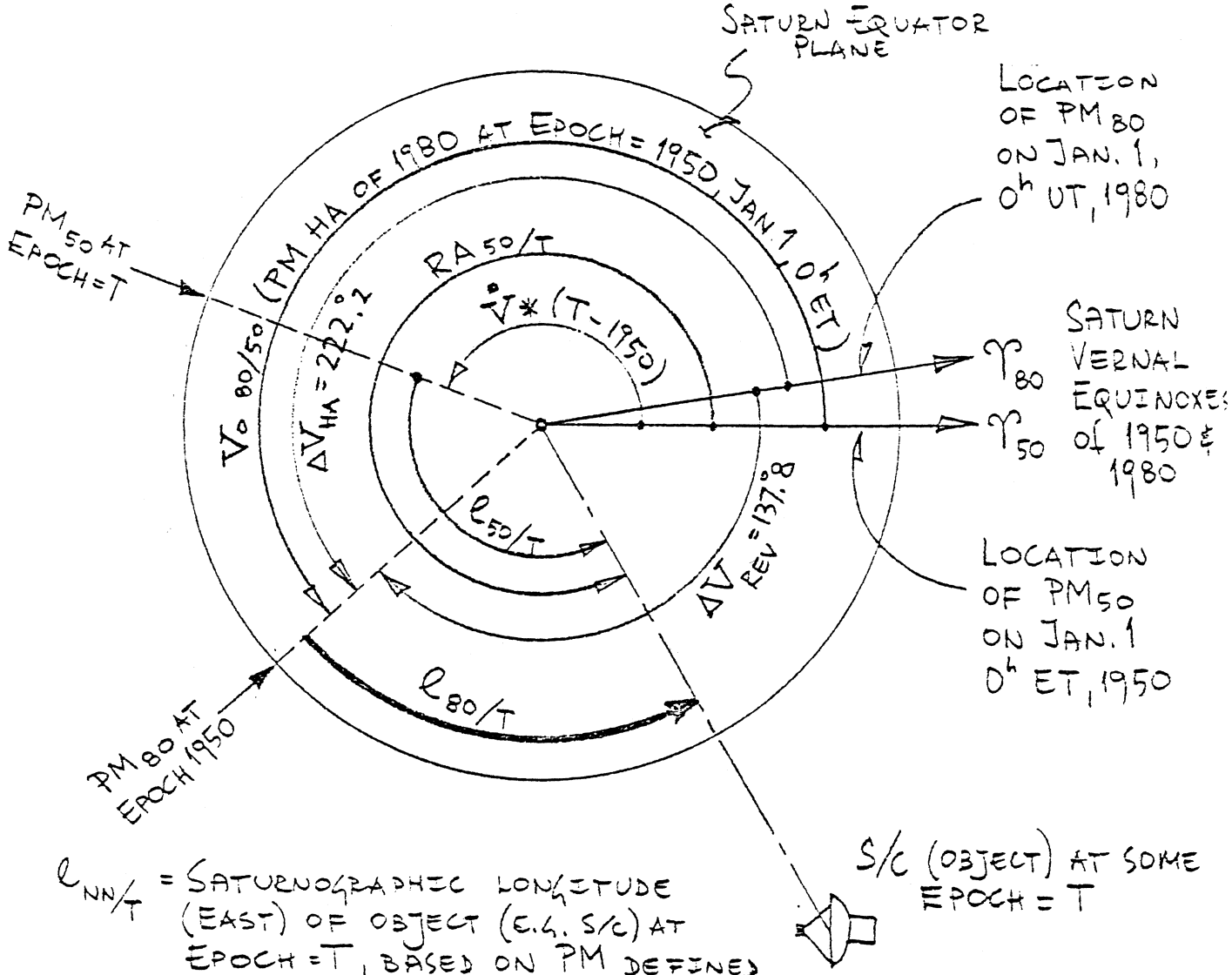
$$\Delta V_{EQNX} = \lambda_{80} - \lambda_{50} = 0^\circ.004863647$$

Thus the desired value of the Goddard (1980) prime meridian hour angle on Jan.1 0^h E.T., 1950 is:

$$V_{0_{80/50}} = \Delta V_{HA} + \Delta V_{EQNX} = 222^\circ.19954362 + 0.00486365 =$$

$$= 222.20440727 \quad \text{(Degr., East)}$$

Figure 1 :



$\ell_{NN/T}$ = SATURNOGRAPHIC LONGITUDE (EAST) OF OBJECT (E.G. S/C) AT EPOCH = T, BASED ON PM DEFINED AT EPOCH NN (E.G. 50 OR 80).

$RA_{50/T}$ = RIGHT ASCENSION OF SAME OBJECT WRT Υ_{50}.

FOR T = 1950, WHEN $\dot{V}_*(1950-1950)=0$ & $\ell_{50/50} = RA_{50/50}$:

$$\ell_{80/50} = \ell_{50/50} - V_{0\ 80/50}$$

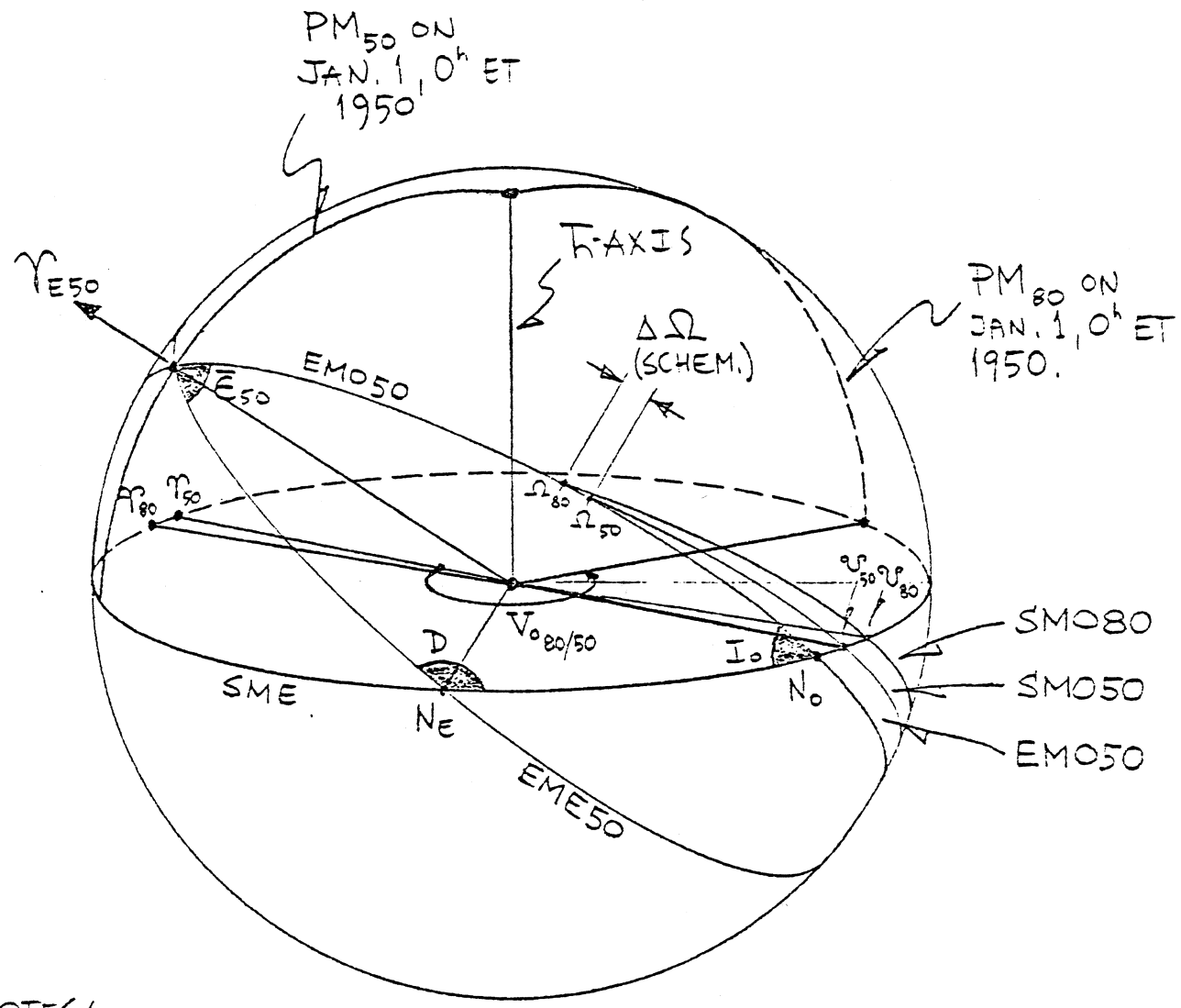
OR GENERALLY:

$$\boxed{\ell_{80/T} = \ell_{50/T} - V_{0\ 80/50}}$$

CONVERSION FROM PM_{50} TO PM_{80} LONGITUDE.

FIG. 1 : PRIME MERIDIAN (PM), LONGITUDE (ℓ) AND HOUR ANGLE (HA) ARITHMETIC AT SATURN

Figure 2:

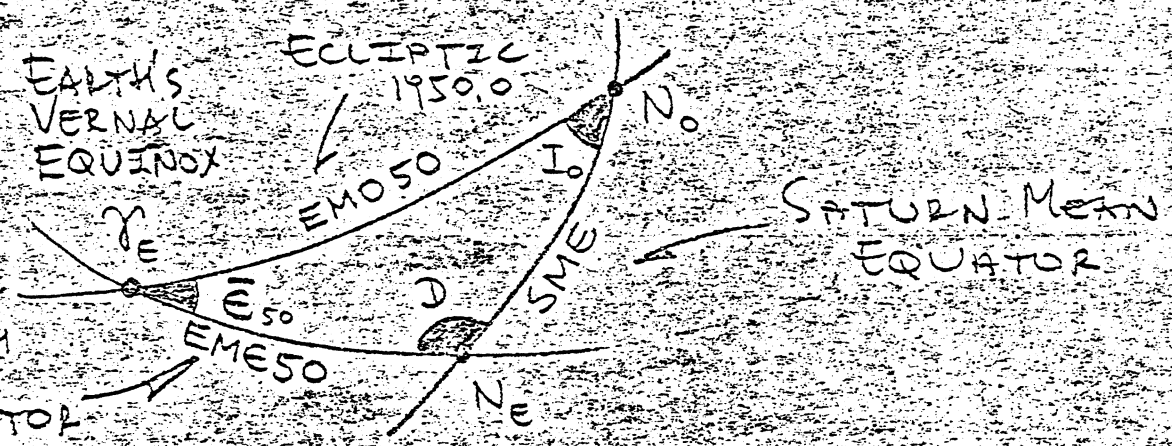


NOTES:

EME50 = EARTH MEAN EQUATOR of 1950.0
EMO50 = EARTH MEAN ORBIT (ECLIPTIC) OF 1950.0
SME = SATURN MEAN EQUATOR (FIXED)
SMO50 = SATURN MEAN ORBIT of 1950, JAN. 1, 0h ET
SMO80 = SATURN MEAN ORBIT of 1980, JAN. 1, 0h UT
PM_{80} = SATURN PRIME MERIDIAN of 1980, JAN. 1, 0h UT DEF.
PM_{50} = SATURN PRIME MERIDIAN of 1950, JAN. 1, 0h ET (DPTRAJ DEFINITION)

FIG. 2: REGRESSION OF SATURN ORBIT UPON ECLIPTIC PLANE (EMO50)

Figure 3:



$$\widehat{\gamma_E N_E} = \alpha_{50} + 90^\circ = N_E$$

$$D = \delta_{50} + 90^\circ$$

$$\widehat{\gamma_E N_0} = N_0$$

FIG. 3 - DEFINITION OF SATURN EQUATOR ON EARTH MEAN EQUATOR AND ECLIPTIC of 1950.0

Figure 4:

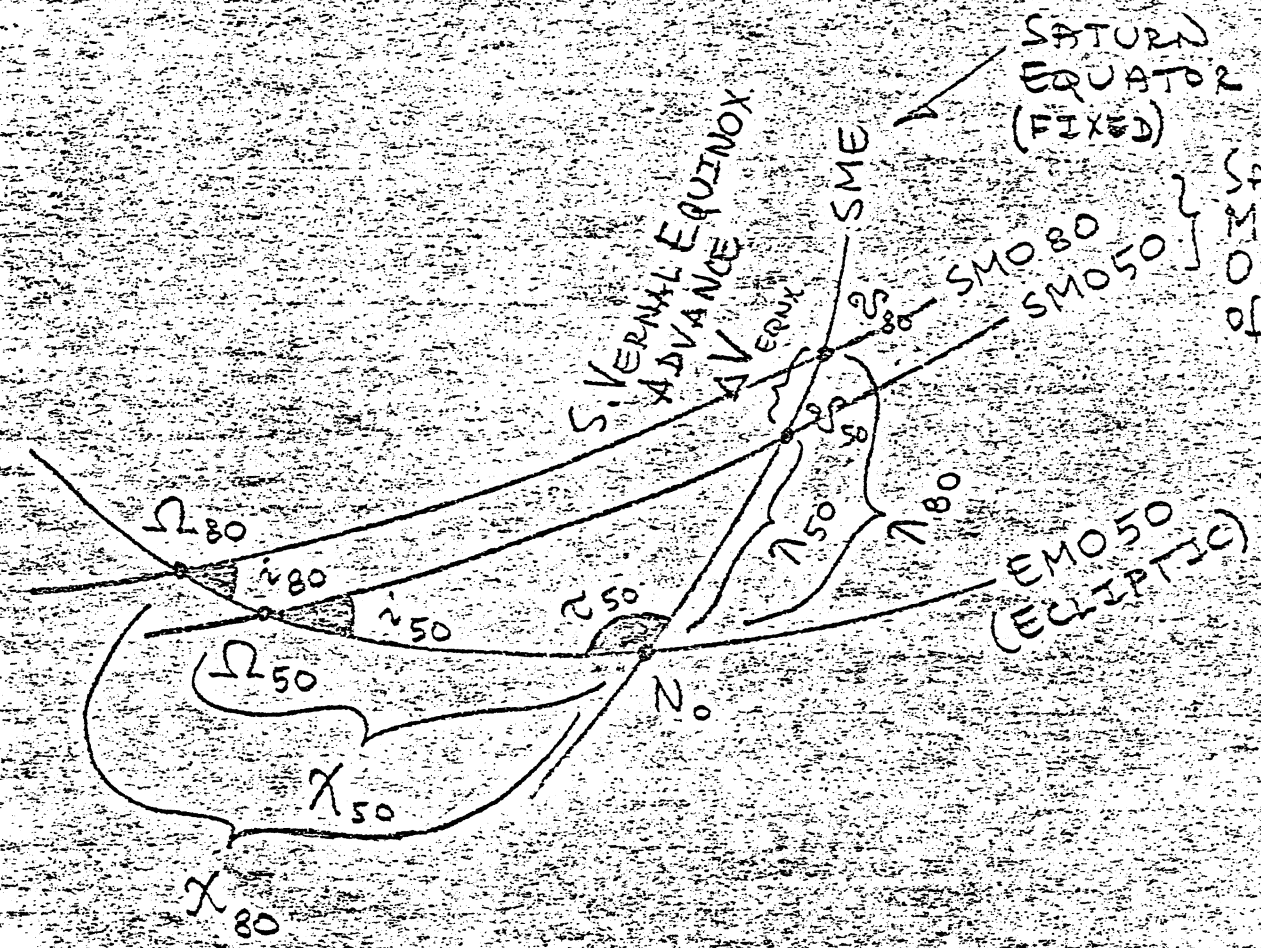


FIG. 4. ADVANCE OF SATURN VERNAL EQUINOX

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INTEROFFICE MEMORANDUM

CALIFORNIA INSTITUTE OF TECHNOLOGY

TO CRS team DATE 5/21/79

FROM Tom Garrard EXTENSION 2635 MAIL CODE 220-47

SUBJECT TET Command

At 02:29:29 SCET of day 136 the TET command state was changed to allow double coincidence W1·W2 to analyze.

Distribution:

GSFC
N Lal
F B McDonald
A Schardt
T Conlon
H Domchick

CIT
A Cumming
N Gehrels
R Vogt
EC Stone
J Trainor
J Poulis

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

14 January 1981

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

By now you should have received Voyager 1 Saturn encounter fixed instrument type SEDR's up to the beginning of sequence A572. I have enclosed with this letter two documents that may help you to interpret the latest set of SEDR's. The first document is Andre Sergeyevsky's memorandum to Charles Stembridge. The memorandum contains the adoption of a Saturn longitude system III and a listing of updated astronomical constants used by the Voyager Navigation Team. The second document is the newly revised Software Interface Specification for the Fixed Instrument SEDR (Rev. C, dated 21 Oct 1980) which defines the content of the SEDR. The most significant change has been the addition of a telemetry use code, word 104, to the SEDR.

If you have any questions concerning these two documents, the SEDR's, or the scheduling of future SEDR's, please call Wayne Sible at FTS 792-7959 or (213) 354-7959.

Sincerely,

Neil Toy

NNT:pp
Encl.

cc: A. Sacks
W. Sible
C. Stembridge
H. Woo
T. Garrard
H. Domchick

Telephone (213) 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

Hal

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

10/23/80
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 10/23/80
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

Bit	0	1 7	8 31
	SIGN	CHAR	FRACTION

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 (ABC) 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

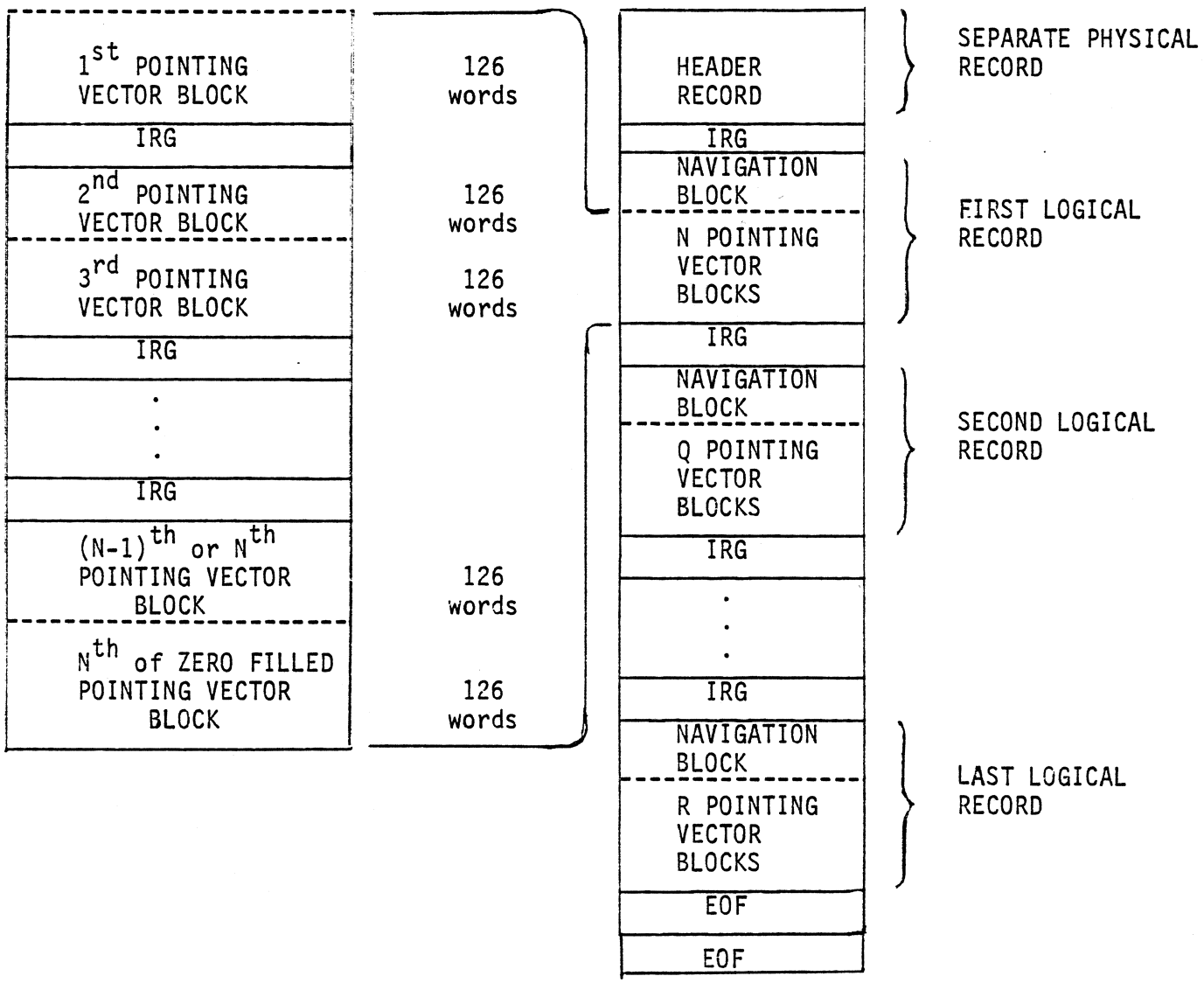
ATTACHMENT A

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.

Navigation	.	.	.	.
Pointing Vector	. . . .	. . . . .	. . .	.
Time ⟶	first logical record	second logical record	third logical record	fourth logical record

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 of hour	I
5	SCE GMT Second of Navigation Data Block	second of 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

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

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		

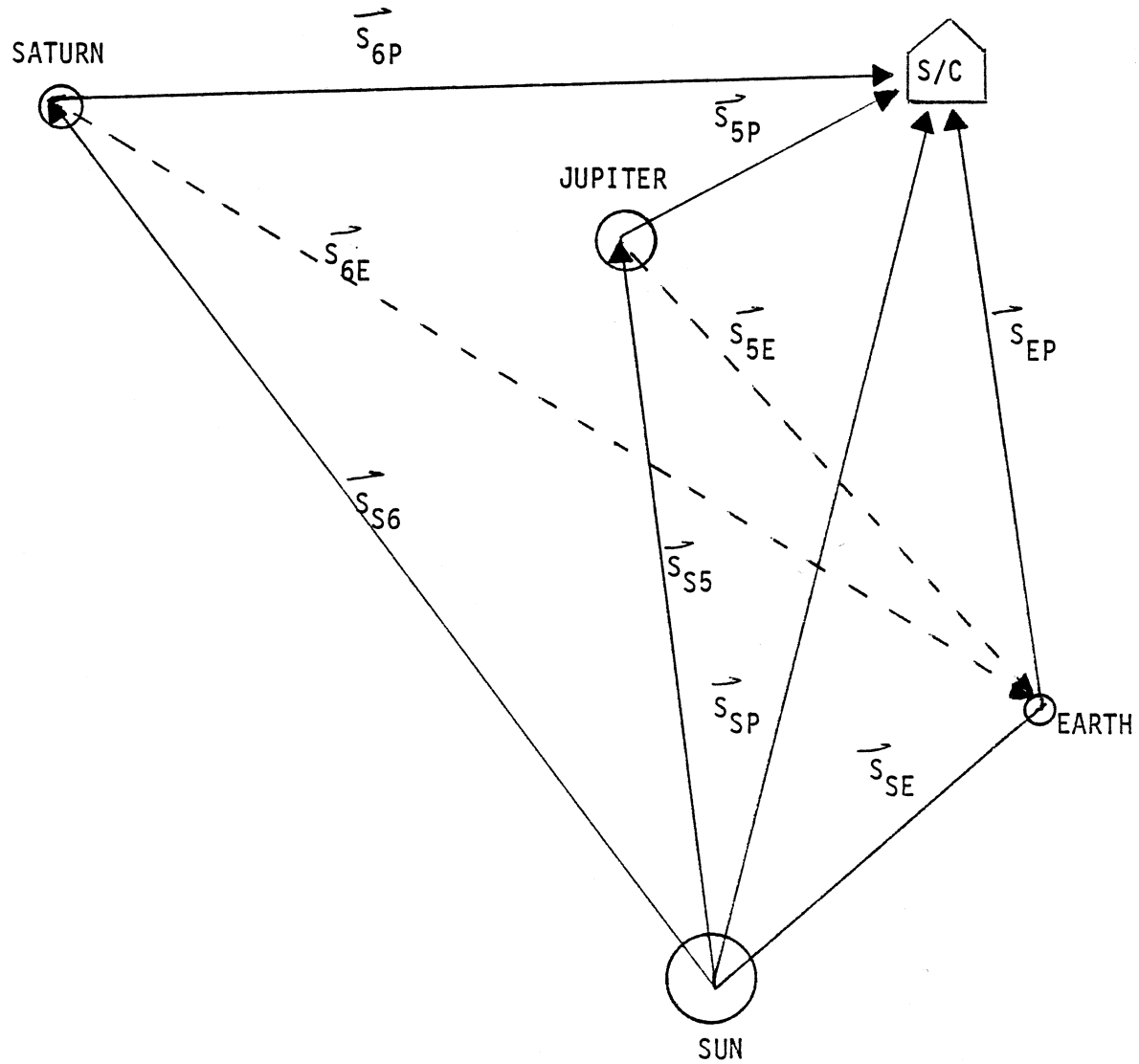


Figure C-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Launch SEDR State Vectors

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

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 of hour	I
5	SCE GMT Second of Navigation Data Block	second of 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		

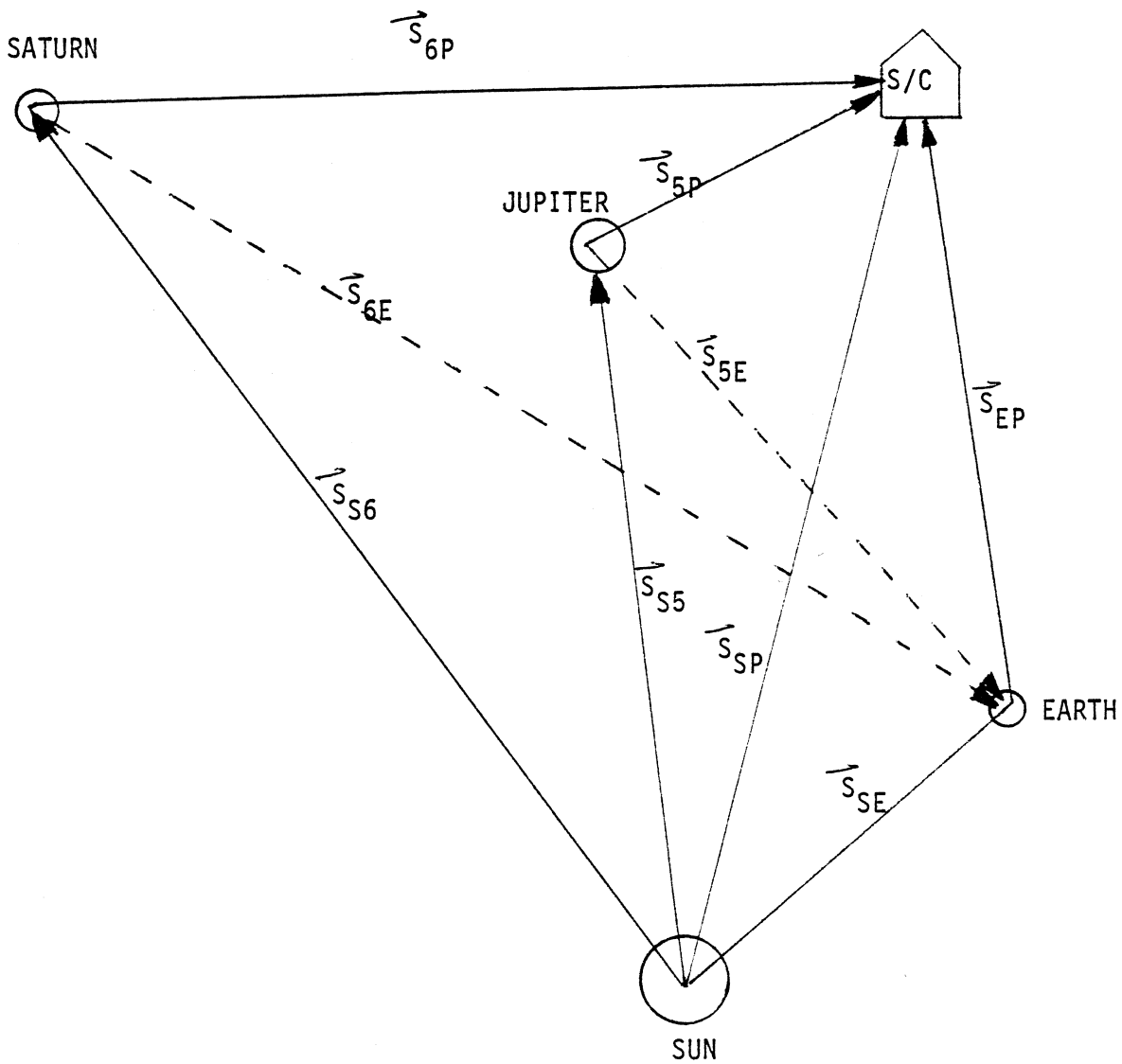


Figure D-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Cruise SEDR State Vectors

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 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, 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		

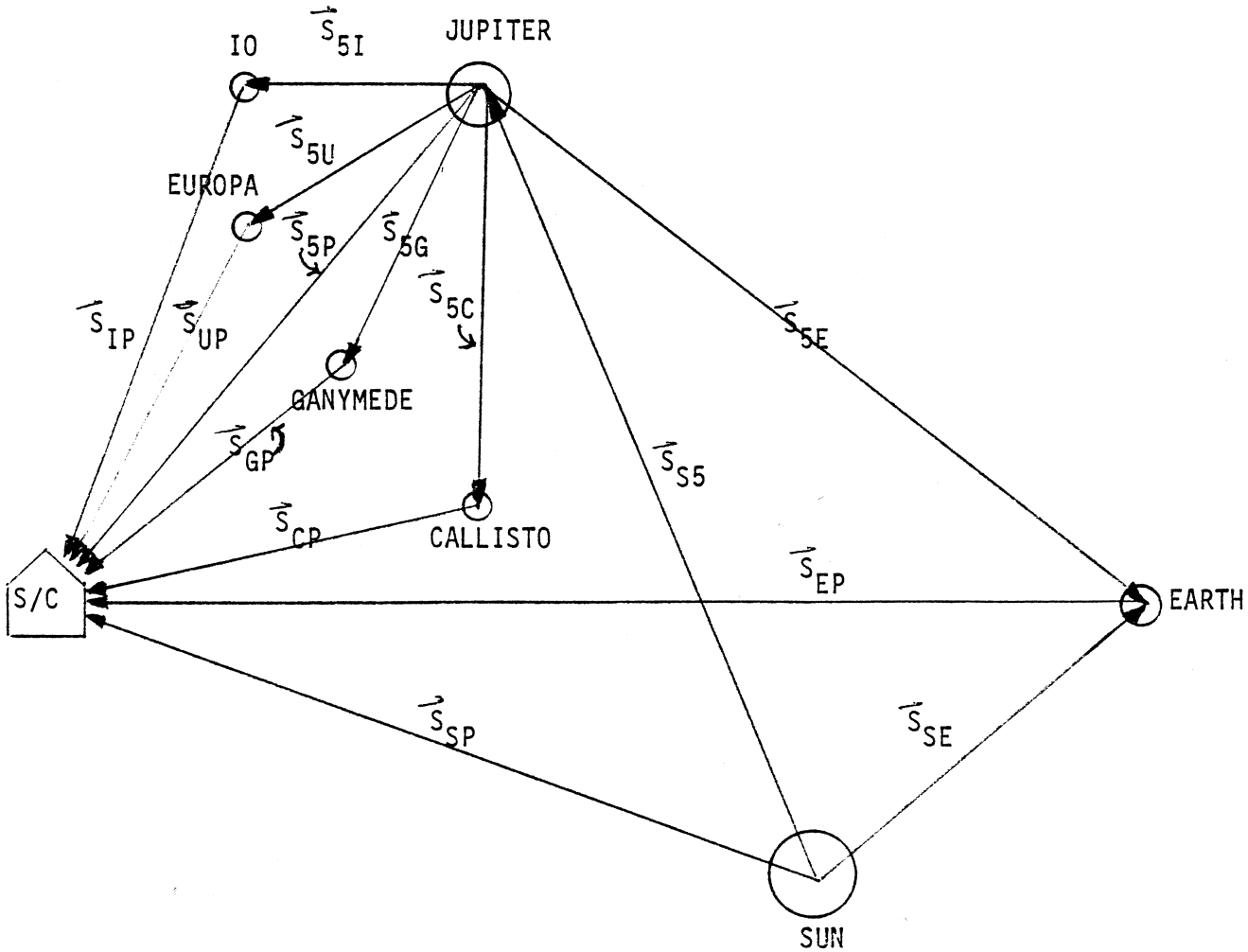


Figure E-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Jupiter Encounter State Vectors

Nomenclature $\longrightarrow \vec{S}$ 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 of 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 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		

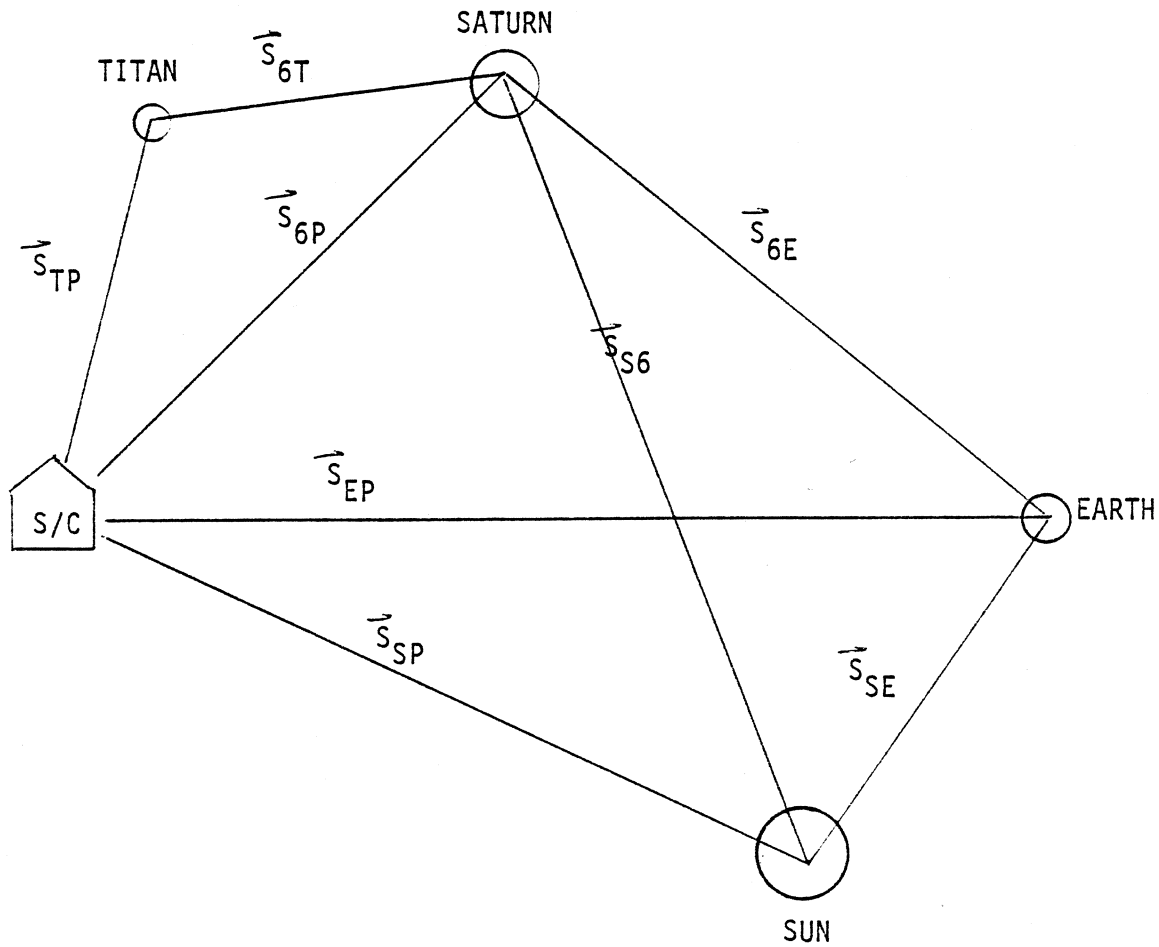


Figure F-1 Earth Mean Ecliptic and Equinox of 1950.0 (ECL50) Saturn Encounter State Vectors

Nomenclature $\longrightarrow \vec{S}$ 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

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

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

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

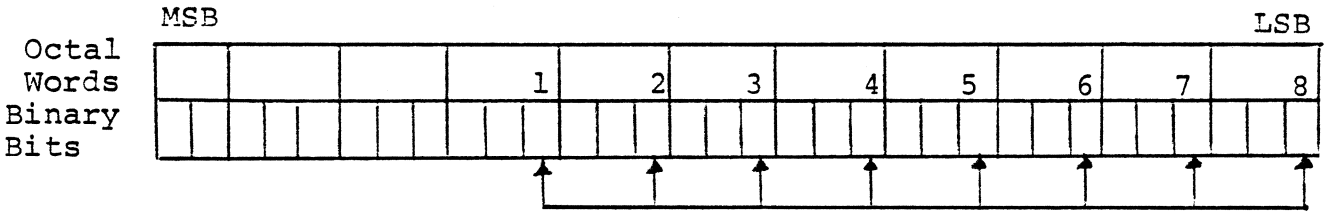
*S/C clock and cone angles are not to be confused with celestial clock and cone angles. The S/C clock/cone system uses the HGA boresight and the Canopus Tracker optic axis as references while the celestial clock/cone system uses the Sun and Canopus.

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. <u>Rotate ECL50 Unit Vector to EME50 Unit Vector</u>

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.

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

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.

$$\vec{U}_{EME50} = T_{\substack{ECL50 \\ \downarrow \\ EME50}} * \vec{U}_{ECL50}$$

Where $\vec{U}_{EME50}$ and $\vec{U}_{ECL50}$ are the EME50 and ECL50 unit vectors, respectively, and $T_{\substack{ECL50 \\ \downarrow \\ EME50}}$ is the transformation matrix.

Step 2. <u>Compute the Right Ascension and Declination Angles</u>

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

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

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

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.

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MAY 1 8 1975
M-24

JET PROPULSION LABORATORY

INTEROFFICE MEMO
292-75-1112

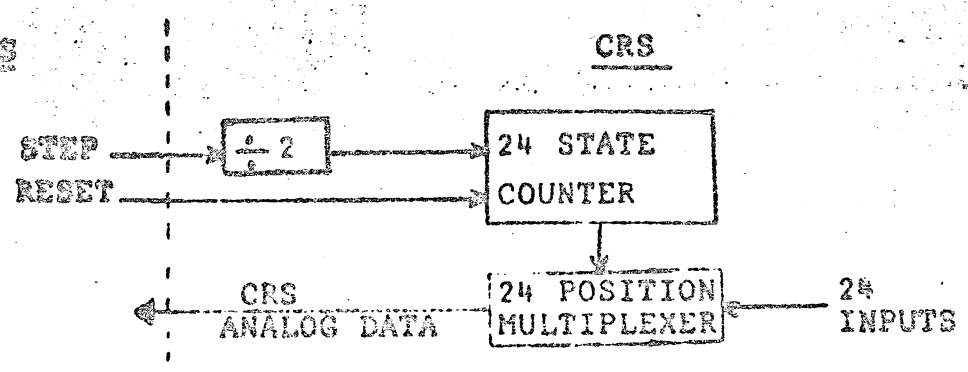
May 5, 1975

TO: R. F. Draper

FROM: D. B. Gauthier

SUBJECT: CRS Analog Multiplexer Implementation

It has been agreed that the CRS analog multiplexer will be implemented as follows:



STEP - 1 per minor frame (every 12s at 40 bps)
(every 48s at 10 bps)

RESET - 1 per 4 major frames (every 48 min at 40 bps)
(every 192 min at 10 bps)

CRS ANALOG DATA - When on the 200 deck, all 24 are sampled every 4 major frames. (There is presently no requirement for read out on the 100 deck, although the capability does exist. All 24 would be read out in 48 minor frames.)

Stepping the multiplexer once with every two STEP pulses, and sampling every 10th minor frame in the 201 slot, the order in which the multiplexer positions are read out will be: 1, 6, 11, 16, 21, 2, 7, 12, 17, 22, 3, 8, 13, 18, 23, 4, 9, 14, 19, 24, 5, 10, 15, 20. (On the 100 deck the order read out would be: 1, 1, 2, 2, 3, 3, 4, 4,... 23, 23, 24, 24.)

Analog data will always be synched with the S/C modulo 60 counter after the CRS receives its first reset pulse. This would result in a maximum delay of 48 min (at 40 bps) after turn-on before synch is achieved. Switching the analog line between the 100 and 200 deck would not change the synchronization between the mux position and the modulo 60 counter, it would only effect a change in the sampling rate.

There is no requirement for reading this analog channel during the 1200 bps engineering telemetry rate.

In the Engineering Telemetry Format document, CRS MUX will be assigned to slot 201 during CRU and ENC. It will not be assigned to any slot during LAU and MAN.

Concurrence:

D. Johnson J. Otte

BSG:mr

Distribution:
W. Fawcett
W. Hodges
J. Howe
D. Johnson
C. King
J. Otte (3)
G. Reisdorf
J. Tupman
MJS77 SDG

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MEMORANDUM

TO: Data Recipient

FROM: MJS Project Library

The enclosed Shipping Request is intended to serve as a packing slip to inform you as to what you are receiving and as an acknowledgment of receipt to let us know you actually received the shipment.

Please check the contents of the package against the Shipping Request and note any discrepancies. Fill in the boxes in the package receipt section marked "Received By" and "Date Received". Follow the instructions on the form for folding and stapling and return it to JPL in the mail within 7 days. If the package receipt is not received by the library within 2 weeks of the shipping date, you will be sent a reminder.

If you lost the Shipping Request form, an informal memo stating the package number and the date received, along with a signature of the person receiving the product, is an acceptable substitute. The shipper number on the blue packing slip and the package number are the same. Keep the blue packing slip for your records and refer to the shipper number in any correspondence concerning a package.

LW:dr

CK5001

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

30 March 1977
RE: DS:pac:108
WBS: 29962

Mr. N. Lal
Goddard Space Flight Center
Code 660
Greenbelt, Maryland 20771

Dear Mr. Lal:

Enclosed is a CR-6 formatted EDR tape (CRS-6593B) containing simulated data for interface verification with your software. The tape contains 3-1/4 hours of science records and the corresponding extracted engineering records. The decom map data has no expected relationship with the engineering data from the spacecraft. The Spacecraft Event Time (SCET) is incorrect due to a current software problem in the EDR PROC program.

The spacecraft is designated as Flight 2. The start FDSC is 0.12.1 and the stop FDSC is 4.17.481.

The tape format is defined by MJS77 (Voyager) Experiment Data Record Format Specification PD618-306. The attachments define data content of the data block. If any difficulties or discrepancies arise, please contact me at 792-6278.

Sincerely,

Deedie Street

Deedie Street

DS:pac

Attachment

cc: W. Fawcett
E. Franzgrote
T. Garrard (CIT)
J. Haas
J. Long
J. Otte
E. Stone (CIT)
B. Teagarden (GSFC)
J. Trainor (GSFC)
J. Tumpan
R. Vogt (CIT)

Telephone 354-4321 *Telex 675421* *Twx 910-588-3294*

ATTACHMENT 1

The measurement field of each instrument contains a finite number of bits (i.e., LECP field = 10 bits, MAG = 6 bits, CRS = 12 bits, etc. see attachment 2). The data in each measurement field is incremented by 1 except for PRA, PPS, UVS and PWS. PRA is incremented by 4, PPS by 256, UVS by 16 and PWS by 4. The value of each measurement field is incremented after each measurement except for LECP, MAG and PLS. The measurement field value for LECP is incremented one bit every six measurements. MAG is incremented one bit every three measurements. PLS is incremented one bit every twenty-five measurements.

The intention was, that the measurement field value would be increased until it reached the maximum value shown in Attachment 2, however the simulator program is not able to accomplish that exactly. Therefore, the measurement values increment to a large value and then are reset to zero and start over again (some instruemtns will reset several times during one major frame). All measurement values should reset to zero at the beginning of a new Mod 16 count.

ATTACHMENT 2

CR-6 DATA MODE
NON-IMAGING SCIENCE
SIMULATION DATA GENERATOR FORMATS
FOR DATA RECORDS TESTING

SCI INST.	DATA GENERATOR FORMATS								
	MEAS SIZE (BITS)	MEAS/ MF	DURA- TION (MIN)	INCR/ MEAS (BITS)	MEAS INCR INT	FUNC. TYPE	START VALUE (BITS)	MAX VALUE (BITS)	RESET TIME (COUNTS)
LECP	10	32	48	1	6	RAMP	0	1023	NEW MOD16
MAG	6	19		1	3	RAMP	0	63	NEW MOD16
CRS	12	32	48	1	0	RAMP	0	4095	NEW MOD16
*PRA	8	15	48	4	0	RAMP	0	255	NEW MOD16
*PPS	24	5	48	256	0	RAMP	0	4095	NEW MOD16
*UVS	10	12	48	16	0	RAMP	0	767	NEW MOD16
PLS	8	39	48	1	25	RAMP	0	233	NEW MOD16
*PWS	8	15	48	4	0	RAMP	0	255	NEW MOD16

*Subcommutated

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SAF016

jpl

MJS77 TEST CONFIGURATION

Test title SPACE SIMULATION S/C MJS77- 2

Test location SSF Procedure 302.01, 300.02A Calendar date 3/10/77

GMT day 69 Start time _____ GMT Stop time _____ GMT RTM off _____

Subsystem (experiment)	Serial No.	Stimulus No.	Stimulus on (√)	Stimulus Off (√)	Subsystem removed (date)	Replaced by serial No.
CRS	2					
PRA	3					
PWS	2					
LCEP	3					
PPS	2					
PLS	2					
UVS	3					
MAG	103, 104					
ISS	7, 6					
IRIS	102					

Other		Configuration Remarks
RFS	202	
MDS	CDU 103,104 TMU 105,104	
PWR	3	
CCS	PROC 23,24	
FDS	2	
AACS	HYBRC 3,6	
PYRO	102	
CABL		
PROP		
DSS	2, XPORT 8	
SXA		

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-9-77 Day 69 GMT
S/C MJS77- 2 Page 1126

Proc MJS77-300.02A/302.01

Time, GMT	Step No.	Command	Test:	Init:
00 10 57	~~242~~		CHAMBER WALL TEMP = -250°F	
00 13 34	241	39C		
00 14 46		16C	7000	
00 32 00		12C		
00 33 02		39E		
00-36-18			Panics panel perm.t ON (PWR-LCET)	
01.00.00			RFS MODE 6770-00	
01.04.50			IRIS purge problem (ENVIRONMENTAL) - valve leaking	
"			Chamber = 3.85 x 10⁻⁴ torr	
01 31 52			EC TO DO ENVIORIMENTAL LEAK CHK	
01 34 11			CHAMBER WALL TEMP = SHROUD -150°C	
01 40 50			CLOSE HI VACUME VALVES	
			AT PRESENT CHAMBER PRESSURE IS ~~4x10~~ 5	
01 43 40			RE-OPENING VALVES 2x10⁻⁴ TORR	
01 51 34			LEAK IDENTIFIED ~~2x10~~ 10⁻⁶ TORR	
02 06 19	252		TURN ON VACUME FAIL ALARM 9x10⁻⁷ TORR	
02 07 50			43°C BAY 5 ALARM	
02.14.00			-155°C FLOOR, -190°C WALLS	
02.18			Green SAFE light at SSF Vacuum	

JPL 2368 R 1/76

OPERATIONS LOG

Proc MJS77-300.82/30201

RTM _____ On
RTM _____ Off

Date 3-9-77 Day 69 GMT
S/C MJS77- 2 Page 1127

Time, GMT	Step No.	Command	Test:	Init:
02.18.37			Enable alarm → fail light OFF, still SAFE	
			B, C Gyros are ON (AACS LN MODE)	
02.33.05		AC7PCG	62 Gyro B OFF	
02.33.42		AC7PCG	72 Gyro C OFF → GET ON WITH THE TEST MODE (TEMP CONTROL)	
02.39.09		16ARP	DSS OFF (& leaving REPL HTR OFF to accellerate COLD MODE)	
			PWR: Margin = 137 SHUNT REG. DISSIPATION = 257 Watts	
02.44 —			Adjust to " " " = 120 Watts (RTG at 14 V/watt)	
			to control bay 7 temp.	
			AACS sends Pwr codes 61, 71 — Gyros Htrs ON	
			PWR reports did see -7 DN Δ for each gyro OFF (normal)	
02.58.00			PLS MOD T Alarm E1-623 = 109 L	
02.59.34		AC7PCG	63 Gyro B ON PWR +6DN Δ d.c. bus current. (net effect of gyro ON, htr OFF)	
03.01.59		AC7PCG	73 Gyro C ON PWR +7DN Δ " " " ?	
03.04.09		CC7GBRP	Gyro B OFF PWR -7 DN Δ	
03.07.09		CC7GCRP	Gyro C OFF PWR -6 DN Δ	
03.16.30		SC06BB	050040 GS-3 LN	
03.17.00			MDS lock 7.2	
03.17.36		3A	29301 — so RFS won't break up	
↓ 03.27.37		22A	PRA ON	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-9-77 Day 69 GMT
S/C MJS77- 2 Page 1128

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
03.28.38		23A	PWS ON	
03.32.01		35A	MAGA ON	
03.33.28		39CR	IRIS FL OFF HTR OFF PWR verified	
03.36.37		22AF	5547	
03.40—			E2-453 LEMPA T Alarm = 84 L	
03.44.17		SC06BB	050090 GS-3 EC → MAG data.	
03.47—			Temp Control has E453 in alarm (LECP) (LEMPA T) = 82 L	
03.51.47		25A	LECP ON	
			MAG bad data at SE, FDS SE. no NERT — only RT	
03.56.07		25AH	6002	
<03.45—>			FDS status word 3 indicates changed (Astronics)	
04.00.02		35AR	MAGA OFF	
04.01.13		25D	LECP TELESCOPE HTR ON PWR 1 DNA	
04.03.17		25E	LECP SUPPLEMENTAL HTR ON PWR no Δ (.5 w htr)	
			SS T alarm = 103 L (E2-236)	
04.07.42		7AHP	SS HTR #1 ON (1.8 W)	
04.08.38		2E	HGA	
04.09.22		27A	PPS ON	
04.11.15		32C	PLS REPLACEMENT HTR ON	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-9-77 Day 69 GMT
S/C MJS77- 2 Page 1129

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
04:12:08		32B	PLS SUPPLEMENTAL HEATER ON	
04:20:34		39A	IRIS ON	
04:24 —			PLS MOD T = 96 L LECP LEMPA T = 78 (-24.05°)	
04:27:28			TEMP CONTROL : add 2 watts to LEMPA TELESCOPE	
04:34:36		21A	CRS ON	
04:33 —			LEMPA T = 77 L (still dropping)	
04:41:37		35A	MAGA ON	
04:44:41		35AI/A Ø	030001	
04:49 —			LEMPA T = 78 DN (+1)	
04:50:53		21AG	CRS HV ON	
05:04:07		34AE	00	
05:05 —			MAG data wasn't routed (?) — now getting data.	
05:09.			PWS reports temp 15° C above ambient.	
05:10:06			TEMP CONTROL vibrators ON (on horizontal struts on bus to close louvers)	
05:11:10			" " " OFF	
05:15:58		34AE	01	
05:19 —			LEPT T Alarm = 84 L (E2-452) (-19.76°C)	
05:23:46		25DR	LECP TELE MTR OFF PWR no Δ	
05:25:08		34AE	02	

OPERATIONS LOG

RTM _____ On Date 3-9-77 Day 69 GMT

Proc MJS77- 302.01 RTM _____ Off S/C MJS77- 2 Page 1130

Time, GMT	Step No.	Command	Test:	Init:
05.30.09		25B	LECP STEPPER MOTOR ON — PWR no Δ	
05.32.25		34AE	03	
05.33.39		25D	LECP TELE HTR ON PWR 1 DN Δ d.c. bus current → PFR proportional heater	
05.36.52		21AF	13005	
05.37.38		34AE	04	
05.41.11		2JRP	X-EXCITER 2 SELECT	
05.41.35		2LRP	X-TWT 2 SELECT	
05.41.55		2GP	X-TRANSMITTER ON → CTA-21 TEST → delays FA COLD 3-6 hours (need uplink)	
05.45.58		25AH	4200	
05.46.59		34AE	05	
05.50.12		25AH	1777 → LECP data still 0s — CCS lock change count message. (only RT data status — NERT looks proper)	
05.50.57		25AH	2617 No CR gliches on recorder.	
05.52.35		25AH	7032 CCS event count correct.	
05.53.28		34AE	06	
05.59.51		34AE	07	
06.02.38		25AH	1777 (again) — received — no change in data.	
06.06.51		34AE	00	
06.09.22		34AE	10	
			LECP appears to only be stepping between positions 7 and 8 (since turn-on of stepper motor)	

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OPERATIONS LOG

RTM _____ On Date 3-9-77 Day 69 GMT

Proc MJS77- 302.01 RTM _____ Off S/C MJS77- 2 Page 1131

Time, GMT	Step No.	Command	Test:	Init:
06·11·12		25AH	4237 LECP MOSTO	
06·12·22		34AE	17	
06·15·33		25AH	4260	
06·16·18		34AE	00	
06·21·01		34A	UVS ON	
06·21·30			Chamber pressure = 6.5×10^{-7} torr	
06·23·05		34AE	03	
06·26·11		25AH	4200 — LECP APPEARS TO BE STEPPING PROPERLY (FDS verified all 1's sent in S-band correct) (for earlier problem)	
06·29·09		27AF	0000	
06·31·12		27AF	0001	
06·31 —			XHGA DR Alarm (E2-048) = 99L	
			LOOKS LIKE LECP STUCK STEPPING BETWEEN POSITIONS 6-7.	
06·33·16		25AH	4240	
			PWR begin reducing pwr into shunt reg.	
06·35·00			LEMPA T = -24.05 (78 DN) → TEMP CONTROL add	
06·35·26			RTG #1 = 55.6 V	
06·35·48			RTG sim #2 = 55.6 V	
06·36·16			RTG SIM #3 = 55.6 V	
06·38·22		21C	CRS SUPPL HTR ON (CRS TLA E2-372, CRS HTA E2-382 in alarm)	

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OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-9-77 Day 69 GMT
S/C MJS77- 2 Page 1132

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
06.41.47		SC06BB	080090 PB-2 EC (for CTA-21)	
			LECP NOW STEPPING TO 4-5 STICKING, GOES BACK TO MOSTO.	
			PWR MARGIN = 121 (MOTOR 10° BELOW FA)	
06 42.26			ADPX OFF ~~ARE ADDING HEAT TO BASE~~	
06.53.12		25AH	4200 - 24 sec step rate, low pwr. (E459 = 230 DN -35.25°C)	
07.00.30			IRIS Stimulus Temp = -80.7°C	
07.07.03		2P	2 WAY NON-COHERENT ON	
			Take NERT down to change out DISK.	
07.27.37			TEMP CONTROL shake	
07.28.45			" " vibrators OFF	
07.28.50		36B	WA ON	
07.31.29		36DP	NA ON	
07.32.14		32A	PLS ON	
07.33.43		SC06BB	050090 GS-3 EC	
		32AJ	15	
		32AF	06	
07.36.49		32AH	14	
		32AK	2	
		32AG	10	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-10-77 Day 69 GMT
S/C MJS77- 2 Page 1133

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
07.39.30		21AF	01020	
07.41.20		32CR	PLS REPL HTR OFF	
07.43.30			PWR completed RTG SIM adjustments for PWR MARGIN (changed with ISS ON)	
			SS T Alarm, (E2-236) = 97L	
		~~7AHRP~~		
07.48.03		CC7AHRP	Sun Sensor #1 HTR OFF	
07.48.40		CC7BHP	" " #2 HTR ON	
07.49.30		21AF	01000	
			Uplink to CTA 21	
07.52.14			Command Mod OFF	
08.04.44			Command Mod ON	
08.05.16		2PR	2 WAY NON COHERENT OFF	
08.06.05			Command Mod OFF	
08.12.35			CTA 21 has the uplink.	
082809			CTA 21 rg modulation ON	
082843			" " CMD mod. ON	
083248			" " " " OFF (Does not Appear to have it)	
083301			" " " " ON/OFF	
083353			" " " " " Looks good	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-10-77 Day 69 GMT
S/C MJS77- 2 Page 1134

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
083436			MDS sees Sub-CAR. lock	
085154			CMD mod off CTA21	
085218			RG MOD off	
085243			MDS out of lock	
085643			21 RG. mod ON / CMD mod ON	
090913			MDS LOST lock / 21 running AGC	
093917		2P	2 way non-coh ON	
094004		06BB	010090 IM-3	
094053			MDS lock 115.2	
094105			FDS "	
094145			TTS " IM-3	
092726			Cmd mod enabled	
102858		06BB	090090 PB-3	
		[redacted]	[redacted]	
102959			MDS Lock	
103321		7PCG	33 CST ION	
103514		16AP	DSS ON	
103607			CMD mod disabled	
105030			CMD " ON	

OPERATIONS LOG

Proc MJS77- 302.01

RTM _____ On
RTM _____ Off

Date 3-10-77 Day 69 GMT
S/C MJS77- 2 Page 1135

Time, GMT	Step No.	Command	Test:	Init:
105132		2BP	S. - ex. 1	
105153		2CP	S. TWTA 1	
105213		2JP	X. - ex. 1	
105234		2LP	X. TWT 1	
105555			S TWT up	
105558			X " "	
105631		2H	X " High	
105659		2FP	RCV 1	
105831			Cmd mod ENABLed	
105950		7PCG	61 BAY 6 HTR. A - OFF	
110244		2PR	2 way Non-coh OFF	
110419		7PCG	71 BAY 6 HTR. B - OFF	
110611			CMD MOD DISABLed	
1147-			CT 21 Dropping uplk	
1213-			MAG IBELT — Low ALARM Limit - actually high	
1221-			MAG IBELT Set to 45°c High TO change ALARM LIMIT	
124731			" OBELT IN ALARM	
1252-			" " Set TO 45°c /also pwr supply temp to 45°c	
132005			21's Xmiter OFF	

jpl → **OPERATIONS LOG**

RTM _____ On Date 3-10-77 Day 69 GMT

Proc MJS77- _____ RTM _____ Off S/C MJS77- 2 Page 1136

Time, GMT	Step No.	Command	Test:	Init:
132014			CMD mod enabled	
132041		2FRP	RCU 2	
132251			22.0278 MH Bad Lock	
132334			21 Xmitr ON	
1325—			RFS mode = 4530 - 11	
134201			21 Finished with test	
134215			21 Xmiter off xfer to RFS	
1348—			WALL Temp. = Lower -192.9 / middle wall -190.9 / Floor = -192.9 / upper wall -187.4	
140332			CMD mod ENABLED	
140406		2FP	RCU. 1 Select	
140555		75HP	AZ ACT HTR ON	
140542			CMD mod enabled	
142059		25AH	4320 Lecp step every 6 sec.	
1430—			Sci sees no change in Lecp stepper - still looks BAD	
143127		25AH	4237 STOW Lecp	
143856		STOGNS	20,2AAE	
↓		"	21,0199	
		"	23,8801	
		"	25,8900	

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OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1137

Proc MJS77- _____

Time, GMT	Step No.	Command	Test:	Init:
1438-			tic - 1987 (EST.)	
144041		16C	2713	
144245		06BB	070090 PB-1	
144257			Sci -Lecp DID NOT Stow	
144405		25AH	4337 Increased pwr.	
144358			MDS Lock	
144620		TRA	CCS tic R/O	
145000			DSS Rm-tic=3593	
145107		16C	1522 PB Rev TRK 2	
145133			TTS Lock on PB	
145153			DSS verifys PB1 Rev TRK 2	
145708		25ER	Lecp Supp Hrk OFF	
145739		25DR	" Tele " "	
145409		16C	7000-DSS-R/M	
150117		TRA	CCS R/O For tic-pos. = 2205	
150650		16C	2713 Slew to EOT	
150756		06BB	010090 Im-3	
151257		16C	3722 PB	
150857			MDS Cock	

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OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1138

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
15 0921			TTS Lock	
1515—			Lecp has Stowed	
152107		16C	7000 R/m	
15 2152		TRA	For tic R/O	
152327		25AH	4200	
1525—			tic = 0770	
152616		16C	2713 Slew to EOT	
152713		06BB	070090 PB-1	
152650			Lecp Still NOT Stepping correctly	
152846			FDS has lock	
153514			DSS Ready AT EOT	
153552		16C	1522	
153619			TTS Lock on P/B	
154402		16C	7000	
154610		TRA	tic R/O	
154859		36CP	ISS NA OPT HTR ON	
154937			tic = 4203	
161159		CC7ML	05 CST ENABLE (STATUS UPDATE ONLY)	
161349		AC7PCG	62 GYRO B OFF "	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1139

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
161438		AC7PCG	72 GYRO C OFF (STATUS UPDATE ONLY)	
163418		CC25E	LECP SUPP HTR ON	
			IRIS VISIBLE LIGHT SOURCE IS OFF	
			CHAMBER WORK LIGHTS ARE OFF	
1648				
1650			> IRIS GLITCH (RADIOMETER)	
1630			PRA NOISE	
170130			IRIS STS T -121.4°C	
			USO RACK IS AT CHAMBER	
174340			IRIS PRIMARY MIRROR HTR TURNED ON	
			E-713 - AUTO CONTROL	
174435			E-453 BELOW -25°C TEMP CONTROL ADDED SOME	
			HTR PWR TO RAISE TEMP	
180420			E-453 (LEMPA T) IS HEATING UP THOUGH NOT SHOWN	
			ON TCM OR DTU.	
1810 -			RTG SIMM 14W RAISED TO 141DN	
181140			CMD MOD ENABLE RFS AGC TEST	
2439			TEMP. CONTROL TO APPLY PWR TO LECP BASE TO RAISE	
			TEMP TO 0°C IN PREPARATION FOR MICROPHONICS TESTS	

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OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1140

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
18 29 39			PWR APPLIED TO LECP BASE	
18 37 24			CHAMBER WORK LIGHTS TURNED ON	
18 40 22			AGC CURVE COMPLETE	
18 40 50			RES CMD MOD ENABLED	
18 41 57			LECP STEPPING STILL ERRATIC	
18 43 44		25D	LECP TELE HTR ON E 458 = 78 DN	
18 45 13			DC WATTS = 151 DN E-074 = 3DN OP	
18 45 28			DC WATTS 149 DN	
			PWR CONFIRMS HTR IS ON	
~ 18 47 44			WORK LITES OFF IN CHAMBER	
	→	25D	AT CMD ISSUE PROPER Δ WAS REGISTERED. SHORTLY	
			THERE AFTER THERE WAS DN TOGGLING	
18 51 45			E-453 79 DN	
18 52 44		25DR		
18 53 43			CMD MOD INHIBITED	
18 57 52			CMD MOD ENABLED	
18 58 29			SUB-CARRIER LOCK	
19 00 20		21AF	04001	
			04000 +TO MN.	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1141

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
190057			CMD MOD DISABLED	
191210			CMD MOD ENABLE	
191245		SC21AF	04000	
1920 –			RFS SPE TEST IN PROGRESS	
			PRA ANTENNA T: 27.7°C BRACKET	
1937 –			" 22°C DEPLOYMENT MECHANISM	
1942 –			RFS SPE TEST COMPLETE	
			BUS 10°C WARMER	
			HYDROZINE LINES GOOD	
			CRS 10°C WARMER THAN PTM	
			PPS 13°C " "	
			VVS 20°C " "	
			SCAN PLATFORM WARMER "	
			AZ ACT WARMER "	
			SUN SENSORS ARE COLDER "	
			PLS SAME (10°C ABOVE FA LIMIT) AS PTM	
			MAG BOOM DAMPERS COLDER THAN PTM	
195757			CMD MOD ENABLE	
195817			MDS SUBCARRIER LOCK	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1142

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
195909		SC21AF	04001	
200215		SC06BB	050040 GS-3 LAUNCH	
200319			MDS LOCK	
200327			FDS LOCK	
202723		FDS BL	OCK LOAD 172F 8700 OSC MON TO 100 DECK	
202259			TTS REAL TIME UP, NERTS STILL DOWN	
202926			CMD MOD DISABLE BEGIN MDS OSC MON TEST	
204832		25C	LECP REPL HTR ON 4DN UP ON DC BUS (4.5W)	
204731			RFS CMD MOD ENABLED	
204824			MDS: SUB-CARRIER LOCK	
2050 —			PWR RE-ADJUST RTG SIMM TO 125W (10W INCRIMENTS)	
210026		21AF	04000	
210227			RTG SIMM = 131 DN PWR MARGIN	
210622		1C	MAG CALIB. COIL 15W LOAD FOR 1MIN 12DN INCREASE	
210752		1CR	" " " OFF	
211424		06BB	010070 Im-3	
211521			MDS IN LOCK	
211523			FDS IN LOCK	
212516		21AF	04200	

OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3-10-77 Day 69 GMT
S/C MJS77- 2 Page 1143

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
212127			WORK LITES OFF AT THIS TIME	
212319		06AU		
212726			IRIS STIM TEMP = -130.8°C	
2128 –			WORK LITES ON IN CHAMBER	
213501		06AU		
213615			ISS BLOCK TERMINATED	
21 ~~[illegible]~~			IRIS STIMULUS BEING PURGED WITH WARM GAS	
			(AMBIENT GAS - 65-70°C)	
214918		SC21AF	04100	
215112		SC013B	050070 GS-3 CRUISE	
215914		SC21AF	04000	
220436		ACTMD	1 AACS LAUNCH MODE	
220756		SC21AF	06200	
221030			IRIS STS ON (HEATER) 16.5 A	
			CHAMBER WORK LIGHTS OFF	
221509		→	CCS READ OUT OMEN QUEUE	
222316			GN_2 TO IRIS STS OFF	
			PWR CODE 57 WAS IN OMEN QUEUE	
223402		XEC	READ OUT 7230 etc	

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OPERATIONS LOG

RTM _____ On
RTM _____ Off

Date 3/10/77 Day 69 GMT
S/C MJS77- 2 Page 1144

Proc MJS77- 302.01

Time, GMT	Step No.	Command	Test:	Init:
224605		DC7ST	AACS SELF TEST	
224706		SC21AF	06000	
225135		XEC	READ OUT 2 BLOCKS 7220	
225535		SC21AF	01040	
225841		ST06PY	25,CD00 E 641 TO DECK POSN: 159	
			CORRESPONDING TTS DECOM MAP CHANGE	
232234			IRIS STS CONTROLLER OFF	
233418			LOUVER VIBRATORS ON	
233523			" " OFF	
234049		SC21AF	01000	
234400	608	SC06BB	030090 GS-4 FAR ENCOUNTER EC	
234456			MDS LOCK	
234501			FDS LOCK	
234923	610	SC23AD	0	
235108		SC21AF	02020	
235148		SC34AE	12	
			PRA LEVELS DROPPED DRASTICALLY	
235619	614	SC23AD	1	

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JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM
3758-065-77
25 April 1977

TO: Distribution

FROM: A. Sacks AS

SUBJECT: Voyager Tape Strap Label Scheme

REFERENCE: IOM 375-99-77, R. Moulder to Distribution, Subject: Revised Multi-Mission External Tape Labeling Scheme, dated 16 March 1977.

The Voyager tape strap label is composed of two parts. The first part is called the Prefix and contains six (6) alphanumeric characters. The second part is called the tape ID and contains six (6) alphanumeric characters. These six characters will uniquely identify a tape and also are identical to the internal magnetic tape label if it is present on the tape. These twelve (12) alphanumeric characters would constitute the entire tape strap label. The following is a detail description of the tape prefix. Tables 1 through 3 contain the tape label prefix for the MTTS, MTIS and MDMT.

First Alphanumeric Character - Project Identification

A - SEASAT-A
B - SEASAT-B
H - Halley
I - IRAS
J - JOP
M - MJS (Voyager)
P - Pioneer Venus
V - VIOR
R - MARS 84

Second Alphanumeric Character - Spacecraft Identification

MJS Voyager

A - FLT 1
B - FLT 2
C - PTM
D - SIM 1
E - SIM 2
X - Mixed

SEASAT

A - SEASAT-A
B - SEASAT-B

Miscellaneous

- - Not Applicable

Third Alphanumeric Character - Data Mode

A - R/T High Rate
B - R/T Low Rate
C - Mixed R/T
G - Raw
H - Raw and Frame Sync
I - IDR
J - Replay R/T H/R
K - Replay R/T L/R
M - Replay Mixed
O - Replay P/B
P - P/B
R - R/T
V - Monitor
- - Not Applicable

Fourth Alphanumeric Character - Tape Type

A - SDR (1530 Log)
B - Memory Mask
C - Channel Data
D - Comsim
E - EDR
F - Foot Print
G - Decom Map
H - Command
I - IDR
J - ISDR
K - Catalog
L - SNORT
M - MDR
N - Navigation
O - Geometry
P - PET
Q - QEDR
S - SDR (Spooler)
T - SDR (Tracking)
U - CEMDR
V - Orbit Determination (Farmer)
W - Event's File
X - SEDR
Y - SASDR
Z - DPTRAG
- - Not Applicable

Fifth and Sixth Alphanumeric Characters - Content

NOTE: These two filelds are to be defined by individual projects. The following is a suggested definition for the MJS (Voyager) Project.

CR - CRS
AA - AACS
FD - FDS
CC - CCS
EN - Engineering
IR - IRIS
PL - PLS
PP - PPS
LE - LECP
MG - MAG
PR - PRA - LOW RATE
MN - MONITOR
RS - RSS
TR - TRK
UV - UVS
PS - PWS - HIGH RATE
PW - PWS - LOW Rate
TV - TV
SQ - SEQUENCE
LB - LIBRARY
FF - FOOT
FS - Frame Sync
FP - Fixed Instrument Pointing Data File
MD - MDR
DM - Decom Map
FL - Fill Tape
-- - Not Applicable
PH - PRA- HIGH RATE

Please review the label scheme and character assignments. Questions should be addressed to A. Sacks at Ext. 7969 or 2258.

AS:hb

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MDMT -- 5

TABLE 1 - MTTS TAPE LABEL PREFIX

	FLT-1	FLT-2	PTM	SIM-1	SIM-2	MIXED
SDR (1530 Log Tape)						
Realtime Data	MARA --	MBRA --	MCRA --	MDRA --	MERA --	MXRA --
Playback Data	MAPA --	MBPA --	MCPA --	MDPA --	MEPA --	MXPA --
Station Replay Data (AODR or DODR recall)	MAMA --	MBMA --	MCMA --	MDMA --	MEMA --	MXMA --
IDR Data	MAIA --	MBIA --	MCIA --	MDIA --	MEIA --	MXIA --
SDR (Spooler)						
Realtime Data	MARS --	MBRS --	MCRS --	MDRS --	MERS --	MXRS --
Playback Data	MAPS --	MBPS --	MCPS --	MDPS	MEPS --	MXPS --
Station Replay Data	MAMS --	MBMS --	MCMS --	MDMS --	MEMS --	MXMS --
IDR Data	MAIS --	MBIS --	MCIS --	MDIS --	MEIS --	MXIS --
Channel Tape						
Realtime Data	MARC --	MBRC --	MCRC --	MDRC --	MERC --	MXRC --
Playback Data	MAPC --	MBPC --	MCPC --	MDPC --	MEPC --	MXPC --
Station Replay Data	MAMC --	MBMC --	MCMC --	MDMC --	MEMC --	MXMC --
IDR DAta	MAIC --	MBIC --	MCIC --	MDIC --	MEIC --	MXIC --

TABLE 2 - MTIS TAPE LABEL PREFIX

	FLT-1	FLT-2	PTM	SIM-1	SIM-2
Imaging (TV)					
Realtime	MAAETV	MBAETV	MCAETV	MDAETV	MEAETV
Playback	MAPETV	MBPETV	MCPETV	MDPETV	MEPETV
Station Replay	MAJETV	MBJETV	MCJETV	MDJETV	MEJETV
IDR Processing	MAIETV	MBIETV	MCIETV	MDIETV	MEIETV
PRA (Hi-Rate)					
Realtime	MAAEPH	MBAEPH	MCAEPH	MDAEPH	MEAEPH
Playback	MAPEPH	MBPEPH	MCPEPH	MDPEPH	MEPEPH
Station Replay	MAJEPH	MBJEPH	MCJEPH	MDJEPH	MEJEPH
IDR Processing	MAIEPH	MBIEPH	MCIEPH	MDIEPH	MEIEPH
PWS (Hi-Rate)					
Realtime	MAAEPS	MBAEPS	MCAEPS	MDAEPS	MEAEPS
Playback	MAPEPS	MBPEPS	MCPEPS	MDPEPS	MEPEPS
Station Replay	MAJEPS	MBJEPS	MCJEPS	MDJEPS	MEJEPS
IDR Processing	MAIEPS	MBIEPS	MCIEPS	MDIEPS	MEIEPS

TABLE 3 - MDMT TAPE LABEL PREFIX

	FLT 1		FLT 2	
	R/T	P/B	R/T	P/B
MDR	MARMMD	MAPMMD	MBRMMD	MBPMMD
CRS	MARECR	MAPECR	MBRECR	MBPECR
ENG	MAREEN	MAPEEN	MBREEN	MBPEEN
IRIS	MAREIR	MAPEIR	MBREIR	MBPEIR
LECP	MARELE	MAPELE	MBRELE	MBPELE
MAG	MAREMA	MAPEMA	MBREMA	MBPEMA
PLS	MAREPL	MAPEPL	MBREPL	MBPEPL
PPS	MAREPP	MAPEPP	MBREPP	MBPEPP
PRA	MAREPR	MAPEPR	MBREPR	MBPEPR
PWS	MAREPW	MAPEPW	MBREPW	MBPEPW
UVS	MAREUV	MAPEUV	MBREUV	MBPEUV

TABLE 3 - MDMT TAPE LABEL PREFIX (Cont.)

	PTM		SIM 1		SIM 2	
	R/T	P/B	R/T	P/B	R/T	P/B
MDR	MCRMMD	MCPMMD	MDRMMD	MEPMMD	MERMMD	MEPMMD
CRS	MCRECR	MDRECR	MDRECR	MDPECR	MERECR	MEPECR
ENG	MCREEN	MCPEEN	MDREEN	MDPEEN	MEREEN	MEPEEN
IRIS	MCREIR	MCPEIR	MDREIR	MDPEIR	MEREIR	MEPEIR
LECP	MCRELE	MCPELE	MDRELE	MDPELE	MERELE	MEPELE
MAG	MCREMG	MCPEMG	MDREMG	MEPEMG	MEREMG	MEPEMG
PLS	MCREPL	MCPEPL	MDREPL	MDPEPL	MEREPL	MEPEPL
PPS	MCREPP	MCPEPP	MDREPP	MDPEPP	MEREPP	MEPEPP
PRA	MCREPR	MCPEPR	MDREPR	MDPEPR	MEREPR	MEPEPR
PWS	MCREPW	MCPEPW	MDREPW	MDPEPW	MEREPW	MEPEPW
UVS	MCREUV	MCPEUV	MDREUV	MDPEUV	MEREUV	MEPEUV

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Table 3.5 CRS Multiplexer Sequence at 40 bps

MUX at Deck Position 201			MUX Anywhere on 100 Deck		
CRS MUX Position	Eng MF	MOD 60/LC	CRS MUX Position	Eng MF*	MOD 60/LC**
1	2	0/201	1	1, 2	0/001, 201
6	12	2/601	2	3, 4	0/401, 601
11	22	5/201	3	5, 6	1/001, 201
16	23	7/601	4	7, 8	1/401, 601
21	42	10/201	5	9, 10	2/001, 201
2	52	12/601	6	11, 12	2/401, 601
7	2	15/201	7	13, 14	3/001, 201
12	12	17/601	8	15, 16	3/401, 601
17	22	20/201	9	17, 18	4/001, 201
22	32	22/601	10	19, 20	4/401/601
3	42	25/201	11	21, 22	5/001, 201
8	52	27/601	12	23, 24	5/401, 601
13	2	30/201	13	25, 26	6/001, 201
18	12	32/601	14	27, 28	6/401, 601
23	22	35/201	15	29, 30	7/001, 201
4	32	37/601	16	31, 32	7/401, 601
9	42	40/201	17	33, 34	8/001, 201
14	52	42/601	18	35, 36	8/401, 601
19	2	45/201	19	37, 38	9/001, 201
24	12	47/601	20	39, 40	9/401, 601
5	22	50/201	21	41, 42	10/001, 201
10	32	52/601	22	43, 44	10/401, 601
15	42	55/201	23	45, 46	11/001, 201
20	52	57/601	24	47, 48	11/401, 601

*These values for Eng MF apply for N = 0 in MOD 60 Count. This will be the first pass of the 48 m CRS MUX major frame.

**To all values of MOD 60 Count in 100 deck column add +12 N where N = 0, 1, 2, 3, 4.

Table 3.6 CRS Multiplexer Sequence at 10 bps

The order in which the CRS Multiplexer positions are read out is the same at 10 bps as it is at 40 bps: at Deck Position 201 it is 1, 6, 11, 16, 21, 2, 7, 12, etc. On the 100 Deck it is also the same as in Table 3.5.

The corresponding FDS Count (MOD 60/LC) for each position is TBD.

3.0 ENGINEERING DATA -- DESCRIPTION

The FDS outputs 26 CRS Engineering data measurements (see Table 3.2) into the Engineering data stream. They contain housekeeping data for the instrument, and have each been digitized to 8 bits by the FDS from their original analog form. Tables 3.3 and 3.4 contain the locations of the Engineering measurements.

The Engineering telemetry (TLM) format structure is illustrated in Figure 3.1 (as in Reference 6). It is now considered final, as is the analog multiplexer (MUX) implementation described here and in Reference 3. The only item which is an assumption is the exact time of the MUX RESET pulse from the FDS: it is assumed to occur at MOD60 = 0, Line Count = 001.

The CRS MUX has 24 positions and is advanced one position every two Engineering minor frames; that is, it is stepped once every 24 seconds. It is sampled by the FDS (and placed in the TLM data stream) once every 10 Engineering minor frames -- once every 120 seconds. It is reset to position 1 at the assumed FDS Count (FDSC) of MOD60=0, Line Count (LC)=001.

This system reads out all 24 positions in exactly 48 minutes (240 Engineering minor frames). The positions are received in the data stream in the following order: 1, 6, 11, 16, 21, 2, 7, 12, 17, 22, 3, 8, 13, 18, 23, 4, 9, 14, 19, 24, 5, 10, 15, 20. Following position 20, the MUX is reset to position 1 and the sequence is repeated. At any point in the TLM stream, then, the MUX position P can be found from Table 3.4 or this equivalent equation (which is exact, has no special cases, and assumes no computer roundoff):

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JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

16 May 1977

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics and Astronomy
220-47
Pasadena, California 91125

Dear Dr. Vogt:

The Voyager data records software has been developed and we have gained experience in its operation. We also have been able to better estimate our computer costs under a mission operations environment. Using this cost information and our understanding of your requirement for final SEDR records, we have estimated total costs for data record production and validation. Based upon this estimate and our current budget, it appears we will be able to generate 62,000 SEDR predict records for each spacecraft during the complete mission. These records will be divided among all experiments in some to be negotiated manner.

During mission operations, we will keep a running account of all computer costs and adjust the total record count if required. I believe we have a very reasonable estimate of our computer costs and do not anticipate any large increase or decrease in the number of predict records we will be able to generate. I will generate, with the help of the Experiment Representatives, a proposed record allocation and distribution as a function of mission phase. Specific record divisions/distributions are not required at this time, but a reasonable understanding of your desires is required for our planning purposes. The proposed allocation will be presented and discussed at the next SSG meeting.

Attached are three tables which present our current plans for producing final SEDR records. Table 1 defines our understanding of your requirements for

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SEDR records as a function of mission phase. In addition, the number of records to be expected on each SEDR tape is presented. Table 2 and 3 presents a definition of the mission phases for Voyager 1 and 2 respectively.

Please review the attachments and provide comments at the next SSG meeting where we will discuss both final and predict SEDR generation.

Yours sincerely,

Jack Tupman

Jack Tupman

JT:jvc

Attachments: (3)

cc:
C. Dickman (GSFC)
W. Fawcett
E. Franzgrote
J. Haas
N. Lal (GSFC)
J. Long
E. Stone (CIT)
B. Teagarden (GSFC)
J. Trainor (GSFC)
C. Yeates

TABLE 1

VOYAGER SEDR RECORD FREQUENCY

MISSION PHASE	INDIVIDUAL SEDR TAPE COVERAGE	FIXED		SCAN		
		RATE	RECORDS PER TAPE	TYPE	RATE	RECORDS PER TAPE
Launch	1 day	1 rec/240 sec (Nav) 1 rec/48 sec (Pointing)	360 1800	IRIS ISS PPS UVS	1 rec/48 sec 1 rec/48 sec* 1 rec/48 sec 1 rec/48 sec	1800 400 1800 1800
Cruise	14 days	1 rec/3 hr (Nav & Pointing)	112	--	--	--
Enc	1 day	1 rec/96 sec (Nav) 1 rec/24 sec (Pointing)	900 3600	IRIS ISS PPS UVS	1 rec/48 sec 1 rec/48 sec* 1 rec/24 sec 1 rec/24 sec	1800 1000 3600 3600
Far Enc	14 days	Cruise	Cruise	IRIS ISS PPS UVS	1 rec/48 sec** 1 rec/48 sec* 1 rec/2 hr 1 rec/2 hr	8400 168 168 168
Movie	4 days	Cruise	Cruise	ISS Others	1 rec/48 sec** Far Enc	3600 Far Enc

* Once per ISS Shutter
** 8 hrs/day (Goldstone Pass)

TABLE 2

VOYAGER 1

PHASE	FROM	TO
Launch (Sampler)	9/1/77	9/11/77
Cruise (Earth-Jupiter)	9/11/77	12/5/78
Far Enc 1	12/5/78	2/3/79
Movie	4 days during Far Enc 1	
Encounter (Jupiter)	2/3/79	4/4/79
Far Enc 2	4/4/79	5/4/79
Cruise (Jupiter-Saturn)	5/4/79	8/14/80
Far Enc 3	8/14/80	10/13/80
Movie	4 days during Far Enc 3	
Encounter (Saturn)	10/13/80	12/12/80
Far Enc. 4	12/12/80	1/11/81
Cruise (Post Saturn)	1/11/81	Whenever

TABLE 3

VOYAGER 2

PHASE	FROM	TO
Launch (Sampler)	8/20/77	8/30/77
Cruise (Earth-Jupiter)	8/30/77	4/10/79
Far Enc 1	4/10/79	6/9/79
Movie	4 days during Far Enc 1	
Encounter (Jupiter)	6/9/79	8/8/79
Far Enc 2	8/8/79	9/7/79
Cruise (Jupiter-Saturn)	9/7/79	5/29/81
Far Enc 3	5/29/81	7/28/81
Movie	4 days during Far Enc 3	
Encounter (Saturn)	7/28/81	9/26/81
Far Enc 4	9/26/81	10/26/81
Cruise (Post Saturn)	10/26/81	Uranus ?

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

19 May 1977

Mr. Nan Lal
Goddard Space Flight Center
Greenbelt, Maryland 20771

Dear Mr. Lal:

Enclosed are the summaries for EDR CRS-07438. This EDR contains spacecraft data for GS-3, CR-2, and CR-6 for interface verification with your software. The data starts with GS-3, then changes to CR-6, to GS-3, to CR-2, then ends with GS-3. The tape contains 3 3/4 hours of science records with the corresponding extracted engineering records.

The decom maps have no expected relationship with the engineering data and the SCET is incorrect.

The spacecraft is designated as Flight 2. The start FDSC is 1.34.001 and the stop FDSC is 6.15.001.

Also enclosed is an SAF log for Days 122/123.

The tape format is defined by MJS77 (Voyager) Experiment Data Record Format Specification, PS618-306.

If any difficulties arise, please contact me at X7981.

Sincerely,

Deedie Street

Deedie Street

DS:jvc
Enclosure (1)
cc: W. Fawcett
E. Franzgrote
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23 May 77

Xerox: TLG
Lal
Trainor

VOYAGER FE-1 MISSION PHASE

SUMMARY OF OPERATIONS AND DATA RECOVERY FOR CRS, LECP, MAG & PLS

The attached pages are a compilation of the FE-1 data recovery, calibration activities, spacecraft maneuvers, and other operations of special interest to the CRS, LECP, PLS and MAG experiments.

SUMMARY OF GENERAL SCIENCE DATA RECOVERY:

	7200 bps	320 bps	Unrecovered
JST	92-99%	-----	1-8%
JSX	76-82%	14-15%	3-10%

Attachments:

The attached histograms labeled JST/FE1 and JSX/FE1 show the percent of data recovered as a function of time during the Far Encounter 1 phase.

Following these histograms are two tables of data derived from the FE1 timelines and used to calculate the above summary values and plot the histograms.

Immediately following the tables are two pages from document 618-53 which define the several telemetry modes listed in the timelines and the tables.

Note that the larger summary values for the percent unrecovered data (JST, 8%; JSX, 10%) are those anticipated if a 5-minute loss of data occurs for each change in telemetry rate. It may be possible to recover most of these data if the actual lock-up times can be reduced by appropriate operational procedures. R. Riggs has requested that measurements of the DSN telemetry system lock-up time be made. Copies of his memorandum of May 4, 1977 and of a response by R. Amorose and N. Fanelli of May 16, 1977 are attached following the pages from 618-53.

DATA-INTERRUPTION SUMMARY:

Most of the breaks in the general science data occur because of data-rate changes; a few longer interruptions are due to trajectory-correction maneuvers, etc.

	FE-1 Duration	# Interruptions	Data Lost	Average Interruption Freq.	Average Interruption Duration
JST	528 hr	476	6.5-40.3*hr	0.90/hr	0.8-5.1*min
JSX	744 hr	700	23.4-73.3*hr	0.94/hr	2.0-6.3*min

* Assumes 5-minute loss for each data-rate change.

SUMMARY OF CALIBRATIONS AND MANEUVERS:

The last page attached gives information on CRS, LECP, MAG and PLS calibrations and spacecraft maneuvers as derived from the FE-1 timelines.

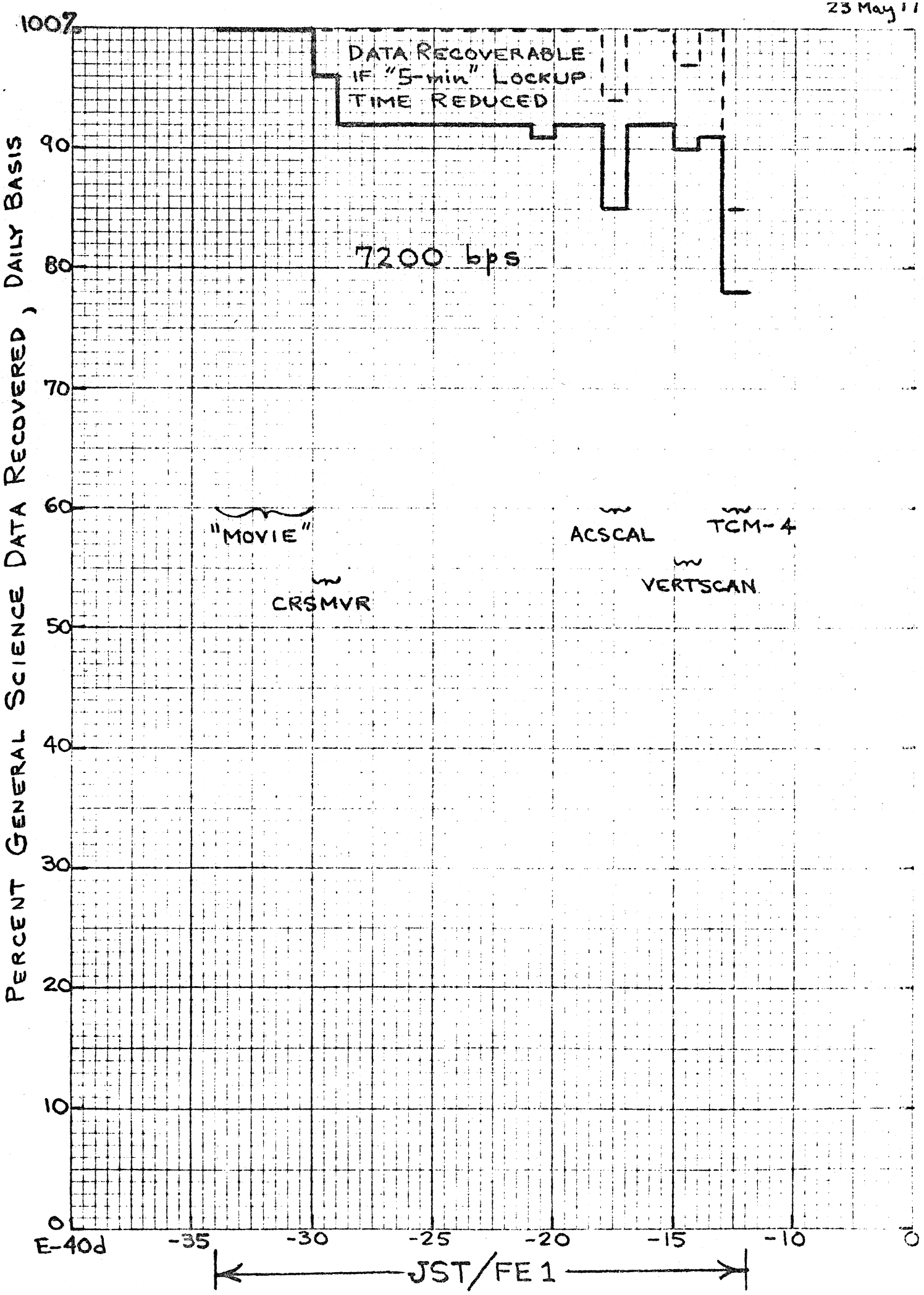
Because of CCS-word limitations, the MAG and PLS calibration commands are planned for alternate CCS loads; some unevenness in the spacing of calibrations will be unavoidable. Because the CCS-loads have not yet been fully defined, the locations of the calibrations in time are to be taken as approximate.

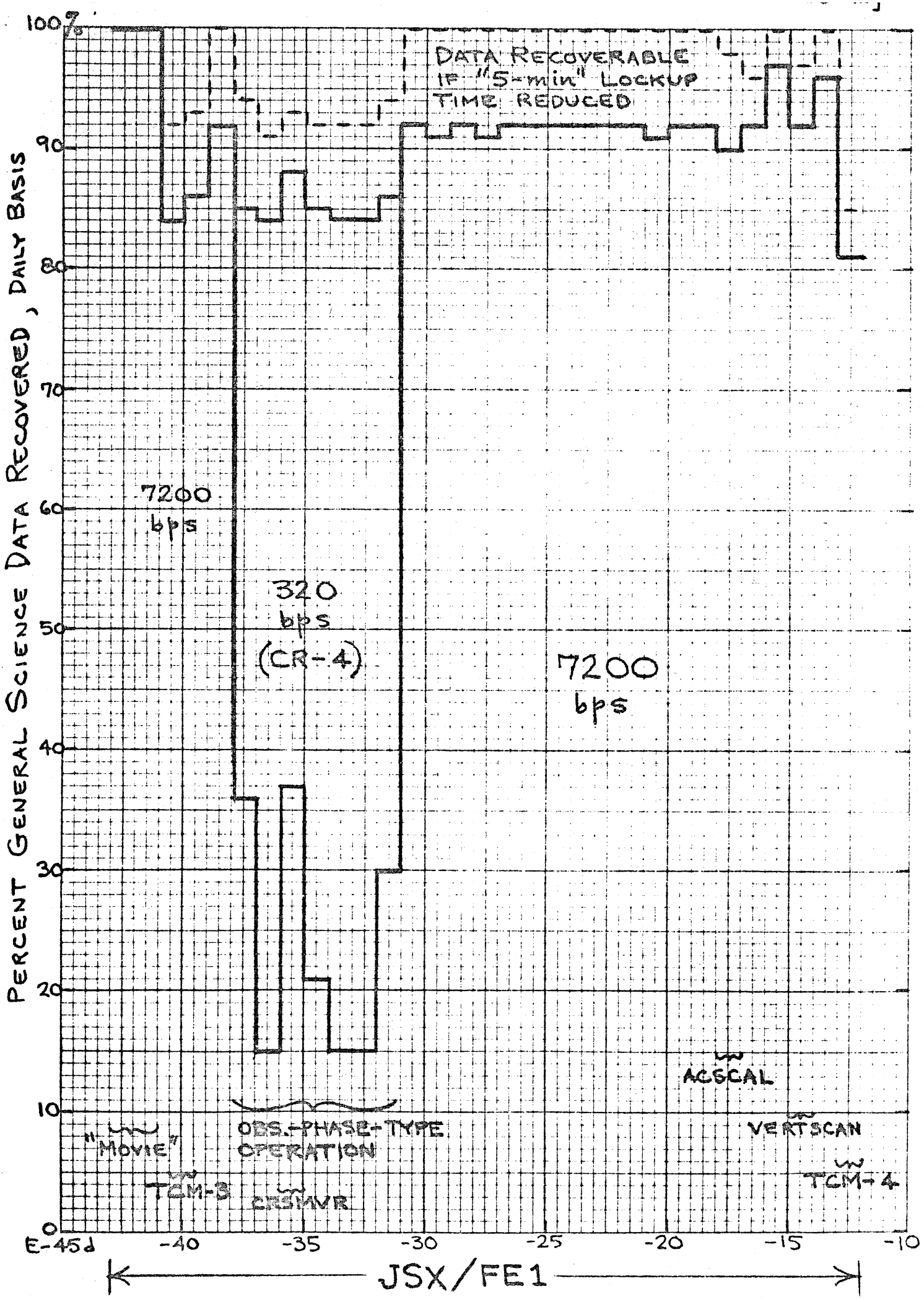
	FE-1 Calibrations		
	Requested Freq.	Av. Freq., JST	Av. Freq., JSX
CRS	1/30 days	1/22 d	1/31 d
LECP/mag (PESCAL)	1/ day	1/ d	1/ d
MAG	1/3.5 days	1/5.5 d	1/7.8 d
PLS	1/ 7 days	1/5.5 d	1/7.8 d

Two of the spacecraft maneuvers (diffuse-plate and Brewster-plate calibrations) formerly planned for the FE-1 phase are now located at the end of the preceding, observatory phase. Note that several of the spacecraft maneuvers occur near the end of FE-1 where the S/C distance from Jupiter is 188 R_J on JST and 151 R_J on JSX.

EJF

23 May 77


100%
90
80
70
60
50
40
30
20
10
0
PERCENT GENERAL SCIENCE DATA RECOVERED, DAILY BASIS
DATA RECOVERABLE IF "5-min" LOCKUP TIME REDUCED
7200 bps
"MOVIE"
CRSMVR
ACSCAL
VERTSCAN
TCM-4
E-40d
-35
-30
-25
-20
-15
-10
0
JST/FE 1


PERCENT GENERAL SCIENCE DATA RECOVERED, DAILY BASIS
100%
90
80
70
60
50
40
30
20
10
0
DATA RECOVERABLE IF "5-min" LOCKUP TIME REDUCED
7200 bps
320 bps (CR-4)
7200 bps
"MOVIE"
TCM-3
OBS.-PHASE-TYPE OPERATION
CRSMVR
ACSCAL
VERTSCAN
TCM-4
E-45d
-40
-35
-30
-25
-20
-15
-10
JSX/FE1

JST-FE1

Day	GS-3 (7200 bps GS&E)	IM-3 (7200 bps GS&E)	IM-4 (7200 bps GS&E)	PB-1,2 (7200 bps GS&E)	MN-12 (No G.S. data)	Data Rate Changes	OF. NAV. FRAMES	MVR	% 7200 bps	% No Data
E-33	—	1020m	—	—	—	0	0	—	100%	0%
-32	—	1440m	—	—	—	0	0	—	100	0
-31	—	1440m	—	—	—	0	0	—	100	0
-30	—	1440m	—	—	—	0	0	—	100	0
-29	655-715m	695m	—	30m	—	12 = 0-60m	1	CRSMVR	96-100%	0-4%
-28	995-1115	220	20	85	—	24 = 0-120m	2	—	92-100	0-8
-27	1080-1200	220	20	—	—	24 = 0-120m	3	—	92-100	0-8
-26	1000-1120	220	20	80	—	24 = 0-120m	1	—	92-100	0-8
-25	1080-1200	220	20	—	—	24 = 0-120m	3	—	92-100	0-8
-24	1000-1120	220	20	80	—	24 = 0-120m	2	—	"	"
-23	"	"	"	"	—	"	3	—	"	"
-22	"	"	"	"	—	"	1	—	"	"
-21	"	"	"	"	—	"	4	—	"	"
-20	1050-1180	240	20	—	—	26 = 0-130m	2	—	91-100	0-9
-19	1000-1120	220	20	80	—	24 = 0-120m	4	—	92-100	0-8
-18	"	"	"	"	—	"	3	—	"	"
-17	910-1030	220	20	80	"90m"	24 = 0-120m	4	ACSCAL	85-94	6-15
-16	920-1040	220	20	160	—	24 = 0-120m	4	—	92-100	0-8
-15	1000-1120	220	20	80	—	24 = 0-120m	5	—	92-100	0-8
-14	930-1040	200	0	160	"40m"	22 = 0-110m	5	VERTSCAN	90-97	3-10
-13	970-1100	260	0	80	—	26 = 0-130m	4	—	91-100	0-9
-12	755-865	240	0	125	210m	22 = 0-110m	1	TCM-4	78-85	15-22
TOTALS						420	52	4	92.5-98.9	1.1-7.5%

NOTE

JSX-FE1

Day	7200 bps GS & E: GS-3	IM-3	IM-5	PB-2	320 bps CR-4	No G.S. data: MN-12	"IM-2"	Data Rate Changes	OP. NAV. Frames	MVR	% 7200 bps	% 320 bps	% No Data
E-42d	—	—	1440	—	—	—	—	0	0	—	100%	—	0
-41	—	—	1440	—	—	—	—	0	0	—	100%	—	0
-40	990-1100	160	60	—	—	120	—	22 = 0-110m	2	TCM-3	84-92	—	8-16
-39	961-1071	167	62	46m	—	94	—	22 = 0-110m	0	TCM-3	86-93	—	7-14
-38	1073-1193	160	87	—	—	—	—	24 = 0-120m	3	—	92-100	—	0-8
-37	323-373	60	30	99	708-788m	—	90m	10 = 0-50m; 16 = 0-80m	2	—	36-39	49-55%	6-15
-36	—	—	—	218	992-1092	—	130	20 = 0-100m	3	—	15	69-76	9-16
-35	313 (RECORD)	—	—	217	730-810	—	100	16 = 0-80m	4	CRSMVR	37	51-56	7-12
-34	—	—	—	300	920-1020	—	120	20 = 0-100m	3	—	21	64-71	8-15
-33	—	—	—	220	1000-1100	—	120	20 = 0-100m	2	—	15	69-76	8-15
-32	—	—	—	220	1000-11[illegible]	—	120	20 = 0-100m	1	—	15	69-76	8-15
-31	188-208m	67m	—	183	802-892	—	90	22 = 0-20m, 0-90m	2	—	30-32	56-62	6-14
-30	1050-1170	180	90m	—	—	—	—	24 = 0-120m	2	—	92-100	—	0-8
-29	1005-1135	180	90	35	—	—	—	26 = 0-130m	2	—	91-100	—	0-9
-28	1050-1170	180	90	—	—	—	—	24 = 0-120m	2	—	92-100	—	0-8
-27	1005-1135	180	90	35	—	—	—	26 = 0-130m	4	—	91-100	—	0-9
-26	1050-1170	180	90	—	—	—	—	24 = 0-120m	3	—	92-100	—	0-8
-25	918-1038	175	150	77	—	—	—	24 = 0-120m	2	—	92-100	—	0-8
-24	965-1085	200	120	35	—	—	—	24 = 0-120m	4	—	92-100	—	0-8
-23	925-1045	200	120	75	—	—	—	24 = 0-120m	2	—	92-100	—	0-8
-22	962-1082	200	120	38	—	—	—	24 = 0-120m	5	—	92-100	—	0-8
-21	1000-1120	200	120	—	—	—	—	24 = 0-120m	3	—	92-100	—	0-8
-20	923-1053	225	120	42	—	—	—	26 = 0-130m	6	—	91-100	—	0-9
-19	958-1078	200	120	42	—	—	—	24 = 0-120m	5	—	92-100	—	0-8
-18	1021-1141	144	120	35	—	—	—	24 = 0-120m	3	—	92-100	—	0-8
-17	955-1075	160	120	60	—	"25"m	—	24 = 0-120m	6	ACSCAL	90-98	—	2-10
-16	284-344	751	270	15	—	"60"m	—	12 = 0-60m	0	ACSCAL	92-96	—	4-8
-15	233-283	853	260	44	—	—	—	10 = 0-50m	2	—	97-100	—	0-3
-14	190-240	766-786	270	(104 PB-1 & PB-2)	—	"40"m	—	14 = 0-70m	1	VERTSCAN	92-97	—	3-8
-13	232-282	845-855	265	38	—	—	—	12 = 0-60m	3	—	96-100	—	0-4
-12	137-177	726-736	270	37	—	220	—	10 = 0-50	5	TCM-4	81-85	—	15-19
TOTALS								612	82	6	76.5-81.8	18.8-15.2	3.0-9.7

Table 6-4. Encounter General Science and DTR Playback Telemetry Modes

Mode Mnemonic	Function	Low Rate Channel Configuration		High Rate Channel Configuration				Tape Recorder Configuration		
		Status (4)	Channel Contents	Status	Channel Contents	Carrier Frequency	Rate (bps)	Status	Record/Playback Contents	Rate (bps)
GS-2	Standard Encounter GS&E + Special PRA	On	Encounter Engineering	On	Standard Encounter GS&E + Special PRA	X-Band	115,200	(1)		
GS-3	Standard Encounter GS&E	On	Encounter Engineering	On	Standard Encounter GS&E	X-Band	(2) 7,200	(1)		
GS-4	Standard Encounter GS&E + Special PWS	On	Encounter Engineering	On	Standard Encounter GS&E + Special PWS	X-Band	115,200	(1)		
OC-1	Special Occultation	On	Encounter Engineering	On	Special Occultation GS&E	X-Band	(3) 7,200	(1)		
PB-1	Playback + Standard Encounter GS&E	On	Encounter Engineering	On	Playback + Standard Encounter GS&E	X-Band	67,200	Playback	(5) and (6)	57,600
PB-2	Playback + Standard Encounter GS&E	On	Encounter Engineering	On	Playback + Standard Encounter GS&E	X-Band	44,800	Playback	(5) and (6)	33,600
PB-3	Playback + Standard Encounter GS&E	On	Encounter Engineering	On	Playback + Standard Encounter GS&E	X-Band	29,866 2/3	Playback	(5) and (6)	21,600
PB-4	Playback Only	On	Encounter Engineering	On	Playback Only	X-Band	21,600	Playback	6	21,600
PB-5	Playback Only	On	Encounter Engineering	On	Playback Only	X-Band	7,200	Playback	6	7,200

Table 6-5 (1) Encounter Imaging Modes

Mode Mnemonic	Function	Low Rate Channel Configuration		High Rate Channel Configuration				Tape Recorder Configuration		
		(4) Status	Channel Contents	Status	Channel Contents	Carrier Frequency	Rate (bps)	Status	Record/Playback Contents	Rate (bps)
IM-2	Standard Encounter GS&E + Record Full Resolution Imaging	On	Encounter Engineering	On	Standard Encounter GS&E	X-Band	7,200	Record	Standard Encounter GS&E + Full Resolution Imaging	115,200
IM-3	Standard Encounter GS&E + Full Resolution Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + Full Resolution Imaging	X-Band	115,200	(1)		
IM-4	Standard Encounter GS&E + 3/4 Edited Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 3/4 Edited Imaging	X-Band	89,600	Off	–	–
IM-5	Standard Encounter GS&E + 2:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 2:1 Slow Scan Imaging	X-Band	67,200	~~Off~~ (1)	–	–
IM-6	Standard Encounter GS&E + 1/2 Edited Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 1/2 Edited Imaging	X-Band	67,200	Off	–	–
IM-7	Standard Encounter GS&E + 3:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 3:1 Slow Scan Imaging	X-Band	44,800	Off	–	–
IM-8	Standard Encounter GS&E + 1/3 Edited Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 1/3 Edited Imaging	X-Band	44,800	Off	–	–
IM-9	Standard Encounter GS&E + Edited 3:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + Edited 3:1 Slow Scan Imaging	X-Band	29,866 2/3	Off	–	–
IM-10	Standard Encounter GS&E + 1/5 Edited Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 1/5 Edited Imaging	X-Band	29,866 2/3	Off	–	–
IM-11	Standard Encounter GS&E + 5:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 5:1 Slow Scan Imaging	X-Band	29,866 2/3	Off	–	–
IM-12	Standard Encounter GS&E + 1/2 Edited, 5:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 1/2 Edited, 5:1 Slow Scan Imaging	X-Band	19,200	Off	–	–
IM-13	Standard Encounter GS&E + 10:1 Slow Scan Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 10:1 Slow Scan Imaging	X-Band	19,200	Off	–	–
IM-14	Standard Encounter GS&E + 1/10 Edited Imaging	On	Encounter Engineering	On	Standard Encounter GS&E + 1/10 Edited Imaging	X-Band	19,200	Off	–	–

Notes:
(1) The FDS routes identical data streams to the high rate channel and tape recorder in these modes. Recording is therefore optional.
(2) Actual GS&E data rate is 3,600 bps which is Golay coded to 7,200 bps.
(3) Actual GS&E data rate. Golay coding is not employed in this mode.
(4) Low rate channel data rate is always 40 bps.
(5) This will consist of whatever data has been previously put on the recorder.
(6) This is uninterrupted tape playback data.

Table 6-2. Engineering Only Telemetry Modes

Mode Mnemonic	Function	Low Rate Channel Configuration		High Rate Channel Configuration				Tape Recorder Configuration		
		Status	Channel Contents	Status	Channel Contents	Carrier Frequency	Rate (bps)	Status	Record/Playback Contents	Rate (bps)
LN-40	Low Rate Launch Engineering	On	Launch Engineering	Off	--	--	--	Record	(1)	7,200
LN-12	High Rate Launch Engineering	Off	--	On	Launch Engineering	S-Band	1200	Record	Launch Engineering	7,200 (2)
CE-40	Cruise Engineering	On	Cruise Engineering	Off (4)	--	--	--	Off	--	--
MN-12	TCM Engineering	Off	--	On	TCM (3) Engineering	S-Band	1200	Record	TCM Engineering	7,200 (2)
EC-40	Encounter Engineering	On	Encounter Engineering	Off (4)	--	--	--	Off	--	--
FD-40	Low Rate FDS Memory Readout	Off	--	On	FDS Memory Data	S-Band (5)	40	Off	--	--
CC-40	Low Rate CCS Memory Readout	Off	--	On	CCS Memroy Data	S-Band (5)	40	Off	--	--
AA-40	Low Rate AACS Memory Readout	Off	--	On	AACS Memroy Data and AACS Engineering Telemetry	S-Band (5)	40	Off	--	--
FD-12	High Rate FDS Memory Readout	Off	--	On	FDS Memory Data	S or X Band	1200	Off	--	--
CC-12	High Rate CCS Memory Readout	Off	--	On	CCS Memory Data	S or X Band	1200	Off	--	--
AA-12	High Rate AACS Memory Readout	Off	--	On	AACS Memory Data and Non-AACS Engineering Telemetry	S or X Band	1200	Off	--	--

Table 6-3. Cruise Telemetry Modes

Mode Mnemonic	Function	Low Rated Channel Configuration		High Rate Channel Configuration				Tape Recorder Configuration		
		Status	Channel Contents	Status	Channel Contents	Carrier Frequency	Rate (bps)	Status	Record/Playback Contents	Rate (bps)
CR-1	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	2560	Off	--	--
CR-2	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	1280	Off	--	--
CR-3	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	640	Off	--	--
CR-4	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	320	Off	--	--
CR-5	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	160	Off	--	--
CR-6	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	80	Off	--	--
CR-7 (6)	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	40	Off	--	--
CR-8 (6)	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	20	Off	--	--
CR-9 (8)	Cruise Science and Engineering	Off	--	On	Cruise Science and Engineering	S-Band	10	Off	--	--

Notes: (1) No data is routed to the recorder in this mode.

(2) Engineering data acquisition rate is 1200 bps.

(3) Real time acquisition of TCM data not required.

(4) Transmission via high rate channel is possible.

(5) Transmission at X-band is possible but unlikely for these modes.

Note: (8) Mode intended for post-Saturn operations. Formats and software will not be developed until extended mission approved is given.

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

May 4, 1977

Voyager-SEQ-77-0014

TO: J. Allen

FROM: R. Riggs

SUBJECT: High-Rate Telemetry DSN Lock-Up Times

This IOM is to request that measurements of the DSN telemetry system lock-up time be made under the conditions described below.

The reason for this request is that some concern has been expressed over the arbitrary 5 min. allowance for lock-up time with a change in data rates. It is recognized that 5 min. may be reasonable assuming a total string lock is required (total string comprising RCV, SDA, SSA and MCD). However, changing data rates only, maintaining a constant carrier, subcarrier and mod index, the lock-up time should be in the order of a few seconds (for high data rates). The Jupiter encounter sequences will show many changes between 115.2 kbps and 7.2 kbps data. A 5 minute lock-up time for each change is a significant percentage of the total time for each data rate.

"Typical" E_b/N_o's for the 64 m stations at X-band during Jupiter Encounter are:

TRAJ	115.2KB	7.2KB
JSX	3.5 dB	15.5 dB
JST	6.2 dB	18.2 dB

Since it is clear that we have ample dB's at 7.2 kbps and are marginal at 115.2 kbps, the system should be optimally configured for the 115.2 kbps.

The test procedure should follow these general guidelines:

a) Data pattern should be PN on the 360 KHz subcarrier at 80° mod index - for both data rates.

b) Receiver bandwidth (BLK IV) may be either 10 or 30 Hz BLK III bandwidth should be 12 Hz.

c) SDA bandwidth and data rate selector optimum for the 115.2 KB data.

d) With the system configured and in-lock on the 115.2 KB data at an E_b/N_o described above, change data rate to 7.2 kbps, initialize SSA and MCD to the 7.2 KB rate within one second of the data rate change time. Do not change SDA data rate settings until after the system is in lock on the 7.2 KB data. Record time from change time to system in lock time as evidenced by both in-lock indication and good data.

e) With the system configured and in-lock on the 7.2 KB data at an E_b/N_o described above, change data rate to 115.2 KB and initialize SSA and MCD to 115.2 KB within one second of data rate change time. Since the SNR will be marginal on the 115.2 KB data, the SDA settings should be changed to the 230.4 KS rate a "few" seconds before the data rate change is made. Record time as described in (d).

If the above guidelines are followed, the system will be operating (for a few seconds) on the 7.2 KBPS data with the SDA configured for the 115.2 KBPS data. This leads to two further questions:

a) How much extra system degradation is incurred with the SDA incorrectly configured?

b) While changing the data rate select switches on the SDA, are bit errors induced in the system?

One further comment; the actual test configuration should be representative of the X-band, 64 m configuration at Jupiter encounters. Thus, the choice of BLK III or BLK IV RCV/SDA combination is at your discretion.

RR:slr

cc: R. Allis
J. Carraway
N. Fanelli
E. Franzgrote
W. Jensen
D. Linick
C. Timpe

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

376D-77-138

16 May 1977

TO: E. Nipper

FROM: R. Amorose/N. Fanelli NF

SUBJECT: Test to determine telemetry lock-up time

REFERENCE: IOM# Voyager-SEQ-77-0014, to J. Allen from R. Riggs, Subject: High-Rate Telemetry DSN Lock-Up Times

The Voyager Project has requested that DSN Operations provide high rate telemetry lock-up time for the Jupiter encounter period. R. Riggs has outlined the conditions for the desired test in a memo to J. Allen.

Please set up and run the lock-up test per instructions in the referenced IOM and provide us with a report of the test results. Since the lock-up time is required for sequence planning, every effort should be made to run this test as early as possible.

RA:NF:ch

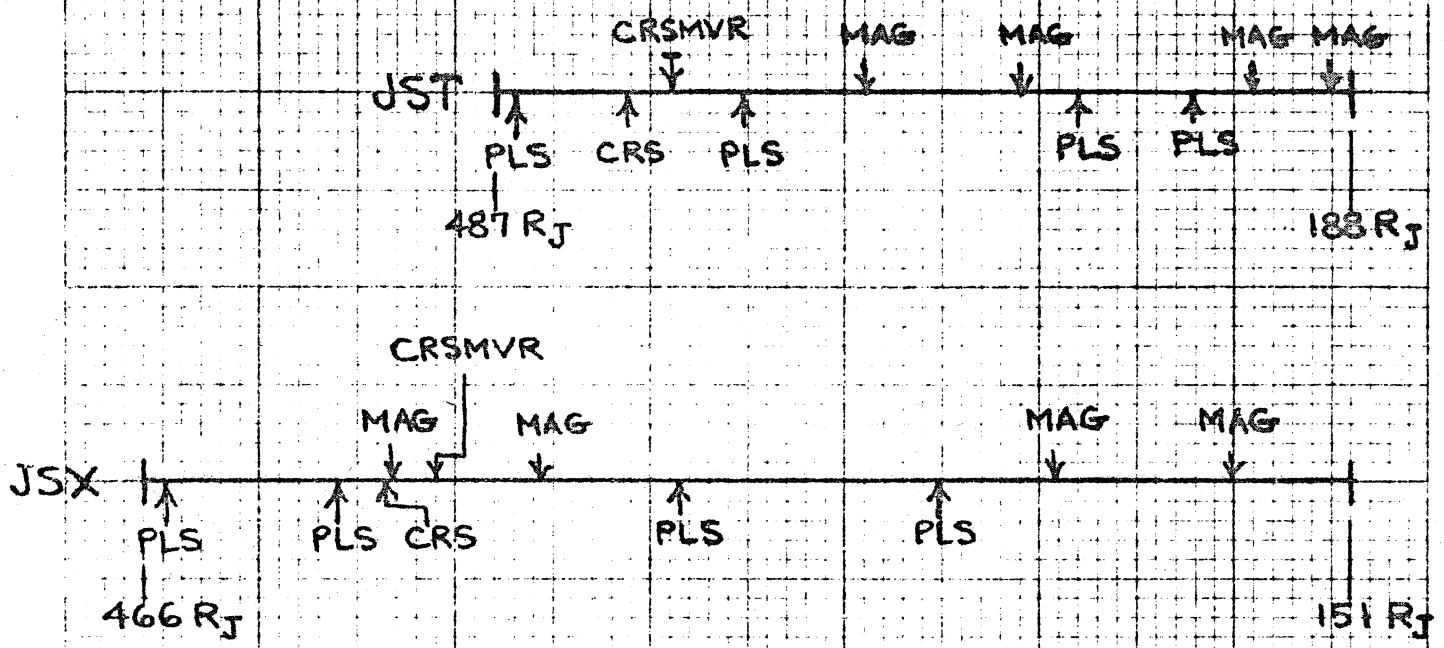
Attachment

cc: J. Allen
R. Allis
F. Borncamp
J. Carraway
E. Franzgrote
G. Gould
J. Hatch
W. Jensen
D. Linick
R. Morris
S. Reed
R. Rey
R. Riggs
T. Taylor
C. Timpe

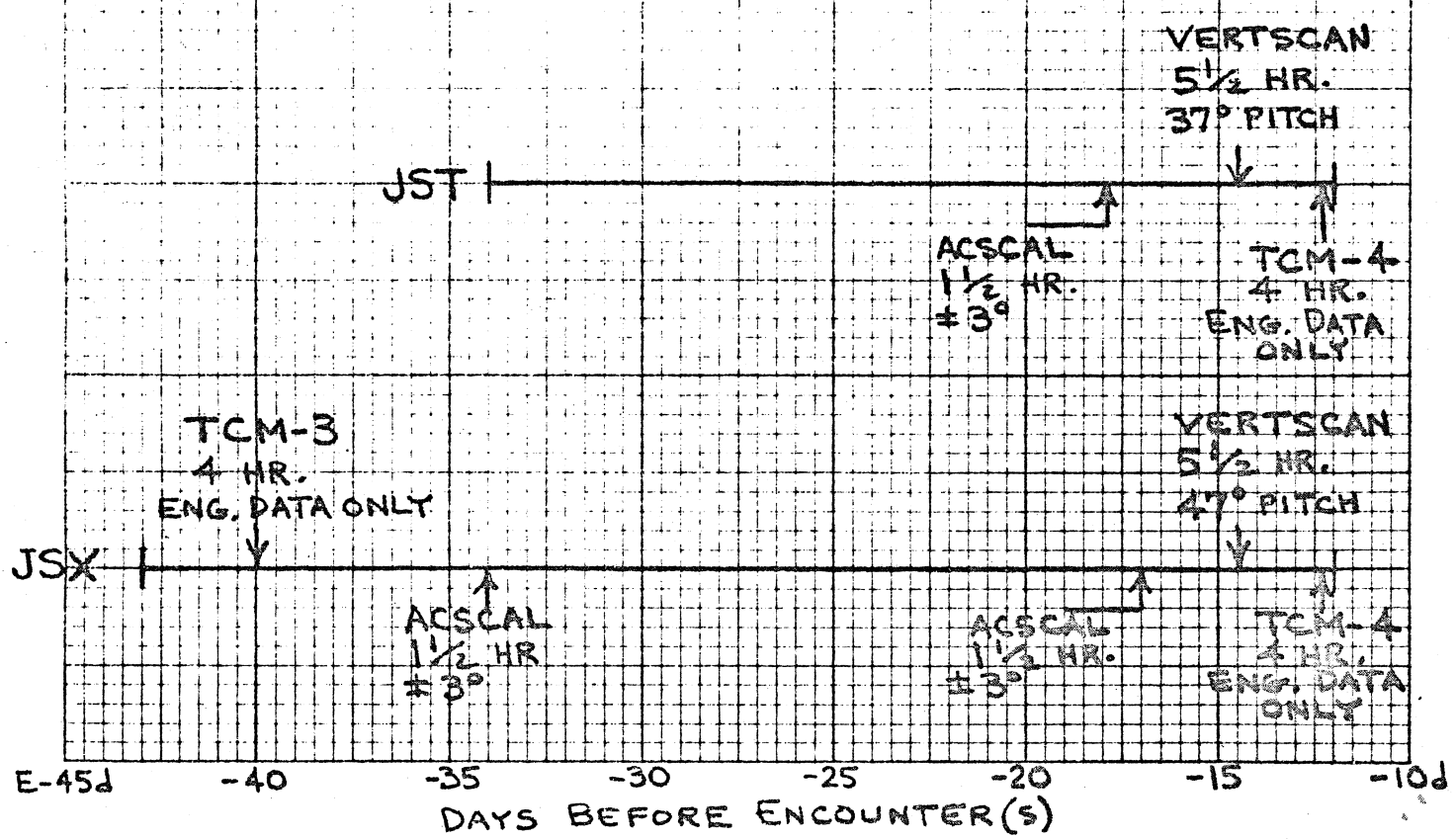
23 May 77

FE1 CALIBRATION ACTIVITIES; CRS, LECP, MAG, PLS

NOTE: PESCAL (LECP, MAG, Engineering) done each day
CRSMVR = 4 YAW TURNS, 4 ROLL TURNS



FE1 S/C MANEUVERS, EXCLUDING CRSMVR



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JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

31 May 1977

Mr. Nan Lal
Goddard Space Flight Center
Code 664
Greenbelt, Maryland 20771

Dear Mr. Lal:

Enclosed is an engineering EDR containing valid decom maps in relationship to the engineering data. The first two records on the tape are decom maps followed by 34 records of engineering data. The second map should be used.

This tape is for verification purposes, to validate the relationship of the decom map to the engineering data using your software programs.

Due to processing, the external tape label is 004060, the internal label is 010370.

If any questions or problems arise, please contact me at X7981, or Ray Stagner at X7928.

Sincerely,

Deedie Street

Deedie Street

DS:jvc
Enclosure (1)
cc: C. Dickman (GSFC)
W. Fawcett
E. Franzgrote
T. Garrard
J. Haas
J. Long
E. Stone (CIT)
B. Teagarden (GSFC)
J. Trainor (GSFC)
J. Tupman
Dr. R.E. Vogt (CIT)

Telephone 354-4321 *Twx 213-449-2451*

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

17 June 1977

Dr. Rochus E. Vogt
California Institute of Technology
Physics, Mathematics, and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

During the SSG on 8 June 1977 I presented a proposed launch day activity training plan. The plan as proposed is currently being implemented. The enclosed copy of the plan provides a schedule of activities for the 13, 14, and 15 of July.

Also enclosed for your review are the following documents:

(1) P.D. 618-686, Volume IX
"CRS Data Flow, Inputs and Outputs"

(2) IOM 296-76-GDH-099
"MJS77 Detail Requirements for CRS Data Processing and Display During System Test"

(3) P.D. 618-205, 3-280B
"Functional Requirement MJS77 Flight Equipment Telemetry Measurements and Data Formats"

Telephone 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

In the interest of saving time, I suggest you review only those parts of the 3-280B document applicable to the CRS instrument. In addition, a review of the 4-2021 (CRS-FR) section of 618-205 might be useful.

Sincerely,

Jack Tupman

J.R. Tupman

JRT:jvc

Enclosures (4)

cc: C.J. Coppock
A. Cummings (CIT) with enclosures
C. Dickman (GSFC)
W. Fawcett
E. Franzgrote
T. Garrard (CIT) with enclosures
N. Gehrels (CIT)
J. Haas
R. Hungerford
N. Lal (GSFC)
J. Long
J. Povlis
E. Stone
B. Teagarden (GSFC)
J. Trainor (GSFC)
H. Woo
C. Yeates

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

30 June 1977

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics, and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

This letter is to confirm and provide additional information on the activities scheduled for the week of 11 July 1977. Attachment 1 provides a list of activities for July 13, 14, and 15. Attachment 2 provides an agenda for the July 13, 9:00 am meeting.

Attachment 3 is the list of names provided at the ETR-SSG defining anticipated personnel to support launch activities at JPL. It is assumed most of these people will participate in the meetings on the 13 and 14 of July in order to better understand the launch environment at JPL. Additional participation is solicited where you feel it advantageous or appropriate. Even those planning to be at ETR during launch could gain some benefit from these meetings.

Telephone 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

My secretary, Joan Van Cleef, will be contacting you by July 8th to determine attendance at the meetings.

Sincerely,

Jack Tupman

J.R. Tupman

JRT:jvc

Enclosures (3)

cc:
C.J. Coppock
A. Cummings (CIT)
C. Dickman (GSFC)
W. Fawcett
E. Franzgrote
T. Garrard (CIT)
N. Gehrels (CIT)
J. Haas
R. Hungerford
N. Lal (GSFC)
J. Long
J. Povlis (CIT)
E. Stone (CIT)
J. Trainor (GSFC)
H. Woo
C. Yeates
R. Laeser

160448
16CC10

LIST OF ACTIVITIES

JULY 13, 14, 15

JULY 13

Voyager Launch Period Science Data Progessing & Data Monitor Capabilities	9:00 am 264-461
Lunch	12:00 Noon
Review of activities for July 14. Discussion on individual experiment processors and displays where appropriate.	1:00 pm 264-461

JULY 14

Hands-on operation and analysis of TTS displayed data.	8:00 am 264-536

JULY 15

Remote NORT Implementation discussions between involved Principal Investigator implementators and JPL implementators. Bit by bit definitions involving hardware and software configurations.	9:00 am 264-525

AGENDA

- PROJECT ORGANIZATION AND FACILITIES AS RELATED TO GENERAL SCIENCE P.I.'S
- COMMUNICATION CAPABILITIES
- TELEMETRY DATA
  - * FLOW
  - * PROCESSING
  - * CONTROL
  - * AVAILABILITY
- LAUNCH PROFILE AND DATA DISPLAY STRATEGY

PRINCIPAL INVESTIGATOR SUPPORT
AT JPL
FOR VOYAGER LAUNCH ACTIVITIES

EXPERIMENT	INDIVIDUAL	ORGANIZATION
PRA	J. Warwick	University of Colorado
	J. Pearce	University of Colorado
	R. Peltzer	University of Colorado
	A. Riddle	University of Colorado
	T. Root	University of Colorado
PLS	H. Bridge	MIT
	J. Sullivan	MIT
	A. Lazarus	MIT
	R. McNutt	MIT
	C. Yeates	JPL
LECP	S.M. Krimigis	APL
	E.P. Keath	APL
	T.P. Armstrong	University of Kansas
	L.J. Lanzerotti	Bell Laboratories
MAG	K.W. Behannon	GSFC
	R.L. Lepping (Alt.)	GSFC
IRIS	F. Chapman	Texas Instruments
	M. Rhodes (Alt.)	Texas Instruments
	S. Kuman (E.R.)	JPL
	J. Taylor	JPL

EXPERIMENT	INDIVIDUAL	ORGANIZATION
UVS	A.L. Broadfoot	Kitt Peak
	I. Gordon	Kitt Peak
	D.E. Shemansky	Kitt Peak
	B.R. Sandel	Kitt Peak
	J. Ajello (E.R.)	JPL
	T. Thompson (E.R.)	PSI, SAI
PPS	C. Lillie	University of Colorado
	C. Hord	University of Colorado
	D. Coffeen	Institute for Space Studies
	K. Pang	JPL
	G. McNutt	University of Colorado
PWS	R.R. Shaw	University of Iowa
	W.S. Kurth	University of Iowa
	D.A. Gurnett	University of Iowa
	F.L. Scarf	TRW
	S.L. Remington	University of Iowa
CRS	A. Cummings	CIT
	R. Vogt	CIT
	T. Garrard	CIT
	N. Gehrels	CIT

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R. Zieger	264-537

PI

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T. Armstrong	Univ. of Kanas
H. S. Bridge	MIT
A. L. Broadfoot	Kitt Peak
N. Feng	MIT
T. Garrard	CIT
G. Gloeckler	Univ. of MD.
I. Gordon	Kitt Peak
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J. Sullivan	MIT
B. Teagarden	GSFC
J. Trainor	GSFC
E. Tums	Univ. of MD.
R. E. Vogt	CIT
J. W. Warwick	Univ. of Colo

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

30 June 1977

Voyager-SDT-77-0021

TO: Distribution

FROM: D.J. Street djs

SUBJECT: Release of PD618-306, MJS77 Experiment Data Record Format Specifications, Change 2, Dated 06-30-77
Incorporation of changes to satisfy SCP #A-185

The attached pages listed below are to update the subject document.

Replace the following pages with the attached Change 2 pages:

Concurrence Page	9-49
9-36	9-50
9-37	9-51
9-39	9-103
9-40	9-104
9-48	

DJS:jvc

Attachments (11)

618-306 REV. B CHANGE 2

MARINER JUPITER/SATURN 1977

EXPERIMENT DATA RECORD FORMAT

SPECIFICATION

PD 618-306 06-30-77

PREPARED BY: D.J. STREET

APPROVED BY: J.R. TUPMAN
MJS77 Data Record System

CONCURRED BY: A. SACKS
MDR/EDR Generation Subsystem
Cognizant Engineer

JET PROPULSION LABORATORY

California Institute of Technology

Pasadena, California

WORD \ BIT	31 … 16	031 … 16		0
1	PLS CMD WRD MF 10	PLS CMD WRD MF20	PLS CMD WRD MF30	PLS CMD WRD MF40
3	PLS CMD WRD MF 50	PLS CMD WRD MF 60	PLS CMD WRD MF 70	SPARE
5	MAG CMD WRD MF 7	MAG CMD WRD MF 8	MAG CMD WRD MF 17	MAG CMD WRD MF 18
7	MAG CMD WRD MF 27	MAG CMD WRD MF 28	MAG CMD WRD MF 37	MAG CMD WRD MF 38
9	MAG CMD WRD MF 47	MAG CMD WRD MF 48	MAG CMD WRD MF 57	MAG CMD WRD MF 58
11	MAG CMD WRD MF 67	MAG CMD WRD MF 68	SPARE	
13	PLS STATUS WRD	Spare	Spare	Spare
15	STARTING SCE TIME IN MILLISECONDS OF A DAY		Spare	Spare
17	Spare	Spare	MAG STATUS WRD MF 1	MAG STATUS WRD MF 2
19	MAG STATUS WRD MF 16	MAG STATUS WRD MF 17	MAG STATUS WRD MF 31	MAG STATUS WRD MF 32
21	MAG STATUS WRD MF 46	MAG STATUS WRD MF 47	MAG STATUS WRD MF 61	MAG STATUS WRD MF 62

For Minor Frames 1-75 (Segment 1)

Figure 9.4-5. MAG Science Record Subheader Format CR-6

WORD \ BIT	31 … 16	031 … 16	16 … 0	0
1	PLS CMD WRD MF 80	PLS CMD WRD MF 90	PLS CMD WRD MF 100	PLS CMD WRD MF 110
3	PLS CMD WRD MF 120	PLS CMD WRD MF 130	PLS CMD WRD MF 140	PLS CMD WRD MF 150
5	MAG CMD WRD MF 77	MAG CMD WRD MF 78	MAG CMD WRD MF 87	MAG CMD WRD MF 88
7	MAG CMD WRD MF 97	MAG CMD WRD MF 98	MAG CMD WRD MF 107	MAG CMD WRD MF 108
9	MAG CMD WRD MF 117	MAG CMD WRD MF 118	MAG CMD WRD MF 127	MAG CMD WRD MF 128
11	MAG CMD WRD MF 137	MAG CMD WRD MF 138	MAG CMD WRD MF 147	MAG CMD WRD MF 148
13	PLS STATUS WRD	Spare	Spare	Spare
15	STARTING SCE TIME IN MILLISECONDS OF A DAY		Spare	Spare
17	Spare	Spare	MAG STATUS WRD MF 76	MAG STATUS WRD MF 77
19	MAG STATUS WRD MF 91	MAG STATUS WRD MF92	MAG STATUS WRD MF 106	MAG STATUS WRD MF 107
21	MAG STATUS WRD MF 121	MAG STATUS WRD MF 1 22	MAG STATUS WRD MF 136	MAG STATUS WRD MF 137

For Minor Frames 76-150 (Segment 2)

Figure 9.4-5. MAG Science Record Subheader Format CR-6

Table 9.4-1. MAG Science Record Subheader Block CR-6

Item	Word	Bits	Description	
			Segment 1	
1	1	31-16	PLS CMD WRD	MF 10
2	1	15-0	PLS CMD WRD	MF 20
3	2	31-16	PLS CMD WRD	MF 30
4	2	15-0	PLS CMD WRD	MF 40
5	3	31-16	PLS CMD WRD	MF 50
6	3	15-0	PLS CMD WRD	MF 60
7	4	31-16	PLS CMD WRD	MF 70
8	4	15-0	SPARE	
9	5	31-16	MAG CMD WRD	MF 7
10	5	15-0	MAG CMD WRD	MF 8
11	6	31-16	MAG CMD WRD	MF 17
12	6	15-0	MAG CMD WRD	MF 18
13	7	31-16	MAG CMD WRD	MF 27
14	7	15-0	MAG CMD WRD	MF 28
15	8	31-16	MAG CMD WRD	MF 37
16	8	15-0	MAG CMD WRD	MF 38
17	9	31-16	MAG CMD WRD	MF 47
18	9	15-0	MAG CMD WRD	MF 48
19	10	31-16	MAG CMD WRD	MF 57
20	10	15-0	MAG CMD WRD	MF 58
21	11	31-16	MAG CMD WRD	MF 67
22	11	15-0	MAG CMD WRD	MF 68
23	12	31-0	SPARE	
25	13	31-16	PLS STATUS WORD BITS 31-22 SPARE BITS 21-17 INTEGRATION TIME FLAGS BIT MF BIT MF BIT MF 21 15 19 45 17 75 20 30 18 60 BIT 16 = DATA AVAILABILITY FLAG 0 = NO DATA 1 = DATA PRESENT	
26	13	15-0	SPARE	
27	14	31-0	SPARE	
28	15	31-0	STARTING SCE TIME IN ms OF DAY	
30	16, 17	31-0	SPARE	
32	18	31-16	MAG STATUS WORD	MF 1
33	18	15-0	MAG STATUS WORD	MF 2
34	19	31-16	MAG STATUS WORD	MF 16
35	19	15-0	MAG STATUS WORD	MF 17
36	20	31-16	MAG STATUS WORD	MF 31
37	20	15-0	MAG STATUS WORD	MF 32
38	21	31-16	MAG STATUS WORD	MF 46
39	21	15-0	MAG STATUS WORD	MF 47
40	22	31-16	MAG STATUS WORD	MF 61
41	22	15-0	MAG STATUS WORD	MF 62

Table 9.4-1. MAG Science Record Subheader Block (Continued) CR-6

Item	Word	Bits	Description	
			Segment 2	
42	1	31-16	PLS CMD WORD	MF 80
43	1	15-0	PLS CMD WORD	MF 90
44	2	31-16	PLS CMD WORD	MF 100
45	2	15-0	PLS CMD WORD	MF 110
96	3	31-16	PLS CMD WORD	MF 120
47	3	15-0	PLS CMD WORD	MF 130
48	4	31-16	PLS CMD WORD	MF 140
49	4	15-0	PLS CMD WORD	MF 150
50	5	31-16	MAG CMD WORD	MF 77
51	5	15-0	MAG CMD WORD	MF 78
52	6	31-16	MAG CMD WORD	MF 87
53	6	15-0	MAG CMD WORD	MF 88
54	7	31-16	MAG CMD WORD	MF 97
55	7	15-0	MAG CMD WORD	MF 98
56	8	31-16	MAG CMD WORD	MF 107
57	8	15-0	MAG CMD WORD	MF 108
58	9	31-16	MAG CMD WORD	MF 117
59	9	15-0	MAG CMD WORD	MF 118
60	10	31-16	MAG CMD WORD	MF 127
61	10	15-0	MAG CMD WORD	MF 128
62	11	31-16	MAG CMD WORD	MF 137
63	11	15-0	MAG CMD WORD	MF 138
64	12	31-16	MAG CMD WORD	MF 147
65	12	15-0	MAG CMD WORD	MF 148
66	13	31-16	PLS STATUS WORD BITS 31-22 SPARE BITS 21-17 INTEGRATION TIME FLAGS BIT MF BIT MF BIT MF 21 90 19 120 17 150 20 105 18 135 BIT 16 = DATA AVAILABILITY FLAG 0 = NO DATA 1 = DATA PRESENT	
67	13	15-0	SPARE	
68	14	31-0	SPARE	
69	15	31-0	STARTING SCE TIME IN ms OF DAY	
70	16, 17	31-0	SPARE	
71	18	31-16	MAG STATUS WORD	MF 76
72	18	15-0	MAG STATUS WORD	MF 77
73	19	31-16	MAG STATUS WORD	MF 91
74	19	15-0	MAG STATUS WORD	MF 92
75	20	31-16	MAG STATUS WORD	MF 106
76	20	15-0	MAG STATUS WORD	MF 107
77	21	31-16	MAG STATUS WORD	MF 121
78	21	15-0	MAG STATUS WORD	MF 122
79	22	31-16	MAG STATUS WORD	MF 136
80	22	15-0	MAG STATUS WORD	MF 137

WORD \ BIT	31 — 16	031 — 16		0
1	PLS CMD WRD MF 10	PLS CMD WRD MF 20	PLS CMD WRD MF 30	PLS CMD WRD MF 40
3	PLS CMD WRD MF 50	PLS CMD WRD MF 60	PLS CMD WRD MF 70	SPARE
5	MAG CMD WRD MF 7	MAG CMD WRD MF 8	MAG CMD WRD MF 17	MAG CMD WRD MF 18
7	MAG CMD WRD MF 27	MAG CMD WRD MF 28	MAG CMD WRD MF 37	MAG CMD WRD MF 38
9	MAG CMD WRD MF 47	MAG CMD WRD MF 48	MAG CMD WRD MF 57	MAG CMD WRD MF 58
11	MAG CMD WRD MF 67	MAG CMD WRD MF 68	SPARE	
13	PLS STATUS WRD	Spare	Spare	Spare
15	STARTING SCE TIME IN MILLISECONDS OF A DAY		Spare	Spare
17	Spare	Spare	MAG STATUS WRD MF 1	MAG STATUS WRD MF 2
19	MAG STATUS WRD MF 16	MAG STATUS WRD MF 17	MAG STATUS WRD MF 31	MAG STATUS WRD MF 32
21	MAG STATUS WRD MF 46	MAG STATUS WRD MF 47	MAG STATUS WRD MF 61	MAG STATUS WRD MF 62

For Minor Frames 1-75 (Segment 1)

Figure 9.5-4. PLS Science Record Subheader Format CR-6

WORD \ BIT	31 — 16	031 — 16	16 — 0	0
1	PLS CMD WRD MF 80	PLS CMD WRD MF 90	PLS CMD WRD MF 100	PLS CMD WRD MF 110
3	PLS CMD WRD MF 120	PLS CMD WRD MF 130	PLS CMD WRD MF 140	PLS CMD WRD MF 150
5	MAG CMD WRD MF 77	MAG CMD WRD MF 78	MAG CMD WRD MF 87	MAG CMD WRD MF 88
7	MAG CMD WRD MF 97	MAG CMD WRD MF 98	MAG CMD WRD MF 107	MAG CMD WRD MF 108
9	MAG CMD WRD MF 117	MAG CMD WRD MF 118	MAG CMD WRD MF 127	MAG CMD WRD MF 128
11	MAG CMD WRD MF 137	MAG CMD WRD MF 138	MAG CMD WRD MF 147	MAG CMD WRD MF 148
13	PLS STATUS WRD	Spare	Spare	Spare
15	STARTING SCE TIME IN MILLISECONDS OF A DAY		Spare	Spare
17	Spare	Spare	MAG STATUS WRD MF 76	MAG STATUS WRD MF 77
19	MAG STATUS WRD MF 91	MAG STATUS WRD MF 92	MAG STATUS WRD MF 106	MAG STATUS WRD MF 107
21	MAG STATUS WRD MF 121	MAG STATUS WRD MF 122	MAG STATUS WRD MF 136	MAG STATUS WRD MF 137

For Minor Frames 76-150 (Segment 2)

Figure 9.5-4 PLS Science Record Subheader Format CR-6

Table 9.5-1. PLS Science Record Subheader CR-6

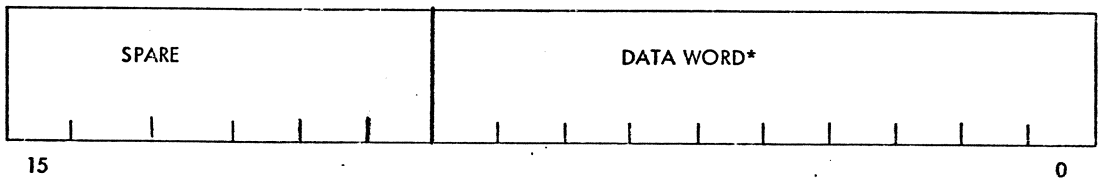
Item	Word	Bits	Description	
			Segment 1	
1	1	31-16	PLS CMD WRD	MF 10
2	1	15-0	PLS CMD WRD	MF 20
3	2	31-16	PLS CMD WRD	MF 30
4	2	15-0	PLS CMD WRD	MF 40
5	3	31-16	PLS CMD WRD	MF 50
6	3	15-0	PLS CMD WRD	MF 60
7	4	31-16	PLS CMD WRD	MF 70
8	4	15-0	SPARE	
9	5	31-16	MAG CMD WRD	MF 7
10	5	15-0	MAG CMD WRD	MF 8
11	6	31-16	MAG CMD WRD	MF 17
12	6	15-0	MAG CMD WRD	MF 18
13	7	31-16	MAG CMD WRD	MF 27
14	7	15-0	MAG CMD WRD	MF 28
15	8	31-16	MAG CMD WRD	MF 37
16	8	15-0	MAG CMD WRD	MF 38
17	9	31-16	MAG CMD WRD	MF 47
18	9	15-0	MAG CMD WRD	MF 48
19	10	31-16	MAG CMD WRD	MF 57
20	10	15-0	MAG CMD WRD	MF 58
21	11	31-16	MAG CMD WRD	MF 67
22	11	15-0	MAG CMD WRD	MF 68
23	12	31-0	SPARE	
25	13	31-16	PLS STATUS WORD BITS 31-22 SPARE BITS 21-17 INTEGRATION TIME FLAGS BIT / MF: 21 / 15; 20 / 30; BIT / MF: 19 / 45; 18 / 60; BIT / MF: 17 / 75 BIT 16 = DATA AVAILABILITY FLAG 0 = NO DATA 1 = DATA PRESENT	
26	13	15-0	SPARE	
27	14	31-0	SPARE	
28	15	31-0	STARTING SCE TIME IN ms OF DAY	
30	16, 17	31-0	SPARE	
34	18	31-16		MF 1
35	18	15-0	MAG STATUS WORD	MF 2
34	19	31-16	MAG STATUS WORD	MF 16
35	19	15-0	MAG STATUS WORD	MF 17
36	20	31-16	MAG STATUS WORD	MF 31
37	20	15-0	MAG STATUS WORD	MF 32
38	21	31-16	MAG STATUS WORD	MF 46
39	21	15-0	MAG STATUS WORD	MF 47
40	22	31-16	MAG STATUS WORD	MF 61
41	22	15-0	MAG STATUS WORD	MF 62
			Segment 2	
42	1	31-16	PLS CMD WORD	MF 80

Table 9.5-1. PLS Science Record Subheader (Continued) CR-6

Item	Word	Bits	Description	
43	1	15-0	PLS CMD WORD	MF 90
44	2	31-16	PLS CMD WORD	MF 100
45	2	15-0	PLS CMD WORD	MF 110
46	3	31-16	PLS CMD WORD	MF 120
47	3	15-0	PLS CMD WORD	MF 130
48	4	31-16	PLS CMD WORD	MF 140
49	4	15-0	PLS CMD WORD	MF 150
50	5	31-16	MAG CMD WORD	MF 77
51	5	15-0	MAG CMD WORD	MF 78
52	6	31-16	MAG CMD WORD	MF 87
53	6	15-0	MAG CMD WORD	MF 88
54	7	31-16	MAG CMD WORD	MF 97
55	7	15-0	MAG CMD WORD	MF 98
56	8	31-16	MAG CMD WORD	MF 107
57	8	15-0	MAG CMD WORD	MF 108
58	9	31-16	MAG CMD WORD	MF 117
59	9	15-0	MAG CMD WORD	MF 118
60	10	31-16	MAG CMD WORD	MF 127
61	10	15-0	MAG CMD WORD	MF 128
62	11	31-16	MAG CMD WORD	MF 137
63	11	15-0	MAG CMD WORD	MF 138
64	12	31-16	MAG CMD WORD	MF 147
65	12	15-0	MAG CMD WORD	MF 148
66	13	31-16	PLS STATUS WORD BITS 31-22 SPARE BITS 21-17 INTEGRATION TIME FLAGS BIT MF BIT MF BIT MF 21 90 19 120 17 150 20 105 18 135 BIT 16 = DATA AVAILABILITY FLAG 0 = NO DATA 1 = DATA PRESENT	
67	13	15-0	SPARE	
68	14	31-0	SPARE	
69	15	31-0	STARTING SCE TIME IN ms OF DAY	
70	16, 17	31-0	SPARE	
71	18	31-16	MAG STATUS WORD	MF 76
72	18	15-0	MAG STATUS WORD	MF 77
73	19	31-16	MAG STATUS WORD	MF 91
74	19	15-0	MAG STATUS WORD	MF 92
75	20	31-16	MAG STATUS WORD	MF 106
76	20	15-0	MAG STATUS WORD	MF 107
77	21	31-16	MAG STATUS WORD	MF 121
78	21	15-0	MAG STATUS WORD	MF 122
79	22	31-16	MAG STATUS WORD	MF 136
80	22	15-0	MAG STATUS WORD	MF 137

WORD	BITS 31 — 16	0 — 31	16	
1	UVS CMD WRD #1 MF 9	UVS CMD WRD #2 MF 19	UVS CMD WRD #3 MF 29	UVS CMD WRD #4 MF 39
3	UVS CMD WRD #5 MF 49	UVS CMD WRD #6 MF 59	UVS CMD WRD #7 MF 69	UVS CMD WRD #8 MF 79
5	UVS CMD WRD #9 MF 89	UVS CMD WRD #10 MF 99	UVS CMD WRD #11 MF 109	UVS CMD WRD #12 MF 119
7	UVS CMD WRD #13 MF 129	UVS CMD WRD #14 MF 139	UVS CMD WRD #15 MF 149	UVS Status Word

Fig. 9.9-3. UVS Science Record Subheader. CR-6



*Zeros will be used as filler.

Fig. 9.9- 4 UVS Science Data Word.

Table 9.9-1. UVS science record subheader block table CR-6

Item	Word	Bits	Description
1	1	31-16	UVS CMD WRD # 1 MF 9
2	1	15-0	UVS CMD WRD # 2 MF 19
3	2	31-16	UVS CMD WRD # 3 MF 29
4	2	15-0	UVS CMD WRD # 4 MF 39
5	3	31-16	UVS CMD WRD # 5 MF 49
6	3	15-0	UVS CMD WRD # 6 MF 59
7	4	31-16	UVS CMD WRD # 7 MF 69
8	4	15-0	UVS CMD WRD # 8 MF 79
9	5	31-16	UVS CMD WRD # 9 MF 89
10	5	15-0	UVS CMD WRD #10 MF 99
11	6	31-16	UVS CMD WRD #11 MF 109
12	6	15-0	UVS CMD WRD #12 MF 119
13	7	31-16	UVS CMD WRD #13 MF 129
14	7	15-0	UVS CMD WRD #14 MF 139
15	8	31-16	UVS CMD WRD #15 MF 149
16	8	15-0	UVS Status Word Bits 15-11 Spare 10-01 UVS Readout Flags Bit MF 10 15 9 30 8 45 7 60 6 75 5 90 4 105 3 120 2 135 1 150 Bit 0 Data Availability Flag 0 = No Data 1 = Data Present

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JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

30 June 1977

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics, and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

This letter is to confirm and provide additional information on the activities scheduled for the week of 11 July 1977. Attachment 1 provides a list of activities for July 13, 14, and 15. Attachment 2 provides an agenda for the July 13, 9:00 am meeting.

Attachment 3 is the list of names provided at the ETR-SSG defining anticipated personnel to support launch activities at JPL. It is assumed most of these people will participate in the meetings on the 13 and 14 of July in order to better understand the launch environment at JPL. Additional participation is solicited where you feel it advantageous or appropriate. Even those planning to be at ETR during launch could gain some benefit from these meetings.

Telephone 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

My secretary, Joan Van Cleef, will be contacting you by July 8th to determine attendance at the meetings.

Sincerely,

Jack Tupman

J.R. Tupman

JRT:jvc

Enclosures (3)

cc:
C.J. Coppock
A. Cummings (CIT)
C. Dickman (GSFC)
W. Fawcett
E. Franzgrote
T. Garrard (CIT)
N. Gehrels (CIT)
J. Haas
R. Hungerford
N. Lal (GSFC)
J. Long
J. Povlis (CIT)
E. Stone (CIT)
J. Trainor (GSFC)
H. Woo
C. Yeates
R. Laeser

LIST OF ACTIVITIES

JULY 13, 14, 15

JULY 13

Voyager Launch Period Science Data Progessing & Data Monitor Capabilities	9:00 am 264-461
Lunch	12:00 Noon
Review of activities for July 14. Discussion on individual experiment processors and displays where appropriate.	1:00 pm 264-461

JULY 14

Hands-on operation and analysis of TTS displayed data.	8:00 am 264-536

JULY 15

Remote NORT Implementation discussions between involved Principal Investigator implementators and JPL implementators. Bit by bit definitions involving hardware and software configurations.	9:00 am 264-525

AGENDA

- PROJECT ORGANIZATION AND FACILITIES AS RELATED TO GENERAL SCIENCE P.I.'S
- COMMUNICATION CAPABILITIES
- TELEMETRY DATA
  - * FLOW
  - * PROCESSING
  - * CONTROL
  - * AVAILABILITY
- LAUNCH PROFILE AND DATA DISPLAY STRATEGY

PRINCIPAL INVESTIGATOR SUPPORT AT JPL FOR VOYAGER LAUNCH ACTIVITIES

EXPERIMENT	INDIVIDUAL	ORGANIZATION
PRA	J. Warwick	University of Colorado
	J. Pearce	University of Colorado
	R. Peltzer	University of Colorado
	A. Riddle	University of Colorado
	T. Root	University of Colorado
PLS	H. Bridge	MIT
	J. Sullivan	MIT
	A. Lazarus	MIT
	R. McNutt	MIT
	C. Yeates	JPL
LECP	S.M. Krimigis	APL
	E.P. Keath	APL
	T.P. Armstrong	University of Kansas
	L.J. Lanzerotti	Bell Laboratories
MAG	K.W. Behannon	GSFC
	R.L. Lepping (Alt.)	GSFC
IRIS	F. Chapman	Texas Instruments
	M. Rhodes (Alt.)	Texas Instruments
	S. Kuman (E.R.)	JPL
	J. Taylor	JPL

EXPERIMENT	INDIVIDUAL	ORGANIZATION
UVS	A.L. Broadfoot	Kitt Peak
	I. Gordon	Kitt Peak
	D.E. Shemansky	Kitt Peak
	B.R. Sandel	Kitt Peak
	J. Ajello (E.R.)	JPL
	T. Thompson (E.R.)	PSI, SAI
PPS	C. Lillie	University of Colorado
	C. Hord	University of Colorado
	D. Coffeen	Institute for Space Studies
	K. Pang	JPL
	G. McNutt	University of Colorado
PWS	R.R. Shaw	University of Iowa
	W.S. Kurth	University of Iowa
	D.A. Gurnett	University of Iowa
	F.L. Scarf	TRW
	S.L. Remington	University of Iowa
CRS	A. Cummings	CIT
	R. Vogt	CIT
	T. Garrard	CIT
	N. Gehrels	CIT

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JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

20 July 1977

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics, and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

The attached IOM (Voyager-SDT-77-0025) is intended to document the changes requested in the processing resulting from our discussions during the Voyager TTS Data System Tutorial at JPL on 14 July 1977. Anomalies observed in the processing have been submitted as TTS Failure Reports. The anomalies will be corrected, but not prior to launch. Most will be corrected for the December 1977 software delivery and the rest for the March 1978 software delivery. Changes requested in the processing are being submitted as Software Change Proposals. Following approval by the TTS Change Control Board, implementation will follow as quickly as schedules permit, but will most probably not be completed until the March 1978 software delivery.

Telephone 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

Please review those portions of the attached document concerning the CRS instrument. If any questions arise or if any significant points have been omitted, please contact C.J. Coppock at (213) 354-7873 (FTS 792-7873) or Ron Hungerford at (213) 354 7849 (FTS 792-7849).

Sincerely,

Harry Woo

Harry Woo

HW:jvc
Enclosure (1)
cc: A. Cummings (CIT)
W. Fawcett
E. Franzgrote
T. Garrard (CIT)
N. Gehrels (CIT)
J. Haas
N. Lal (GSFC)
A. Lane
J. Long
J. Povlis (CIT)
E. Stone
J. Trainor (GSFC)
C. Yeates
J. Tupman

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

20 July 1977

Voyager-SDT-77-0025

TO: J.R. Tupman

FROM: H. Woo HW

Subject: Problems and/or Changes to TTS Science Processing Noted in Voyager Data System Tutorial of 14 July 1977

The following is a list of problems and/or requested changes resulting from the Voyager Data System Tutorial at JPL on 14 July 1977. Actual problems or failures in the processing have been submitted as MCCC Failure Reports (FR's). Processing modifications have been submitted to the TTS Change Control Board as Software Change Proposals (SCP's).

CRS

1. Top of form on printer does not work.
2. CRS PHA Single Display Message (M3-396) requires state label change due to instrument modification (G3 to G3*).

LECP

1. Printer top of form does not work.
2. Two titles in LECP CMD/STATUS 4 (M3-460, M3-461) require change:

   a. TPAC ⟶ L/L CON

   b. IDL ⟶ DDL

PLS

1. TTS processing for CR-1 does not match new FDS output definition for PLS.
2. Put blank lines back in M displays (M3-631).
3. Increase spacing between blocks of four words in M displays (M3-631).
4. Modify PLS DISC (M3-632) to check mode sequence as well as gain.
5. Change titles in status and command messages M3-622 (E1 status), M3-624 (L CMD), M3-625 (L status), M3-627 (E2 status), M3-629 (M CMD), and M3-630 (M status) as follows:
   a. Under AGN: $1 \longrightarrow 2$
      $10 \longrightarrow 20$
   b. Under IGN (change to ICAP):
      $1 \longrightarrow 1.15$
      $7 \longrightarrow 0.15$
   c. Under DCRT (change to PLSIDC)
6. Delete M-Start word label from L mode display of M3-638.
7. Formats of electron flux, temperature, and G_{jn} peak channel should be exponential (E).
8. M-start words in M3-618 should start at word 1.

MAG

1. Printer top of form does not work.
2. New EU coefficients and coupling constants need to be entered.
3. Errors in field locations of printer output of MAG Mode 1A (M3-670).

4. Calibration polarity (bit 5) of MAG status 2 should be ANDed with the result of ORing bits 1, 1, 2, and 4; the result being used to determine whether a change has occurred in the status of the polarity.

PPS

1. Printer top of form does not work
2. Overflow counter is now 20 bits (was 21), 20th bit is set on overflow. Algorithum has been supplied to "predict" output when in overflow condition (M3-606).
3. Status bits outside of filter and analyzer wheel position should be output in binary in full frame display (M3-606) without state titles.
4. PPS engineering should be output as a block following science display output.
5. Time tags in full frame display (M3-606) for OC-1 should be changed to reflect predicted times instead of being constant for the 60 data samples of one MF.

UVS

1. Printer top of form does not work
2. Engineering output seems to be missing from some telemetry modes.
3. Delete channels 127, 128 from summation in UVS Mode 3 (M3-644).

HW:jvc
cc: Distribution

DISTRIBUTION

H. Bridge	MIT
A.L. Broadfoot	Kitt Peak
K. Burden	264-536
C.J. Coppock	264-536
J. Farrar	233-208
E. Franzgrote	85-8
J. Haas	233-208
R. Hanel	GSFC
R. Hungerford	264-536
S.M. Krimigis	Johns Hopkins
C. Lillie	University of Colorado
W. McDougal	183-801
H. Mertz	ETR
N.F. Ness	GSFC
J. Otte	ETR
F.L. Scarf	TRW
R. Schutz	ETR
P. Theisinger	233-208
N. Toy	ETR
J. Tupman	264-536
R.E. Vogt	CIT
J. Warwick	University of Colorado
J. Watkins	233-201

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CRUISE MODE VOYAGER CELESTIAL COORDINATES
User's Guide

Program Purpose

The purpose of this program is to print the celestial coordinates of Voyager, the Earth, and Jupiter in degrees during cruise mode. One set of coordinates per day is required on the printed output. In addition, the time of readout and the range from Voyager to the Sun in a.u. are printed.

Program Location

The source program is located in the data set 'SBMJS.SEDR.SOURCE'.
The member name containing the source is 'SBMJS.SEDR.SOURCE(CRUISE)'
The JCL required to build an object module is in 'SBMJS.SEDR.SOURCE(BUILD)'
The JCL required to run the program is in 'SBMJS.LIB.CNTL(SEDR)'
The data set that contains the object program is 'SBMJS.SEDR.LOAD'

Input Required

There are two inputs required for this program. First, the volume serial number must be specified in the JCL. Second, there is one data card to be read in by the program.

Column Range	Type	Default	Description
1	I*4	--	1 → Voyager 1 data to be processed 2 → Voyager 2 data to be processed <1 → invalid input data >2 → invalid input data

Example:

In this example the volume serial number is S1077A and Voyager 1 data is to be processed.

```
// EXEC LOADER,PROG=LINKER,PARM='EP=MAIN,SIZE=140K',REGION=150K
//FT12F001 DD UNIT=(6250,,DEFER),LABEL=(1,NL),VOL=SER=S1077A,
// DCB=(RECFM=VBS,LRECL=1516,BLKSIZE=32760,DEN=4,BUFNO=1,OPTCD=B)
1
// EXEC NOTIFYTS
```

Output Generated

The output generated at the beginning of every run is

```
VOYAGER _ CELESTIAL COORDINATES OF S/C, EARTH AND JUPITER
PRINT RECORDS AT LEAST 2.4E 01 HOURS APART
```

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NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

DATA CENTER

June 6, 1980

Reply to Attn of: JDAP

Dr. R. E. Vogt
Physics Department, 103-33
California Institute of Technology
Pasadena, CA 91125

Dear Dr. Vogt:

I am working for NASA Headquarters on the Jupiter Data Analysis Program (JDAP). The program, as you know, is well into the first round of proposals. There is a concern at NASA Headquarters about flight mission experiment data availability, especially for the Voyager science experiments, because this data is essential for the JDAP analysis program.

Charles H. Stembridge, in his letter to the Voyager SSG, dated January 17, 1980, pointed out that the reduced data for each experiment should be in the National Space Science Data Center (NSSDC) by April 1, 1980. In the event this could not be accomplished, a plan was to be worked out with the data center so that the reduced data will be available by October 1, 1980. At this time I need to know that plan. In the event that your plan is not yet completed I am enclosing a bulletin from NSSDC which has guidelines for the reduced data content and the accompanying documentation needed. If you have not contacted NSSDC about your reduced data input, you should do so as soon as possible. Mr. Robert Vostray of NSSDC will work with you. His number is on the last page of the bulletin.

The plan is a necessary part of the material needed for the evaluation of the JDAP proposals. An accurate catalog of the available reduced data is required in order to determine the support that should be extended to any of the scientists for analysis.

Please have your plan to me by Wednesday, June 25, 1980. If there are any questions, in the interest of time, please contact me by phone. My number is listed below.

Sincerely,

R. H. Steinbacher

R. H. Steinbacher
JDAP Data Coordinator
Jet Propulsion Laboratory, M.S. 180-401
4800 Oak Grove Drive
Pasadena, CA 91103
Phone: (213) 354-5076
FTS 792-5076

Enclosure

cc: M. A. Mitz, HQ, SL-4
C. H. Stembridge, JPL

RECEIVED
JUN 09 1980
CHAIRMAN'S OFFICE

GUIDELINES FOR SUBMITTING DATA TO THE NATIONAL SPACE SCIENCE DATA CENTER

GENERAL PHILOSOPHY

The mission of the National Space Science Data Center (NSSDC) is to disseminate space science data for further analysis beyond that provided by the principal investigators (PIs) or team leaders (TLs) and their coworkers. Consequently, the NSSDC is responsible for the acquisition, organization, storage, retrieval, announcement, and distribution of scientific data obtained mainly from satellites and spacecraft. Any scientist may acquire data from the NSSDC and use them in further studies, either alone or in conjunction with data from ground-based or spacecraft experiments. With the responsibility for archiving data is the concomitant responsibility for distributing the documentation necessary to make those data usable. Since the group most knowledgeable about a particular experiment and its data is the PI or TL and his coworkers, and since the NSSDC cannot possibly supply the qualified personnel needed to write this documentation comprehensively, it is the responsibility of the PI or TL to provide the essential documentation. The NSSDC will support this effort by defining what is needed, by reviewing what is provided, and by reproducing and distributing the resulting documentation with the data. For a high-use data set, the NSSDC may publish the documentation as a Data Users Note; for a low-use data set, the NSSDC may distribute a Xerox, microfilm, or microfiche copy of the documentation.

TYPES OF DATA

In general, there are two types of data collected by the NSSDC. These are "reduced" data and "analyzed" data. A third type, which the NSSDC does not collect, is "raw" data, or data as they are returned from an experiment. The transformation from raw data to reduced data is generally too expensive and too detailed to merit repeating the PI's or team's work.

Reduced data usually are prepared as the first step of any analysis effort. The reduction of raw data typically includes compaction, editing, correction, and merging operations. Temperature, voltage, gain change, offsets, and other known instrument corrections should be incorporated in the reduction process. Further, data from unusably noisy periods and periods of questionable instrument performance should be eliminated. The resulting reduced data should contain all the basic usable information obtained from the experiment as functions of time (or another appropriate variable), along with the position, attitude,

and equipment performance information needed to analyze the data in an independent fashion. Since time-averaging reduces the temporal resolution of an experiment, time-averaged data normally are not considered as reduced data. Hopefully, by preserving the maximum amount of useful information, other scientists can make the proper interpretation of the instrument responses for their specific purposes.

Analyzed data are defined as those final data which the PI or TL designates as the best to display the scientific results of an experiment. It may be time-averaged data and may incorporate model-dependent assumptions with which other scientists might not fully agree. This type of data includes charts, graphs, photographs, and tables which are the results of data processing and analysis techniques applied to the reduced data. Examples of these data appear in the publications by the PI or TL and his coworkers, but the total amount of analyzed data is usually too large to be published in its entirety. In many cases, these unpublished data are the most useful and appropriate as inputs to other studies.

PHYSICAL FORM OF THE DATA: MAGNETIC TAPE

The NSSDC can handle virtually any standard 1/2 inch magnetic tape (7 track or 9 track) generated on almost any computer, although it may be possible to eliminate unnecessary processing by generating tapes using formats which are more compatible for digital data exchange. For example, tapes using extremely large physical records, or on which many separate items are packed into a single word, often prove difficult or expensive to handle. It is important that the overall transfer operation be as economical as possible. Three modes for transferring digital data on magnetic tape into the NSSDC are available:

A. The PI or TL may copy his data onto tapes supplied by the NSSDC using his own computer facilities, or

B. The PI or TL may lend his tapes to the NSSDC, where they will be copied using NSSDC computer facilities (the NSSDC will arrange with the PI or TL for shipping the tapes both ways), or

C. The PI or TL may give the NSSDC the backup copy of the data.

When the tape data are transferred to the NSSDC, it is imperative that the tape format accompany the data. This format must include both the tape characteristics (e.g., physical record size, logical record size, number of end-of-file indicators, total number of records, density, number of tracks, etc.) and the data description (i.e., the scientific meaning of each word, byte, or bit).

PHYSICAL FORM OF THE DATA: HARDCOPY

When graphs, charts, tables, and other hardcopy are presented to the NSSDC, they will normally be microfilmed in order to conserve storage space and to facilitate both copying and reproduction. Because of the black and white limitations of standard microfilm processing, color coding of lines or symbols should be avoided. To insure good reproduction, the original copy should be submitted. If the PI or TL wishes to retain this original copy, it will be returned after microfilming. A courtesy copy of the microfilm will be provided at the PI's or TL's request. In the event that the original cannot be made available, NSSDC personnel should help select the best reproducible copy. Since individual sections of a data set are often requested, adequate labeling of all items will assure proper identification and acknowledgement.

PHYSICAL FORM OF THE DATA: PHOTOGRAPHIC FILM

In the case of microfilm or photographic data, the most useful generation (usually the generation closest to the original) should be provided as the working copy. When the original is archived at the NSSDC, the NSSDC should be able to produce a working copy from it. Two modes are available for generating the NSSDC copy of photographic material:

A. A copy may be made by the PI or TL and his coworkers on their equipment using film supplied by the NSSDC, or

B. The NSSDC may copy and return originals sent to the NSSDC by the PI or TL.

Note that silver copies are essential for archival purposes. Kalvar, Diazo, and other nonsilver copying techniques usually will not suffice as they lack sufficient dynamic range to provide usable photographic copies even though they work reasonably well on microfilm reader/printers. Diazo will be accepted only if it is the only form available; most other nonsilver copies are not acceptable under any conditions. If special processing beyond the capabilities of the NSSDC is required, a reasonable approach is for the PI or TL to provide a minimum of two copies to the NSSDC. One copy will become the permanent archival copy, and the other(s) will be available for loan to other scientists. Individual frames, whether loose or on roll film, should be marked and ordered so that the frames can be filed and indexed properly.

CONTENT OF DOCUMENTATION

The documentation provided for a particular data set should be oriented towards the second generation of users (i.e., those users who are scientifically competent, who understand the

terminology, but who have never seen the data before). Therefore, the documentation must include:

A. A summary of the rationale and motivation for doing the experiment, including a description of the phenomena measured,

B. A description of the instrument or measuring device, with particular emphasis placed upon describing those parts of the instrument which affect the data and their interpretation,

C. A clear and complete description of the data (If magnetic tapes are submitted, the scientific meaning of each bit, byte, and word must be described, as well as the characteristics of the tape itself, i.e.,
   1. physical record size,
   2. logical record size,
   3. number of files and end-of-file marks,
   4. number of records per file,
   5. number of tracks [7 or 9],
   6. density [556, 800, or 1600 bpi], and
   7. total number of records or time period covered for each individual tape.

   Note that the job control language [JCL] statement used to generate the tape does not describe all of the above items.),

D. A catalog of the data (e.g., for a set of photographs, a frame index listing when each frame was taken, what was in view, coordinates, exposure times, aperture settings, etc.; in some cases this catalog may be on tape [see item C above] and constitute a separate data set),

E. A discussion of the calibration procedures used, the resulting calibration of the instrument (both on a relative and an absolute basis), and its corresponding uncertainty, as best it can be determined,

F. A discussion of the scientific areas where the data are known to be excellent, as well as a discussion of scientific areas where the data are known to be invalid or misleading,

G. A discussion of any unusual or important events which may have occurred during the operational life of the experiment which may affect the resulting data and their interpretation (e.g., "During the period of May-July 1968, the spacecraft orientation caused the experiment to overheat, and as a result the data from channels 1, 2, and 3 were too noisy

to be useful."),

H. A discussion of the known anomalies in the data, with attention drawn to examples of each (e.g., "Occasionally, for periods of some tens of minutes, detector B showed count rates of some 100,000 counts/second [see Figure 16]. This effect is believed due to a flaw in the detector or in the electronics. Such data should be disregarded."),

I. A discussion of the overall data reduction procedure used to generate the data set, with attention being placed on arbitrary decisions (reversible or otherwise) which affect the resulting data (e.g., "Nonlinear, dead-time corrections, shown on Figures 7-10, were applied to the data."),

J. A thorough discussion of any procedures which the next user should follow in his reduction/analysis of the data (this section may take the form of a "cookbook" if necessary to insure that identical procedures will be followed by all users),

K. References to particularly useful published results and descriptions, especially those publications which explain aspects of the experiment which affect the data (the NSSDC sends to all data requesters a bibliography of all known papers resulting from the experiment in question), and

L. Any other known conditions in the data, or affecting the data, which should be brought to the attention of any user.

In many cases, not all of the above items will be appropriate. The determination of which items are needed is subjective and must be decided on a case-by-case basis by the PI or TL and the NSSDC acquisition scientist handling that experiment.

As mentioned in item K above, the NSSDC sends, along with the data and documentation, a bibliography of papers related to the experiment and data. In order to help the NSSDC maintain its bibliographic file, it is most helpful if the PIs or TLs and their coworkers add the NSSDC to their mailing list for copies of all papers deriving from data which the NSSDC will eventually archive. Copies of any bibliographies, such as those periodically sent to project offices, are also very useful.

FORM OF DOCUMENTATION

In the ideal case, the needed documentation is simply a

reprint of the documentation used day-to-day by the PI or TL and his coworkers in their data reduction and analysis. Quite often, however, such documentation has never been organized formally into a single paper. Preferably, then, someone under the PI's or TL's direction would gather all the needed information, write up the missing pieces, organize it into a cohesive research report (or Data Users Handbook), circulate it through the PI or TL and his coworkers for review, and submit it to the NSSDC. In such a case, the NSSDC acquisition scientist assigned to that experiment would review the document from the perspective of the next generation of users (i.e., from the viewpoint of someone not familiar with the experiment, its data, and the pitfalls therein) and recommend any necessary changes to the author.

In the worst case, the NSSDC is willing to accept a collection of research reports, published papers, and informal memoranda which, when taken in toto, contain the needed information in some reasonable context. Such an information packet would then be microfilmed at the NSSDC, and the microfilm or microfiche would be distributed with the data. Again, the assigned NSSDC acquisition scientist would review the content and organization of the supplied documentation.

The NSSDC does not need journal quality writing in its documentation. Conversely, the documentation should not be handwritten, first-draft material. Typewritten, double-spaced, second-draft copy usually will suffice. Clarity, correctness, and completeness are of paramount importance; aesthetically pleasing printing and pictures, while nice, are not required.

The NSSDC maintains an information file containing lists of everyone who requested data from the NSSDC. This file is indexed by experiment and data set. Should any documentation for any data set need to be amended, a revised version would be sent to all persons who had received those data. Future data requesters would receive the revised documentation. Inevitably, errors will occur in some documentation, and new information will be discovered about instrumental behavior as analysis efforts progress; the NSSDC is equipped to transmit such changes to parties who should be informed.

PROCEDURE FOR SUBMITTING DATA TO THE NSSDC

The interface between the NSSDC, per se, and the PI or TL is the NSSDC acquisition scientist assigned to the experiment in question. This person can be contacted at:

National Space Science Data Center
Acquisition and Analysis Branch
Code 601.1
Goddard Space Flight Center
Greenbelt, Maryland 20771 (U.S.A.)
Telephone: (301) 982-2354

This person will coordinate the submission of data with other relevant personnel at the NSSDC and will review the supporting documentation. The NSSDC should be contacted if there are any questions.

Because of the variety of experiments conducted in space science, the specific formats of the collected data will vary widely. For those data sets where data processing has been completed, a selection will be made from what is available by consultation between the PI and the assigned NSSDC acquisition scientist. For planned experiments, it is hoped that contact between the NSSDC and the PIs or TLs can be established during the formulation of the prime data analysis plan. In this way the NSSDC can identify which phase of the data processing generates the data which should be retained for the NSSDC. In the case of a NASA-funded PI or team whose contract calls for the deposition of data in the NSSDC, the prime analysis plan, including plans for submitting the data and its documentation to the NSSDC, should be coordinated with the NSSDC, and the budget for the experiment should reflect an awareness of these guidelines.

Normally data are acquired by the NSSDC after the completion of the prime analysis period (i.e., that period when the PI or team has exclusive use and control over the availability of the data). For experiments flown on spacecraft, this prime analysis period is longer than that for experiments performed on other vehicles. For NASA-funded investigations, the typical time interval has been 2 years between the launch of the spacecraft and the submission of the first 6-month block of data to the NSSDC. Each succeeding 6-month block of data then follows at 6-month intervals. Delays in this schedule can result from difficulties encountered in spacecraft operation, orbit determination, or data processing. Data from experiments sponsored by other agencies or groups are acquired on a schedule consistent with agreements with the NSSDC. Note that data can be submitted to the NSSDC at an earlier time, if convenient, and can be declared proprietary. In this case, the data are not distributed without authorization from the PI or TL. When the proprietary period expires, the data are then distributed to any requester.

Each data set is individually assigned an NSSDC identification number by the NSSDC. When corresponding with the NSSDC or when sending data to the NSSDC, unless this NSSDC-ID is known, it is imperative that the data be referred to, or identified by:

A. The PI's or TL's name,
B. The name of the spacecraft flown on, and
C. The name of the experiment.

When data are sent to the NSSDC this identification must be included so that the appropriate acquisition scientist can be notified.

CONCLUDING REMARKS

The effectiveness of the NSSDC in performing its service to the space science community depends upon the communication between, and the working relationships established with, each PI or TL and his coworkers. These guidelines are intended to form the basis for determining how data and their accompanying documentation should be prepared for submission to the NSSDC. Should questions arise, the staff at the NSSDC will be happy to answer them and to assist each experimenter in submitting his data. Furthermore, it is hoped that the various experimenters will avail themselves of the services which the NSSDC offers to all members of the space science community. The NSSDC stands ready both to supply requesters with space science data and to relieve the PIs or teams of the burden of supplying copies of their data to fellow scientists who request them.

REVISED: September 1975

Robert Vostray
NSSDC
(301) 344-8310 or 8105
FTS 344-8310

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8/2/80

Voyager-1 Data Center Activity.

There still remain periods w/ faulty counts.

To identify these we need to map

4/11 — 4/13

5/5 — 6/10

We already have other rates, but LA did not ~~come~~ appear because of coincidence condition.

For the above 2 periods we only need to list 15 min average rate LA requiring

$\underbrace{L1 \cdot L2 \cdot \neg 5L \cdot \neg 14}$

A more specific list.

4/11 — 4/13

5/5 — 5/6

5/9 — 5/10

5/13 — 5/17

5/19 — 5/20

5/21 — 6/7

8/2/80

Vayager - 2

Need 15 min averages for LIST only

IAS

IBSp

IBSe

LA L1. L2. ¬L4. ¬SL

LA1

IPENH

IPENL

for the periods

77/8/25	18:00	-	77/8/26	00:00
- 78/4/24	0:00	-	78/4/24	06:00
78/4/25	0:00	-	78/4/25	06:00
78/4/26	6:00	-	78/4/27	00:00
~~78/4/30~~				
78/5/8	0:00	-	5/8	06:00
5/10	6:00	-	5/10	12:00
5/14	0:00	-	5/14	6:00
5/16	12:00	-	5/16	18:00
6/1	12:00	-	6/1	18:00
6/7	00:00	-	6/7	06:00
6/10	00:00	-	6/15	00:00
6/19	00:00	-	6/23	00:00
7/27	00:00	-	7/27	08:00

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Please run the Voyager-2 Time history plots using the following scheme:

Frame 1 $10^{-4} - 10^{2}$

Proton LA3
2.00 - 6.00

Proton IA2
4.00 - 6.00

IA3
6.00 - 10.00

Frame 2 $10^{-6} - 10^{0}$

Alpha
IA2
4.0 - 6.0

IA3
6.0 - 10.0

Frame 3 $10^{-6} - 10^{0}$

Proton
IA3
10.00 - 28.00
IB3
28.00 - 50.00
50.00 - 70.00

Frame 4 $10^{-6} - 10^{0}$

ALPHA
IA3
10.0 - 28.0

IB3
28.0 - 50.0
50.0 - 70.0

Frame 5 $10^{-1} - 10^{4}$

LA_1

Frame 6 $10^{-5} - 10^{-1}$

3.4 - 8.8 MeV electron

Frame 7 $10^{-1} - 10^{1}$

IPENH

IPENL

Voyager - 2

8/25/77	22:45	
4/25/78	2:30	
4/25/78	20:45	
4/26	0:00	
4/26	11:45	
4/26	21:30	
4/26	23:00	
5/8	3:45	
5/10	10:15	
5/14	4:30	
5/14	4:45	
5/16	16:30	
6/1	16:45	
6/6	17:45	
6/7	2:30	
6/10	0:15	
6/10	2:00	
		6:30
6/10	8:15	
6/10	8:30	
		9:15
		18:15
6/11	2:30	
6/11	5:30	
6/11	14:30	
6/11	18:30	
6/12	0:30	

6/12	4:15	
	9:45	— 8:00
	10:15	
	13:30	
	14:00	
	19:30	
6/13	1:15	
	2:30	
	6:30	— 7:15
	8:30	
	11:00	
	12:45	
	16:15	
	17:30	— 18:00
	19:15	
6/14	17:30	
6/19	1:45	
6/20	6:00	
6/22	0:30	

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JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

2 April 1981

Dr. R.E. Vogt
California Institute of Technology
Physics, Mathematics and Astronomy
220-47 Downs
Pasadena, California 91125

Dear Dr. Vogt:

Attached is a rough draft of the proposed EDR format for Cruise 7 (CR-7) telemetry data. This attachment describes only the CRS subheader and science data block. The standard EDR header will be used. The CR-7 format is intended to closely follow that for CR-5 with modifications made to allow for the different timing and data cycling in CR-7.

Please have your cognizant personnel review this material by April 17. I will be contacting each group by telephone prior to that date to discuss any questions that may arise.

Please feel free to call me at FTS 792-7840.

Sincerely,

David Wagner

David Wagner

DW:pp
Encl.
cc: A. Cummings
R. Collins
H. Domchick
E. Franzgrote
T. Garrard
N. Gehrels
N. Lal
J. Povlis
C. Stembridge
E. Stone
T. Trainor
A. Sacks
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Telephone (213) 354-4321 *Twx 910-588-3269* *Twx 910-588-3294*

SECTION VII

EXPERIMENT DATA RECORD DESCRIPTIONS

10.1 COSMIC RAY SCIENCE (CRS) EXPERIMENT

The CRS EDR physical science record corresponds to a 19.2 minute measurement period. Any data not present within a given physical record is filled with zeroes.

One logical record corresponds to five physical records for a 96 minute instrument cycle. Each physical record contains data from 24 minor frames. The formats which follow are applicable to the CR-7 data mode.

The science/physical record structure is shown in Figure 10.1-1 and the physical magnetic tape organization is shown in Figure 10.1-2. Figure 10.1-3 defines the structure and contents of the CRS science record subheader. Figure 10.1-4 defines the structure and contents of the CRS science data block. The standard EDR science header is defined for CR-7 in Appendix C.

FIGURE 10.1-1

CRS EDR PHYSICAL SCIENCE TAPE RECORDS

STANDARD HEADER (60-WORDS	SUBHEADER (6-WORDS)	DATA BLOCK (432-WORDS)	24 MF 19.2 MIN 498-WORDS

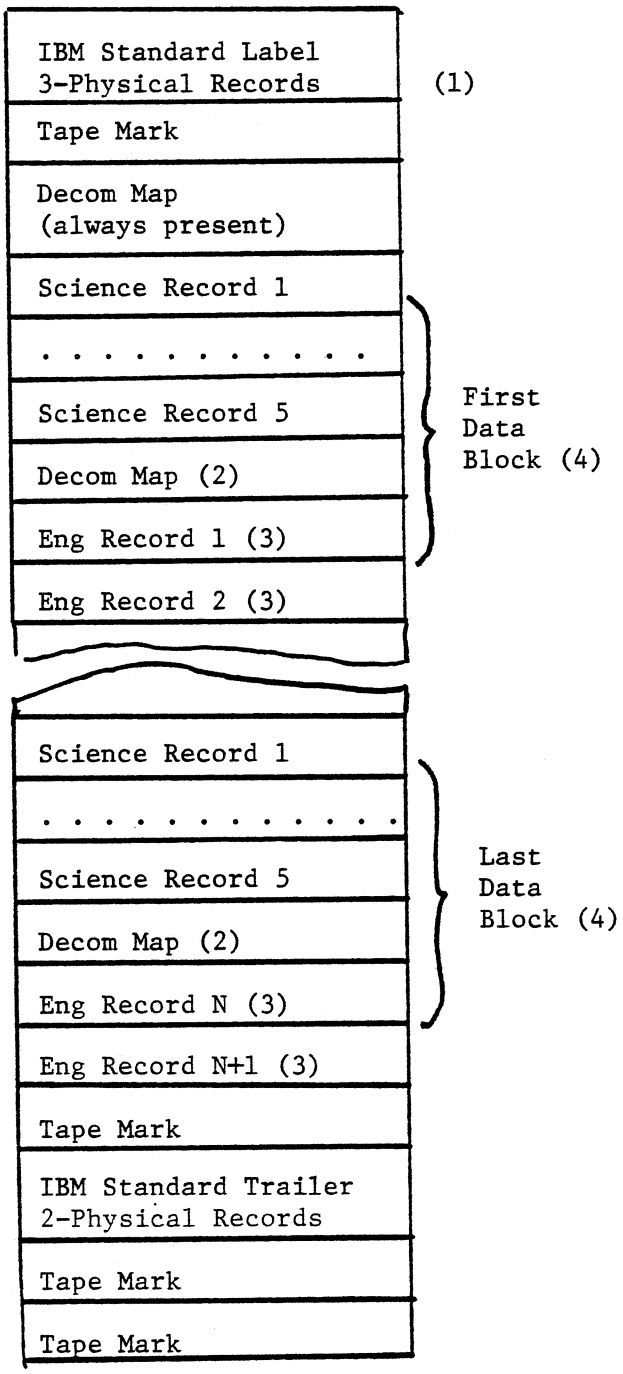
All words 32-bits.

One physical record contains a standard EDR header followed by a science subheader followed by a science data block. One physical record contains all the data from 24 telemetry frames relevant to the experiment.

One physical record contains one fifth of an instrument cycle.

FIGURE 10.1-2

CRS PHYSICAL TAPE ORGANIZATION



NOTES

(1) Lines imply IRG

(2) Present only if Decom Map changes during process interval.

(3) Any Eng Record can be preceeded by a Decom Map.

(4) Data Blocks and Eng Records may contain up to 48-minutes of data. TTS Record flushes will result in less data being written into these Data Blocks.

FIGURE 10.1-3

CRS SCIENCE SUBHEADER FORMAT

EDR WORD	BITS			
	31 16	15 0	31 16	15 0
1	CRS CMD MF 6	CRS STAT MF 3	CRS STAT MF 7	CRS CMD MF 14
3	CRS STAT MF11	CRS STAT MF 15	CRS CMD MF 22	CRS STAT MF 19
5	CRS STAT MF 23	SPARE	SPARE	

MF 1 is in: SCT 60 = 0,24,48 when MOD 2^{16} = EVEN

SCT 60 = 12,36 when MOD 2^{16} = ODD

Total Block length is 6 EDR (32-bit) words (24 MF; 9 stutus/CMD words; 19.2 minutes).

15	0
CMS COMMAND WORD	

15 12	11 0
ZERO	CRS STATUS WORD

FIGURE 10.1-4

CRS EDR SCIENCE DATA BLOCK FORMAT

MF	EDR WORD	BITS 31 16	15 0	31 16	15 0
1	1	P1	P2	P3	P4
1	3	R1	P5	P6	P7
1	5	P8	P9	P10	P11
1	7	P12	R2	P13	P14
1	9	P15	P16	P17	P18
1	11	P19	P20	R3	P21
1	13	P22	P23	P24	P25
1	15	P26	P27	P28	R4
1	17	P29	P30	P31	P32

This structure is repeated 23 more times for a total of 432 EDR (32-bit) words (24 MF; 864 data words, 19.2 minutes).

MF 1 is in: SCT 60 = 0,24,48 when MOD 2^{16} = EVEN

SCT 60 = 12,36 when MOD 2^{16} = ODD

P = PHA word R = Rate data

5 12	11 0
ZERO	CRS Data Word

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JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

27 May 1981

VGR-SDT-81-045

TO: Distribution

FROM: S.M. Spohn

SUBJECT: Explanation of the Mission Events Log Terminology

It has come to the attention of the Science Data Team that certain aspects of the Mission Events Log are not fully understood. We are providing the following in the hope it will clarify some of the more common notations in the Log. If any questions remain, please contact any of us in the Science Data Team.

SMS:pp
Encl.

Distribution

M. Acuna
A. Broadfoot
H. Domchick
R. Hanel
W. Kurth
J. O'Donnell
J. Pearce
F. Scarf
K. Simmons
J. Sullivan
V. Young
J. Rhoads
W. Hodges
SDT
DMT

EXPLANATION OF THE MISSION EVENTS LOG TERMINOLOGY

The following provides a brief explanation of the Voyager Mission Events Log. The Log maintains a daily record of the Voyager spacecraft and Deep Space Network activities and/or anomalies. It is divided into two sections, the Telemetry Chart and the Science Events Log.

The Telemetry chart visually depicts Deep Space Station (DSS) coverage, digital tape recorder (DTR) activity and telemetry reception at JPL with associated mode, band ERT and FDSC. The left side of the Chart also indicates planned and anomalous data gaps. Planned gaps are denoted with the word "Gap" and are non-recoverable (unless recorded on board the spacecraft as depicted by the center DTR portion of the Chart). Unplanned data gaps are denoted with asterisks to reflect whether the data is merely not received at JPL in real time or non-recoverable. The TTS processing change notation on the DSN side of the Chart is more fully explained in the Science Events Log section below.

The Science Events Log is a detailed, handwritten log reflecting the events of the day. It denotes exact DSS equipment lock times (both in and out of lock), science and DTR activities, spacecraft configuration and comments concerning mission events and problems. The log is divided into 10 fields that reflect the above events. The following provides information that may prove useful when using the log:

FIELD 1

GMT/ERT - refers to Earth Received Time of all spacecraft events (with the exception of real time ground commands where the time refers to ground transmission time).

FIELD 2

DSS - indicates the Deep Space Station to which line comments refer.

(GC) - indicates a real time ground command. The command is explained in the "Comments" field. The "GMT/ERT" time is the ground transmission time of the command.

FIELD 3

AOS/RIL - indicates the first reception of a signal from the spacecraft at any one DSS. RIL means Receiver in Lock and AOS indicates Acquisition of Signal. AOS does not indicate actual data reception but only reception of a carrier signal.

FIELD 4

LOS/EOT - indicates the planned loss of the spacecraft signal at any one DSS. LOS means Loss of Signal and EOT refers to the End of Planned Tracking by the DSS.

FIELD 5

RIL - indicates Receivers Back in Lock at the noted DSS after a loss of data during a planned tracking period. Only the carrier signal is being received at this point unless TLM in lock.

FIELD 6

ROL - indicates Receivers Out of Lock during a planned tracking period. No data recovery is possible and there is no contact with the spacecraft signal.

FIELD 7

TLM Out of Lock - indicates telemetry is out of lock and no data recovery is possible. The DSS is still receiving a carrier signal from the spacecraft unless ROL.

FIELD 8

TLM in Lock - indicates science and/or engineering data is being received, processed, recorded and transmitted to JPL from the DSS.

FIELD 9

Data Rate - indicates present data rate being affected by station configuration (RIL, ROL, TLM, etc.).

FIELD 10

Comments -

a. X Band/S Band - refers to the telemetry band associated with noted data rate.

b. No DSS tracking - indicates no DSN station is currently receiving signals from the spacecraft.

c. TTS processing switch - indicates the ERT of a JPL computer processing switch from one station to another.

d. Quasar tracking - refers to a ranging function performed at the DSS involving known Quasars and the Voyager spacecraft. No data reception is possible as the DSS antenna pointing is moved from the spacecraft to the Quasar.

e. Dead bands - indicates the degree of variance allowed to the spacecraft antenna pointing before it is moved back in line with Earth point.

f. DTR activities - refer to start (record mode or playback mode), end (ready mode) and ERT/FDSC/SCET of any Digital Tape Recorder activity onboard the spacecraft.

g. Wide band or high speed data line anomalies - indicates the transmission lines from the DSS to JPL are having problems. Data is usually recorded at the DSS until the lines are restored.

Other comments usually refer to ground commands, science events and spacecraft configuration information.