77SDS4204
22 FEBRUARY 1977

LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT 23 OCTOBER 1976 TO 23 JANUARY 1977

Prepared By

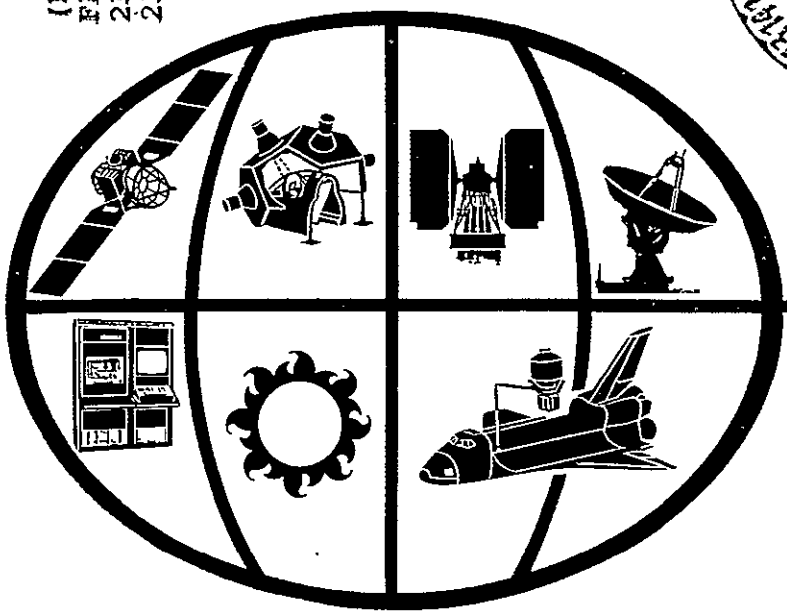
GE LANDSAT OPERATIONS CONTROL CENTER

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Goddard Space Flight Center

Greenbelt, Maryland 20771



space division

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Contract NAS5-21808

APPROVED: Thomas W. Winchester
Thomas W. Winchester

SPACE DIVISION
Valley Forge Space Center
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GENERAL ELECTRIC

LANDSAT–1

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LIST OF TABLES

INTRODUCTION

This is the ninteenth report in a continuing series of documents issued at launch, and thereafter quarterly, to present flight performance analysis of the Landsat-1 Spacecraft. Previously issued documents are:

72SD4255	ERTS-1 Launch and Flight Activation Evaluation Report 23 to 26 July 1972	18 October 1972
72SD4262	ERTS-1 Flight Evaluation Report 23 July 1972 to 23 October 1972	28 November 1972
72SD4224	ERTS-1 Flight Evaluation Report 23 October 1972 to 23 January 1973	27 February 1973
73SD4249	ERTS-1 Flight Evaluation Report 23 January 1973 to 23 April 1973	29 May 1973
73SD4260	ERTS-1 Flight Evaluation Report 23 April 1973 to 23 July 1973	10 August 1973
73SD4274	ERTS-1 Flight Evaluation Report 23 July 1973 to October 1973	28 November 1973
74SD4205	ERTS-1 Flight Evaluation Report 23 October 1973 to 23 January 1974	26 February 1974
74SD4217	ERTS-1 Flight Evaluation Report 23 January 1974 to 23 April 1974	18 May 1974
74SD4236	ERTS-1 Flight Evaluation Report 23 April 1974 to 23 July 1974	15 August 1974
74SD4255	ERTS-1 Flight Evaluation Report 23 July 1974 to 23 October 1974	31 December 1974
75SDS4222	Landsat-1 Flight Evaluation Report 23 October 1974 to 23 January 1975	30 April 1975
75SDS4228	Landsat-1 and Landsat-2 Flight Evaluation Report 23 January 1975 to 23 April 1975	15 August 1975
75SDS4255	Landsat-1 and Landsat-2 Flight Evaluation Report 23 April 1975 to 23 July 1975	10 October 1975
75SDS4266	Landsat-1 and Landsat-2 Flight Evaluation Report 23 July 1975 to 23 October 1975	1 December 1975
76SDS4207	Landsat-1 and Landsat-2 Flight Evaluation Report 23 October 1975 to 23 January 1976	29 February 1976
76SDS4248	Landsat-1 and Landsat-2 Flight Evaluation Report 23 January 1976 to 23 April 1976	14 July 1976
76SDS4263	Landsat-1 and Landsat-2 Flight Evaluation Report 23 April 1976 to 23 July 1976	15 October 1976
76SDS4278	Landsat-1 and Landsat-2 Flight Evaluation Report 23 July 1976 to 23 October 1976	30 November 1976

This report contains analysis of performance for Orbits 2160 to 22930 for Landsat-1.

SECTION 1

SUMMARY

LANDSAT-1 OPERATIONS

NASA
FORMAL
REPORT

FFNo 665 Aug 65

SECTION 1

SUMMARY LANDSAT-1 OPERATIONS

Landsat-1 continues to perform its mission nominally.

The Landsat-1 spacecraft was launched from the Western Test Range on 23 July 1972, at 18:08:06.508Z. The launch and orbital injection phase of the space flight was nominal and deployment of the spacecraft followed predictions.

Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147, 3 August 1972, after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2).

In Orbit 196, 6 August 1972, the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands. Landsat-1 continued to perform its imaging mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data.

The remaining Wideband Tape Recorder (WBVTR-1) experienced four suspensions of operation, the last being in Orbit 9881 on 2 July 1974, and has not been used operationally since.

In Orbit 4396, 3 June 1973, an integrated circuit chip in the TMP failed, disabling four TLM functions.

COMSTOR "B" has an intermittent problem with cell 12, and is not being used operationally.

The "B" section of the USB with full power output of 1.5 watts was substituted for the "A" section in Orbit 10068 15 July 1974, because of excessive decline of transmitter power.

The pitch flywheel stopped for 2 minutes in Orbit 8040, 20 February 1974; and for 8 hours, 2 minutes in Orbits 11125 to 11130, 29 September 1974. It has been kept close to zero speed ever since, using pitch-bias control.

The RMP was switched from B to A in Orbit 11257, 8 October 1974, as a precautionary measure after RMP B began showing current variations.

The DCS subsystem was turned off after Orbit 12690, 19 January 1975, and the function assumed by DCS in Landsat-2.

Narrow Band Recorder 2 became noisy and was turned off in Orbit 13015, 12 February 1975. Operation of NBR 2 resumed in Orbit 14116, 2 May 1975, until failure in Orbit 15253, 22 July 1975, when its operation was terminated.

Battery 6 was turned off from Orbits 13346, 7 March 1975, to 14100 30 April 1975, due to electrical characteristics causing high temperatures. Between Orbits 14780, 18 June 1975 and 15467, 6 August 1975, Battery 6 was turned off again due to high temperature. Because high current transient occurred at Battery 6 turn-on in Orbit 15467, 6 August 1975, the battery turn-on command is temporarily suspended from use.

Battery 8 was turned off in Orbit 15588, 15 August 1975, due to electrical characteristics causing high temperature and will not be returned to service because of the battery "ON" command problem.

The pitch flywheel stopped again for 45 minutes in Orbit 15309, 26 July 1975, and 3 minutes in Orbit 15312, 26 July 1975. Pitch flywheel motor driver duty cycle remained high from Orbit 15191, 18 July 1975 to Orbit 15393, 1 August 1975, when it returned to normal. MSS operation was suspended during the pitch flywheel anomaly between Orbit 15309, 26 July 1975, and 15393, 1 August 1975.

The rear ACS scanner had intermittent electrical failures beginning in Orbit 19078, 21 April 1976, and it failed in Orbit 19086, 22 April 1976. The spacecraft was switched to single scanner mode (forward scanner) in Orbit 19089, 22 April 1976, and normal ACS operation resumed.

A series of orbit adjust firings began in Orbit 21613, 20 October 1976, to adjust time phasing between Landsat-1 and Landsat-2. This will also change the repeat cycle pattern coverage of Landsat-1 and Landsat-2 from a 9 day/9 day to a 12 day/6 day coverage. Landsat-1 is designated non-operational until completion of the orbit adjust sequence anticipated for completion approximately 2/1/77.

Battery 5 was turned off in Orbit 22605, 31 December 1976, due to electrical characteristics causing high temperature and will not be returned to service because of the battery "On" command problem.

The position of the sun with respect to the orbit after five years is on the marginal edge of the sun sensor detector response angle. The solar panels have tracked the sun with increasing offset errors and the resulting sun position and panel tracking offset errors have reduced the solar array output. The solar array, however, has supplied sufficient power for the spacecraft operation.

See Table 1-1 for a summary of payload in-orbit operation.

Table 1-1. In-Orbit Payload System Performance Launch Thru Orbit 22930 (1/23/77) Landsat-1

RBV	Total Scenes Imaged	1,690
	AVG. Scenes/Day	139
	Total Area Imaged (millions of sq. n. mi.)	14.7
	ON TIME (hr.)	14.0
	ON/OFF Cycles	91
	% Real Time Images	57
	% Recorded Images	43
MSS	Total Scenes Images	255,554
	AVG. Scenes/Day	173
	Total Area Imaged (millions of sq. n. mi.)	2,227
	ON TIME (hr.)	2,637
	ON/OFF Cycles	18,125
	% Real Time Images	81
	% Recorded Images	19
DCS	Messages at OCC	1,152,045
	Non-Perfect MSGS	90,691
	Max. DCP's ACTIVE/DAY	114
	Users	44
	Avg. MSG/ACTIVE Orbit	181
	ON TIME (hr.)	21,820.2
WPA-1	% Real Time Mode	55
	% Playback Mode	45
	ON TIME (hr.)	31.9
	ON/OFF Cycles	312
WPA-2	% Real Time Mode	78
	% P/B Mode	22
	ON TIME (hr.)	2,548
	ON/OFF Cycles	15,897
WBVTR-1	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	Minor Frame Sync Error Count in P/B Failed Orbit	9,881
	Time Head-Tape Contact (hr.)	732.8
	Cycles Head-Tape Contact	11,954
	ON TIME (hr.)	927.6
WBVTR-2	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	MFSE Count in P/B Failed Orbit	148
	Time Head-Tape Contact (hr.)	5.1
	Cycles Head-Tape Contact	44
	ON TIME (hr.)	6.5

SECTION 2

ORBITAL PARAMETERS

LANDSAT-1

SECTION 2

ORBITAL PARAMETERS

The initial orbit of Landsat-1 required some correction at Orbits 38, 44, and 59 to achieve the desired 18-day repeat cycle.

During Orbits 938, 2416, 6390 and 7826 it was necessary to fire the -X thruster of the orbit adjust system to maintain the ground trace in the desired 18-day repeat pattern of $\pm$ 10 nm.

On 29 September 1974, the ACS control system fired gas during the spacecraft emergency (pitct flywheel stoppage) which resulted in an unplanned orbit change similar to firing the -X thruster.

The +X thruster was fired during the Orbits 11367, 11464, 13611, 19747 and 19871 in order to maintain the 18-day repeat cycle ground trace within +10 nm.

A 101 day orbit adjust program commenced in Orbit 21613 (20 October 1976) and lasted through Orbit 23007 (28 January 1977). Results of this program are summarized in Table 2-1.

Table 2-1. Landsat-1 Orbit Adjust Summary

	Pre-Orbit Adjust	Post Orbit Adjust
1. Separation time between Landsat-1 and Landsat-2 at the descending node.	17.56 min. (Landsat-2 leading Landsat-1)	29.73 min. (Landsat-2 leading Landsat-1)
2. Ground track position from center	1.01 NM West	1.78 NM East
3. Equatorial crossing; Local time	08 47 02.64	08 38 14.38
4. Semi-major axis	7285.4911 KM	7285.4690 KM
5. Nodal Period	103.260 (18 Oct. '76)	103.254 (28 Jan. '77)

This program increased the time separation between the Landsat spacecrafts by 12.17 minutes so that the operational limits for ground station turn around time to track the spacecrafts in successive passes would not be exceeded; long term effects of minor differences in orbital parameters between the Landsats resulted in Landsat-1's converging on Landsat-2.

Another consequence of the orbit adjust program was the alteration of the Landsat-1 - Landsat-2 combined total earth coverage repeat cycle from a nine day - nine day schedule to a twelve day - six day schedule, i.e., Landsat-2 will pass over a reference point on earth twelve days after Landsat-1's passage. Six days after Landat-2 crosses this point, Landsat-1 will pass over it again.

Current orbital parameters are given in Table 2-2 and orbital parameters determined during the orbit adjust program and given in Tables 2-3 and 2-4.

Additional information pertinent to the orbit adjust program can be found in Sections 4 and 7.

Figure 2-1 shows the longitude error as a function of time and orbit maintenance burns. The longitude error has been maintained within $\pm$ 10 nm in the east-west direction at the equator as planned. Figure 2-2 shows the change of sun time at the descending node. Appendix B gives the ground trace repeat cycle predictions.

Table 2-2. Landsat-1 Brouwer Mean Orbital Parameters

Element / Date	Apogee (km)	Perigee (km)	Inclination (Deg.)	Semi Major Axis (km)	Eccentricity	Two Body Period (Min)	Nodal Period (Min)	Argument of Perigee (Deg)	Right Ascension (Deg)	Mean Anomaly (Deg)
25 Oct 1972	917.3	898.1	99.103	7285.850	0.00132	103.152	103.268	93.721	1.060	86.484
25 Jan 1973	922.3	893.1	99.090	7285.865	0.00200	103.153	103.268	133.693	91.805	52.797
25 Apr 1973	911.056	888.763	99.073	7285.767	0.00073	103.151	103.267	168.857	181.411	11.098
25 Jul 1973	914.341	900.810	99.068	7285.741	0.00093	103.150	103.266	95.602	268.944	84.301
25 Oct 1973	922.913	893.229	99.056	7285.786	0.00198	103.151	103.266	65.071	0.291	301.002
25 Jan 1974	915.873	899.111	99.041	7285.657	0.00115	103.148	103.264	160.866	88.606	19.049
24 Apr 1974	920.090	912.672	99.023	7285.691	0.000802	103.149	103.265	117.631	176.743	62.319
23 Jul 1974	922.363	892.629	99.017	7285.661	0.002041	103.148	103.264	109.225	269.779	70.540
23 Oct 1974	918.657	896.316	99.004	7285.652	0.00153	103.148	103.264	150.750	354.743	29.110
24 Jan 1975	914.18	900.67	98.990	7285.590	0.000928	103.147	103.262	278.848	85.403	261.138
24 Apr 1975	914.74	900.05	98.972	7285.559	0.001008	103.146	103.262	37.047	173.043	142.764
25 Jul 1975	915.12	899.63	98.964	7285.541	0.001063	103.145	103.261	138.138	262.528	41.661
23 Oct 1975	914.19	900.54	98.951	7285.531	0.000937	103.145	103.261	250.370	349.952	289.612
24 Jan 1976	914.39	900.32	98.936	7285.523	0.000966	103.145	103.261	2.826	80.147	177.049
23 Apr 1976	915.28	899.41	98.919	7285.511	0.001089	103.145	103.261	110.622	167.275	69.142
22 Jul 1976	914.24	900.35	98.911	7285.464	0.000953	103.144	103.260	218.207	254.289	321.741
23 Oct 1976	914.33	900.42	98.894	7285.543	0.000955	103.145	103.262	332.337	343.897	207.595
28 Jan 1977	913.57	900.95	98.878	7285.427	0.000867	103.143	103.254	60.280	77.333	119 515

Table 2-3. Landsat-1 Orbit Adjust Program Phase 1 (Ascending), Post Burn, Brouwer Mean Orbital Elements

Element / Date	Apogee (km)	Perigee (km)	Inclination (Deg.)	Semi Major Axis (km)	Eccentricity	Two Body Period (Min)	Nodal Period (Min)	Argument of Perigee (Deg)	Right Ascension (Deg)	Mean Anomaly (Deg)
*18 Oct 76	914.18	900.38	98.899	7285.451	0.000947	103.144	103.260	345.241	339.261	194.667
20 Oct 76	914.15	900.43	98.898	7285.455	0.000942	103.144	103.260	340.254	341.199	199.663
21 Oct 76	914.34	900.27	98.894	7285.472	0.000966	103.144	103.260	337.355	341.960	202.568
22 Oct 76	914.34	900.34	98.894	7285.508	0.000960	103.145	103.261	334.924	342.929	205.004
23 Oct 76	914.33	900.42	98.894	7285.543	0.000955	103.146	103.262	332.337	343.897	207.595
24 Oct 76	914.32	900.50	98.893	7285.578	0.000949	103.146	103.262	329.759	344.866	210.177
25 Oct 76	914.32	900.58	98.893	7285.613	0.000943	103.147	103.263	327.055	345.834	212.885
26 Oct 76	914.30	900.67	98.893	7285.648	0.000935	103.148	103.264	324.310	346.803	215.633
27 Oct 76	914.31	900.73	98.893	7285.688	0.000932	103.149	103.265	321.246	347.771	218.702
28 Oct 76	914.28	900.92	98.893	7285.764	0.000917	103.150	103.266	318.816	348.671	221.134
29 Oct 76	914.31	900.97	98.894	7285.803	0.000915	103.151	103.267	315.794	349.639	224.160
30 Oct 76	914.29	901.07	98.894	7285.843	0.000907	103.152	103.268	312.318	350.607	227.640
31 Oct 76	914.27	901.16	98.893	7285.879	0.000900	103.153	103.269	309.506	351.576	230.454
1 Nov 76	914.27	901.24	98.894	7285.920	0.000895	103.154	103.270	305.895	352.543	234.069
2 Nov 76	914.19	901.40	98.893	7285.961	0.000877	103.154	103.271	304.776	353.512	235.187
3 Nov 76	914.24	901.42	98.893	7285.995	0.000880	103.155	103.271	300.041	354.480	239.927
4 Nov 76	914.16	901.56	98.890	7286.026	0.000865	103.156	103.272	298.060	355.450	241.908
5 Nov 76	914.20	901.61	98.892	7286.070	0.000864	103.157	103.273	294.508	356.417	245.463
8 Nov 76	914.12	901.75	98.890	7286.101	0.000848	103.157	103.274	286 437	359.322	253.537
9 Nov 76	914.09	901.85	98.889	7286.134	0.000840	103.158	103.274	283.499	0.290	256.476

*Pre-Orbit Adjust Reference Data

Table 2-4. Landsat-1 Orbit Adjust Program Phase 3 (Descending), Post Burn, Brouwer Mean Orbital Elements

Element / Date	Apogee (km)	Perigee (km)	Inclination (Deg.)	Semi Major Axis (km)	Eccentricity	Two Body Period (Min)	Nodal Period (Min)	Argument of Perigee (Deg)	Right Ascension (Deg)	Mean Anomaly (Deg)
7 Jan 77	914.82	901.06	98.881	7286.105	0.000944	103.157	103.274	117.907	57.096	61.875
10 Jan 77	914.78	901.09	98.880	7286.102	0.000940	103.157	103.274	110.766	59.997	69.014
11 Jan 77	914.63	901.07	98,880	7286.019	0.000930	103.156	103.272	107.902	60.963	71.877
13 Jan 77	914.59	901.03	98.881	7285.975	0.000930	103.155	103.271	102.892	62.897	76.885
14 Jan 77	914.54	900.99	98.880	7285.933	0.000930	103.154	103.270	99.570	63.864	80.206
15 Jan 77	914.49	900.96	98.880	7285.890	0.000929	103.153	103.269	96.813	64.831	82.962
16 Jan 77	914.43	900.93	98.880	7285.845	0,000927	103.152	103.268	94.288	65.798	85.487
17 Jan 77	914.36	900.90	98.880	7285.800	0.000924	103.151	103.267	91.057	66.766	88.718
18 Jan 77	914.31	900.87	98.879	7285.754	0.000922	103.150	103.266	88.190	67.732	91.585
19 Jan 77	914.22	900.86	98.879	7285.702	0.000917	103.149	103.265	85.386	68.699	94.390
20 Jan 77	914.14	900.83	98.878	7285.649	0.000913	103.148	103.264	82.269	69.666	97.508
21 Jan 77	914.04	900.83	98.879	7285.598	0.000907	103.147	103.263	72.283	70.632	100.476
22 Jan 77	913.94	900.83	98.879	7285.547	0.000900	103.146	103.262	76.490	71.600	103.291
23 Jan 77	913.82	900.84	98.879	7285.498	0.000891	103.145	103.261	73.673	72.567	106.110
24 Jan 77	913.71	900.85	98.879	7285.449	0.000883	103.144	103.260	70.743	73.534	109.042
25 Jan 77	913.67	900.87	98.879	7285.439	0.000878	103.144	103.260	68.459	74.432	111.328
28 Jan 77	913.57	900.95	98.878	7285.427	0.000867	103.143	103.254	60.280	77.333	119.515

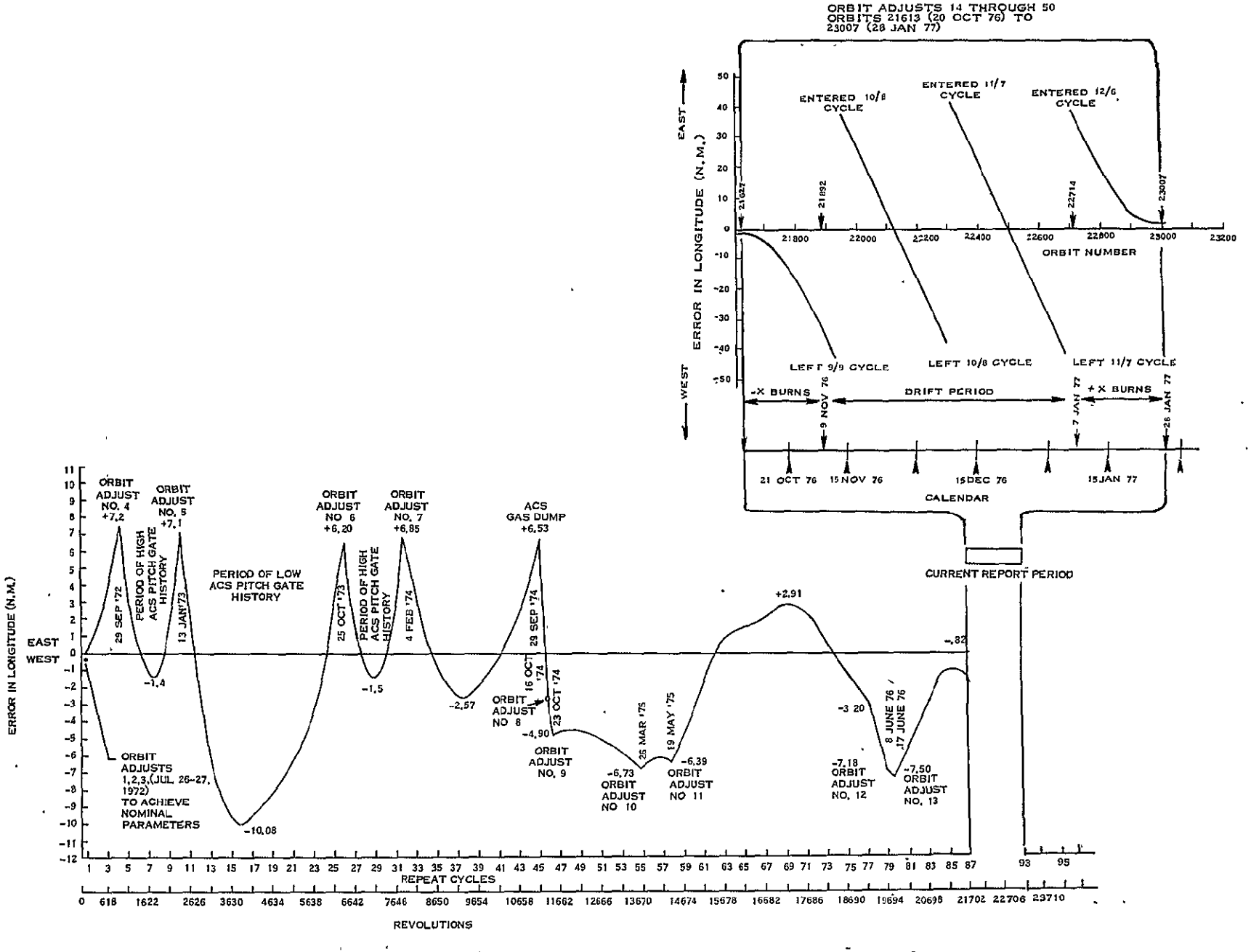


Figure 2-1. Effect of Orbit Adjusts on Landsat 1's Ground Track

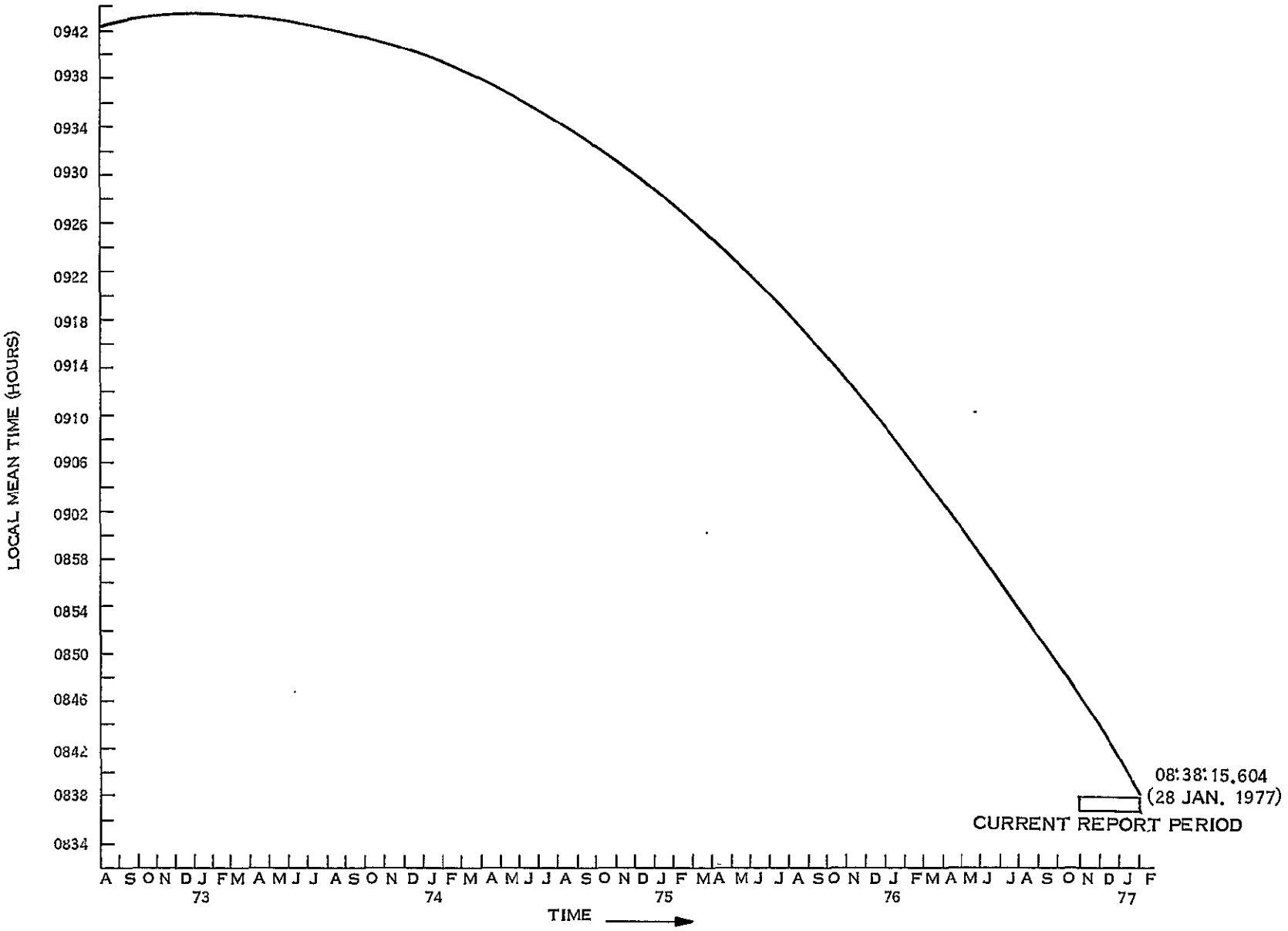


Figure 2-2. Local Mean Time of Descending Node

SECTION 3

POWER SUBSYSTEM (PWR)

LANDSAT-1

SECTION 3

POWER SUBSYSTEM (PWR)

The solar array continued to provide excess energy for the payload and spacecraft load throughout this repor period. Compensation loads and auxiliary loads dissipated the excess power above the battery and load requirements using Landsat-1 power management procedures. The power subsystem is predicted to have adequate power through 1977 for the present Landsat-1 payload configuration.

A plot of measured and predicted midday solar array current is shown in Figure 3-1. Figure 3-2 shows actual and predicted midday solar array degradation. Solar array degradation was 30.3% at the end of 54 months in orbit. Figure 3-3 shows actual sun angles to the spacecraft and solar panels. Figure 3-4 is a prediction of the variation of sun angle through 1977 for Landsat-1 and 2. It is noted in Figure 3-1 that the high noon solar array current is slightly lower than predicted. This is due to slightly different solar panel sun angles and solar array degradation larger than initially predicted.

Solar panel tracking was near normal until December 1, 1976. At that time, the sun angle rose above 46^{o} and the right panel began tracking with an offset which increased as the sun angle increased to 53^{o} at the end of this report period. See Section 4 for a discussion of solar panel tracking and action required. The solar array provided excess energy for the spacecraft with the tracking offset and did not affect spacecraft operation. The solar array current notch of approximately 500-600 ma still occurs for a short portion of each satellite day but does not affect operation as there is still excess power.

Since 30 August 1975, the batteries have been kept slightly undercharged to avert the possible recurrence of a run-away condition. Battery 8 was turned off as previously reported. Battery 5 was turned off in Orbit 22605 (30 December 1976) because of high C/D ratios and high temperature (36.8^{o}C). These batteries will remain off because of the "All Battery On" command restriction resulting from 'the battery on' anomaly reported previously. Battery temperatures have increased this report period because of increasing sun intensity, sun angle, and long day short nights. Temperatures will continue to increase until February 1977 at which time they will begin to decrease. Temperatures between batteries ranged from 16.7 to 37.7^{o}C and battery packs averaged a typical 8.3 Depth of Discharge (DOD) at the beginning of the report period and 7.3% (DOD) at the end of this report period.

The power system electronics performed well in this report period with all voltages stable. Table 3-1 shows major power subsystem parameters and Table 3-2 shows power subsystem telemetry for selected orbits. Some parameters in Table 3-2 may slightly differ from Table 3-1, because Table 3-1 uses a power management time span (night followed by a day); whereas, the time span used in Table 3-2 is the playback period for the NBR.

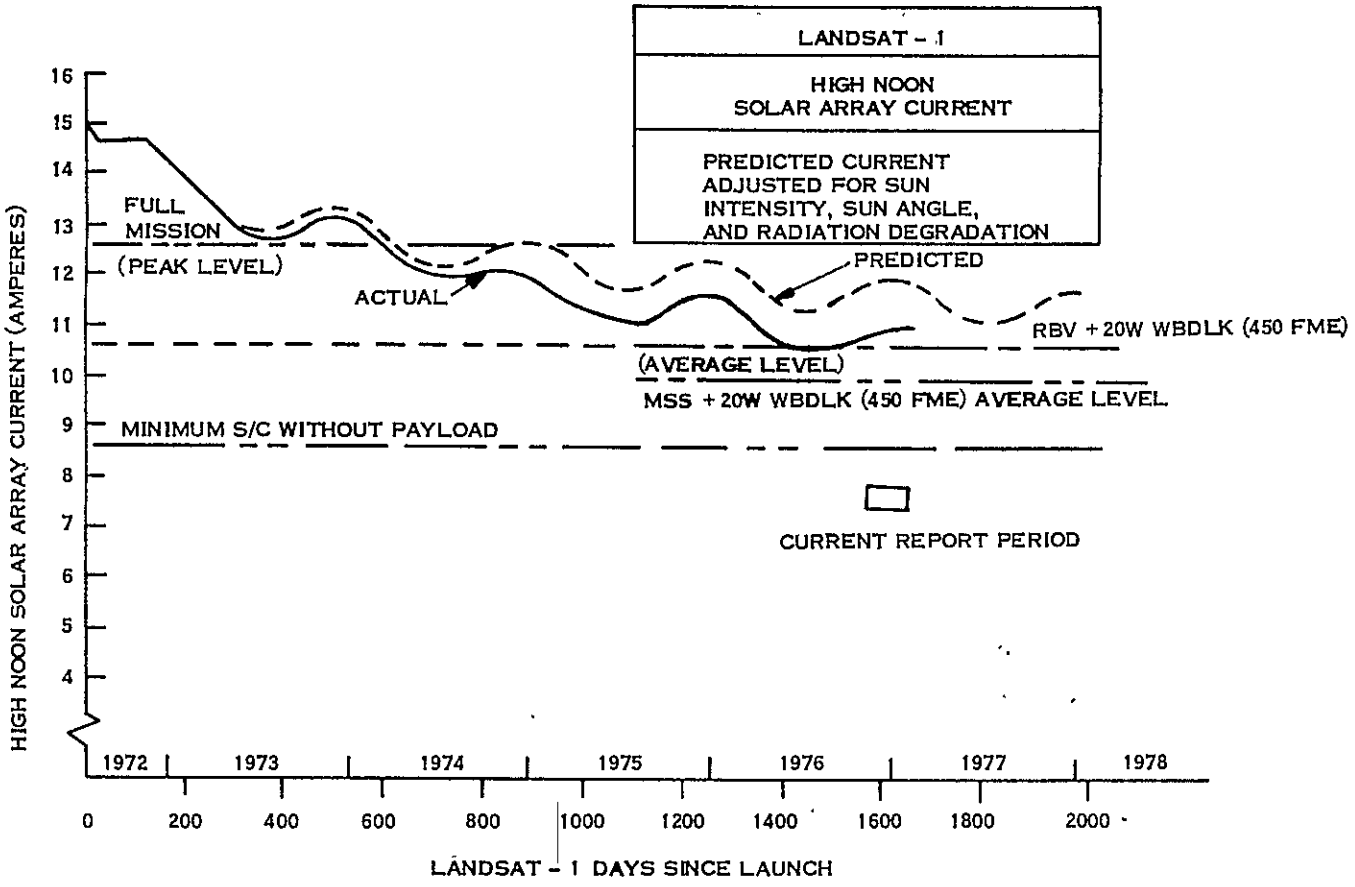


Figure 3-1. Midday Solar Array Current

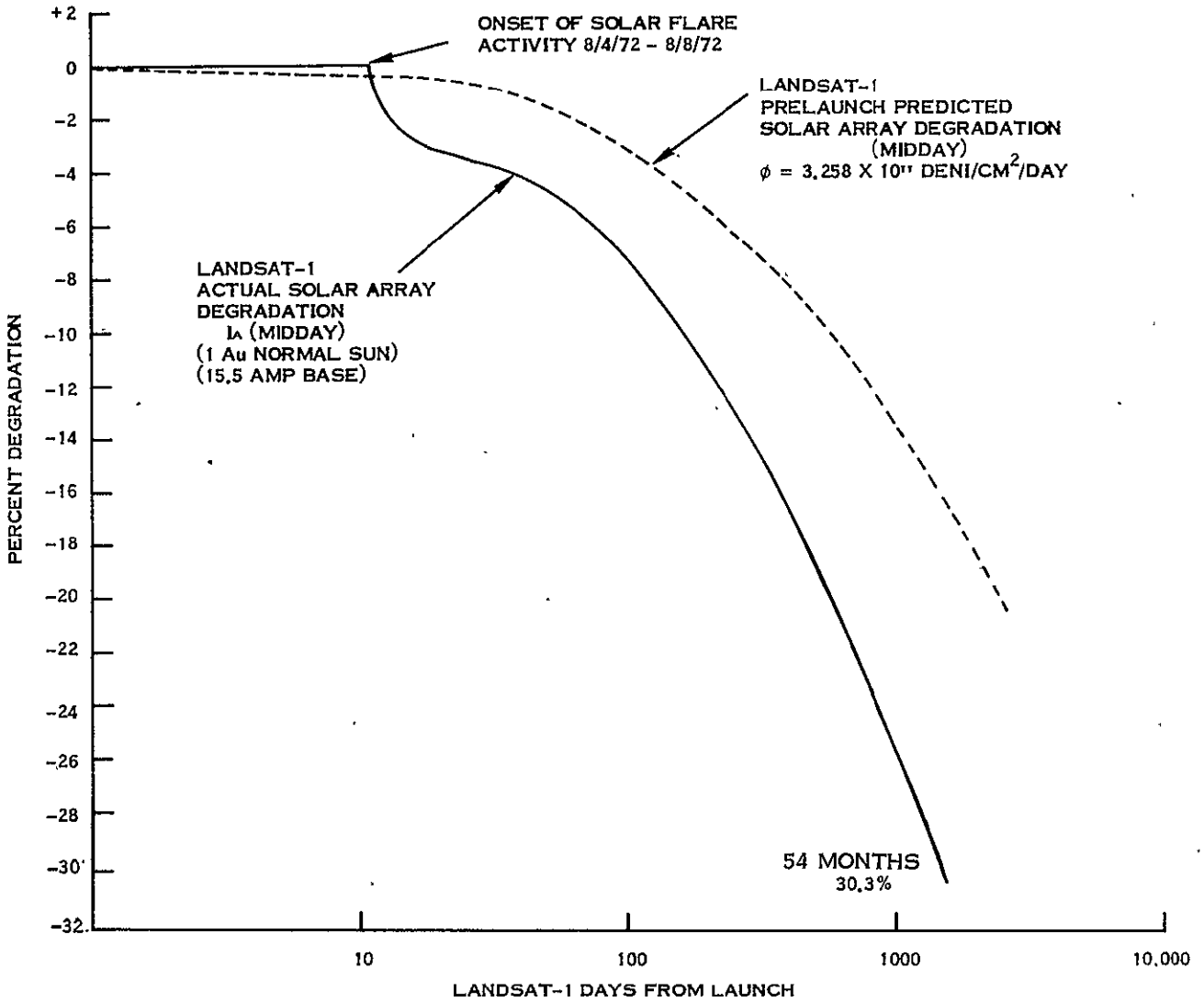


Figure 3-2. I_A (Midday) Degradation vs. Days

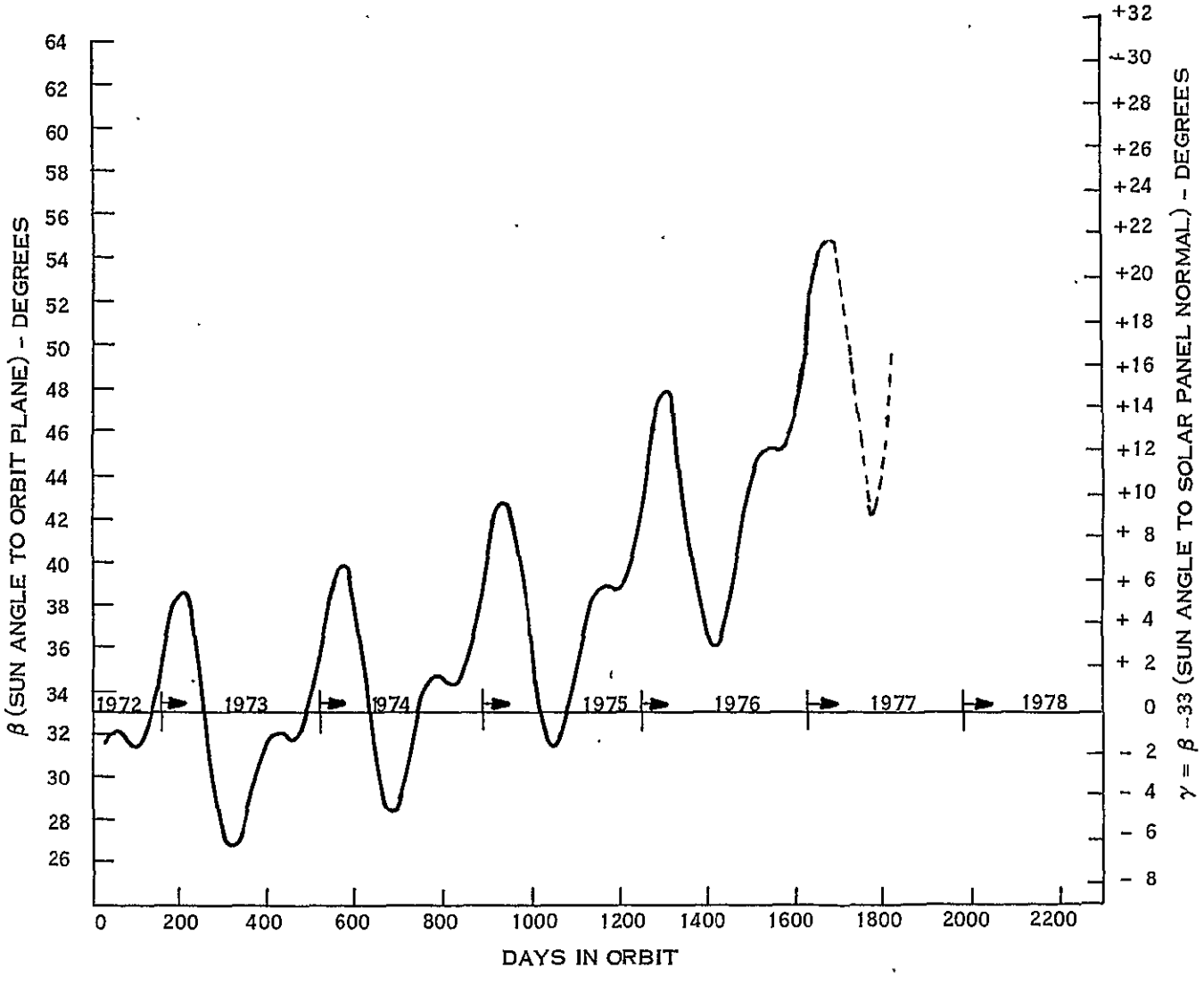


Figure 3-3. Actual β and γ (Paddle) Sun Angles, Landsat-1

FOLDOUT FRAME 1

FOLDOUT FRAME 2

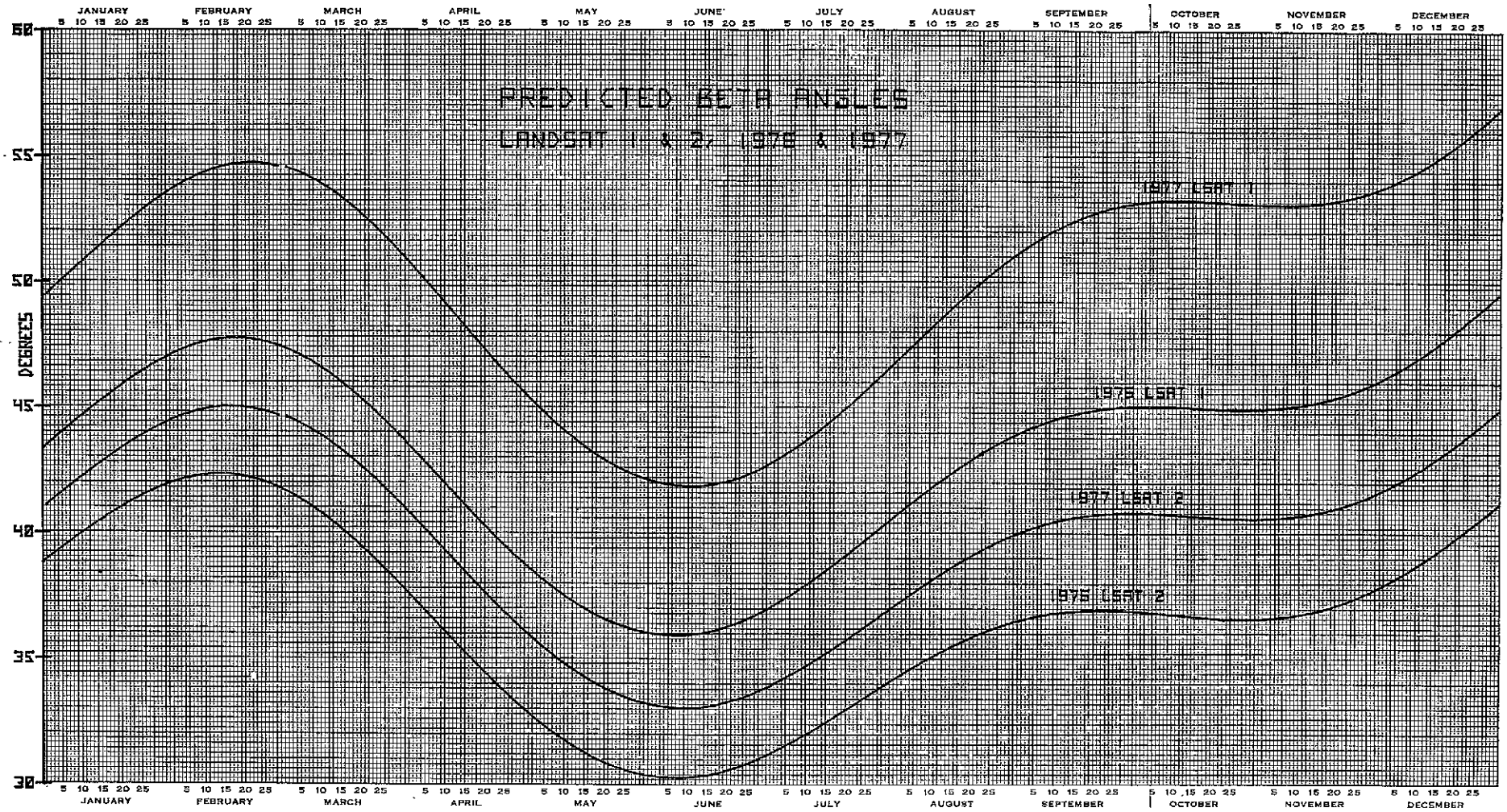


Figure 3-4. Predicted Beta Angles, Landsat 1 & 2, 1976 & 1977

Table 3-1. Landsat-1 Major Power Subsystem Parameters

ORBIT NO.	26	5098	10178	15254	20363	22086	22491	22911
BATT 1 MAX	32.48	32.91	33.25	33.16	32.48	32.39	32.39	32.22
2 CHGE	32.48	32.91	33.16	33.16	32.48	32.39	32.39	32.22
3 VOLTS	32.48	32.99	33.25	33.16	32.48	32.39	32.39	32.31
4	32.48	32.99	33.25	33.16	32.48	32.39	32.39	32.31
5	32.48	32.99	33.33	33.25	32.57	32.48	32.48	***
6	32.31	32.91	33.25	28.21	32.48	32.39	32.39	32.31
7	32.22	32.91	33.25	33.16	32.48	32.48	32.39	32.31
8	32.14	32.91	33.25	33.16	***	***	***	***
AVERAGE +	32.38	32.92	33.25	33.17	32.49	32.42	32.40	32.28
BATT 1 END-	28.81	28.30	28.98	29.15	29.23	28.81	29.15	28.98
2 OF-	28.81	28.30	28.98	29.15	29.23	28.89	29.15	28.98
3 NIGHT	28.81	28.30	28.98	29.15	29.23	28.81	29.15	28.98
4 VOLTS	28.89	28.38	28.98	29.15	29.32	28.89	29.15	29.06
5	28.89	28.38	29.06	29.23	29.32	28.89	29.23	****
6	28.81	28.30	28.98	28.12	29.23	28.81	29.06	28.98
7	28.81	28.30	28.98	29.15	29.23	28.81	29.15	29.06
8	28.81	28.30	28.98	29.15	***	***	***	***
AVERAGE +	28.84	28.32	28.99	29.16	29.26	28.84	29.15	29.01
BATT 1 CHGE	13.11	13.58	13.96	15.27	14.45	14.68	14.25	16.48
2* SHARE	12.93	13.58	13.96	15.27	15.06	15.21	14.88	17.29
3 (%)	11.38	11.38	11.95	13.59	13.26	13.25	12.74	14.75
4	12.39	11.85	12.28	14.06	14.19	13.99	13.03	15.55
5	12.32	11.85	11.98	13.63	14.32	14.46	15.61	****
6	12.80	12.35	11.79	**	14.59	14.46	15.26	18.52
7	12.62	12.42	12.13	13.59	14.11	13.95	14.24	17.42
8	12.45	12.10	11.98	14.54	***	***	***	***
BATT 1 LOAD	12.71	12.44	12.58	14.67	14.32	14.63	15.19	17.13
2 SHARE	12.90	13.62	13.70	15.88	14.89	15.21	15.85	17.48
3 (%)	11.43	11.91	12.23	13.85	13.54	14.10	15.02	16.20
4	12.77	13.01	13.12	14.91	14.81	15.13	15.68	17.35
5	12.54	12.42	12.60	14.02	14.31	13.77	12.59	****
6	12.53	12.21	11.30	**	13.73	13.08	12.03	14.74
7	12.80	12.41	12.50	13.77	14.36	14.05	13.62	17.09
8	12.32	11.98	11.97	12.88	***	***	***	***
BATT 1 TEMP	21.11	24.65	24.76	23.12	21.47	23.06	24.41	25.34
2 IN	18.74	21.42	20.89	19.32	17.81	18.44	19.17	19.28
3 (°C)	18.77	20.29	20.16	18.77	17.25	17.50	17.69	18.25
4	21.57	23.17	23.32	23.71	21.64	22.65	22.78	23.50
5	21.82	23.85	24.09	23.69	24.40	30.23	34.98	37.63
6	21.21	24.37	24.78	22.10	23.52	28.51	32.60	35.95
7	21.41	25.01	24.96	23.75	23.23	27.03	30.25	33.00
8	21.82	25.14	25.24	24.59	22.15	24.98	26.76	28.33
AVERAGE	20.81	23.49	23.53	22.26	21.43	24.05	26.08	27.72
S/C REG BUS PWR (W)	176.8	153.4	165.0	137.9	123.49	122.7	111.7	113.6
COMP LOAD PWR (W) (P/O S/C REG BUS PWR)	49.0	34.8	41.9	29.4	17.4	17.40	6.62	6.62
P/L REG BUS PWR (W)	16.2	13.7	8.9	8.9	9.13	9.14	9.14	9.14
C/D RATIO	1.06	1.13	1.21	1.18	1.04	1.23	1.29	1.16
TOTAL CHARGE (A-M)	309.2	290.21	*258.3	229.29	172.42	190.33	173.36	140.46
TOTAL DISCHARGE (A-M)	290.9	256.28	214.2	194.13	168.31	154.86	134.88	121.6
SOLAR ARRAY (A-M)	1044.0	908.0	832.0	876.0	754	791	795	816
S.A. PEAK I (AMP)	15.8	13.88	12.44	11.60	10.88	11.12	11.04	11.12
MIDDAY ARRAY I (AMP)	15.01	12.80	N/A	11.04	10.56	10.72	10.64	10.80
SUN ANGLE (DEG)	-3.33	-3.54	-1.82	1.49	6.4	+12°	+12.6°	+15.5°
MAX R PAD TEMP (°C)	+62.00	+68.00	63.20	62.0	58.40	62.00	62.00	58.40
MIN R PAD TEMP (°C)	-62.00	-58.00	-42.79	-42.18	-38.54	-36.11	-33.68	-29.43
MAX L PAD TEMP (°C)	+57.90	+60.50	56.00	56.00	55.12	62.00	63.20	60.80
MIN L PAD TEMP (°C)	-67.00	-64.00	-47.00	-46.25	-42.18	-37.93	-35.50	-26.47

+Average of batteries on-line.
*After the telemetry failure in Orbit 4396 Battery 2 charge share was taken equal to Battery 1 charge as an approximation in order to derive a charge share value of each battery.
**Battery 6 turned off in Orbit 14780 was returned to service in Orbit 15467.
***Battery 8 was turned off in Orbit 15588 and remained off through the end of this report period.
****Battery 5 was turned off in Orbit 22605 and remained off through the end of this report period.

Table 3-2. Landsat-1 Power Subsystem Analog Telemetry
(Average Value for Data Received in NBTR Playback)

Function	Description	Unit	Orbits							
			26	5089	10182	16254	20364	22081	22491	22928
6001	BATT 1 DISC	AMP	0.94	0.81	0.81	0.91	0.81	0.88	0.78	0.86
6002	2		0.95	*	*	*	*	0.90	0.80	0.88
6003	3		0.84	0.78	0.80	0.86	0.75	0.88	0.75	0.82
6004	4		0.93	0.86	0.86	0.92	0.84	0.89	0.80	0.89
6005	5		0.92	0.82	0.82	0.87	0.79	0.83	0.66	***
6006	6		0.91	0.78	0.72	++	0.78	0.79	0.65	0.74
6007	7		0.94	0.82	0.80	0.85	0.80	0.85	0.71	0.84
6008	8		0.91	0.77	0.78	0.80	**	**	**	**
6011	BATT 1 CHG	AMP	0.58	0.58	0.69	0.52	0.35	0.38	0.33	0.37
6012	2		0.67	*	*	*	*	0.38	0.35	0.38
6013	3		0.50	0.48	0.60	0.46	0.33	0.36	0.31	0.34
6014	4		0.54	0.51	0.60	0.48	0.35	0.36	0.32	0.36
6015	5		0.54	0.50	0.56	0.46	0.35	0.36	0.36	***
6016	6		0.57	0.52	0.56	++	0.35	0.36	0.35	0.42
6017	7		0.55	0.53	0.60	0.46	0.35	0.36	0.33	0.39
6018	8		0.55	0.52	0.55	0.49	**	**	**	**
6021	BATT 1 VOLT	VDC	30.87	31.24	31.64	31.62	31.20	30.85	31.19	31.40
6022	2		30.87	31.25	31.66	31.62	31.19	30.84	31.17	31.39
6023	3		30.87	31.25	31.66	31.62	31.18	30.84	31.17	31.39
6024	4		30.90	31.28	31.70	31.65	31.22	30.87	31.21	31.42
6025	5		30.95	31.33	31.75	31.71	31.26	30.94	31.25	***
6026	6		30.86	31.24	31.65	++	31.16	30.84	31.17	31.37
6027	7		30.89	31.27	31.68	31.64	31.21	30.87	31.20	31.41
6028	8		30.89	31.27	31.68	31.63	**	**	**	**
6031	BATT 1 TEMP	DGC	21.17	24.48	26.09	23.02	21.43	23.38	24.36	25.44
6032	2		18.80	21.29	22.81	19.28	17.80	18.81	19.16	19.34
6033	3		18.76	20.17	21.26	18.76	17.21	17.58	17.65	18.13
6034	4		21.57	23.04	23.83	22.89	21.60	22.55	22.82	23.53
6035	5		21.84	23.77	24.78	23.64	24.36	30.66	34.94	37.15
6036	6		21.24	24.27	25.78	22.08	23.51	28.91	32.54	36.22
6037	7		21.48	24.38	26.09	23.87	23.18	27.45	30.21	33.09
6038	8		21.86	25.02	26.21	24.51	23.14	26.12	26.72	28.84
6040	RT PAD TEMP	DGC	25.82	27.22	27.16	27.29	28.24	32.03	33.11	33.04
6041	R PAD V N	VDC	33.40	33.85	34.36	34.18	33.06	31.49	31.30	30.47
6042	R PAD V M	VDC	33.29	33.50	33.60	32.92	31.75	31.09	31.15	30.95
6044	LT PAD TEMP	DGC	14.14	16.81	19.11	19.84	22.62	28.00	29.96	33.90
6045	L PAD V F	VDC	33.69	34.16	34.67	34.63	33.84	33.44	33.78	33.95
6046	L PAD V G	VDC	33.68	34.19	34.72	34.68	33.88	33.43	33.81	33.98
6050	S/C UR BUS V	VDC	31.24	31.68	32.60	32.07	31.61	31.24	31.64	31.85
6051	S/C RG BUS V	VDC	24.54	24.55	24.55	24.54	24.55	24.54	24.54	24.54
6052	AUX REG A V	VDC	23.41	23.48	23.47	23.49	23.49	23.48	23.50	23.48
6053	AUX REG B V	VDC	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
6054	SOLAR I	AMP	14.87	12.69	11.60	10.83	10.17	10.32	10.09	9.69
6055+	S/C RG BUS I	AMP	7.11	6.27	6.80	5.63	5.04	5.32	4.56	4.61
6056+	S/C RG BUS I	AMP	7.11	6.27	5.79	5.62	5.02	5.30	4.56	4.61
6058	PC MOD T 1	DGC	21.82	22.23	23.22	20.63	19.54	19.84	19.46	19.92
6059	PC MOD T 2	DGC	21.68	22.53	23.00	21.17	20.14	20.44	20.33	20.73
6070	P/L RG BUS V	VDC	24.66	24.68	24.68	24.68	24.67	24.66	24.67	24.68
6071	P/L UR BUS V	VDC	31.08	31.63	31.92	31.92	31.45	31.08	31.47	31.68
6072+	P/L RG BUS I	AMP	0.57	0.56	0.36	0.36	0.37	0.38	0.37	0.36
6073	P AUX A V	VDC	23.51	23.51	23.50	23.50	23.50	23.50	23.50	23.50
6074	P AUX B V	VDC	23.51	23.51	23.50	23.50	23.50	23.50	23.50	23.50
6075	PR MOD T 1	DGC	21.50	23.13	23.62	21.44	20.69	21.31	21.22	21.66
6076	PR MOD T 2	DGC	20.34	21.45	21.84	19.88	19.35	19.91	19.87	20.26
6079	FUSE BLOW V	VDC	24.56	24.57	24.60	24.59	24.58	24.58	24.57	24.58
6080	SHUNT 1 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6081	SHUNT 2 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6082	SHUNT 3 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6083	SHUNT 4 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6084	SHUNT 5 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6085	SHUNT 6 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6086	SHUNT 7 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6087	SHUNT 8 I	AMP	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
6100	P/L RG BUS I	AMP	0.58	0.56	0.36	0.36	0.37	0.38	0.37	0.36
Total No.	MAJOR FRAMES	FRM	764.0	389.0	384.0	785	788	785	789	784

*Function 6002, 6012; missing data resulted from disabled telemetry resulting from IC chip failure which affected charge current directly and discharge current indirectly.

+FUNC 6055, 6056, 6072 data is derived from Pseudo FUNC 6155, 6156, 6172 used after change to Mode 11.

** Battery 8 turned off in Orbit 14780 was returned to service in Orbit 15467.

*** Battery 8 was turned off in Orbit 15588 and remained off through the end of this report period.

**** Battery 5 was turned off in Orbit 22606 and remained off through the end of this report period.

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)
LANDSAT-1

SECTION 4

ATTITUDE CONTROL SYSTEM (ACS)

During this report period, Landsat-1's ACS system performed normally in the Forward Single Scanner mode and spacecraft attitude was accurately maintained.

A 101 day, in plane orbit adjust program was successfully conducted between 20 October 1976 (Orbit 21613) and 28 January 1977 (Orbit 23007), in order to increase the time separation between the Landsat spacecrafts. Long-term effects of minor differences between the Landsats' orbital parameters caused Landsat-1 to converge on Landsat-2 and the operational limits (turn around time) for tracking the Landsat spacecrafts successively were being approached.

The orbit adjust program was performed over an extended period in order to save the freon that would normally be spent to maintain spacecraft attitude - via pneumatic gating - if continuous, long duration burns were commanded.

During the entire program, the ACS system was in the Roll Diff Tach High Gain (RDTHG) mode with pneumatics disabled and payload operations suspended.

Stable spacecraft response to an orbit adjust maneuver with the ACS in the RDTHG mode was confirmed at the commencement of the orbit adjust program by performing two, 2.4 second duration test burns, one each along the -X and +X axis respectively (Orbits 21613 and 21616, 20 October 1976).

Depending on the polarity of the burn, Pitch flywheel speed was maintained between $\pm$ 150 RPM without pneumatic gating by commanding Pitch Position Bias (PPB) sequences during the actual maneuver.

Immediately preceding a burn, $+0.6^{\circ}$ PPB was employed. During a burn, PPB was out completely. After a -X burn, $+2.0^{\circ}$ PPB was commanded to compensate for the -Pitch torque effects created by the offset -X thruster; $+0.6^{\circ}$ PPB was commanded after +X axis burns.

Detailed descriptions of the orbit adjust program plan, chronology and results are given in Sections 2 and 7 of this report.

Figures 4-1 through 4-6 are actual telemetry recordings of -X and +X axis burns and show typically the response of the ACS system to these maneuvers.

Due to a large Beta angle, Landsat-1's sun sensors were relatively ineffective in maintaining solar array attitude normal to the sun during the latter part of this report period. Landsat-1's orbit has regressed with time and Beta angle - the angle between the orbit plan and sun - increased to a level that exceeded the sun sensors' fields of view and stimulus to the sensors decreased below the sensors' threshold for positive control. Figure 4-7 shows Beta angle plotted as a function of time. Tracking errors commenced when Beta was approximately 46.5°. Historically, solar array tracking errors first appeared in mid-January 1976 and lasted through March 1976. They reappeared in December 1976 and should continue through April 1977.

The Right Solar Array (RSA) sun sensors were particularly affected and RSA tracking errors ranged from 30° lagging to 90° leading. Left Solar Array tracking errors averaged 15° to 25° lagging.

On January 16, 1977 (Orbit 22840) a procedure was implemented to semi-manually align the RSA with sun. The RSAD is either stopped or commanded into high rate via COMSTOR commands, depending on the magnitude and polarity of the tracking error determined at AOS. The procedure served two purposes:

1. It oriented the RSA for maximum solar incidence when the sun sensors were ineffective in automatically performing this task.

2. It maintained the RSA within 30^{o} of the true noon position so that if the RSAD had failed, the RSA would still have been nominally oriented toward the sun and would have been capable of contributing charge-though diminished-to the batteries.

Figure 4-8 is a typical example of this procedure.

Since payload operations were suspended due to the orbit adjust program solar array tracking errors had no serious effects on spacecraft power management. Aux loads were still employed to dissipate excess electrical energy.

During this report period, Pitch flywheel duty cycle was stable and averaged approximately 5% in both the clockwise and counterwise directions.

With pneumatics disabled, the remaining freon and gating status curves - Figures 4-9, 4-10 and 4-11 are unchanged.

RMP 1 functioned normally.

The Forward Scanner pressure decreased from 2.40 PSIA in Orbit 21656 (23 October 1976) to 2.20 PSIA in Orbit 22953 (24 January 1977) and is following a leak rate predicted in earlier reports.

Pressure/temperature ratios have all been satisfactory.

Tables 4-1, 4-2 and 4-3 are a summary of Landsat-1's Attitude Control Subsystem's Telemetry.

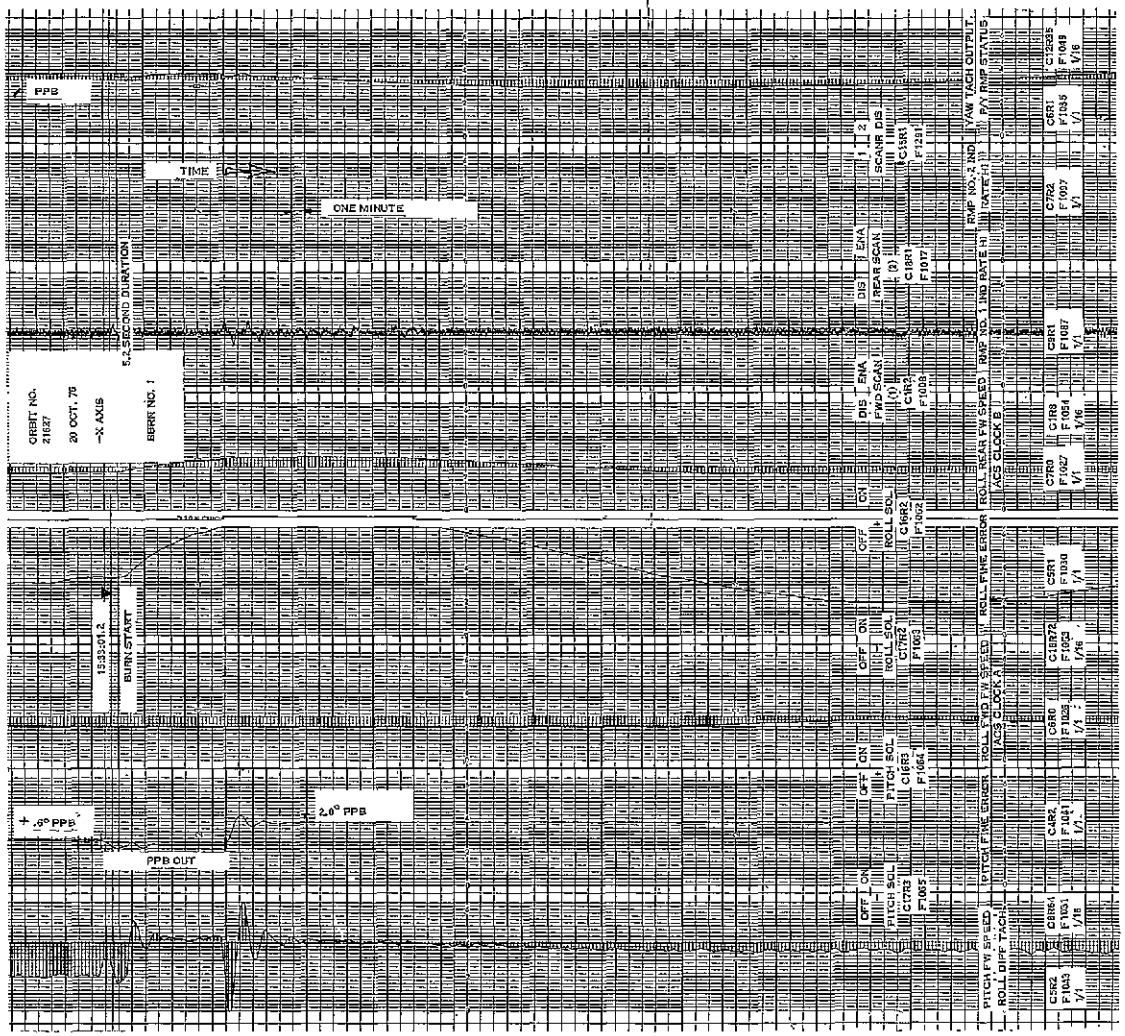


Figure 4-1. Typical Response of the ACS System to a -X Axis Burn

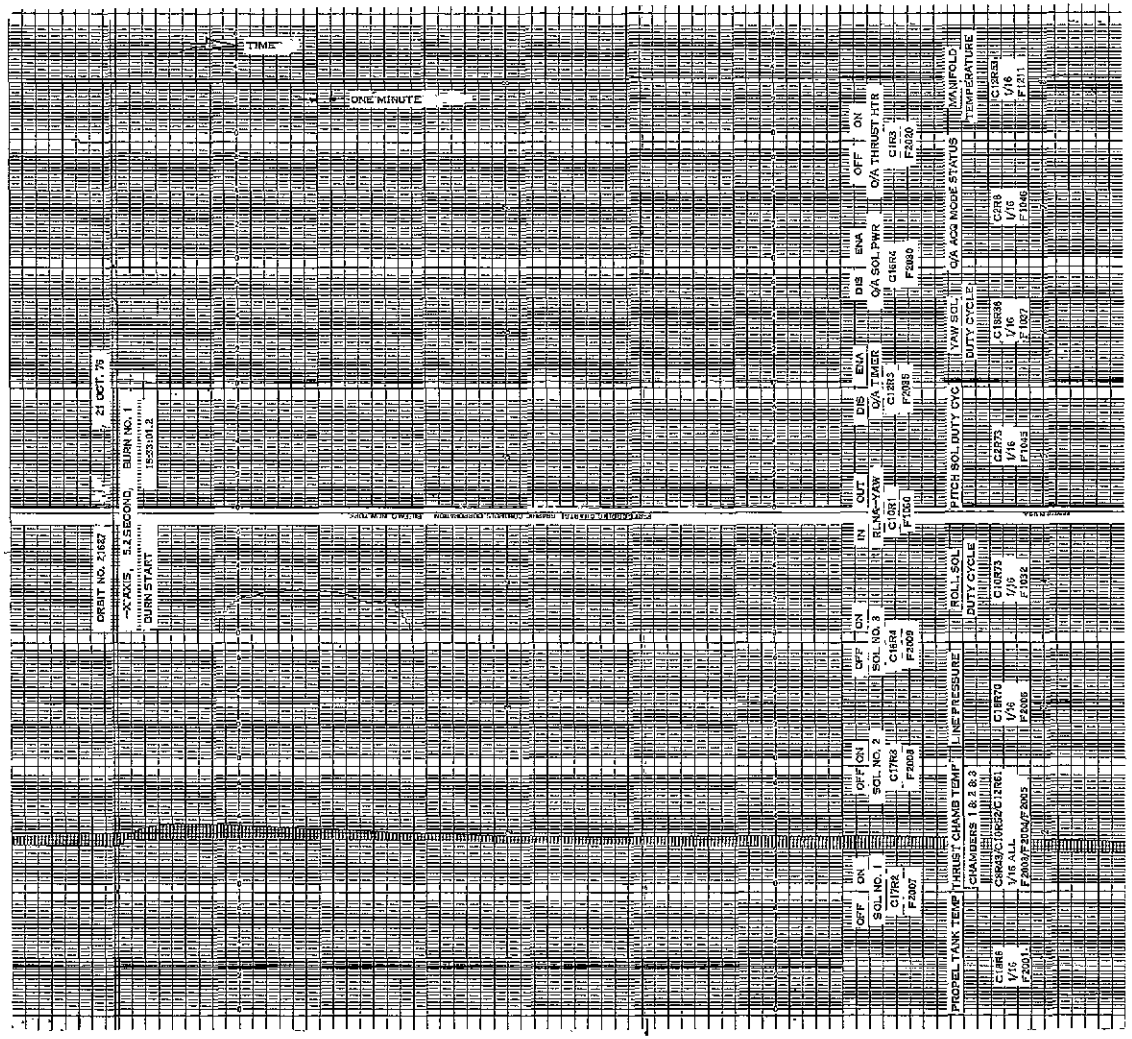


Figure 4-2. Typical Response of the ACS System to a -X Axis Burn

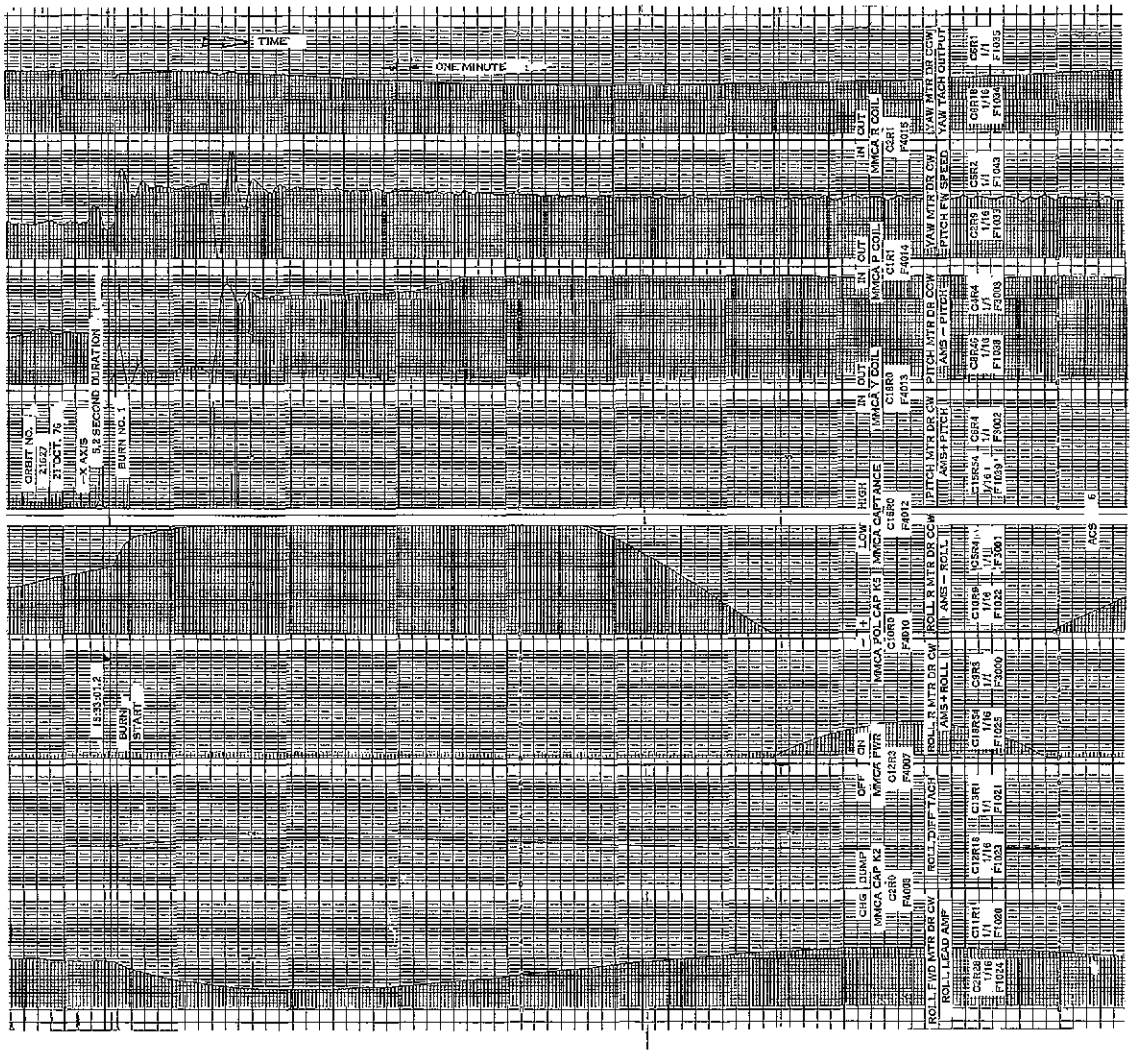


Figure 4-3. Typical Response of the ACS System to a -X Axis Burn

FOLDOUT FRAME 1

FOLDOUT FRAME 2

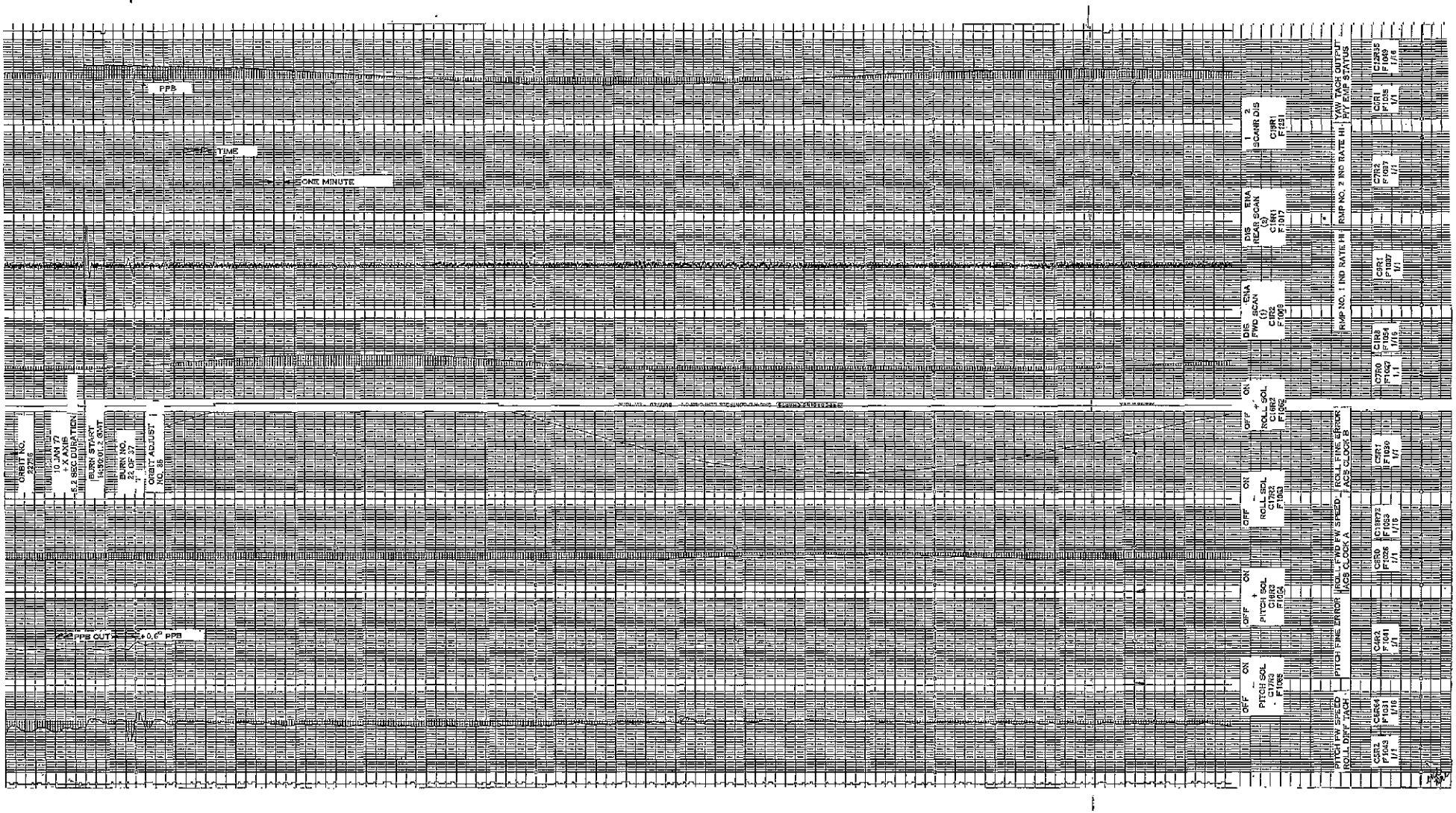


Figure 4-4. Typical Respone of the ACS System to a +X Axis Burn

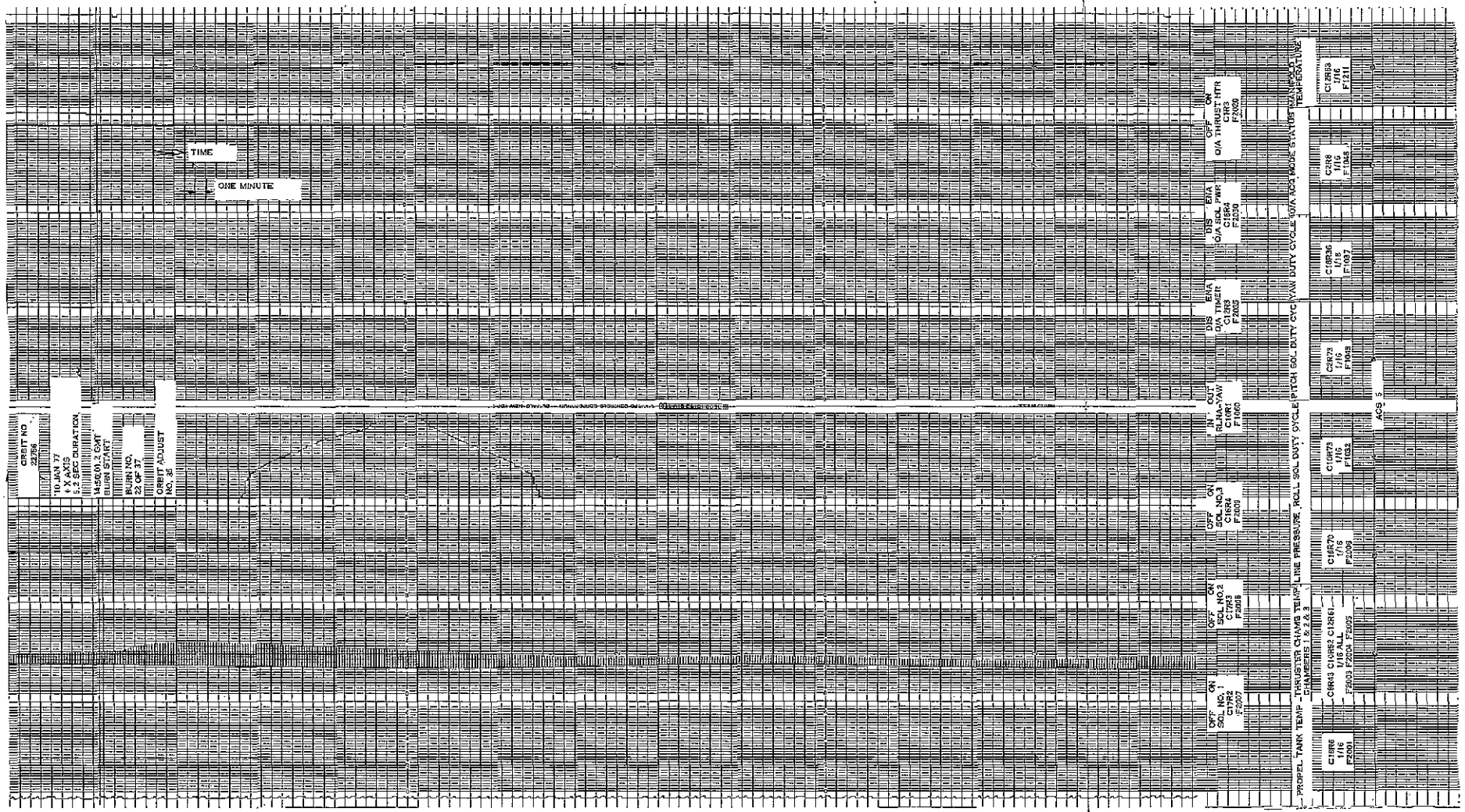


Figure 4-5. Typical Response of the ACS System to a +X Axis Burn

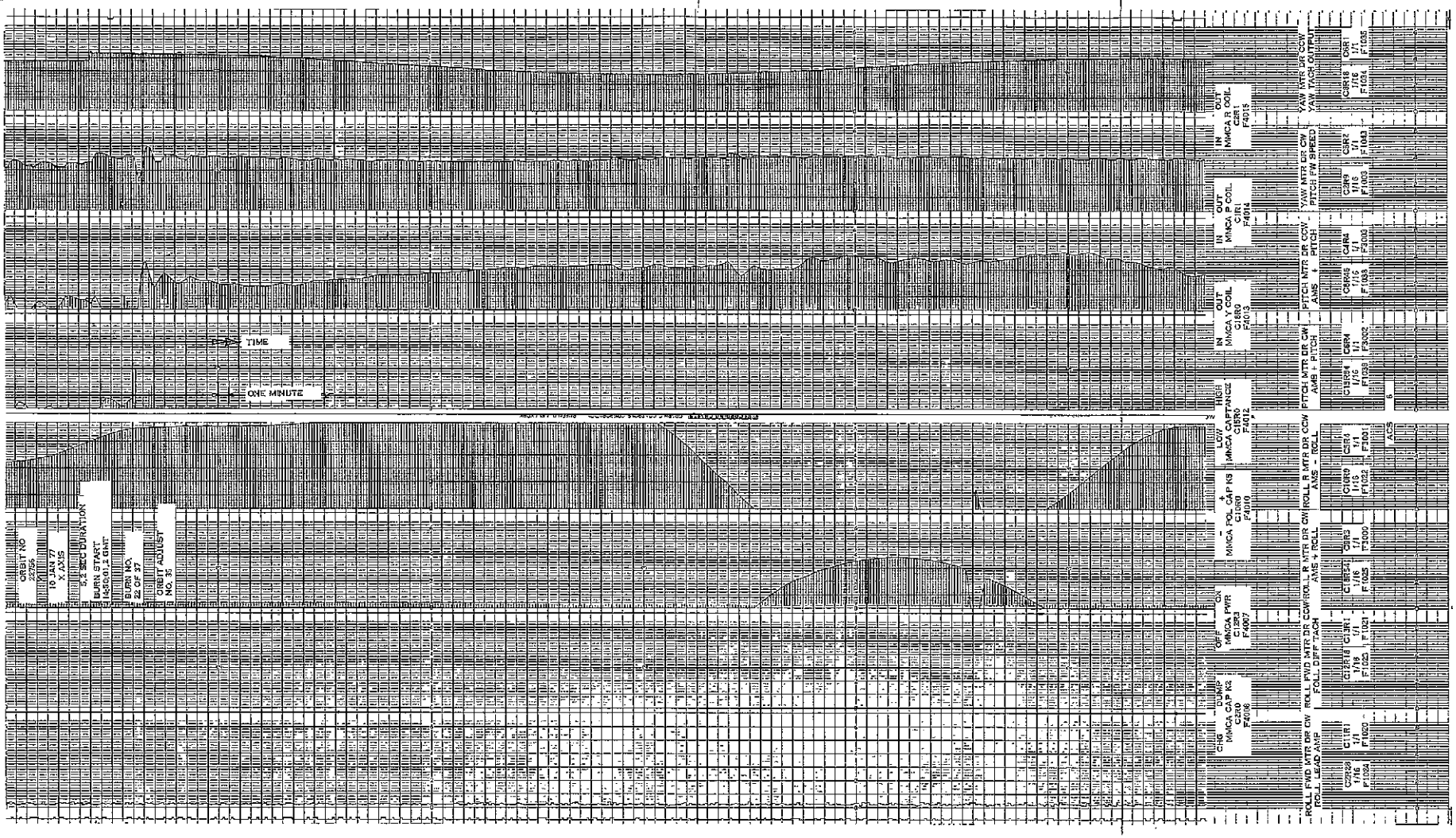


Figure 4-6. Typical Response of the ACS System to a +X-Axis Burn

FOLDOUT FRAME 1

FOLDOUT FRAME 2

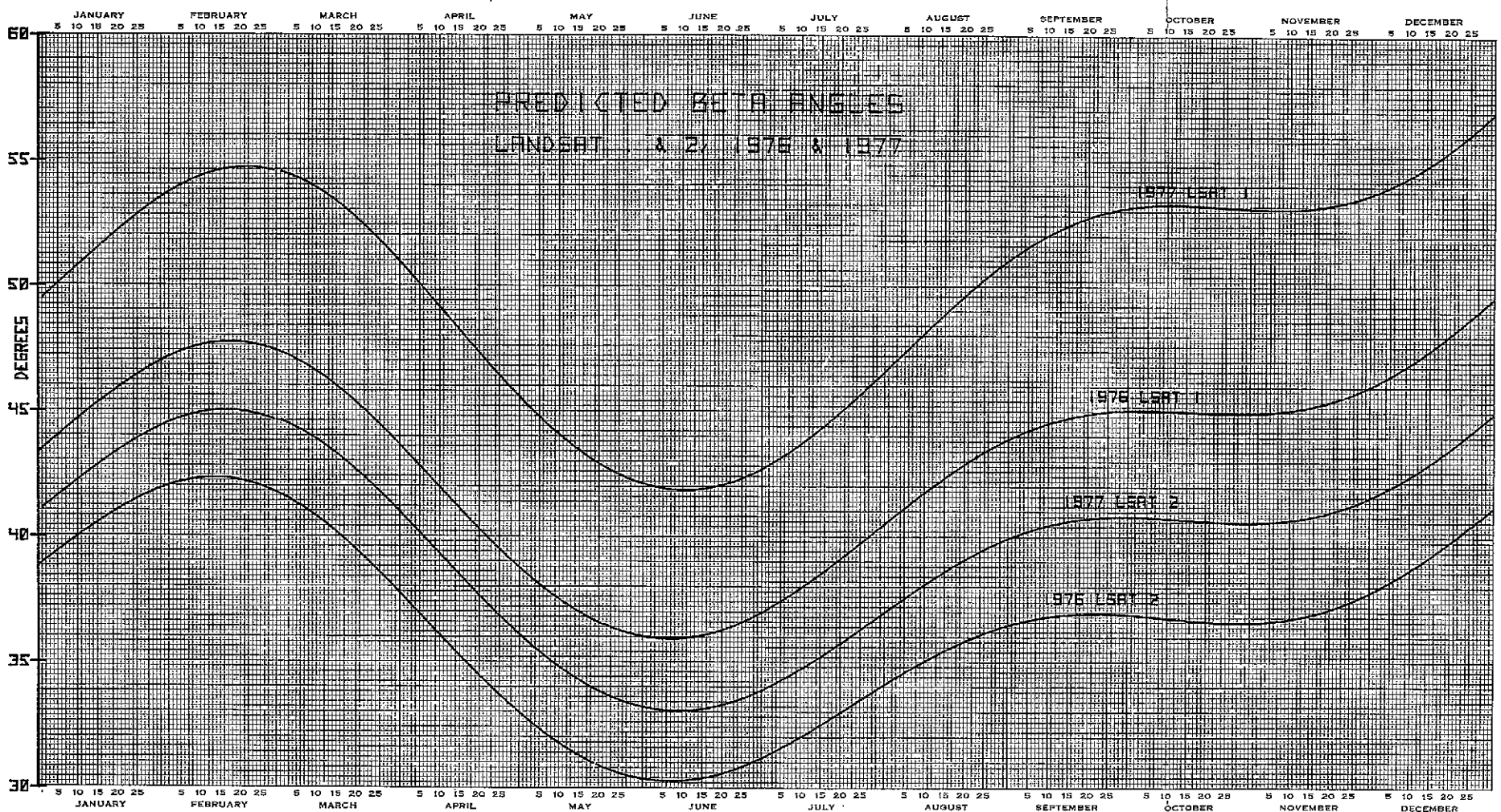
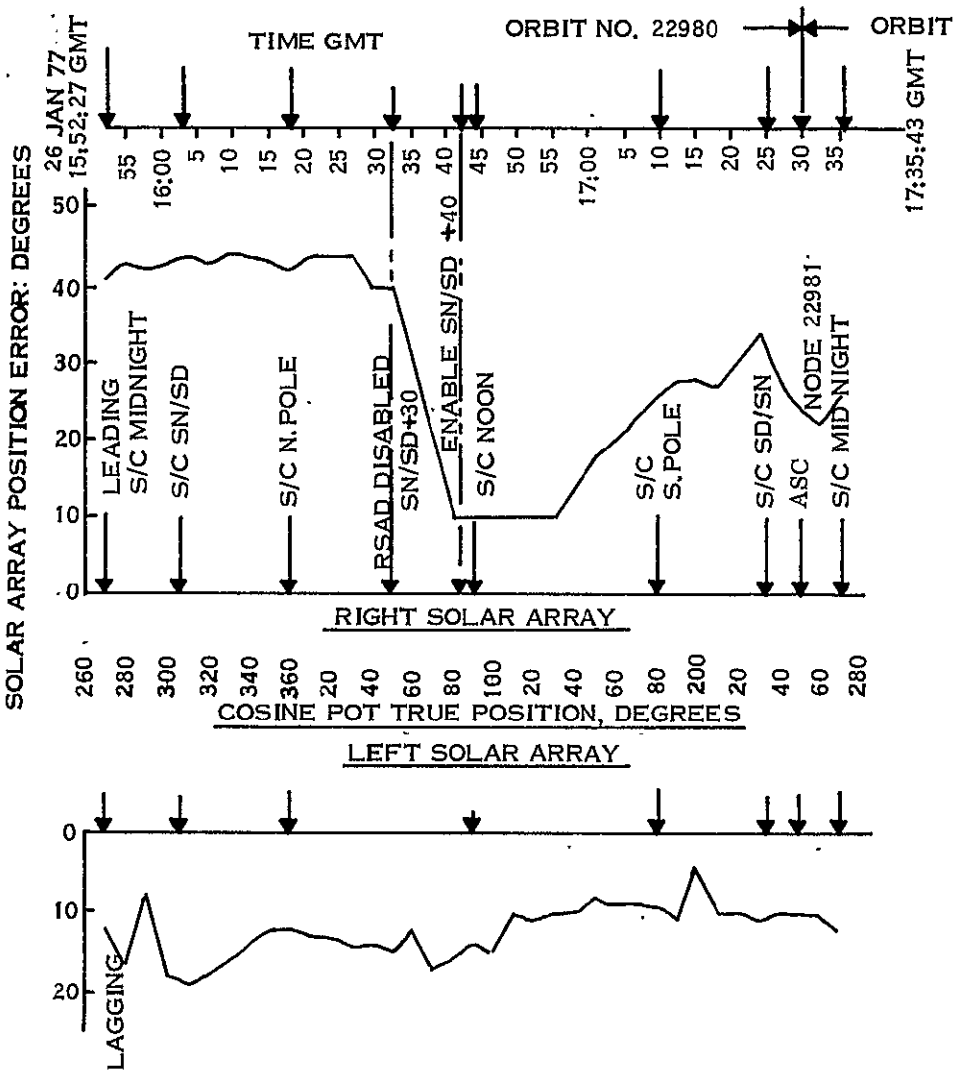


Figure 4-7. Predicted Beta Angles, Landsat-1 & 2, 1976 & 1977



BETA ANGLE = 52.9°
ACS IN ROLL DIFF TACH HIGH GAIN MODE

Figure 4-8. Landsat-1 Solar Array Tracking Error - Orbit 22980, 26 January 1976

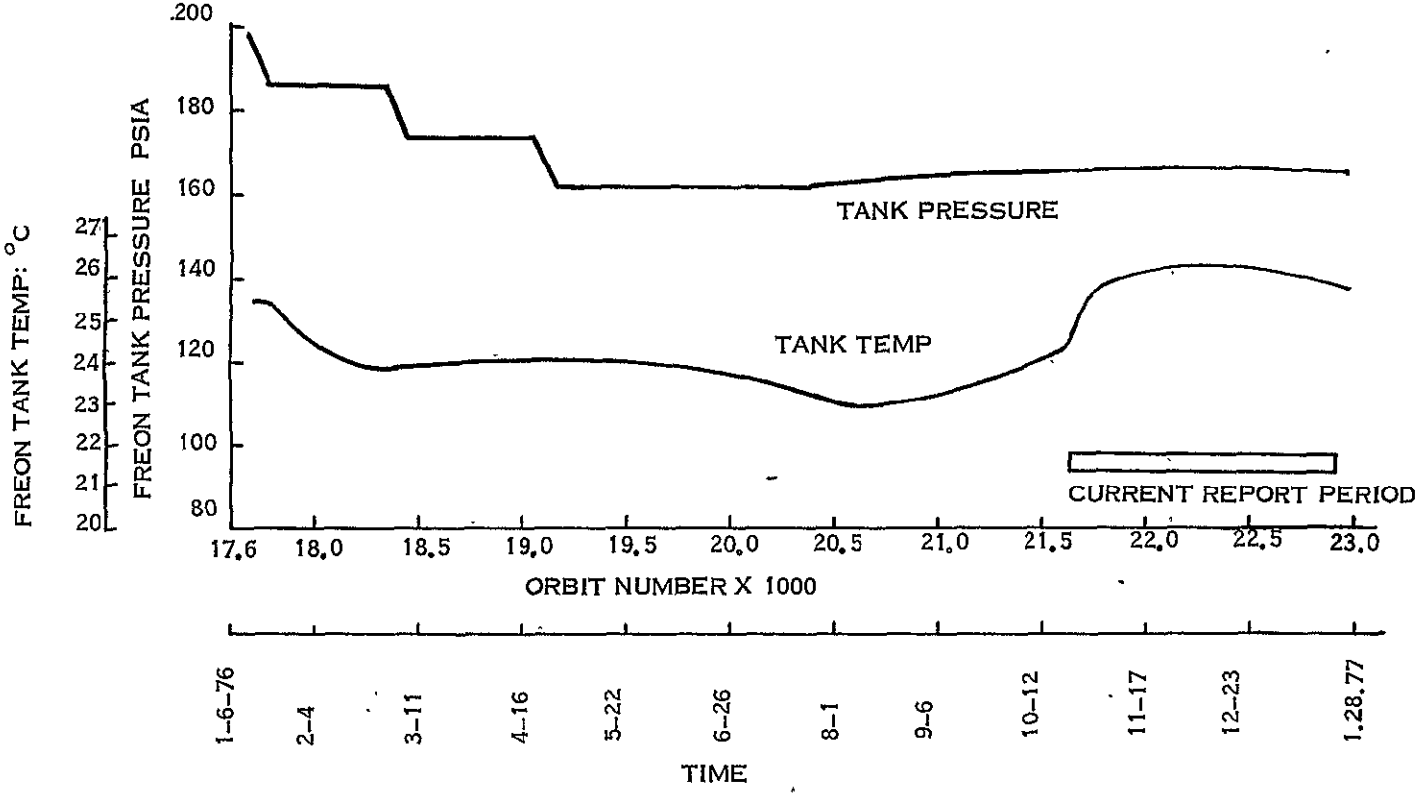
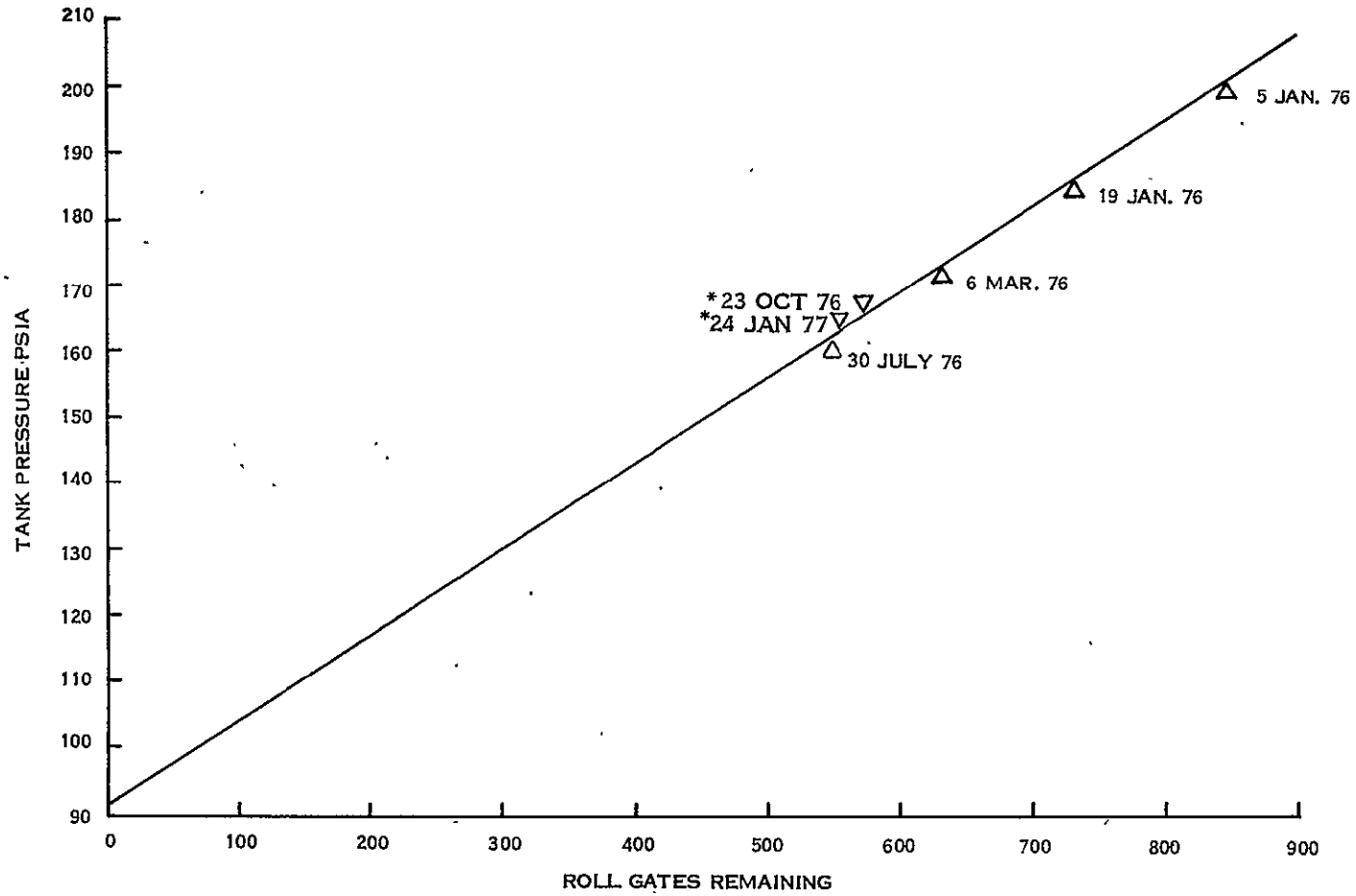
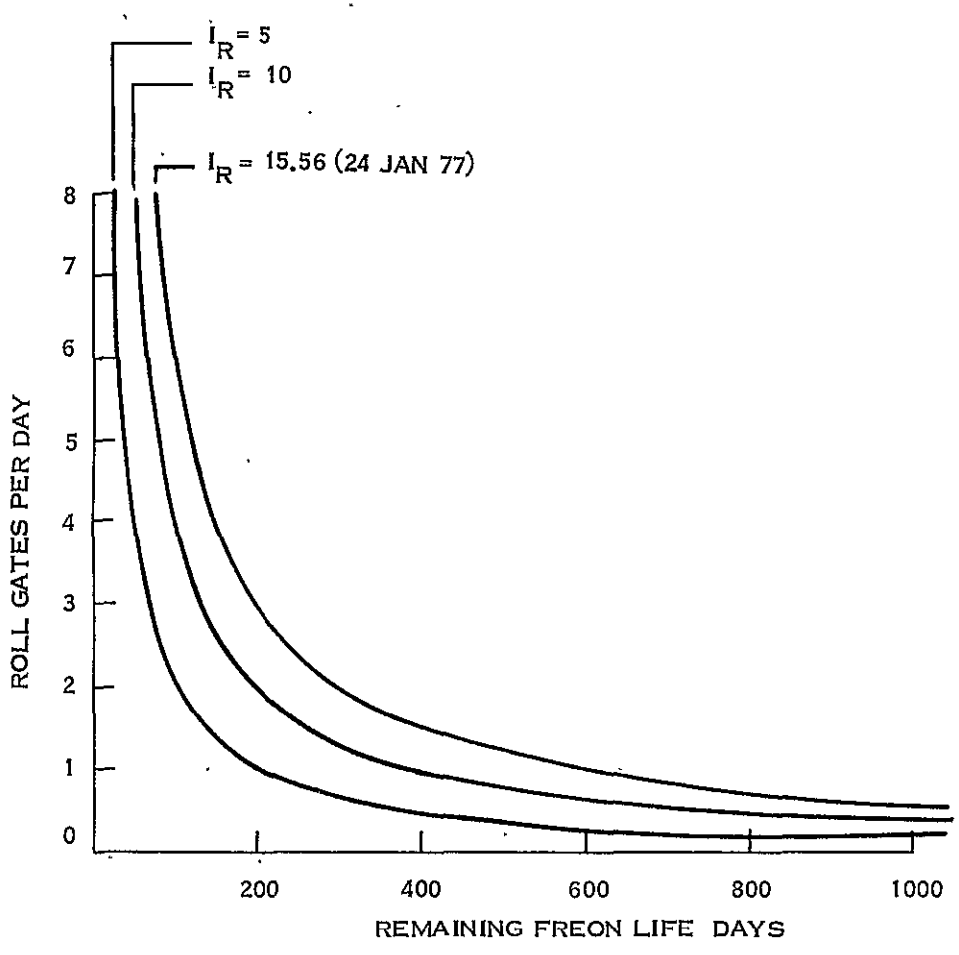


Figure 4-9. Landsat-1 Freon History (Telemetry Values)



*PRESSURE SHOWN IS GREATER THAN 30 JULY 76 DATA DUE TO SEASONAL TEMPERATURE EFFECTS AND TELEMETRY GRANULARITY

Figure 4-10. Landsat-1 Pressure, - Roll Gate Prediction



I_R; REMAINING USEABLE IMPULSE, LB SECS.

Figure 4-11. Landsat-1 Remaining Freon Life vs Gating Frequency

Table 4-1. Landsat-1 ACS Temperature and Pressure Telemetry Summary

Function	Units	Orbit							
		31	5099	10182	15254	20364	22081	22505	22928
1084 RMP 1 Gyro Temperature	DGC	44.5	23.06	21.22	42.40	41.47	43.68	44.12	43.35
1094 RMP 2 Gyro Temperature	DGC	74.3	75.10	43.45	24.05	23.49	26.28	26.82	26.44
1222 SAD RT MTR HSING Temp	DGC	21.1	22.00	20.55	22.89	21.70	24.08	24.38	22.97
1242 SAD LT MTR HSING Temp	DGC	27.0	30.38	28.18	29.53	28.88	31.76	32.32	31.92
1223 SAD RT MTR WNDNG Temp	DGC	25.3	26.54	24.63	27.06	25.74	27.72	27.76	26.15
1243 SAD LT MTR WNDNG Temp	DGC	28.7	32.92	30.32	31.98	31.40	34.48	35.03	34.71
1228 SAD RT HSG Pressure	PSI	7.6	7.35	7.12	6.88	6.70	6.65	6.65	6.53
1248 SAD LT HSG Pressure	PSI	7.0	6.86	6.47	6.18	5.90	5.80	5.79	5.79
1007 FWD Scanner MTR Temp	DGC	19.8	19.88	18.46	20.36	19.16	20.94	21.23	20.68
1016 Rear Scanner MTR Temp	DGC	20.5	19.83	17.86	19.24	18.87	20.58	20.96	20.48
1003 FWD Scanner Pressure	PSI	4.6	4.02	3.50	3.00	2.60	2.40	2.40	2.20
1012 Rear Scanner Pressure	PSI	7.8	7.87	7.44	6.97	6.74	6.73	6.73	6.51
1212 Gas Tank Pressure	PSI	1988.0	1702.34	1454.19	235.44	162.92	166.16	164.65	165.64
1210 Gas Tank Temperature	DGC	22.6	24.30	22.56	24.36	23.22	25.86	26.29	25.53
1213 Manifold Pressure	PSI	56.7	57.44	58.73	61.67	61.66	62.09	62.08	62.23
1211 Manifold Temperature	DGC	21.9	23.62	21.77	23.82	22.69	25.54	25.96	25.21
1059 CLB Power Supply Card Temp	DGC	37.1	40.54	38.83	40.58	39.55	42.19	42.71	42.22
1260 ACS Baseplate 1	DGC	25.4	27.93	25.36	26.54	26.01	29.00	29.59	29.31
1261 ACS Baseplate 2	DGC	22.9	24.73	23.00	25.05	24.21	26.96	27.51	26.98
1262 ACS Baseplate 3	DGC	23.4	23.69	21.97	24.95	23.89	26.37	26.76	25.91
1263 THO1 STS	DGC	-6.8	-0.97	-3.41	1.22	1.86	.5.61	6.95	6.71
1264 THO2 STS	DGC	-14.6	-9.42	-8.27	-4.50	-3.17	-1.07	-0.12	1.33
1265 THO3 STS	DGC	-3.1	9.31	7.58	12.92	15.02	18.23	19.65	20.25
1266 THO4 STS	DGC	-13.9	2.85	-1.85	2.40	3.05	6.73	8.13	6.47
1267 THO5 STS	DGC	-8.9	-1.16	-5.17	2.92	4.80	10.10	13.64	13.08
1224 SAD R FSST	DGC	39.5	60.21	63.25	64.74	62.86	59.30	50.63	41.29
1244 SAD L FSST	DGC	27.1	51.11	53.21	54.69	53.22	57.22	57.84	58.83

Table 4-2. Landsat-1 ACS Voltages and Currents

Function	Units	Orbit							
		31	5099	10182	15254	20364	22081	22505	22928
1057 CLB Power Supply Volts	TMV	2.8	2.78	2.78	2.78	2.77	2.78	2.79	2.78
1081 RMP 1 MTR Volts	VDC	OFF	OFF	OFF	-30.14	-30.14	-30.14	-30.14	-30.14
1082 RMP 1 MTR Current	Amps	OFF	OFF	OFF	.11	.11	0.11	0.11	0.11
1080 RMP 1 Supply Volts	VDC	OFF	OFF	OFF	-23.78	-23.79	-23.75	-23.75	-23.77
1091 RMP 2 MTR Volts	VDC	-29.7	-29.63	-29.63	OFF	OFF	OFF	OFF	OFF
1092 RMP 2 MTR Current	Amps	0.10	0.10	0.11	OFF	OFF	OFF	OFF	OFF
1090 RMP 2 Supply Volts	VDC	-23.4	-23.41	-23.50	OFF	OFF	OFF	OFF	OFF
1320 SAD RT MTR WNDNG Volts	VDC	-4.8	-4.25	-3.89	-3.85	-4.20	-3.84	-3.77	-3.70
1240 SAD LT MTR WNDNG Volts	VDC	-4.8	-4.09	-3.36	-3.43	-3.65	-3.46	-3.45	-3.57
1227 SAD RT -15 VDC Conv.	VDC	14.9	14.88	14.89	14.87	14.87	14.88	14.87	14.85
1247 SAD LT -15 VDC Conv.	VDC	15.2	15.13	15.14	15.06	15.11	15.11	15.08	15.08
1056 CLB $\pm$ 6 VDC	TMV	2.4	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1055 CLB $\pm$ 10 VDC TMV	TMV	2.75	2.75	2.74	2.74	2.73	2.74	2.74	2.74

Table 4-3. Landsat-1 ACS Attitude Errors and Driver Duty Cycles

Function	Units	Orbits							
		13198	13569	14001	15254	20364	22081	22505	22928
1141 Pitch Fine-Error *	DEG	- 0.40	- 0.08	- 0.02	- 2.13	-.11	-0.45	-0.38	-0.78
1143 Pitch Flywheel Speed	RPM	- 10 49	- 26.86	- 1.21	12.92	-76.17	-44 30	-70 53	-36.64
1038 Pitch MTR DRVR CCW	PCT	4 96	5 81	4.55	3.28	2.69	1.17	1.50	1.10
1039 Pitch MTR DRVR CW	PCT	2 29	2.17	5.10	19.65	1.04	0.47	0.63	0.35
1030 Roll Fine Error **	DEG	- 2.25	- 0.20	- 0 20	- 2.52	-2.70	-1.24	-2.60	-2 47
1127 Roll Rear Flywheel Speed	RPM	715 78	756.92	782.08	714 05	720.23	741 26	719.32	734.76
1126 Roll Fwd Flywheel Speed	RPM	641 82	674.47	693.31	641.32	640.80	660.06	642.84	650 05
1022 Roll Rear MTR DRVR CCW	PCT	0.01	0.68	0 90	.13	.96	0.06	0.00	0.00
1025 Roll Rear MTR DRVR CW	PCT	4.26	5.22	5.52	4.17	5.61	4.70	4.54	4.84
1023 Roll Fwd MTR DRVR CCW	PCT	0.01	0.66	0.72	.08	.99	0 04	0.00	0.00
1024 Roll Fwd MTR DRVR CW	PCT	4.15	4.94	5.35	4.24	5.16	4.35	4 51	4.09
1035 Yaw Tach	RPM	-206.08	-116.50	- 93.72	-169.52	-200.01	-183.52	-235.07	-191 10
1033 Yaw MTR DRVR CW	PCT	0 04	1 53	1.84	.09	.05	0.34	0.01	0.11
1034 Yaw MTR DRVR CCW	PCT	0.07	1.60	1.76	.68	.67	0.72	0.65	0.64
1221 SAD Right Tach	DEG/MIN	3.37	3.37	2.81	3 37	3.40	3.35	3.37	4.30
1241 SAD Left Tach	DEG/MIN	2 80	2 81	2.81	2.79	2.79	2.77	2.74	2.74

NOTE: Tabulation of these functions began after the pitch flywheel anomaly (stopped) in Orbit 11125.

* Pitch Fine Error is high due to use of Pitch Position Bias (PPB) to control Pitch wheel speed on some orbits which raise the average error above that of normal attitude without PPB.

** Roll Fine Error is high due to use of High Gain Roll Differential Tachometer mode to control Roll wheel speed which raises the average error above that of normal attitude in Normal Gain Roll Differential Tachometer mode

SECTION 5

COMMAND CLOCK SUBSYSTEM (CMD)

LANDSAT-1

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

The Command Clock Subsystem operated nominally in this report period. The clock was reset in Orbit 22623, 1 January 1977. Figure 5-1 shows the history of the S/C clock drift since launch. Figure 5-2 show the cumulative clock drift, 16.565 seconds slower in 54 months, and gives drift rate of S/C clock, an average of 0.722 msec slow per orbit. In this period, the drift rate is at the average rate of 0.360 msec slow per orbit. The clock in Landsat-1 drifts in opposite direction from the clock of Landsat-2.

Table 5-1 shows typical telemetry values since launch. All are nominal.

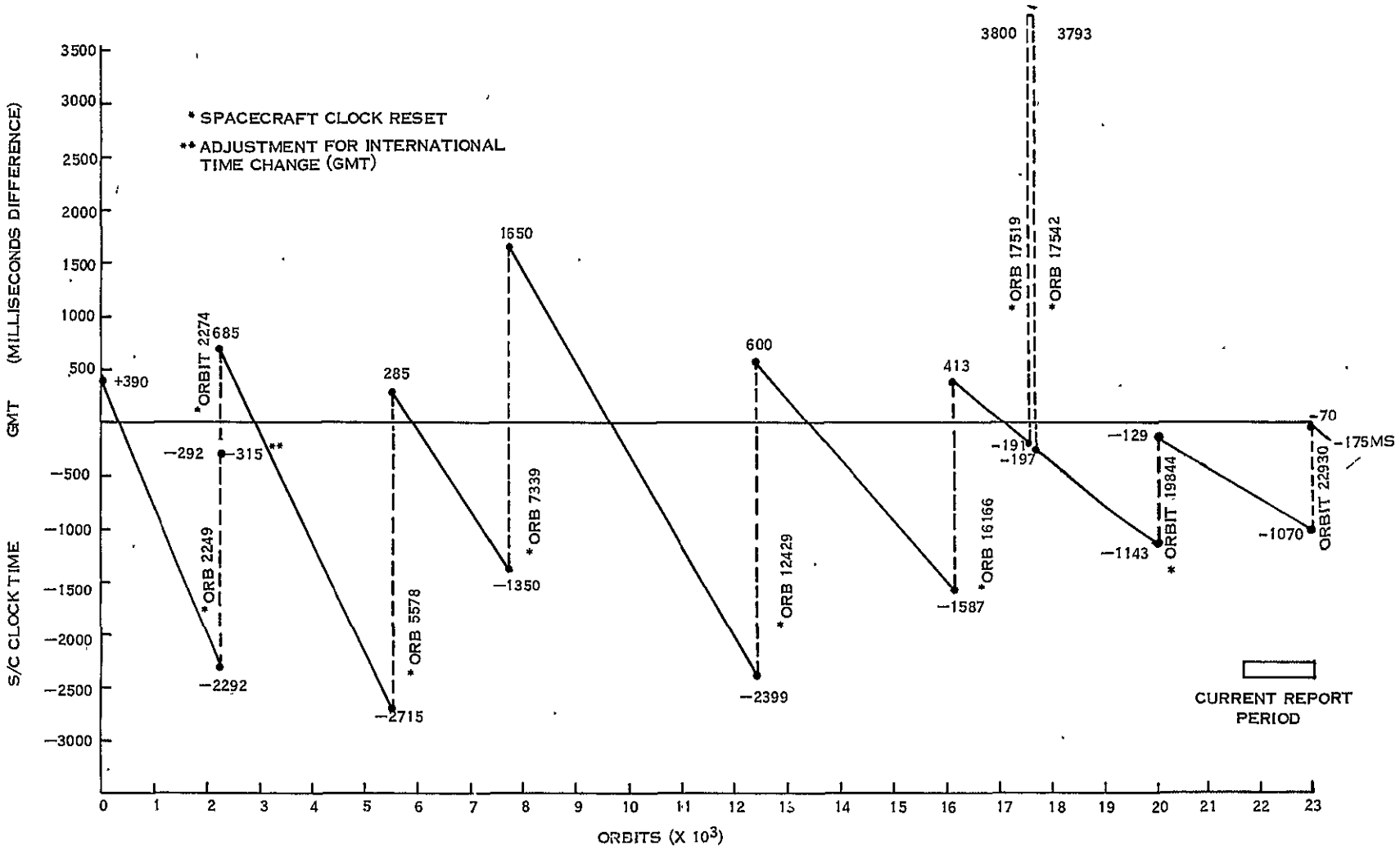


Figure 5-1. Landsat-1 Spacecraft Clock Drift History

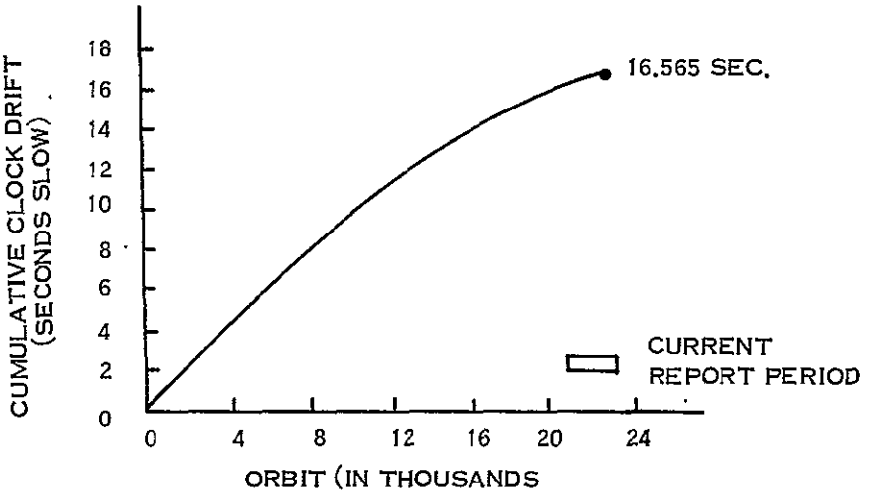


Figure 5-2. Cumulative Clock Drift

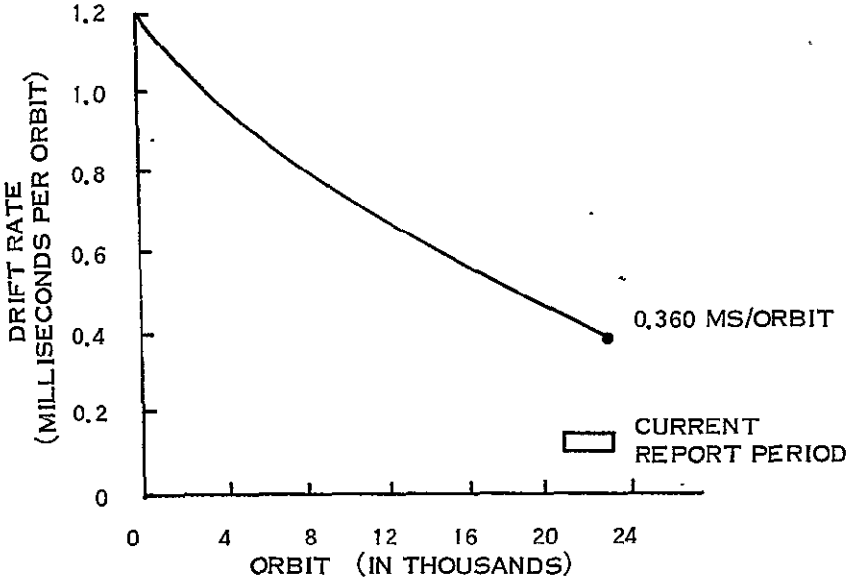


Figure 5-3. Drift Rate of S/C Clock

Table 5-1. Landsat-1 Command Clock Telemetry Summary

Function No.	Name	Mode	Units	Orbit							
				35	5099	10182	15233	20364	22086	22505	22928
8005	Pri. Power Supply Temp	-	°C	37.31	39.37	39.50	38 26	38.06	38.21	37.78	38.08
8006	Red. Power Supply Temp	-	°C	35.73	38.08	38.38	37.06	37.33	37.37	36.87	37.16
8007	Pri. Osc. Temp	-	°C	31.14	31.98	32.11	31.14	31.04	31.36	30.90	31.38
8008	Red. Osc. Temp	-	°C	30.47	31.39	31.42	30.48	30.18	30.55	29.96	30.59
8009	Pri. Osc. Output	-	TMV	0.95	0.96	0.97	0.97	0.95	0.96	0.95	0.96
8010	Red. Osc. Output	-	TMV	**	**	**	**	**	1.00	1.00	1.00
8011	100 kHz	Pri.-Red.	TMV	3.11	3.10	3.11	3.12	3.11	3.11	3.11	3.10
8012	10 kHz	Pri.-Red.	TMV	3.10	3.07	3.08	3.08	3.08	3.07	3.07	3.07
8013	2.5 kHz	Pri.-Red.	TMV	2.95	2.95	2.95	2.96	2.95	2.95	2.95	2.95
8014	400 Hz	Pri -Red.	TMV	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
8015	Pri. +4 V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.08	4.09	4.09	4.08
8016	Red. +4 V Power Supply	Red. Clk ON	VDC	3.95	3.95	3.95	3.95	3.92	3.92	3.92	3.91
8017	Pri. +6 V Power Supply	Pri. Clk ON	VDC	6.06	6.07	6.07	6.11	6.06	6.06	6.06	6.06
8018	Red. +6 V Power Supply	Red. Clk ON	VDC	6.00	5.94	5.94	5.97	5.93	5.93	5.93	5.93
8019	Pri. -6 V Power Supply	Pri. Clk ON	VDC	-6.02	-6.02	-6 03	-6.04	-6.02	-6.02	-6.02	-6.02
8020	Red. -6 V Power Supply	Red. Clk ON	VDC	-5.99	-6.00	-6.00	-6.01	-5.99	-5.99	-5.99	-5.99
8021	Pri. -23 V Power Supply	Pri. Clk ON	VDC	-22.88	-22.89	-22.89	-22.95	-22.88	-22.88	-22.88	-22.88
8022	Red. -23 V Power Supply	Red. Clk ON	VDC	-22.98	-23.00	-23.01	-23.06	-22.99	-22.99	-22.99	-22.99
8023	Pri. -29 V Power Supply	Pri. Clk ON	VDC	-29.13	-29.16	-29.15	-29.15	-29.16	-29.15	-29.15	-29.15
8024	Red. -29 V Power Supply	Red. Clk ON	VDC	-29.07	-29.21	-29.21	-29.21	-29.21	-29.21	-29.21	-29.21
8101	CIU A -12 V	CIA A ON	VDC	-12.33	-12.33	-12.34	-12.35	-12.34	-12.35	-12.35	-12.34
8102	CIU B -12 V	CIU B ON	VDC	-12.26	-12.26	-12.23	-12.20	-12.24	-12.25	-12.25	-12.25
8103	CIU A -5 V	CIU A ON	VDC	-5.32	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34
8104	CIU B -5 V	CIU B ON	VDC	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31
8105	CIU A Temp	CIU A ON	°C	24.47	24.77	25.04	24.09	24.11	24.84	24.66	25.40
8106	CIU B Temp	CIU B ON	°C	24.96	25.31	25.45	24.48	24.44	25.15	24.99	25.73
8201	Receiver RF-A Temp	-	°C	**	**	28.67	27.53	26.88	27.29	26.81	27.45
8202	Receiver RF-B Temp	-	°C	27.98	28.22	**	**	17.47	18.02	17.44	18.31
8203	D MOD A Temp	-	°C	25.41	25.73	37.98	37.31	36.40	36.79	36.42	37.12
8204	D MOD B Temp	-	°C	35.03	35.61	26.12	25.27	24.10	24.74	24.13	25.11
8205	Receiver A AGC	Receiver A ON	DBM	**	**	-96.77	-85.62	-95.73	-95.61	-95.30	-93.34
8206	Receiver B AGC	Receiver B ON	DBM	-94.74	-84.67	**	**	**	*	*	*
8207	Amp. A Output	Receiver A ON	TMV	**	**	2.31	2.94	2.46	2.63	2.65	2.47
8208	Amp. B Output	Receiver B ON	TMV	2.81	3.22	**	**	**	*	*	*
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	**	**	1.10	1.11	1.10	1.11	1.11	1.11
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.11	**	**	**	*	*	*
8211	Amp. A Output	Receiver A ON	TMV	**	**	1.10	1.10	1.10	1.11	1.11	1.10
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.13	**	**	**	*	*	*
8215	D MOD A -15 V	Receiver A ON	TMV	**	**	5.00	5.00	4.99	5.00	2.44	2.51
8216	D MOD B -15 V	Receiver B ON	TMV	5.00	5.00	**	**	**	*	*	*
8217	Regulator A -10 V	Receiver A ON	TMV	**	**	5.40	5.39	5.38	5.39	5.38	5.40
8218	Regulator B -10 V	Receiver B ON	TMV	5.50	5.50	**	**	**	*	*	*

**Units not in use

SECTION 6

TELEMETRY SUBSYSTEM (TLM)
LANDSAT-1

SECTION 6

TELEMETRY SUBSYSTEM (TLM)

The Telemetry Subsystem has performed nominally during this report period.

Landsat-1 used Memory Section 0.0 until Orbit 12,565, 10 January 1975, after which it was reprogrammed (Memory Section 1, 1) to be compatible with Landsat-2 telemetry matrix. Memory Section 1, 1 continues to be used in the telemetry matrix.

Table 6-1 shows typical telemetry values since launch.

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Unit	Orbit							
			35	5099	10592	15233	20364	22086	22505	22928
9001	Memory Sequencer A Converter	VDC	6.35	6.33	6.33	6.33	6.33	6.33	6.33	6.33
9002	Memory Sequencer B Converter	VDC	**	**	**	**	**	**	**	**
9003	Memory Sequencer Temp	°C	19.59	21.06	21.30	21.94	20.78	21.97	23.44	24.09
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99	6.02	6.02	6.02
9005	Formatter B Converter	VDC	**	**	**	**	**	**	**	**
9006	Dig., Mux A Converter	VDC	10.01	10.04	10.07	10.07	10.07	10.07	10.07	10.07
9007	Dig. Mux B Converter	VDC	**	**	**	**	**	**	**	**
9008	Formatter/Dig. Mux Temp	°C	22.50	24.89	25.00	23.55	25.00	30.00	35.00	37.50
9009	Analog Mux A Converter	VDC	26.01	21.18	26.20	26.32	26.35	26.35	26.35	26.35
9010	Analog Mux B Converter	VDC	**	**	**	**	**	**	**	**
9011	A/D Converter A Voltage	VDC	10.00	10.07	10.07	10.07	10.07	10.07	10.07	10.07
9012	A/D Converter B Voltage	VDC	**	**	**	**	**	**	**	**
9013	Analog Mux A/D Converter Temp	°C	25.00	26.83	27.49	25.63	26.56	29.29	29.29	32.50
9014	Preregulator A Voltage	VDC	19.93	19.95	19.94	19 98	19 90	19.97	20.00	20.00
9015	Preregulator B Voltage	VDC	**	**	**	**	**	**	**	**
9016	Reprogrammer Temp	°C	22.00	22.50	22.53	22.50	22.50	26.15	30.00	32.48
9017	Memory A Converter	VDC	6.00	5.99	6.00	5 97	5.97	6.00	5.99	6.00
9018	Memory A Temp	°C	17.51	17.50	17.50	17 50	17.47	17.50	18.87	19.92
9019	Memory B Converter	VDC	**	**	**	**	**	**	**	**
9020	Memory B Temp	°C	17.68	17.63	17.51	17.50	16.93	18.03	19.89	20.61
9100	Reflected Power (Xmtr A)	dBm	11.95	12.32	12.38	11.37	11.45	13.50	13.30	13.86
9101	Xmtr A -20 VDC	VDC	-19.75	-19.76	-19.75	-19.84	-19.75	-19.76	-19.75	-19.75
9102	Xmtr B -20 VDC	VDC	**	**	**	**	**	**	**	**
9103	Xmtr A Temp	°C	20.95	21.14	22.01	21.98	23.02	30.97	36.69	41.98
9104	Xmtr B Temp	°C	21.69	21.95	22.78	22.91	23.92	37.43	37.86	43.10
9105	Xmtr A Power Output	dBm	25.12	25.35	25.24	25.00	24 57	24.77	24.91	25.10
9106	Xmtr B Power Output	dBm	**	**	**	**	**	**	**	**

** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)
LANDSAT-1

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has been fired 50 times, 26 times using the -X thruster and 24 times using the +X thruster.

A 101 day orbit adjust program commenced in Orbit 21613 (20 October 1976) and continued through Orbit 23007 (28 January 1977). The program increased the time separation between Landsat-1 and Landsat-2 by 12.17 minutes and changed the total combined earth coverage provided by both Landsats from nine days - nine days to twelve days - six days. (Landsat-2 will pass over a reference point on earth 12 days after Landsat-1's passage. Six days after Landsat-2 crosses this point, Landsat-1 will pass over it again.)

An orbit adjust was required because Landsat-1 advanced toward Landsat-2 (due to cumulative effects of small differences in their orbital periods) and the ground stations' turn around time limits for tracking successive passes were being approached. As of 28 January 1977, the time separation between the spacecrafts at their descending nodes was 29.73 minutes with Landsat-2 leading.

In summary, the orbit adjust program consisted of three phases:

PHASE I

- One +X axis, 2.4 second duration test burn.
- One -X axis, 2.4 second duration test burn.
- One -X axis, 5.2 second duration burn conducted daily for eighteen days.

PHASE II

- 58 days of coasting

PHASE III

- One +X axis, 5.2 second duration burn conducted daily for nine days.
- One +X axis, 6.0 second duration burn conducted daily for seven days.
- One +X axis, 1.2 second duration burn completing the program.

During the entire 101 day orbit adjust period, payload operations were suspended and the ACS system was in the Roll Diff Tach High Gain mode with pneumatics disabled. All of the burns were normal and spacecraft attitude remained stable during these maneuvers via flywheel response and the commanding of Pitch Position Bias sequences.

The subsystem pressure/temperature parameters continue to be normal. There are 64.43 pounds of hydrazine fuel remaining from an initial pre-launch load of 67.00 pounds. Figure 2-1 shows spacecraft ground track drift from standard orbit tracks and the effects of orbit adjustment. Table 7-1 is a summary of OAS performance to date, and Table 7-2 gives average telemetry values for the off quiescent state.

Table 7-2. Landsat-1 OAS Telemetry Values

Function No.	Name	Units	Orbit							
			35	5099	10182	15254	20364	22081	22505	22928
2001	Prop. Tank Temp.	°C	22.03	22.86	23.28	21.62	21.20	23.28	24.53	26.19
2003	Thrust Chamber No. 1 (-x) Temp. **	°C	29.57	29.93	30.55	30.52	27.32	25.44	24.60	22.78
2004	Thrust Chamber No. 2 (+x) Temp. **	°C	38.76	40.28	38.91	36.25	35.20	35.85	34.59	34.63
2005	Thrust Chamber No. 3 (-y) Temp. **	°C	34.55	34.41	36.09	38.45	43.88	56.41	62.33	71.18
2006	Line Pressure	psia	539.29	486.87	490.61	486.87	489.66	486.80	490.61	490.47

**Wide spread of temperature is due to nozzle locations and satellite day/night transitions relative data averaged. Typical orbital range is from 19 to 59 DGC.

+ Higher temperatures shown reflect the effects of an orbit adjust conducted in this orbit.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

LANDSAT-1

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

From launch through Orbit 20370 (23 July 1976) Landsat-1's MMCA has been energized eleven times in seven orbits, i.e., Orbits 73, 85, 110, 220, 11181, 11185* and 11186*. The MMCA was operated in the early orbits to reduce +Roll pneumatic gating. (*Energized 3 times in one orbit).

In Orbits 11181 and 11186, it was energized in the plus and minus Yaw dipole configuration respectively in order to save freon gas by reducing the amplitude of the Pitch flywheel orbit frequency oscillation. In a short successful test during Orbit 11185 the plus Roll dipole was temporarily energized to determine if a positive roll dipole at the poles could unload the pitch flywheel. Upon test completion the Roll dipole was returned to 500 pole-cm.

No dipole adjustments were made during this report period.

The current dipole values are:

Pitch	+2950 Pole-Cm
Roll	-500 Pole-Cm
Yaw	-3600 Pole-Cm

Telemetry Measurement shown in Table 8-1 shows that the dipoles are holding steady without drift.

Table 8-1. MMCA Telemetry Summary (Landsat-1)

Number	Name	Units	Orbits							
			35	5099	10182	15254	20364	22081	22505	22928
4001	A1 Board Temp	°C	19.77	19.03	19.11	17.59	16.69	17.03	17.24	18.05
4002	A2 Board Temp	°C	23.58	23.05	23.13	21.83	21.05	21.32	21.50	22.26
4003	Hall Current	TMV	3.48	3.48	3.48	3.47	3.48	3.47	3.47	3.47
4004	Yaw Flux Density	TMV	3.11	3.11	3.15	4.02	4.03	4.04	4.03	4.04
4005	Pitch Flux Density	TMV	3.13	2.51	2.52	2.52	2.52	2.52	2.52	2.52
4006	Roll Flux Density	RMV	3.19	3.19	3.20	3.28	3.28	3.28	3.28	3.28

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR (USB/PMP)

LANDSAT-1

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR (USB/PMP)

The USB Subsystem performed all functions nominally during this period.

Table 9-1 shows telemetry values since launch. All are nominal. The high temperatures are attributable to the time of year, and the high Beta angle (see Figure 3-3). The temperatures are well within allowable limits and are expected to decline before they reach dangerous values.

Table 9-1. Landsat-1 USB/PMP Telemetry Values

Functions			Orbits							
No.	Name	Units	35	5099	10592	15233	20364	22086	22491	22928
11001	USB Rcvr AGC	DBM	-122.78	-131.99	-129.81	-105.41	-132.06	-127.20	-130.27	-127.95
11002	USB Xmtr Pwr	WTS	1.60	0.29	1.54	1.53	1.55	1.50	1.56	1.56
11003	USB Rcvr Error	KHZ	21.79	-21.32	-23.25	-18.01	-21.76	- 21.80	- 21.58	- 21.44
11004	USB Xpond Temp	DGC	22.92	22.64	25.64	25.11	25.37	29.85	32.60	37.31
11005	USB Xpond Press	PSI	15.91	15.91	15.92	15.94	15.90	16.23	16.42	16.72
11007	USB Xmtr A -15V	VDC	-15.20	-15.20	**	**	**	**	**	**
11008	USB Xmtr B -15V	VDC	**	**	-15.20	-15.20	-15.20	- 15.20	- 15.20	- 15.20
11009	USB Range -15V	VDC	-14.76	-14.76	-14.58	-14.58	-14.58	- 14.58	- 14.58	- 14.58
11101	PMP Pwr A Volt	VDC	-15.12	-15.18	**	**	**	**	**	**
11102	PMP Pwr B Volt	VDC	**	**	-15.12	-15.12	-15.13	- 15.12	- 15.15	- 15.11
11103	PMP Temp A	DGC	30.44	30.23	26.60	26.09	26.62	33.60	38.78	43.53
11104	PMP Temp B	DGC	**	**	31.64	31.67	31.12	37.82	42 56	47.58

** Units Not in Use

Figure 9-1 shows the USB power output history since launch. Figure 9-2 shows AGC readings at Goldstone for a constant reference orbit in each cycle since launch. The scatter of data points reflect variations in the ground station calibration and readout. The recent elevated readings are probably due to changes in ground station calibrations.

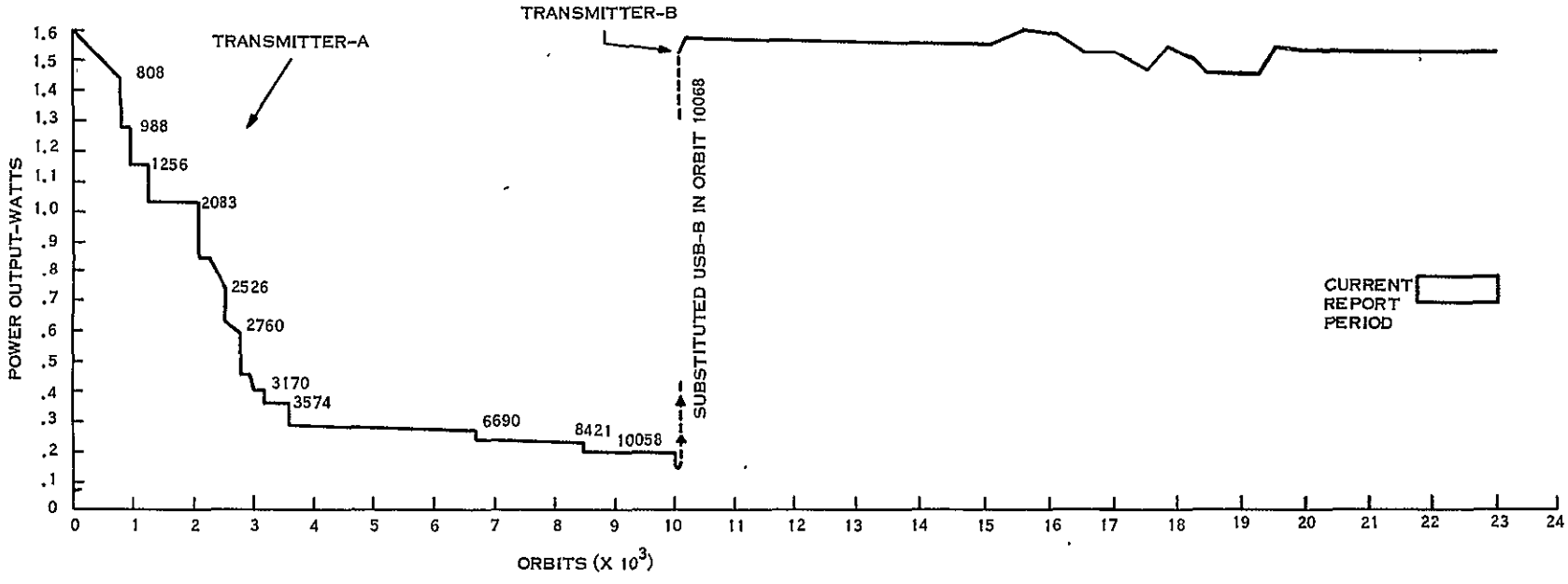


Figure 9-1. USB Power Output History (Landsat-1)

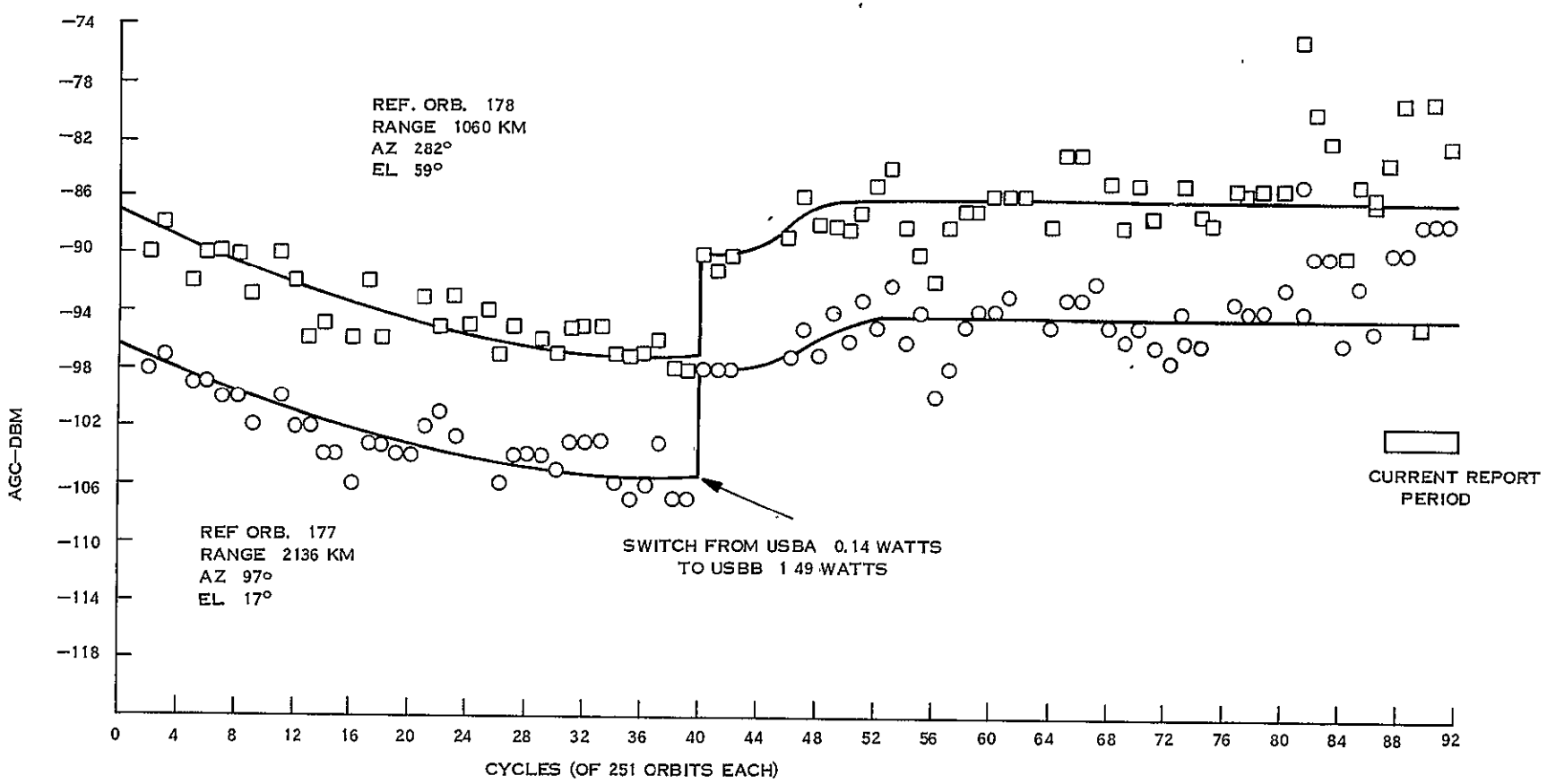


Figure 9-2. USB (Link 4) AGC Readings at Goldstone with 30' Antenna, Landsat-1

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM (EIS)
LANDSAT-1

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM (EIS)

Auxiliary Processing Unit (APU) consisting of Search Track Data, Time Code Data, and Backup Timers, operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1. The APU is in Normal mode.

Table 10-1. Landsat-1 APU Telemetry Functions

			Orbit							
Functions	Description	Unit	7	5098	10182	15254	20364	22081	22491	22928
13200	APU, -24.5 VDC	VDC	-24.90	-24.90	-24.91	-24.90	-24.90	-24.90	-24.90	-24.90
13201	APU, -12 Volts	VDC	-12.08	-12.08	-12.07	-12.06	-12.05	-12.05	-12.05	-12.05
13202	APU Temp.	DGC	25.49	26.95	27.15	26.82	27.31	30.89	32.77	35.35

The Power Switching Module (PSM), containing the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2., RBV and PRM, functioned normally. The MSS power circuits have been operating on a regular basis throughout this report period. The power relay for the RBV remained in a failed closed condition since Orbit 196.

The Interface Switching Module (ISM) performed all switching normally during this report period.

SECTION 11

THERMAL SUBSYSTEM (THM)
LANDSAT-1

SECTION 11

THERMAL SUBSYSTEM (THM)

The Thermal Subsystem in Landsat-1 has completed four years of successful temperature control of all spacecraft equipment. The minor anomalies in the subsystem were mainly associated with telemetry and have not affected the spacecraft mission.

Since the time of launch, the right sun sensor on Landsat-1 has registered temperatures higher than expected However, this has been determined to be justifiable for the particular location and bonding techniques used for the sensor. During Orbit 4396 (3 June 1973) telemetry function 7101 (THM TH07 ST1) became disabled when four telemetry gates mounted on one integrated circuit chip failed.

During each year in the past, Landsat-1 has experienced a period of high temperatures brought about by a combination of adverse peaks of high sun intensity, sun angle and longer satellite days. The cyclically varying sun angle and length of satellite day reaches higher and higher peaks in successive years due to the drift in the satellite's orbital plane. Thus, during February 1976, Landsat-1 experienced the highest temperatures to date. The increase in temperature was most noticeable along bays 11 through 17, which are normally warmer than others. The temperature spread between batteries increased to more than 15°C with battery 5 in bay 14 registering temperatures as high as 34.7°C. Although the spacecraft mission was unaffected, the high temperature environment affected the response of the sensor potentiometer for shutter 14 position telemetry (FUNC 7072). However, the response became normal when the temperatures dropped to a lower range. During February 1977, the spacecraft will experience still higher sun angles and longer satellite days, resulting in even higher spacecraft temperatures.

During this report period the sun intensity ranged between 1.010 and 1.034 of the mean value and the spacecraft temperatures increased. The temperature spread between batteries increased to more than 22°C with battery 5 in bay 14 registering temperatures as high as 37.9°C which is already higher than the previous February 1976 peak noted above. The temperatures are expected to increase further in the on-coming period of higher sun intensity, higher sun angle, longer satellite days and shorter satellite nights. Figure 11-1 shows a typical thermal profile for average bay temperatures of the sensory ring at the end of this report period.

Table 11-1 shows average analog telemetry values from data recorded on the NBR, for selected orbits since launch.

The compensation load configuration on Landsat-1 has been switched several times to get even temperatures among spacecraft components. A history of compensation load switching is given in Table 11-2.

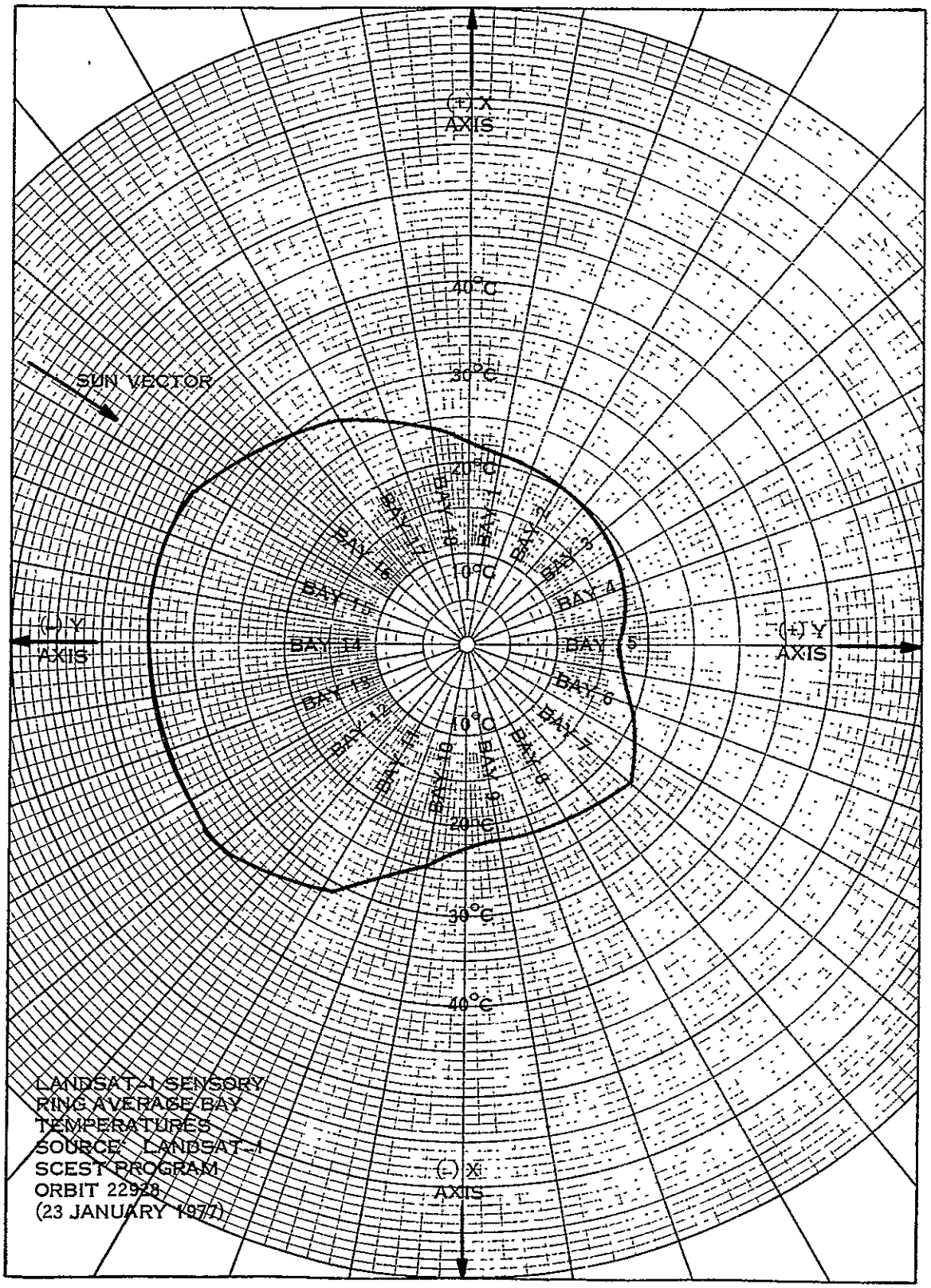


Figure 11-1. Landsat-1 Sensory Ring Thermal Profile

Table 11-1. Landsat-1 Thermal Subsystem Analog Telemetry (Average Value of Frames for Data Received in NBTR Playback)

Function			Orbits							
No.	Description	Unit	26	5098	10182	15254	20364	22081	22491	22923
7001	THM TH01 ST1	DGC	19.52	20.85	21.65	19.48	18.72	20.24	21.10	22.17
7002	THM TH02 SBO	DGC	18.60	19.95	20.60	18.62	17.87	18.61	18.73	19.05
7003	THM TH03 STI	DGC	18.48	20.16	20.87	18.11	17.20	18.25	18.58	19.19
7004	THM TH10 TCB	DGC	19.47	20.25	20.86	19.76	19.75	21.83	22.81	24.57
7005	THM TH04 STI	DGC	18.39	19.71	20.35	17.86	17.08	17.99	17.96	18.52
7006	THM TH05 SBO	DGC	17.57	18.39	18.81	17.20	16.47	16.87	16.76	17.14
7007	OA-X THRUSTER	DGC	21.95	22.95	22.90	22.25	21.33	21.48	21.60	21.80
7008	THM TH06 STO	DGC	15.95	16.61	16.90	16.34	14.52	14.88	14.78	15.16
7009	THM TH08 SBI	DGC	19.38	20.35	20.93	18.98	17.86	18.42	18.46	19.02
7010	THM TH07 STI	DGC	18.61	*	*	*	*	*	*	*
7011	THM TH08 STO	DGC	21.78	22.77	22.88	22.03	21.17	21.22	21.20	21.27
7012	THM TH09 SBI	DGC	21.81	22.87	23.08	22.20	21.66	22.48	22.44	23.09
7013	THM TH10 SBO	DGC	18.73	19.53	19.64	19.00	18.56	19.67	20.00	21.00
7014	THM TH11 STI	DGC	22.37	23.35	23.57	22.80	22.88	25.50	26.73	28.82
7015	THM TH12 SBO	DGC	22.37	23.17	23.03	22.86	23.71	26.40	30.83	34.80
7016	THM TH13 STI	DGC	20.95	22.02	22.47	22.00	22.89	26.28	31.46	35.27
7017	RBV BEAM CTR LN	DGC	21.53	22.62	22.84	21.88	21.63	23.28	23.60	24.95
7018	THM TH14 STO	DGC	20.38	21.40	21.93	21.83	23.19	30.69	35.37	39.86
7019	NBR RAD OUTBD B4	DGC	5.09	5.86	6.00	4.37	3.31	3.91	4.32	5.02
7020	THM TH15 SBI	DGC	21.14	23.24	23.99	22.18	23.06	29.18	32.96	36.93
7021	THM TH16 STI	DGC	20.73	22.90	23.68	21.64	21.68	26.40	29.44	32.84
7022	THM TH17 SBI	DGC	20.22	22.76	23.56	21.47	20.83	24.57	26.87	29.63
7023	THM TH18 SBO	DGC	21.90	24.29	25.19	23.47	22.56	25.25	26.64	28.16
7030	THM TH03 BUR	DGC	16.05	17.07	17.42	15.35	14.62	15.31	15.11	15.38
7031	THM TH06 BUR	DGC	13.59	14.17	14.28	12.87	12.07	12.25	12.15	12.46
7032	THM TH09 BUR	DGC	19.92	20.75	20.74	20.17	19.64	20.14	20.38	20.88
7033	THM TH12 BUR	DGC	21.51	22.16	22.76	22.65	23.67	28.98	31.87	36.64
7034	THM TH15 BUR	DGC	19.70	21.67	22.38	21.33	22.23	28.80	32.76	36.86
7035	THM TH18 BUR	DGC	20.11	21.36	22.02	20.54	20.07	21.92	22.95	23.54
7040	THM TH01 TCB	DGC	19.27	20.46	21.26	19.19	18.69	19.84	20.27	20.84
7041	THM TH02 TCB	DGC	17.99	19.23	19.89	17.80	17.11	17.71	17.89	18.27
7042	THM TH03 TCB	DGC	18.34	19.94	20.92	17.79	17.16	18.26	17.70	18.02
7043	THM TH04 TCB	DGC	18.95	19.94	20.26	18.60	18.00	18.58	18.50	18.84
7044	THM TH05 TCB	DGC	16.27	16.98	17.32	15.90	15.22	15.56	15.54	15.88
7045	THM TH07 TCB	DGC	18.41	19.21	19.45	16.25	17.46	17.70	17.70	17.96
7046	THM TH09 TCB	DGC	19.38	20.37	20.64	19.85	19.17	19.86	20.07	20.64
7048	THM TH11 TCB	DGC	21.98	22.94	23.18	22.80	23.18	26.32	27.94	30.53
7049	THM TH12 TCB	DGC	21.92	22.46	22.35	22.30	23.35	29.08	32.14	36.47
7050	THM TH13 TCB	DGC	21.21	21.99	22.29	22.26	23.62	30.30	34.89	39.63
7051	THM TH14 TCB	DGC	21.38	22.88	23.62	22.74	23.83	31.44	36.28	39.94
7052	THM TH16 TCB	DGC	21.30	23.95	25.13	22.68	23.00	28.28	31.25	35.04
7053	THM TH17 TCB	DGC	21.73	24.03	25.02	23.33	21.89	24.78	26.60	28.64
7054	THM TH18 TCB	DGC	20.02	22.20	23.35	21.04	20.10	21.76	22.52	23.40
7060	THM SHUTTER BY 1	DEG	25.85	33.12	38.62	24.41	19.19	29.34	33.27	37.89
7061	THM SHUTTER BY 2	DEG	6.62	8.65	13.28	1.73	0.00	0.00	0.00	0.00
7062	THM SHUTTER BY 3	DEG	10.96	23.58	30.24	17.80	12.44	13.91	13.13	13.59
7063	THM SHUTTER BY 4	DEG	30.60	35.71	37.92	29.50	25.00	24.01	25.10	25.50
7064	THM SHUTTER BY 5	DEG	15.08	16.25	15.00	8.08	4.62	3.49	3.46	3.99
7065	THM SHUTTER BY 7	DEG	17.14	24.64	21.96	14.50	8.00	8.02	9.00	8.50
7067	THM SHUTTER BY 9	DEG	33.26	38.44	39.50	38.24	37.50	38.71	40.39	41.00
7068	THM SHUTTER BY 10	DEG	24.68	28.68	27.31	26.08	24.26	35.41	44.16	56.48
7069	THM SHUTTER BY 11	DEG	39.66	46.39	48.96	46.97	48.40	61.83	64.64	64.69
7070	THM SHUTTER BY 12	DEG	43.81	46.63	45.68	45.95	52.19	67.95	67.97	67.97
7071	THM SHUTTER BY 13	DEG	40.39	46.38	44.79	42.84	44.43	62.64	62.62	62.62
7072	THM SHUTTER BY 14	DEG	34.20	39.70	41.91	34.28	34.65	49.00	49.00	49.00
7073	THM SHUTTER BY 15	DEG	45.40	58.74	64.79	55.15	63.60	80.54	80.36	80.64
7074	THM SHUTTER BY 16	DEG	24.50	48.46	53.54	38.76	40.06	63.19	65.64	65.80
7075	THM SHUTTER BY 17	DEG	39.06	54.96	61.38	51.06	39.95	60.70	71.83	78.98
7076	THM SHUTTER BY 18	DEG	29.70	43.15	51.20	35.12	28.09	39.63	45.09	49.77
7080	THM Q1 T ZENER V	VDC	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19
7081	THM Q2 T ZENER V	VDC	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40
7082	THM Q3 T ZENER V	VDC	8.31	8.31	8.32	8.31	8.31	8.32	8.31	8.31
7083	THM Q1 S ZENER V	VDC	8.31	8.32	8.35	8.31	8.31	8.33	8.35	8.35
7084	THM Q2 S ZENER V	VDC	8.19	8.19	8.20	8.19	8.19	8.19	8.20	8.23
7085	THM Q3 S ZENER V	VDC	8.15	8.15	8.15	8.15	8.15	8.15	8.15	8.16
7090	THM PSM MOUNT	DGC	21.60	22.54	22.98	21.43	20.98	23.11	24.55	26.34
7091	THM IND ATTITUDE	DGC	19.40	20.42	20.58	19.13	18.23	18.34	18.96	19.51
7092	THM RBV RADIATOR	DGC	15.65	17.22	17.47	16.55	16.52	18.08	16.21	17.39
7093	THM RBVC CTR BM	DGC	20.30	21.61	21.87	20.73	20.69	22.46	21.71	22.98
7094	THM WBVTR ROOT	DGC	12.96	15.71	16.07	13.77	12.00	13.82	15.00	16.49
7095	THM WBVTR RAD CT	DGC	4.81	8.17	8.68	6.99	5.99	7.26	7.87	8.23
7096	THM WBVTR STRAP	DGC	16.62	19.32	19.66	17.29	14.72	16.56	17.66	19.11
7097	THM WB MT BAY 1	DGC	20.56	19.52	21.37	16.97	16.35	17.62	18.58	19.66
7098	THM WB MAT BAY 1	DGC	20.22	18.90	20.39	17.12	16.65	18.29	19.43	20.81
7099	THM WBVTR SEP 8	DGC	18.60	20.55	21.05	18.45	17.09	18.33	18.87	19.69
7100	THM WBVTR SEP 17	DGC	21.31	23.66	24.23	22.02	20.96	24.17	26.21	28.69
7101	THM WBVTR 1 CENT	DGC	21.49	23.72	24.01	21.63	18.23	20.17	21.42	22.99
7102	THM WBVTR 2 BAY	DGC	17.46	18.92	19.32	17.33	16.31	17.26	17.67	18.50
7103	THM WBVTR 2 BY 15	DGC	21.00	23.16	23.82	21.73	21.33	25.73	28.70	31.92
7104	THM WBVTR 2 CTR	DGC	19.35	21.51	21.81	19.54	17.53	19.78	21.47	23.44
7105	THM NBTR B SEP 6	DGC	18.06	19.30	19.79	17.82	16.74	17.63	18.31	19.45
7106	THM NBTR B SEP 1	DGC	20.82	22.35	22.89	21.61	22.04	27.15	30.31	33.67
7107	THM NBTR BM CTR	DGC	19.87	21.04	21.34	19.51	18.94	21.07	22.48	24.31
7108	THM MSS MOUNT 14	DGC	19.16	21.15	21.70	20.06	20.70	25.81	28.99	32.41
7109	THM OA -Y THRUSTER	DGC	22.21	23.80	24.69	24.40	26.22	33.73	38.09	42.52
7110	THM MSS WBVTR BM	DGC	18.14	20.06	20.53	18.18	17.38	18.74	19.78	21.15
7111	THM OA +X THRUSTER	DGC	20.30	19.92	21.22	18.07	17.57	19.01	19.82	20.90
7130	THM AUX P1 T	DGC	15.69	8.49	-18.90	9.68	10.29	15.59	19.02	20.22
7131	THM AUX P2 T	DGC	10.63	1.59	.41	5.64	25.81	31.21	35.13	37.79

*Function 7010 became invalid after an integrated circuit chip failure in the TMP on Orbit 4396.

Table 11-2. Landsat-1 Compensation Load History

Orbits	Compensation Load Status							
	1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
2	0	0	X	X	X	0	X	X
6	X	X	X	X	X	0	X	X
115	0	0	0	0	0	0	0	0
156	X	X	X	X	X	0	X	X
194	0	0	0	0	0	0	0	0
197	X	X	X	X	X	0	X	X
701	X	X	0	X	X	0	X	X
1410	X	X	0	X	X	0	0	X
3484	X	X	X	X	X	0	0	X
3641	X	X	0	X	X	0	0	X
3646	X	X	X	X	X	0	0	X
4177	X	X	0	X	X	0	0	X
6872	X	X	X	X	X	0	0	X
6966	X	X	0	X	X	0	0	X
8291	X	X	X	X	X	0	0	X
8348	X	X	0	X	X	0	0	X
8449	X	X	X	X	X	0	0	X
8472	X	X	0	X	X	0	0	X
8538	X	X	X	X	X	0	0	X
8928	X	X	0	X	X	0	0	X
9898	X	X	X	X	X	0	0	X
10410	X	X	0	X	X	0	0	X
11125	0	0	0	0	0	0	0	0
11126	X	X	0	X	X	0	0	X
11127	0	0	0	0	0	0	0	0
11133	X	X	0	X	X	0	0	X
12604	X	X	X	X	X	0	0	X
13206	X	X	0	X	X	0	0	0
15584	X	X	0	0	X	0	0	0
22487	X	X	0	0	0	0	0	0

* Note: X = ON
0 = OFF

SECTION 12

NARROWBAND TAPE RECORDERS (NBR)
LANDSAT-1

SECTION 12

NARROW BAND TAPE RECORDERS (NBR)

Narrowband Recorder-A operated satisfactorily during this report period, and has provided coverage for MSS real-time operations as well as approximately 3-1/2 hours daily of normal orbital telemetry recording and playback functions.

Table 12-1 gives cumulative operating hours for both recorders by modes, and Table 12-2 gives typical telemetry values.

Table 12-1. NBR Operating Hours by Modes, Landsat-1

NBR	ON	OFF	Playback	Record
A	16,694	22,830	670	16,024
B*	11,909	12,666	476	11,433

*Not used since Orbit 15,253, 22 July 1975

Table 12-2. Narrowband Tape Recorder Telemetry Values, Landsat-1

Function		Typical Telemetry Values - Orbits							
No.	Name	6	3750-3751	10862	15256	20375	22086	22505	22928
10001	A - Motor Cur. (ma)								
	Record	190.10	189.20	186.31	192.63	196.20	186.66	187.30	183.26
	P/B	180.00	178.69	180.00	N.A.	192.60	197.37	168.41	186.41
10101	B - Motor Cur. (ma)								
	Record	193.26	193.04	198.95	198.95	*	*	*	*
	P/B	188.18	185.44	187.89	202.1	*	*	*	*
10002	A - Pwr Sup. Cur. (ma)								
	Record	320.56	338.20	339.81	343.24	343.20	340.72	342.13	343.18
	P/B	535.78	568.38	567.75	N.A.	572.90	569.59	562.41	576.97
10102	B - Pwr Sup. Cur. (ma)								
	Record	317.62	336.05	350.00	346.75	*	*	*	*
	P/B	570.78	553.63	567.50	580.51	*	*	*	*
10003	A - Rec. Temp. (DGC)	25.47	34.40	23.60	22.00	20.80	23.61	23.83	25.43
10103	B - Rec. Temp. (DGC)	24.58	23.41	23.41	23.18	18.40	19.61	19.89	21.26
10004	A - Supply (VDC)	-24.47	-24.44	-24.62	-24.62	-24.60	-24.56	-24.56	-24.56
10104	B - Supply (VDC)	-24.44	-24.51	-24.29	-24.57	-24.70	-24.71	-24.71	-24.71

N.A. - Data not available
* - No data. NBR-B out of service

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM (WBTS)
LANDSAT-1

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM (WBTS)

The Wideband Telemetry Subsystem has not been used since Orbit 21598 on 19 October. Operations will be resumed in February 1977. This time period was necessary to adjust the in-orbit spacing between Landsat-1 and Landsat-2.

Table 13-1 shows typical telemetry values since launch. All are nominal.

Figure 13-1 is the AGC history at Goldstone. The scatter of data points reflect variations in the ground station calibration and readout. The recent elevated readings are probably due to changes in ground station

Table 13-1. Wideband Modulator Telemetry Values, Landsat-1

WBPA-1

Function			Orbits			
Number	Name		26	1894	1944	2095
12001	Tmpt TWT Coll.	(DgC)	35.7	39.20	39.90	39.90
12002	Helix Current	(Ma)	6.08	6.49	6.58	6.78
12003	TWT Cath. Curr.	(Ma)	45.89	43.54	43.48	45.01
12004	Forward Pwr	(DBM)	43.18	42.88	42.61	43.15
12005	Reflected Pwr	(DBM)	34.95	34.99	34.80	35.21
12227	Loop Str. AFC Con Volt (1)	(MHz)	-0.39	-1.29	-0.86	-0.67
12229	Mod Temp VCO	(DgC)	21.93	20.31	20.88	20.39
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.69	2.69	2.65	2.62
12234	-15 VDC Pwr Sup A	(TMV)	5.98	5.96	5.73	5.78
12235	+5 VDC Pwr Sup A	(TMV)	3.94	3.94	3.94	3.95
12238	-5 VDC Pwr Sup A	(TMV)	5.28	5.26	5.18	5.12
12240	-24 VDC Unreg Volt A	(TMV)	5.56	5.51	5.42	5.49
12242	Inv. Temp	(DgC)	20.60	23.43	24.71	24.04

WBPA-2

Function			Orbits							
Number	Name		33	4096	10602	15233	20358	20808	21236	22081
12101	Temp TWT Coll. (Max)	(DgC)	35.38	34.24	35.96	29.77	33.90	32.50	33.46	34.23
12102	Helix Current	(Ma)	7.32	7.70	7.67	7.90	7.82	7.66	7.94	7.69
12103	TWT Cath. Cur.	(Ma)	44.30	43.85	42.72	43.70	42.83	41.65	42.80	43.84
12104	Forward Pwr	(DBM)	43.57	43.57	43.47	43.52	43.41	43.32	43.49	43.50
12105	Reflected Pwr	(DBM)	31.59	32.79	32.62	33.07	32.60	32.18	32.99	32.83
12228	Loop Str. AFC Con Volt (1)	(MHz)	1.11	-0.78	-1.12	-1.05	-1.53	-1.05	-1.31	-1.93
12229	Mod Temp VCO	(DgC)	21.70	20.88	21.50	21.78	23.65	22.32	21.44	19.26
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.68	2.69	2.69	2.65	2.66	2.69	2.62	2.69
12234	-15 VDC Pwr Sup A	(TMV)	5.90	5.98	5.92	5.81	5.85	5.98	5.93	5.94
12236	+5 VDC Pwr Sup A	(TMV)	3.97	4.01	4.01	3.97	3.96	3.92	3.95	4.02
12239	-5 VDC Pwr Sup A	(TMV)	5.24	telemetry point defective						
12240	-24.5 VDC Unreg Volt A	(TMV)	5.43	5.52	5.46	5.44	5.37	5.55	5.37	5.48
12242	Inv. Temp	(DgC)	23.03	22.96	23.86	23.66	22.73	22.34	22.87	21.64

(1) Satisfactory if not -14.0 to +14.0. (2) B Power Supply not yet used in orbit

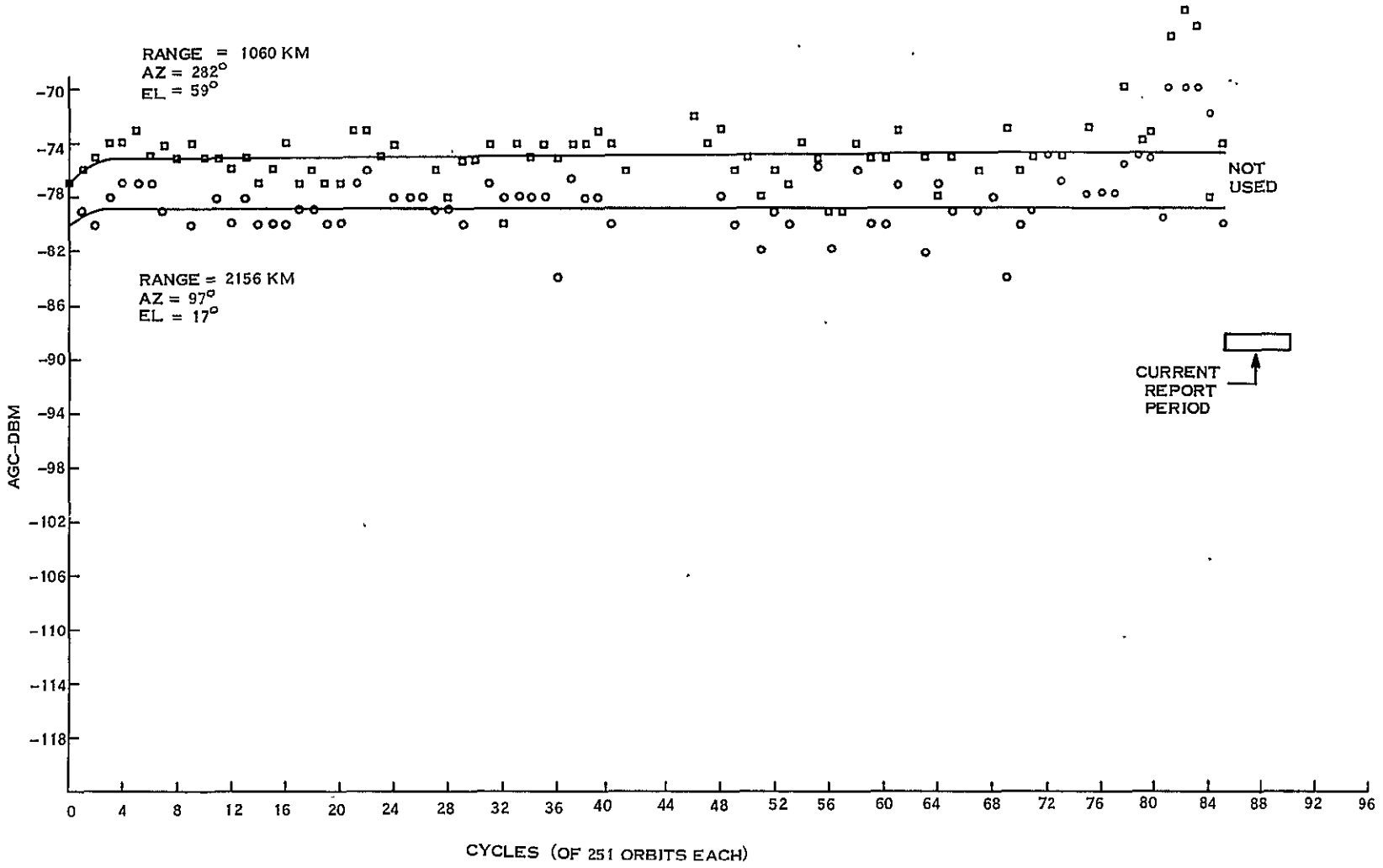


Figure 13-1. WPA-2 (Link 3) AGC Readings at Goldstone with 30' Antenna - Landsat-1

SECTION 14

ATTITUDE MEASUREMENT SENSOR (AMS)
LANDSAT-1

SECTION 14

ATTITUDE MEASUREMENT SYSTEM (AMS)

The AMS subsystem was launched in the OFF mode and energized in Orbit 6. Its performance since Orbit 6 has been without incident. Attitude measurements made with the AMS are in good agreement with ACS fine attitude error measurements.

Table 14-1 gives typical AMS telemetry values.

Table 14-1. Landsat-1 AMS Temperature Telemetry

Function	Description	Units	Orbits							
			35	5099	10182	15254	20364	22081	22505	2292
3004	Case-Temp 1	DGC	18.92	19.42	19.71	18.54	18.23	18.92	18.60	19.5
3005	Assembly-Temp 2	DGC	19.15	19.76	19.96	18.73	18.51	19.17	18.93	19.9

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS (WBVTR)
LANDSAT-1

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS (WBVTR)

WBVTR-2 has not been operated since its failure in Orbit 148, 3 August 1972.

WBVTR-1 was removed from operational service after Orbit 9881, 2 July 1974, because of high minor frame sync error counts. The recorder has remained inactive since suspension of engineering tests after Orbit 10861, 10 September 1974.

SECTION 16

RETURN BEAM VIDICON (RBV)
LANDSAT-1

SECTION 16

RETURN BEAM VIDICON (RBV)

The RBV has not been reactivated since Orbit 196, but it is capable of operation through individual component power switching. An assessment of the RBV performance was given in ERTS-1 Flight Evaluation Report 23 July to 23 October 1972.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM (MSS)
LANDSAT-1

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM (MSS)

The MSS Subsystem has not been used since Orbit 21598 on 19 October. Operations will be resumed in February 1977. The time period was necessary to adjust the in-orbit spacing between Landsat-1 and Landsat-2.

Figure 17-1 shows the number of scenes imaged at each geographical location in the first 3 years of operati Figure 17-2 shows the number of scenes imaged since the first 3 years. In these maps, only those scenes r ceived by U.S. ground stations are shown. Scenes transmitted to Canada, Brazil and Italy (44% of total) are shown.

Table 17-1 shows typical telemetry values since launch. All telemetry values are nominal.

Table 17-2 shows the history of sensor response to a constant input radiance level. Each sensor is sampled 5 radiance levels, and all show essentially the same trends. Only one of these levels (the second highest) is listed in Table 17-2. Sensor 5 has declined most (24%) since launch. This is twice the average sensor declir

Line length history is also shown in Table 17-2.

Sun calibrations, performed every two weeks, continue to show nominal performance.

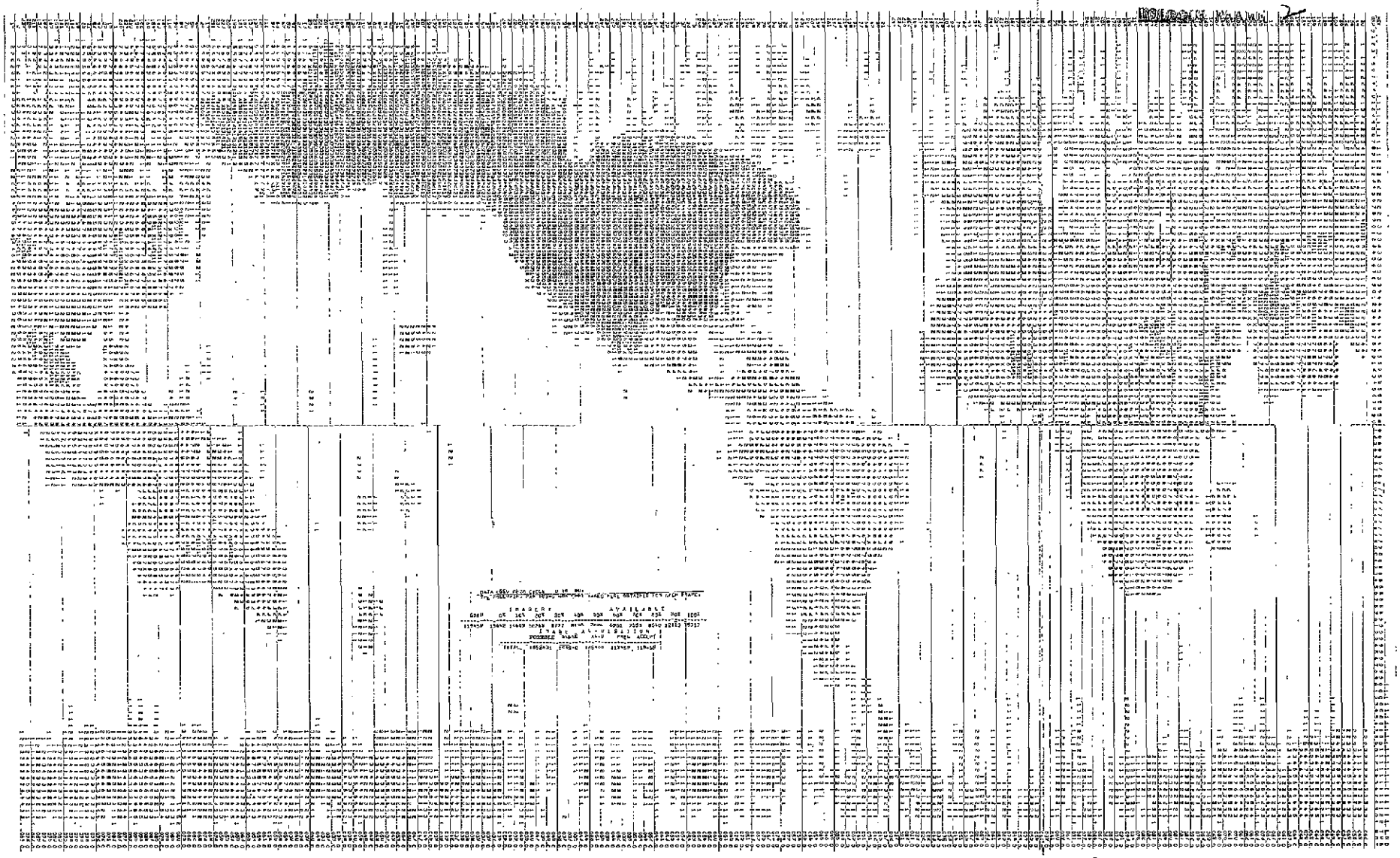


Figure 17-1. Computer Map of MSS Scenes for First Three Years Operation - Landsat-1

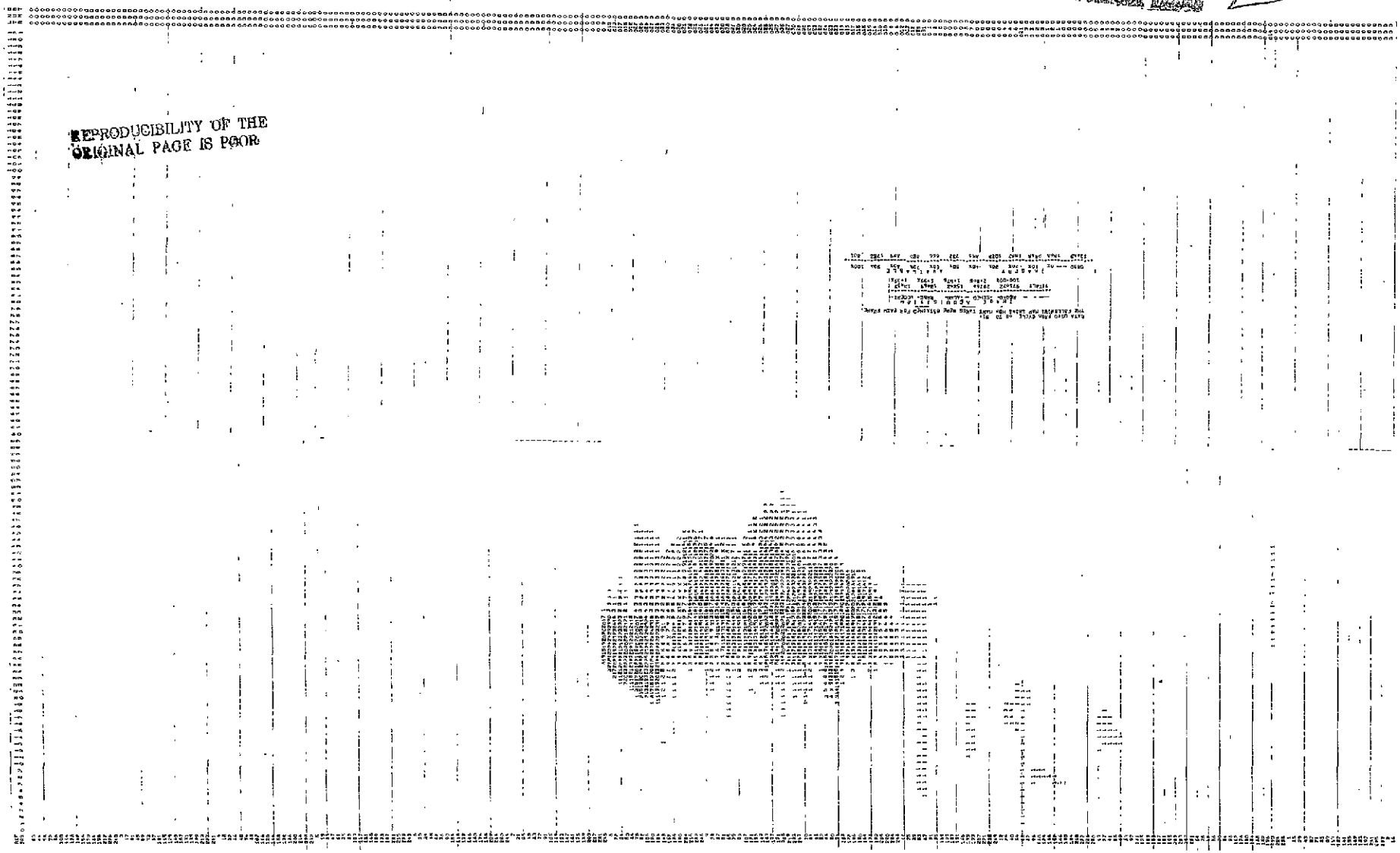


Figure I7-2. MSS Scenes Imaged Since Third Year

Table 17-1. MSS Telemetry Values

Function No.	Name		Telemetry Values in Orbits							
			20	5060	10587	15233	20358	20808	21236	22471
15044	FOPT 2 T	(DGC)	17.46	19.84	19.75	18.15	18.07	18.43	18.80	20.17
15046	ELEC CVR T	(DGC)	19.37	21.83	21.96	20.20	20.11	20.17	20.64	20.51
15048	SCAN MIR REG T	(DGC)	16.35	19.77	20.48	20.94	21.90	21.27	23.11	23.35
15050	SCAN MIR DR. COIL T	(DGC)	15.94	19.30	19.78	19.21	19.96	20.13	21.36	22.51
15052	ROT SHUT HSG T	(DGC)	16.91	20.07	20.23	18.74	18.78	19.02	19.34	20.57
15043	FOPT 1 T	(DGC)	17.67	20.01	19.93	18.35	18.28	18.65	18.96	20.37
15045	MUX T	(DGC)	21.19	22.03	23.87	26.92	28.63	27.08	30.45	28.02
15047	PWR SUP T	(DGC)	17.41	20.00	20.21	19.83	20.28	20.00	21.06	21.51
15049	SCAN MIR DR. ELC T	(DGC)	16.12	19.41	20.23	21.16	22.41	21.38	23.61	23.42
15051	SCAN MIR HSG T	(DGC)	15.60	19.05	19.49	18.40	19.04	19.51	20.54	22.16
15040	MUX -6 VDC	(TMV)	4.03	4.03	3.98	4.02	4.03	4.03	4.03	4.03
15042	AVE DENS DATA	(TMV)	1.67	2.13	2.05	2.28	2.28	2.29	2.11	1.72
15054	CAL LAMP CUR A	(TMV)	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.72
15056	BAND 2 $\pm$ 15 VDC	(TMV)	5.10	5.10	5.04	5.10	5.10	5.10	5.10	5.10
15058	BAND 4 $\pm$ 15 VDC	(TMV)	5.10	5.10	5.04	5.10	5.10	5.10	5.10	5.10
15060	+ 12 -6 VDC REG	(TMV)	4.82	5.02	4.97	5.02	5.02	5.01	5.02	5.02
15062	+ 19 VDC REC OUT	(TMV)	4.80	4.90	4.97	5.03	5.03	5.03	5.03	5.03
15064	BAND 1 HV A	(TMV)	5.10	5.16	5.12	5.12	5.12	5.12	5.12	5.12
15066	BAND 2 HV A	(TMV)	4.50	4.52	4.52	4.50	4.50	4.50	4.50	4.52
15068	BAND 3 HV A	(TMV)	4.60	4.62	4.62	4.62	4.62	4.62	4.62	4.62
15070	SHUT MOT CON OUT	(TMV)	2.43	2.44	2.47	2.51	2.50	2.50	2.50	2.50
15041	A/D SUPPLY	(TMV)	5.93	5.93	5.87	5.93	5.92	5.90	5.82	5.93
15053	SCAN MIR REG V	(TMV)	4.42	4.51	4.51	4.61	4.61	4.61	4.62	4.61
15055	BAND 1 $\pm$ 15 V	(TMV)	4.97	4.97	4.92	4.97	4.97	4.97	4.97	4.97
15057	BAND 3 $\pm$ 15 V	(TMV)	5.00	5.00	4.94	5.00	5.00	5.00	5.00	5.00
15059	-15 VDC TEL.	(TMV)	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02
15061	+ 5 VDC LOGIC REG	(TMV)	4.82	4.81	4.77	4.76	4.78	4.82	4.75	4.80
15063	-19 VDC REG OUT	(TMV)	3.43	3.39	3.50	3.58	3.57	3.57	3.57	3.57
15071	SCAN MIR DR. CLK	(TMV)	1.93	1.97	1.98	2.00	1.96	1.99	1.99	2.00

Table 17-2. MSS Response History Landsat-1

Quantum Level for Selected Word (0=Black: 63=White)

Band	Sensor	1st Year: Launch	1st Year: 2-4 Quar.	2nd Year: 5-8 Quar.	3rd Year: 9-12 Quar.	4th Year: 13-16 Quar.	5th Year: 17-18 Quar.	% Change Since Launch
1	1	43	39	39	38	37	37	-14
	2	44	39	40	40	39	38.5	-13
	3	43	38	40	40	39	39.5	-8
	4	43	38	39	39	38	37.5	-13
	5	41	36	35	34	32	31	-24
	6	43	39	41	41	40	39	-9
2	7	47	43	43	42	41	41	-13
	8	46	41.5	41	41	40	39	-15
	9	47	44	42.5	42	41	40	-15
	10	46	42	41.5	41	41	40.5	-12
	11	47	42.5	42	42	41	40	-15
	12	45	42	42.5	42	42	41	-9
3	13	46	46	49	51	52	52	+13
	14	44	42	42	42	42	42	-5
	15	45	42.5	42	41	41	40	-11
	16	40	37.5	37.5	37	37	37	-8
	17	42	39	40	40	40	40	-5
	18	44	40	40.5	41	41	40.5	-8
4	19	28	28	27	25	23	23	-18
	20	25	26	25	23	21	20	-20
	21	26	27	26.5	25	23	22	-15
	22	23	23	22	21	19	19	-17
	23	22	22.5	23	21	21	20.5	-7
	24	24	23.5	24	23	22	22	-8
Line Length		3221	3219	3217	3216	3217	3216	-0.16

SECTION 18

DATA COLLECTION SUBSYSTEM (DCS)
LANDSAT-1

SECTION 18

DATA COLLECTION SUBSYSTEM

The Data Collection Subsystem was turned OFF after Orbit 12690 on 19 January 1975, and has not been used since, although it is still operational, and could be returned to service at any time.

The DCS in Landsat-2 has performed the DCS mission since turn off of the subsystem in Landsat-1.

APPENDIX A

LANDSAT-1 ANOMALY LIST

APPENDIX B

LANDSAT-1 SPACECRAFT ORBIT REFERENCE TABLES

LANDSAT-1

SPACECRAFT ORBIT REFERENCE TABLES

FROM OCTOBER 1976 THROUGH MARCH, 1978

ORBIT 21339 THROUGH 28966

FLIGHT DAY 1531 THROUGH 2077

LANDSAT-1

OCT.1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE No.
1	275	1531	21339-21352	140-153	11	5
2	276	1532	21353-21366	154-167	12	5
3	277	1533	21367-21380	168-181	13	5
4	278	1534	21381-21394	182-195	14	5
5	279	1535	21395-21408	196-209	15	5
6	280	1536	21409-21422	210-223	16	5
7	281	1537	21423-21436	224-237	17	5
8	282	1538	21437-21450	238-251	18	5
9	283	1539	21451-21464	1- 14	1	6
10	284	1540	21465-21478	15- 28	2	6
11	285	1541	21479-21492	29- 42	3	6
12	286	1542	21493-21506	43- 56	4	6
13	287	1543	21507-21520	57- 70	5	6
14	288	1544	21521-21534	71- 84	6	6
15	289	1545	21535-21548	85- 98	7	6
16	290	1546	21549-21561	99-111	8	6
17	291	1547	21562-21575	112-125	9	6
18	292	1548	21576-21589	126-139	10	6
19	293	1549	21590-21603	140-153	11	6
20	294	1550	21604-21617	154-167	12	6
21	295	1551	21618-21631	168-181	13	6
22	296	1552	21632-21645	182-195	14	6
23	297	1553	21646-21659	196-209	15	6
24	298	1554	21660-21673	210-223	16	6
25	299	1555	21674-21687	224-237	17	6
26	300	1556	21688-21701	238-251	18	6
27	301	1557	21702-21715	1- 14	1	7
28	302	1558	21716-21729	15- 28	2	7
29	303	1559	21730-21743	29- 42	3	7
30	304	1560	21744-21757	43- 56	4	7
31	305	1561	21758-21771	57- 70	5	7

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NOV 1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	306	1562	21772-21785			
2	307	1563	21786-21799			
3	308	1564	21800-21812			
4	309	1565	21813-21826			
5	310	1566	21827-21840			
6	311	1567	21841-21854			
7	312	1568	21855-21868			
8	313	1569	21869-21882			
9	314	1570	21883-21896			
10	315	1571	21897-21910			
11	316	1572	21911-21924			
12	317	1573	21925-21938			
13	318	1574	21939-21952			
14	319	1575	21953-21966	REFERENCE FRAME BEING		
15	320	1576	21967-21980	SHIFTED THREE DAYS		
16	321	1577	21981-21994	(NOV 76 - JAN 77)		
17	322	1578	21995-22008			
18	323	1579	22009-22022			
19	324	1580	22023-22036			
20	325	1581	22037-22050			
21	326	1582	22051-22063			
22	327	1583	22064-22077			
23	328	1584	22078-22091			
24	329	1585	22092-22105			
25	330	1586	22106-22119			
26	331	1587	22120-22133			
27	332	1588	22134-22147			
28	333	1589	22148-22161			
29	334	1590	22162-22175			
30	335	1591	22176-22189			

LANDSAT-1

DEC, 1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	336	1592	22190-22203			
2	337	1593	22204-22217			
3	338	1594	22218-22231			
4	339	1595	22232-22245			
5	340	1596	22246-22259			
6	341	1597	22260-22273			
7	342	1598	22274-22287			
8	343	1599	22288-22301			
9	344	1600	22302-22314			
10	345	1601	22315-22328			
11	346	1602	22329-22342			
12	347	1603	22343-22356			
13	348	1604	22357-22370			
14	349	1605	22371-22384	REFERENCE FRAME BEING SHIFTED THREE DAYS (NOV 76 - JAN 77)		
15	350	1606	22385-22398			
16	351	1607	22399-22412			
17	352	1608	22413-22426			
18	353	1609	22427-22440			
19	354	1610	22441-22454			
20	355	1611	22455-22468			
21	356	1612	22469-22482			
22	357	1613	22483-22496			
23	358	1614	22497-22510			
24	359	1615	22511-22524			
25	360	1616	22525-22538			
26	361	1617	22539-22552			
27	362	1618	22553-22565			
28	363	1619	22566-22579			
29	364	1620	22580-22593			
30	365	1621	22594-22607			
31	366	1622	22608-22621			

LANDSAT-1

JAN 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	1623	22622-22635			
2	2	1624	22636-22649			
3	3	1625	22650-22663			
4	4	1626	22664-22677			
5	5	1627	22678-22691			
6	6	1628	22692-22705			
7	7	1629	22706-22719			
8	8	1630	22720-22733			
9	9	1631	22734-22747			
10	10	1632	22748-22761			
11	11	1633	22762-22775			
12	12	1634	22776-22789			
13	13	1635	22790-22803			
14	14	1636	22804-22816	REFERENCE FRAME BEING SHIFTED THREE DAYS (NOV 76 - JAN 77)		
15	15	1637	22817-22830			
16	16	1638	22831-22844			
17	17	1639	22845-22858			
18	18	1640	22859-22872			
19	19	1641	22873-22886			
20	20	1642	22887-22900			
21	21	1643	22901-22914			
22	22	1644	22915-22928			
23	23	1645	22929-22942			
24	24	1646	22943-22956			
25	25	1647	22957-22970			
26	26	1648	22971-22984			
27	27	1649	22985-22998			
28	28	1650	22999-23012			
29	29	1651	23013-23026			
30	30	1652	23027-23040			
31	31	1653	23041-23054			

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FEB. 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	1654	23054-23067	140-153	11	92
2	33	1655	23068-23081	154-167	12	92
3	34	1656	23082-23095	168-181	13	92
4	35	1657	23096-23109	182-195	14	92
5	36	1658	23110-23123	196-209	15	92
6	37	1659	23124-23137	210-223	16	92
7	38	1660	23138-23151	224-237	17	92
8	39	1661	23152-23165	238-251	18	92
9	40	1662	23166-23179	1- 14	1	93
10	41	1663	23180-23193	15- 28	2	93
11	42	1664	23194-23207	29- 42	3	93
12	43	1665	23208-23221	43- 56	4	93
13	44	1666	23222-23235	57- 70	5	93
14	45	1667	23236-23249	71- 84	6	93
15	46	1668	23250-23263	85- 98	7	93
16	47	1669	23264-23276	99-111	8	93
17	48	1670	23277-23290	112-125	9	93
18	49	1671	23291-23304	126-139	10	93
19	50	1672	23305-23318	140-153	11	93
20	51	1673	23319-23332	154-167	12	93
21	52	1674	23333-23346	168-181	13	93
22	53	1675	23347-23360	182-195	14	93
23	54	1676	23361-23374	196-209	15	93
24	55	1677	23375-23388	210-223	16	93
25	56	1678	23389-23402	224-237	17	93
26	57	1679	23403-23416	238-251	18	93
27	58	1680	23417-23430	1- 14	1	94
28	59	1681	23431-23444	15- 28	2	94

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MAR 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	1682	23445-23458	29- 42	3	94
2	61	1683	23459-23472	43- 56	4	94
3	62	1684	23473-23486	57- 70	5	94
4	63	1685	23487-23500	71- 84	6	94
5	64	1686	23501-23514	85- 98	7	94
6	65	1687	23515-23527	99-111	8	94
7	66	1688	23528-23541	112-125	9	94
8	67	1689	23542-23555	126-139	10	94
9	68	1690	23556-23569	140-153	11	94
10	69	1691	23570-23583	154-167	12	94
11	70	1692	23584-23597	168-181	13	94
12	71	1693	23598-23611	182-195	14	94
13	72	1694	23612-23625	196-209	15	94
14	73	1695	23626-23639	210-223	16	94
15	74	1696	23640-23653	224-237	17	94
16	75	1697	23654-23667	238-251	18	94
17	76	1698	23668-23681	1- 14	1	95
18	77	1699	23682-23695	15- 28	2	95
19	78	1700	23696-23709	29- 42	3	95
20	79	1701	23710-23723	43- 56	4	95
21	80	1702	23724-23737	57- 70	5	95
22	81	1703	23738-23751	71- 84	6	95
23	82	1704	23752-23765	85- 98	7	95
24	83	1705	23766-23778	99-111	8	95
25	84	1706	23779-23792	112-125	9	95
26	85	1707	23793-23806	126-139	10	95
27	86	1708	23807-23820	140-153	11	95
28	87	1709	23821-23834	154-167	12	95
29	88	1710	23835-23848	168-181	13	95
30	89	1711	23849-23862	182-195	14	95
31	90	1712	23863-23876	196-209	15	95

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APR. 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	1713	23877-23890	210-223	16	95
2	92	1714	23891-23904	224-237	17	95
3	93	1715	23905-23918	238-251	18	95
4	94	1716	23919-23932	1-14	1	96
5	95	1717	23933-23946	15-28	2	96
6	96	1718	23947-23960	29-42	3	96
7	97	1719	23961-23974	43-56	4	96
8	98	1720	23975-23988	57-70	5	96
9	99	1721	23989-24002	71-84	6	96
10	100	1722	24003-24016	85-98	7	96
11	101	1723	24017-24029	99-111	8	96
12	102	1724	24030-24043	112-125	9	96
13	103	1725	24044-24057	126-139	10	96
14	104	1726	24058-24071	140-153	11	96
15	105	1727	24072-24085	154-167	12	96
16	106	1728	24086-24099	168-181	13	96
17	107	1729	24100-24113	182-195	14	96
18	108	1730	24114-24127	196-209	15	96
19	109	1731	24128-24141	210-223	16	96
20	110	1732	24142-24155	224-237	17	96
21	111	1733	24156-24169	238-251	18	96
22	112	1734	24170-24183	1-14	1	97
23	113	1735	24184-24197	15-28	2	97
24	114	1736	24198-24211	29-42	3	97
25	115	1737	24212-24225	43-56	4	97
26	116	1738	24226-24239	57-70	5	97
27	117	1739	24240-24253	71-84	6	97
28	118	1740	24254-24267	85-98	7	97
29	119	1741	24268-24280	99-111	8	97
30	120	1742	24281-24294	112-125	9	97

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MAY 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	1743	24295-24308	126-139	10	97
2	122	1744	24309-24322	140-153	11	97
3	123	1745	24323-24336	154-167	12	97
4	124	1746	24337-24350	168-181	13	97
5	125	1747	24351-24364	182-195	14	97
6	126	1748	24365-24378	196-209	15	97
7	127	1749	24379-24392	210-223	16	97
8	128	1750	24393-24406	224-237	17	97
9	129	1751	24407-24420	238-251	18	97
10	130	1752	24421-24434	1- 14	1	98
11	131	1753	24435-24448	15- 28	2	98
12	132	1754	24449-24462	29- 42	3	98
13	133	1755	24463-24476	43- 56	4	98
14	134	1756	24477-24490	57- 70	5	98
15	135	1757	24491-24504	71- 84	6	98
16	136	1758	24505-24518	85- 98	7	98
17	137	1759	24519-24531	99-111	8	98
18	138	1760	24532-24545	112-125	9	98
19	139	1761	24546-24559	126-139	10	98
20	140	1762	24560-24573	140-153	11	98
21	141	1763	24574-24587	154-167	12	98
22	142	1764	24588-24601	168-181	13	98
23	143	1765	24602-24615	182-195	14	98
24	144	1766	24616-24629	196-209	15	98
25	145	1767	24630-24643	210-223	16	98
26	146	1768	24644-24657	224-237	17	98
27	147	1769	24658-24671	238-251	18	98
28	148	1770	24672-24685	1- 14	1	99
29	149	1771	24686-24699	15- 28	2	99
30	150	1772	24700-24713	29- 42	3	99
31	151	1773	24714-24727	43- 56	4	99

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JUNE 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	1774	24728-24741	57- 70	5	99
2	153	1775	24742-24755	71- 84	6	99
3	154	1776	24756-24769	85- 98	7	99
4	155	1777	24770-24782	99-111	8	99
5	156	1778	24783-24796	112-125	9	99
6	157	1779	24797-24810	126-139	10	99
7	158	1780	24811-24824	140-153	11	99
8	159	1781	24825-24838	154-167	12	99
9	160	1782	24839-24852	168-181	13	99
10	161	1783	24853-24866	182-195	14	99
11	162	1784	24867-24880	196-209	15	99
12	163	1785	24881-24894	210-223	16	99
13	164	1786	24895-24908	224-237	17	99
14	165	1787	24909-24922	238-251	18	99
15	166	1788	24923-24936	1- 14	1	100
16	167	1789	24937-24950	15- 28	2	100
17	168	1790	24951-24964	29- 42	3	100
18	169	1791	24965-24978	43- 56	4	100
19	170	1792	24979-24992	57- 70	5	100
20	171	1793	24993-25006	71- 84	6	100
21	172	1794	25007-25020	85- 98	7	100
22	173	1795	25021-25033	99-111	8	100
23	174	1796	25034-25047	112-125	9	100
24	175	1797	25048-25061	126-139	10	100
25	176	1798	25062-25075	140-153	11	100
26	177	1799	25076-25089	154-167	12	100
27	178	1800	25090-25103	168-181	13	100
28	179	1801	25104-25117	182-195	14	100
29	180	1802	25118-25131	196-209	15	100
30	181	1803	25132-25145	210-223	16	100

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JULY 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	1804	25146-25159	224-237	17	100
2	183	1805	25160-25173	238-251	18	100
3	184	1806	25174-25187	1- 14	1	101
4	185	1807	25188-25201	15- 28	2	101
5	186	1808	25202-25215	29- 42	3	101
6	187	1809	25216-25229	43- 56	4	101
7	188	1810	25230-25243	57- 70	5	101
8	189	1811	25244-25257	71- 84	6	101
9	190	1812	25258-25271	85- 98	7	101
10	191	1813	25272-25284	99-111	8	101
11	192	1814	25285-25298	112-125	9	101
12	193	1815	25299-25312	126-139	10	101
13	194	1816	25313-25326	140-153	11	101
14	195	1817	25327-25340	154-167	12	101
15	196	1818	25341-25354	168-181	13	101
16	197	1819	25355-25368	182-195	14	101
17	198	1820	25369-25382	196-209	15	101
18	199	1821	25383-25396	210-223	16	101
19	200	1822	25397-25410	224-237	17	101
20	201	1823	25411-25424	238-251	18	101
21	202	1824	25425-25438	1- 14	1	102
22	203	1825	25439-25452	15- 28	2	102
23	204	1826	25453-25466	29- 42	3	102
24	205	1827	25467-25480	43- 56	4	102
25	206	1828	25481-25494	57- 70	5	102
26	207	1829	25495-25508	71- 84	6	102
27	208	1830	25509-25522	85- 98	7	102
28	209	1831	25523-25535	99-111	8	102
29	210	1832	25536-25549	112-125	9	102
30	211	1833	25550-25563	126-139	10	102
31	212	1834	25564-25577	140-153	11	102

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AUG. 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	1835	25578-25591	154-167	12	102
2	214	1836	25592-25605	168-181	13	102
3	215	1837	25606-25619	182-195	14	102
4	216	1838	25620-25633	196-209	15	102
5	217	1839	25634-25647	210-223	16	102
6	218	1840	25648-25661	224-237	17	102
7	219	1841	25662-25675	238-251	18	102
8	220	1842	25676-25689	1- 14	1	103
9	221	1843	25690-25703	15- 28	2	103
10	222	1844	25704-25717	29- 42	3	103
11	223	1845	25718-25731	43- 56	4	103
12	224	1846	25732-25745	57- 70	5	103
13	225	1847	25746-25759	71- 84	6	103
14	226	1848	25760-25773	85- 98	7	103
15	227	1849	25774-25786	99-111	8	103
16	228	1850	25787-25800	112-125	9	103
17	229	1851	25801-25814	126-139	10	103
18	230	1852	25815-25828	140-153	11	103
19	231	1853	25829-25842	154-167	12	103
20	232	1854	25843-25856	168-181	13	103
21	233	1855	25857-25870	182-195	14	103
22	234	1856	25871-25884	196-209	15	103
23	235	1857	25885-25898	210-223	16	103
24	236	1858	25899-25912	224-237	17	103
25	237	1859	25913-25926	238-251	18	103
26	238	1860	25927-25940	1- 14	1	104
27	239	1861	25941-25954	15- 28	2	104
28	240	1862	25955-25968	29- 42	3	104
29	241	1863	25969-25982	43- 56	4	104
30	242	1864	25983-25996	57- 70	5	104
31	243	1865	25997-26010	71- 84	6	104

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SEP*1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	1866	26011-26024	85- 98	7	104
2	245	1867	26025-26037	99-111	8	104
3	246	1868	26038-26051	112-125	9	104
4	247	1869	26052-26065	126-139	10	104
5	248	1870	26066-26079	140-153	11	104
6	249	1871	26080-26093	154-167	12	104
7	250	1872	26094-26107	168-181	13	104
8	251	1873	26108-26121	182-195	14	104
9	252	1874	26122-26135	196-209	15	104
10	253	1875	26136-26149	210-223	16	104
11	254	1876	26150-26163	224-237	17	104
12	255	1877	26164-26177	238-251	18	104
13	256	1878	26178-26191	1- 14	1	105
14	257	1879	26192-26205	15- 28	2	105
15	258	1880	26206-26219	29- 42	3	105
16	259	1881	26220-26233	43- 56	4	105
17	260	1882	26234-26247	57- 70	5	105
18	261	1883	26248-26261	71- 84	6	105
19	262	1884	26262-26275	85- 98	7	105
20	263	1885	26276-26288	99-111	8	105
21	264	1886	26289-26302	112-125	9	105
22	265	1887	26303-26316	126-139	10	105
23	266	1888	26317-26330	140-153	11	105
24	267	1889	26331-26344	154-167	12	105
25	268	1890	26345-26358	168-181	13	105
26	269	1891	26359-26372	182-195	14	105
27	270	1892	26373-26386	196-209	15	105
28	271	1893	26387-26400	210-223	16	105
29	272	1894	26401-26414	224-237	17	105
30	273	1895	26415-26428	238-251	18	105

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OCT 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	1896	26429-26442	1- 14	1	106
2	275	1897	26443-26456	15- 28	2	106
3	276	1898	26457-26470	29- 42	3	106
4	277	1899	26471-26484	43- 56	4	106
5	278	1900	26485-26498	57- 70	5	106
6	279	1901	26499-26512	71- 84	6	106
7	280	1902	26513-26526	85- 98	7	106
8	281	1903	26527-26539	99-111	8	106
9	282	1904	26540-26553	112-125	9	106
10	283	1905	26554-26567	126-139	10	106
11	284	1906	26568-26581	140-153	11	106
12	285	1907	26582-26595	154-167	12	106
13	286	1908	26596-26609	168-181	13	106
14	287	1909	26610-26623	182-195	14	106
15	288	1910	26624-26637	196-209	15	106
16	289	1911	26638-26651	210-223	16	106
17	290	1912	26652-26665	224-237	17	106
18	291	1913	26666-26679	238-251	18	106
19	292	1914	26680-26693	1- 14	1	107
20	293	1915	26694-26707	15- 28	2	107
21	294	1916	26708-26721	29- 42	3	107
22	295	1917	26722-26735	43- 56	4	107
23	296	1918	26736-26749	57- 70	5	107
24	297	1919	26750-26763	71- 84	6	107
25	298	1920	26764-26777	85- 98	7	107
26	299	1921	26778-26790	99-111	8	107
27	300	1922	26791-26804	112-125	9	107
28	301	1923	26805-26818	126-139	10	107
29	302	1924	26819-26832	140-153	11	107
30	303	1925	26833-26846	154-167	12	107
31	304	1926	26847-26860	168-181	13	107

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NOV 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	1927	26861-26874	182-195	14	107
2	306	1928	26875-26888	196-209	15	107
3	307	1929	26889-26902	210-223	16	107
4	308	1930	26903-26916	224-237	17	107
5	309	1931	26917-26930	238-251	18	107
6	310	1932	26931-26944	1- 14	1	108
7	311	1933	26945-26958	15- 28	2	108
8	312	1934	26959-26972	29- 42	3	108
9	313	1935	26973-26986	43- 56	4	108
10	314	1936	26987-27000	57- 70	5	108
11	315	1937	27001-27014	71- 84	6	108
12	316	1938	27015-27028	85- 98	7	108
13	317	1939	27029-27041	99-111	8	108
14	318	1940	27042-27055	112-125	9	108
15	319	1941	27056-27069	126-139	10	108
16	320	1942	27070-27083	140-153	11	108
17	321	1943	27084-27097	154-167	12	108
18	322	1944	27098-27111	168-181	13	108
19	323	1945	27112-27125	182-195	14	108
20	324	1946	27126-27139	196-209	15	108
21	325	1947	27140-27153	210-223	16	108
22	326	1948	27154-27167	224-237	17	108
23	327	1949	27168-27181	238-251	18	108
24	328	1950	27182-27195	1- 14	1	109
25	329	1951	27196-27209	15- 28	2	109
26	330	1952	27210-27223	29- 42	3	109
27	331	1953	27224-27237	43- 56	4	109
28	332	1954	27238-27251	57- 70	5	109
29	333	1955	27252-27265	71- 84	6	109
30	334	1956	27266-27279	85- 98	7	109

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DEC. 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	1957	27280-27292	99-111	8	109
2	336	1958	27293-27306	112-125	9	109
3	337	1959	27307-27320	126-139	10	109
4	338	1960	27321-27334	140-153	11	109
5	339	1961	27335-27348	154-167	12	109
6	340	1962	27349-27362	168-181	13	109
7	341	1963	27363-27376	182-195	14	109
8	342	1964	27377-27390	196-209	15	109
9	343	1965	27391-27404	210-223	16	109
10	344	1966	27405-27418	224-237	17	109
11	345	1967	27419-27432	238-251	18	109
12	346	1968	27433-27446	1- 14	1	110
13	347	1969	27447-27460	15- 28	2	110
14	348	1970	27461-27474	29- 42	3	110
15	349	1971	27475-27488	43- 56	4	110
16	350	1972	27489-27502	57- 70	5	110
17	351	1973	27503-27516	71- 84	6	110
18	352	1974	27517-27530	85- 98	7	110
19	353	1975	27531-27543	99-111	8	110
20	354	1976	27544-27557	112-125	9	110
21	355	1977	27558-27571	126-139	10	110
22	356	1978	27572-27585	140-153	11	110
23	357	1979	27586-27599	154-167	12	110
24	358	1980	27600-27613	168-181	13	110
25	359	1981	27614-27627	182-195	14	110
26	360	1982	27628-27641	196-209	15	110
27	361	1983	27642-27655	210-223	16	110
28	362	1984	27656-27669	224-237	17	110
29	363	1985	27670-27683	238-251	18	110
30	364	1986	27684-27697	1- 14	1	111
31	365	1987	27698-27711	15- 28	2	111

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JAN, 1978

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	1988	27712-27725	29- 42	3	111
2	2	1989	27726-27739	43- 56	4	111
3	3	1990	27740-27753	57- 70	5	111
4	4	1991	27754-27767	71- 84	6	111
5	5	1992	27768-27781	85- 98	7	111
6	6	1993	27782-27794	99-111	8	111
7	7	1994	27795-27808	112-125	9	111
8	8	1995	27809-27822	126-139	10	111
9	9	1996	27823-27836	140-153	11	111
10	10	1997	27837-27850	154-167	12	111
11	11	1998	27851-27864	168-181	13	111
12	12	1999	27865-27878	182-195	14	111
13	13	2000	27879-27892	196-209	15	111
14	14	2001	27893-27906	210-223	16	111
15	15	2002	27907-27920	224-237	17	111
16	16	2003	27921-27934	238-251	18	111
17	17	2004	27935-27948	1- 14	1	112
18	18	2005	27949-27962	15- 28	2	112
19	19	2006	27963-27976	29- 42	3	112
20	20	2007	27977-27990	43- 56	4	112
21	21	2008	27991-28004	57- 70	5	112
22	22	2009	28005-28018	71- 84	6	112
23	23	2010	28019-28032	85- 98	7	112
24	24	2011	28033-28045	99-111	8	112
25	25	2012	28046-28059	112-125	9	112
26	26	2013	28060-28073	126-139	10	112
27	27	2014	28074-28087	140-153	11	112
28	28	2015	28088-28101	154-167	12	112
29	29	2016	28102-28115	168-181	13	112
30	30	2017	28116-28129	182-195	14	112
31	31	2018	28130-28143	196-209	15	112

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FEB 1978

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	2019	28144-28157	210-223	16	112
2	33	2020	28158-28171	224-237	17	112
3	34	2021	28172-28185	238-251	18	112
4	35	2022	28186-28199	1-14	1	113
5	36	2023	28200-28213	15- 28	2	113
6	37	2024	28214-28227	29- 42	3	113
7	38	2025	28228-28241	43- 56	4	113
8	39	2026	28242-28255	57- 70	5	113
9	40	2027	28256-28269	71- 84	6	113
10	41	2028	28270-28283	85- 98	7	113
11	42	2029	28284-28296	99-111	8	113
12	43	2030	28297-28310	112-125	9	113
13	44	2031	28311-28324	126-139	10	113
14	45	2032	28325-28338	140-153	11	113
15	46	2033	28339-28352	154-167	12	113
16	47	2034	28353-28366	168-181	13	113
17	48	2035	28367-28380	182-195	14	113
18	49	2036	28381-28394	196-209	15	113
19	50	2037	28395-28408	210-223	16	113
20	51	2038	28409-28422	224-237	17	113
21	52	2039	28423-28436	238-251	18	113
22	53	2040	28437-28450	1-14	1	114
23	54	2041	28451-28464	15- 28	2	114
24	55	2042	28465-28478	29- 42	3	114
25	56	2043	28479-28492	43- 56	4	114
26	57	2044	28493-28506	57- 70	5	114
27	58	2045	28507-28520	71- 84	6	114
28	59	2046	28521-28534	85- 98	7	114

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MAR 1978

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF. DAY	CYCLE NO.
1	60	2047	28535-28547	99-111	8	114
2	61	2048	28548-28561	112-125	9	114
3	62	2049	28562-28575	126-139	10	114
4	63	2050	28576-28589	140-153	11	114
5	64	2051	28590-28603	154-167	12	114
6	65	2052	28604-28617	168-181	13	114
7	66	2053	28618-28631	182-195	14	114
8	67	2054	28632-28645	196-209	15	114
9	68	2055	28646-28659	210-223	16	114
10	69	2056	28660-28673	224-237	17	114
11	70	2057	28674-28687	238-251	18	114
12	71	2058	28688-28701	1- 14	1	115
13	72	2059	28702-28715	15- 28	2	115
14	73	2060	28716-28729	29- 42	3	115
15	74	2061	28730-28743	43- 56	4	115
16	75	2062	28744-28757	57- 70	5	115
17	76	2063	28758-28771	71- 84	6	115
18	77	2064	28772-28785	85- 98	7	115
19	78	2065	28786-28798	99-111	8	115
20	79	2066	28799-28812	112-125	9	115
21	80	2067	28813-28826	126-139	10	115
22	81	2068	28827-28840	140-153	11	115
23	82	2069	28841-28854	154-167	12	115
24	83	2070	28855-28868	168-181	13	115
25	84	2071	28869-28882	182-195	14	115
26	85	2072	28883-28896	196-209	15	115
27	86	2073	28897-28910	210-223	16	115
28	87	2074	28911-28924	224-237	17	115
29	88	2075	28925-28938	238-251	18	115
30	89	2076	28939-28952	1- 14	1	116
31	90	2077	28953-28966	15- 28	2	116

APPENDIX C

LANDSAT-1 DOCUMENTS ISSUED THIS REPORT PERIOD

APPENDIX C

LANDSAT-1 DOCUMENTS ISSUED THIS REPORT PERIOD

No.	Document No.	Title and Date
1	PIR-1N25-L-1/2-193	Recommended Tests Regarding Frequency Drifts in Landsat Link 2 and 3, dated 8 November 1976.

LANDSAT–2

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

This is the ninth report in a continuing series of documents issued at launch, and thereafter quarterly, to present flight performance analysis of the Landsat-2 spacecraft. Previously issued documents are:

Document No.	Title	Date
75SDS4214	Landsat-2 Launch and Flight Activation Evaluation Report, 22 to 26 January 1975, Launch through Orbit 50 and Orbit Adjust Operation.	21 March 1975
75SDS4228	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 January 1975 to 23 April 1975.	15 August 1975
75SDS4255	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 April 1975 to 23 July 1975.	10 October 1975
75SDS4266	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 July 1975 to 23 October 1975.	1 December 1975
76SDS4207	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 October 1975 to 23 January 1976.	29 February 1976
76SDS4248	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 January 1976 to 23 April 1976.	14 July 1976
76SDS4263	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 April 1976 to 23 July 1976.	15 October 1976
76SDS4278	Landsat-1 and Landsat-2 Flight Evaluation Report, 23 July 1976 to 23 October 1976	30 November 1976

This report contains analysis of performance for Orbits 8920 to 10,200 for Landsat-2.

SECTION 1

SUMMARY

LANDSAT-2 OPERATIONS

SECTION 1

SUMMARY LANDSAT-2 OPERATIONS

The Landsat-2 spacecraft was launched from the Western Test Range on January 22, 1975, at 022:17:55:51, 604. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions.

All systems continue normal except Forward Scanner Pressure, Forward Scanner Pressure Telemetry, and Wideband Video Tape Recorder No. 1 (WBVTR-1). The Forward Scanner Pressure had begun leaking before launch but will not affect scanner performance. The Forward Scanner Pressure (Function 1003) telemetry became erratic in Orbit 2244 on 2 July 1975.

WBVTR-1 failed to rewind on Orbit 1021, 5 June 1975, and had intermittent operation until Orbit 2238, 2 July 1975, when normal operation was resumed. WBVTR-1 had a new anomaly in Orbit 2683 on August 3, 1975 because of failure of one of the 4 heads. As a result, it cannot be used with MSS data, but will perform satisfactorily with RBV data because RBV provides a synchronizing pulse which permits data from the bad head to be isolated and eliminated. The loss of 25% of the data is obscured by substituting an adjacent line of data maintaining usefulness of the scene for most purposes. Since Orbit 7181 on June 20, 1976, the recorder has been used regularly in this service recording RBV data until failure of a second head in Orbit 10086, 15 January 1977. All operation of WBVTR-1 was discontinued on that date.

WBVTR-2 started rewind but stopped prematurely in Orbit 1919, 9 June 1975, and again in Orbit 3854, 26 October 1975, with the cause unknown. Unit remains operational.

Spacecraft performance has not been degraded by these anomalies except as indicated. Table 1-1 shows cumulative in-orbit payload system performance.

Table 1-1. In-Orbit Payload Systems Performance Launch Thru Orbit 10246 (1/20/77), Landsat-2

RBV	Total Scenes Imaged	2,452
	Avg. Scenes/Day in Operation	8
	Total Area Imaged (million sq. n. mi.)	21.3
	ON TIME (hr.)	23.5
	ON/OFF Cycles	306
	% Real Time Images	70
	% Recorded Images	30
MSS	Total Scenes Imaged	128,066
	Avg. Scenes/Day	160
	Total Area Images (million sq. n. mi.)	1,115.6
	ON TIME (hr.)	1,489.3
	ON/OFF Cycles	10,186
	% Real Time Images	67
	% Recorded Images	33
DCS	Messages at OCC	906,638
	Users	48
	ON TIME (hr.)	17,635
WPA-1	% Real Time Mode	70
	% Playback Mode	30
	ON TIME (hr.)	102
	ON/OFF Cycles	664
WPA-2	% Real Time Mode	67
	% P/B Mode	33
	ON TIME (hr.)	1,242.3
	ON/OFF Cycles	7,175
WBVTR-1	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	Time Head-Tape Contact (hr.)	121.6
	Cycles Head-Tape Contact	1,949
	ON TIME (hr.)	154
WBVTR-2	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	MFSE Count in P/B	10
	Time Head-Tape Contact (hr.)	702.7
	Cycles Head-Tape Contact	8,847
	ON TIME (hr.)	889

SECTION 2

ORBITAL PARAMETERS

LANDSAT-2

SECTION 2

ORBITAL PARAMETERS

During this report period, Landsat-2's ground track has been maintained within 3 nm longitude error at the equator. This was accomplished by controlling the ACS Pitch gates through use of the Pitch Position Bias mode. (See Section 4 also.) Therefore, no orbit maintenance burn of the OAS was required during the current report period.

The error in longitude since launch as a function of time and orbit maintenance burns is shown in Figure 2-1. Figure 2-2 shows the change in sun time at the descending equatorial crossings.

As of 24 January 1977, Landsat-2 has descending equatorial crossings at approximately 9:17 AM local time as opposed to 8:38 AM for Landsat-1. A projection of the variation of local mean time at the descending modes for both spacecrafts is given in Figure 2-3.

The difference in orbital periods between Landsat-1 and Landsat-2 caused a drift in the angular phasing between the two satellites with Landsat-1 converging on Landsat-2. Landsat-1's orbit was adjusted between 20 October 1976 and 28 January 1977 in order to increase the time (angular) separation between the Landsat spacecrafts. At the conclusion of the Landsat-1's orbit adjust program on 28 January 1977, the GMT time difference (not local time difference) separating Landsat-2 from Landsat-1 at their descending nodes was 29.73 minutes. Figure 2-4 shows an approximation of this phasing pattern.

The Brouwer Mean Orbital Parameters for Landsat-2 are given in Table 2-1. Appendix B gives ground trace repeat cycle predictions.

Table 2-1. Landsat-2 Brouwer Mean Orbital Parameters

Element / Date	Apogee (KM)	Perigee (KM)	Inclination (Deg)	Semi-Major Axis (KM)	Eccentricity	Two Body Period (Min)	Nodal Period (Min)	Argument of Perigee (Deg)	Right Ascension (Deg)	Mean Anomaly (Deg)
25 Jan 1975[1]	915.03	901.56	99 095	7286.462	0.000925	103 165	-	272.852	86.637	139 578
6 Feb 1975[2]	916.84	898.47	99.096	7285.820	0.001260	103.151	-	256.040	99.347	134.523
24 Apr 1975	917.85	897.40	99.079	7285.738	0.001403	103.151	103 266	62 55	174 339	117.183
25 July 1975	917 45	897.68	99 071	7285 733	0 001356	103.150	103.265	166 118	264 891	13 726
23 Oct 1975	916.70	898 49	99 059	7285.752	0.001250	103 150	103.266	282 749	353.366	257.271
24 Jan 1976	917.36	897.81	99.046	7285.754	0.001342	103.150	103.266	31.621	84.584	148.179
23 Apr 1976	917.67	897:44	99.029	7285.721	0.001389	103.149	103.265	139.745	172.774	40.033
22 July 76	916.62	898.40	99.021	7286.677	0.001251	103.148	103.264	253.964	260.924	286.054
22 Oct. 76	916.95	898 09	99.009	7285.683	0.001251	103.148	103.264	6.744	350.795	173.119
22 Jan. 77	917.59	897.47	98.993	7285.693	0.001381	103.149	103.265	111.579	80.587	68.155

1 Post launch

2 After the sequence of phasing maneuvers completed in Orbit 212

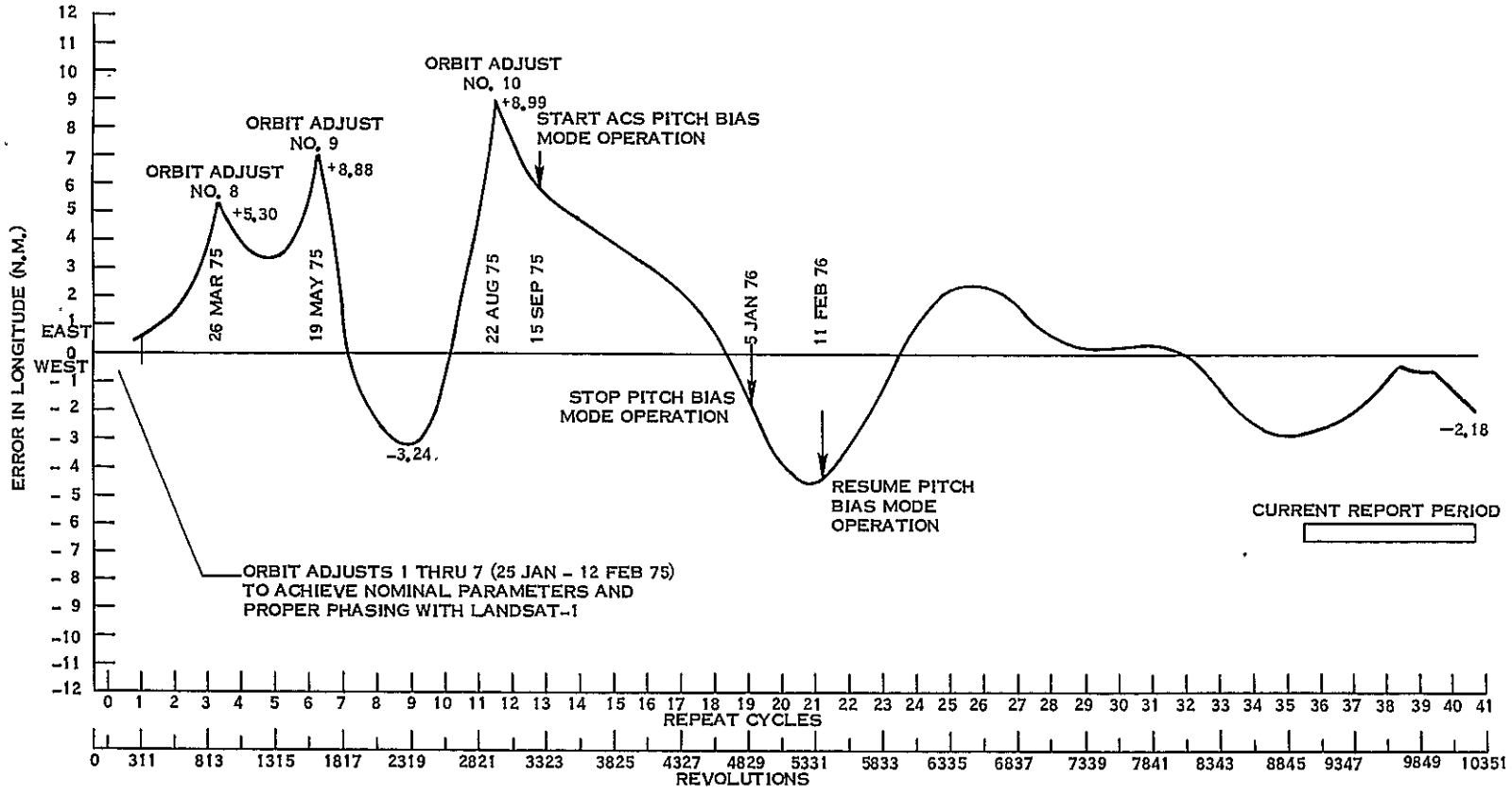

Figure 2-1. Effect of Orbit Adjusts and Pitch Position Bias Orbit Maintenance on Landsat-2's Ground Track

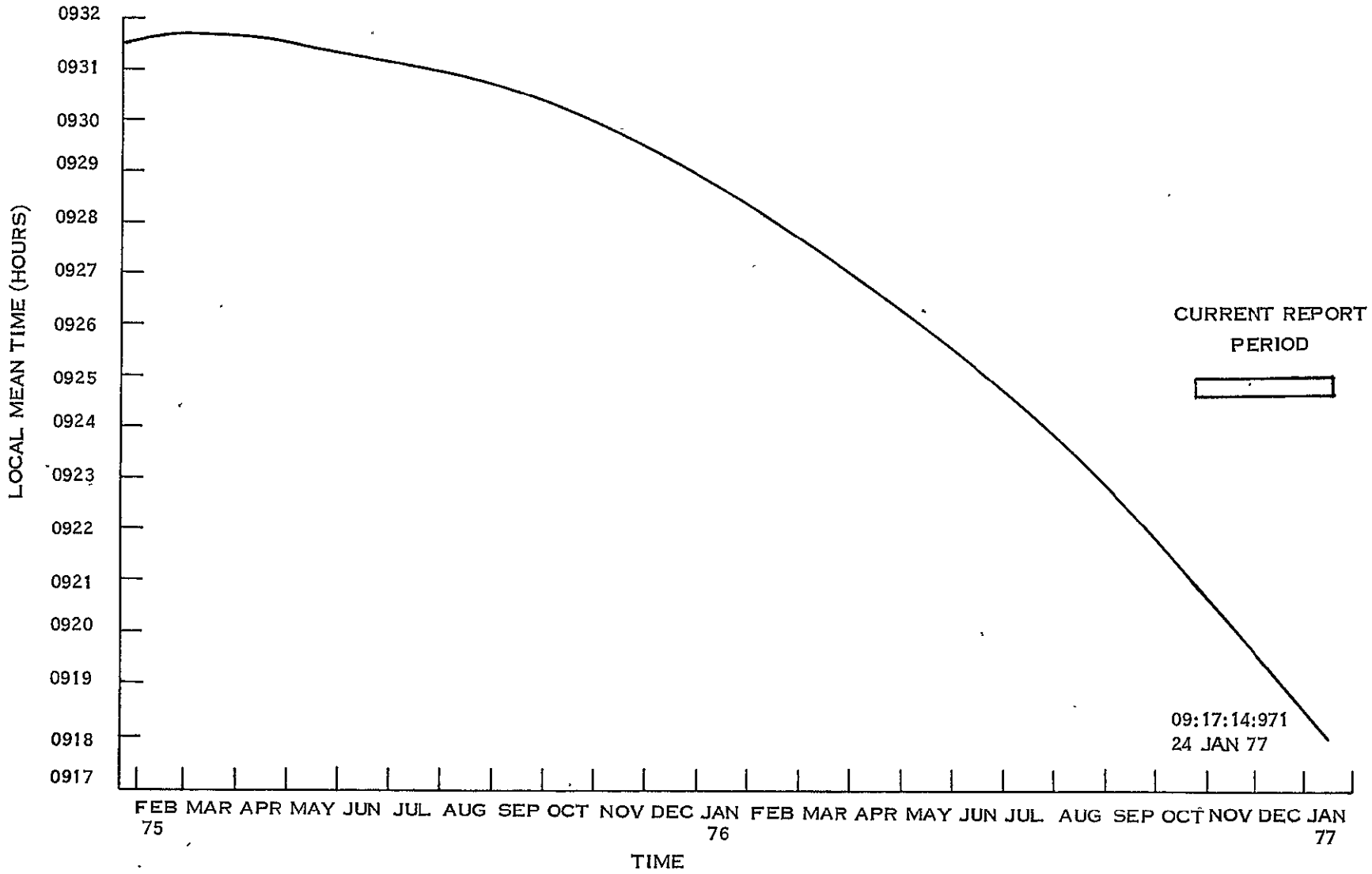

Figure 2-2. Local Mean Time of Descending Node - Landsat-2

FOLDOUT FRAME 2

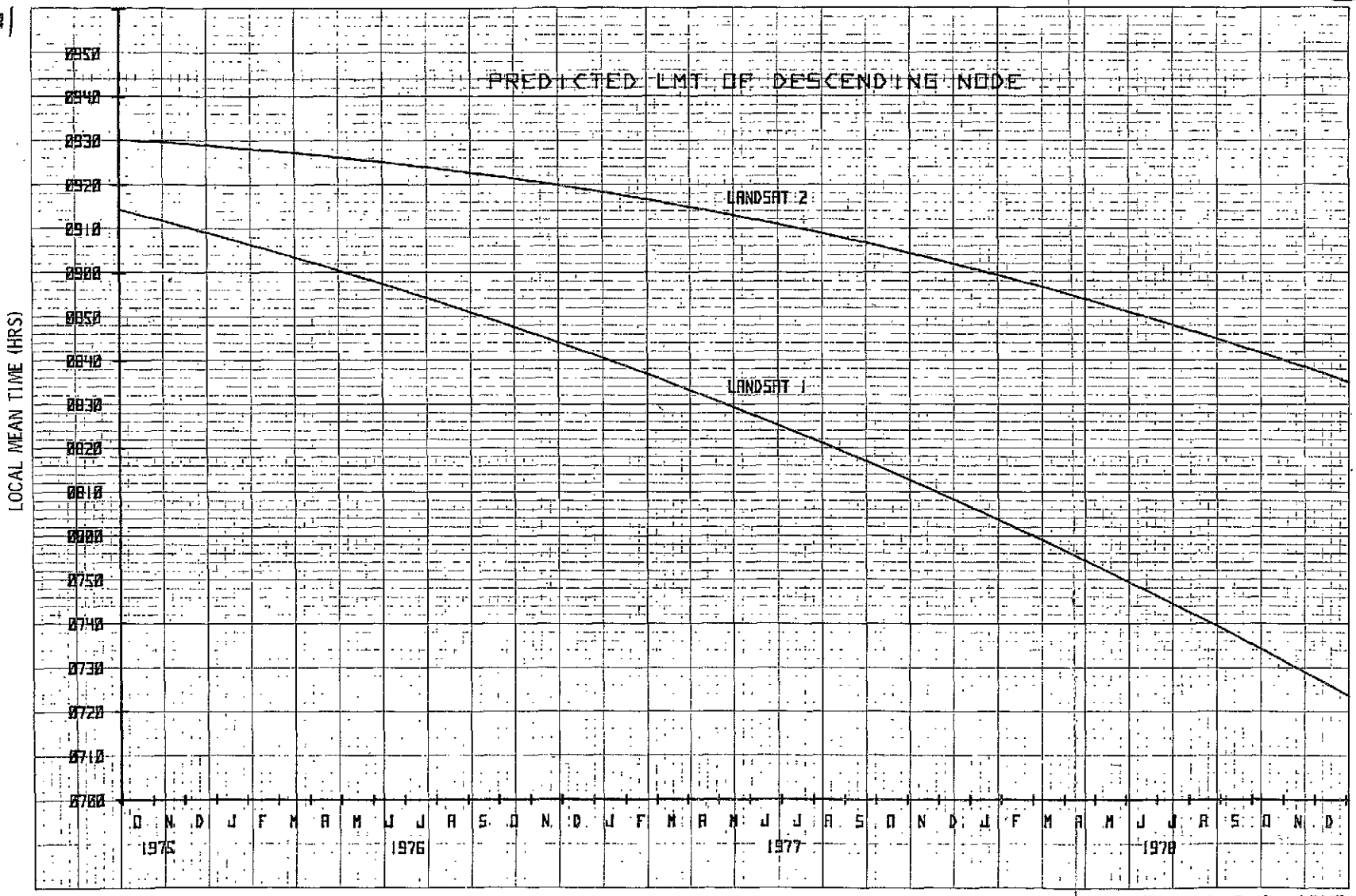

Figure 2-3. Predicted LMT of Descending Node

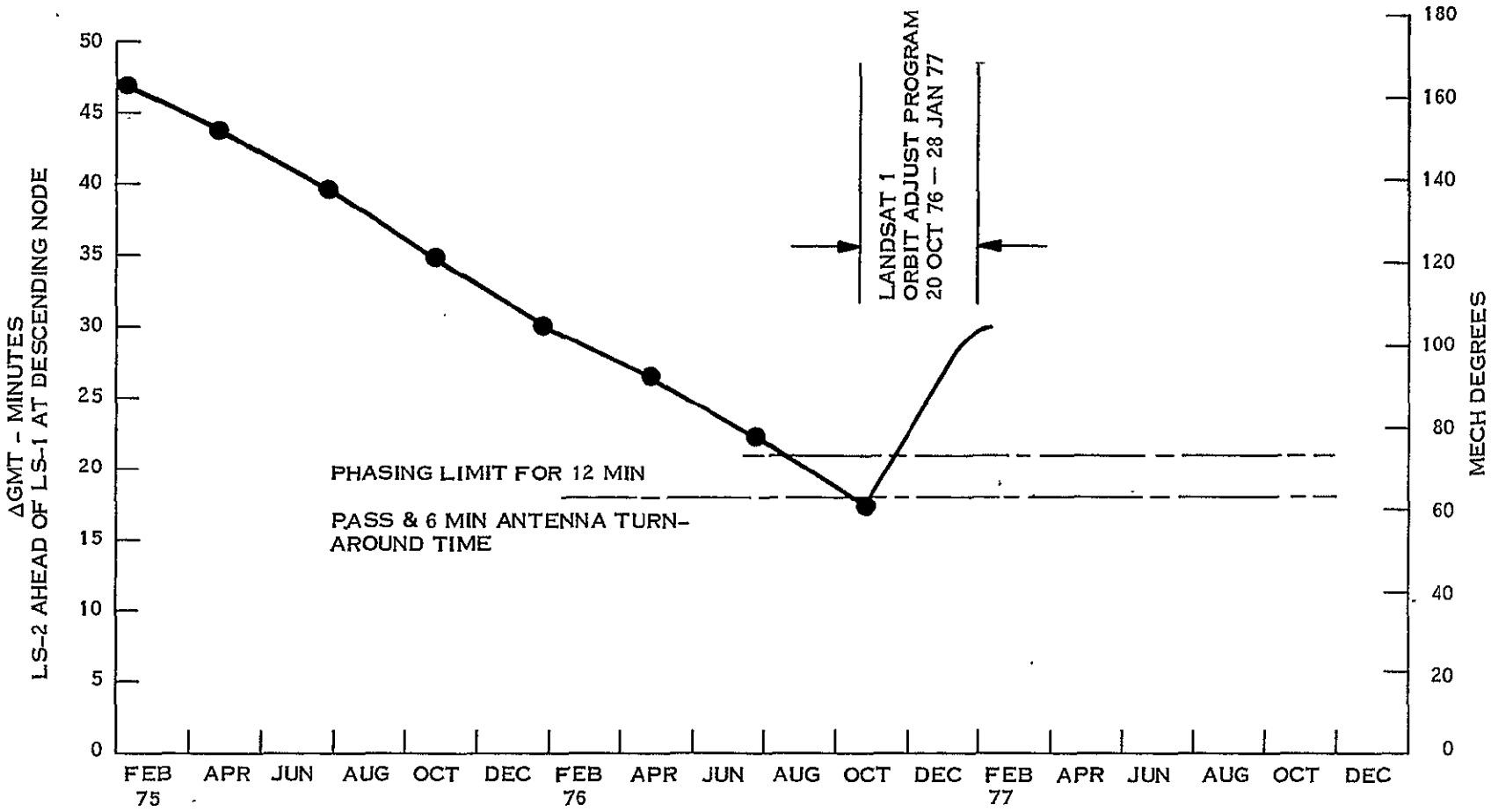

Figure 2-4. Drift in the Angular Phasing Between Landsat-1 and Landsat-2

SECTION 3
POWER SUBSYSTEM (PWR)
LANDSAT-2

SECTION 3

POWER SUBSYSTEM (PWR)

The Power Subsystem on Landsat-2 has performed satisfactorily throughout this report period.

The solar arrays continued to provide excess energy above spacecraft and payload requirements and are expected to support the Landsat-2 mission through 1977. The percentage degradation of the arrays is plotted as a function of days in orbit in Figure 3-1, along with the pre-launch predicted array degradation. The array degradation at the end of twenty-four months in Orbit is 15.8%, which is higher than predicted. The projected values of midday array current are plotted in Figure 3-2. Here the array current is adjusted for sun intensity and array degradation, as well as sun angle. Along with the same curve is plotted the actual telemetry values observed until the end of the current report period.

The battery packs on-line averaged 10 to 11% depth of discharge (DOD) during this report period. Battery 6 charge and discharge characteristics became unstable a second time and it was turned off in Orbit 8591 (29 September 1976) for a restoration cycle and was returned to normal operation in Orbit 9164 (9 November 1976). Battery 6 charge and discharge characteristics became unstable a third time and it was turned off in Orbit 9652 (14 December 1976) for a restoration cycle and was returned to normal operation in Orbit 10028 (10 January 1977). All other battery pack performance remained satisfactory. Battery voltages have been maintained within suitable limits with Landsat-2 power management procedure, excess array energy being dissipated through auxiliary loads. Temperatures between batteries ranged from 16.8 to 30.4^{o}C during this report period.

The power subsystem electronics have performed well during this report period with all regulated voltages stable. Table 3-1 shows major subsystem parameters and Table 3-2 shows power subsystem telemetry for selected orbits. Some parameters in Table 3-1 may be slightly different from those in Table 3-2 because Table 3-1 uses a power management time span (night followed by day), whereas the time span used in Table 3-2 is the playback period from the NBR.

The shunt limiter on Landsat-2 has operated several times since launch and has held the solar array bus voltage at specified levels.

Figure 3-3 shows the actual variation in sun angle to orbit plane and solar panels for Landsat-2. Figure 3-4 is a prediction of the variations of the sun angle through 1977 for Landsat-1 and 2.

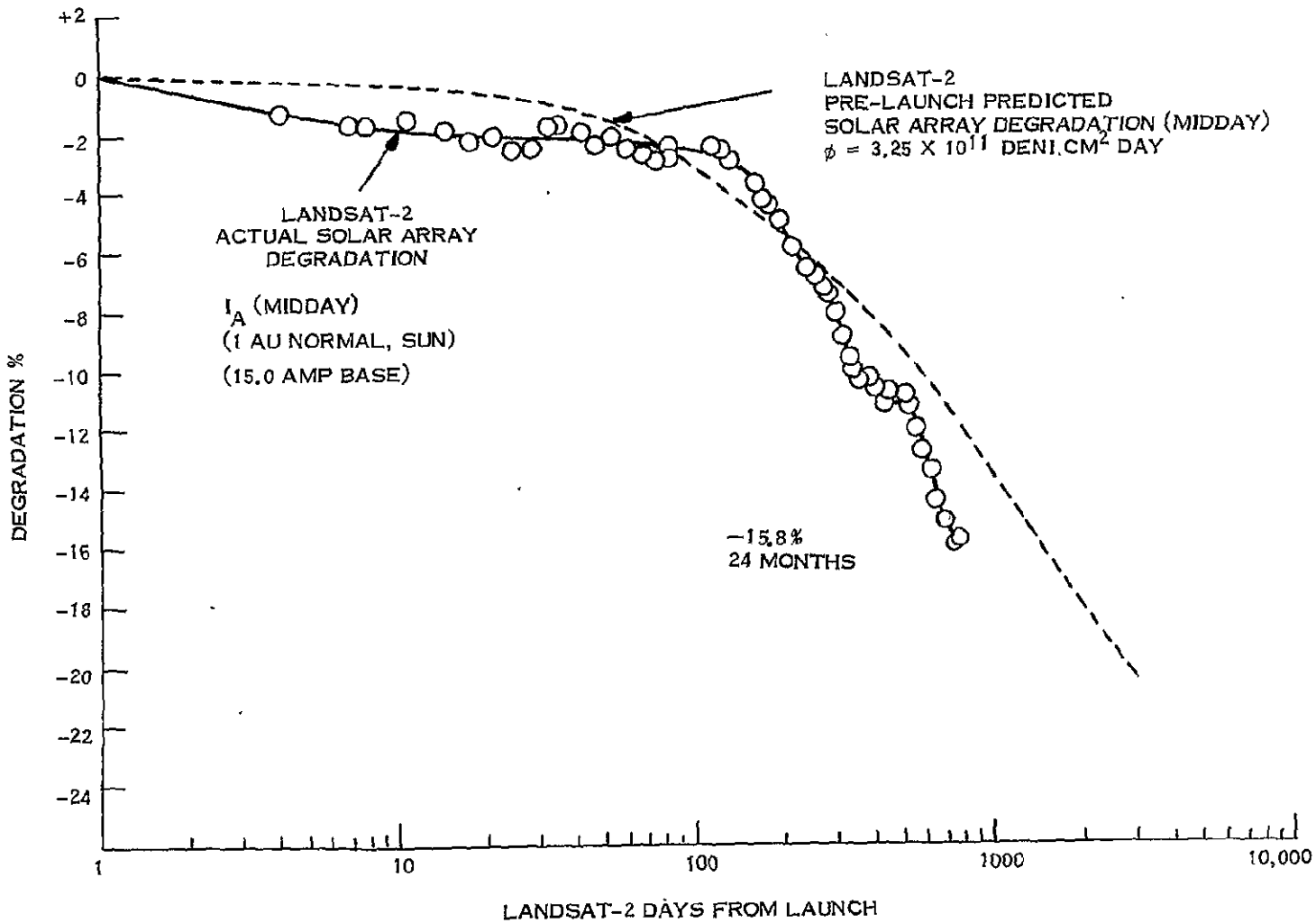

Figure 3-1. Landsat-2 I_A (Midday) Degradation vs. Days

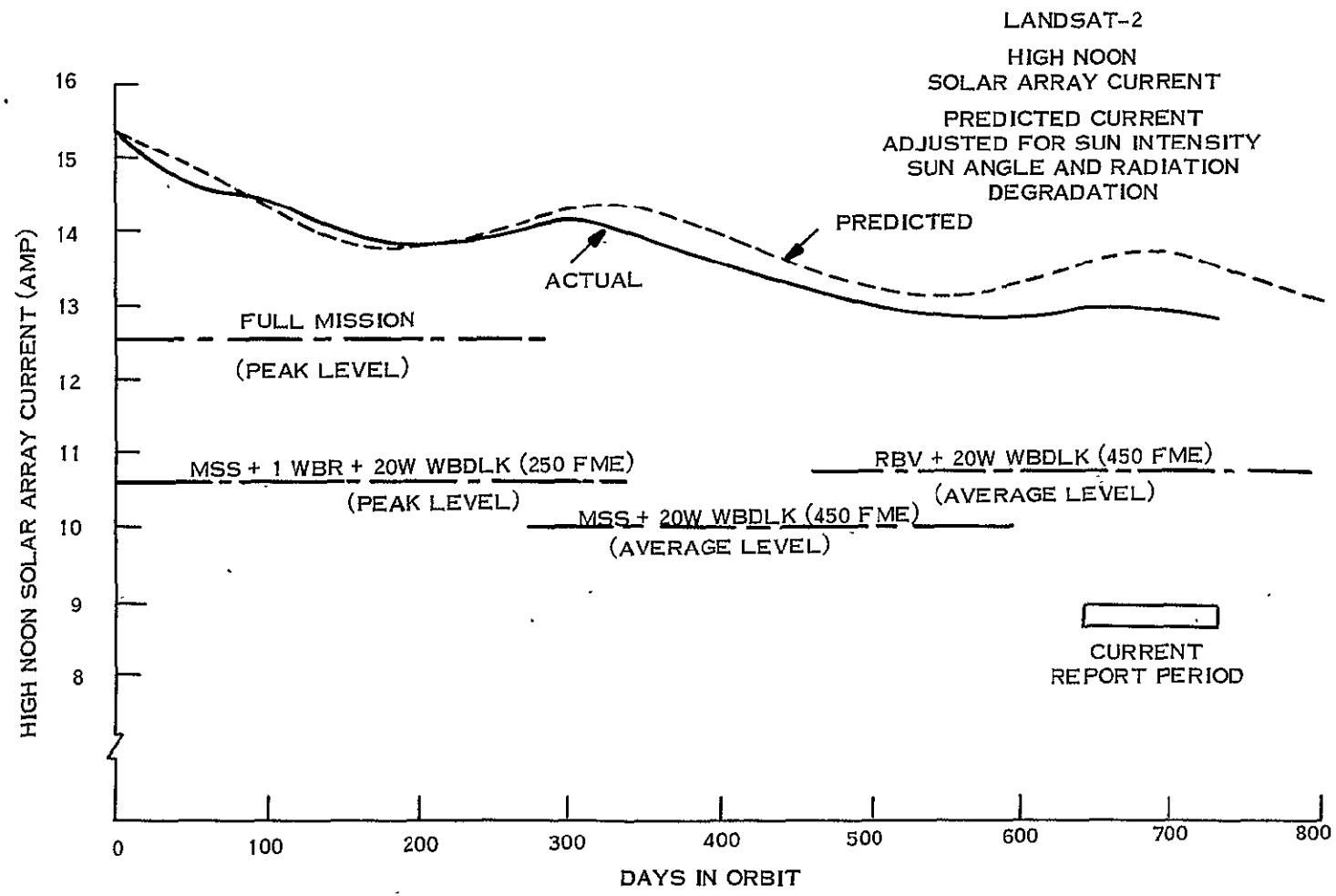

Figure 3-2. Landsat-2 Midday Solar Array Current

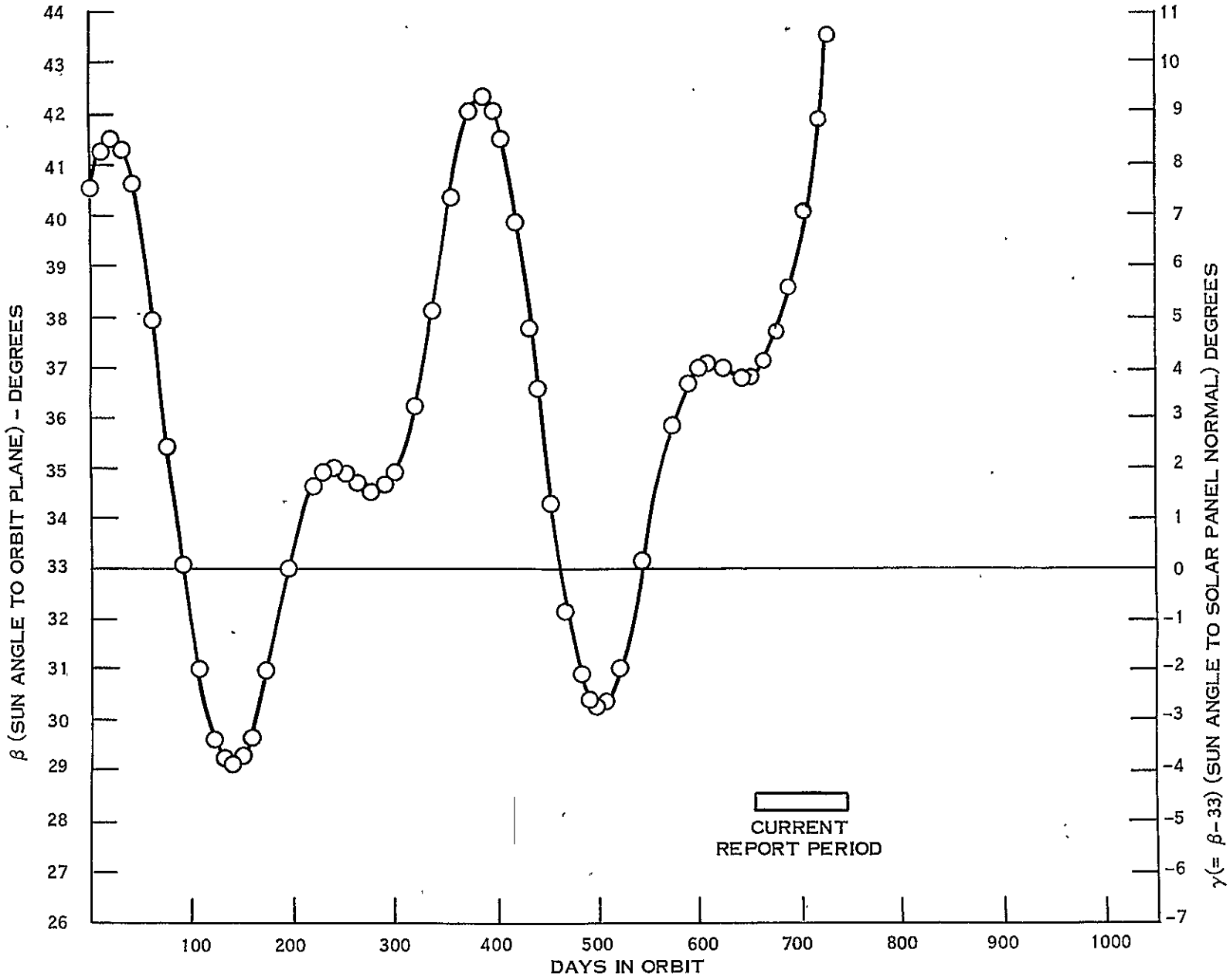

Figure 3-3. Landsat-2 Actual β and α (Paddle) Sun Angles

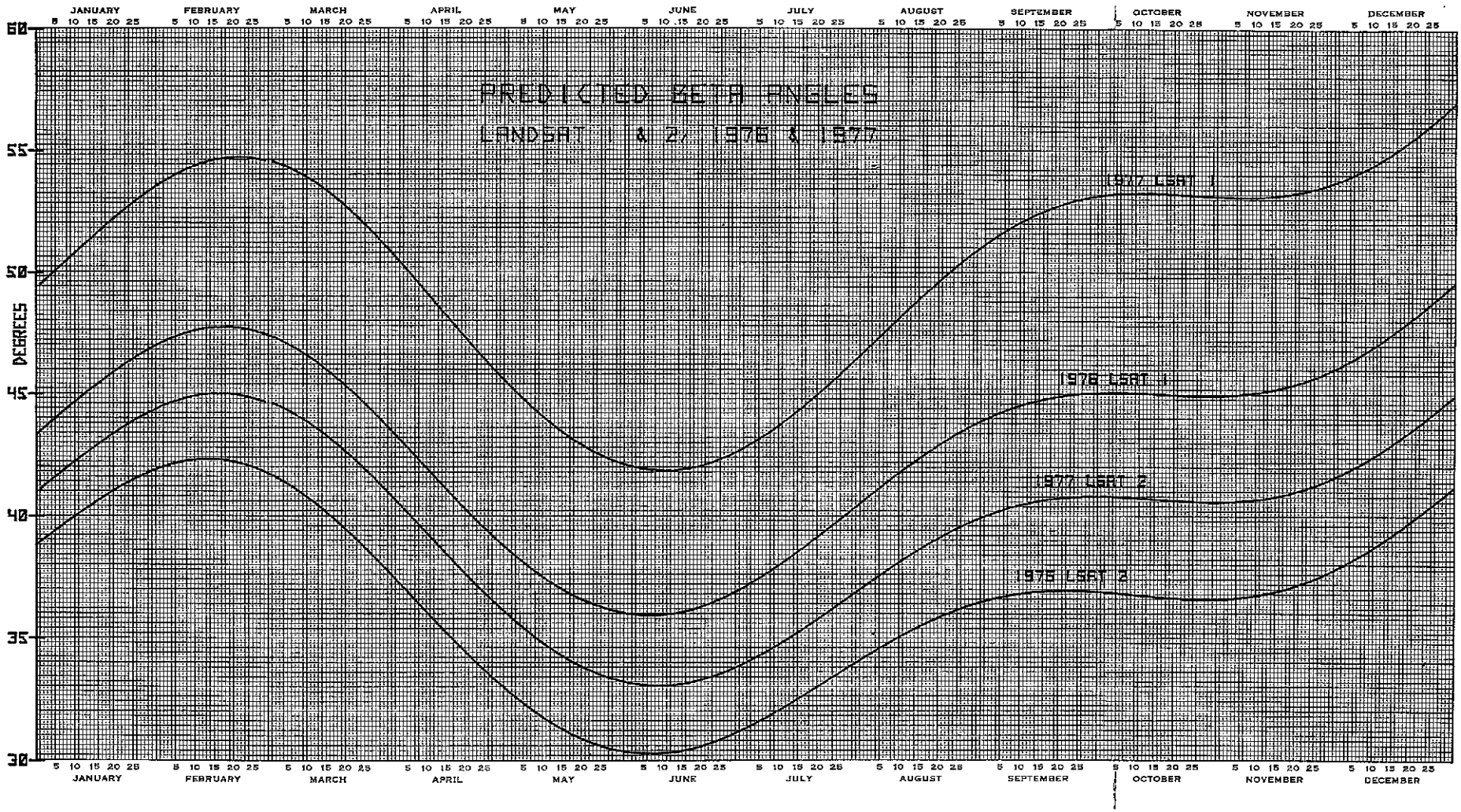

Figure 3-4. Predicted Beta Angles for Landsat-1 and Landsat-2 - 1976 and 1977

Table 3-1. Landsat-2 Major Power Subsystem Parameters

Pwr. Mgmt. Orbit No.	50	2540	5100	7640	9352	9791	10192
Batt 1 Max	33.43	33.25	32.66	33.08	32.66	32.91	32.57
2 Chge	33.40	33.14	32.63	33.05	32.63	32.89	32.54
3 Volts	33.35	33.09	32.57	33.09	32.66	32.92	32.57
4	33.45	33.20	32.68	33.20	32.68	32.94	32.59
5	33.42	33.25	32.65	33.08	32.65	32.91	32.56
6	33.41	33.24	32.64	28.79	32.64	**	32.56
7	33.45	33.28	32.68	33.11	32.68	32.93	32.59
8	33.45	33.27	32.68	33.10	32.68	32.93	32.59
Average	33.42	33.21	32.65	33.10	32.66	32.92	32.57
Batt 1 End-of-Night	29.32	29.06	29.06	29.06	28.89	28.89	28.98
2 Volts	29.38	29.12	29.04	29.12	28.87	28.87	28.95
3	29.32	29.07	29.07	29.07	28.89	28.89	28.89
4	29.34	29.09	29.09	29.09	28.91	28.83	28.91
5	29.40	29.06	29.06	29.06	28.89	28.80	28.97
6	29.31	28.96	28.96	28.71	28.88	**	28.88
7	29.34	29.08	29.08	29.00	28.91	28.91	29.00
8	29.34	29.00	29.00	29.00	28.91	28.82	28.91
Average	29.34	29.05	29.04	29.06	28.89	28.86	28.94
Batt 1 Chge	12.76	12.13	12.43	15.51	13.75	16.59	13.74
2 Share	11.68	12.45	11.42	13.54	11.81	13.08	11.44
3 (%)	12.24	13.67	12.48	14.13	12.46	13.54	12.41
4	11.99	12.50	11.76	13.97	12.28	13.55	11.81
5	12.84	11.52	13.24	14.32	12.32	14.87	12.95
6	13.35	13.20	14.32	**	13.91	**	15.14
7	12.90	12.81	12.97	14.30	12.20	14.68	11.74
8	12.24	11.72	11.38	13.14	11.27	12.82	10.77
Batt 1 Load	12.60	11.35	11.80	12.84	11.83	13.37	11.16
2 Share	12.70	13.99	13.34	15.60	13.33	15.65	14.14
3 (%)	12.67	14.38	13.74	15.41	13.66	15.96	13.94
4	12.44	12.99	12.48	14.71	12.87	15.16	13.00
5	12.34	11.58	12.36	13.69	11.16	13.09	9.96
6	12.70	11.30	11.56	**	14.28	**	15.27
7	12.47	12.35	12.70	14.03	11.54	13.43	11.33
8	12.04	12.06	12.02	13.72	11.33	13.34	11.21
Batt 1 Temp	21.46	21.34	21.94	21.47	21.86	22.73	22.71
2 m	20.25	21.44	19.94	19.90	20.49	20.27	20.30
3 (°C)	18.60	19.18	17.86	17.79	17.93	17.25	17.52
4	20.83	20.91	20.36	20.37	21.04	20.17	20.36
5	24.98	22.31	27.27	22.64	24.47	26.46	30.49
6	24.26	23.01	27.28	20.49	23.33	23.62	27.69
7	24.71	23.62	26.32	22.90	24.47	25.75	27.01
8	23.63	22.71	24.41	22.40	23.24	23.93	24.55
Average	22.34	21.81	23.17	21.00	22.11	22.52	23.83
S/C Reg Bus Pwr. (W)	*	185.0	149.3	146.12	166.05	134.56	154.49
Comp Load Pwr. (W)	*	41.2	24.8	17.64	16.42	6.64	6.64
P/L Reg Bus Pwr. (W)	*	9.6	9.8	11.81	12.55	9.59	9.59
C/D Ratio	1.15	1.10	1.11	1.15	1.12	1.33	1.24
Total Charge (A-M)	271.9	267.55	223.46	239.11	247.89	240.34	223.51
Total Discharge (A-M)	237.2	244.33	201.45	207.47	221.30	180.40	180.84
Solar Array (A-M)	1106	981	1003	892	944	939	939
S.A. Peak I (Amp)	16.05	14.67	14.43	13.41	13.88	13.65	13.25
Midday Array I (Amp)	*	13.88	13.72	12.78	13.02	12.96	12.86
Sun Angle (Deg)	*	-1.22	8.35	0.3	4.3	7.2	10.7
Max R Pad Temp (°C)	*	59.60	63.20	58.40	60.80	62.00	58.40
Min R Pad Temp (°C)	*	-38.00	-35.00	-38.00	-35.00	-34.40	-34.40
Max L Pad Temp (°C)	*	56.92	62.15	56.92	62.15	63.23	62.15
Min L Pad Temp (°C)	*	-45.00	-42.14	-45.71	-42.14	-41.43	-39.43

* Data not processed and unavailable

**Bat 6 was turned off for a restoration cycle

+Average of batteries on line

Table 3-2. Landsat-2 Power Subsystem Analog Telemetry
(Average Value for Data Received in NBTR Playback)

Function	Description	Unit	Orbits						
			50	2532	5102	7641	9350	9791	10192
6001	Batt 1 Disc I	Amp	1.01	0.85	0.74	0.85	0.74	0.82	0.52
6002	2		1.01	0.97	0.84	1.02	0.68	0.96	0.65
6003	3		1.00	0.99	0.87	1.01	0.79	0.98	0.64
6004	4		1.00	0.93	0.78	0.97	0.79	0.93	0.60
6005	5		0.99	0.85	0.78	0.91	0.68	0.81	0.47
6006*	6		1.02	0.86	0.73	*	0.76	*	0.70
6007	7		1.00	0.91	0.80	0.92	0.65	0.82	0.52
6008	8		0.97	0.87	0.75	0.90	0.67	0.82	0.52
6011	Batt 1 Chg I	Amp	0.47	0.57	0.42	0.52	0.54	0.57	0.46
6012	2		0.43	0.57	0.38	0.46	0.49	0.46	0.37
6013	3		0.45	0.61	0.42	0.48	0.50	0.48	0.40
6014	4		0.44	0.57	0.39	0.47	0.50	0.47	0.39
6015	5		0.47	0.54	0.44	0.48	0.50	0.51	0.45
6016*	6		0.49	0.60	0.47	*	0.56	*	0.49
6017	7		0.47	0.60	0.43	0.48	0.48	0.51	0.40
6018	8		0.45	0.55	0.38	0.44	0.45	0.45	0.36
6021	Batt 1 Volt	VDC	31.50	30.92	31.11	31.42	30.95	31.24	30.79
6022	2		31.48	30.90	31.09	31.41	30.95	31.24	30.80
6023	3		31.49	30.91	31.10	31.43	30.96	31.25	30.81
6024	4		31.49	30.91	31.10	31.43	30.96	31.25	30.81
6025	5		31.50	30.92	31.11	31.43	30.96	31.25	30.79
6026*	6		31.49	30.90	31.08	28.69	30.96	28.42	30.80
6027	7		31.52	30.94	31.14	31.46	30.99	31.27	30.83
6028	8		31.49	30.92	31.11	31.43	30.96	31.25	30.81
6031	Batt 1 Temp	DGC	21.59	20.93	21.91	21.45	21.78	22.85	22.67
6032	2		20.53	20.75	19.90	19.86	20.45	20.34	20.36
6033	3		18.80	18.66	17.77	17.43	17.71	17.26	17.54
6034	4		20.90	20.88	20.33	20.34	21.00	20.13	20.43
6035	5		25.16	22.22	27.18	22.62	24.41	26.47	30.52
6036	6		24.37	22.55	27.19	20.42	23.30	23.77	27.67
6037	7		24.83	23.26	26.19	22.89	24.42	25.88	26.95
6038	8		23.75	22.52	24.36	22.36	23.19	24.05	24.49
6040	Rt. Pad Temp	DGC	28.96	26.16	30.90	25.34	29.06	31.49	26.11
6041	Rt. Pad VM	VDC	33.72	33.56	32.86	34.00	32.94	32.85	31.44
6042	Rt. Pad VN	VDC	33.46	33.18	32.44	33.45	32.27	33.24	31.27
6044	Lt. Pad Temp	DGC	25.56	21.16	28.22	22.53	27.54	30.16	26.41
6045	Lt. Pad VF	VDC	34.40	33.80	33.82	34.39	33.69	34.25	33.36
6046	Lt. Pad VG	VDC	34.48	33.91	33.91	34.48	33.79	34.32	33.45
6050	S/C UR Bus V	VDC	31.73	31.14	31.33	31.69	31.16	31.48	30.93
6051	S/C RG Bus V	VDC	24.57	24.57	24.58	24.58	24.58	24.58	24.57
6052	Aux Reg AV	VDC	23.36	23.40	23.44	23.43	23.44	23.44	23.44
6053	Aux Reg BV	VDC	23.37	23.39	23.44	23.44	23.44	23.44	23.43
6054	Solar I	Amp	14.81	13.76	13.40	12.37	12.85	12.59	12.25
6056	S/C RG Bus I	Amp	7.23	7.17	6.28	5.98	6.69	5.38	6.41
6058	PC Mod T1	DGC	21.67	21.98	20.77	20.49	21.53	19.78	20.08
6059	PC Mod T2	DGC	20.44	20.53	19.56	19.39	19.67	18.82	19.16
6070	P/L RG Bus V	VDC	24.61	24.60	24.60	24.62	24.60	24.61	24.59
6071	P/L UR Bus V	VDC	31.85	31.21	31.40	31.79	31.23	31.57	30.97
6073	P Aux AV	VDC	23.47	23.51	23.51	23.50	23.50	23.50	23.50
6074	P Aux BV	VDC	23.46	23.51	23.51	23.50	23.50	23.50	23.50
6075	PR Mod T1	DGC	20.84	21.39	20.32	20.21	20.93	20.48	20.82
6076	PR Mod T2	DGC	22.13	22.38	21.79	21.72	22.19	21.91	22.14
6079	Fuse Blow V	VDC	24.48	24.48	24.49	24.51	24.49	24.49	24.48
6080	Shunt 1 I	Amp	0.0	0.0	0.00	0.0	0.00	0.00	0.00
6081	2		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6082	3		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6083	4		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6084	5		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6085	6		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6086	7		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6087	8		0.0	0.0	0.00	0.0	0.00	0.00	0.00
6100	P/L RG Bus I	Amp	0.38	0.80	0.54	0.43	0.40	0.39	0.40
Total No.	Major Frames	Frm	396	387	785	788	383	655	697

*Battery 6 was turned off for a restoration cycle.

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)
LANDSAT-2

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)

Landsat-2's Attitude Control System performed normally since launch and has consistently maintained correct spacecraft attitude.

Low pressure in the Forward Scanner resulting from a pre-launch leak has had no effect on the ACS System's performance.

The program implemented in September 1975 to minimize spacecraft ground track drift by controlling Pitch gating was continued during this quarter. Table 4-1 summarizes the Pitch Position Bias mode sequences implemented this quarter as part of this program, and Figure 2-1 in Section 2 shows the effects of Pitch gating control on the spacecraft's orbital ground track drift.

Table 4-1. Landsat-2 Pitch Position Bias Quarterly Pneumatic Gating Summary

Period		PPB Implementation Sequence Orbit Number			Duration Centered About Satellite Midnight (minutes)	Resulting Average Number of Pitch Gates Per Day
From Orbit	To Orbit	N_0	$N_0 + 1$	$N_0 + 2$		
8941 24 Oct 76	9173 10 Nov 76	+ 2.0	+ 2.0	+ 2.0	40	1 to 2 (+P)
9174 10 Nov 76	9455 30 Nov 76	+ 2.0	+ 2.0	+2.0	45	0 to 1 (-P)
9456 30 Nov 76	9578 9 Dec 76	+ 2.0	+ 2.0	+ 2.0	50	2 to 3 (-P)
9579 9 Dec 76	9859 29 Dec 76	+ 2.9	+ 2.9	+ 2.9	46	7 to 9 (-P)
9860 29 Dec 76	9972 6 Jan 77	+ 2.9	+ 2.9	+ 2.9	39	4 (-P)
9973 6 Jan 77	10059 13 Jan 77	+ 2.9	+ 2.9	+ 2.9	37	4 (-P)
10060 13 Jan 77	10108 16 Jan 77	+ 2.0	+ 2.0	+ 2.0	44	1 (-P)
10109 16 Jan 77	10126 17 Jan 77	+ 2.0	+ 2.0	+ 2.0	42	1 (-P)
10127 17 Jan 77	10264 27 Jan 77	+ 2.0	+ 2.0	+ 2.0	38	0

As a result of the ground track drift maintenance program, Freon Usable Impulse declined at a lower rate as shown in Figures 4-1 and 4-2.

RMP2 commanded into operation shortly after ACS acquisition as the primary control of the Yaw subsystem has functioned normally.

Both Solar Array Drives (SAD) performed normally and maintained proper solar panel alignment with the sun line during satellite day. Motor voltages and temperatures are within specifications.

Typically, flywheel duty cycles have averaged seven percent or less. Pitch and Yaw flywheel speeds have averaged less than -150 RPM while the Roll Flywheels have averaged +760 RPM. Sun transient response due to dual scanner mode operation has been normal.

Tables 4-2, 4-3, and 4-4 show typical telemetry for temperatures and pressures; voltages and currents, and attitude errors and driver duty cycles as obtained from SCEST program averages.

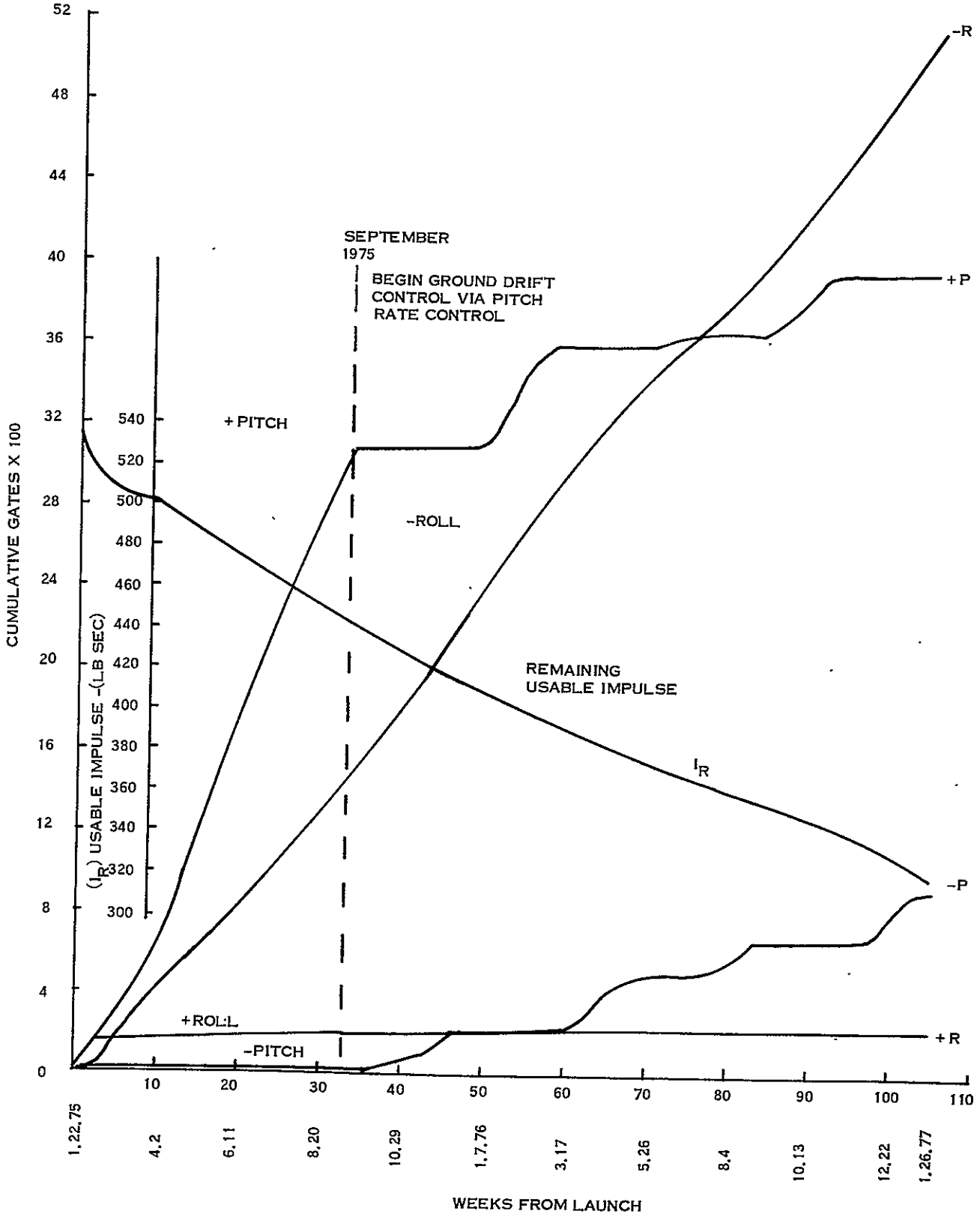

Figure 4-1. Landsat-2 Gating History

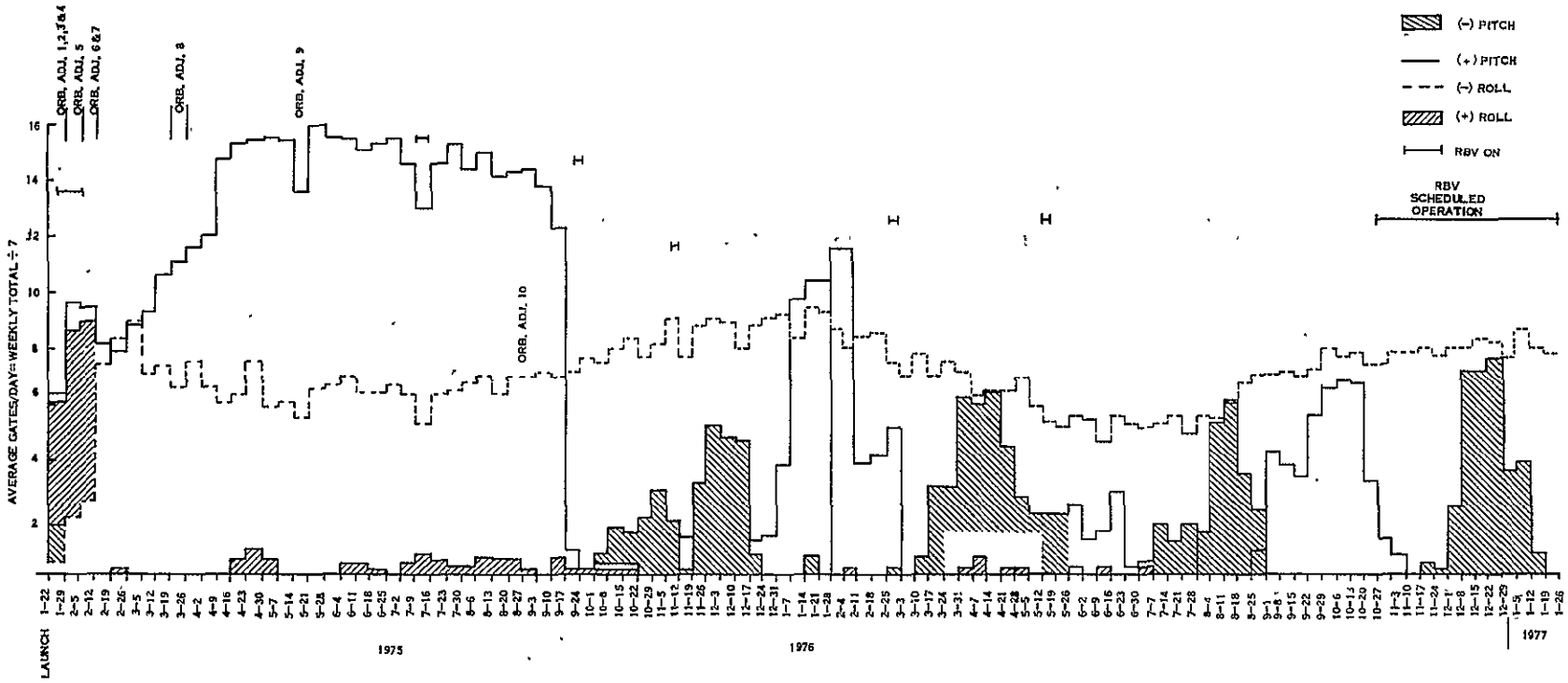

Figure 4-2. Landsat-2 Gating Frequency vs Time

Table 4-2. Landsat-2 Subsystem Temperature and Pressure Averages

Function	Units	Orbits						
		29	2532	5102	7641	9350	9791	10191
1084 RMP 1 Gyro Temperature	DGC	19.33(1)	21.02	22.69	22.45	24.45	24.39	22.70
1094 RMP 2 Gyro Temperature	DGC	74.00	74.00	74.26	74.45	74.51	74.52	74.50
1222 SAD RT MTR HSNG Temp.	DGC	19.50	22.23	22.98	23.62	25.27	24.90	22.73
1242 SAD LT MTR HSNG Temp.	DGC	26.87	27.54	29.79	28.94	31.23	31.38	30.26
1223 SAD RT MTR WNDNG Temp.	DGC	21.76	24.23	24.36	25.23	26.67	26.02	23.72
1243 SAD LT MTR WNDNG Temp.	DGC	30.23	30.32	32.83	31.68	34.28	34.31	33.15
1228 SAD RT HSG Pressure	PSI	7.26	7.25	7.18	7.13	7.11	7.10	7.00
1248 SAD LT HSG Pressure	PSI	7.28	7.27	7.21	7.02	6.97	6.96	6.91
1007 FWD Scanner MTR Temp.	DGC	22.07	22.25	23.80	23.39	25.69	25.64	23.97
1016 Rear Scanner MTR Temp.	DGC	24.19	23.62	25.04	24.59	26.34	26.34	24.83
1003 FWD Scanner Pressure	PSI	9.59(2)	D	D	D	D	D	D
1012 Rear Scanner Pressure	PSI	6.21	6.00	5.62	5.35	5.19	5.18	5.11
1212 Gas Tank Pressure	PSI	1948.0	1672.12	1517.04	1381.12	1321.24	1290.88	1256.98
1210 Gas Tank Temperature	DGC	20.66	22.33	24.25	23.75	25.99	26.00	24.43
1213 Manifold Pressure	PSI	53.98	54.83	54.56	54.78	55.08	55.02	55.26
1211 Manifold Temperature	DGC	19.18	20.50	22.59	21.91	24.29	24.37	22.78
1059 CLG Power Supply Card Temp	DGC	39.00	39.52	41.47	40.71	42.63	42.80	41.81
1260 TH01 EBP	DGC	24.29	25.01	27.21	26.43	28.58	28.82	27.58
1261 TH02 EBP	DGC	20.29	21.36	23.25	22.79	24.90	25.02	23.48
1262 TH03 EBP	DGC	18.29	20.05	21.46	21.34	23.18	23.19	21.29
1263 TH01 STS	DGC	6.54	-6.22	0.52	-2.62	0.22	2.98	-1.66
1264 TH02 STS	DGC	D	D	D	D	D	D	D
1265 TH03 STS	DGC	8.46	-.48	8.67	5.75	10.33	10.48	11.66
1266 TH04 STS	DGC	-2.78	-9.65	-3.26	-3.63	0.32	-1.26	-0.08
1267 TH05 STS	DGC	9.62	-2.64	5.57	2.20	5.47	7.68	4.24
1224 SAD R FSST	DGC	35.00	36.57	35.81	40.86	43.58	42.83	34.24
1244 SAD L FSST	DGC	50.00	46.29	49.13	51.71	56.03	57.32	55.24

(1) RMP-1 Left off after initial test in Orbit 1
(2) Prelaunch leak - refer to text
D = Defective telemetry point

Table 4-3. Landsat-2 ACS Voltages and Currents

Function	Units	Orbit						
		29	2532	5102	7641	9350	9791	10191
1081 RMP 1 MTR Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1082 RMP 1 MTR Current	Amps	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1080 RMP 1 Supply Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1091 RMP 2 MTR Volts	VDC	29.99	29.94	29.92	29.87	29.87	29.87	29.87
1092 RMP 2 MTR Current	Amps	0.10	0.10	0.10	0.11	0.11	0.11	0.10
1090 RMP 2 Supply Volts	VDC	-23.63	-23.61	-23.59	-23.59	-23.57	-23.57	-23.58
1220 SAD RT MTR WNDNG Volts	VDC	- 5.47	- 4.51	- 4.47	- 4.22	- 4.04	- 4.17	- 4.09
1240 SAD LT MTR WNDNG Volts	VDC	- 5.08	- 4.70	- 4.72	- 4.54	- 4.67	- 4.67	- 4.57
1227 SAD RT -15 VDC Conv	VDC	15.14	15.15	15.16	15.13	15.13	15.11	15.15
1247 SAD LT -15 VDC Conv	VDC	15.23	15.22	15.21	15.20	15.22	15.20	15.22
1056 CLB $\pm$ 6 VDC	TMV	2.35	2.35	2.38	2.38	2.39	2.38	2.40
1055 CLB $\pm$ 10 VDC	TMV	2.88	2.90	2.92	2.93	2.94	2.94	2.94
1057 CLB Power Supply Volts	TMV	2.97	2.94	2.96	2.96	2.97	2.97	2.97

Table 4-4. Landsat-2 ACS Attitude Errors and Driver Duty Cycles

Function	Units	Orbit						
		26	2532	5102	7641	9350	9791	10191
1041 Pitch Fine Error	DEG	- 0.15	- 0.14	- 0.13	- 1.48	- 1.11*	- 1.75*	- 0.82
1043 Pitch Flywheel Speed	RPM	-156.12	-198.41	-162.97	214.14	111.44	179.04	3.39
1038 Pitch Mtr Drvr CCW	PCT	6.64	7.35	6.05	4.24	4.51	4.01	4.33
1039 Pitch Mtr Drvr CW	PCT	2.03	2.60	1.80	8.51	7.79	7.48	3.87
1030 Roll Fine Error	DEG	- 0.13	- 0.09	- 0.14	- 0.14	- 0.17	- 0.12	- 0.21
1027 Roll Rear Flywheel SPD	RPM	729.30	739.75	748.56	742.88	790.57	763.14	792.27
1026 Roll Fwd Flywheel SPD	RPM	703.02	725.23	735.81	721.03	755.38	759.39	737.44
1022 Roll Rear Mtr Drvr CCW	PCT	0.67	0.39	0.63	0.41	1.08	0.57	0.87
1025 Roll Rear Mtr Drvr CW	PCT	7.54	5.47	6.34	6.80	6.15	6.06	6.09
1023 Roll Fwd Mtr Drvr CCW	PCT	0.70	0.37	0.87	0.68	1.49	0.60	0.72
1024 Roll Fwd Mtr Drvr CW	PCT	5.46	4.74	4.01	3.82	4.51	3.46	4.34
1035 Yaw Tach	RPM	- 95.73	- 41.57	-38.16	- 11.03	- 60.36	- 45.53	-163.04
1033 Yaw Mtr Drvr CW	PCT	1.98	1.77	2.01	1.76	2.51	2.03	1.91
1034 Yaw Mtr Drvr CCW	PCT	2.10	1.72	1.90	1.64	2.84	2.15	2.49
1221 SAD Right Tach	D/M	3.38	3.38	3.38	3.38	3.35	3.39	3.37
1241 SAD Left Tach	D/M	3.68	3.63	3.56	3.55	3.52	3.56	3.48

*Pitch Pos. Bias Implemented During This Orbit

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

LANDSAT-2

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

The Command Clock Subsystem operated nominally in this report period. The clock was reset in Orbit 9891, 1 January 1977. Figure 5-1 shows the history of the S/C clock drift since launch. Figure 5-2 shows the cumulative clock drift, 9.305 seconds faster in 24 months, and Figure 5-3 gives drift rate of S/C clock, an average of 0.912 msec fast per orbit. In this period, the drift rate is increasing and is at the average rate of 1.117 msec fast per orbit. The clock of Landsat-2 drifts in opposite direction from the clock of Landsat-1.

Table 5-1 shows typical telemetry values since launch. All are nominal.

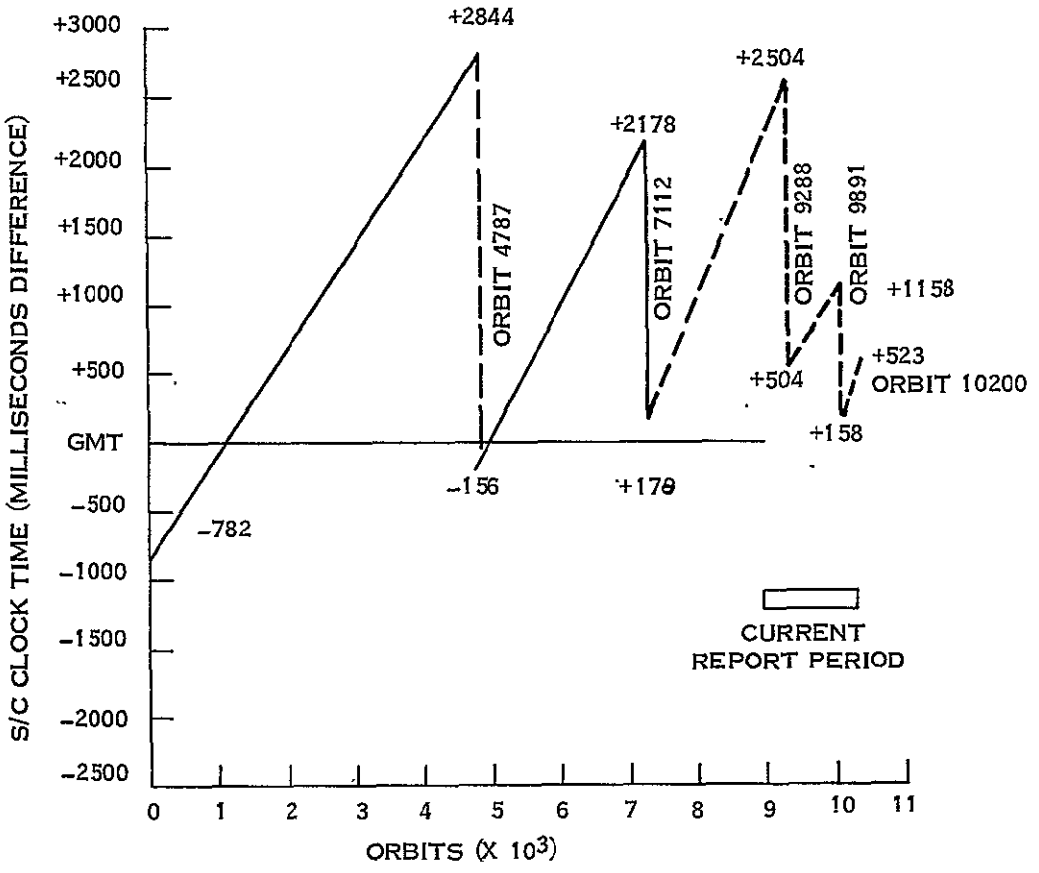

Figure 5-1. Landsat-2 Drift History

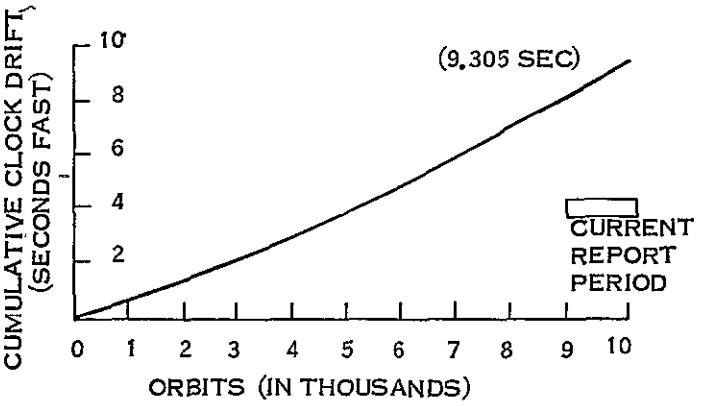

Figure 5-2. Cumulative Clock Drift

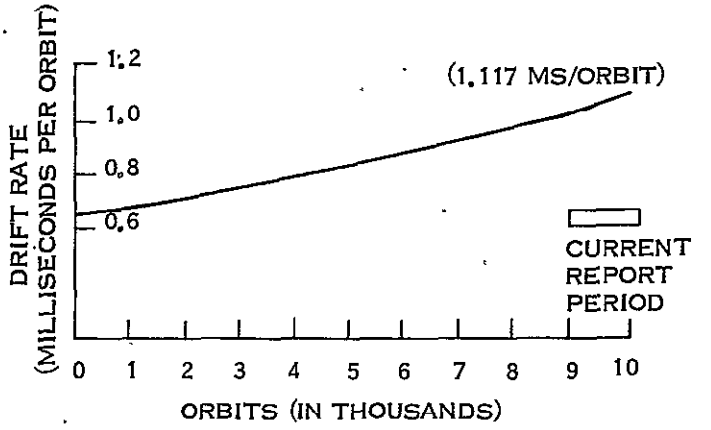

Figure 5-3. Drift Rate of S/C Clock

Table 5-1. Command/Clock Telemetry Summary, Landsat-2

Function No.	Name	Mode	Units	Orbit						
				35	2462	5091	7641	9350	9791	10,192
8005	Pri. Power Supply Temp	-	DGC	38.82	40.43	39.43	39.94	40.3	39.15	39.08
8006	Red. Power Supply Temp	-	DGC	36.93	38.70	38.00	38.52	38.65	37.90	37.85
8007	Pri. Osc Temp	-	DGC	28.70	29.35	28.70	28.69	28.72	27.97	28.56
8008	Red Osc. Temp	-	DGC	27.82	28.68	27.26	27.60	28.19	26.95	26.97
8009	Pri. Osc. Output	-	TMV	1.06	1.06	1.05	1.05	1.06	1.05	1.05
8010	Red. Osc. Output	-	TMV	1.17	1.20	1.18	1.10	1.19	1.18	1.18
8011	100 KHz	Pri. - Red	TMV	3.17	3.16	3.15	3.15	3.15	3.15	3.15
8012	10 KHz	Pri. - Red	TMV	3.08	3.05	3.05	3.05	3.05	3.05	3.05
8013	2.5 KHz	Pri. - Red	TMV	3.01	2.95	2.95	2.95	2.95	2.95	2.95
8014	400 Hz	Pri. - Red	TMV	4.17	4.45	4.45	4.45	4.45	4.45	4.45
8015	Pri. +4V Power Supply	Pri. Clk ON	VDC	NA	2.05	2.05	2.05	2.05	2.05	2.05
8016	Red. +4V Power Supply	Red Clk ON	VDC	NA	2.01	2.00	2.00	2.00	2.00	2.00
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	NA	2.30	2.30	2.30	2.30	2.30	2.30
8018	Red. +6V Power Supply	Red Clk ON	VDC	NA	2.31	2.30	2.30	2.30	2.30	2.30
8019	Pri. - 6V Power Supply	Pri. Clk ON	VDC	NA	5.23	5.23	5.22	5.23	5.22	5.23
8020	Red. - 6V Power Supply	Red. Clk ON	VDC	NA	5.23	5.23	5.23	5.23	5.22	5.23
8021	Pri. - 23V Power Supply	Pri. Clk ON	VDC	NA	5.70	5.70	5.70	5.70	5.70	5.70
8022	Red - 23V Power Supply	Red Clk ON	VDC	NA	5.65	5.65	5.65	5.65	5.65	5.65
8023	Pri. - 29V Power Supply	Pri. Clk ON	VDC	NA	5.30	5.29	5.29	5.29	5.29	5.29
8024	Red - 29V Power Supply	Red Clk ON	VDC	NA	5.29	5.29	5.29	5.29	5.29	5.28
8101	CIU A - 12V	CIU A ON	VDC	3.79	3.97	3.97	3.96	3.97	3.97	3.96
8102	CIU B - 12V	CIU B ON	VDC	3.78	3.95	3.95	3.95	3.95	3.95	3.95
8103	CIU A - 5V	CIU A ON	VDC	3.93	4.15	4.15	4.14	4.14	4.14	4.15
8104	CIU B - 5V	CIU B ON	VDC	3.90	4.10	4.10	4.10	4.10	4.10	4.10
8105	CIU A Temp	CIU A ON	DGC	26.01	22.50	21.67	21.62	22.17	21.29	21.67
8106	CIU B Temp	CIU B ON	DGC	23.35	20.38	19.70	19.65	20.09	19.41	19.71
8201	Receiver RF-A Temp	-	DGC	NA	30.02	29.14	29.22	29.33	28.58	28.83
8202	Receiver RF-B Temp	-	DGC	29.09	*	*	24.04	23.32	22.36	22.66
8203	D MOD A Temp	-	DGC	28.95	39.20	38.56	39.08	38.63	38.09	38.25
8204	D MOD B Temp	-	DGC	37.73	27.56	26.72	28.11	26.77	26.07	26.31
8205	Receiver A AGC	Receiver A ON	DGC	*	-92.18	-91.43	-89.93	-92.60	-92.38	-90.78
8206	Receiver B AGC	Receiver B ON	DBM	-87.83	*	*	-88.46	*	*	*
8207	Amp. A Output	Receiver A ON	TMV	*	2.51	2.54	2.56	2.51	2.42	2.75
8208	Amp. B Output	Receiver B ON	TMV	2.10	*	*	2.51	*	*	*
8209	Freq. Shift Key A Out	Receiver A ON	TMV	*	1.08	1.08	1.08	1.08	1.08	1.09
8210	Freq. Shift Key B Out	Receiver B ON	TMV	1.11	*	*	1.13	*	*	*
8211	Amp. A Output	Receiver A ON	TMV	*	1.12	1.13	1.11	1.13	1.13	1.14
8212	Amp. B Output	Receiver B ON	TMV	1.13	*	*	1.16	*	*	*
8215	D MOD A - 15V	Receiver A ON	TMV	*	4.87	4.87	4.87	4.87	4.87	4.87
8216	D MOD B - 15V	Receiver B ON	TMV	4.77	*	*	4.77	*	*	*
8217	Regulator A - 10V	Receiver A ON	TMV	*	5.40	5.40	5.40	5.40	5.40	5.40
8218	Regulator B - 10V	Receiver B ON	TMV	5.32	*	*	5.31	*	*	*
8311	ECAM Mem. Tmp	ECAM ON	DGC	NA	18.03	18.44	18.10	18.55	18.60	18.44
8312	ECAM Pwr Spply Temp	ECAM ON	DGC	NA	23.13	23.13	22.45	23.11	23.17	23.00

NA - Not available due to processing problem - MIT 710

* - OFF

SECTION 6

TELEMETRY SUBSYSTEM (TLM)

LANDSAT-2

SECTION 6

TELEMETRY SUBSYSTEM (TLM)

The TLM has operated nominally in this report period.

Table 6-1 shows typical telemetry values since launch. All are nominal except for functions 1264 (Thermal Shield 5 Temperature), 4002 (MMCA Board 2 Temperature), and 13200 (APU 24 Volt Input), which were defective before launch. Verification of these functions is acceptable by adjacent temperature and downstream voltage measurements respectively.

The memory section of the telemetry matrix remains in the 0.0 mode.

Table 6-1. Landsat-2 TMP Telemetry Values

Func. No.	Function Name	Unit	Orbit						
			35	2467	5091	7641	9350	9791	10,192
9001	Memory Sequencer A Converter	VDC	4.45	4.45	4.45	4.45	4.45	4.45	4.45
9002	Memory Sequencer B Converter	VDC	**	**	**	**	**	**	**
9003	Memory Sequencer Temp	°C	20.00	20.77	21.37	20.46	20.34	21.35	21.34
9004	Formatter A Converter	VDC	4.52	4.51	4.52	4.50	4.51	4.52	4.52
9005	Formater B Converter	VDC	**	**	**	**	**	**	**
9006	Dig. Mux A Converter	VDC	4.22	4.22	4.22	4.21	4.22	4.22	4.22
9007	Dig. Mux B Converter	VDC	**	**	**	**	**	**	**
9008	Formatter/Dig Mux Temp	°C	25.00	23.98	27.80	22.51	25.33	27.46	29.75
9009	Analog Mux A Converter	VDC	4.02	4.05	4.05	4.05	4.05	4.05	4.05
9010	Analog Mux B Converter	VDC	**	**	**	**	**	**	**
9011	A/D Converter A Voltage	VDC	4.02	4.02	4.03	4.04	4.04	4.04	4.04
9012	A/D Converter B Voltage	VDC	**	**	**	**	**	**	**
9013	Analog Mux, A/D Conv. Temp	°C	25.00	24.91	27.33	25.00	25.74	27.50	27.44
9014	Preregulator A Voltage	VDC	4.00	4.00	4.00	4.00	4.00	4.00	4.00
9015	Preregulator B Voltage	VDC	**	**	**	**	**	**	**
9016	Reprogrammer Temp	°C	22.50	22.27	24.74	21.89	22.25	22.57	25.47
9017	Memory A Converter	VDC	4.45	4.45	4.45	4.45	4.45	4.45	4.45
9018	Memory A Temp	°C	17.50	17.33	17.17	15.62	16.76	17.32	17.16
9019	Memory B Converter	VDC	**	**	**	**	**	**	**
9020	Memory B Temp	°C	17.50	17.28	17.41	17.45	17.13	17.50	17.50
9100	Reflected Power (Xmtr A)	dBm	18.29	13.68	14.18	13.88	14.04	14.08	14.53
9101	Xmtr A-20 VDC	VDC	3.80	3.98	3.97	3.97	3.97	3.97	3.98
9103	Xmtr A Temp	°C	27.73	20.97	26.40	21.06	23.38	25.50	30.37
9104	Xmtr B Temp	°C	*	22.07	27.74	22.13	24.58	26.80	31.74
9105	Xmtr A Power Output	dBm	27.73	26.19	26.29	26.19	26.27	26.33	26.41
9106	Xmtr B Power Output	dBm	**	**	**	**	**	**	**

*Not available due to software
**Not turned on since Prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

LANDSAT-2

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem on Landsat-2 has been fired ten times since launch, 6 times using the -X thruster and 4 times using the +X thruster. One firing of the -X and +X thruster each was for alignment tests. Three +X firings and two -X firings were made to phase the satellite with Landsat-1 to obtain a combined nine day ground track repeat pattern. Three -X firings were for orbit maintenance.

No firing of the OAS was made during this report period (See Section 2 also).

The Subsystem activity since launch is summarized in Table 7-1. A total of 6.87 lbs. of hydrazine has been expended so far from the pre-launch load of 67 lbs.

The OAS telemetry has consistently shown normal pressure temperature parameters. A sampling of the same is given in Table 7-2. The variations in the thrust chamber temperatures in Table 7-2 are consistent with the variations in sun intensity and sun angle.

Table 7-1. Landsat-2 Orbit Adjust Summary

Orbit	Orbit Adjust No.	Ignition Epoch	Burn Duration (Seconds)	$+\Delta a$ (Meters)	Engine Performance Efficiency %	Fuel[1] Used (Lbs)	Tank Pressure (PSIA)	Tank Temperature (° F)	Thruster Axis
32	1	25 Jan 75 00 34 00.8	4.8	39	104.3	0.02	539.96	72.0	-X
71	2	27 Jan 75 19 57 00.8	4.8	-36	90.1	0.02	547.46	73.5	+X
79	3	28 Jan 75 09 49 00.8	420.0	3455	107.0	1.62	547.46	73.5	-X
86	4	28 Jan 75 21 13 00.8	420.0	3233	107.0	1.51	502.46	73.5	-X
163	5	3 Feb 75 10 36 00.8	420.0	-2974	97.0	1.42	468.75	75.0	+X
191	6	5 Feb 75 10 51 00.8	360.0	-2421	97.5	1.15	438.71	75.0	+X
212	7	6 Feb 75 22 31 00.8	308.8	-2009	98.6	0.95	416.21	75.0	+X
880	8	26 Mar 75 21 44 00.8	12.8	82	107.6	0.04	397.47	70.5	-X
1632	9	19 May 75 18 54 00.8	24.0	+154	107.6	0.07	401.21	73.5	-X
2958	10	22 Aug 75 22 11 58.8	22.0	146	110.3	0.07	404.96	73.5	-X

[1] Initial Fuel Capacity - 67 lbs.

Table 7-2. Landsat-2 OAS Telemetry Values

Function No.	Name	Units	Orbit						
			50	2532	5102	7641	9350	9791	10191
2001	Prop. Tank Temp.	°C	23.03	23.05	23.89	22.22	22.22	22.22	23.05
2003	Thrust Chamber No. 1 (-X) Temp.*	°C	24.84	30.14	25.12	28.57	27.84	26.30	21.75
2004	Thrust Chamber No. 2 (+X) Temp.*	°C	37.34	38.41	38.55	39.29	39.10	38.21	37.60
2005	Thrust Chamber No. 3 (-Y) Temp.*	°C	47.22	34.20	46.35	34.82	40.89	44.68	49.78
2006	Line Pressure	psia	545.60	404.97	413.25	415.39	416.44	417.86	419.94

*Widespread of temperature is due to nozzle locations and satellite day/night transitions relative to data averaged. Typical orbital range is from 19 to 59 DGC.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

LANDSAT-2

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in Orbits 293 and 321 as reported earlier. These adjustments were made on the pitch magnetic rod of the MMCA.

No adjustment to the MMCA dipoles was made during this report period.

Orbital averages of MMCA telemetry functions for selected orbits are given in Table 8-1.

Table 8-1. Landsat-2 MMCA Telemetry Values

Function	Name	Units	Orbit						
			50	2532	5102	7641	9350	9791	10191
4001	A1 Board Temp	°C	20.56	19.82	19.47	19.20	19.12	18.98	19.12
4002	A2 Board Temp	°C	*	*	*	*	*	*	*
4003	Hall Current	TMV	3.40	3.40	3.40	3.40	3.40	3.40	3.40
4004	Yaw Flux Density	TMV	3.05	3.07	3.07	3.07	3.07	3.07	3.07
4005	Pitch Flux Density	TMV	3.15**	2.90	2.90	2.90	2.90	2.90	2.90
4006	Roll Flux Density	TMV	2.99	2.98	2.97	2.97	2.97	2.97	2.97

*Defective Telemetry Function (Pre-launch)
**Post launch telemetry drift.

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR (USB/PMP)

LANDSAT-2

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR (USB/PMP)

The USB Subsystem has operated nominally in this report period.

Table 9-1 shows telemetry values since launch. All are nominal. The high temperatures are attributable to the time of year, and the high Beta angle (see Figure 3-3). The temperatures are well within allowable limits, and are expected to decline after February. The transmitter has maintained a steady indicated power output of about 1.4 watts since launch. Figure 9-1 shows AGC readings of Goldstone for a constant position in space. The scatter of data points reflect variations in the ground station calibration and readout. The recent elevated readings are probably due to changes in ground station calibration.

Table 9-1. Landsat-2 USB/PMP Telemetry Values

No.	Function Name	Units	T/V (20°C)	Orbits						
				15	2462	5091	7641	9350	9791	10192
11001	USB Rcvr AGC	DBM	N/A	-112.72	-128.8	-124.29	-122.37	-125.45	-131.50	-122.24
11022	USB Xmtr Pwr	WTS	1.40	1.36	1.43	1.38	1.37	1.38	1.36	1.37
11003	USB Rcvr Error	KHz	-2.15	-2.15	-4.64	-2.97	-4.30	-6.92	-4.17	-4.69
11004	USB Xpond Temp	DGC	22.93	25.88	24.37	27.49	24.12	27.23	26.76	29.60
11005	USB Xpond Press	PSI	16.99	17.08	16.74	16.49	15.94	15.86	15.85	16.00
11007	USB Xmtr A -15V	VDC	2.35	2.36	F	F	F	F	F	F
11008	USB Xmtr B -15V	VDC	2.39	F	2.40	2.42	2.39	2.42	2.40	2.37
11009	USB Range -15V	VDC	2.07	2.07	2.07	2.06	2.05	2.05	2.05	2.06
11101	PMP Pwr A Volt	VDC	-15.22	-15.10	F	F	F	F	F	F
11102	PMP Pwr B Volt	VDC	-15.07	F	-15.02	-14.99	-14.99	-14.93	-15.03	-14.94
11103	PMP Temp A	DGC	N/A	37.30	29.12	34.67	28.38	31.76	33.23	38.03
11104	PMP Temp B	DGC	N/A	28.34	30.57	36.08	29.62	34.09	34.47	39.42

F-Unit OFF in this period.

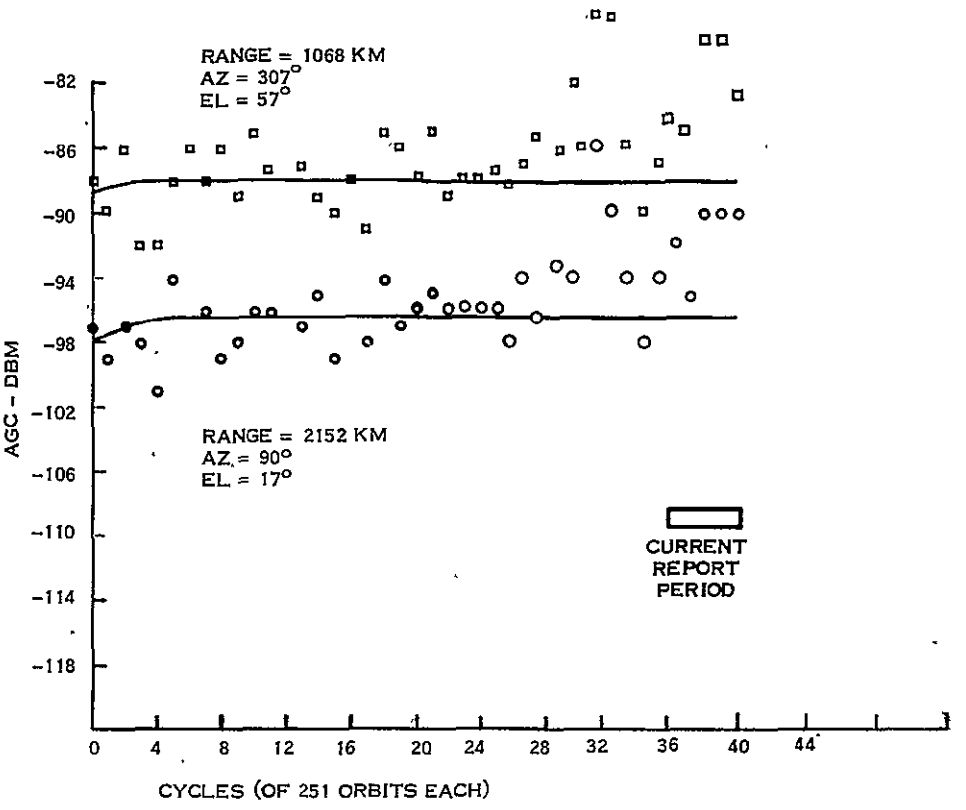

Figure 9-1. USB (Link) AGC Readings at Goldstone with 30' Antenna - Landsat-2

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM (EIS)

LANDSAT-2

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM (EIS)
LANDSAT-2

The Auxiliary Processing Unit (APU) consisting of Search Track Data, Time Code Data, and Back-up Timers operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1.

Table 10-1. Landsat-2 APU Telemetry Functions

Function	Description	Unit	Orbit							
			21	1253	2532	5102	7641	9350	9791	10192
13200	APU, -24.5 VDC	TMV	*	*	*	*	*	*	*	*
13201	APU, -12 Volts	TMV	2.42	2.44	2.45	2.45	2.45	2.45	2.45	2.45
13202	APU Temp	DGC	27.44	26.65	26.60	27.70	26.21	27.59	27.42	28.78

*Defective Telemetry (Prelaunch)

The Power Switching Module (PSM) containing the switching relays for power to the OAS, MSS, WBVTR No. 1 and No. 2, RBV and PRM, functioned normally. During this report period, the MSS as well as WBVTR No. 2 power circuits, have been operated on a regular basis. RBV and WBVTR No. 1 power circuits have been used for limited operation.

The Interface Switching Module performed all switchings normally during this report period.

SECTION 11

THERMAL SUBSYSTEM (THM)

LANDSAT-2

SECTION 11

THERMAL SUBSYSTEM (THM)

The Thermal Control Subsystem on Landsat-2 has provided excellent control of all spacecraft equipments since launch.

Table 11-1 gives average subsystem telemetry values for several representative orbits during the last twenty-four months of operation of Landsat-2. Average temperatures of the sensory ring bays are plotted in Figure 11-1.

During this report period, the sun intensity varied from 1.010 to 1.034 of the mean value and the average spacecraft temperatures increased. Temperatures will continue to increase in the on-coming period of higher sun intensity, higher sun angle, longer satellite days and shorter satellite nights (see Figure 3-4).

During Orbit 9753 (22 December 1976) the compensation load configuration was switched from 1, 2, 5 ON to 1, 2 ON. This was done to reduce the temperature gradient among batteries. A history of compensation load switchings since launch is given in Table 11-2.

Table 11-1. Landsat-2 Thermal Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function No	Function Description	Unit	Orbits						
			21	2532	5102	7641	9350	9791	10192
7001	THM TH01 STI	DGC	19 40	19 59	19.97	18.63	18.95	19.21	19.59
7002	THM TH02 SBO	DGC	17 18	18.05	17.47	17.21	17.85	17.40	17.65
7003	THM TH03 STI	DGC	18 73	19 49	18 50	17.73	18.45	18.06	18.65
7004	THM TH10 TCB	DGC	19.38	19.01	19 34	18.64	19.46	19.10	19.94
7005	THM TH04 STI	DGC	17.19	17 92	16.76	16.30	17.39	16.68	17.37
7006	THM TH05 SBO	DGC	17.42	17 46	16 68	16.52	16.93	16.46	16.65
7007	OA-X Thruster	DGC	19 66	20.58	19.65	20.02	20.26	19.46	19.44
7008	THM TH06-STO	DGC	14.78	14.77	13.94	13.78	13 94	13.44	13.57
7009	THM TH06 SBI	DGC	19.18	19.18	18 41	18.06	18.36	17.64	18.10
7010	THM TH07 STI	DGC	18.08	18.26	17.44	17.56	17.52	16.76	17.11
7011	THM TH08 STO	DGC	19.34	20 22	19 23	19.74	19.80	19.10	19.00
7012	THM TH09 SBI	DGC	21 44	21 80	20.93	20.68	21.75	20.47	20.94
7013	THM TH10 SBO	DGC	18.58	18 56	18.39	18.05	18.81	18.36	18.59
7014	THM TH11 STI	DGC	21 65	21.13	21.93	20.61	21.89	21.40	22.75
7015	THM TH12 SBO	DGC	23.93	22 13	24.68	21.83	24.06	24.82	26.68
7016	THM TH13 STI	DGC	22 21	20.51	23.62	20.24	22.12	22.84	25.73
7017	RBV Beam Ctr Ln	DGC	20.38	20.33	19.92	19.09	20.53	19.21	20.16
7018	THM TH14 STO	DGC	24 12	21.29	26 43	21.40	23.55	25.17	29.64
7019	NBR Rad Outbd B4	DGC	2.72	3.26	2.93	2.31	2.35	2.12	2.44
7020	THM TH15 SBI	DGC	23.07	21.13	25.56	20.11	22.25	23.49	27.07
7021	THM TH16 STI	DGC	23.26	22.29	25.46	21.07	22.58	23.37	25.87
7022	THM TH17 SBI	DGC	21.77	21.22	23.74	20.21	21 59	22.44	23.75
7023	THM TH18 SBO	DGC	21.67	21.49	23.36	21.30	22 40	22.49	23.69
7030	THM TH03 Bur	DGC	15 50	16.28	15.14	15.21	15.89	15.31	15.59
7033	THM TH12 Bur	DGC	23 05	21.70	24 59	21.44	23.89	24.80	27.14
7035	THM TH18 Bur	DGC	19 53	19 32	20.39	19.05	19.40	18.84	20.20
7040	THM TH01 TCB	DGC	19.42	19.78	19.72	18.82	19.53	19.54	19.96
7041	THM TH02 TCB	DGC	17.55	18.02	17 39	17.06	17.44	17.27	17.42
7042	THM TH03 TCB	DGC	16.85	18.23	16.32	16.37	18.31	16.96	18.04
7043	THM TH04 TCB	DGC	19.90	20.05	19.33	19.21	19.75	19.38	19.65
7044	THM TH05 TCB	DGC	16.42	16 21	15.75	15.47	15.74	15.27	15.44
7045	THM TH07 TCB	DGC	17 76	18 12	17.33	17.64	17.53	18.50	17.01
7046	THM TH09 TCB	DGC	19 30	19.31	18 81	18.83	19.36	23.51	18.82
7048	THM TH11 TCB	DGC	23.27	22.45	23 74	22.07	23.59	23.77	24.99
7049	THM TH12 TCB	DGC	23.04	20 62	23.94	20.34	22.87	24.01	26.83
7050	THM TH13 TCB	DGC	22.89	20.34	24.67	20.46	22.50	24.01	27.61
7051	THM TH14 TCB	DGC	25 07	22.11	27.69	22.22	24.33	26.34	31.17
7052	THM TH16 TCB	DGC	22.22	21 59	24.29	20.64	22.75	23.04	25.62
7053	THM TH17 TCB	DGC	23.52	22.79	24.86	22.53	23.53	24.09	25.00
7054	THM TH18 TCB	DGC	20.01	20.05	20 99	20.27	20.61	21.24	21.41
7060	THM Shutter By 1	DEG	22 54	24.43	26 65	15.42	21.69	25.13	27.36
7061	THM Shutter By 2	DEG	19 34	24 75	21.13	17.50	15.30	17.73	17.89
7062	THM Shutter By 3	DEG	22 75	31.67	11.99	12.70	30.45	20.47	28.91
7063	THM Shutter By 4	DEG	33 89	36.32	33.00	33.02	32.42	32.00	32.90
7064	THM Shutter By 5	DEG	7.50	8.67	2.90	2.88	2.88	2.88	2.42
7065	THM Shutter By 7	DEG	17.06	22.52	14.11	18.98	14.78	9.28	8.88
7067	THM Shutter By 9	DEG	33.75	38 22	34.12	33.75	37 11	34.13	33.70
7068	THM Shutter By 10	DEG	37 46	34 96	37.09	33.32	38.03	35.72	40.64
7069	THM Shutter By 11	DEG	52.25	10 16	17 39	3.29	13.63	10.26	22.81
7070	THM Shutter By 12	DEG	61 38	46.20	67.46	45.57	61.73	67 17	80.70
7071	THM Shutter By 13	DEG	63 60	45.76	74.14	47.35	62.53	70.75	81.89
7072	THM Shutter By 14	DEG	59.44	40 40	72.14	40.22	53.07	66.11	72.91
7073	THM Shutter By 15	DEG	67 79	53 78	82.12	48.88	65.15	74.82	83.87
7074	THM Shutter By 16	DEG	45.20	43.68	61.13	36.55	51.60	53.94	68.30
7075	THM Shutter By 17	DEG	57.88	52.10	67.62	50.12	57.29	64.23	68.67
7076	THM Shutter By 18	DEG	40.49	39 32	45.84	40.47	42.86	48.57	47.59
7080	THM Q1 T Zener V	VDC	4.85	4 85	4.85	4.85	4.85	4.85	4.85
7081	THM Q2 T Zener V	VDC	4.90	4 90	4.90	4.90	4.90	4.90	4.90
7082	THM Q3 T Zener V	VDC	5 05	5 04	5.05	5.04	5.04	5.03	5.04
7083	THM Q1 S Zener V	VDC	4.97	4.96	4 96	4.95	4.96	4.95	4.96
7084	THM Q2 S Zener V	VDC	4 98	4.98	4.99	4.98	4.98	4.98	4.98
7085	THM Q3 S Zener V	VDC	5.15	5 15	5.15	5.15	5.15	5.15	5.15
7090	THM PSM Mount	DGC	21 02	21.05	21.71	19.63	20.57	20 14	21.28
7091	THM Ind Attitude	DGC	17.79	17 86	17.24	16.55	17.19	16.44	16.95
7092	THM RBV Radiator	DGC	18.01	18 06	16.24	14.46	18.76	15.90	16.71
7093	THM RBVC Ctr Bm	DGC	20.74	20.82	19 31	17.95	21.00	18.40	19.44
7094	THM WBVTR Root	DGC	13.77	14.71	15.72	11.86	12.69	12.93	13.90
7095	THM WBV TR Rad Ct	DGC	3.64	4.99	5.55	3.24	3.92	3.83	4.45
7096	THM WBV TR Strap	DGC	15 90	16.95	17 63	13.48	14.26	14.46	15.29
7097	THM WB Mt Bay 1	DGC	22 91	22.60	22.49	21.29	15.91	16.08	16.47
7098	THM WB Mat Bay 1	DGC	22.07	19.25	20 14	18.71	15.37	15.69	16.20
7099	THM WBVTR Sep 3	DGC	18 03	18.76	18.12	16.69	17.42	17.24	17.79
7100	THM WBVTR Sep 17	DGC	21 83	21.55	23 51	19.96	21.01	21.75	22.98
7101	THM WBV TR 1 Cent	DGC	22.45	23 13	23 78	18.59	19.22	19.59	20.33
7102	THM WBVTR 2 Bay	DGC	17.34	17.69	17.29	16.15	16.80	16.39	17.04
7103	THM WBVTR 2 By 15	DGC	21.77	20.99	23 87	19.11	20.39	21.15	23.50
7104	THM WBVTR 2 Ctr	DGC	20.74	21.08	22.34	17.73	18.32	18.55	19.94
7105	THM NBTR B Sep 6	DGC	17 82	17.96	17.86	16.61	16.99	16.49	17.29
7106	THM NBTR B Sep 1	DGC	22.11	20 70	23.85	19.82	21.27	22 09	24.92
7107	THM NBTR Bm Ctr	DGC	20.32	20.44	21.21	18.38	19.54	19.08	20.59
7108	THM MSS Mount 14	DGC	20.59	19.40	22.86	18.20	20.01	20.93	23.83
7109	THM OA - Y Thruster	DGC	25.64	21.99	27.51	21.88	24.26	25.93	29.91
7110	THM MSS WBVTR Bm	DGC	16.75	17.54	18.21	14.97	15.82	15.79	16.84
7111	THM OA +X Thruster	DGC	20.33	19.72	20.43	19.28	17.11	17.28	17.54
7130	THM Aux P1 T	DGC	34.18	6.21	29.67	8.42	9.39	24.55	12.01
7131	THM Aux P2 T	DGC	2 90	2 22	6.97	22.95	24.22	10.65	28.16

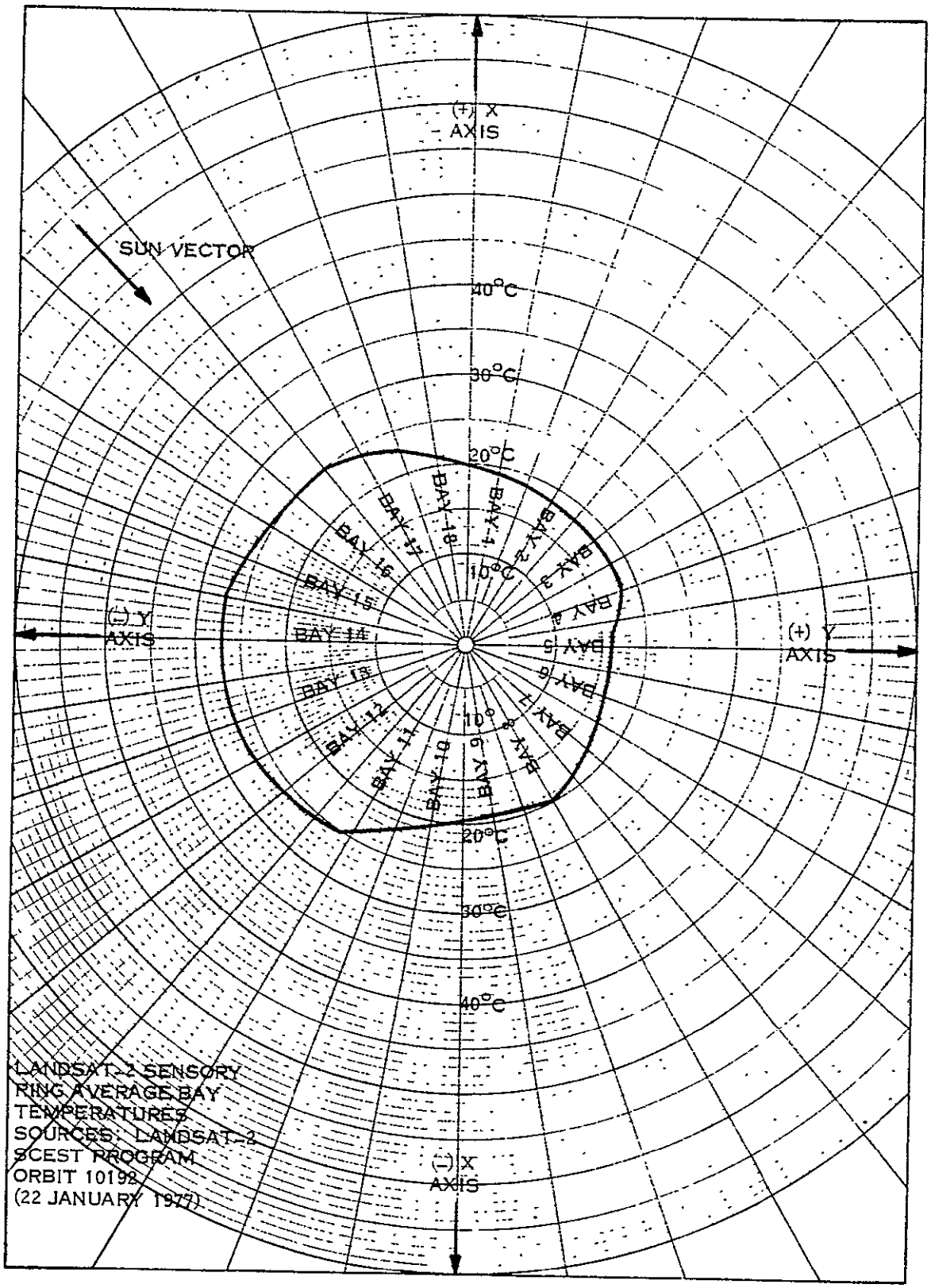

Figure 11-1 Landsat-2 Sensory Ring Thermal Profile

Table 11-2. Landsat-2 Compensation Load History

Orbits	Compensation Load Status*							
	1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
2	X	X	X	X	X	0	X	X
237	X	X	X	X	X	0	0	0
272	X	X	X	X	X	0	X	X
306	X	X	0	X	X	0	0	0
572	X	X	0	X	X	0	0	X
1367	X	X	X	X	X	0	0	X
1645	X	X	0	X	X	0	0	X
1657	X	X	X	X	X	0	0	X
4202	0	0	X	X	0	0	0	0
4372	0	0	X	X	0	0	0	X
6735	0	X	X	0	0	X	0	0
8312	X	X	0	0	X	0	0	0
9753	X	X	0	0	0	0	0	0

* Note

X = ON
0 = OFF

SECTION 12

NARROWBAND TAPE RECORDERS (NBR)
LANDSAT-2

SECTION 12

NARROWBAND TAPE RECORDERS (NBR)

The Narrowband Recorder Subsystem operated satisfactorily throughout the entire period, both Recorders alternating in Record and Playback modes with a nominal one minute overlap.

Table 12-1 gives cumulative operating hours for both Recorders by mode, and Table 12-2 gives typical telemetry values.

Table 12-1. NBR Operating Hours by Modes

NBR	ON	OFF	PLAYBACK	RECORD
A	9224	8346	360	8856
B	9224	8346	360	8856

Table 12-2. Narrowband Tape Recorder Telemetry Values, Landsat-2

Function		Typical Telemetry Values - Orbits						
No.	Name	36/37	2111/2112	4980/4981	7631/7632	9351/9352	9790/9791	10192/10194
10001	A - Motor Cur. (ma)							
	Record	132.0	133.3	130.2	128.6	128.76	126.64	122.86
	P/B	108.0	95.2	93.7	90.5	88.34	90.40	93.70
10101	B - Motor Cur. (ma)							
	Record	148.5	141.7	135.7	129.6	128.56	128.67	128.05
	P/B	143.6	138.7	135.7	125.1	125.10	123.30	135.42
10002	A - Pwr Sup. Cur. (ma)							
	Record	170.5	157.5	162.5	155.9	147.15	149.34	157.79
	P/B	410.0	399.3	399.3	396.0	479.70	474.11	475.60
10102	B - Pwr Sup. Cur. (ma)							
	Record	260.0	261.3	264.5	261.4	268.60	264.72	268.12
	P/B	481.0	479.7	489.2	470.2	476.74	480.20	479.15
10003	A - Rec. Temp (DGC)	26.1	26.1	24.2	21.8	23.07	22.38	24.87
10103	B - Rec. Temp. (DGC)	27.0	27.0	26.2	25.4	24.69	25.11	23.41
10004	A - Supply (VDC)	-24.87	-25.1	-25.1	-25.1	-25.09	-25.09	-25.07
10104	B - Supply (VDC)	-24.55	-24.6	-24.6	-24.4	-24.61	-24.62	-24.71

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM (WBTS)
LANDSAT-2

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM (WBTS)
LANDSAT-2

The WBTS has operated nominally in this report period.

Table 13-1 shows typical telemetry values. All are nominal.

Figure 13-1 is the AGS history recorded at Goldstone with the spacecraft successively at the same points in space. The scatter of data points reflect variations in the ground station calibration and readout. The recent elevated readings are probably due to changes in ground station calibration. WBPA-2 has been used more consistently and is presented in this Figure. Values from WBPA-1 are nearly identical when this power amplifier is used.

Table 13-1. Typical Wideband Subsystem Telemetry

Function (1)	Name	20W	Orbit						
			47	2462	5091	7501	9091	9662	10082
12001	Temp TWT Coll. (DGC)	33.6	34.38	35.00	F	35.63	26.29	35.63	35.63
12101		31.2	30.00	37.14	32.16	26.69	34.29	37.14	30.00
12002	Cur. Helix (MA)	3.85	4.29	4.51	F	4.06	4.03	4.10	4.23
12102		4.56	4.41	4.48	4.59	4.63	4.77	4.74	4.77
12003	Cur. Cath (MA)	46.10	46.04	45.12	F	45.05	44.93	45.15	45.15
12103		46.78	46.42	45.24	46.00	44.66	45.79	46.00	45.79
12004	Fwd. Pwr. (DBM)	42.68	42.83	42.77	F	42.78	42.82	42.82	42.87
12104		43.71	43.81	43.69	43.61	43.56	43.81	43.77	43.77
12005	Refl. Pwr (DBM)	27.0	26.50	26.10	F	25.85	25.89	25.89	25.89
12105		36.45	37.50	37.14	37.08	36.50	37.44	37.44	37.50
12227	Con Volt Loop Stress (MHz) (2)	1.54	2.14	1.12	F	1.60	1.24	1.47	1.23
12228		2.53	1.51	-0.01	-0.22	0.41	0.01	-0.02	-0.18
12229	Temp. Mod (DGC)	19.5	18.51	20.88	17.97	17.71	19.25	19.54	18.67
12232	+15 VDC Pwr Sply (TMV)	2.65	2.65	2.65	2.65	2.60	2.65	2.65	2.65
12234	-15 VDC Pwr Sud (TMV)	4.07	4.27	3.94	4.04	4.04	4.06	4.05	4.07
12236	+5 VDC Pwr Suply (TMV)	3.55	3.57	3.54	3.51	3.50	3.51	3.55	3.51
12238	-5 VDC Pwr Sud (TMV)	4.08	4.20	4.01	4.07	4.02	4.08	4.08	4.07
12240	-24 VDC Unreg Pwr (TMV)	5.86	6.20	5.66	5.90	5.91	5.85	5.82	5.85
12242	Temp. Inv. (DGC)	23.7	24.12	23.79	22.53	20.90	22.81	23.32	22.85

(1) Function Numbers for WPA-1 = 120xx; for WPA-2 = 121xx
(2) Any reading other than -14 or +14 is acceptable
F Unit OFF in this period
N/A Not Available

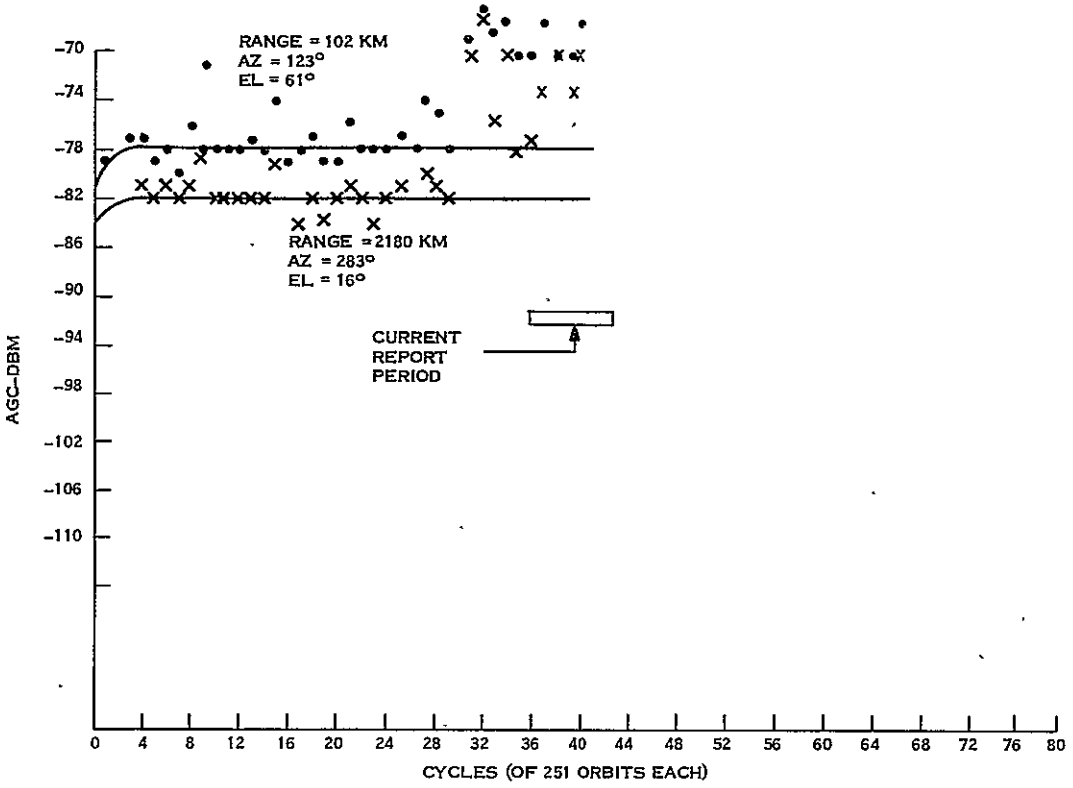

Figure 13-1. WPA-2 (Link 3) AGC Readings at Goldstone with 30' Antenna, Landsat-2

SECTION 14

ATTITUDE MEASUREMENT SENSOR (AMS)
LANDSAT-2

SECTION 14

ATTITUDE MEASUREMENT SENSOR (AMS)

The AMS is a passive radiometric balance sensor which operates in the 14-16 micron IR band. AMS Telemetry Values are shown in Table 14-1.

The AMS was launched in the OFF mode (CMD 774), turned ON during Orbit 6, and has been performing normally since then.

Table 14-1. Landsat-2 AMS Temperature Telemetry

Function	Description	Units	Orbit Number						
			50	2532	5102	7641	9350	9791	10191
3004	Case Temp 1	DGC	19.00	19.02	18.68	17.87	18.82	17.98	18.36
3005	Assembly - Temp-2	DGC	18.70	18.71	18.30	17.45	18.51	17.66	17.97

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS (WBVTR)
LANDSAT-2

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS (WBVTR)

WBVTR-1 has had limited operational use through this reporting period because of previously reported failure of one of its Record/Playback heads (heat 1, Orbit 2683, 3 August 1975). A second head failed (head 3) during record in Orbit 10064 on 13 January 1977. During playback in Orbit 10086, 15 January 1977 the anomaly was apparent. WBVTR-1 has been used selectively since and head 3 remains in a failed mode. Details of the analysis is contained in PIR-14N5-L/2-201.

On 21 December 1976, during Orbit 9738, a playback of MSS data from WBVTR-2 of Landsat-2 was unusable due to high bit error counts. The recorder also overran the intended footage stop into previously good recorded data, and the playback continued to be unusable. Procedural refinement corrected this condition and normal operational use has been restored. Detailed analysis and waveforms are contained in PIR-14N5-L/2-195.

Table 15-1 gives typical telemetry values for WBVTR-1 and WBVTR-2. Tables 15-2 and 15-3 show the telemetry values for Record, Playback, Rewind, and Standby operational modes.

Figure 15-1 shows tape usage for WBVTR-2.

Table 15-1. WBVTR Telemetry Values

WBVTR-1 Functions		Telemetry Values In Orbits						
Number	Name	45/46	2642	4879 (ET)	7628	9397	9661	10156
13022	Pressure Trans	16.52	16.51	16.39	16.14	16.14	16.12	16.14
13023	Temp Trans	20.74	20.62	20.12	18.70	17.22	17.50	18.50
13024	Temp Elec	25.00	24.57	21.68	19.05	14.09	14.23	14.54
13032	Limiter Volt	1.48	1.51	1.41	1.48	1.45	1.41	1.46
13034	+5.6 VDC Conv	5.70	5.54	5.67	5.67	5.67	5.60	5.54
13201	+12 VDC APU	2.44	2.45	2.45	2.45	2.45	2.45	2.45
13202	Temp APU	29.06	26.76	27.29	26.44	27.59	27.42	28.78

WBVTR-2 Functions		Telemetry Values In Orbits						
Number	Name	45/46	2642	5071	7621	9392	9796	10199
13122	Pressure Trans	16.12	15.81	15.33	14.67	14.54	15.54	14.54
13123	Temp Trans	21.50	20.00	23.08	19.41	17.72	18.23	19.92
13124	Temp Elec	23.50	18.31	22.72	22.07	15.59	15.91	16.63
13132	Limiter Volt	1.30	1.32	1.28	1.35	1.35	1.34	1.34
13134	+5.6 VDC Conv	5.71	5.69	5.85	5.87	5.70	5.68	5.66
13201	-12 VDC APU	2.44	2.45	2.45	2.45	2.45	2.45	2.45
13202	Temp APU	29.06	26.76	27.63	26.36	27.59	27.42	28.78

(ET) - Engineering Test of WBVTR-1

Table 15-2. Function Values by Mode, Landsat-2 WBVTR-1 Telemetry

WBVTR-1 Function/Description	Orbit 31/46	2642	4878(ET)	7628/7643	9355/9397	9620/9661	10050/10081
13029 - Input P/B Voltage							
Record	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Playback	0.60	0.32	0.30	0.32	0.38	0.32	0.35
Rewind	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13028 - Capstan Motor Current							
Record	0.31	0.33	0.31	0.33	0.32	0.32	0.31
Playback	0.26	0.31	0.30	0.35	0.35	0.35	0.30
Rewind	0.19	0.23	0.28	0.31	0.37	0.36	0.28
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13030 - Headwheel Motor Current							
Record	0.50	0.50	0.53	0.50	0.46	0.52	0.56
Playback	0.49	0.49	0.53	0.53	0.45	0.46	0.44
Rewind	0.44	0.44	0.47	0.47	0.44	0.45	0.45
Standby	0.45	0.45	0.46	0.44	0.45	0.44	0.44
13031 - Recorder Input Current							
Record	3.69	3.59	3.62	3.62	3.52	3.45	3.62
Playback	3.37	3.86	3.86	3.34	3.33	3.17	3.86
Rewind	2.23	2.19	2.23	2.28	2.26	2.21	2.23
Standby	1.78	1.95	1.95	1.81	1.80	1.86	1.95
13033 - Servo Voltage							
Record	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Playback	50.01	50.08	50.37	50.04	50.08	49.52	49.61
Rewind	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13026 - Capstan Motor Speed							
Record	88.61	88.03	85.13	85.03	85.86	96.00	87.45
Playback	88.35	86.87	85.13	87.45	87.45	95.10	94.90
Rewind	100.2	98.48	96.73	98.48	98.48	96.52	96.00
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13027 - Headwheel Motor Speed							
Record	96.72	95.07	93.96	94.07	94.28	95.44	94.16
Playback	97.28	94.52	92.86	92.86	92.86	94.80	94.44
Rewind	98.6	96.73	96.73	96.73	96.60	96.00	96.73
Standby	98.39	95.62	95.07	93.96	93.55	94.10	95.07

(ET) - Engineering Test of WBVTR-1

Table 15-3. Function Values by Mode - Landsat-2 WBVTR-2 Telemetry

WBVTR-2 Function/Description	Orbit						
	31/46	2642	4878	7626/7631	9350/9362	9779/9793	10198/10199
13129 - Input P/B Voltage							
Record	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Playback	0.35	0.33	0.34	0.34	0.32	0.34	0.34
Rewind	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13128 - Capstan Motor Current							
Record	0.33	0.37	0.38	0.34	0.35	0.33	0.32
Playback	0.33	0.34	0.35	0.34	0.34	0.34	0.35
Rewind	0.20	0.18	0.15	0.19	0.19	0.17	0.18
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13130 - Headwheel Motor Current							
Record	0.47	0.47	0.48	0.50	0.47	0.50	0.49
Playback	0.48	0.47	0.48	0.48	0.50	0.49	0.49
Rewind	0.44	0.42	0.41	0.49	0.40	0.45	0.43
Standby	0.43	0.43	0.41	0.42	0.41	0.42	0.44
13131 - Recorder Input Current							
Record	2.90	2.90	2.90	2.96	2.90	2.94	2.90
Playback	3.14	3.08	3.11	3.08	3.12	3.10	3.20
Rewind	1.80	1.80	1.80	1.83	1.79	1.81	1.80
Standby	1.51	1.48	1.62	1.53	1.61	1.53	1.49
13133 - Servo Voltage							
Record	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Playback	49.00	49.52	49.43	49.52	49.34	49.48	49.45
Rewind	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13126 - Capstan Motor Speed							
Record	112.10	105.33	105.33	105.33	105.00	104.70	105.30
Playback	112.10	105.33	103.96	105.33	103.71	105.33	105.07
Rewind	120.43	116.31	117.68	117.68	116.34	117.28	117.14
Standby	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13127 - Headwheel Motor Speed							
Record	98.08	96.52	95.48	94.44	95.44	96.00	95.01
Playback	97.04	94.44	94.44	94.44	94.45	94.96	94.80
Rewind	98.6	95.48	96.52	97.04	95.38	97.00	96.81
Standby	100.79	94.96	96.00	94.44	97.08	96.00	95.95

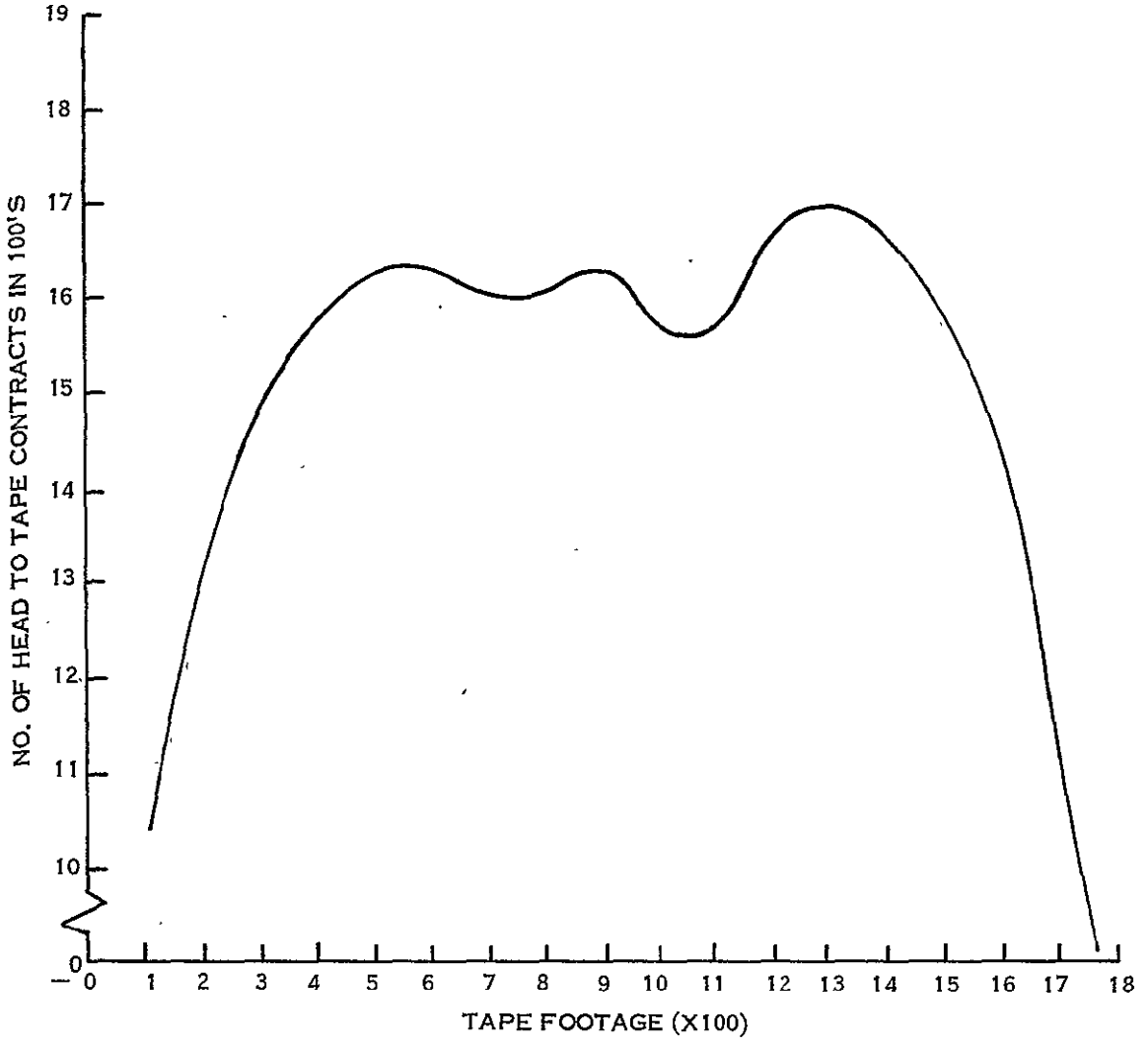

Figure 15-1. Landsat-2 WBR-2 Tape Usage thru Orbit 10199

SECTION 16

RETURN BEAM VIDICON (RBV)

LANDSAT-2

SECTION 16

RETURN BEAM VIDICON (RBV)

Throughout this report period, the RBV and WBVTR-1 were used for limited operations. All RBV operations during this report period were nominal, and telemetry data was normal.

Table 16-1 gives typical telemetry values for the RBV Subsystem. Tables 16-2, 16-3 and 16-4 give telemetry values for Prepare, Hold, and Read modes of the three RBV cameras.

Table 16-1. RBV Telemetry Values

Function		Orbits						
No.	Name	54	2371	5662	7671	9356	9703	10157
14001	CCC Board Temp. (DgC)	19.65	20.27	20.41	19.17	19.76	19.80	20.15
14002	CCC Pwr. Sup. Temp (DgC)	20.52	21.46	20.80	19.84	19.63	19.42	20.17
14003	15 VDC Sup. (TMV)	3.92	3.92	4.00	3.44	3.78	3.90	3.84
14004	+6V, -5.25 VDC Sup. (TMV)	2.92	3.07	3.13	2.69	2.95	2.76	3.03
14100		NA	0.70	0.70	1.20	1.77	1.86	1.95
14200 *	VID Output V (TMV)	1.05	1.23	1.26	1.15	1.09	1.98	0.88
14300		1.03	1.27	1.31	1.05	1.01	1.02	1.10
14102		3.85	3.81	3.82	3.82	3.84	3.82	3.70
14202 *	Comb. Align Cur. (TMV)	3.91	3.92	3.88	3.92	3.90	3.90	3.92
14302		3.90	3.80	3.83	3.40	3.40	3.87	3.75
14103		24.24	24.49	26.51	22.41	22.44	23.18	23.00
14203 *	Elec Temp. (DgC)	19.84	22.40	22.05	20.01	19.95	20.44	20.18
14303		25.05	24.15	29.42	22.46	23.10	23.83	23.42
14104		23.44	24.13	26.28	21.83	22.90	21.95	23.15
14204 *	LV Pwr Sup T. (DgC)	18.14	20.87	20.61	18.32	18.45	18 10	18.90
14304		25.36	24.12	29.47	22.22	23.10	22.95	24.09
14105		4.00	3.94	3.96	3.50	3.64	3.99	3.84
14205 *	Defl. Pwr. Sup. +10 VDC (TMV)	3.97	3.92	3.94	3.98	3.60	3.98	3.82
14305		4.00	3.95	3.96	4.00	4.00	4.00	3.96
14106		3.67	3.59	3.63	3.23	3.35	3.70	3.26
14206 *	L.V.P.S. +6V, -6.3 VDC (TMV)	3.65	3.61	3.62	3.19	3.30	3.24	3.34
14306		3.70	3.66	3.68	3.71	3.71	3.52	3.42
14107		2.61	2.54	2.61	2.53	2.55	2.49	2.60
14207 *	Ther. Elec. Cur. (TMV)	2.49	2.44	2.51	2.31	2.31	2.52	2.44
14307		2.57	2.52	2.57	2.85	2.53	2.48	2.71
14108		2.43	2.48	2.50	2.23	2.13	2.30	2.46
14208 *	Vid. Fil. Cur. (TMV)	2.40	2.34	2.36	2.12	2.15	2.23	2.39
14308		2.58	2.54	2.54	2.27	2.30	2.42	2.59
14110		2.98	2.95	2.96	2.98	2.98	2.96	2.98
14210 *	Vid. Tgt. Volt (TMV)	2.86	2.93	2.96	2.64	2.71	2.63	2.60
14310		2.63	2.56	2.58	2.31	2.30	2.45	2.37
14113		2.92	2.79	2.81	3.22	3.13	3.18	2.98
14213 *	Vert Def V (TMV)	3.15	2.99	3.05	3.79	2.90	3.11	3.16
14313		3.59	3.48	3.44	3.09	3.40	3.18	3.04
14114		19.87	20.67	19.21	16.32	16.70	18.20	19.85
14214 *	Vid FPT (DgC)	20.55	21.14	19.80	17.77	19.90	18.95	20.46
14314		20.65	21.12	20.56	18.05	20.10	19.88	20.38
14115		21.04	22.41	21.31	17.79	18.16	20.40	21.02
14215 *	Foc Coil T (DgC)	20.67	22.22	21.26	18.16	20.34	19.88	19.17
14315		22.25	23.08	22.89	19.17	19.40	21.28	20.61

* 141XX refers to Camera 1
142XX refers to Camera 2
143XX refers to Camera 3
NA - Data not Available

Table 16-2. Camera #1 (Blue) Telemetry (Values in TMV)

Function		Mode	Orbit						
No.	Name		054	2371	5663	7671	9356	9703	10157
14101	Focus I	Hold	0.65	0.70	0.69	0.63	0.63	0.69	0.65
		Prep	1.68	1.75	1.74	1.67	1.67	1.70	1.67
		Read	2.80	2.90	2.85	2.80	2.82	2.82	2.80
14109	Grid V	Prep	0.80	0.80	0.78	0.77	0.77	0.79	0.80
		Read	2.42	2.44	2.42	2.45	2.45	2.45	2.45
		Hold	3.95	4.00	3.98	3.95	3.98	4.00	3.95
14111	Cath I	Hold	0.38	0.40	0.37	0.37	0.37	0.37	0.37
		Read	0.83	0.85	0.83	*	0.84	0.84	0.85
		Prep	3.05	3.10	3.02	3.02	3.05	3.02	3.05
14112	Hor Def	Hold	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Prep	1.75	1.80	1.77	1.80	1.77	1.77	1.77
		Read	3.25	3.30	3.25	*	3.25	3.25	3.21
14120	+500 V	Prep	0.85	0.90	0.90	0.91	0.90	0.90	0.92
		Read	4.05	4.10	4.05	4.03	4.03	4.05	4.05

* No data due to slow TLM sample rate (1/16) which does not always get a sample for short "on time."

Table 16-3 Camera #2 (Yellow) Telemetry (Values in TMV)

Function		Mode	Orbit						
No.	Name		054	2371	5663	7671	9356	9703	10157
14201	Focus I	Hold	0.54	0.60	0.53	0.50	0.52	0.52	0.54
		Prep	1.56	1.60	1.54	1.50	1.52	1.52	1.50
		Read	2.65	2.70	2.65	2.62	2.62	2.67	2.65
14209	Grid V	Prep	0.75	0.85	0.80	0.77	0.77	0.77	0.80
		Read	2.25	2.30	2.22	2.25	2.21	2.22	2.25
		Hold	4.05	4.10	4.11	4.07	4.10	4.10	4.11
14211	Cath I	Hold	0.37	0.35	0.35	0.37	0.37	0.37	0.35
		Read	0.95	1.00	0.95	*	0.95	0.95	0.95
		Prep	3.05	3.10	3.05	3.05	3.05	3.07	3.05
14212	Hor Def	Hold	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Prep	1.85	1.90	1.87	1.87	1.87	1.87	1.87
		Read	3.25	3.30	3.31	*	3.21	3.30	3.24
14220	+500 V	Prep	1.15	1.20	1.14	1.14	1.14	1.14	1.15
		Read	4.25	4.30	4.27	4.27	4.30	4.27	4.27

* No data due to slow TLM sample rate (1/16) which does not always get a sample for short "on time"

Table 16-4. Camera #3 (Red) Telemetry (Values in TMV)

Function No.	Function Name	Mode	Orbit 054	2371	5663	7671	9356	9703	10157
		Hold	0.65	0.70	0.72	0.65	0.65	0.67	0.69
14301	Focus I	Prep	1.79	1.83	1.85	1.77	1.80	1.80	1.77
		Read	2.85	2.90	2.93	2.85	2.90	2.85	2.85
		Prep	0.75	0.80	0.75	0.77	0.77	0.76	0.77
14309	Grid V	Read	2.65	2.70	2.66	2.71	2.66	2.70	2.66
		Hold	4.08	4.18	4.13	4.09	4.09	4.12	4.12
		Hold	0.39	0.40	0.40	0.40	0.40	0.40	0.40
14311	Cath I	Read	0.54	0.55	0.55	*	0.55	0.55	0.55
		Prep	3.25	3.30	3.22	3.23	3.25	3.25	3.23
		Hold	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14312	Hor Def	Prep	2.05	2.10	2.07	2.06	2.06	2.07	2.07
		Read	3.35	3.45	3.42	*	3.35	3.42	3.42
14320	+500 V	Prep	1.15	1.20	1.15	1.15	1.15	1.15	1.15
		Read	4.25	4.30	4.27	4.27	4.27	4.27	4.27

* No Data due to slow TLM sample rate (1/16) which does not always get a sample for short "on time".

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM (MSS)

LANDSAT-2

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM (MSS)

The MSS Subsystem has operated nominally in this period without incident. Figure 17-1 shows the number of scenes imaged at each geographic location this quarter, and Figure 17-2 shows images since launch.

In these maps, only those scenes received by U.S. and Pakistan ground stations are shown. Scenes transmitted to Canada, Brazil and Italy (40% of total) are not shown.

Table 17-1 shows typical telemetry values since launch. All are nominal. Table 17-2 shows the history of sensor response to a constant input radiance level. Each sensor is sampled at 5 radiance levels and all show essentially the same trends. Only one of these levels (the second highest) is listed in Table 17-2. Line length history is also shown in Table 17-2 and is nominal.

Sun calibrations, performed every two weeks, show nominal performance.

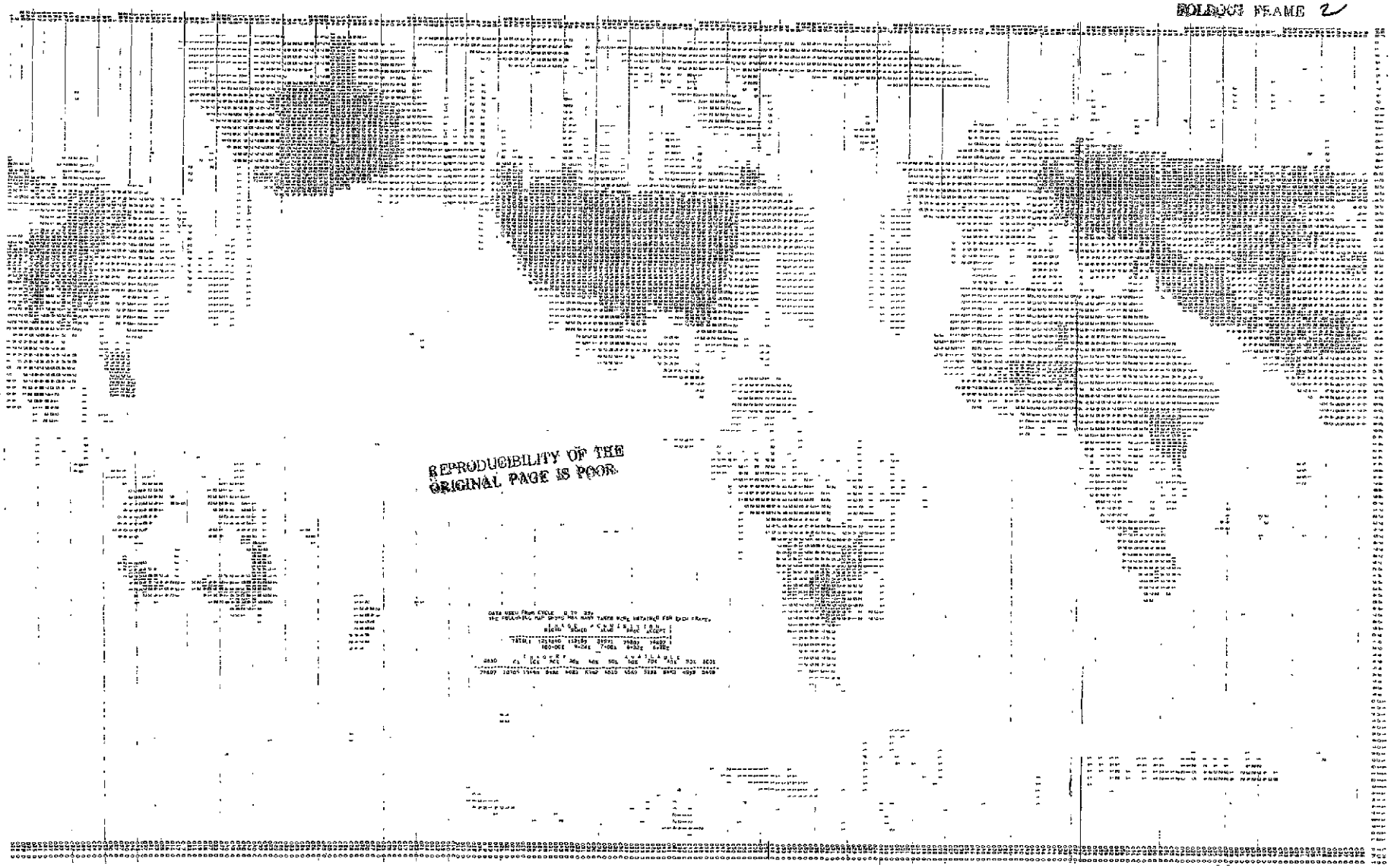

Figure 17-2. Computer Map of MSS Scenes Since Launch - Landsat-2

Table 17-1. MSS Telemetry - Landsat-2

Function	Name	*T.V. Norm	Orbit							
			27	2500	5091	6362	7641	9350	9790	10192
15040	MUX -6 VDC (TMV)	3.92	4.05	4.04	4.07	4.04	4.05	4.05	4.0	4.07
15041	A/D SUPPLY (TMV)	5.74	5.95	5.95	5.95	5.95	5.93	5.95	5.95	5.95
42	AVERAGE DENSITY (TMV)	1.72	1.71	2.39	1.95	2.39	2.16	2.39	2.36	2.62
43	FIBER OPTICS PLATE 1 TEMP (DGC)	22.30	18.13	20.41	21.75	20.59	17.21	18.74	19.05	20.15
44	FIBER OPTICS PLATE 2 TEMP (DGC)	22.30	17.87	18.86	20.28	19.04	15.29	17.08	17.27	18.54
45	MUX TEMP (DGC)	25.59	23.38	20.57	23.63	21.48	19.57	22.16	23.04	24.68
46	ELEC COVER TEMP (DGC)	23.09	20.25	21.40	22.96	21.72	16.63	18.93	18.87	20.01
47	PWR. SUP. TEMP. (DGC)	23.85	19.45	19.83	21.62	20.19	16.51	18.84	19.29	20.66
48	SCAN MIR REG. TEMP (DG)	23.44	18.30	18.29	21.13	19.07	15.93	20.28	19.02	20.94
49	SCAN MIR DRIVE ELEC. TEMP. (DGC)	24.34	18.96	18.49	21.42	19.32	16.01	18.64	19.33	21.25
15050	SCAN MIR DRIVE COVER TEMP. (DGC)	22.50	17.26	18.28	21.21	19.21	16.02	18.96	19.06	20.85
51	SCAN MIR TEMP (DGC)	21.87	17.26	18.09	20.89	18.76	15.87	17.98	18.72	20.46
52	ROT. SHUT HOUSING TEMP (DGC)	22.58	23.26	18.91	20.28	19.03	15.29	17.34	17.34	18.58
53	SCAN MIR REG VOLT (TMV)	4.56	4.7	4.57	4.57	4.63	4.39	4.63	4.63	4.63
54	CAL LAMP CURRENT (TMV)	1.18	1.17	1.20	1.17	1.17	1.17	1.17	1.17	1.17
55	BAND 1 15 VDC (TMV)	4.97	4.98	4.97	4.97	4.97	4.97	4.97	4.97	4.97
56	BAND 2 15 VDC (TMV)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
57	BAND 3 15 VDC (TMV)	4.88	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95
58	BAND 4 15 VDC (TMV)	4.83	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
59	TLM 15 VDC (TMV)	5.04	5.06	5.07	5.07	5.07	5.07	5.07	5.07	5.07
15060	+12 VDC +6 VDC (TMV)	4.92	5.03	5.02	5.02	5.02	5.01	5.01	5.01	5.01
61	LOGIC +5 VDC (TMV)	4.86	4.81	4.80	4.83	4.80	4.83	4.85	4.86	4.85
62	RECT. +19 VDC (TMV)	4.97	5.03	5.05	5.05	5.05	5.05	5.05	5.05	5.05
63	RECT. -19 VDC (TMV)	3.54	3.60	3.60	3.60	3.52	3.60	3.60	3.60	3.60
64	BAND 1 HVA (TMV)	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95	4.95
65	BAND 1 HVB (TMV)	5.03	F	F	F	F	F	F	F	F
66	BAND 2 HVA (TMV)	4.72	4.70	4.72	4.75	4.72	4.71	4.72	4.72	4.73
67	BAND 2 HVB (TMV)	4.70	F	F	F	F	F	F	F	F
68	BAND 3 HV A (TMV)	4.75	4.72	4.76	4.73	4.75	4.75	4.75	4.75	4.75
69	BAND 3 HVB (TMV)	4.65	F	F	F	F	F	F	F	F
15070	SHUT MOT. CONTR. INTEG (TMV)	2.49	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
15071	SCAN MIRROR DRIVE CLOCK (TMV)	1.93	2.0	2.00	2.00	2.01	1.99	2.01	2.01	2.01

* Thermal Vacuum Test Data at 20°C

F = Unit OFF

Table 17-2. MSS Response History - Landsat-2

Quantum Level for Selected Work
(0 = Black; 63 = White)

Band	Sensor	Launch	Average Value 1st Year	Qtr. 5,6,7	This Qtr.	% Change Since Launch
1	1	43	40	40	38	12
	2	41	40	39	38	7
	3	46	43	43	41	11
	4	46	45	45	44	4
	5	44	40	40	38	14
	6	46	43	43	43	9
2	7	47	45	45	45	4
	8	44	40	41	40	9
	9	48	46	46	45	6
	10	50	48	48	47	6
	11	48	47	47	47	2
	12	47	44	44	43	9
3	13	42	40	40	39	7
	14	44	43	43	41	7
	15	47	46	47	46	2
	16	47	45	46	45	4
	17	48	46	46	46	4
	18	46	44	45	44	4
4	19	25	25	25	25	0
	20	26	27	27	26	0
	21	32	32	32	21	3
	22	29	30	30	29	0
	23	32	33	33	32	0
	24	28	28	28	28	0
Line Length		3250	3249	3248	3246	0.06

SECTION 18

DATA COLLECTION SYSTEM (DCS)

LANDSAT-2

SECTION 18

DATA COLLECTION SUBSYSTEM (DCS)

The DCS Subsystem performed nominally during this report period, continuing message collection at the normal rate.

Figure 18-1 shows the number of DCS messages received in each 18-day cycle at OCC. The large number of messages shown for cycle 21 (February 1975) was due to an accidental mode selection for one of the ground transmitters, DCS-6402. The recent drop in DCS messages received was caused by the reduction of active DCP's in the field from 110 to about 85. The percentage of good messages remain at about 95%.

There are 48 users in the data base. 246 DCP's have been shipped with 240 in the data base.

Table 18-1 shows telemetry values since launch. All are nominal.

Table 18-1. DCS Telemetry Values

Func. No.	Name	Orbits						
		5	2462	5091	7641	9350	9791	10192
16001	Receiver 1 Sig Strength (DBM)*	-123.34	-124.81	-122.02	-123.16	-124.63	-121.78	-123.06
16002	Receiver 1 Temp (DGC)	22.54	24.20	24.37	25.12	24.52	23.87	24.82
16003	Rec-1 Pwr Input Volt (VDC)	2.35	2.36	2.36	2.37	2.36	2.36	2.37
16004	Receiver 2 Sig Volt (DBM)	F	F	F	F	F	F	F
16005	Receiver 2 Temp (DGC)	F	F	F	F	F	F	F
16006	Receiver 2 Input Volt (VDC)	F	F	F	F	F	F	F

*This value is for a CW carrier only; it is not valid during DCS message reception
F = Receiver 2 was OFF

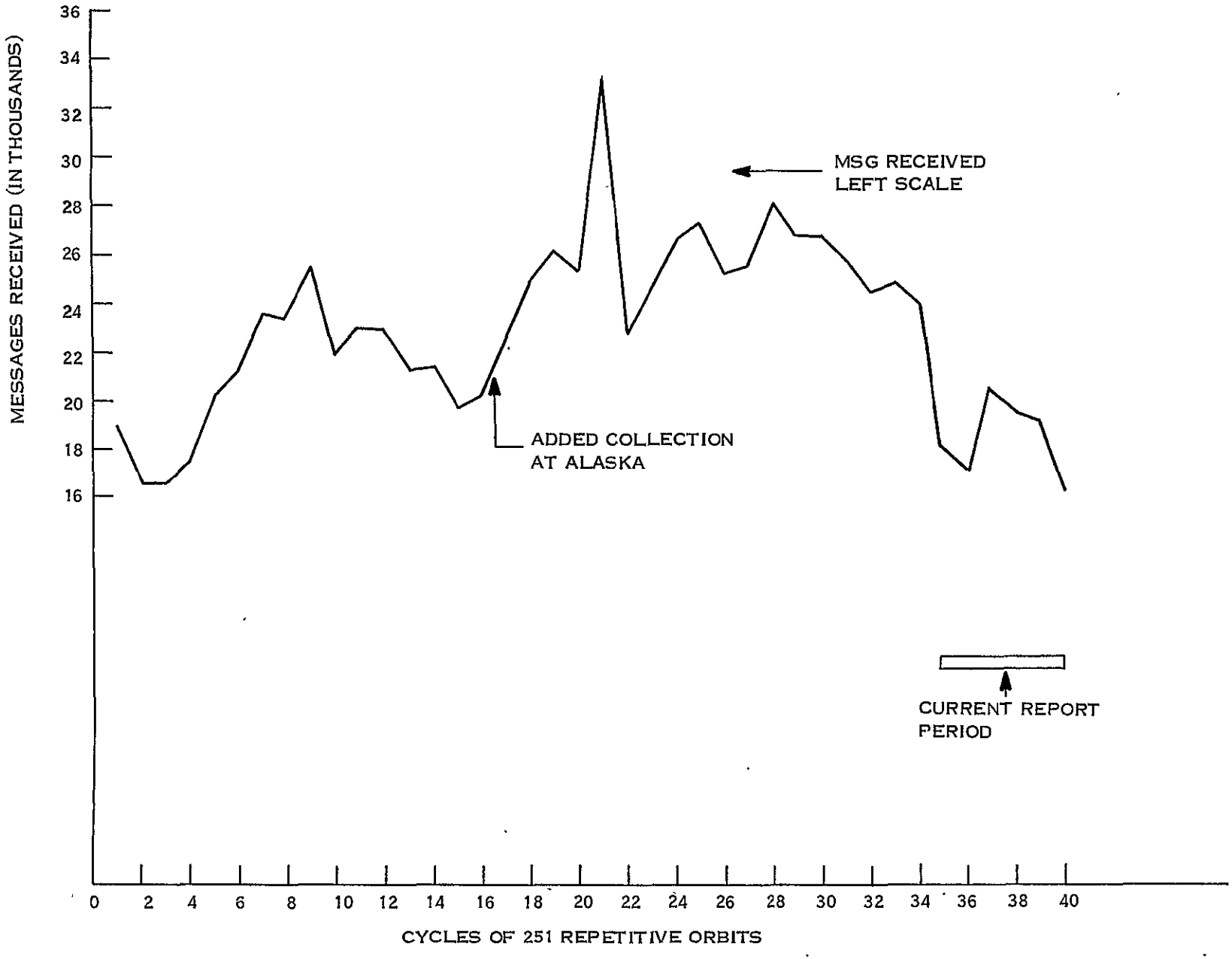

Figure 18-1. DCS Message History

APPENDIX A

LANDSAT-2 ANOMALY LIST

Landsat-2 Anomalies and Observations

Date	Anomaly/ Observation	How Observed	Comments
Prelaunch	Forward Scanner Pressure Leak	Spacecraft Integration	Before launch pressure increased. After launch pressure decreased. No anticipated effect on Scanner or S/C mission.
Prelaunch	Defective TLM Functions 1264, 4002, 13200	Spacecraft Integration	Functions measure non-critical temperatures. Sensors failed prior to launch. Mission unaffected
3/8/75	Unencoded command 781, CIU Channel B Off, received by spacecraft from RF Interference. Commands 782 or 786, switch comdecs; and commands 780 or 784, switch PWM regulator, received at other times.	On-Line	Non-Landsat OCC Authorized Unencoded commands received in Orbit 619, 640, 743, 1575, 1700, 2605, 3164, 4769, 5025, 7925, 8721, 8804, 9523, 9863.
3/17/75	MMCA Pitch Flux Density TLM Drift	Off-Line	Telemetry decreased 5 counts and indicates increase flux density on charged magnet. Probable sensor drift. No apparent effect on S/C performance.
4/5/75	WBVTR-1 Rewind Failure (MDR E01252)	On-Line	WBVTR-1 failed to execute Rewind command or prematurely terminated rewinds due to false BOT signal. Subsequent commands or Fool-Logic techniques allowed return to operation. Investigation Committee report issued. Problems occurred Orbit 1021, 1532, 1568, 2238. Operation restricted to 300 thru 1500 feet.
6/9/75	WBVTR-2 had Short Rewind (MDR E01255)	On-Line	WBVTR-2 started rewind but stopped prematurely in Orbit 1919 and again in Orbit 3854. Investigation Committee did not define a probable cause but assigned a momentary False BOT as reason for short rewind. Unit remains operational.
8/3/75	WBVTR-1 data did not provide sync to ground station (MDR D04930)	On-Line	One head circuit of WBVTR-1 failed to operate. 25% of data lost in data stream. Operation discontinued until early 1976, when it was used with RBV only.
11/14/75	MSS False End-of-Line Codes (MDR D04940)	Off-Line	Occasional End-of-Line codes occurring in preamble or along video data. Creates 4 black and 4 white words in scene data. Occurs over magnetic anomalies with low incidence rate operation continued.
1/25/76	Solar Array Current Notch (MDR D04934)	On-Line	In Orbit 5123, abnormal drops in solar array current appeared for portion of satellite day. S/C operation unaffected because solar array has excess power to date.
7/20/76	Battery 6 Turned Off	On-Line & Off-Line	Battery 6 decreased in load share and rose in charge share thereby causing overcharge. Temperature increased and unit was turned off in Orbit 7601. (Returned to service in Orbit 7992.)
7/29/76	WBVTR-2 Automatic Shutdown by SMART	On-Line	SMART circuits detected high headwheel currents in Orbit 7720 and shutdown WBVTR-2. WBVTR-2 operation was normal; high headwheel current assigned to slipped phase. Normal operation resumed.
8/20/76	Battery 1 Turned Off	On-Line/ Off-Line	Battery 1 increased in load share and rose in charge share; thereby causing overcharge. Temperature increased and unit was turned off in Orbit 8028. Returned to service in Orbit 8509.
9/29/76	Battery 6 Turned Off	On-Line/ Off-Line	Battery 6 decreased in load share and rose to charge share; thereby causing overcharge. Temperature increased and unit was turned off in Orbit 8591. Returned to service in Orbit 9164.
10/24/76	Battery 6 Turned Off	On-Line/ Off-Line	Battery 6 turned off for restoration cycle in Orbit 9652. See 7/26/65 and 8/20/76 above.
12/21/76	WBVTR-2 had 30% high P/B speed (MDRD04936)	On-Line	Ground equipment would not synch on WBVTR-2 P/B data during Orbit 9738 P/B. Analysis showed P/B speed was 30% high. Toggling, record to P/B, restored normal operation. Reoccurred and cured by toggling in Orbits 9930 and 10199.
1/15/77	WBVTR-1 second head failed (MDR D04937)	On-Line	Observation of CRT trace during WBVTR-1 RBV P/B data in Orbit 10086 showed second head failed. Operation discontinued.

APPENDIX B

LANDSAT-2 SPACECRAFT ORBIT REFERENCE TABLES

LANDSAT-2

SPACECRAFT ORBIT REFERENCE TABLES

FROM OCTOBER 1976 THROUGH MARCH, 1978

ORBITS 8608 THROUGH 16123

FLIGHT DAY 618 THROUGH 1156

LANDSAT-2

OCT, 1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	275	618	8608- 8621	15- 28	2	34
2	276	619	8622- 8635	29- 42	3	34
3	277	620	8636- 8649	43- 56	4	34
4	278	621	8650- 8663	57- 70	5	34
5	279	622	8664- 8677	71- 84	6	34
6	280	623	8678- 8691	85- 98	7	34
7	281	624	8692- 8705	99-112	8	34
8	282	625	8706- 8719	113-126	9	34
9	283	626	8720- 8732	127-139	10	34
10	284	627	8733- 8746	140-153	11	34
11	285	628	8747- 8760	154-167	12	34
12	286	629	8761- 8774	168-181	13	34
13	287	630	8775- 8788	182-195	14	34
14	288	631	8789- 8802	196-209	15	34
15	289	632	8803- 8816	210-223	16	34
16	290	633	8817- 8830	224-237	17	34
17	291	634	8831- 8844	238-251	18	34
18	292	635	8845- 8858	1- 14	1	35
19	293	636	8859- 8872	15- 28	2	35
20	294	637	8873- 8886	29- 42	3	35
21	295	638	8887- 8900	43- 56	4	35
22	296	639	8901- 8914	57- 70	5	35
23	297	640	8915- 8928	71- 84	6	35
24	298	641	8929- 8942	85- 98	7	35
25	299	642	8943- 8956	99-112	8	35
26	300	643	8957- 8970	113-126	9	35
27	301	644	8971- 8983	127-139	10	35
28	302	645	8984- 8997	140-153	11	35
29	303	646	8998- 9011	154-167	12	35
30	304	647	9012- 9025	168-181	13	35
31	305	648	9026- 9039	182-195	14	35

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NOV, 1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	306	649	9040- 9053	196-209	15	35
2	307	650	9054- 9067	210-223	16	35
3	308	651	9068- 9081	224-237	17	35
4	309	652	9082- 9095	238-251	18	35
5	310	653	9096- 9109	1- 14	1	36
6	311	654	9110- 9123	15- 28	2	36
7	312	655	9124- 9137	29- 42	3	36
8	313	656	9138- 9151	43- 56	4	36
9	314	657	9152- 9165	57- 70	5	36
10	315	658	9166- 9179	71- 84	6	36
11	316	659	9180- 9193	85- 98	7	36
12	317	660	9194- 9207	99-112	8	36
13	318	661	9208- 9221	113-126	9	36
14	319	662	9222- 9234	127-139	10	36
15	320	663	9235- 9248	140-153	11	36
16	321	664	9249- 9262	154-167	12	36
17	322	665	9263- 9276	168-181	13	36
18	323	666	9277- 9290	182-195	14	36
19	324	667	9291- 9304	196-209	15	36
20	325	668	9305- 9318	210-223	16	36
21	326	669	9319- 9332	224-237	17	36
22	327	670	9333- 9346	238-251	18	36
23	328	671	9347- 9360	1- 14	1	37
24	329	672	9361- 9374	15- 28	2	37
25	330	673	9375- 9388	29- 42	3	37
26	331	674	9389- 9402	43- 56	4	37
27	332	675	9403- 9416	57- 70	5	37
28	333	676	9417- 9430	71- 84	6	37
29	334	677	9431- 9444	85- 98	7	37
30	335	678	9445- 9458	99-112	8	37

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DEC, 1976

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	336	679	9459- 9472	113-126	9	37
2	337	680	9473- 9485	127-139	10	37
3	338	681	9486- 9499	140-153	11	37
4	339	682	9500- 9513	154-167	12	37
5	340	683	9514- 9527	168-181	13	37
6	341	684	9528- 9541	182-195	14	37
7	342	685	9542- 9555	196-209	15	37
8	343	686	9556- 9569	210-223	16	37
9	344	687	9570- 9583	224-237	17	37
10	345	688	9584- 9597	238-251	18	37
11	346	689	9598- 9611	1- 14	1	38
12	347	690	9612- 9625	15- 28	2	38
13	348	691	9626- 9639	29- 42	3	38
14	349	692	9640- 9653	43- 56	4	38
15	350	693	9654- 9667	57- 70	5	38
16	351	694	9668- 9681	71- 84	6	38
17	352	695	9682- 9695	85- 98	7	38
18	353	696	9696- 9709	99-112	8	38
19	354	697	9710- 9723	113-126	9	38
20	355	698	9724- 9736	127-139	10	38
21	356	699	9737- 9750	140-153	11	38
22	357	700	9751- 9764	154-167	12	38
23	358	701	9765- 9778	168-181	13	38
24	359	702	9779- 9792	182-195	14	38
25	360	703	9793- 9806	196-209	15	38
26	361	704	9807- 9820	210-223	16	38
27	362	705	9821- 9834	224-237	17	38
28	363	706	9835- 9848	238-251	18	38
29	364	707	9849- 9862	1- 14	1	39
30	365	708	9863- 9876	15- 28	2	39
31	366	709	9877- 9890	29- 42	3	39

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JAN. 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF. DAY	CYCLE NO.
1	1	710	9891- 9904	42- 56	4	39
2	2	711	9905- 9918	57- 70	5	39
3	3	712	9919- 9932	71- 84	6	39
4	4	713	9933- 9946	85- 98	7	39
5	5	714	9947- 9960	99-112	8	39
6	6	715	9961- 9974	113-126	9	39
7	7	716	9975- 9987	127-139	10	39
8	8	717	9988-10001	140-153	11	39
9	9	718	10002-10015	154-167	12	39
10	10	719	10016-10029	168-181	13	39
11	11	720	10030-10043	182-195	14	39
12	12	721	10044-10057	196-209	15	39
13	13	722	10058-10071	210-223	16	39
14	14	723	10072-10085	224-237	17	39
15	15	724	10086-10099	238-251	18	39
16	16	725	10100-10113	1- 14	1	40
17	17	726	10114-10127	15- 28	2	40
18	18	727	10128-10141	29- 42	3	40
19	19	728	10142-10155	43- 56	4	40
20	20	729	10156-10169	57- 70	5	40
21	21	730	10170-10183	71- 84	6	40
22	22	731	10184-10197	85- 98	7	40
23	23	732	10198-10211	99-112	8	40
24	24	733	10212-10225	113-126	9	40
25	25	734	10226-10238	127-139	10	40
26	26	735	10239-10252	140-153	11	40
27	27	736	10253-10266	154-167	12	40
28	28	737	10267-10280	168-181	13	40
29	29	738	10281-10294	182-195	14	40
30	30	739	10295-10308	196-209	15	40
31	31	740	10309-10322	210-223	16	40

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FEB, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	741	10323-10336	224-237	17	40
2	33	742	10337-10350	238-251	18	40
3	34	743	10351-10364	1- 14	1	41
4	35	744	10365-10378	15- 28	2	41
5	36	745	10379-10392	29- 42	3	41
6	37	746	10393-10406	43- 56	4	41
7	38	747	10407-10420	57- 70	5	41
8	39	748	10421-10434	71- 84	6	41
9	40	749	10435-10448	85- 98	7	41
10	41	750	10449-10462	99-112	8	41
11	42	751	10463-10476	113-126	9	41
12	43	752	10477-10489	127-139	10	41
13	44	753	10490-10503	140-153	11	41
14	45	754	10504-10517	154-167	12	41
15	46	755	10518-10531	168-181	13	41
16	47	756	10532-10545	182-195	14	41
17	48	757	10546-10559	196-209	15	41
18	49	758	10560-10573	210-223	16	41
19	50	759	10574-10587	224-237	17	41
20	51	760	10588-10601	238-251	18	41
21	52	761	10602-10615	1- 14	1	42
22	53	762	10616-10629	15- 28	2	42
23	54	763	10630-10643	29- 42	3	42
24	55	764	10644-10657	43- 56	4	42
25	56	765	10658-10671	57- 70	5	42
26	57	766	10672-10685	71- 84	6	42
27	58	767	10686-10699	85- 98	7	42
28	59	768	10700-10713	99-112	8	42

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MAR, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE No.
1	60	769	10714-10727	113-126	9	42
2	61	770	10728-10740	127-139	10	42
3	62	771	10741-10754	140-153	11	42
4	63	772	10755-10768	154-167	12	42
5	64	773	10769-10782	168-181	13	42
6	65	774	10783-10796	182-195	14	42
7	66	775	10797-10810	196-209	15	42
8	67	776	10811-10824	210-223	16	42
9	68	777	10825-10838	224-237	17	42
10	69	778	10839-10852	238-251	18	42
11	70	779	10853-10866	1- 14	1	43
12	71	780	10867-10880	15- 28	2	43
13	72	781	10881-10894	29- 42	3	43
14	73	782	10895-10908	43- 56	4	43
15	74	783	10909-10922	57- 70	5	43
16	75	784	10923-10936	71- 84	6	43
17	76	785	10937-10950	85- 98	7	43
18	77	786	10951-10964	99-112	8	43
19	78	787	10965-10978	113-126	9	43
20	79	788	10979-10991	127-139	10	43
21	80	789	10992-11005	140-153	11	43
22	81	790	11006-11019	154-167	12	43
23	82	791	11020-11033	168-181	13	43
24	83	792	11034-11047	182-195	14	43
25	84	793	11048-11061	196-209	15	43
26	85	794	11062-11075	210-223	16	43
27	86	795	11076-11089	224-237	17	43
28	87	796	11090-11103	238-251	18	43
29	88	797	11104-11117	1- 14	1	44
30	89	798	11118-11131	15- 28	2	44
31	90	799	11132-11145	29- 42	3	44

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APR, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	800	11146-11159	43- 56	4	44
2	92	801	11160-11173	57- 70	5	44
3	93	802	11174-11187	71- 84	6	44
4	94	803	11188-11201	85- 98	7	44
5	95	804	11202-11215	99-112	8	44
6	96	805	11216-11229	113-126	9	44
7	97	806	11230-11242	127-139	10	44
8	98	807	11243-11256	140-153	11	44
9	99	808	11257-11270	154-167	12	44
10	100	809	11271-11284	168-181	13	44
11	101	810	11285-11298	182-195	14	44
12	102	811	11299-11312	196-209	15	44
13	103	812	11313-11326	210-223	16	44
14	104	813	11327-11340	224-237	17	44
15	105	814	11341-11354	238-251	18	44
16	106	815	11355-11368	1- 14	1	45
17	107	816	11369-11382	15- 28	2	45
18	108	817	11383-11396	29- 42	3	45
19	109	818	11397-11410	43- 56	4	45
20	110	819	11411-11424	57- 70	5	45
21	111	820	11425-11438	71- 84	6	45
22	112	821	11439-11452	85- 98	7	45
23	113	822	11453-11466	99-112	8	45
24	114	823	11467-11480	113-126	9	45
25	115	824	11481-11493	127-139	10	45
26	116	825	11494-11507	140-153	11	45
27	117	826	11508-11521	154-167	12	45
28	118	827	11522-11535	168-181	13	45
29	119	828	11536-11549	182-195	14	45
30	120	829	11550-11563	196-209	15	45

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MAY, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	830	11564-11577	210-223	16	45
2	122	831	11578-11591	224-237	17	45
3	123	832	11592-11605	238-251	18	45
4	124	833	11606-11619	1- 14	1	46
5	125	834	11620-11633	15- 28	2	46
6	126	835	11634-11647	29- 42	3	46
7	127	836	11648-11661	43- 56	4	46
8	128	837	11662-11675	57- 70	5	46
9	129	838	11676-11689	71- 84	6	46
10	130	839	11690-11703	85- 98	7	46
11	131	840	11704-11717	99-112	8	46
12	132	841	11718-11731	113-126	9	46
13	133	842	11732-11744	127-139	10	46
14	134	843	11745-11758	140-153	11	46
15	135	844	11759-11772	154-167	12	46
16	136	845	11773-11786	168-181	13	46
17	137	846	11787-11800	182-195	14	46
18	138	847	11801-11814	196-209	15	46
19	139	848	11815-11828	210-223	16	46
20	140	849	11829-11842	224-237	17	46
21	141	850	11843-11856	238-251	18	46
22	142	851	11857-11870	1- 14	1	47
23	143	852	11871-11884	15- 28	2	47
24	144	853	11885-11898	29- 42	3	47
25	145	854	11899-11912	43- 56	4	47
26	146	855	11913-11926	57- 70	5	47
27	147	856	11927-11940	71- 84	6	47
28	148	857	11941-11954	85- 98	7	47
29	149	858	11955-11968	99-112	8	47
30	150	859	11969-11982	113-126	9	47
31	151	860	11983-11995	127-139	10	47

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JUN, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	861	11996-12009	140-153	11	47
2	153	862	12010-12023	154-167	12	47
3	154	863	12024-12037	168-181	13	47
4	155	864	12038-12051	182-195	14	47
5	156	865	12052-12065	196-209	15	47
6	157	866	12066-12079	210-223	16	47
7	158	867	12080-12093	224-237	17	47
8	159	868	12094-12107	238-251	18	47
9	160	869	12108-12121	1- 14	1	48
10	161	870	12122-12135	15- 28	2	48
11	162	871	12136-12149	29- 42	3	48
12	163	872	12150-12163	43- 56	4	48
13	164	873	12164-12177	57- 70	5	48
14	165	874	12178-12191	71- 84	6	48
15	166	875	12192-12205	85- 98	7	48
16	167	876	12206-12219	99-112	8	48
17	168	877	12220-12233	113-126	9	48
18	169	878	12234-12246	127-139	10	48
19	170	879	12247-12260	140-153	11	48
20	171	880	12261-12274	154-167	12	48
21	172	881	12275-12288	168-181	13	48
22	173	882	12289-12302	182-195	14	48
23	174	883	12303-12316	196-209	15	48
24	175	884	12317-12330	210-223	16	48
25	176	885	12331-12344	224-237	17	48
26	177	886	12345-12358	238-251	18	48
27	178	887	12359-12372	1- 14	1	49
28	179	888	12373-12386	15- 28	2	49
29	180	889	12387-12400	29- 42	3	49
30	181	890	12401-12414	43- 56	4	49

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JUL, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	891	12415-12428	57- 70	5	49
2	183	892	12429-12442	71- 84	6	49
3	184	893	12443-12456	85- 98	7	49
4	185	894	12457-12470	99-112	8	49
5	186	895	12471-12484	113-126	9	49
6	187	896	12485-12497	127-139	10	49
7	188	897	12498-12511	140-153	11	49
8	189	898	12512-12525	154-167	12	49
9	190	899	12526-12539	168-181	13	49
10	191	900	12540-12553	182-195	14	49
11	192	901	12554-12567	196-209	15	49
12	193	902	12568-12581	210-223	16	49
13	194	903	12582-12595	224-237	17	49
14	195	904	12596-12609	238-251	18	49
15	196	905	12610-12623	1- 14	1	50
16	197	906	12624-12637	15- 28	2	50
17	198	907	12638-12651	29- 42	3	50
18	199	908	12652-12665	43- 56	4	50
19	200	909	12666-12679	57- 70	5	50
20	201	910	12680-12693	71- 84	6	50
21	202	911	12694-12707	85- 98	7	50
22	203	912	12708-12721	99-112	8	50
23	204	913	12722-12735	113-126	9	50
24	205	914	12736-12748	127-139	10	50
25	206	915	12749-12762	140-153	11	50
26	207	916	12763-12776	154-167	12	50
27	208	917	12777-12790	168-181	13	50
28	209	918	12791-12804	182-195	14	50
29	210	919	12805-12818	196-209	15	50
30	211	920	12819-12832	210-223	16	50
31	212	921	12833-12846	224-237	17	50

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AUG, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	922	12847-12860	238-251	18	50
2	214	923	12861-12874	1- 14	1	51
3	215	924	12875-12888	15- 28	2	51
4	216	925	12889-12902	29- 42	3	51
5	217	926	12903-12916	43- 56	4	51
6	218	927	12917-12930	57- 70	5	51
7	219	928	12931-12944	71- 84	6	51
8	220	929	12945-12958	85- 98	7	51
9	221	930	12959-12972	99-112	8	51
10	222	931	12973-12986	113-126	9	51
11	223	932	12987-12999	127-139	10	51
12	224	933	13000-13013	140-153	11	51
13	225	934	13014-13027	154-167	12	51
14	226	935	13028-13041	168-181	13	51
15	227	936	13042-13055	182-195	14	51
16	228	937	13056-13069	196-209	15	51
17	229	938	13070-13083	210-223	16	51
18	230	939	13084-13097	224-237	17	51
19	231	940	13098-13111	238-251	18	51
20	232	941	13112-13125	1- 14	1	52
21	233	942	13126-13139	15- 28	2	52
22	234	943	13140-13153	29- 42	3	52
23	235	944	13154-13167	43- 56	4	52
24	236	945	13168-13181	57- 70	5	52
25	237	946	13182-13195	71- 84	6	52
26	238	947	13196-13209	85- 98	7	52
27	239	948	13210-13223	99-112	8	52
28	240	949	13224-13237	113-126	9	52
29	241	950	13238-13250	127-139	10	52
30	242	951	13251-13264	140-153	11	52
31	243	952	13265-13278	154-167	12	52

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SEP, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	953	13279-13292	168-181	13	52
2	245	954	13293-13306	182-195	14	52
3	246	955	13307-13320	196-209	15	52
4	247	956	13321-13334	210-223	16	52
5	248	957	13335-13348	224-237	17	52
6	249	958	13349-13362	238-251	18	52
7	250	959	13363-13376	1- 14	1	53
8	251	960	13377-13390	15- 28	2	53
9	252	961	13391-13404	29- 42	3	53
10	253	962	13405-13418	43- 56	4	53
11	254	963	13419-13432	57- 70	5	53
12	255	964	13433-13446	71- 84	6	53
13	256	965	13447-13460	85- 98	7	53
14	257	966	13461-13474	99-112	8	53
15	258	967	13475-13488	113-126	9	53
16	259	968	13489-13501	127-139	10	53
17	260	969	13502-13515	140-153	11	53
18	261	970	13516-13529	154-167	12	53
19	262	971	13530-13543	168-181	13	53
20	263	972	13544-13557	182-195	14	53
21	264	973	13558-13571	196-209	15	53
22	265	974	13572-13585	210-223	16	53
23	266	975	13586-13599	224-237	17	53
24	267	976	13600-13613	238-251	18	53
25	268	977	13614-13627	1- 14	1	54
26	269	978	13628-13641	15- 28	2	54
27	270	979	13642-13655	29- 42	3	54
28	271	980	13656-13669	43- 56	4	54
29	272	981	13670-13683	57- 70	5	54
30	273	982	13684-13697	71- 84	6	54

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OCT, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	983	13698-13711	85- 98	7	54
2	275	984	13712-13725	99-112	8	54
3	276	985	13726-13739	113-126	9	54
4	277	986	13740-13752	127-139	10	54
5	278	987	13753-13766	140-153	11	54
6	279	988	13767-13780	154-167	12	54
7	280	989	13781-13794	168-181	13	54
8	281	990	13795-13808	182-195	14	54
9	282	991	13809-13822	196-209	15	54
10	283	992	13823-13836	210-223	16	54
11	284	993	13837-13850	224-237	17	54
12	285	994	13851-13864	238-251	18	54
13	286	995	13865-13878	1- 14	1	55
14	287	996	13879-13892	15- 28	2	55
15	288	997	13893-13906	29- 42	3	55
16	289	998	13907-13920	43- 56	4	55
17	290	999	13921-13934	57- 70	5	55
18	291	1000	13935-13948	71- 84	6	55
19	292	1001	13949-13962	85- 98	7	55
20	293	1002	13963-13976	99-112	8	55
21	294	1003	13977-13990	113-126	9	55
22	295	1004	13991-14003	127-139	10	55
23	296	1005	14004-14017	140-153	11	55
24	297	1006	14018-14031	154-167	12	55
25	298	1007	14032-14045	168-181	13	55
26	299	1008	14046-14059	182-195	14	55
27	300	1009	14060-14073	196-209	15	55
28	301	1010	14074-14087	210-223	16	55
29	302	1011	14088-14101	224-237	17	55
30	303	1012	14102-14115	238-251	18	55
31	304	1013	14116-14129	1- 14	1	56

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NOV, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	1014	14130-14143	15- 28	2	56
2	306	1015	14144-14157	29- 42	3	56
3	307	1016	14158-14171	43- 56	4	56
4	308	1017	14172-14185	57- 70	5	56
5	309	1018	14186-14199	71- 84	6	56
6	310	1019	14200-14213	85- 98	7	56
7	311	1020	14214-14227	99-112	8	56
8	312	1021	14228-14241	113-126	9	56
9	313	1022	14242-14254	127-139	10	56
10	314	1023	14255-14268	140-153	11	56
11	315	1024	14269-14282	154-167	12	56
12	316	1025	14283-14296	168-181	13	56
13	317	1026	14297-14310	182-195	14	56
14	318	1027	14311-14324	196-209	15	56
15	319	1028	14325-14338	210-223	16	56
16	320	1029	14339-14352	224-237	17	56
17	321	1030	14353-14366	238-251	18	56
18	322	1031	14367-14380	1- 14	1	57
19	323	1032	14381-14394	15- 28	2	57
20	324	1033	14395-14408	29- 42	3	57
21	325	1034	14409-14422	43- 56	4	57
22	326	1035	14423-14436	57- 70	5	57
23	327	1036	14437-14450	71- 84	6	57
24	328	1037	14451-14464	85- 98	7	57
25	329	1038	14465-14478	99-112	8	57
26	330	1039	14479-14492	113-126	9	57
27	331	1040	14493-14505	127-139	10	57
28	332	1041	14506-14519	140-153	11	57
29	333	1042	14520-14533	154-167	12	57
30	334	1043	14534-14547	168-181	13	57

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DEC, 1977

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE No.
1	335	1044	14548-14561	182-195	14	57
2	336	1045	14562-14575	196-209	15	57
3	337	1046	14576-14589	210-223	16	57
4	338	1047	14590-14603	224-237	17	57
5	339	1048	14604-14617	238-251	18	57
6	340	1049	14618-14631	1- 14	1	58
7	341	1050	14632-14645	15- 28	2	58
8	342	1051	14646-14659	29- 42	3	58
9	343	1052	14660-14673	43- 56	4	58
10	344	1053	14674-14687	57- 70	5	58
11	345	1054	14688-14701	71- 84	6	58
12	346	1055	14702-14715	85- 98	7	58
13	347	1056	14716-14729	99-112	8	58
14	348	1057	14730-14743	113-126	9	58
15	349	1058	14744-14756	127-139	10	58
16	350	1059	14757-14770	140-153	11	58
17	351	1060	14771-14784	154-167	12	58
18	352	1061	14785-14798	168-181	13	58
19	353	1062	14799-14812	182-195	14	58
20	354	1063	14813-14826	196-209	15	58
21	355	1064	14827-14840	210-223	16	58
22	356	1065	14841-14854	224-237	17	58
23	357	1066	14855-14868	238-251	18	58
24	358	1067	14869-14882	1- 14	1	59
25	359	1068	14883-14896	15- 28	2	59
26	360	1069	14897-14910	29- 42	3	59
27	361	1070	14911-14924	43- 56	4	59
28	362	1071	14925-14938	57- 70	5	59
29	363	1072	14939-14952	71- 84	6	59
30	364	1073	14953-14966	85- 98	7	59
31	365	1074	14967-14980	99-112	8	59

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JAN, 1978

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	1075	14981-14994	113-126	9	59
2	2	1076	14995-15007	127-139	10	59
3	3	1077	15008-15021	140-153	11	59
4	4	1078	15022-15035	154-167	12	59
5	5	1079	15036-15049	168-181	13	59
6	6	1080	15050-15063	182-195	14	59
7	7	1081	15064-15077	196-209	15	59
8	8	1082	15078-15091	210-223	16	59
9	9	1083	15092-15105	224-237	17	59
10	10	1084	15106-15119	238-251	18	59
11	11	1085	15120-15133	1- 14	1	60
12	12	1086	15134-15147	15- 28	2	60
13	13	1087	15148-15161	29- 42	3	60
14	14	1088	15162-15175	43- 56	4	60
15	15	1089	15176-15189	57- 70	5	60
16	16	1090	15190-15203	71- 84	6	60
17	17	1091	15204-15217	85- 98	7	60
18	18	1092	15218-15231	99-112	8	60
19	19	1093	15232-15245	113-126	9	60
20	20	1094	15246-15258	127-139	10	60
21	21	1095	15259-15272	140-153	11	60
22	22	1096	15273-15286	154-167	12	60
23	23	1097	15287-15300	168-181	13	60
24	24	1098	15301-15314	182-195	14	60
25	25	1099	15315-15328	196-209	15	60
26	26	1100	15329-15342	210-223	16	60
27	27	1101	15343-15356	224-237	17	60
28	28	1102	15357-15370	238-251	18	60
29	29	1103	15371-15384	1- 14	1	61
30	30	1104	15385-15398	15- 28	2	61
31	31	1105	15399-15412	29- 42	3	61

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FEB. 1978

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	1106	15413-15426	43- 56	4	61
2	33	1107	15427-15440	57- 70	5	61
3	34	1108	15441-15454	71- 84	6	61
4	35	1109	15455-15468	85- 98	7	61
5	36	1110	15469-15482	99-112	8	61
6	37	1111	15483-15496	113-126	9	61
7	38	1112	15497-15509	127-139	10	61
8	39	1113	15510-15523	140-153	11	61
9	40	1114	15524-15537	154-167	12	61
10	41	1115	15538-15551	168-181	13	61
11	42	1116	15552-15565	182-195	14	61
12	43	1117	15566-15579	196-209	15	61
13	44	1118	15580-15593	210-223	16	61
14	45	1119	15594-15607	224-237	17	61
15	46	1120	15608-15621	238-251	18	61
16	47	1121	15622-15635	1- 14	1	62
17	48	1122	15636-15649	15- 28	2	62
18	49	1123	15650-15663	29- 42	3	62
19	50	1124	15664-15677	43- 56	4	62
20	51	1125	15678-15691	57- 70	5	62
21	52	1126	15692-15705	71- 84	6	62
22	53	1127	15706-15719	85- 98	7	62
23	54	1128	15720-15733	99-112	8	62
24	55	1129	15734-15747	113-126	9	62
25	56	1130	15748-15760	127-139	10	62
26	57	1131	15761-15774	140-153	11	62
27	58	1132	15775-15788	154-167	12	62
28	59	1133	15789-15802	168-181	13	62

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DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	1134	15803-15816	182-195	14	62
2	61	1135	15817-15830	196-209	15	62
3	62	1136	15831-15844	210-223	16	62
4	63	1137	15845-15858	224-237	17	62
5	64	1138	15859-15872	238-251	18	62
6	65	1139	15873-15886	1- 14	1	63
7	66	1140	15887-15900	15- 28	2	63
8	67	1141	15901-15914	29- 42	3	63
9	68	1142	15915-15928	43- 56	4	63
10	69	1143	15929-15942	57- 70	5	63
11	70	1144	15943-15956	71- 84	6	63
12	71	1145	15957-15970	85- 98	7	63
13	72	1146	15971-15984	99-112	8	63
14	73	1147	15985-15998	113-126	9	63
15	74	1148	15999-16011	127-139	10	63
16	75	1149	16012-16025	140-153	11	63
17	76	1150	16026-16039	154-167	12	63
18	77	1151	16040-16053	168-181	13	63
19	78	1152	16054-16067	182-195	14	63
20	79	1153	16068-16081	196-209	15	63
21	80	1154	16082-16095	210-223	16	63
22	81	1155	16096-16109	224-237	17	63
23	82	1156	16110-16123	238-251	18	63

STOP 0

APPENDIX C

LANDSAT-2 DOCUMENTS ISSUED THIS REPORT PERIOD

APPENDIX C

LANDSAT-2 DOCUMENTS ISSUED THIS REPORT

No.	Document No.	Title and Data
1	PIR-1N25-L-1/2-193	Recommended Tests Regarding Frequency Drifts in Landsat Link 2 and 3, dated 8 November 1976.

GENERAL ELECTRIC

Space Division

Headquarters: Valley Forge, Pennsylvania ☐ Daytona Beach, Fla. ☐ Evendale, Ohio

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