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## DEEP SPACE NETWORK INTERFACE CHANGE AUTHORIZATION

820-13 MODULE TRK-2-25 TITLE

DSN Tracking System Interfaces  
Archival Tracking Data File Interface

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**DESCRIPTION OF CHANGE:**

- 1) Page 11, Item 112

**REASON FOR CHANGE:**

- 1) Redefine parameter description

**CONCURRENCES:**

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**DISPOSITION:**

CHANGE REJECTED. REASONS:

CHANGE RELEASED FOR PUBLICATION

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DATE: 13 June 1988

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TRK-2-25

DSN TRACKING SYSTEM INTERFACES  
ARCHIVAL TRACKING DATA FILE INTERFACE

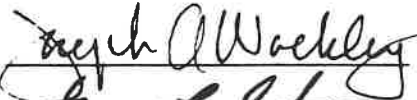
(Insert this module in Document 820-13; Rev. A)


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A. PURPOSE

This module specifies the Archival Tracking Data File (ATDF) format of the radio metric data from the Deep Space Network (DSN). The content and format of the ATDFs generated by the Network Operations Control Center (NOCC) Navigation Subsystem (NAV) are defined herein.

B. REVISION AND CONTROL

Revisions or changes to information contained in this module may be initiated in accordance with the procedures described in Section I of this document.

### C. GENERAL INFORMATION

Radio metric data are received by the NAV in the form of Intermediate Data Record tapes (IDRs). These IDRs are processed to generate ATDFs. An ATDF contains all radio metric data received from the Deep Space Communications Complexes (DSCCs). These data include angles, S- and X-band doppler, S- and X-band range, S- and X-band differenced range versus integrated doppler (DRVID), programmed frequency data, pseudo-residuals, and validation data. An ATDF will contain data for a single spacecraft, for one or more stations, and for one or more passes or days.

### D. DATA FORMAT

The data on the ATDF are arranged as follows:

- (1) File Identification logical record (one only)
- (2) Transponder logical record (one only)
- (3) Tracking Data logical records (time ordered)
- (4) Software end-of-file mark (one only)
- (5) Hardware end-of-file mark (one only)

The logical record types are described in detail in Tables 1, 2, and 3.

The ATDF block (physical record) is 2016 32-bit words in length and consists of 28 72-word (2304-bit) logical records.

Note that several items of data have been split into two parts: a Sign Bits field and a Data item. For these items, the leftmost (sign) bit of the Data item has been left-extended to fill another item of information. For always non-negative items, the Sign Bits field will be zero; for items that may be positive, zero, or negative (provided as two's complement numbers), the Sign Bits field will be filled with zeros (non-negative) or ones (negative). The user may extract any specific Data item and sign-extend manually, or may use any portion of the Sign Bits field combined with the Data item to get a signed integer that will fill one word on the user's computer system. For

example, a 22-Sign Bits/14-bit Data item pair may be taken as a 20-bit item to be ignored plus a 16-bit data item, or as a 4-bit item to be ignored plus a 32-bit data item, or as a single 36-bit item of data, etc. This is always true -- whether the Sign Bits field is all zero-bits or all one-bits.

E. EXPLANATORY NOTES

The following explanatory notes apply to Tables 1, 2, and 3:

- (1) A two-part Length indicator (n/m) specifies a Sign Bits field (n bits in length) plus a Data item (m bits in length). If the Data item is specified to be two's complement, the Sign Bits field may be all zero-bits (non-negative) or all one-bits (negative); otherwise it will be all zero-bits.
- (2)  $H/P = \text{high part} = \text{variable} / 10^4$   
 $L/P = \text{low part} = (\text{variable modulo } 10^4) \times 10^3$   
Double precision variable =  $(H/P) \times 10^4 + (L/P) / 10^3$
- (3) Items not applying to a record data type are set to zero for that record.

Table 1. File Identification Logical Record

Item Number	Bit Number	Length (Bits)	Description
1	1-36	29/7	Data Length = 8
2	37-72	29/7	Record Type = 10
3*	73/84	12	Last 2 Digits of Year
4*	85/100	16	Day-of-Year
5*	101-108	8	Hour
6*	109-120	12	Minute
7*	121-128	8	Second
8	129-148	20	0 (not used)
9	149-156	8	Spacecraft ID Number
10	157-164	8	73 (= 'I') or 83 (= 'S')
11	165-172	8	68 (= 'D') or 80 (= 'P')
12	173-180	8	82 (= 'R')
13	181-192	12	32 (= ' ')
14	193-208	16	65 (= 'A')
15	209-216	8	84 (= 'T')
16	217-228	12	68 (= 'D')
17	229-236	8	70 (= 'F')
18	237-252	16	0 (not used)
---	253-2304	2052	Not Used (all zeros)

\*File creation time

Table 2. Transponder Logical Record

Item Number	Bit Number	Length (Bits)	Description
1	1-36	29/7	Data Length = 8
2	37-72	29/7	Record Type = 30
3	73-84	12	Last 2 Digits of Year
4	85-100	16	Day-of-Year
5	101-108	8	Hour
6	109-120	12	Minute
7	121-128	8	Second
8	129-148	20	0
9	149-156	8	Spacecraft ID Number
10	157-180	24	Reserved (set to zeros)
11	181-192	12	Last 2 Digits of Year
12	193-208	16	Day-of-Year
13	209-216	8	Hour
14	217-228	12	Minute
15	229-236	8	Second
16	237-252	16	0
17	253-288	12/24	Spacecraft Transponder Frequency H/P (Hz x 1000)
18	289-324	12/24	Spacecraft Transponder Frequency L/P (Hz x 1000)
---	325-2304	1980	Not Used (all zeros)

"On" Time

"Off" Time

15.72

bit 81-

Table 3. Tracking Data Logical Record

Item Number	Bit Number	Length (Bits)	Description
1	1-36	29/7	Data Length = 64
2	37-72	29/7	Record Type 90 = Low Rate Data 91 = High Rate (H/R) Data
3	73-84	12	Last 2 Digits of Year
4	85-100	16	Day-of-Year
5	101-108	8	Hour
6	109-120	12	Minute
7	121-128	8	Second
8	129-156	28	Spacecraft ID Number
9	157-164	8	Network ID 2 = Deep Space Network (DSN)
10	165-172	8	Station Number
11	173-180	8	Downlink Frequency Band (Receiver Type) 0 = Not Applicable 1 = S-band 2 = X-band 3 = L-band
12	181-184	4	Data Type Identifier 0 = Old/Unknown 1 = High Rate Doppler 2 = Low Rate Doppler 3 = Angles 4 = DRVID 5 = Range 6 = Ramp 7 = Mixed
13	185-192	8	Ground Mode 0 = No Doppler, No Range, No DRVID 1 = 1-Way Doppler 2 = 2-Way Doppler 3 = 3-Way Doppler 4 = 3-Way Coherent Doppler 5 = 1-Way, No Doppler 6 = 2-Way, No Doppler 7 = 3-Way, No Doppler 8 = 3-Way Coherent, No Doppler
14	193-200	8	Range Type 0 = No Range Data 6 = PLOP 7 = SRE (see item 28) 8 = MU2
15	201-208	8	Angle Type 0 = No Angle Data 1 = Azimuth/Elevation 2 = Hour Angle/Declination

95  
250  
Record Time Tag

21  
35  
00

Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
15 (Cont)			Angle Type (Cont.) 3 = X/Y (+X is East) 4 = X/Y (+X is South)
16	209-216	8	DRVID Type 0 = No DRVID Data 6-8 = Same as for Range Type (item 14)
17	217-221	5	Doppler Good/Bad Indicator 0 = Good 1 = Bad
18	222	1	Doppler Data Tolerance 0 = In Tolerance 1 = Out of Tolerance
19	223	1	0
20	224-227	4	Doppler Bias (two's complement, MHz)
21	228	1	Reserved (set to zero)
22	229	1	Angle Good/Bad Indicator 0 = Good 1 = Bad
23	230-232	3	Reserved (set to zeros)
24	233-235	3	Reserved (set to zeros)
25	236	1	Receiver Loop Lock Indicator 0 = In Lock 1 = Out of Lock
26	237	1	Transmitter/Exciter On/Off 0 = On 1 = Off
27	238-239	2	Reserved (set to zeros)
28	240-242	3	Source Designation 1 = Deep Space Network (DSN) (34m/70m) 2 = Deep Space Network (26m)
29	243-252	10	Reserved (set to zeros)
30	253-288	5/31	Sample Time (seconds x 100)
31	289-324	12/24	Doppler Count H/P (cycles x 1000)
32	325-360	12/24	Doppler Count L/P (cycles x 1000)
33	361-396	12/24	Range Data Field - Part 1 0 if Item 14 = 0 otherwise, range-at- $T_0$ H/P (RU x 1000 or NS x 1000)
34	397-432	12/24	Range Data Field - Part 2 0 if Item 14 = 0 otherwise, range-at- $T_0$ L/P (RU x 1000 or NS x 1000)



Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
35	433-452	4/16	Lowest Ranging Component
36	453-524	72	Reserved (set to zeros)
37	525-540	16	DRVID Power/Noise Ratio (two's complement, dB x 10)
38	541-576	17/19	Angle 1 (Azimuth/Hour Angle/X, degrees x 1000)
39	577-612	17/19	Angle 2 (Elevation/Declination/Y, degrees x 1000)
40	613-648	5/31	Doppler Reference Frequency (Hz x 10)
41	649-684	8/28	DRVID (two's complement, RU x 100)
42	685-720	12/24	No. 2 H/R Doppler H/P (cycles x 1000) or 0
43	721-756	12/24	No. 2 H/R Doppler L/P (cycles x 1000) or Round Trip Light Time (seconds)
44	757-792	12/24	No. 3 H/R Doppler H/P (cycles x 1000) or 0
45	793-828	12/24	No. 3 H/R Doppler L/P (cycles x 1000) or Tacquisition (seconds past 0-hour)
46	829-864	12/24	No. 4 H/R Doppler H/P (cycles x 1000) or 0
47	865-900	12/24	No. 4 H/R Doppler L/P (cycles x 1000) or T <sub>1</sub> Integration Time Constant (seconds)
48	901-936	12/24	No. 5 H/R Doppler H/P (cycles x 1000) or 0
49	937-972	12/24	No. 5 H/R Doppler L/P (cycles x 1000) or T <sub>2</sub> Integration Time Constant (seconds)
50	973-1008	12/24	No. 6 H/R Doppler H/P (cycles x 1000) or 0
51	1009-1044	12/24	No. 6 H/R Doppler L/P (cycles x 1000) or T <sub>3</sub> Integration Time Constant (seconds)
52	1045-1080	12/24	No. 7 H/R Doppler H/P (cycles x 1000) or 0
53	1081-1116	12/24	No. 7 H/R Doppler L/P (cycles x 1000) or Ref. Voltage (two's complement, millivolts)
54	1117-1152	12/24	No. 8 H/R Doppler H/P (cycles x 1000) or 0
55	1153-1188	12/24	No. 8 H/R Doppler L/P (cycles x 1000) or Quad. Voltage (two's complement, millivolts)
56	1189-1224	12/24	No. 9 H/R Doppler H/P (cycles x 1000) or 0
57	1225-1260	12/24	No. 9 H/R Doppler L/P (cycles x 1000) or Carrier Suppression (two's complement, dB or millivolts)
58	1261-1296	12/24	No. 10 H/R Doppler H/P (cycles x 1000) or 0
59	1297-1332	12/24	No. 10 H/R Doppler L/P (cycles x 1000) or Highest Ranging Component
60	1333-1368	5/31	Doppler Residual (two's complement, Hz x 1000)
61	1369-1404	14/22	Range Residual (two's complement, RU)
62	1405-1422	18	Angle 1 Residual (two's complement, degrees x 1000)
63	1423-1440	18	Angle 2 Residual (two's complement, degrees x 1000)

Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
64	1441-1443	3	Uplink Frequency Band and Source ID 0 = S-band, TRK-2-14 1 = S-band, TRK-2-15 2 = X-band, TRK-2-15 7 = S-band, TRK-2-20
65	1444-1446	3	Angle Mode 0 = Auto Track 1 = Manual Aided 2 = Computer 3 = Sidereal 4 = Brake
66	1447-1448	2	Conscan Mode 0 = Conscan Off 1 = Closed Loop 2 = Open Loop
67	1449	1	Angle 1 Residual Tolerance 0 = In Tolerance 1 = Out of Tolerance
68	1450	1	Angle 2 Residual Tolerance 0 = In Tolerance 1 = Out of Tolerance
69	1451-1453	3	Doppler Channel Number 1 = S-band, 26-meter DSS 2 = S-band, 34/70-meter DSS 3 = X-band, 34/70-meter DSS
70	1454	1	Frequency Standard Reference 0 = Backup 1 = Prime
71	1455-1458	4	Doppler Receiver Reference 1 = Block III, Receiver 1 2 = Block III, Receiver 2 3 = Block IV, Receiver 1 4 = Block IV, Receiver 2 5 = Block III, Receiver 1
72	1459-1462	4	Reserved (set to zeros)
73	1463	1	Doppler Residual Tolerance 0 = In Tolerance 1 = Out of Tolerance
74	1464	1	Doppler Noise Tolerance 0 = In Tolerance 1 = Out of Tolerance
75	1465-1494	30	Reserved (set to zeros)
76	1495-1512	18	Total Slipped Cycles During Count (cycles)
77	1513-1530	18	Doppler Noise (Hz x 1000)

Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
78	1531-1548	18	Received Signal Strength (two's complement, dBm or volts x 10)
79	1549-1584	5/31	Differential Doppler Phase (two's complement, cycles x 1000): S - 3/11 X
80	1585	1	Range Modulation On/Off 0 = On 1 = Off
81	1586	1	Prime Ranging Channel 0 = S-band 1 = X-band
82	1587	1	Pipelining On/Off 0 = On 1 = Off
83	1588	1	Chopper Frequency On/Off 0 = On 1 = Off
84	1589	1	Reserved (set to zero)
85	1590	1	Range Validity 0 = Good 1 = Bad
86	1591	1	Range Calibration Tolerance 0 = In Tolerance 1 = Out of Tolerance
87	1592	1	Range Configuration Change Flag 0 = Same 1 = Different
88	1593	1	Range Power/Noise Ratio Tolerance 0 = In Tolerance 1 = Out of Tolerance
89	1594	1	Range Residual Tolerance 0 = In Tolerance 1 = Out of Tolerance
90	1595	1	Pseudo DRVID Tolerance 0 = In Tolerance 1 = Out of Tolerance
91	1596	1	Differenced S-X Range Tolerance 0 = In Tolerance 1 = Out of Tolerance
92	1597-1600	4	Receiver Number
93	1601	1	Reserved (set to zero)
94	1602-1603	2	Amplifier Number

Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
95	1604-1605	2	Amplifier Type 0 = S-band Maser 1 = X-band Maser 2 = Parametric Amplifier 3 = FET
96	1606	1	Transmitter Power Indicator 0 = Low Power 1 = High Power
97	1607	1	Reserved (set to zero)
98	1608-1620	13	Transmitter Power (kilowatts)
99	1621-1644	24	Range Calibration (RU x 100)
100	1645-1656	12	Range Power/Noise Ratio (two's complement, dB x 10)
101	1657-1692	15/21	Average Doppler Residual (two's complement, Hz x 1000)
102	1693-1728	8/28	Pseudo DRVID (two's complement, RU x 100)
103	1729-1764	14/22	Differenced S-X Range (two's complement, RU x 100) or Ramp Delay Time (two's complement, nanoseconds)
104	1765-1786	22	Z Correction (two's complement, nanoseconds x 100)
105	1787-1800	14	Spacecraft Delay (nanoseconds)
106	1801-1833	19/14	DRVID Noise (RU x 100)
107	1834	1	DRVID Validity 0 = Good 1 = Bad
108	1835	1	DRVID Noise Tolerance 0 = In Tolerance 1 = Out of Tolerance
109	1836	1	DRVID Power/Noise Ratio Tolerance 0 = In Tolerance 1 = Out of Tolerance
110	1837-1872	8/28	Differenced S-X DRVID (two's complement, RU x 100)
111	1873-1877	5	Ramp Controller Indicator 0 = POCA Controller 1 = DCO Controller 2 = New Controller
112	1878-1908	31	Programmed Frequency Ramp Rate (two's complement, Hz x 1000000) or Received Signal Strength (two's complement, dBm or volts x 4096) or Ranging Transmitter Coder In-Phase offset from Sample Timetag (seconds)
113	1909-1944	12/24	Programmed Start Frequency - Part 1 (Hz / 10)

Table 3. Tracking Data Logical Record (Continued)

Item Number	Bit Number	Length (Bits)	Description
114	1945-1980	12/24	Programmed Start Frequency - Part 2 (Hz modulo 10, x 1000000)
115	1981-2124	144	Reserved (set to zeros)
116	2125-2160	5/31	Transmitter/Exciter Frequency (Hz x 10)
117	2161-2304	144	0 (not used)