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JPL

August 29, 1991

Dr. Paul Butterworth
Code 933 GSFC
National Space Science Data Center
NASA - Goddard Space Flight Center
Greenbelt, MD 20771

Dear Dr. Butterworth,

SUBJECT: Data Submission for Pioneer 10/11 Celestial Mechanics Experiment

I have been asked by Dr. John D. Anderson to send the rest of the Intermediate Data Records (IDR) files to you. The nine tapes that I am sending contain several files as before. Enclosed is a list of the contents of each of the tapes. The format of the data records on these tapes is the same as the format of the data submitted in June 1990, and I presume you still have the format information sent by Eunice Lau in October 1990 (copy of letter attached).

We will be sending more data at a later time in the form of Tracking Data Files (TDF). All other data up to the present will be submitted in this form, and appropriate documentation will be enclosed with the data.

Sincerely yours,

Janet E. Hierath

Janet E. Hierath

cc: Dr. John D. Anderson
Eunice K. Lau

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109
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JPL

October 17, 1990

Dr. Paul Butterworth
Code 933 GSFC
National Space Science Data Center
NASA - Goddard Space Flight Center
Greenbelt, MD 20771

Dear Dr. Butterworth:

SUBJECT: Data Submission for Pioneer 10/11 Celestial Mechanics Experiment

This is in response to Norman J. Schofield's letter to Dr. John D. Anderson dated July 26, 1990. Dr. Anderson was out of the country for the summer and did not open his mail until he returned at the end of September.

This is in reference to our data set submitted June 20, 1990 to Donald Sawyer with your NSSDC ID number of 72-012A-09C. The header information noted in paragraph 3 of Schofield's letter can be ignored. It does not contain much useful information. The only header information which you may wish to look at are the fields containing "IDR" and the time span. The times are data request times, and usually the file stop time is open-ended. Also "WDT" should be "UDT" with a 015 hex code for radio metric data.

In reading the data record, the block size should be 150 bytes with 8 blocks per record. I am enclosing documentation entitled DSN Tracking System Interfaces, Metric Data Interface, TRK-2-15. This document contains a complete description of the 1200-bit data blocks in each data record.

Also enclosed is the JPL Technical Report 32-1527, "Mathematical Formulation of the Double-Precision Orbit Determination Program (DPODP)," by Theodore D. Moyer.

Please keep us informed as to your progress in reading the Intermediate Data Record (IDR) files. We will be submitting more data as soon as you confirm their readability. My phone number is (818) 354-6013, FTS 792-6013, and mail stop 301-150G. John Anderson's phone number is (818) 354-2956, FTS 792-3956, mail stop 301-230.

Sincerely,

Eunice Lau

cc: J. D. Anderson

PIONEER 10 DATA

external/label	year	file #	IDR tape #	begin date	end date	records
SC23-81A	1981	1	L8142	340	343	4776
	"	2	L8101	337	341	12028
	"	3	L8034	335	338	6587
	"	4	K8376	326	329	7100
	"	5	K8339	323	327	10017
	"	6	K8253	319	321	5665
	"	7	K8223	317	320	5497
SC23-81B	1981	1	L8009	333	336	7509
	"	2	K8447	330	334	11395
	"	3	K8412	328	331	7616
	"	4	K8282	322	324	6518
SC23-82A	1982	1	K8574	329	333	9739
	"	2	K8533	327	330	6094
	"	3	K8468	325	327	7832
	"	4	K8415	322	326	10699
	"	5	K8344	320	323	6377
	"	6	K8322	319	321	2929
SC23-82B	1982	1	L8305	343	347	4623
	"	2	L8245	341	344	7921
	"	3	L8207	339	342	8207
	"	4	L8147	336	340	11533
	"	5	L8043	334	337	6766
	"	6	L8005	332	335	7063
SC23-83A	1983	1	L8336	345	347	2026
	"	2	L8273	342	346	4293
	"	3	L8182	340	343	3841
	"	4	L8139	338	341	3007
	"	5	L8101	336	339	3107
	"	6	L8020	333	335	2661
	"	7	K8553	331	334	3301
	"	8	K8516	328	332	1960
	"	9	K8472	326	329	2403
	"	10	K8455	324	327	4413
	"	11	K8393	321	325	2177
	"	12	K8311	319	322	1425
	"	13	K8274	317	320	148
	"	14	K8232	314	318	170
SC23-84A	1984	1	K5657	325	328	280
	"	2	K5732	327	331	392
	"	3	K5795	330	333	135
	"	4	K5845	332	335	882
	"	5	L5930	334	338	1203
	"	6	L5987	337	340	1195
	"	7	L6030	339	342	1046
	"	8	L6106	341	345	1041
	"	9	L6161	344	347	76
	"	10	L6219	346	349	71
	"	11	L6289	348	352	127
	"	12	L6343	351	354	63
	"	13	L6398	353	356	72

external label	year	file #	IDR tape #	begin date	end date	records
SC23-84B	1984	1	K5647	327	327	30
	"	2	K5674	328	328	20
	"	3	K5694	329	329	54
	"	4	K5721	330	330	47
	"	5	K5796	331	331	70
	"	6	K5770	332	332	52
	"	7	K5799	333	333	27
	"	8	K5860	335	335	1169
	"	9	L5895	336	336	1134
	"	10	L5914	337	337	29
	"	11	L5939	338	338	743
	"	12	L5971	339	339	1576
	"	13	L6036	342	342	36
	"	14	L6067	343	343	87
	"	15	L6084	344	344	288
	"	16	L6122	345	345	46
	"	17	L6376	345	346	42
SC23-85A	1985	1	K1194	321	324	282
	"	2	K1485	325	329	323
	"	3	K1564	328	331	233
	"	4	K1672	330	333	153
	"	5	L1819	332	336	1794
	"	6	L1961	335	338	1414
	"	7	L2059	337	340	1436
	"	8	L2191	339	343	2246
	"	9	L2272	342	345	917
	"	10	L2360	344	347	1978

PIONEER 11 DATA

external label	year	file #	IDR tape #	begin date	end date	records
SC24-82A	1982	1	E8142	127	130	223
	"	2	E8081	124	126	105
	"	3	E8058	123	125	96
	"	4	E8028	119	122	100
	"	5	D8437	117	120	2207
	"	6	D8379	112	116	2055
	"	7	D8329	110	113	1799
	"	8	D8307	108	111	2060
	"	9	D8272	105	109	865
	1983	10	E8317	135	137	1513
	"	11	E8283	133	136	9701
	"	12	E0340	141	143	1970
	"	13	E0316	138	142	5966

TRK-2-15

IDR-12-1A

DSN INTERFACES

INTERMEDIATE DATA RECORD FORMATS

(MARK IVA)

Insert this modular document in 820-13; Rev. A)

EFFECTIVE SERVICE: All Projects (for Telemetry System, except Helios and Pioneer 10 and 11)

EFFECTIVE DATE: Mark IVA Implementation
Initial Release Date: April 1, 1985

Approved by: Chi Tung Peng
Wolfgang P Hoehn 1/31/85
Robert G. Collins 3/11/85
Roger A. Crowe 3/12/85

A. PURPOSE

This module defines and controls the formats of the DSN Intermediate Data Record (IDR) for all Mark IVA or Goddard Space Flight Center (GSFC) projects.

B. REVISION AND CONTROL

Revisions or changes to the information herein presented may be initiated according to the procedures in Section I of this document.

C. GENERAL INFORMATION AND DEFINITIONS

The Data Records Subsystem (GDR) Data Records Generator (DRG) is used to generate IDRs for various project data in real time. All data directed to the

DRG are separated into streams by the DRG. A stream is uniquely defined by specifying a combination of a source station (DSS number), a spacecraft number, a data type (user-dependent type code (UDT) for DSN data and Block Format Code (BFC) for GSFC and RMOC data), and status (i.e., real-time or recall (Gross Data Description (GDD) for DSN data and a BFC for GSFC data). IDRs are digital tapes, which will conform to the format defined in Section D, created by the DRG for a real-time stream or a merged result of real-time and recalled streams.

Data on the IDRs will be time ordered by Earth-received time of a given data stream. However, Very Long Baseline Interferometry (VLBI) IDRs will have the following: (1) time-ordered ancillary data only, (2) time-ordered correlator data only, or (3) time-ordered ancillary data followed by time-ordered correlator data. All IDR tapes will consist of a single data file as defined in Figure IDR-12-1A-1. All IDR files with the exception of Radio Metric data will contain data for one spacecraft from one DSS (on one subcarrier and carrier for Telemetry); each Tracking IDR file will contain data for one spacecraft from one or more DSSs for one or more passes or partial passes.

D. IDR FORMAT

The IDR is recorded on a 9-track magnetic tape. The recording method is NRZI (non-return-to-zero, change-on-one) at 800 b/in. or PE (phase-encoded) at 1600 b/in. dependent on user requirements. The format of the IDR file is shown in Figure IDR-12-1A-1.

1. IDR Files

An IDR file may be of any length depending on data rate and time interval. The end of a tape/IDR file is always indicated by a double end-of-file (EOF) mark. An IDR file is always an integral number of records; if the last record is not full, it is completed with filler blocks (defined in this document). If the IDR stretches over multiple tapes, each tape is formatted as described in paragraph 2. of this module.

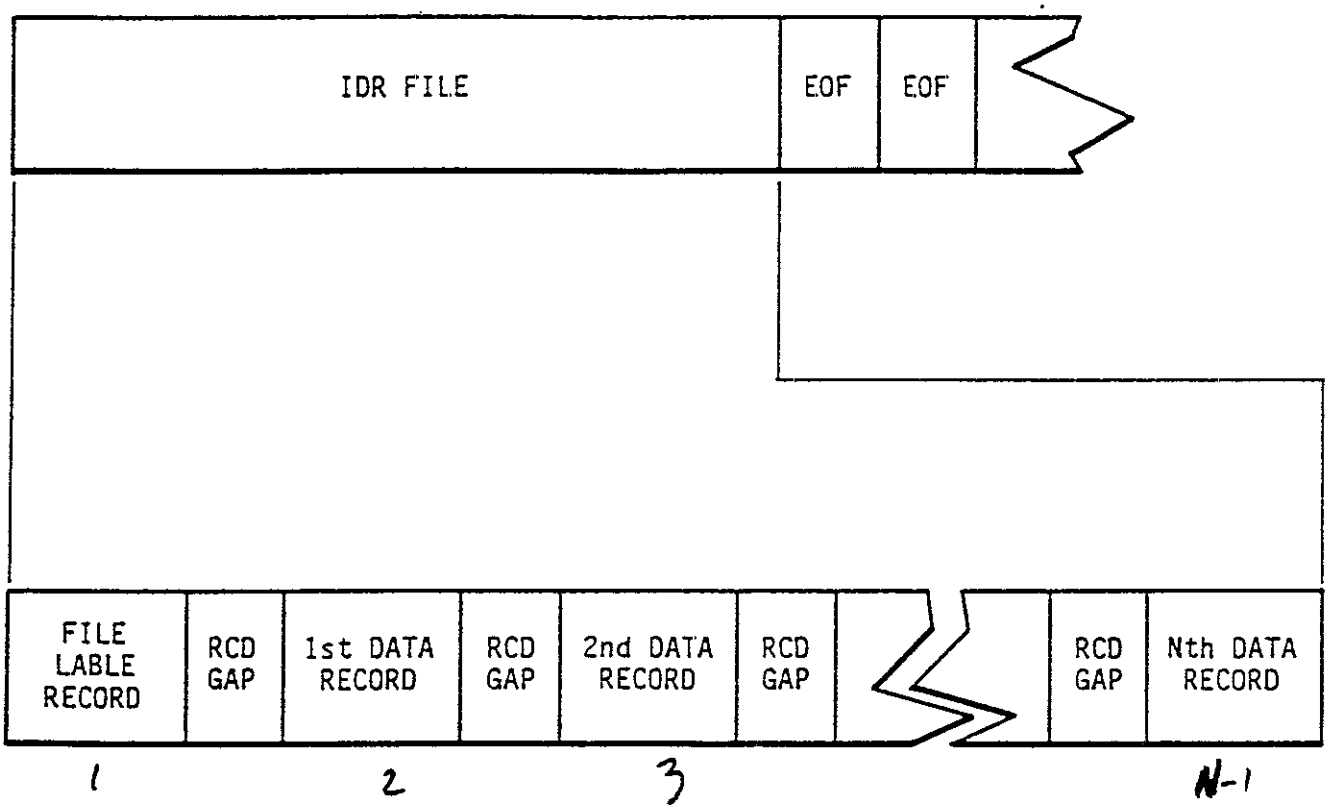

Figure IDR-12-1A-1. IDR File Format

2. IDR Records

a. File Label Record. The file label record will always be the first record of an IDR file. It consists of 608 16-bit words (9728 bits) comprised of a 16-bit record sequence number (all zeros), 8 zero bits, 840 bits of data and 8864 unused (zero) bits. The data portion will contain information specifying the IDR file type and contents (content parameters are derived from operator manual inputs). Table IDR-12-1A-1 describes the general format of the IDR file label record.

b. Data Records (General and RT or RSC formats). The file label record is followed by N data records, where N is the appropriate number of records necessary to provide all data for a selected spacecraft, station(s), and pass(es). Each data record consists of 608 16-bit words (9728 bits) comprised of a 16-bit record sequence number (1 through 32767), seven additional 16-bit items of information, and eight 1200-bit, or two 4800-bit blocks. Each block appears on the IDR exactly as it was received on the communication circuit (i.e., with sync word, and error code and status). Blocks with GCF errors will not be recorded.

Table IDR-12-1A-4 describes the general format of an IDR Data Record. Each block is identified as to whether it is data or filler by BFC (bit positions 41-48 of each block). Filler blocks have a BFC of $5E_{16}$ and 8888_{16} pattern from the fourth word to the end of the block.

Each IDR file will have a new record number sequence beginning with all zero bits (0) for the file label record, incrementing sequentially from 1 to $N \leq 32767$ for the data records. There will be no discontinuities in the sequence numbers for the data records.

Table IDR-12-1A-1. File Label Record Format

Bit Number	Length (bits)	Description
1-16	16	Record Sequence Number - binary integer (binary number, right-justified with leading zeros) = (RJ/LZ)
17-24	8	0 (spare)
25-48	24	File Type - 3 ASCII characters (File Type is a software input: nominally "TLM" is for Telemetry, and "RMD" is for Tracking. Table IDR-12-1A-2 describes the characters that may be used on the IDR tapes; for any other data types not defined in this table, including GSFC data, DRG will print spaces in this field.
49-72	24	Tape ID number - 3 ASCII characters = "IDR"
73-96	24	DSS Number if applicable (see OPS-6-7, 8) - 3 ASCII characters, right-justified with leading character zero (RJ/LZ)
97-120	24	Spacecraft Number (see OPS-6-7, 8) - 3 ASCII characters, RJ/LZ
121-152	32	Pass Number - 4 ASCII characters (manual input)
153-168	16	Tape Number - 2 ASCII characters (manual input)
169-192	24	Data Type - 3 ASCII characters (Data Type is a manual input provided only for convenience in identification and labeling) Table IDR-12-1A-3 describes the ASCII characters that may be used for this field. If not entered by operator, this field will be blanks.
193-200	8	"0" - ASCII character zero
201-216*	16	File Start Year - 2 ASCII characters, RJ/LCZ
217-240	24	File Start Day-of-Year - 3 ASCII characters, RJ/LCZ

*If the time parameter has not been entered by the operator, the start time is the time of the first block and the end time is set to zero. The UDTs and DDTs are operator inputs and may not be encountered in generation (not in file). If the UDT/DDT parameter is bypassed (not entered by operator), those fields will be set to three-character ASCII zeros.

Table IDR-12-1A-1. File Label Record Format (Contd)

Bit Number	Length (bits)	Description
241-264	24	File Stop Day-of-Year - 3 ASCII characters, RJ/LCZ
265-280	16	File Start Hour - 2 ASCII characters, RJ/LCZ
281-296	16	File Start Minute - 2 ASCII characters, RJ/LCZ
297-312	16	File Start Second - 2 ASCII characters, RJ/LCZ
313-328	16	File Stop Hour - 2 ASCII characters, RJ/LCZ
329-344	16	File Stop Minute - 2 ASCII characters, RJ/LCZ
345-360	16	File Stop Second - 2 ASCII characters, RJ/LCZ
361-384	24	File Start Day-of-Year - binary integer
385-408	24	0 (spare)
409-432	24	File Start UTC (seconds times 100; i.e., 1/100ths of a second but with 1 second resolution) - binary integer
433-456	24	File Stop UTC (seconds times 100) - binary integer
457-480	24	User Dependent Type Code - 3 ASCII characters^{+} = UDT
481-504	24	1st UDT - 3 ASCII characters, RJ/LCZ*
505-528	24	2nd UDT - 3 characters, RJ/LCZ**
529-600	72	9 ASCII zeros
601-624	24	Data Dependent Type Code - 3 ASCII characters = "DDT."***
625-648	24	1st DDT - 3 ASCII characters, RJ/LCZ***
649-672	24	2nd DDT - 3 ASCII characters, RJ/LCZ***

$^{+}$Characters "BFC" ASCII will appear here for GSFC data.
*Block Format Code will appear here for GSFC data block.
**Always "000" for GSFC data blocks.
***Not applicable to GSFC blocks after this field.

Table IDR-12-1A-1. File Label Record Format (Contd)

Bit Number	Length (bits)	Description
673-696	24	3rd DDT - 3 ASCII characters, RJ/LCZ*
o o o	o o o	o o o
841-864	24	10th DDI - 3 ASCII characters, RJ/LCZ*
865-9728	8864	0 (Not used)

*Not applicable to GSFC blocks after this field.

NOTE: Bits 217-456 indicate the nominal file start and stop times. They are not the exact time tags of the first and last data blocks in the file, but there are no records in the file with time tags outside these limits.

NOTE: Unused UDTs and DDTs are set to 3 character zeros ("000").

Table IDR-12-1A-2. User-Dependent Type Code and Data Type Assignments for Data Requiring Generation of IDRs

Binary Bits (Word 4) 4	5	6	7	8	9	10	Hex/OCT Representation	User-Dependent Types	File Type
0	0	0	1	0	1	1	0B/013	TLM Data-IPA 1, Channel 1	TLM
1	1	1	0	0	1	1	73/163	TLM Data-IPA 2, Channel 1	TLM
0	0	0	1	1	0	0	0C/014	TLM Data-TPA 3, Channel 1	TLM
0	0	0	1	1	0	1	0D/015	TLM Data-TPA 4, Channel 1	TLM
0	0	0	0	1	1	1	07/007	TLM Data-IPA 1, Channel 2	TLM
0	0	0	1	0	0	0	08/010	TLM Data-TPA 2, Channel 2	TLM
0	0	0	1	0	0	1	09/011	TLM Data-TPA 3, Channel 2	TLM
0	0	0	1	0	1	0	0A/012	TLM Data-IPA 4, Channel 2	TLM
0	0	1	0	1	0	1	15/025	Radio Metric Data-MDA Mark IVA	RMD
0	0	1	0	1	1	0	16/026	Radio Metric Data-MDA Mark III	RMD
1	0	0	0	1	1	1	47/107*	CMD Data - Prime CPA	CMD
0	0	1	0	1	1	1	17/027	Ground Weather Data	MMA GWD
0	1	1	1	1	1	0	3E/076	LMC to NMP Link Status Block	MON
0	0	0	0	1	1	0	06/006	Telecom Link Analysis (MON-5-9)	MON
1	1	1	0	0	0	0	70/160	Supplementary AGC Data (MON-5-10)	MON
0	0	0	1	1	1	0	0E/016	Galileo AGC Data (MON-5-11)	MON
0	1	1	1	1	1	1	3F/077	DSS Monitor Data (DIS)	MON
0	1	1	0	0	0	1	31/061	Radio Science Data or VLBI High-Speed Data	RSC
0	1	1	0	1	0	0	34/064	VLBI Status Data	VLB
0	1	1	0	1	0	1	35/065	VLBI Data (Quick Look)	VLB
0	0	1	0	0	0	1	11/021	VLBI	VLB
0	1	1	0	1	1	0	36/066	VLBI Data (Correlator Assembly)	VLB

*Command IDR delivery required only on request.

Table IDR-12-1A-3. Allowable IDR ASCII Characters

Character	Octal Code	Hexa-decimal Code	Character	Octal Code	Hexa-decimal Code
0	60	30	I	111	49
1	61	31	J	112	4A
2	62	32	K	113	4B
3	63	33	L	114	4C
4	64	34	M	115	4D
5	65	35	N	116	4E
6	66	36	O	117	4F
7	67	37	P	120	50
8	70	38	Q	121	51
9	71	39	R	122	52
A	101	41	S	123	53
B	102	42	T	124	54
C	103	43	U	125	55
D	104	44	V	126	56
E	105	45	W	127	57
F	106	46	X	130	58
G	107	47	Y	131	59
H	110	48	Z	132	5A

NOTE: ASCII characters are 8-bit, right-justified, zero-filled binary integers (i.e., numeric code representations of alphanumeric characters).

Table IDR-12-1A-4. Data Record Format

Bit Number	Length (bits)	Description	
1-16	16	Record Sequence Number - binary integer (1 to 32767)	
17-32	16	Record Size in Bytes - binary integer	
33-48	16	Block Size in Bytes - binary integer	
49-64	16	Number of Bytes to 1st Block - binary integer	
65-80	16	Number of Blocks in Record - binary integer	
81-96	16	0 (spare)	
97-112	16	0 (spare)	
113-128	16	0 (spare)	
129-1328	1200	1st 1200-bit HSD Block	1st 4800-bit WBD Block
1329-2528	1200	2nd 1200-bit HSD Block	
2529-3728	1200	3rd 1200-bit HSD Block	
3729-4928	1200	4th 1200-bit HSD Block	
4929-6128	1200	5th 1200-bit HSD Block	2nd 4800-bit WBD Block
6129-7328	1200	6th 1200-bit HSD Block	
7329-8528	1200	7th 1200-bit HSD Block	
8529-9728	1200	8th 1200-bit HSD Block	