DATA SET CATALOG #103

PIONEER 6, 7, 8, & 9
EPHEMERIS

65-105A-00E	9 tapes
66-075A-00E	9 tapes
67-123A-00D	6 tapes
68-100A-00D	6 tapes

PIONEER 6, EPHEMERIS
65-105A-00E
800 BPI, 7-track, binary, 1 file, IBM 7094

D#	C#	START	STOP	
D-05739	C-04804	12/16/65	07/06/66	12/16/65 10/24/66
D-05740	C-04805	12/16/65	10/24/66	12/16/65 07/06/66 → 10/24
D-05741	C-04806	10/14/66	11/18/67	10/14/66 11/18/67
D-05742	C-04807	03/09/67	04/01/68	
D-05743	C-04808	03/15/68	03/15/69	
D-05744	C-04809	03/15/69	03/15/70	
D-05745	C-04810	10/01/69	10/01/71	
D-05746	C-04811	01/15/70	01/16/72	
D-05747	C-04812	03/15/70	05/16/72	

PIONEER 7, EPHEMERIS
66-075A-00E
800 BPI, 7-track, BINARY, 1 file IBM 7094

D#	C#	START	STOP
D-05748	C-04813	08/17/66	03/05/67
D-05749	C-04814	08/19/66	03/07/67
D-05750	C-04815	03/01/67	02/01/68
D-05751	C-04816	01/25/68	05/01/68
D-05752	C-04817	04/18/68	10/18/68
D-05753	C-04818	07/15/68	07/15/69
D-05754	C-04819	07/15/69	07/15/71
D-05755	C-04820	11/15/69	12/31/69
D-05756	C-04821	01/01/70	01/02/72

PIONEER 8, EPHEMERIS
67-123A-00D
800 BPI, 7-track, BINARY, 1 file, IBM 7094

D#	C#	START	STOP
D-05757	C-04823	02/13/67	06/30/68
D-05758	C-04824	12/16/67	07/03/68
D-05759	C-04825	03/15/68	03/15/69
D-05760	C-04826	07/25/68	07/25/69
D-05761	C-04827	07/20/69	07/20/71
D-05762	C-04828	11/15/69	11/15/71

PIONEER 9, EPHEMERIS
68-100A-00D
800 BPI, 7-track, BINARY, 1 file, IBM 7094

D#	C#	START	STOP
D-05763	C-04829	11/08/68	07/26/71
D-05764	C-04830	11/10/68	06/08/69
D-05765	C-04831	04/15/69	08/15/69
D-05766	C-04832	08/15/69	08/16/71
D-05767	C-04833	12/15/69	12/15/71
D-05768	C-04834	04/15/70	04/16/72

MEMO: POLDPS-1

AREA OF INTEREST: POLDPS - Pioneer 6, 7, 8, and 9

SUBJECT: Pioneer 6, 7, 8, and 9 Trajectory Tape Format

ORIGINATED BY: L. van der Veen
(Bendix Field Engineering Corporation)

DATE: January 28, 1971

APPROVED BY: [signature]
PRODUCTION PROCESSING SUPERVISOR

Bendix Field Engineering Corporation

A. INTRODUCTION

All Pioneer 6, 7, 8, and 9 trajectory tapes used by the Pioneer Off-Line Data Processing System (POIDPS) are written to be compatible with the Bell-Jones IBM 7040/7094 Direct Coupled System (DCS). Because these tapes may also be used on other computer systems, the following discussions define the unique physical and logical structure of the Pioneer trajectory tapes.

B. PHYSICAL DCS RECORD FORMAT OF PIONEER TRAJECTORY TAPE

Each physical tape record contains two physical-record control words, and 458 words for logical records. Preceding the first word of each logical record within a physical record is a logical-record control word or "logical checksum". These logical checksums will be found every 270 logical data words for the trajectory standard data records. Logical checksums are defined in Paragraph C.

For trajectory tape records, the address portion of the first physical-record control word contains the number of the record within the file (only one file is stored on a trajectory tape). The second control word contains the reel label (in BCD) that was assigned to that tape.

C. LOGICAL RECORD FORMAT OF PIONEER TRAJECTORY TAPE

Preceding the first word of each logical record is the logical checksum. The decrement of this word contains the word count of the previous logical record, and its address contains the word count of the following logical record. The remaining bits of the word, prefix and tag, are used to indicate the following:

S = 0	The previous logical record is complete in this buffer.
S = 1	The previous logical record is incomplete in this buffer or ends in the last word of the previous buffer.
1 = 0	The previous logical record is a BCD record.
1 = 1	The previous logical record is a binary record.
18 = 0	The next logical record is complete in this buffer.
18 = 1	The next logical record is incomplete in this buffer or starts in the first word of the next buffer.
19 = 0	The next logical record is a BCD record.
19 = 1	The next logical record is a binary record.

Record 1 contains information which points to the main table record 2. (See Figure 1.) Word N_1 is the table size in octal.

RECORD 1 - MAIN ID RECORD

LOGICAL CHECKSUM	WD1	WD2	WD3
WD4	WD5	WD6	WD7

(36 bit words)

WD1 = PZE (File Number)

WD2 = PZE N_1 $(=N_2 + N_3 + 4 + N_4 + N_5 + 1)$

WD3 = PZE N_2

WD4 = PZE N_3

WD5 = PZE N_4

WD6 = PZE N_5

WD7 = PZE 0^8 (0 means tape not FORTRAN readable)

The first N_2 words are the BCD title of the main table. The next N_3 words are the BCD names of the main table items. The next words are subtable titles. There are N_4 subtables, with four words per individual title, giving a total of $4 * N_4$ words.

The next N_5 words are the labels of each datum in any one subtable (quantities in corresponding positions in different subtables represent the same measurement for the different stations). Refer to Figure 1 for example.

NOTE: Tapes for FN 6, 7, 8, and 9 do not contain station parameters; therefore logical records 1 and 2 can be ignored.

EXAMPLE

Where the contents of record 1 is: (See Figure 1.)

$N_1 = 271_8$ $(N_2 + N_3 + 4 + N_4 + N_5 + 1)$
$N_2 = 50_8$
$N_3 = 131_8$
$N_4 = 5_8$
$N_5 = 44_8$
$N_6 = 0$

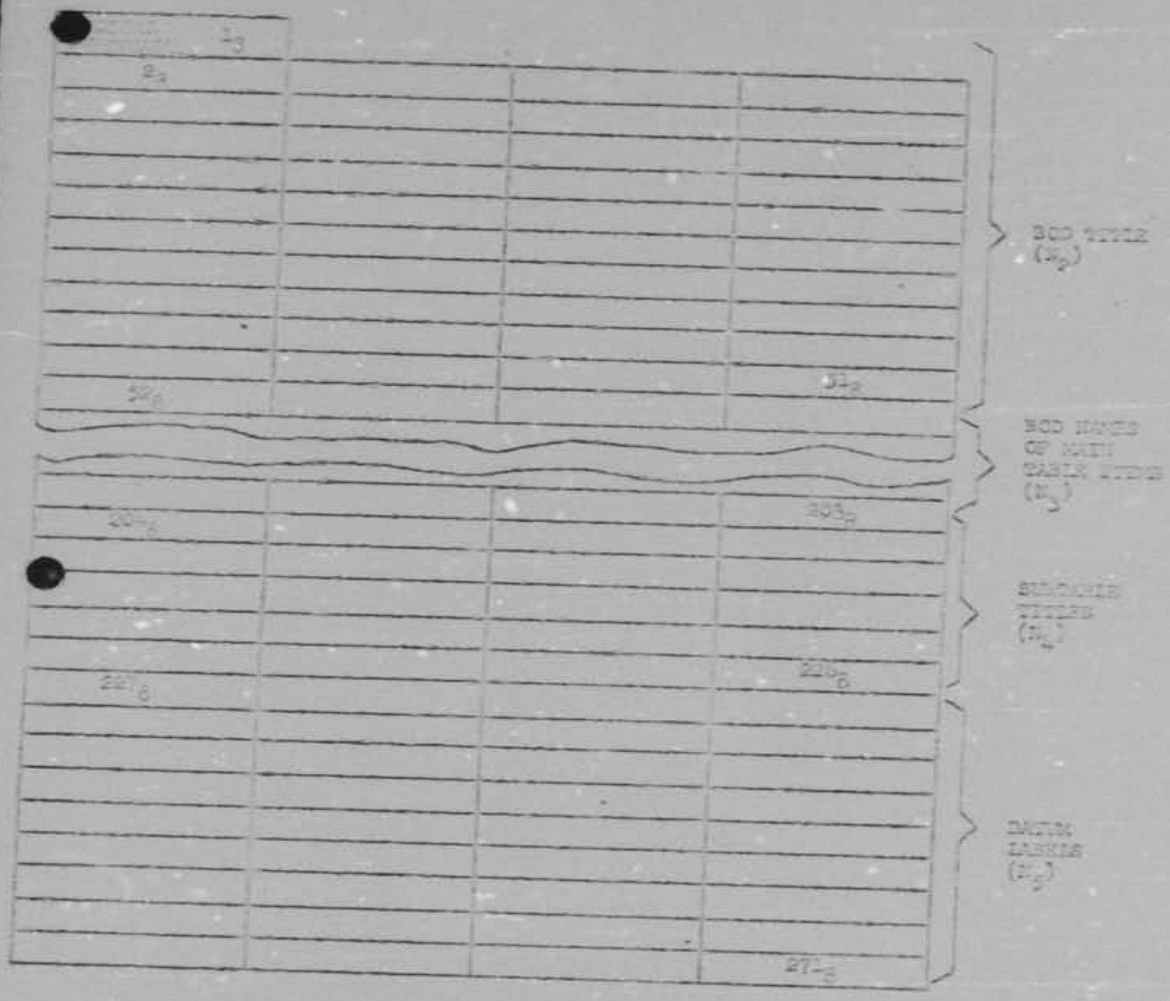

Figure 1. Record 2 - Main Table

Records 3 through 7 are the standard data records; each record is 270_{10} words in length including a logical checksum. Of the 270_{10} words, the data of interest is contained in only the first 89_{10} words; Attachment 1 defines the content of each word.

The following words require additional explanation:

Word 003 - Contains total days and a fraction since January 1, 4713 B.C. Use the constant 2,439,125.5 to convert to Modulo 1968 A.D.

Word 004 - Contains the remainder of the decimal fraction portion of word 003. Words 003 and 004 must be combined arithmetically before use.

Word 005 - Is floated.

Word 006 - Must be floated if used in conjunction with word 005.

JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM

392.4-381

5 April 1971

TO: Judith Schatten, National Space Science Data Center (NSSDC)

FROM: J. Hudes

SUBJECT: Definition of 89 Parameters Written on SPPRØ Tapes

Attached are the definitions for the 89 variables written on the present SPPRØ save tapes, as requested. The following should be noted:

1. Reference plane is Earth true equator of date unless otherwise stated. Positive X axis is along intersection of reference plane and ecliptic plane (plane of Earth's orbit) of date where the Sun crosses the equatorial plane from south to north in its apparent annual motion along ecliptic. Point of intersect is called vernal equinox. Positive Z axis is along north pole vector, and positive Y axis is Z $\times$ (cross) X. For the following definitions, geocentric will refer to above coordinate system with Earth as center, heliocentric is above system with Sun as center, moon-centered system has moon as center, etc.

2. All times are in seconds, angles in degrees, and distances in kilometers unless otherwise stated.

3. All angles and ranges are measured from center of body whether it be a probe, planet, etc. unless otherwise stated.

4. Ranges of the following angles are:

$0^\circ \leq$ clock angle $\leq 360^\circ$

$0^\circ \leq$ longitude $\leq 360^\circ$

$0^\circ \leq$ right ascension $\leq 360^\circ$

$-90^\circ \leq$ latitude $\leq 90^\circ$

$-90^\circ \leq$ declination $\leq 90^\circ$

SFPRØ VAR. Number	Header Record Name	Variable Description
1 2	TIME1 TIME2	Double precision universal time (UTC) past January 1, 1950, 0 hours UTC.
3 4	JULD1 JULD2	Double precision Julian date in days
5 6	GREG1 GREG2	Gregorian calendar date where format is as follows GREG1: YYMMDDDHH { Y = years, M = months, D = days, H = hours GREG2: MMSSFFF { M = minutes, S = seconds, F = fractions of seconds
7	TIME	Single precision time from injection. Injection time is taken to be epoch at which integration of orbit begins.
8	TFL	Time from launch
9	GEØ R	Range from Earth to probe
10	SC DEC	Declination of probe. Angle made by reference plane and Earth to probe vector.
11	SC RA	Geocentric right ascension of probe. The angular distance from vernal equinox along reference plane to the projection of the Earth to probe vector on plane. The angle is measured counterclockwise from vernal equinox as viewed from Earth's North Pole vector.
12	GEØ V	Geocentric magnitude of velocity vector.
13	SC PTH	Inertial path angle. Angle made by probe velocity vector and plane normal to Earth to probe vector.

SFPBØ VARIABLE Number	Header Record Name	Variable Description
14	SC AZ	Geocentric inertial azimuth angle. Let plane 1 be defined by vector along Earth's pole and Earth to probe vector. Let plane 2 be defined by earth to probe vector and geocentric inertial velocity vector. Geocentric inertial azimuth angle would be angle measured clockwise from 1 to 2 as viewed from ~~north pole vector~~. Earth to pole vector
15	RS	Earth to Sun range
16	DES	Declination of Sun (geocentric)
17	RAS	Right ascension of Sun (geocentric)
18	RM	Earth to Moon range
19	DEM	Declination of moon (geocentric)
20	RAM	Right ascension of Moon (geocentric)
21	RSP	Sun to probe range
22	LAT	Angle made by Sun to probe vector and ecliptic plane of date (plane of Earth's orbit about Sun).
23	LØN	Celestial longitude of probe. Angular distance measured counterclockwise along ecliptic plane of date from vernal equinox to projection of Sun-probe vector on plane as viewed from ecliptic north pole.
24	V	Heliocentric inertial velocity. Magnitude of velocity vector with respect to the Sun.
25	PTH	Probe inertial path angle (heliocentric) Angle made by heliocentric velocity vector and plane normal to Sun to probe vector.
26	LTE	Celestial latitude of Earth. Value is not zero because Earth-Moon barycenter is precisely 0° latitude and latitude of Earth's center is not exactly latitude of barycenter.