Viking Mission Support

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This report covers the period 1 January through 28 February 1977 and includes the initial Viking Extended Mission period of DSN "normal" support, following the nonstandard operations during the Solar Conjunction period. The operational testing subsequent to the MK III Data System installations at DSS 12, 44, and 62 during this period is also discussed.

I. Viking Operation Activities

Several maneuvers have been carried out with both VO-1 and VO-2, resulting, at the end of February 1977, with VO-1 in a 23.5-hour orbit and a periapsis altitude of 300 km. This orbit causes the spacecraft to "walk" around Mars progressively and ending at its starting point every 25 days. The low periapsis altitude pictures are the closest ever taken but, although there are some clear areas, a large percentage of the pictures is degraded due to possible dust clouds in the southern hemisphere and the carbon dioxide polar hood in the northern hemisphere. VL-1, 22°N of the equator, is now experiencing temperatures on the Mars surface of about 178 K (-140°F).

VO-2 is in a synchronous orbit over VL-2 with a periapsis altitude of 800 km. VL-2, higher in the northern hemisphere (48°N), which is now in Mars winter, is experiencing outside temperatures of about 150 K (-190°F).

With minor exceptions the four spacecraft are functioning normally.

Both orbiters are experiencing daily occultations, i.e., the RF signal is being interrupted as the spacecraft passes behind Mars as viewed from Earth.

II. DSN Support for Viking

The statistics listing the DSN tracking and command support for Viking during this reporting period are shown in Tables 1 and 2.

The Discrepancy Report status for this period is summarized in Table 3.

III. MK III Data System (MDS) Capabilities

As mentioned in previous articles, the MDS implementation replaces the digital processing equipment at the DSSs with new equipment. At the 26-m stations, the total data processing capability, i.e., supporting a single spacecraft carrier and processing two telemetry channels, nominally a low rate <

33-1/3 bps and a medium rate < 2 kbps, remains unchanged, though either channel can now process from 8-1/3 bps up to 2 kbps. However, the 64-m station capability of processing three spacecraft carriers and six TLM channels simultaneously, i.e., two low, two medium, and two high < 16 kbps (see Fig. 1) will be reduced to nominally two spacecraft carriers with two low/medium channels and two high-rate channels (see Fig. 2).

However, although the telemetry from four subcarriers only can be processed in real time, the 64-m stations will still retain the original four receivers, so the third Viking spacecraft carrier can be recorded on analog tape and replayed and processed in near-real time if required.

IV. Network Operations Plan for Viking Extended Mission

Due to the fact that the MDS modifications will be progressively implemented at all DSN stations over a period of about 18 months, the Viking Extended Mission (VEM) will be supported by both modified and unmodified stations at any time up to May 1978.

As the MDS modifications change the hardware configurations, software programs, and operational procedures, a completely new Network Operations Plan (NOP) is required for the MDS stations. Therefore, the Viking NOP has been updated for use by the modified DSN stations. The unmodified stations are still using the original NOP to support the Viking Extended Mission.

V. MDS Testing

Testing after the MDS modifications to verify the station's capability to support the Viking Extended Mission followed a similar pattern to the prelaunch testing but on a reduced scale.

The stations affected during this reporting period were DSS 12, DSS 44, and DSS 62.

A. DSS 12

(1) System Performance Tests (SPTs)

Completed by 1 January 1977.

(2) Operational Verification Tests (OVTs)

(a) On 8 January 1977, OVT 1 experienced problems caused by known software anomalies and some equipment failures.

(b) On 12 January, OVT 2 met all test acceptance criteria and was considered successful.

(3) DSN-VMCCC System Integration Tests (SITs)

(a) On 14 January 1977, SIT 1 experienced hardware failures.

(b) On 24 January, SIT 2 was successfully completed.

(4) Demonstration Passes

Two demonstration passes were successfully carried out on live tracks of the Viking spacecraft. After the completion of the second pass on 31 January 1977, DSS 12 was placed in configuration control for Viking.

B. DSS 62

During February 1977, DSS 62 completed the OVT portion of the program successfully on schedule with a planned completion of the remainder of the tests in March.

C. DSS 44

The MDS implementation at DSS 44 was near completion at the end of February with the first OVT scheduled for 6 March 1977.

Table 1. VEM tracking support (1977)

DSS	January		February	
	Tracks	Hours	Tracks	Hours
11	23	135	22	142
12	4	11	1	6
14	52	341	59	392
42	21	247	25	226
43	68	721	62	627
44	0	0	0	0
61	35	261	29	227
62	0	0	2	7
63	38	327	28	202
Total	241	2043	228	1829

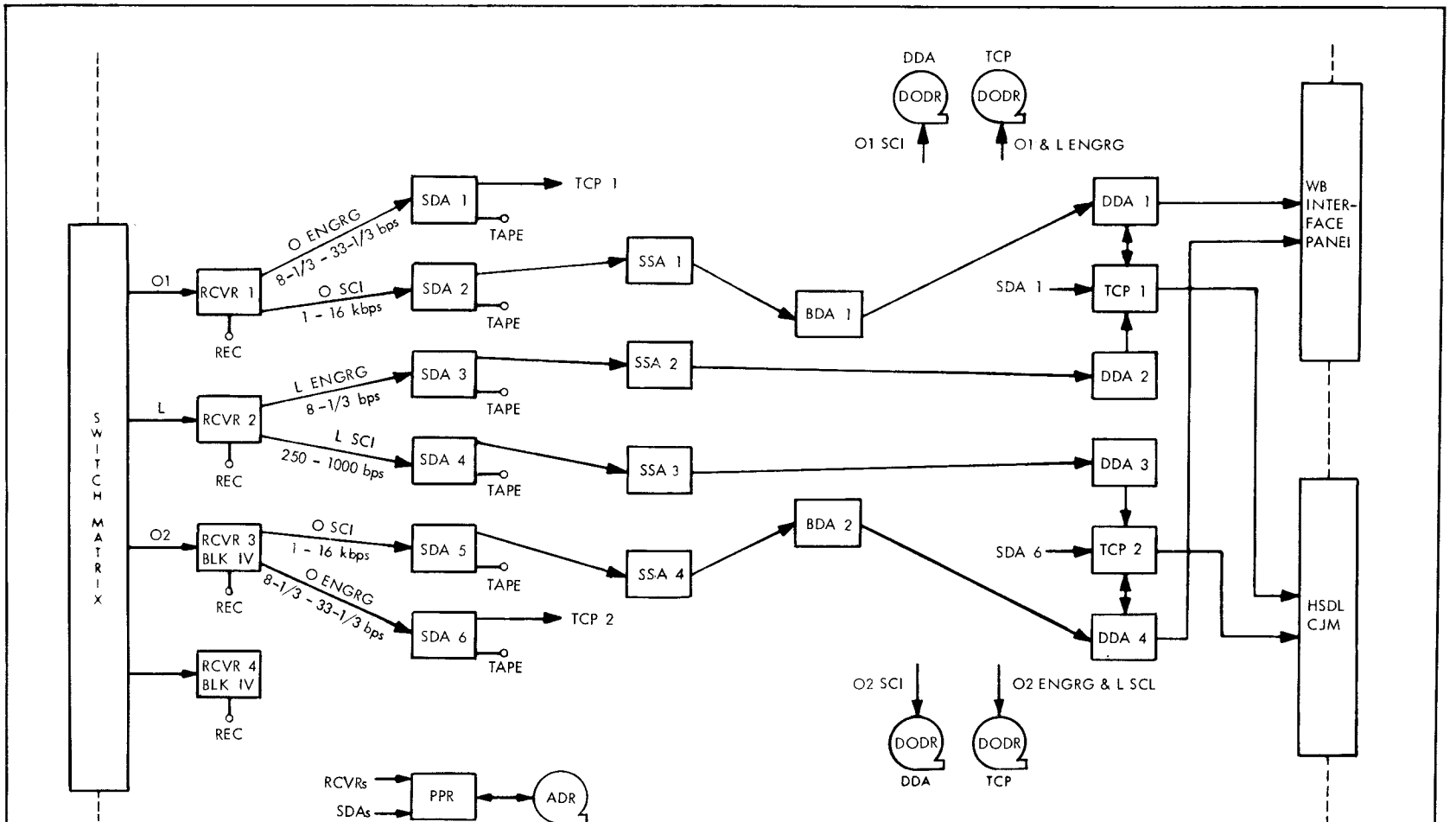
Table 2. VEM commands transmitted

DSS	January	February
11	1521	1394
12	0	0
14	769	1404
42	2072	953
43	919	2523
44	0	0
61	605	1116
62	0	0
63	795	472
Total	6681	7862

Table 3. DSN VEM discrepancy reports

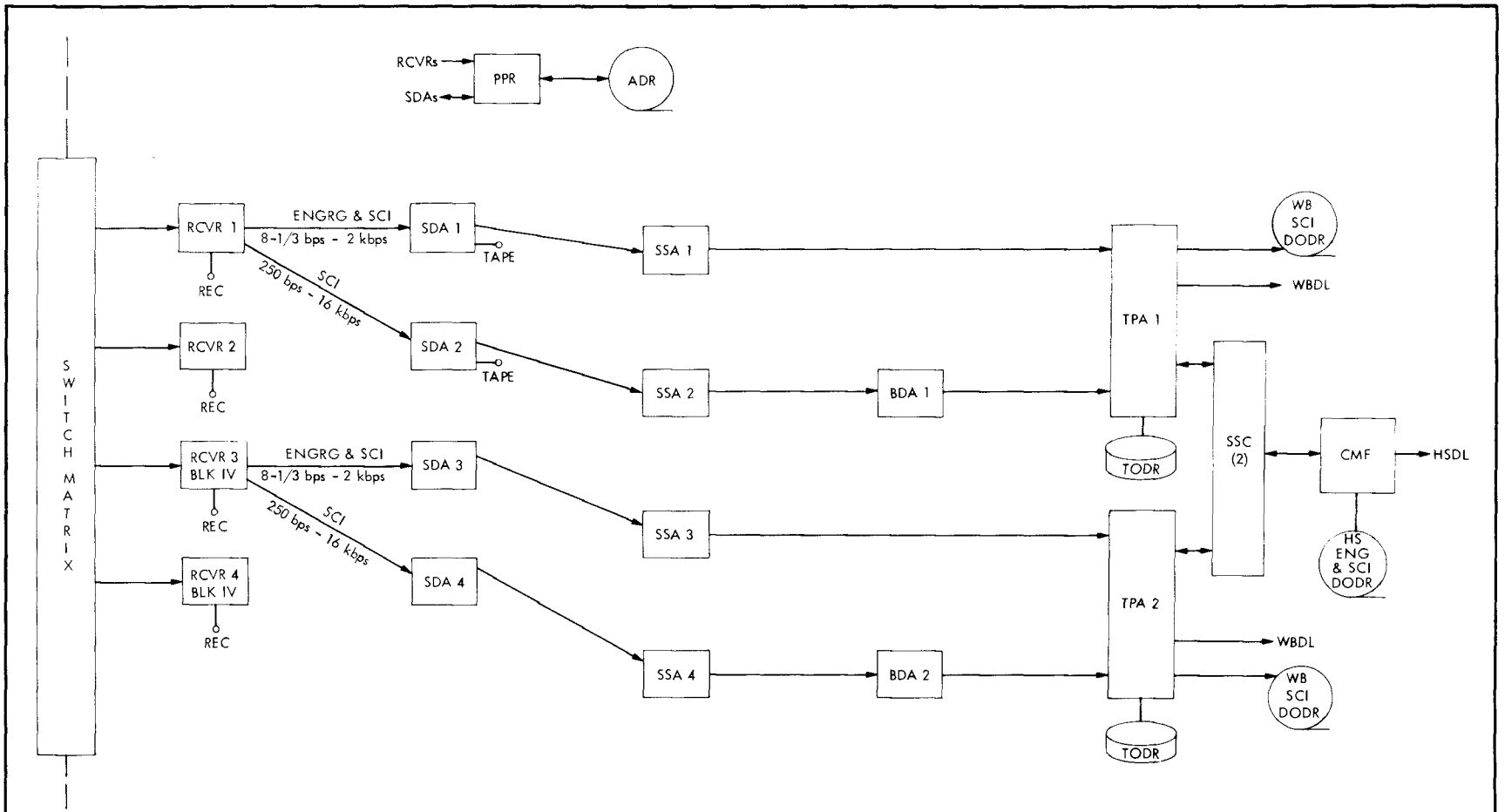
DSS	January		February	
	Opened	Closed	Opened	Closed
11	4	0	3	4
12	4	0	0	0
14	14	2	11	19
42	0	1	2	3
43	10	13	11	10
44	0	0	0	0
61	1	9	1	6
62	0	0	0	8
63	1	4	7	3
Others*	4	3	3	9
Total	38	32	38	62

*Others = DSN, Network Data Processing Area, Network Operations Control Area.



SPACECRAFT	RECEIVER	DATA TYPE	SDA	SSA	BDA	DDA	TCP
ORBITER 1	1	ENGRG	1	0	0	0	1
		SCI	2	1	1	1	
LANDER	2	ENGRG	3	2	0	2	
		SCI	4	3	0	3	2
ORBITER 2	3	SCI	5	4	2	4	
		ENGRG	6	0	0	0	

Fig. 1. Standard planetary configuration, Orbiter-Lander-Orbiter (Code 30)



SPACECRAFT	RECEIVER	DATA TYPE	SDA	SSA	BDA	TPA
1	1	ENGRG & SCI	1	1	0	1
		SCI	2	2	1	1
2	3	ENGRG & SCI	3	3	0	2
		SCI	4	4	2	2

Fig. 2. Standard VEM two spacecraft configuration (Code 1)