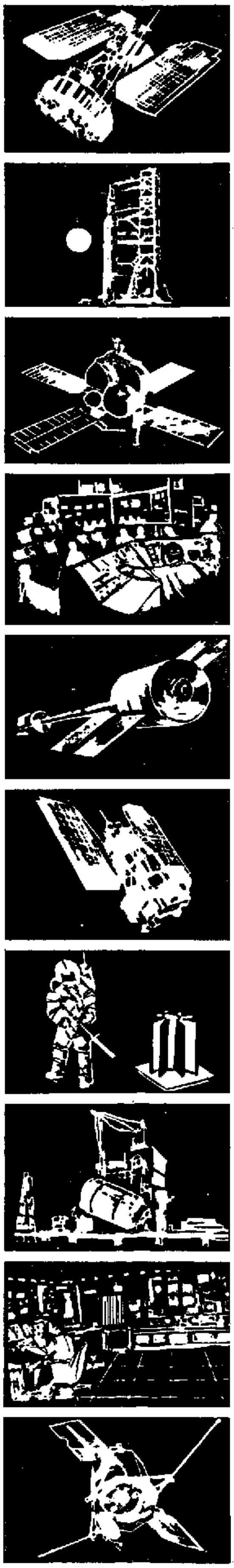
74SD4236
15 AUGUST 1974

SPACE DIVISION



ERTS 1 FLIGHT EVALUATION REPORT
23 APRIL 1974 TO 23 JULY 1974

Prepared By
GE ERTS OPERATIONS CONTROL CENTER

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

Contract NAS5-21808

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GENERAL ELECTRIC

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APPROVED: Thomas W. Winchester
Thomas W. Winchester

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SPACE DIVISION
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GENERAL ELECTRIC

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LIST OF ILLUSTRATIONS

INTRODUCTION

This is the ninth report in a continuing series of documents issued quarterly to present flight performance analysis of the ERTS-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 23 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

This report contains analyses of performance for the eighth quarter of operation i.e., Orbit 8908 to 10182.

SECTION 1

SUMMARY - ERTS-1 OPERATIONS

SECTION 1

SUMMARY - ERTS-1 OPERATIONS

The ERTS-1 spacecraft was launched from the Western Test Range on 23 July 1972 at 18:06:06.508Z. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147 after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196 when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands and since that time ERTS-1 has performed its mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. The remaining Wideband Video Tape Recorder experienced four suspensions of operation, but corrective measures have permitted resumption of limited operations the first three times. The last suspension of operations was in Orbit 9881 on 2 July 1974, and corrective measures are still being studied. In Orbit 4396 an integrated circuit chip in the TMP failed, disabling four TLM functions. COMSTOR "B" has an intermittent problem with cell 12, and the pitch flywheel duty cycle is somewhat higher than normal for this flight and also exhibited a two minute halt in Orbit 8040. The "B" section of the USB with full power output of 1.5 watts was substituted for the "A" section in Orbit 10068 because of excessive decline of transmitter power. Spacecraft performance has not been degraded by these anomalies thus far, except for the inability to record remote MSS imagery.

ORBITAL PARAMETERS

The initial orbit of ERTS-1 required some correction at Orbits 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. The ground trace was within the allowable band throughout this reporting period.

POWER SUBSYSTEM

The power subsystem performed well throughout this report period. Solar array current has been slightly lower than predicted. Data from this period shows the array degradation to be -21.1% after 24 months in orbit. The power subsystem will meet ERTS-1 power requirements thru 1976 with the present payload configuration. Battery temperature spread remained low and performance of each battery remained good.

ATTITUDE CONTROL SUBSYSTEM

From the initial acquisition, the ACS performance has been excellent. All functions are active and well within specifications. Perturbations due to sun glint in the IR horizon scanners are not disruptive enough to necessitiate single scanner mode. Gating frequency decreased during this period conforming to performance at this time last year. The forward IR scanner pressure has decreased slightly (4.6 PSIA at launch, 3.50 PSIA at Orbit 10182). Pitch, roll and yaw flywheel drive duty cycles increase for short periods but return to normal. The increases in pitch are more sustained and a two minute halt in the pitch flywheel was noted in Orbit 8040. The pitch flywheel average speed was increased to obtain a better lubrication condition.

COMMAND/CLOCK SUBSYSTEM

All stored commands and real time commands have executed except for the expected one-in-approximately 10,000 associated with the logic race condition. No serious problems have resulted from these few commands failing to execute. Use of cell 12 COMSTOR "B" has been discontinued for active commands because of intermittent time delta errors of 256 seconds. Occasionally stored commands are blocked by real-time sequences which overlap in time. Specific cause has not been determined. The VHF command receiver was switched from side B to side A at the time of USB subsystem switchover to side B.

TELEMETRY SUBSYSTEM

The telemetry subsystem has consistently performed in an excellent manner. Memory Section 0, 0 has been in use since launch. All dropouts have been associated with known link or ground problems. Except for failure of an integrated circuit chip in the TMP (Orbit 4396), disabling four telemetry functions, all functions have performed in a nominal manner.

ORBIT ADJUST SUBSYSTEM

The orbit adjust subsystem has been fired eight times, using the -X thruster each time. Three firings were for initial correction, and five for orbit maintenance. All functions were normal with the expected ephemeris changes being achieved. Pressure/temperature parameters continue to be normal.

MAGNETIC MOMENT COMPENSATING ASSEMBLY

The Magnetic Moment Compensating Assembly has been operated five times prior to this report period and performance has been considered excellent. It has held the Pole-Cm values commanded in earlier orbits. Status Telemetry values continue to be normal.

UNIFIED "S" BAND/PRE-MODULATION PROCESSOR

The Unified S-Band Subsystem has operated satisfactorily since launch. On Orbit 10068 the B-Section was substituted for the A-Section because the A-transmitter power output had declined from 1.6 watts at launch to 0.14 watts with noticeable loss of DCS coverage. The B-transmitter has power output of 1.5 watts.

ELECTRICAL INTERFACE SUBSYSTEM

The Auxiliary Processing Unit (APU), Interface Switching Module (ISM) and Power Switching Module (PSM) performed normally in this report period. The RBV switching relay (within the PSM) failed in Orbit 196.

THERMAL CONTROL SUBSYSTEM

The thermal subsystem performed normally throughout this period. Temperatures decreased slightly due to decreasing sun intensity but had no noticeable effect on operation.

NARROWBAND TAPE RECORDER SUBSYSTEM

The Narrowband Tape Recorder Subsystem has continued to operate satisfactorily without incident. The total ON time is 9217 hours for each recorder (A and B).

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has continued to operate satisfactorily. The power output has continued at 20 watts since launch. WPA-2 is currently in use. WPA-1 was used with RBV to Orbit 196 and subsequently between Orbits 1890 and 2099 with MSS during Apollo 17 operations.

ATTITUDE MEASUREMENT SENSOR

The AMS continues to function normally in all aspects.

WIDEBAND VIDEO TAPE RECORDERS

Wideband Video Tape Recorder-2 failed after 10 days in orbit. Wideband Video Tape Recorder-1 has 3 prior gaps in its satisfactory performance since launch, and again has been temporarily removed from service since Orbit 9881 pending study of corrective action.

RETURN BEAM VIDICON

The Return Beam Vidicon has been idle since Orbit 196 when its prime input power switching relay failed. RBV performed satisfactorily up to that point and is available for use, if needed, by an alternate switching mode.

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem continues to operate in a completely satisfactory manner. It has imaged more than 27% of the earth's surface (including water) between the latitudes of 81.42°, including 78% of the continents, with a cloud cover of 30% or less. All units of the Subsystem are normal and stable.

DATA COLLECTION SYSTEM

The Data Collection Subsystem continues to operate satisfactorily. Only Receiver A has been used to date.

PAYLOAD OPERATION SUMMARY

Launch through Orbit 10182

Subsystem	Orbital On-Time HH:MM:SS	Operational Summary	
RBV	13:59:09	Total scenes photographed	1,690
		Average scenes per day	139
		Total area photographed (millions of square nautical miles)	14.7
		ON-OFF cycles	91
		% Real Time scenes	57
		% Recorded scenes	43
MSS	1431:59:24	Total scenes photographed	113,781
		Average scenes per day	184
		Total area photographed (millions of square nautical miles)	1166.5
		ON-OFF cycles	11284
		% Real Time scenes	65
		% Recorded scenes	35
DCS	17516:14:43	Messages received at OCC	945,451
		Non perfect messages	74,442
		Maximum Ground platforms active/day	110
		Users	43
		Average messages per orbit	186
WBVTR-1	882:25:04	% Record Mode	38
		% Playback Mode	41
		% Rewind Mode	20
		% Standby Mode	1
		Minor Frame Sync. Error Count during Playback	150
		Time Video Head-to tape contact	724:18:00
		Cycles of Head-to tape contact	12017
WBVTR-2	9:26:33	% Usage same as WBVTR-1 Failed in Orbit 148/9	
WPA-1	31:55:09	% Real Time Mode	55
		% Playback Mode	45
		(Used in Orbits 5 thru 196 and 1890 thru 2099)	
		ON-OFF cycles	311
WPA-2	1377:31:48	% Real Time Mode	65
		% Playback Mode	35
		(Used in Orbits 5 thru 1899 and since 2100)	
		ON-OFF cycles	8774

SECTION 2

ORBITAL PARAMETERS

SECTION 2

ORBITAL PARAMETERS

ERTS-1 launch and injection was satisfactory and required only a minor orbit adjust to achieve normal parameters. These adjustments were made in Orbits 38, 44 and 59. After several 18-day repeat cycles, orbit maintenance burns were made in Orbit 938, Orbit 2416, Orbit 6390 and Orbit 7826.

The orbital parameters are given in Table 2-1. Figure 2-1 shows the sub-satellite plot and Figure 2-2 shows the longitude error as a function of time and orbit maintenance burns. The longitude error has been maintained within the ± 10 nm average in the east-west direction at the equator as planned. Figure 2-3 shows the change of sun time at the descending node equator crossing. Appendix B gives ground trace repeat cycle predictions.

Table 2-1. Brouwer Mean Orbital Parameters

	Element		25 Oct 1972	25 Jan 1973	25 Apr 1973	25 July 1973	25 Oct 1973	25 Jan 1974	24 Apr 1974	23 July 1974
(1)	Apogee	KM	917.3	922.3	911.056	914.341	922.013	915.873	920.090	922.363
(2)	Perigee	KM	898.1	893.1	888.763	900.810	893.229	899.111	912.672	892.629
(3)	Inclination	deg	99.103	99.090	99.073	99.068	99.056	99.041	99.023	99.017
(4)	Semimajor Axis	KM	7,285.850	7,285.865	7,285.767	7,285.741	7,285.786	7,285.657	7,285.691	7,285.661
(5)	Eccentricity	---	0.00132	0.00200	0.00073	0.00093	0.00198	0.00115	0.000802	0.002041
(6)	Anomalistic Period	min	103.152	103.153	103.151	103.150	103.151	103.148	103.149	103.148
(7)	Nodal Period	min	103.268	103.268	103.267	103.266	103.266	103.264	103.265	103.264
(8)	Argument of Perigee	deg	93.721	133.693	168.857	95.602	65.071	160.866	117.631	109.225
(9)	Right Ascension	deg	1.060	91.805	181.411	268.944	0.2912	88.606	176.743	269.779
(10)	Mean Anomaly	deg	86.484	52.797	11.098	84.301	301.002	19.049	62.319	70.540

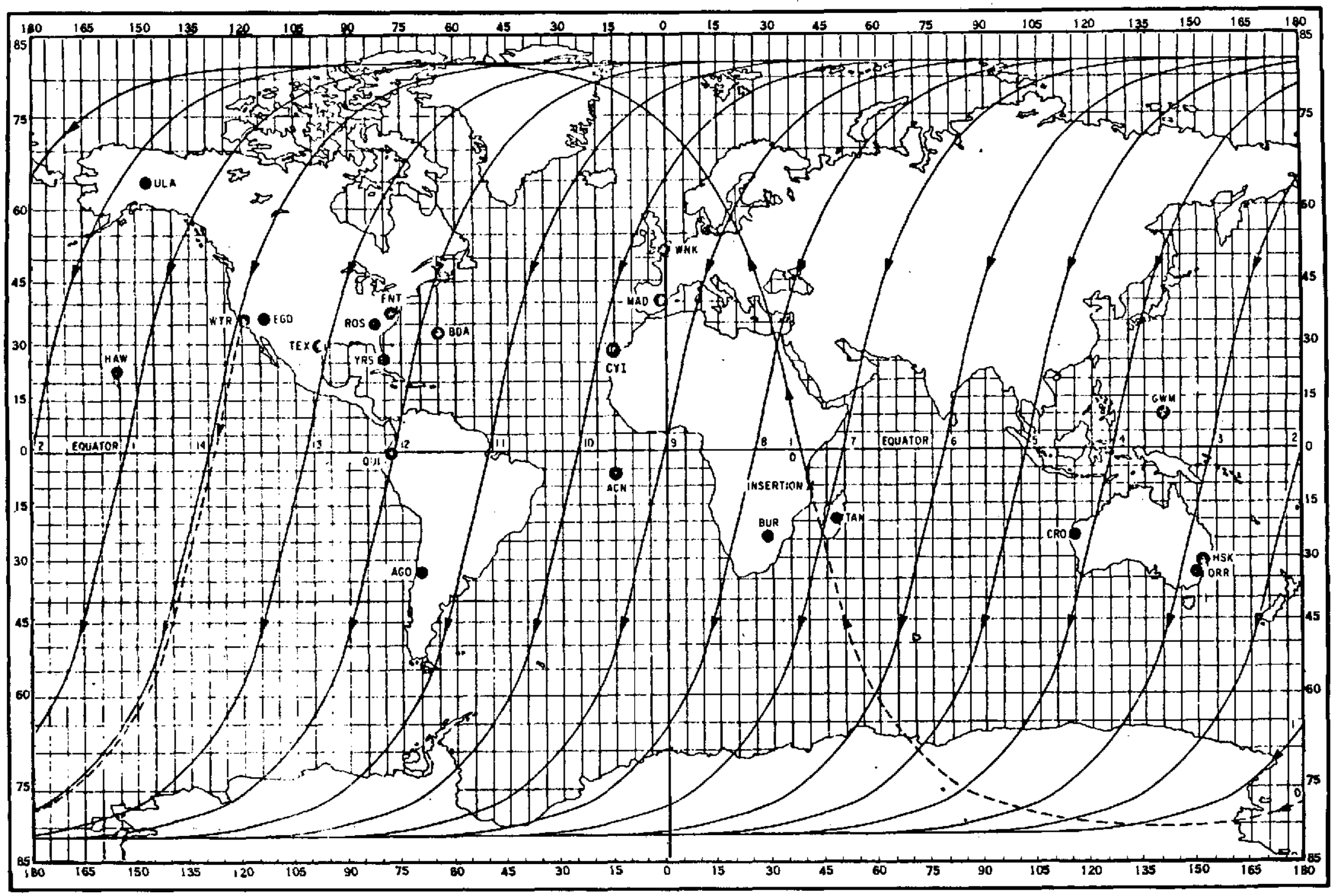


Figure 2-1. Typical Subsatellite Plot of the ERTS-1 Spacecraft

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

FOLDOUT FRAME 1

FOLDOUT FRAME 2

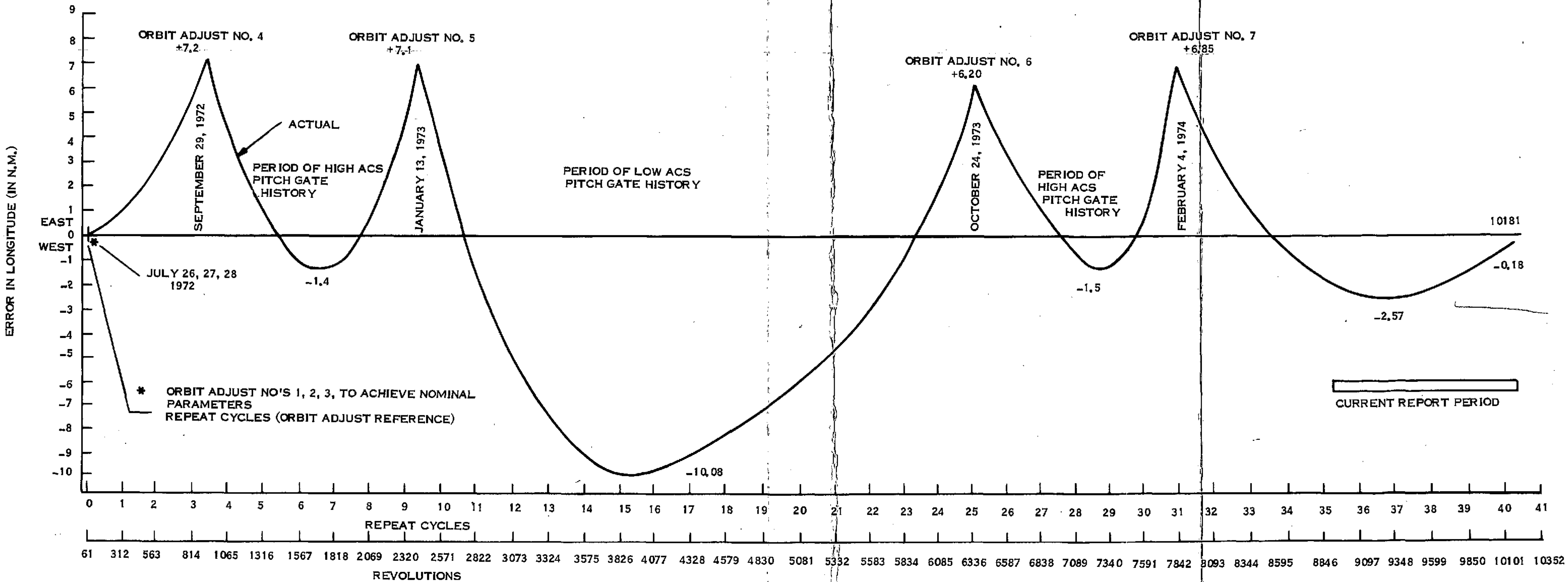


Figure 2-2. Effects of Orbits Adjust on Ground Track

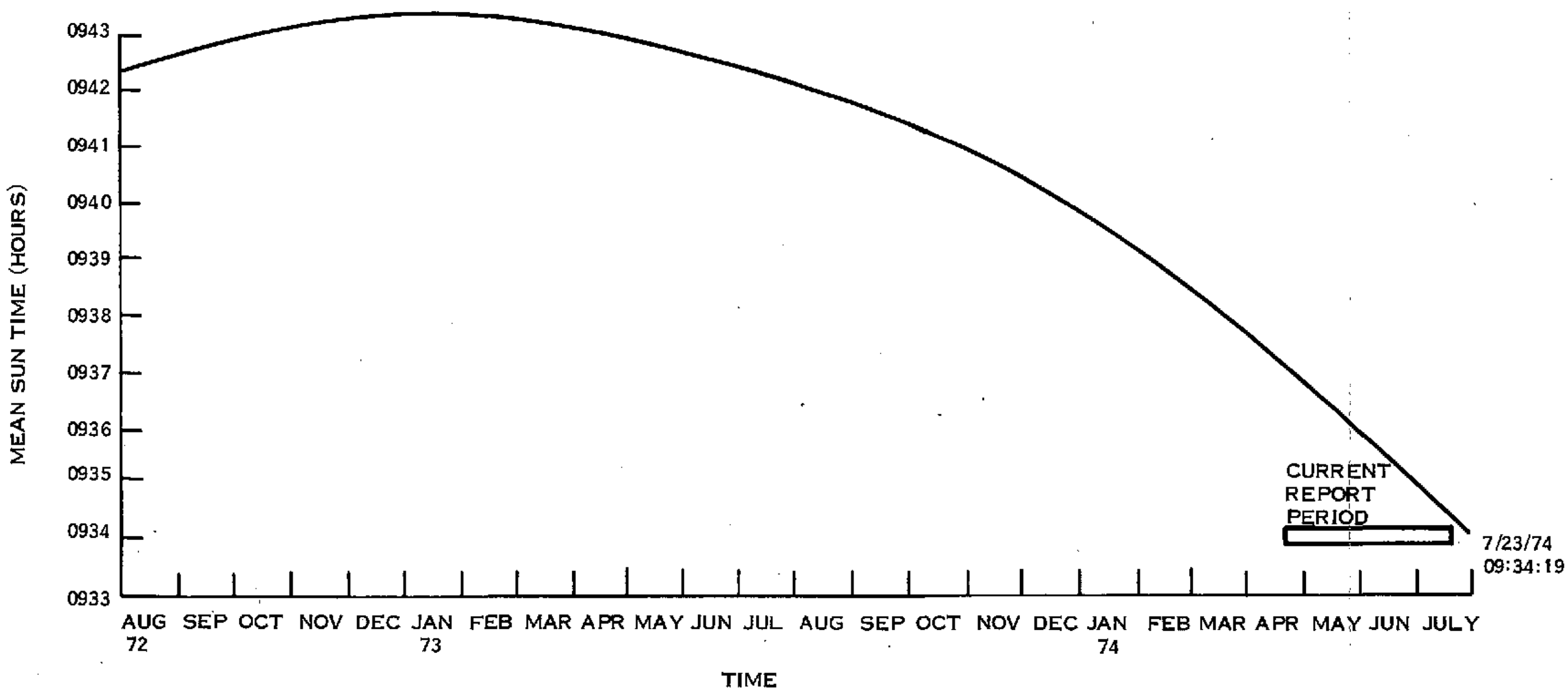


Figure 2-3. Mean Sun Time Equator Crossing-Descending Node

SECTION 3

POWER SUBSYSTEM (PWR)

SECTION 3

POWER SUBSYSTEM (PWR)

The solar array continued to provide excess energy for the payload and spacecraft load throughout this report period. Compensation loads and auxiliary loads dissipated the excess power above the battery and load requirements using ERTS-1 power management procedures. Midday measured solar array current tracked slightly below the values predicted earlier due to higher than predicted beta angle variations. Solar array degradation was -21.1% at the end of 24 months in orbit. The power subsystem is predicted to have adequate power through 1976 for the present ERTS-1 payload configuration and may extend to 1977 and 1978 depending on the electro-chemical degradation of the battery packs for that period.

A plot of measured and predicted midday solar current is shown in Figure 3-1. Figure 3-2 shows actual and predicted solar array current degradation. Figure 3-3 shows actual sun angles to the spacecraft and solar panels. Figure 3-4 shows seasonal solar intensity variation. It is noted on 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 operating point high noon solar array degradation than initially predicted. On 20 June 1974, in Orbit 9711, ERTS-1 passed through a total solar eclipse in the southern hemisphere over the Indian Ocean. The ground trace through the eclipse is shown in Figure 3-5.

Battery packs ranged from 9.8 to 11.2 percent depth of Discharge (DOD) with an average of 10.0 over a 24-hour period of normal operation. Temperature spread between batteries decreased to 5.1 degrees C during this report period due to decreasing sun intensity. Charge and load sharing were satisfactory.

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 be slightly different than Table 3-1 because Table 3-1 uses a time span for power management (night followed by a day) different from the time span which is used in Table 3-2 which is the playback period from the NBTR. The Shunt Limiter has not operated since Orbit 3 because the unregulated voltage has been held below cut-in voltage by power management.

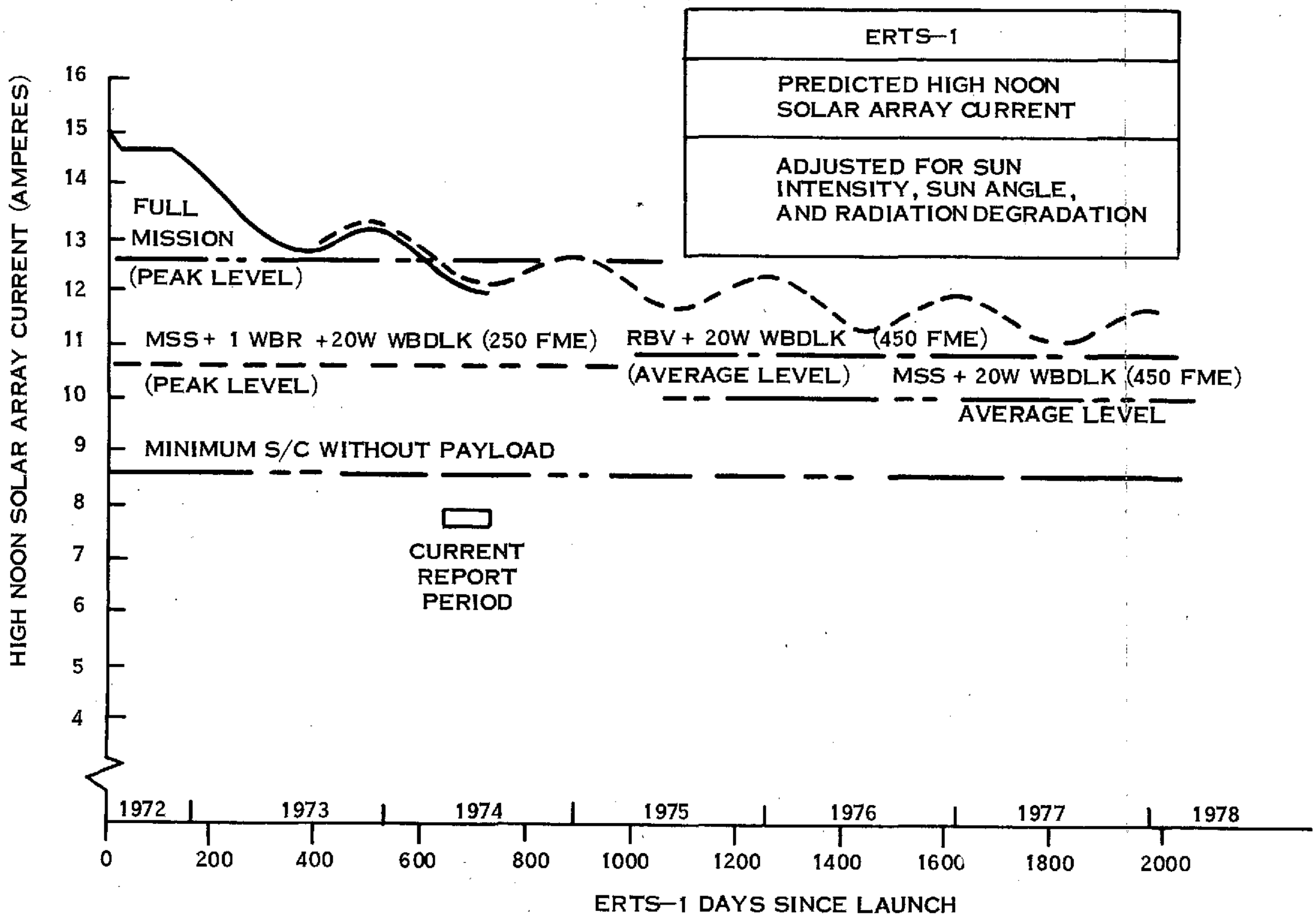


Figure 3-1. Predicted Midday Solar Current

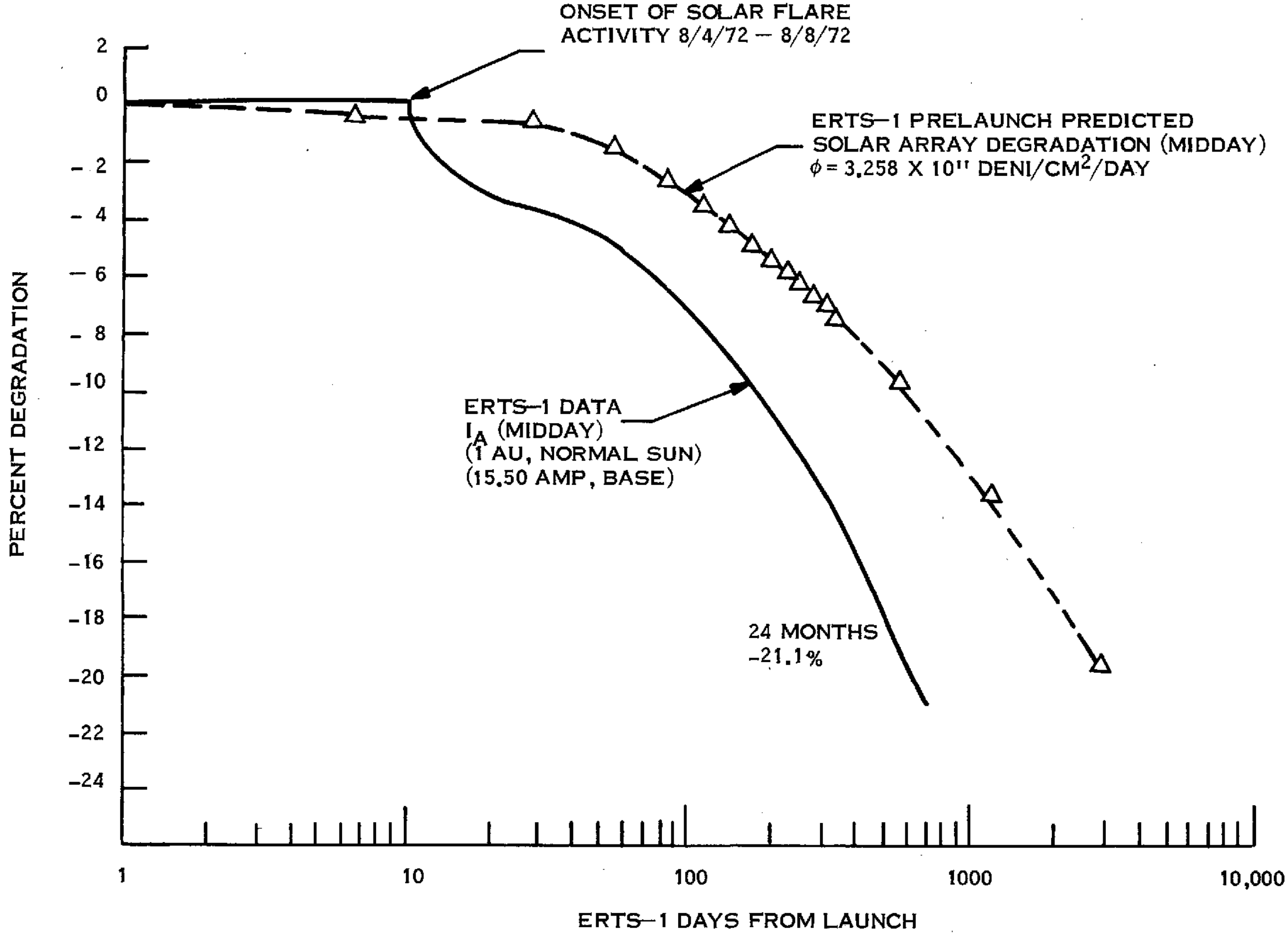


Figure 3-2. IA (Midday) Degradation vs. Days

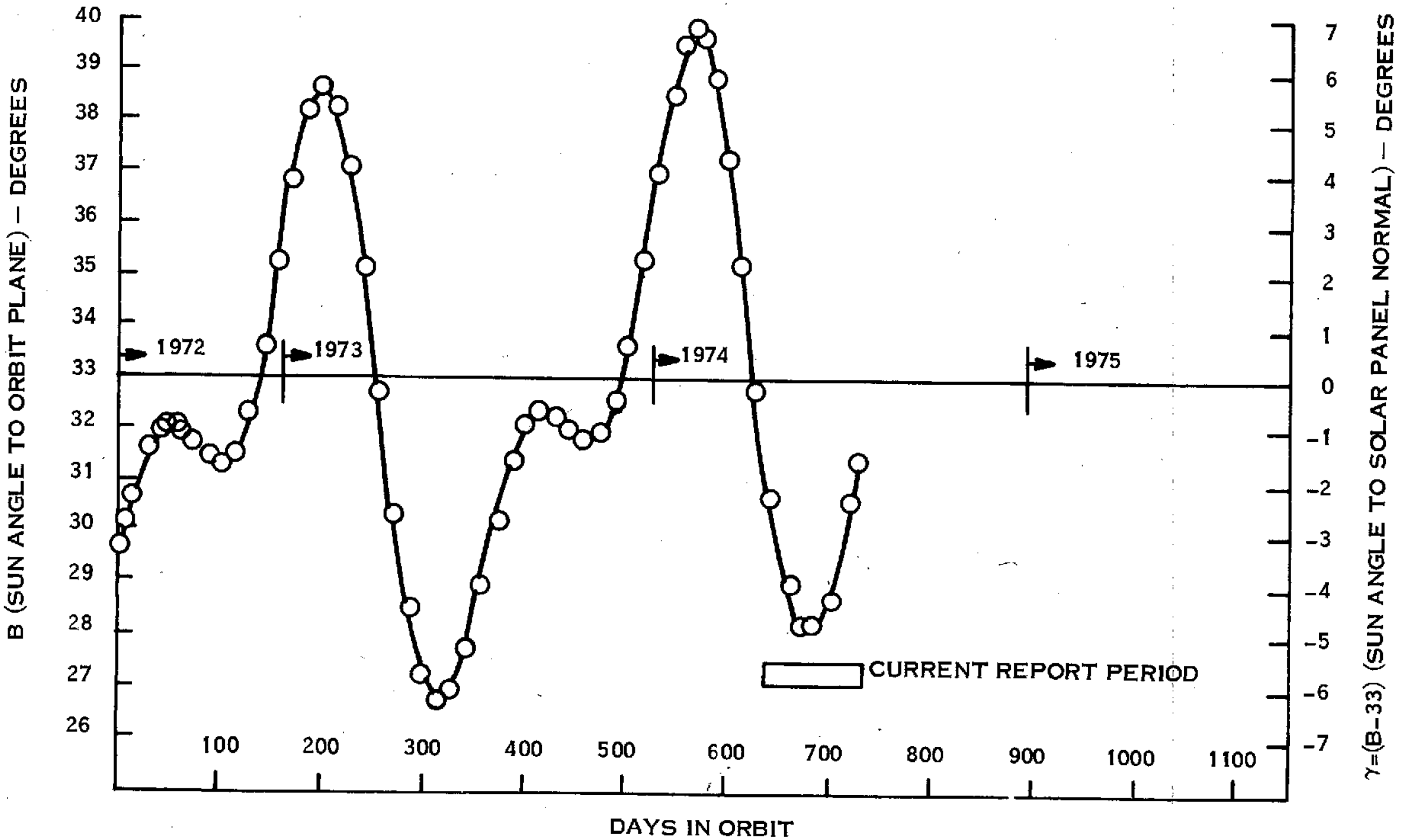


Figure 3-3. Actual β and γ (Paddle) Sun Angles

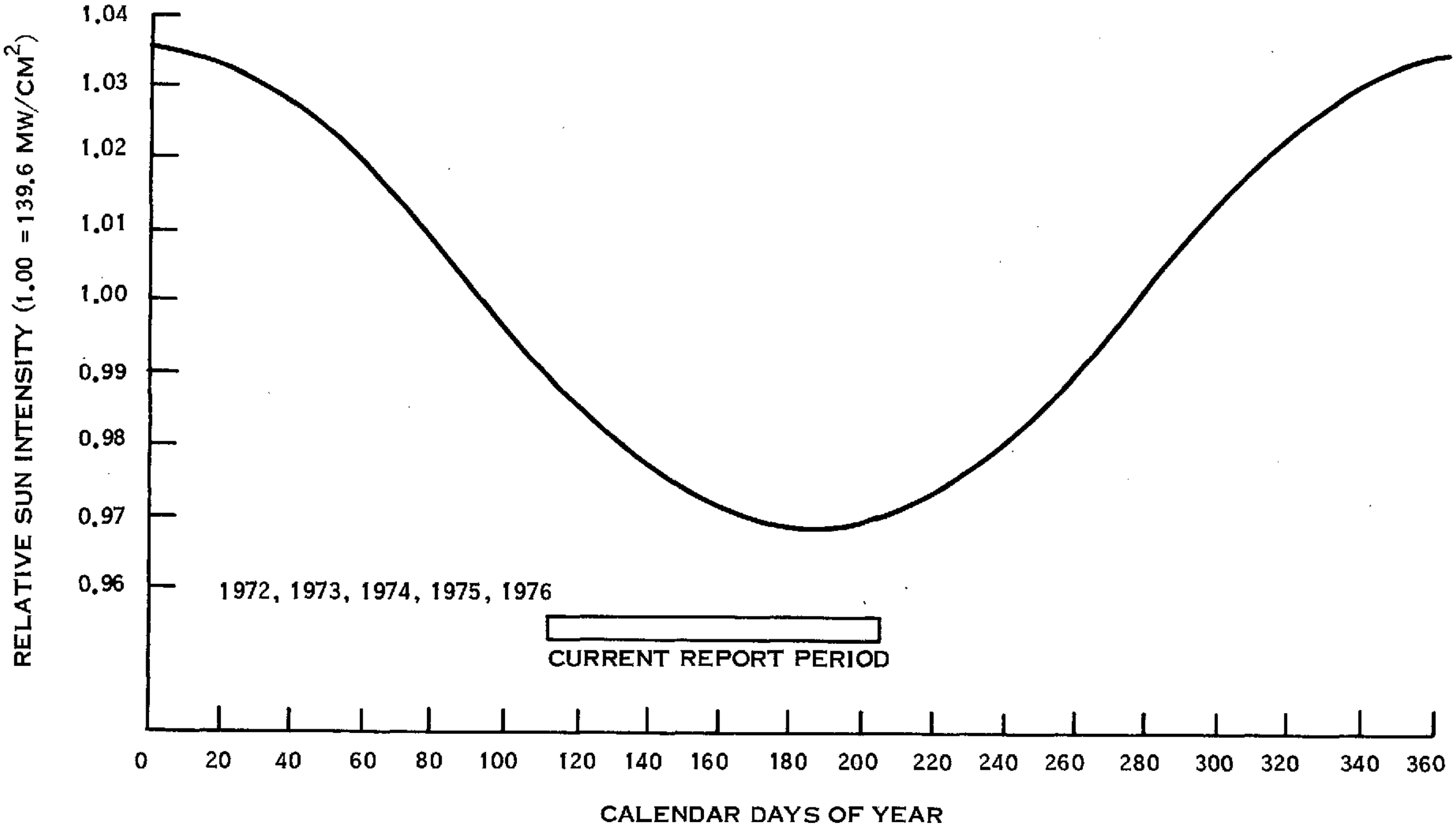


Figure 3-4. Seasonal Solar Intensity Variations

TOTAL SOLAR ECLIPSE OF 1974 JUNE 20

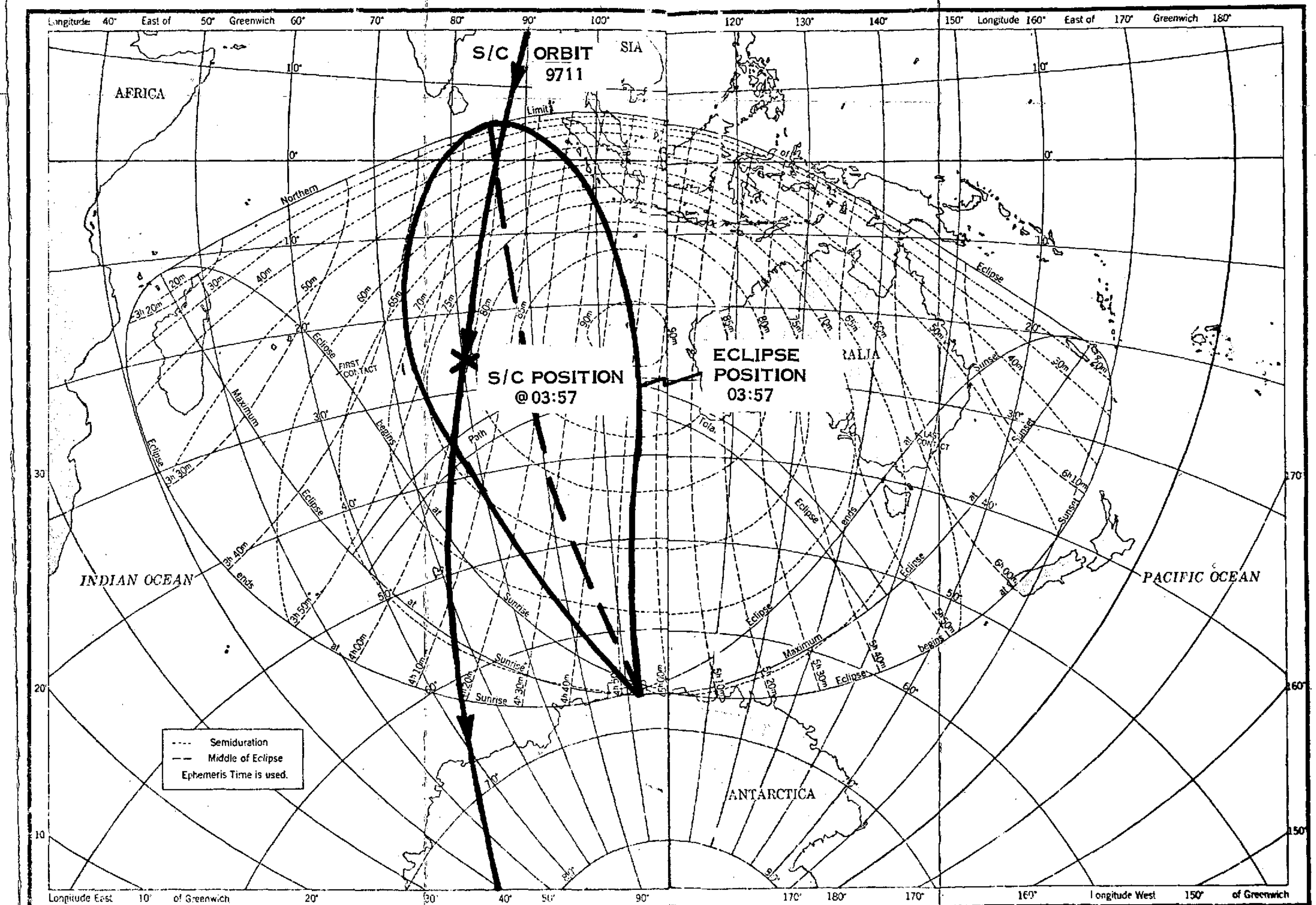


Figure 3-5. ERTS-1 Ground Trace Through Eclipse

Table 3-1. Major Power Subsystems Parameters

ORBIT NO.	26	2600	5098	7650	8912	9327	9751	10178
BATT 1 MAX	32.48	32.91	32.91	32.73	33.08	32.99	33.08	33.25
2 CHGE	32.48	32.91	32.91	32.73	33.08	32.99	33.08	33.16
3 VOLTS	32.48	32.91	32.99	32.73	33.08	32.99	33.16	33.25
4	32.48	32.48	32.99	32.73	33.16	33.08	33.16	33.25
5	32.48	32.99	32.99	32.82	33.16	33.08	33.16	33.33
6	32.31	32.91	32.91	32.73	33.08	32.99	33.16	33.25
7	32.22	32.91	32.91	32.73	33.08	32.99	33.16	33.25
8	32.14	32.91	32.91	32.73	33.08	32.99	33.16	33.26
AVERAGE	32.38	32.92	32.92	32.75	33.10	33.01	33.14	33.25
BATT 1 END-	28.81	28.12	28.30	28.04	29.23	28.98	28.98	28.98
2 OF-	28.81	28.12	28.30	28.04	29.32	28.98	28.98	28.98
3 NIGHT	28.81	28.04	28.30	28.04	29.23	28.98	28.98	28.98
4 VOLTS	28.89	28.12	28.38	28.04	29.32	28.98	28.98	28.98
5	28.89	28.21	28.38	28.12	29.32	28.98	29.06	29.06
6	28.81	28.04	28.30	27.95	29.23	28.89	28.98	28.98
7	28.81	28.12	28.30	28.04	29.23	28.98	[illegible]	28.98
8	28.81	28.12	28.30	28.04	29.23	28.98	28.98	28.98
AVERAGE	28.84	28.11	28.32	28.04	29.27	28.97	28.99	28.99
BATT 1 (*) CHGE	13.11	13.00	13.58	13.14	13.78	13.82	13.84	13.96
2 SHARE	12.93	13.00	* 13.58	*13.14	*13.78	*13.82	*13.84	*13.96
3 (%)	11.38	11.53	11.38	11.66	11.99	12.02	12.22	11.95
4	12.39	12.13	11.95	12.02	12.18	12.27	12.40	12.28
5	12.32	12.41	11.85	12.38	11.86	11.77	11.82	11.93
6	12.80	12.82	12.35	12.84	11.91	12.05	11.76	11.79
7	12.62	12.66	12.42	12.55	12.39	12.24	12.08	12.13
8	12.45	12.45	12.10	12.25	12.11	12.01	12.02	11.98
BATT 1 LOAD	12.71	12.61	12.44	12.68	12.58	12.64	12.61	12.58
2 SHARE	12.90	13.43	13.62	13.44	13.97	13.75	14.01	13.70
3 (%)	11.43	12.11	11.91	12.04	12.26	12.02	12.32	12.23
4	12.77	12.88	13.01	12.83	13.35	13.04	13.10	13.12
5	12.54	12.29	12.42	12.41	12.35	12.37	12.34	12.60
6	12.53	12.29	12.21	12.11	11.43	11.64	11.40	11.30
7	12.80	12.27	12.41	12.41	12.42	12.48	12.33	12.50
8	12.32	12.12	11.98	12.09	11.66	12.05	11.88	11.97
BATT 1 TEMP	21.11	25.13	24.65	25.31	25.92	24.13	24.40	24.76
2 IN	18.74	22.33	21.42	21.37	23.06	20.71	21.45	20.89
3 (°C)	18.77	20.72	20.29	20.33	21.34	20.12	20.64	20.16
4	21.57	23.23	23.17	23.28	23.86	23.27	23.37	23.32
5	21.82	26.77	23.85	27.62	25.28	23.47	23.68	24.09
6	21.21	26.95	24.37	27.84	25.87	24.08	24.32	24.78
7	21.41	27.18	25.01	27.62	26.43	24.44	24.66	24.96
8	21.82	26.68	25.14	27.01	26.40	24.79	24.91	25.24
AVERAGE	20.81	24.87	23.49	25.05	24.77	23.13	23.43	23.53
S/C REG BUS PWR (W)	176.8	182.3	153.4	160.0	167.9	144.8	151.2	165.6
COMP LOAD PWR (W) (P/O S/C REG BUS PWR)	49.0	34.8	34.8	34.8	41.9	34.8	34.8	41.9
P/L REG BUS PWR (W)	16.2	36.1	13.7	16.5	8.9	8.9	8.9	8.9
C/D RATIO	1.06	1.08	1.13	1.17	1.17	1.26	1.27	1.21
TOTAL CHARGE (A-M)	309.2	353.85	290.21	*291.6	*257.8	*263.1	*270.7	*258.3
TOTAL DISCHARGE (A-M)	290.9	327.08	256.28	249.0	220.1	209.5	213.8	214.2
SOLAR ARRAY (A-M)	1044	1028	908	934	865	844	835	832
S.A. PEAK I(AMP)	16.8	15.10	13.68	13.68	13.06	12.80	12.53	12.44
SUN ANGLE (DEG)	-3.33	+5.15	-3.54	+5.81	-1.4	-4.47	-4.31	-1.82
MAX R PAD TEMP (°C)	+62.0	+71.00	+68.00	+72.0	+64.40	64.40	62.00	63.20
MIN R PAD TEMP (°C)	-62.0	-56.00	-59.00	-56.0	-42.18	-43.39	-43.39	-42.79
MAX L PAD TEMP (°C)	+57.9	+66.00	+60.50	+67.0	+57.20	55.12	54.25	56.00
MIN L PAD TEMP (°C)	-67.0	-60.00	-64.00	-60.0	-46.25	-47.75	-47.74	-47.00

* 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 for each battery.

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

Function	Description	Unit	Orbits							
			26	2600	5098	7650	8912	9335	9751	10182
6001	BATT 1 DISC	AMP	0.94	1.23	0.81	1.01	0.75	0.89	0.72	0.81
6002	2		0.95	1.29	*	*	*	0.00	0.00	0.00
6003	3		0.84	1.17	0.78	0.95	0.75	0.84	0.70	0.80
6004	4		0.93	1.23	0.86	1.02	0.79	0.90	D.76	0.86
6005	5		0.92	1.19	0.82	0.98	0.74	0.87	0.77	0.82
6006	6		0.91	1.20	0.78	0.96	0.71	0.81	0.72	0.72
6007	7		0.94	1.19	0.82	1.01	0.74	0.85	0.73	0.80
6008	8		0.91	1.19	0.77	0.97	0.71	0.83	0.71	0.78
6011	BATT 1 CHG	AMP	0.58	0.71	0.58	0.49	0.53	0.57	0.57	0.69
6012	2		0.57	0.71	*	*	*	0.79	0.79	0.78
6013	3		0.50	0.63	0.48	0.44	0.47	0.50	0.51	0.60
6014	4		0.54	0.66	0.51	0.45	0.47	0.51	0.52	0.60
6015	5		0.54	0.68	0.50	0.46	0.46	0.50	0.49	0.58
6016	6		0.57	0.70	0.52	0.48	0.46	0.50	0.49	0.56
6017	7		0.55	0.70	0.53	0.47	0.48	0.51	0.50	0.60
6018	8		0.55	0.69	0.52	0.46	0.47	0.50	0.50	0.58
6021	BATT 1 VOLT	VDC	30.87	30.74	31.24	31.08	31.31	-31.15	-31.50	-31.64
6022	2		30.87	30.74	31.25	31.08	31.32	-31.15	-31.50	-31.66
6023	3		30.87	30.74	31.25	31.08	31.32	-31.15	-31.50	-31.66
6024	4		30.90	30.77	31.28	31.11	31.35	-31.18	-31.54	-31.70
6025	5		30.95	30.82	31.33	31.17	31.41	-31.24	-31.59	-31.75
6026	6		30.86	30.72	31.24	31.07	31.31	-31.14	-31.49	-31.65
6027	7		30.89	30.76	31.27	31.10	31.41	-31.18	-31.53	-31.68
6028	8		30.89	30.75	31.27	31.10	31.34	-31.18	-31.53	-31.68
6031	BATT 1 TEMP	DGC	21.17	25.19	24.48	25.38	25.75	24.17	24.39	26.09
6032	2		18.80	22.44	21.29	21.51	22.96	21.10	21.37	22.81
6033	3		18.76	20.80	20.17	20.36	21.39	20.33	20.61	21.26
6034	4		21.57	23.20	23.04	23.30	23.96	23.35	23.45	23.83
6035	5		21.84	26.86	23.77	27.68	25.20	23.55	23.70	24.78
6036	6		21.24	26.99	24.27	27.95	25.69	24.08	24.31	25.78
6037	7		21.43	27.20	24.88	27.74	26.21	24.35	24.63	26.09
6038	8		21.86	26.75	25.02	27.10	26.25	24.68	24.91	26.21
6040	RT PAD TEMP	DGC	25.82	27.98	27.22	33.79	21.00	23.65	26.76	27.16
6041	R PAD V N	VDC	33.40	33.01	33.85	33.00	34.00	33.74	34.13	34.36
6042	R PAD V N	VDC	33.29	32.43	33.50	32.05	32.69	33.23	33.80	33.60
6044	LT PAD TEMP	DGC	14.14	18.56	16.61	24.89	12.10	14.91	18.30	19.11
6045	L PAD V F	DVC	33.69	33.71	34.16	33.84	34.32	34.02	34.44	34.67
6046	L PAD V G	DVC	33.68	33.73	34.19	33.89	34.37	34.07	34.46	34.72
6050	S/C UR BUS V	VDC	31.24	31.03	31.68	31.50	31.67	-31.54	-31.90	-32.06
6051	S/C RG BUS V	VDC	24.54	24.54	24.55	24.55	24.55	-24.55	-24.55	-24.55
6052	AUX REG A V	VDC	23.41	23.46	23.48	23.47	23.47	-23.49	-23.49	-23.47
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	13.97	12.69	12.61	12.04	11.77	11.70	11.60
6055	S/C RG BUS I	AMP	7.11	7.45	6.27	6.54	6.86	6.41	6.18	6.80
6056	S/C RG BUS I	AMP	7.11	7.46	6.27	6.53	6.85	6.40	6.17	6.79
6058	PC MOD T 1	DGC	21.82	23.53	22.23	22.65	23.29	22.39	22.48	23.22
6059	PC MOD T 2	DGC	21.68	23.08	22.53	22.72	23.26	22.48	22.61	23.00
6070	P/L RG BUS V	VDC	24.66	24.67	24.68	24.68	24.67	-24.67	-24.68	-24.68
6071	P/L UR BUS V	VDC	31.08	30.88	31.53	31.55	31.52	-31.38	-31.75	-31.92
6072	P/L RG BUS I	AMP	0.57	1.47	0.56	0.67	0.36	0.66	0.36	0.36
6073	P AUX A V	VDC	23.51	23.53	23.51	23.51	23.50	-23.51	-23.50	-23.50
6074	P AUX B V	VDC	23.51	23.53	23.51	23.51	23.50	-23.51	-23.50	-23.50
6075	PR MOD T1	DGC	21.50	24.40	23.13	23.36	23.91	22.97	23.02	23.62
6076	PR MOD T2	DGC	20.34	22.31	21.45	21.62	22.12	21.24	21.39	21.84
6079	FUSE BLOW V	VDC	24.56	**	24.57	24.58	24.61	-24.60	-24.60	-24.60
6080	SHUNT 1 I	AMP	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6081	2		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6082	3		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6083	4		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6084	5		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6085	6		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6086	7		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6087	8		0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
6100	P/L RG BUS I	AMP	0.58	1.47	0.56	0.67	0.36	0.66	0.36	0.36
TOTAL NO.	MAJOR FRAMES	FRM	764	425	389	387	494	421	380	384

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

** Function 6079; missing data resulted from logic error in master information file used in computer processing.

SECTION 4

ATTITUDE CONTROL SUBSYSTEMS

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)

Performance of the Attitude Control Subsystem has been excellent throughout the launch and orbital operations during this flight.

Pressure/temperature ratios have all been satisfactory. The forward scanner pressure has decreased slightly since launch (4.6 PSIA at launch, 3.50 PSIA at Orbit 10182); however, it is not decreasing at a rate fast enough to cause alarm. It should reach half pressure at about Orbit 16,000.

All pneumatic gating functions are performing well with no evidence of propellant leaks. (The (+) Pitch and (-) Roll gate history is shown in Figure 4-1. There is close correlation between gating frequency and sun intensity. Usable impulse remaining is 420.35 lb-sec. (575 lb-sec. at launch).

Rate Measuring Package "2" is still performing well. The RMP heater was turned off in Orbit 8048 to lower ACS package temperatures.

A modified momentary enable gating plan is in operation to hold the pitch flywheel speed between 400 and 500 RPM to improve lubrication of the bearings. Roll, yaw, and pitch orbit average motor driver duty cycles have been nominal during this report period (5-6% for roll; 1-2% for yaw; 6-9% for pitch), except as noted, during this report period. From orbit 9290 to 9340 the pitch CCW motor driver duty cycle rose to approximately 15% orbit average and then returned to normal. From orbit 9887 to 9910 the pitch CCW motor driver duty cycle rose to approximately 25.9% orbit average and returned to normal. Spacecraft performance was unaffected. It is postulated that since the pitch CCW motor driver duty cycle returned to normal the anomaly was connected with lubrication. Other types of bearing problems would not be expected to recover to their previous low torque requirement.

The Solar Array Drives performed well during this period.

Table 4-1 is a summary of telemetry in the Attitude Control Subsystem.

Table 4-1. ACS Temperature and Pressure Telemetry Summary

Function	Units	Orbit							
		31	2600	5099	7650	8911	9335	9751	10182
1084 RMP 1 Gyro Temperature	DGC	44.5	24.28	23.06	25.21	22.06	22.30	20.70	21.22
1094 RMP 2 Gyro Temperature	DGC	74.3	75.07	75.10	75.42	43.90	44.10	43.39	43.45
1222 SAD RT MTR HSING Temp	DGC	21.1	23.07	22.00	24.29	21.28	21.61	21.00	20.55
1242 SAD LT MTR HSING Temp	DGC	27.0	32.27	30.38	33.44	29.11	29.03	28.42	28.18
1223 SAD RT MTR WNDNG Temp	DGC	25.3	27.39	26.54	28.26	25.57	25.93	25.29	24.63
1243 SAD LT MTR WNDNG Temp	DGC	28.7	34.99	32.92	35.87	31.26	31.31	30.61	30.32
1228 SAD RT HSG Pressure	PSI	7.6	7.53	7.35	7.28	7.18	7.18	7.12	7.12
1248 SAD LT HSG Pressure	PSI	7.0	7.04	6.86	6.76	6.53	6.53	6.47	6.47
1007 FWD Scanner MTR Temp	DGC	19.8	21.35	19.88	22.26	19.36	19.47	18.84	18.46
1016 Rear Scanner MTR Temp	DGC	20.5	21.25	19.83	21.79	18.53	18.65	18.18	17.86
1003 FWD Scanner Pressure	PSI	4.6	4.52	4.02	3.84	3.55	3.50	3.50	3.50
1012 Rear Scanner Pressure	PSI	7.8	8.05	7.87	7.87	7.52	7.42	7.43	7.44
1212 Gas Tank Pressure	PSI	1988.0	1849.00	1702.34	1598.59	1487.00	1474.62	1462.25	1454.19
1210 Gas Tank Temperature	DGC	22.6	26.07	24.30	27.16	23.23	23.53	22.89	22.56
1213 Manifold Pressure	PSI	56.7	57.16	57.44	57.81	58.21	58.27	58.33	58.73
1211 Manifold Temperature	DGC	21.9	25.51	23.62	26.61	22.76	22.80	22.11	21.77
1059 CLB Power Supply Card Temp	DGC	37.1	42.22	40.64	43.34	39.75	39.93	39.09	38.83
1057 CLB Power Supply Volts	TMV	2.8	2.79	2.78	2.79	2.79	2.78	2.77	2.78
1081 RMP 1 MTR Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1082 RMP 1 MTR Current	Amps	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1080 RMP 1 Supply Volts	VDC	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1091 RMP 2 MTR Volts	VDC	-29.7	-29.63	-29.63	-29.59	-29.64	-29.63	-29.64	-29.63
1092 RMP 2 MTR Cuvvent	Amps	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
1090 RMP 2 Supply Volts	VDC	-23.4	-23.38	-23.41	-23.38	-23.48	-23.48	-23.49	-23.50
1220 SAD RT MTR WNDNG Volts	VDC	-4.8	-4.32	-4.25	-4.18	-4.15	-3.90	-3.84	-3.89
1240 SAD LT MTR WNDNG Volts	VDC	-4.8	-4.12	-4.09	-3.95	-3.40	-3.33	-3.43	-3.36
1227 SAD RT -15 VDC Conv.	VDC	14.9	14.90	14.88	14.88	14.90	14.88	14.88	14.89
1247 SAD LT -15 VDC Conv.	VDC	15.2	15.15	15.13	15.13	15.14	15.14	15.14	15.14
1056 CLB ± 6 VDC	TMV	2.4	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1055 CLB ± 10 VDC TMV	TMV	2.75	2.75	2.75	2.75	2.74	2.74	2.74	2.74
1260 ACS Baseplate 1	DGC	25.4	29.71	27.93	31.01	26.31	26.24	25.69	25.36
1261 ACS Baseplate 2	DGC	22.9	26.42	24.73	27.76	24.00	23.99	23.38	23.00
1262 ACS Baseplate 3	DGC	23.4	25.09	23.69	26.24	22.91	23.17	22.55	21.97
1263 THO1 STS	DGC	-6.8	0.59	-0.97	3.97	-0.28	-1.17	-1.13	-3.41
1264 THO2 STS	DGC	-14.6	-8.81	-9.42	-3.85	-4.51	-7.72	-6.71	-8.27
1265 THO3 STS	DGC	-3.1	9.32	9.31	15.52	11.27	8.27	8.28	7.58
1266 THO4 STS	DGC	-13.9	-2.55	2.85	4.46	-0.01	.05	-.64	-1.85
1267 THO5 STS	DGC	-8.9	-0.97	-1.16	6.73	-1.64	-1.02	-1.30	-5.17
1224 SAD R FSST	DGC	39.5	52.87	60.21	61.90	66.07	64.04	64.70	63.25
1244 SAD L FSST	DGC	27.1	45.64	51.11	56.46	55.34	52.94	53.20	53.21

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

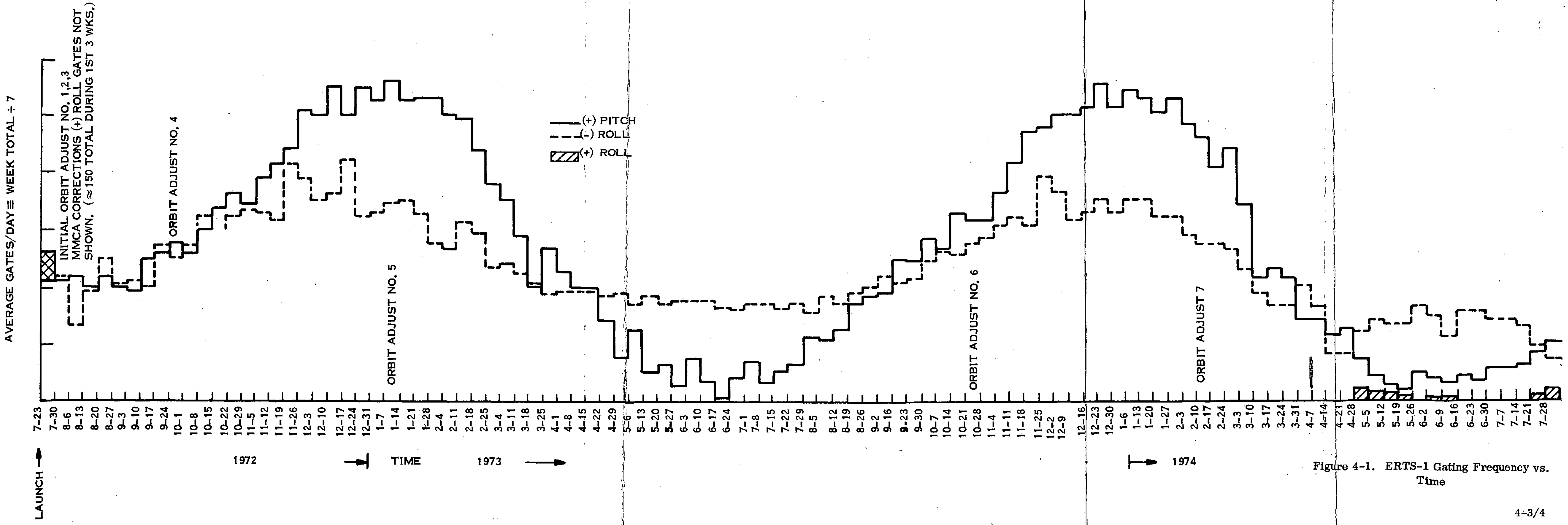


Figure 4-1. ERTS-1 Gating Frequency vs. Time

SECTION 5

COMMAND/CLOCK SUBSYSTEM

SECTION 5

COMMAND/CLOCK SUBSYSTEM (CMD)

Command processing for both real time and stored commands for ERTS-1 has been normal during this period.

Commanding difficulties which have been experienced have been isolated to ground transmission problems.

Missed real time commands, attributed to the logic race in the command clock design, are occasionally noted.

On rare occasions stored commands are blocked by a real time sequence being transmitted during the stored command time tag. Usually the commands interlace as expected, however, several instances have been noted when the stored command did not execute. The condition is being investigated.

The spacecraft time base, provided by the time code generator, has been well within specifications. The clock has been reset three times in orbit, at the beginning of 1973, in Orbit 5578, and at the beginning of 1974. See Figure 5-1. Clock drift is approximately 1 millisecond/orbit. A plot of accumulative drift is shown in Figure 5-2.

The changes in the subsystem are not sufficient to consider switching to alternate units from the original launch configuration. However the VHF command receiver was switched from side B to side A in orbit 10068 when the USB subsystem was switched to side B. Performance of side A is excellent and normal.

Table 5-1 gives typical telemetry values.

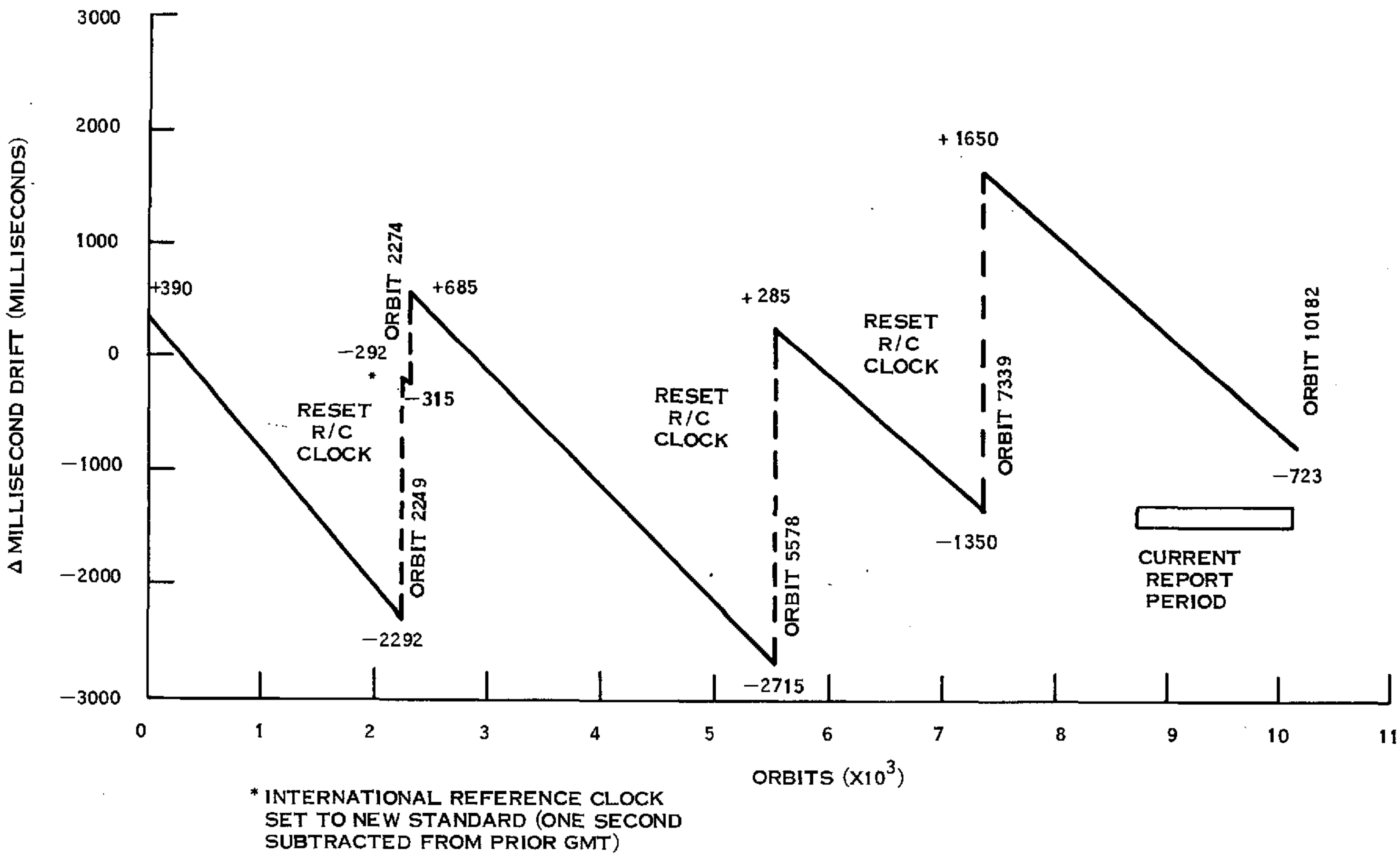


Figure 5-1. Spacecraft Clock Drift

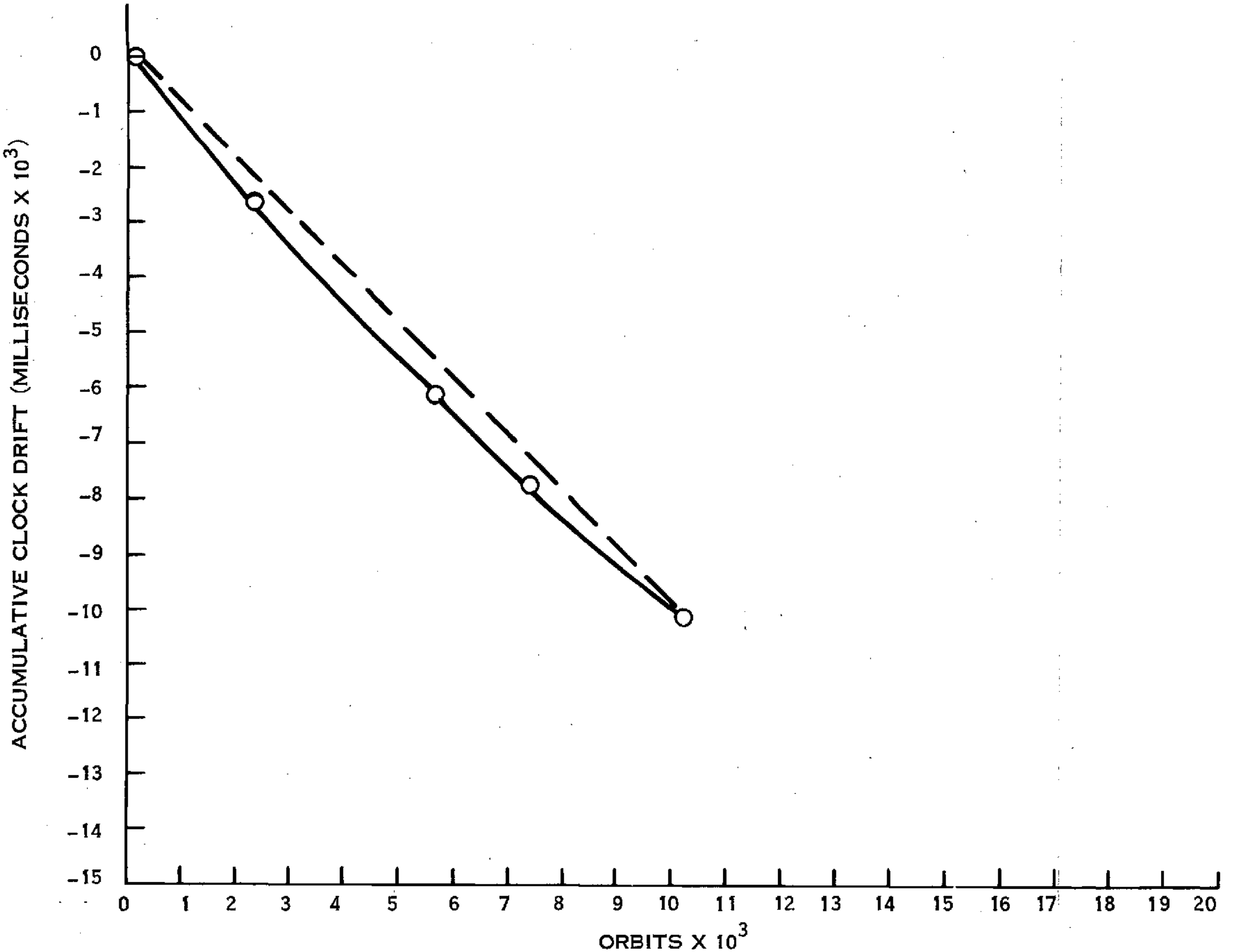


Figure 5-2. Accumulated Clock Drift

Table 5-1. Command Clock Telemetry Summary

Function No.	Name	Mode	Units	Orbit 35	2600	5099	7650	8911	9335	9751	10182
8005	Pri. Power Supply Temp	-	°C	37.31	38.91	39.37	39.24	39.65	39.68	39.70	39.50
8006	Red. Power Supply Temp	-	°C	35.73	37.56	38.08	38.09	38.49	38.56	38.60	38.38
8007	Pri. Osc. Temp	-	°C	31.14	31.92	31.98	32.05	32.31	32.33	32.35	32.11
8008	Red. Osc. Temp	-	°C	30.47	31.31	31.39	31.41	31.55	31.49	31.55	31.42
8009	Pri. Osc. Output	-	TMV	0.95	0.96	0.96	0.97	0.97	0.97	0.97	0.97
8010	Red. Osc. Output	-	TMV	**	**	**	**	**	**	**	**
8011	100 kHz	Pri. - Red.	TMV	3.11	3.11	3.10	3.11	3.11	3.11	3.11	3.11
8012	10 kHz	Pri. - Red.	TMV	3.10	3.08	3.07	3.08	3.08	3.08	3.08	3.08
8013	2.5 kHz	Pri. - Red.	TMV	2.95	2.95	2.95	2.95	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. +4V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
8016	Red. +4V Power Supply	Red. Clk ON	VDC	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	6.06	6.08	6.07	6.07	6.08	6.07	6.07	6.07
8018	Red. +6V Power Supply	Red. Clk ON	VDC	6.00	5.95	5.94	5.94	5.94	5.94	5.94	5.94
8019	Pri. -6V Power Supply	Pri. Clk ON	VDC	-6.02	-6.03	-6.02	-6.02	-6.03	-6.02	-6.02	-6.03
8020	Red. -6V Power Supply	Red. Clk ON	VDC	-5.99	-6.00	-6.00	-6.00	-6.00	-6.00	-6.00	-6.00
8021	Pri. -23V Power Supply	Pri. Clk ON	VDC	-22.88	-22.90	-22.89	-22.89	-22.90	-22.89	-22.89	-22.89
8022	Red. -23V Power Supply	Red. Clk ON	VDC	-22.98	-23.02	-23.00	-23.00	-23.01	-23.00	-23.00	-23.01
8023	Pri. -29V Power Supply	Pri. Clk ON	VDC	-29.13	-29.14	-29.16	-29.15	-29.15	-29.15	-29.16	-29.15
8024	Red. -29V Power Supply	Red. Clk ON	VDC	-29.07	-29.21	-29.21	-29.21	-29.22	-29.21	-29.22	-29.21
8101	CIU A -12V	CIA A ON	VDC	-12.33	-12.33	-12.33	-12.33	-12.33	-12.33	-12.33	-12.34
8102	CIU B -12V	CIU B ON	VDC	-12.26	-12.26	-12.26	-12.26	-12.26	-12.26	-12.26	-12.23
8103	CIU A -5V	CIU A ON	VDC	-5.32	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34	-5.34
8104	CIU B -5V	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	24.85	24.77	25.04	25.08	25.10	25.09	25.04
8106	CIU B Temp	CIU B ON	°C	24.96	25.42	25.31	25.54	25.57	25.60	25.56	25.45
8201	Receiver RF-A Temp	-	°C	**	**	**	**	**	**	**	26.67
8202	Receiver RF-B Temp	-	°C	27.98	28.46	28.22	28.39	28.68	28.46	28.45	**
8203	D MOD A Temp	-	°C	25.41	25.82	25.73	25.86	26.12	25.89	25.92	37.98
8204	D MOD B Temp	-	°C	35.03	35.59	35.61	35.71	35.93	35.77	35.67	26.12
8205	Receiver A AGC	Receiver A ON	DBM	**	**	**	**	**	**	**	-96.77
8206	Receiver B AGC	Receiver B ON	DBM	-94.74	-89.91	-84.67	-89.05	90.65	-88.96	-97.12	**
8207	Amp. A Output	Receiver A ON	TMV	**	**	**	**	**	**	**	2.31
8208	Amp. B Output	Receiver B ON	TMV	2.81	2.81	3.22	2.92	2.72	2.89	2.71	**
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	**	**	**	**	**	**	**	1.10
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.10	1.11	1.11	1.10	1.10	1.10	**
8211	Amp. A Output	Receiver A ON	TMV	**	**	**	**	**	**	**	1.10
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.14	1.13	1.13	1.13	1.13	1.13	**
8215	D MOD A -15V	Receiver A ON	TMV	**	**	**	**	**	**	**	5.00
8216	D MOD B -15V	Receiver B ON	TMV	5.00	5.00	5.00	5.00	5.00	5.00	5.00	**
8217	Regulator A -10V	Receiver A ON	TMV	**	**	**	**	**	**	**	5.40
8218	Regulator B -10V	Receiver B ON	TMV	5.50	5.50	5.50	5.50	5.50	5.00	5.50	**

**Units not in use

SECTION 6

TELEMETRY SUBSYSTEM

SECTION 6

TELEMETRY SUBSYSTEM

The Telemetry Subsystem was launched in the ON mode and has been operating continuously since then providing data from the spacecraft either to ground stations, the narrow band recorders, or both. Typical telemetry values are given in Table 6-1. Only memory Section 0.0 has been used in the telemetry matrix. Total performance has been excellent except for one integrated circuit chip failure, containing four functions (6012, 1011, 12238, 7010) in Orbit 4396.

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Orbit								
		Unit	35	2600	5099	7650	8911	9335	9751	10182
9001	Memory Sequencer A Converter	VDC	6.35	6.34	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	21.47	21.06	22.67	22.11	21.15	21.11	21.76
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99	5.99	5.99	5.99
9005	Formatter B Converter	VDC	**	**	**	**	**	**	**	**
9006	Dig. Mux A Converter	VDC	10.01	10.07	10.04	10.07	10.07	10.06	10.06	10.07
9007	Dig. Mux B Converter	VDC	**	**	**	**	**	**	**	**
9008	Formatter/Dig. Mux Temp.	°C	22.50	27.34	24.89	27.97	28.19	25.00	24.87	24.96
9009	Analog Mux A Converter	VDC	26.01	26.18	21.18	26.18	26.18	26.18	26.19	26.20
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	°C	25.00	27.50	26.83	29.43	28.46	27.26	27.31	27.25
9014	Preregulator A Voltage	VDC	19.93	19.99	19.95	19.19	19.99	19.95	19.94	19.28
9015	Preregulator B Voltage	VDC	**	**	**	**	**	**	**	**
9016	Reprogrammer Temp.	°C	22.00	25.00	22.50	26.05	25.72	22.50	22.52	24.13
9017	Memory A Converter	VDC	6.00	6.00	5.99	6.00	6.00	6.00	6.00	6.00
9018	Memory A Temp.	°C	17.51	19.06	17.50	19.00	18.63	17.50	17.50	18.98
9019	Memory B Converter	VDC	**	**	**	**	**	**	**	**
9020	Memory B Temp.	°C	17.68	19.29	17.63	19.82	19.57	17.54	17.69	19.09
9100	Reflected Power (Xmtr A)	dBm	11.95	12.75	12.32	13.11	13.14	12.32	12.31	12.32
9101	Xmtr A -20 VDC	VDC	-19.75	-19.78	-19.76	-19.78	-19.78	-19.76	-19.76	-19.76
9102	Xmtr B -20 VDC	VDC	**	**	**	**	**	**	**	**
9103	Xmtr A Temp.	°C	20.95	24.06	21.14	25.24	25.80	21.20	21.17	21.55
9104	Xmtr B Temp.	°C	21.69	25.02	21.95	26.36	26.99	21.95	21.92	22.31
9105	Xmtr A Power Output	dBm	25.12	25.36	25.35	25.38	25.40	25.24	25.24	25.24
9106	Xmtr B Power Output	dBm	**	**	**	**	**	**	**	**

** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has been fired seven times prior to this report period (all from ~~the (-)X thruster). There are 64.87 pounds of hydrazine fuel remaining from an initial~~ pre-launch fuel load of 67.00 pounds. Table 7-1 is a summary of OAS performance to date and Table 7-2 gives average telemetry values for the off quiescent state. Figure 2-2 shows spacecraft ground track drift from standard orbit tracks and the effects of orbit adjust to correct and hold the drift to pre-determined limits.

Table 7-1. Orbit Adjust Performance

Orbit	Burn Time (sec)	+ Δ a (meters)	Average SMA (2) (KM)	Performance % of Plan	N_2H_4 Used Lbs. (3)
(1)	--	--	7281.461	--	--
38	4.8	12	7281.484	60.0	0.018
44	251.0	1975	7283.456	103.5	0.934
59	318.0	2381	7285.838	101.5	1.19
938	12.8	98	7285.877	110.0	0.039
2416	20.4	154	7285.877	106.0	0.071
6390	14.8	110	7285.786	100.0	0.048
7826	14.8	112	7285.763	101.8	0.048

(1) After Injection
(2) Semi-Major Axis
(3) Initial fuel load 67.0 pounds

Table 7-2. OAS Telemetry Values

Function No.	Name	Units	Orbit 35	2600	5099	7650	8911	9335	9751	10182
2001	Prop. Tank Temp.	°C	22.03	23.91	22.86	24.53	23.69	22.86	22.86	23.28
2003	Thrust Chamber No. 1 (-x) Temp. (1)	°C	29.57	28.50	29.93	27.77	31.49	32.88	32.75	30.55
2004	Thrust Chamber No. 2 (+x) Temp. (1)	°C	38.76	33.74	40.28	39.27	42.03	38.05	38.85	38.91
2005	Thrust Chamber No. 3 (-y) Temp. (1)	°C	34.55	46.23	34.41	47.52	38.67	33.88	34.10	36.09
2006	Line Pressure	Psia	539.29	486.87	486.74	491.10	490.61	486.87	486.84	490.61

(1) Wide spread 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)

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in Orbits 73, 85, 110 and 220. Adjustments were made in the pitch positive. The unit responded well as noted in Table 8-1 and has held its charge. The current dipole values are Pitch: +2950 Pole-Cm; Roll: zero; Yaw: zero. These values are unchanged since Orbit 220. Table 8-2 gives typical telemetry for the MMCA.

Table 8-1. MMCA Telemetry Before and After Adjustment

		Orbits							
Function	Units	72	75	83	88	106	115	218	224
4003	TMV	3.49	3.48	3.48	3.48	3.47	3.49	3.50	3.50
4004	TMV	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0
4005	TMV	3.13	2.87	2.87	2.77	2.77	2.65	2.65	2.52
	Pole-Cm	≈0	1200	1200	1800	1800	2350	2350	2950
4006	TMV	3.18	3.20	3.20	3.20	3.18	3.18	3.18	3.18
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0

Table 8-2. MMCA Telemetry Summary

			Orbits							
Number	Name	Units	35	2600	5099	7650	8911	9335	9751	10182
4001	A1 Board Temp	°C	19.77	19.37	19.03	19.12	19.23	19.03	19.11	19.11
4002	A2 Board Temp	°C	23.58	23.36	23.05	23.15	23.17	23.07	23.15	23.13
4003	Hall Current	TMV	3.48	3.49	3.48	3.48	3.47	3.48	3.48	3.48
4004	Yaw Flux Density	TMV	3.11	3.10	3.11	3.13	3.14	3.14	3.14	3.15
4005	Pitch Flux Density	TMV	3.13	2.50	2.51	2.52	2.52	2.52	2.52	2.52
4006	Roll Flux Density	TMV	3.19	3.20	3.19	3.19	3.20	3.20	3.20	3.20

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

The Unified S-Band (USB) Subsystem has operated satisfactorily since launch, despite repeated and large drops in transmitter power output. The B transmitter/receiver section of the USB dual installation was substituted for the A-section during Orbit 10068 restoring full 1.5 watts output to this subsystem from the 0.14 watts to which it had declined, as shown in Figure 9-1.

The USB-A Receiver was ON continuously from launch to mid-orbit 10068, for a total of 17,327 hours.

The USB-A Transmitter was ON only during station passes from launch to mid-orbit 10068, for a total of 2253 hours. It was commanded ON for transmission of real time telemetry, play-back of stored telemetry, ranging data for computation of ERTS-A ephemeris, and for relay of DCS data.

The USB-B Receiver has been ON continuously since Orbit 10068 for a total of 198 hours. The USB-B transmitter has been ON for a total of 26 hours.

Table 9-1 lists telemetry values, all normal, and typical for orbits in this reporting period.

On 19 March 1974 during Orbits 8421 to 8424 (Figure 9-1), the USB-A transmitter power dropped to 0.192 watts. At this level, the range for USB relay service for the DCS subsystem had substantially shrunk from the horizon. A description of this shrinkage is given in Appendix C. When the USB output again declined in Orbit 10058 to a value of 0.140 watts, the B section was substituted. Ground stations reported an immediate 10 dB rise in AGC levels, corresponding to the telemetry-indicated rise of power output to 1.5 watts shown in Figure 9-1.

Table 9-1. USB/PMP Telemetry Values

Function			Telemetry Value						
			Orbit						
No.	Name	Units	35	2566	5099	7650	9335	9752	10182
11001	USB Revr. AGC	DBM	-122.78	-126.18	-131.99	-132.00	-121.10	-131.18	-132.00
11002	USB Trans. Pwr	WTS	1.60	0.62	0.29	0.26	0.19	0.18	1.55
11003	Receiver Error	KHZ	21.79	-20.87	-21.32	-21.63	-22.22	-22.18	-21.46
11004	Trans. Temp.	DGC	22.92	25.30	22.64	25.71	23.25	22.76	24.73
11005	Trans. Pressure	PSI	15.91	16.09	15.91	16.06	15.89	15.82	15.92
11007	Trans A-15VDC	VDC	-15.20	-15.20	-15.20	-15.20	-15.20	-15.20	**
11009	Ranging-15 VDC	VDC	-14.76	-14.76	-14.76	-14.76	-14.76	-14.76	-14.60
11101	PMP A Volt	VDC	-15.12	-15.18	-15.18	-15.19	-15.09	-15.18	**
11103	PMP A Temp.	DGC	30.44	33.70	30.23	34.93	31.02	30.15	**
11102	PMP B Volt	VDC	**	**	**	**	**	**	-15.12
11104	PMP B Temp	DGC	**	**	**	**	**	**	30.76
11008	Trans B-15VDC	VDC	**	**	**	**	**	**	-15.20

** Unit Not In Use.

Figure 9-2 is the recorded AGC signal at Alaska on two receivers, shown in Channels 2 and 3. Telemetry and command link was maintained via VHF shown on Channel 4. The 10 dB rise can be seen at 17:55:37 when the change-over occurred. As additional change-overs occurred in the Pre Modulation Processors and in the Command Integration Channels, USB lock was lost for about 30 seconds until it could be re-acquired by the Goldstone ground station whose horizon the spacecraft was just entering.

Figure 9-3 shows AGC readings at Goldstone for a constant reference orbit in each cycle since launch, resulting in each curve having all data points in the same range, elevation and azimuth. The AGC difference (8 dB) between the curves for the two distances shown is caused by the dual effects of doubling the distance (6 dB) and using a different section of the USB antenna pattern. The effect of the power decline of the USB transmitter can be seen, as well as the (single-point) rise after switch-over to USB-B.

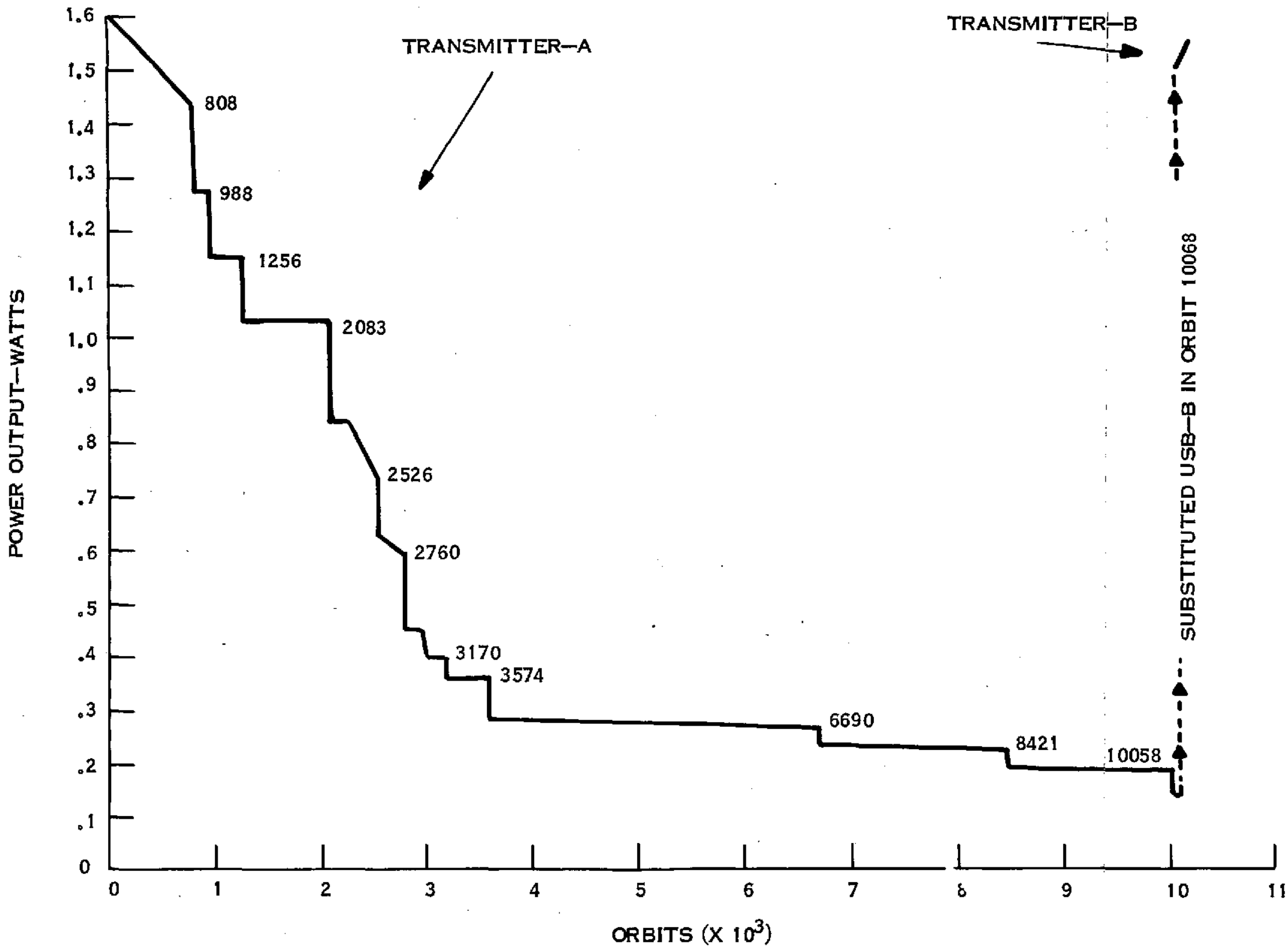
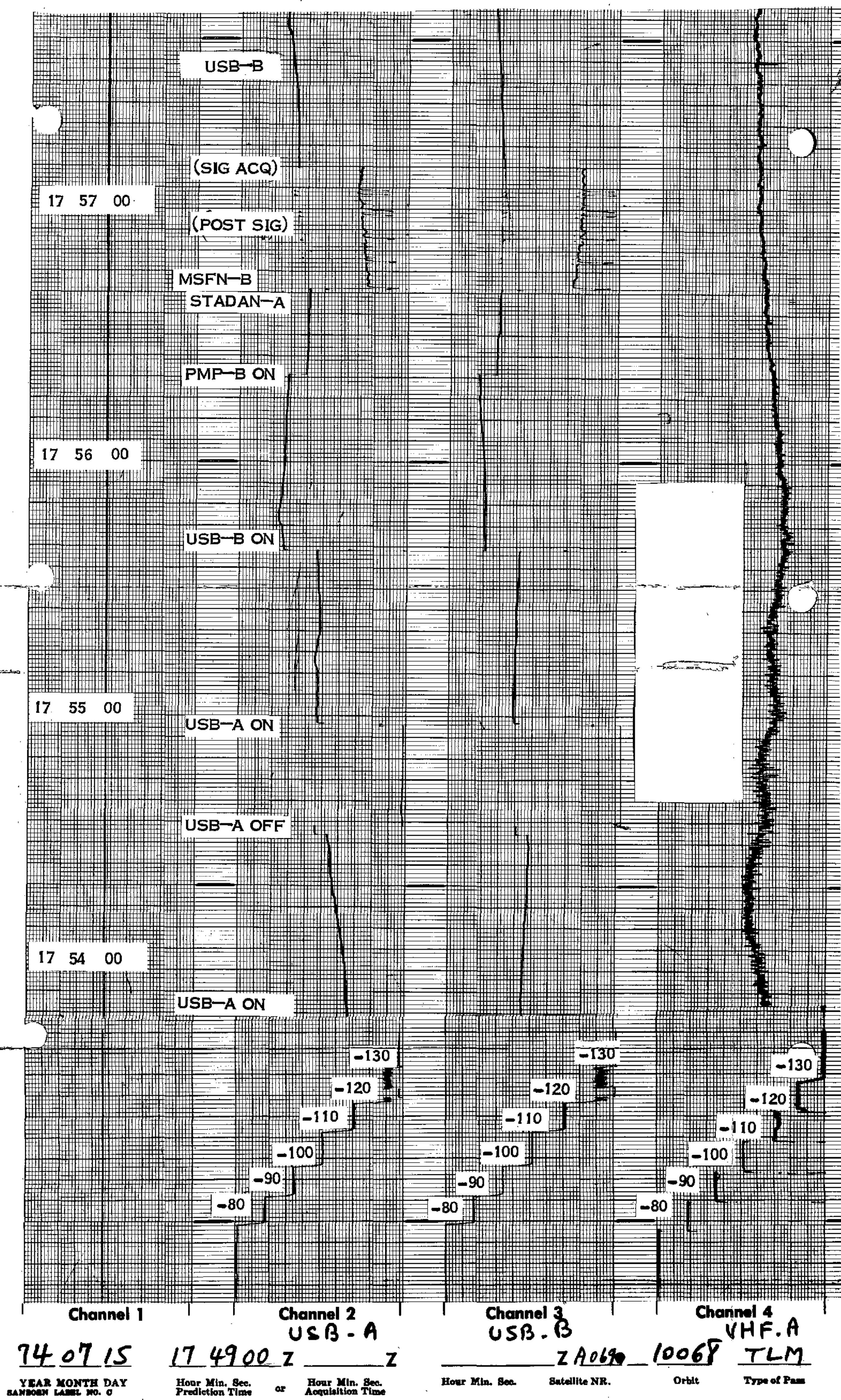


Figure 9-1. USB 2-Year Power Output History



FOLDOUT FRAME

FOLDOUT FRAME

2

Figure 9-2. Change-over USB-A to USB-B Strip Chart Alaska

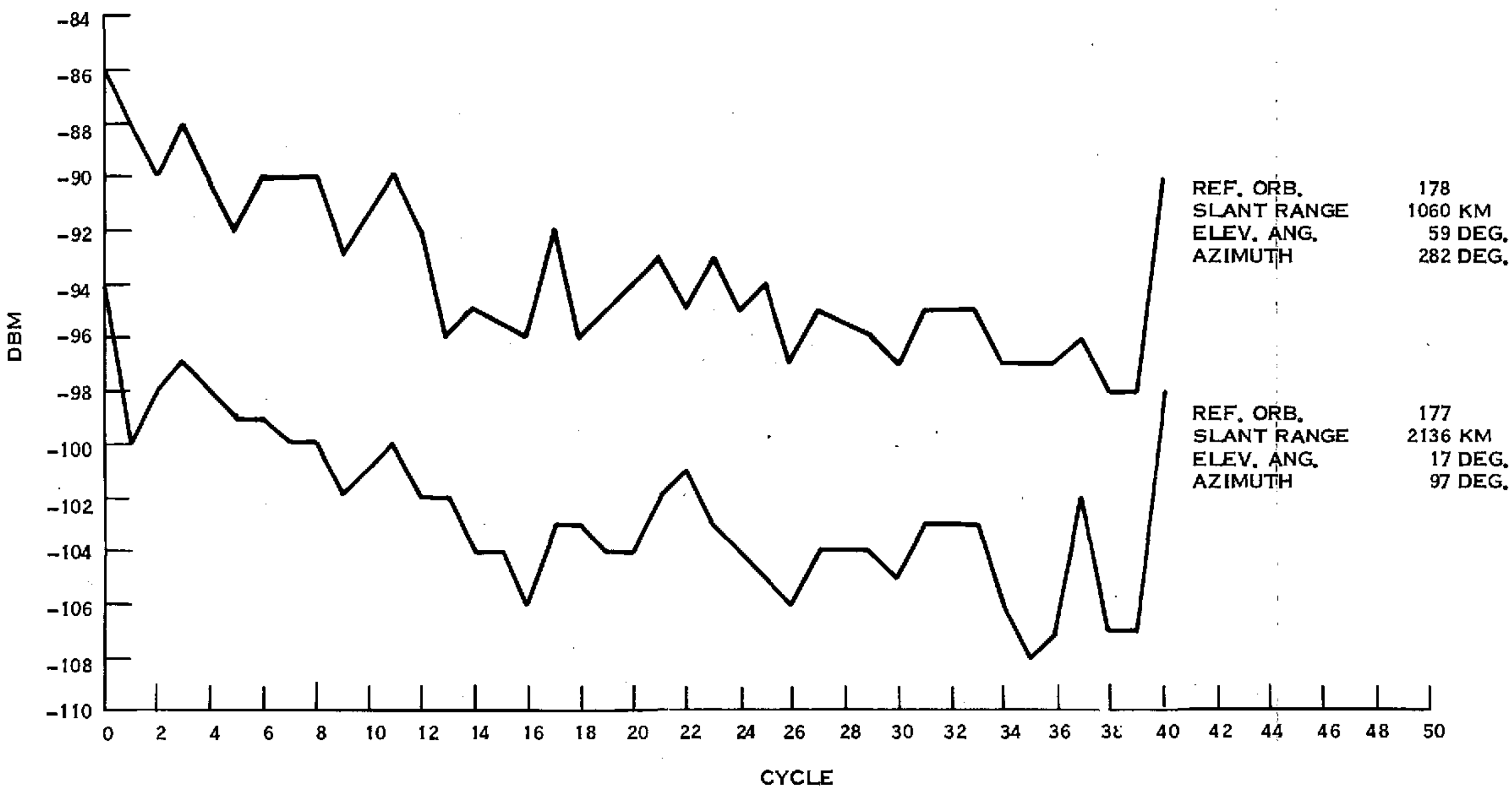


Figure 9-3. USB AGC Readings at Goldstone with 30-Foot Antenna

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

Auxiliary Processing Unit (APU) consists of Search Track Data, Time Code Data, and Back-up Timers which 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. APU Telemetry Functions

Functions	Description	Unit	Orbit							
			7	2600	5098	7650	8911	9335	9751	10182
13200	APU, -24.5 VDC	VDC	-24.90	-24.90	-24.90	-24.91	-24.91	-24.90	-24.90	-24.91
13201	APU, -12 Volts	VDC	-12.08	-12.08	-12.08	-12.07	-12.07	-12.07	-12.07	-12.07
13202	APU Temp.	DGC	25.49	28.50	26.95	29.21	27.65	27.25	27.05	27.15

The Power Switching Module (PSM) contains the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2, RBV and PRM. The MSS and WBVTR No. 1 power circuits have been operated on a regular basis throughout this report period. The power relay for the RBV remained in a failed closed condition since Orbit 196, but the RBV remained off by relays in the camera subsystem. The WBVTR No. 2 remained off due to the failure occurring in Orbit 148. All switching during this report period was normal.

The Interface Switching Module (ISM) performed all switching normally during this report period. Compensation Loads changes were exercised in this report period as reported in Table 11-2.

SECTION 11

THERMAL SUBSYSTEM

SECTION 11

THERMAL SUBSYSTEM

The Thermal Subsystem has maintained spacecraft temperature control over a satisfactory range during this report period. Table 11-1 shows average analog telemetry values from data recorded on the NBTR. During this report period, the sun angle varied as shown in Figure 3-3 and the intensity decreased as shown in Figure 3-4 for day 114 to 204. Figure 11-1 shows a typical thermal profile for average bay temperatures of the sensory ring in this report period. The values are consistent with the limits established through two years of orbital operation.

Compensation Load History is shown in Table 11-2. In Orbits 8928, compensation load number 3 was turned off when the Wide Band Electronic Unit 1 resumed normal operation. In Orbit 9898, compensation load number 3 was turned on again to keep the Wide Band Electronic unit 1 temperature in normal limits while it was off during investigation. Normal operation had not resumed at the end of this report period.

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

Function No.	Description	Unit	Orbit 26	Orbit 2600	Orbit 5098	Orbit 7650	Orbit 8912	Orbit 9335	Orbit 9751	Orbit 10182
7001	THM TH01 STI	DGC	19.52	22.18	20.85	22.24	21.81	20.53	20.62	21.65
7002	THM TH02 SBO	DGC	18.60	20.55	19.95	20.38	20.85	19.93	19.98	20.60
7003	THM TH03 STI	DGC	18.48	21.79	20.16	20.83	21.19	19.83	19.91	20.87
7004	THM TH03 SBI	DGC	19.47	21.11	20.25	21.50	20.80	20.51	20.45	20.36
7005	THM TH04 STI	DGC	18.39	21.17	19.71	20.12	20.67	19.55	19.65	20.35
7006	THM TH05 SBO	DGC	17.57	19.04	18.39	18.55	18.98	18.30	18.46	18.81
7007	OA -X THRUSTER	DGC	21.95	22.38	22.95	22.55	23.06	23.32	23.37	22.90
7008	THM TH07-STO	DGC	15.95	17.09	16.61	16.72	17.14	16.58	16.65	16.90
7009	THM TH06 SBI	DGC	19.38	21.05	20.35	21.04	21.11	20.28	20.49	20.93
7010	THM TH07 STI	DGC	18.61	19.79	*	*	*	*	*	*
7011	THM TH08 STO	DGC	21.78	22.52	22.77	22.61	23.05	23.06	23.11	22.88
7012	THM TH09 SBI	DGC	21.81	23.10	22.87	23.32	23.43	23.19	23.19	23.08
7013	THM TH10 SBO	DGC	18.73	19.87	19.53	20.04	19.77	19.72	19.79	19.64
7014	THM TH11 STI	DGC	22.37	24.52	23.35	25.01	24.09	23.57	23.49	23.57
7015	THM TH12 SBO	DGC	22.37	25.36	23.17	25.95	23.71	23.26	23.09	23.03
7016	THM TH13 STI	DGC	20.95	24.55	22.02	25.37	22.97	22.09	21.95	22.47
7017	RBV BEAM CTR LN	DGC	21.53	23.30	22.62	23.72	23.31	22.90	22.86	22.84
7018	THM TH14 STO	DGC	20.38	24.77	21.40	26.10	22.39	21.29	21.27	21.93
7019	NBR RAD OUTBD B4	DGC	5.09	6.06	5.86	6.10	6.17	5.91	6.00	6.00
7020	THM TH15 SBI	DGC	21.14	26.21	23.24	27.39	24.29	23.03	23.19	23.99
7021	THM TH16 STI	DGC	20.73	25.44	22.90	26.30	23.96	22.65	22.81	23.68
7022	THM TH17 SBI	DGC	20.22	25.18	22.76	25.72	23.76	22.37	22.54	23.56
7023	THM TH18 SBO	DGC	21.90	25.79	24.29	26.55	25.40	24.06	24.17	25.19
7030	THM TH03 BUR	DGC	16.05	17.89	17.07	17.01	17.64	16.81	16.93	17.42
7031	THM TH06 BUR	DGC	13.59	14.49	14.17	14.15	14.51	14.13	14.19	14.28
7032	THM TH09 BUR	DGC	19.92	20.61	20.75	20.83	20.93	21.03	21.05	20.74
7033	THM TH12 BUR	DGC	21.51	24.59	22.16	25.25	22.58	22.12	22.06	22.76
7034	THM TH15 BUR	DGC	19.70	24.36	21.67	25.92	23.18	21.64	21.53	22.38
7035	THM TH18 BUR	DGC	20.11	22.45	21.36	23.10	22.59	21.24	21.12	22.02
7040	THM TH01 TCB	DGC	19.27	21.58	20.46	21.59	21.42	20.18	20.32	21.26
7041	THM TH02 TCB	DGC	17.99	20.00	19.23	19.60	20.06	19.03	19.16	19.89
7042	THM TH03 TCB	DGC	18.34	21.83	19.94	20.12	21.22	19.60	19.84	20.92
7043	THM TH04 TCB	DGC	18.95	20.71	19.94	20.03	20.50	19.80	19.88	20.26
7044	THM TH05 TCB	DGC	16.27	17.45	16.98	17.09	17.54	16.91	17.03	17.32
7045	THM TH07 TCB	DGC	18.41	19.36	19.21	19.27	19.73	19.34	19.42	19.45
7046	THM TH09 TCB	DGC	19.38	20.52	20.37	20.51	20.87	20.57	20.59	20.64
7048	THM TH11 TCB	DGC	21.98	24.32	22.94	24.92	23.64	23.18	23.11	23.18
7049	THM TH12 TCB	DGC	21.92	25.10	22.46	25.61	23.13	22.52	22.20	22.35
7050	THM TH13 TCB	DGC	21.21	25.22	21.99	26.29	22.81	21.91	21.86	22.29
7051	THM TH14 TCB	DGC	21.38	26.19	22.88	27.41	24.04	22.66	22.74	23.62
7052	THM TH16 TCB	DGC	21.30	26.65	23.95	27.72	25.27	23.51	23.86	25.13
7053	THM TH17 TCB	DGC	21.73	25.74	24.03	26.41	25.13	23.67	23.89	25.02
7054	THM TH18 TCB	DGC	20.02	22.99	22.20	23.33	23.22	21.87	22.07	23.35
7060	THM SHUTTER BY 1	DEG	25.85	43.64	33.12	43.03	40.15	31.29	32.01	38.62
7061	THM SHUTTER BY 2	DEG	6.62	13.88	8.65	13.85	15.00	12.11	10.97	13.28
7062	THM SHUTTER BY 3	DEG	10.96	38.14	23.58	24.46	34.13	22.48	22.91	30.24
7063	THM SHUTTER BY 4	DEG	30.60	38.29	35.71	35.41	39.17	36.26	36.95	37.92
7064	THM SHUTTER BY 5	DEG	15.03	16.	16.25	16.25	15.62	15.06	14.69	15.00
7065	THM SHUTTER BY 7	DEG	17.14	21.	24.64	24.14	21.43	21.43	20.93	21.96
7067	THM SHUTTER BY 9	DEG	33.26	38.45	38.44	38.73	39.88	38.48	38.94	39.50
7068	THM SHUTTER BY 10	DEG	24.68	33.65	28.68	36.36	30.83	31.25	26.47	27.31
7069	THM SHUTTER BY 11	DEG	39.66	55.79	46.89	59.06	52.59	49.23	48.33	48.96
7070	THM SHUTTER BY 12	DEG	43.81	55.84	46.63	61.36	51.75	47.74	45.05	45.68
7071	THM SHUTTER BY 13	DEG	40.39	59.02	46.38	59.61	47.44	44.87	44.08	44.79
7072	THM SHUTTER BY 14	DEG	34.20	62.55	39.70	70.80	44.26	41.03	37.53	41.91
7073	THM SHUTTER BY 15	DEG	45.40	75.54	58.74	80.38	65.57	59.03	59.73	64.79
7074	THM SHUTTER BY 16	DEG	24.50	59.81	48.46	62.87	53.29	44.76	47.15	53.54
7075	THM SHUTTER BY 17	DEG	39.06	66.93	54.96	70.35	62.46	52.77	54.70	61.88
7076	THM SHUTTER BY 18	DEG	29.70	48.57	43.15	49.89	49.43	40.32	41.71	51.20
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	8.32	8.31	8.32	8.32	8.32	8.32	8.32
7083	THM Q1 S ZENER V	VDC	8.31	8.35	8.32	8.36	8.35	8.33	8.32	8.35
7084	THM Q2 S ZENER V	VDC	8.19	8.21	8.19	8.21	8.20	8.19	8.19	8.20
7085	THM Q3 S ZENER V	VDC	8.15	8.16	8.15	8.15	8.15	8.15	8.15	8.15
7090	THM PSM MOUNT	DGC	21.60	23.78	22.54	24.32	23.43	22.72	22.71	22.98
7091	THM IND ATTITUDE	DGC	19.40	21.07	20.42	20.95	21.22	20.55	20.65	20.88
~~7092~~	~~THM RBV RADIATOR~~	~~DGC~~	~~15.65~~	~~17.89~~	~~17.22~~	~~18.55~~	17.76	17.54	17.57	17.47
7093	THM RBVC CTR BM	DGC	20.30	22.49	21.61	23.01	22.35	21.93	21.91	21.87
7094	THM WBVTR ROOT	DGC	12.96	17.10	15.71	17.61	16.42	15.64	15.69	16.07
7095	THM WBVTR RAD CT	DGC	4.81	8.66	8.17	9.97	9.29	8.53	8.37	8.68
7096	THM WBVTR STRAP	DGC	16.62	21.06	19.32	21.16	20.00	19.11	19.09	19.66
7097	THM WB MT BAY 1	DGC	20.56	22.36	19.52	21.11	21.75	18.66	18.34	21.37
7098	THM WB MAT BAY 1	DGC	20.22	21.05	18.90	20.78	20.76	18.42	18.28	20.39
7099	THM WBVTR SEP 3	DGC	18.60	22.32	20.55	21.49	21.38	20.16	20.18	21.05
7100	THM WBVTR SEP 17	DGC	21.31	26.15	23.66	26.28	24.48	23.21	23.28	24.23
7101	THM WBVTR 1 DENT	DGC	21.49	25.95	23.72	25.50	24.30	23.22	23.19	24.01
7102	THM WBVTR 2 BAY	DGC	17.46	20.04	18.92	19.66	19.67	18.79	18.89	19.32
7103	THM WBVTR 2 BY 15	DGC	21.00	25.65	23.16	26.44	24.18	22.96	23.08	23.82
7104	THM WBVTR 2 CTR	DGC	19.35	23.50	21.51	23.60	22.21	21.30	21.31	21.81
7105	THM NBTR B SEP 6	DGC	18.06	20.17	19.30	20.22	19.99	19.31	19.48	19.79
7106	THM NBTR B SEP 1	DGC	20.82	24.88	22.35	25.78	23.40	22.31	22.33	22.89
7107	THM NBTR BM CTR	DGC	19.37	22.44	21.04	22.86	21.89	21.05	21.06	21.34
7108	THM MSS MOUNT 14	DGC	19.18	23.89	21.15	24.79	22.27	21.09	21.17	21.70
7109	THM OA -Y THRUSTER	DGC	22.21	28.11	23.80	29.56	25.22	23.69	23.81	24.69
7110	THM MSS WBVTR BM	DGC	18.14	21.29	20.06	21.57	20.90	20.08	20.21	20.53
7111	THM OA +X THRUSTER	DGC	20.30	23.43	19.92	21.55	21.47	19.40	19.34	21.22
7130	THM AVX P1 T	DGC	15.69	11.23	8.49	12.76	-3.34	6.34	8.35	-18.90
7131	THM AVX P2 T	DGC	10.63	3.63	1.59	23.20	0.39	1.07	2.56	.41

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

FOLDOUT FRAME 1

FOLDOUT FRAME 2

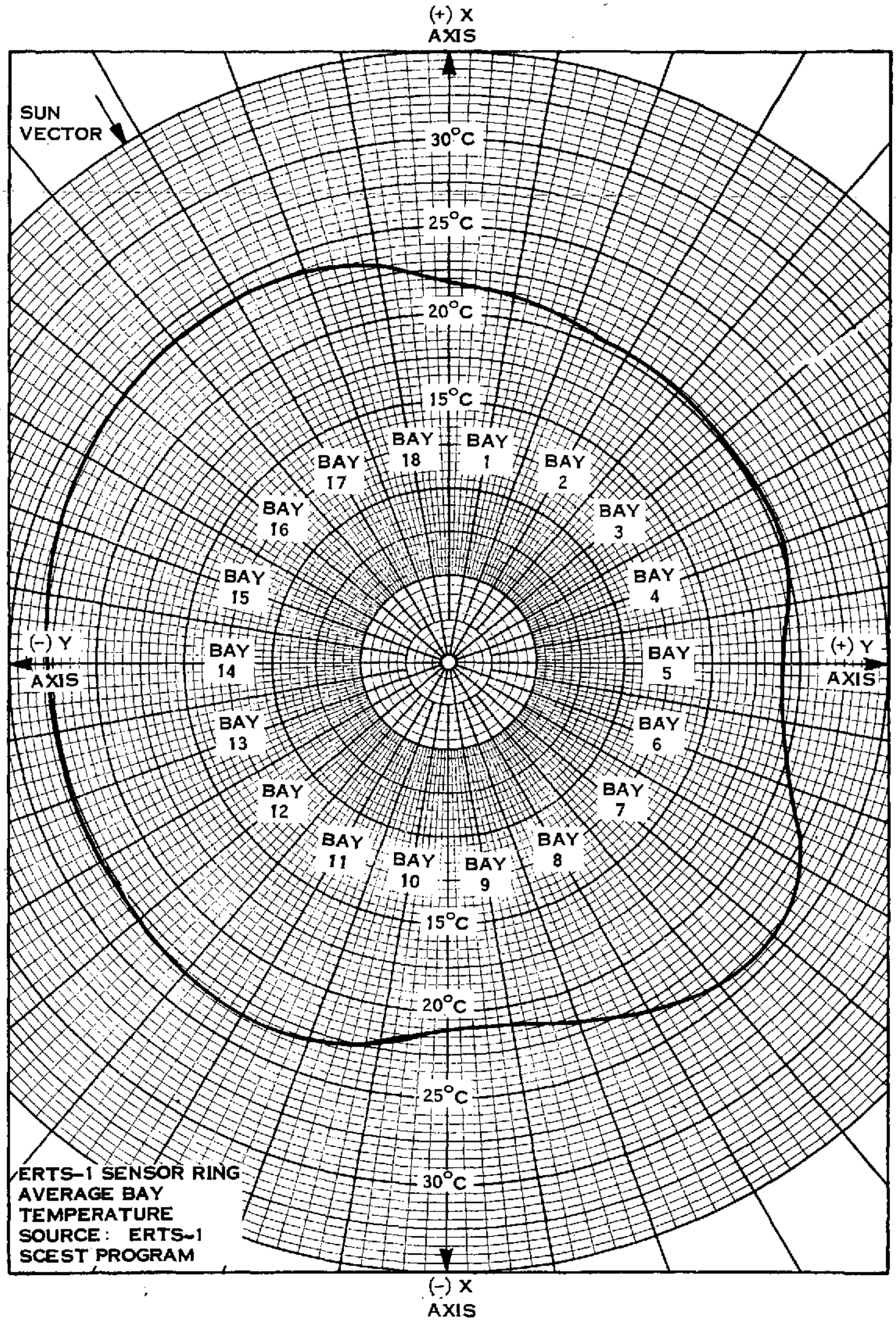


Figure 11-1. Sensory Ring Thermal Profile

Table 11-2. Compensation Load History

Compensation Load Status *								
ORBITS	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
118	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
3644	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

*NOTE:
x = ON
0 = OFF

SECTION 12

NARROWBAND TAPE RECORDERS

SECTION 12

NARROWBAND TAPE RECORDERS

The Narrowband Tape Recorder Subsystem continued to operate in a completely satisfactory manner. Since Orbit 1 the two recorders A and B have alternated in Record and Playback modes, generally switching roles each orbit. There is a nominal one minute overlap in Record for continuity.

Since launch, each recorder has had an ON time of 9217 hours and an OFF time of 8308 hours. Each recorder was in the Playback mode for 369 hours; in the Record mode for 8848 hours.

Table 12-1 shows typical telemetry values since launch. They are normal and show no significant trends.

Table 12-2 is a significant sample of the data in this reporting period showing the performance parameters of the Narrowband Recorders. It includes data to evaluate the entire link, including the radio downlink transmitting data from the recorders and the effect of ground station processing. The "mean data rate", nominally 24 kilobits, reflects the motor speed. The slightly slower speed has no effect on fidelity, but only increases operating time by less than one percent. The standard deviation is a measure of effects that would cause "wow" and "flutter" in a major frame. Occasional high values are attributed to transmission link noise. The performance appears excellent and is as good as it has been at any time since launch.

Table 12-1. Narrowband Tape Recorder Telemetry Values

No.	Function / Name	Typical Telemetry Values - Orbits					
		6	1951-1959	3750-3751	5199-5200	7480-7481	9865-9866
10001	A - Motor Cur. (ma)						
	Record	190.10	189.47	189.20	188.76	186.31	186.31
	P/B	180.00	177.63	178.69	176.64	172.10	172.10
10101	B - Motor Cur. (ma)						
	Record	193.26	192.79	193.04	195.60	194.79	195.79
	P/B	188.18	189.47	185.44	189.58	186.31	189.47
10002	A - Pwr Sup. Cur. (ma)						
	Record	320.56	339.81	338.20	342.48	339.81	339.81
	P/B	535.78	563.11	568.38	567.30	569.56	569.56
10102	B - Pwr Sup. Cur. (ma)						
	Record	317.62	333.75	336.05	341.87	343.50	346.75
	P/B	570.78	567.50	555.63	565.95	574.00	567.50
10003	A - Rec. Temp. (DGC)	25.47	26.25	24.40	24.56	24.20	22.80
10103	B - Tec. Temp. (DGC)	24.58	25.38	23.41	23.99	24.54	24.77
10004	A - Supply (VDC)	-24.47	-24.50	-24.44	-24.41	-24.62	-24.62
10104	B - Supply (VDC)	-24.44	-24.57	-24.51	-24.57	-24.57	-24.29

Table 12-2. Narrowband Recorder Subsystem Performance

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
9150	0.00	0.00	-23.84	0.02	B
9151	0.00	0.00	-23.86	0.02	A
9152	0.00	0.00	-23.84	0.02	B
9153	0.01	0.77	-23.86	0.02	A
9154	0.00	0.00	-23.84	0.00	B
9250	0.00	0.00	-23.88	0.03	A
9251	0.00	0.51	-23.84	0.02	B
9252	0.01	0.25	-23.86	0.02	A
9253	0.01	0.00	-23.84	0.02	B
9254	0.01	0.00	-23.86	0.02	A
9357	0.00	0.00	-23.87	0.02	A
9358	0.00	0.00	-23.84	0.02	B
9359	0.01	0.01	-23.86	0.02	A
9360	0.00	0.00	-23.84	0.02	B
9361	0.00	0.00	-23.86	0.02	A
9470	0.00	0.00	-23.84	0.02	B
9471	0.05	0.00	-23.87	0.27	A
9472	0.00	0.26	-23.84	0.02	B
9474	0.00	0.52	-23.84	0.02	B
9475	0.00	0.24	-23.86	1.17	A
9550	0.00	0.13	-23.86	0.03	B
9551	0.13	0.70	-23.88	0.45	A
9552	0.01	0.00	-23.84	0.02	B
9553	0.00	0.00	-23.86	0.02	A
9554	0.00	0.26	-23.84	0.02	B
9640	0.08	0.14	-23.85	0.04	B
9641	0.00	0.27	-23.86	0.03	A
9642	0.01	0.47	-23.84	0.02	B
9643	0.00	0.00	-23.86	0.02	A
9644	0.00	0.26	-23.84	0.02	B
9750	0.01	0.00	-26.86	0.02	A
9751	0.01	0.00	-23.84	0.02	B
9752	0.00	0.00	-23.86	0.02	A
9753	0.00	0.26	-23.84	0.02	B
9754	0.23	0.48	-23.86	0.59	A
9851	0.01	0.23	-23.87	0.02	A
9852	0.00	0.00	-23.84	0.02	B
9853	0.25	0.00	-23.86	0.61	A
9854	0.25	0.00	-23.85	0.61	B
9857	0.00	0.25	-23.88	0.03	A

Orbit No.	% Data		Data Rate		RCDR
	Bad	Missing	Mean	Std. Dev.	
9947	0.00	0.31	-23.84	0.02	B
9948	0.01	0.26	-23.86	0.02	A
9949	0.24	0.00	-23.81	0.59	B
9950	0.01	0.00	-23.86	0.02	A
9951	0.25	0.00	-23.84	0.60	B
10062	0.00	0.00	-23.86	0.02	A
10063	1.04	0.25	-23.84	1.35	B
10066	0.00	0.13	-23.88	0.43	A
10067	0.15	0.29	-23.85	0.46	B
10069	0.52	0.13	-23.88	0.94	A
10143	0.00	0.27	-23.86	0.02	A
10144	0.23	0.00	-23.90	0.06	B
10145	0.01	0.00	-23.86	0.03	A
10146	1.44	1.02	-23.84	1.51	B
10147	0.00	0.21	2.98	0.00	A
Sample From Prior Orbits					
953	0.00	0.00	-23.82	0.02	
1320	0.01	0.00	-23.82	0.03	
2091	0.21	0.23	-23.85	0.57	
2496	0.00	0.25	-23.85	0.60	
4056	0.00	0.13	-23.85	0.03	
6050	0.01	0.00	-23.87	0.03	
6953	0.26	0.00	-23.84	0.61	
7650	0.00	0.00	-23.84	0.02	
8750	0.00	0.00	-23.87	0.02	

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has operated successfully since turn-on in Orbit 12. This Subsystem consists of two independent and similar 10/20 watt S-Band FM transmitters WPA-1 and 2 with associated filters, antennas, modulators and signal conditioning equipment.

WPA No. 1 was used with RBV input until Orbit 196 when the RBV power input circuit failed. WPA-1 was used again, this time with MSS input, between Orbits 1890 and 2099 because its operating frequency was less likely to interfere with the Apollo-17 launch operations. The cumulative ON-time for WPA No. 1 is 31 hours, 55 minutes and 9 seconds. When used after Orbit 20 it operated in the 20-watt mode.

WPA No. 2 has been used with MSS input since its initial turn-ON in the 10 watt mode during Orbit 12. It was changed to the 20 watt mode in Orbit 30, and has operated at this power ever since. It was not used between Orbits 1890 and 2099. The cumulative ON time for WPA No. 2 is 1379 hours, 6 minutes and 25 seconds.

Table 13-1 gives the telemetry values for both Wideband Power Amplifier units. All values are normal and show no significant trends.

Figure 13-1 shows the power delivered to Goldstone from two selected points in space (identical azimuth, elevation and slant ranges) as a function of time. Variations in equipment performance, calibration procedures, and readout accuracy probably cause the curves to have a saw-tooth appearance. The large variations in AGC levels have been attributed to equipment substitutions or adjustments. Within the limits of repeatable calibration and equipment adjustment the power delivered to Goldstone appears to have been generally constant since launch. The power output of the WPA-2 as measured by telemetry (Table 13-1) has remained level since launch at about 43.5 dBm.

PIR-U-ERTS-1N23-109 (see Appendix D) shows the extreme range of 3705 Kilometers over which the Wide Band Telemetry Subsystem transmitted MSS data to the Prince Albert ground station. Due to the altitude of the Prince Albert Station, it was able to receive good quality data at an elevation angle of 0.8 degrees below the horizon.

Table 13-1. Wideband Modulator Telemetry Values

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 ConVolt (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	2595	4096	7650	9335	9752	10182
12101	Temp TWT Coll. (Max)	(DgC)	35.38	34.80	34.24	33.65	32.50	32.50	35.96
12102	Helix Current	(Ma)	7.32	7.46	7.70	7.74	7.47	7.38	7.71
12103	TWT Cath. Cur.	(Ma)	44.30	42.52	43.85	41.72	40.62	41.34	42.79
12104	Forward Pwr	(DBM)	43.57	43.35	43.57	43.52	43.39	43.46	43.47
12105	Reflected Pwr	(DBM)	31.59	32.11	32.79	32.83	31.89	32.37	32.91
12228	Loop Str AFC Con Volt (1)	(MHz)	1.11	-1.01	-0.78	-1.10	-1.41	-1.21	-1.14
12229	Mod Temp VCO	(DgC)	21.70	24.04	20.88	20.55	22.18	20.37	22.25
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.68	2.58	2.69	2.68	2.69	2.69	2.69
12234	-15 VDC Pwr Sup A	(TMV)	5.90	5.71	5.98	5.94	5.98	5.99	5.91
12236	+5 VDC Pwr Sup A	(TMV)	3.97	3.91	4.01	4.01	3.94	4.01	4.02
12239	-5 VDC Pwr Sup A	(TMV)	5.24	5.05	telemetry point defective				
12240	-24.5 VDC Unreg Volt A	(TMV)	5.43	5.33	5.52	5.51	5.56	5.59	5.43
12242	Inv. Temp	(DgC)	23.03	22.95	22.96	24.10	22.55	22.89	23.99

(1) Satisfactory if not zero or -7.5 (2) B Power Supply not yet used in orbit

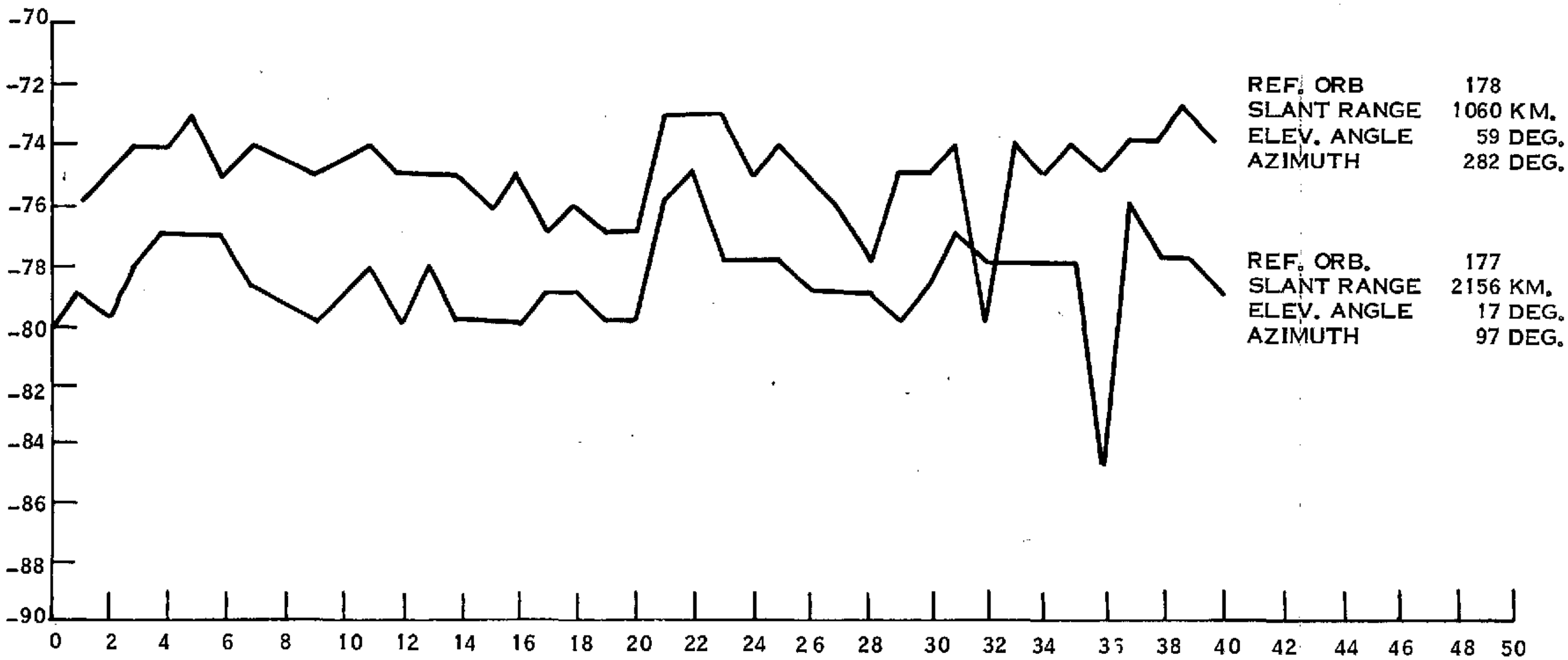


Figure 13-1. AGC Readings at Goldstone with 30-Foot Antenna Wide Band Power Amplifier

SECTION 14

ATTITUDE MEASUREMENT SENSOR

SECTION 14

ATTITUDE MEASUREMENT SENSOR

Telemetry output of the AMS continues to be normal and in ± 0.30 degree agreement with the ACS Subsystem.

Table 14-1 gives typical AMS telemetry values.

Table 14-1. AMS Temperature Telemetry Summary

Function No.		Units	Orbit							
			35	2600	5099	7650	8911	9335	9752	10182
3004	Case - Temp 1	°C	18.92	20.05	19.42	20.29	20.05	19.88	19.78	19.71
3005	Assembly - Temp 2	°C	19.15	20.27	19.76	20.68	20.34	20.17	20.06	19.96

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

The Wideband Video Tape Recorder Subsystem consists of two components. WBVTR-1 and WBVTR-2. WBVTR-2 failed in Orbit 148 after 9 hours, 26 minutes and 33 seconds of satisfactory flight performance.

WBVTR-1 operated with RBV through Orbit 196 after which it was re-configured to operate with MSS. The WBVTR-1 has had 4 major disruptions in its service, generally characterized by high headwheel current (above 0.70 amperes) and high Minor Frame Sync Error counts (above 300). These disruptions occurred during:

Orbit 3469 on 29 March 1973

Orbit 8253 on 7 March 1974

Orbit 8845 on 19 April 1974

Orbit 9881 on 2 July 1974

After Orbit 9881, the tape recorder has temporarily been removed from operational service for engineering tests. The history of WBVTR-1 since Orbit 9000 is summarized in Appendix E. It is currently being operated in a test mode, cycling thru Records and Playbacks to provide data for selecting effective corrective measures.

In Figure 15-1 the usage of the tape by footage is shown.

Telemetry values for all functions are shown in Table 15-1. Values for WBVTR-2 are also shown for convenience and completeness.

Some of the telemetered functions have different values for different operating modes: Playback, Standby, Rewind and Record. These are shown in Table 15-2, showing stable operations since launch. It would appear the tape recorder itself is still in good operating condition, but that the video tape is both damaged and beginning to deteriorate.

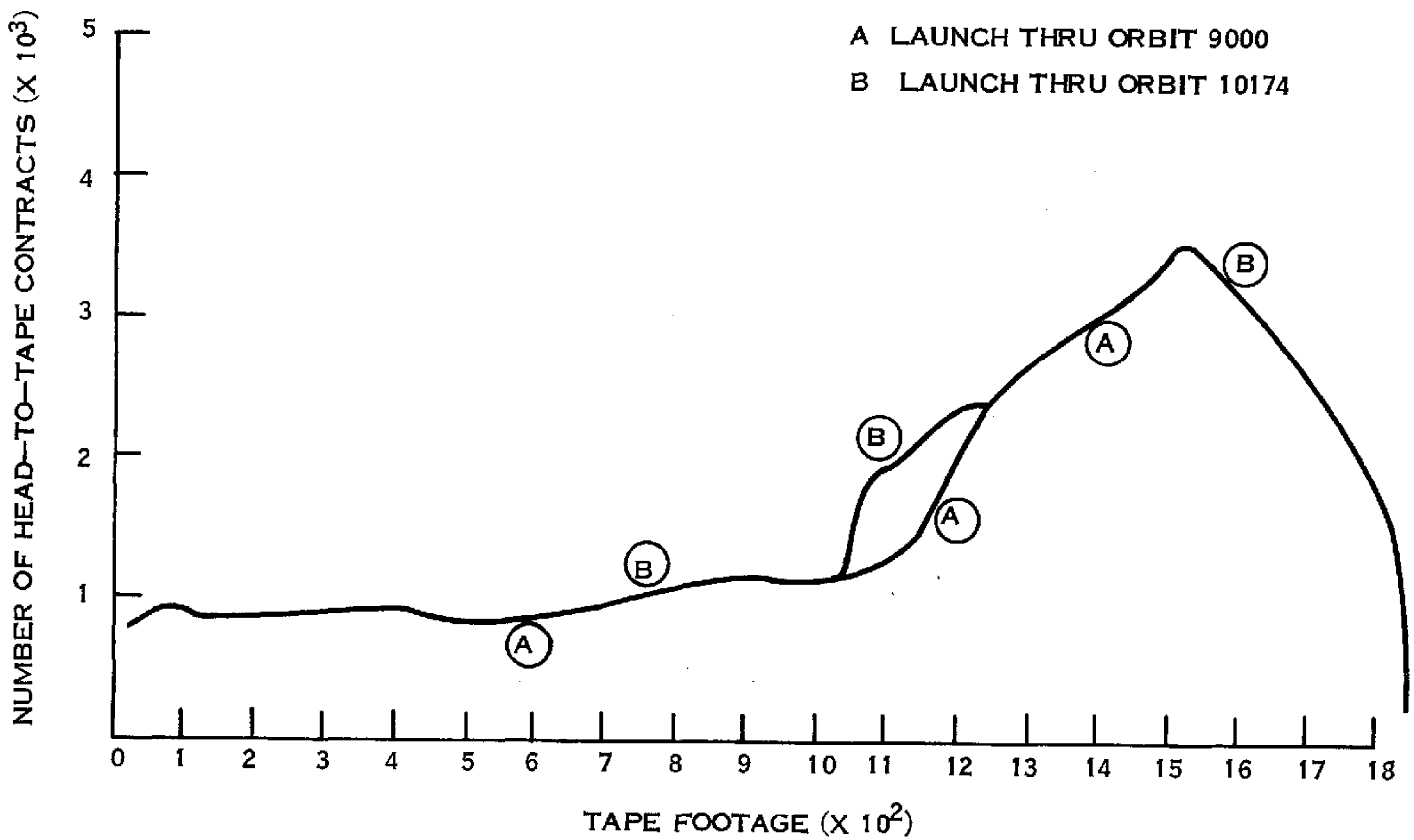


Figure 15-1. Tape Usage by Footage

Table 15-1. WBVTR Telemetry Values

WBVTR-1 Functions			Telemetry Value in Orbits						
Number	Name		15	2599	5029	7650	9435	9878	10088
13022	Pressure Trans	(PSI)	16.12	16.38	16.11	16.12	15.98	15.97	15.98
13023	Temp Trans	(DgC)	19.50	25.05	21.84	23.78	21.25	20.74	20.81
13024	Temp Elec	(DgC)	22.78	25.34	20.44	21.91	19.00	17.41	23.72
13026	Capstan Speed	(%)	100.51	98.25	101.93	101.11	97.77	97.34	102.84
13027	Headwheel Speed	(%)	95.16	96.84	95.17	93.14	92.05	90.93	93.47
13028	Capstan Mot I	(Amp)	0.25	0.26	0.27	0.24	0.25	0.24	0.28
13029	Input P/B Volt.	(VPP)	0.72	0.41	0.45	0.46	0.48	0.59	0.33
13030	Headwheel Mot I	(Amp)	0.55	0.55	0.54	0.54	0.55	0.57	0.55
13031	Rec Input I	(Amp)	3.15	3.31	3.68	3.16	2.77	2.95	2.82
13032	Lim Volt Out	(VPP)	1.44	1.42	1.45	1.45	1.36	1.36	1.17
13033	Servo Volt	(%)	50.03	50.23	50.74	50.74	50.16	50.25	47.71
13034	+5.6 VDC Conv	(VDC)	5.66	5.71	5.68	5.78	5.79	5.64	5.65

WBVTR-2 Functions			Orbit Number			
Number	Name		15	64	103	147
13122	Pressure, Trans	(PSI)	15.99	16.25	16.25	16.11
13123	Temp Trans	(DgC)	18.46	19.19	20.72	21.09
13124	Temp Elec	(DgC)	21.50	22.00	24.00	21.92
13126	Capstan Speed	(%)	99.91	100.53	100.80	99.38
13127	Headwheel Speed	(%)	94.16	95.48	97.64	98.78
13128	Capstan Mot I	(Amp)	0.17	0.24	0.24	0.28
13129	Input P/B Volt	(VPP)	0.66	0.63	0.62	0.61
13130	Headwheel Mot I	(Amp)	0.55	0.59	0.52	0.53
13131	Rec Input I	(Amp)	3.70	3.53	3.07	3.43
13132	Lim Volt Out	(VPP)	1.34	1.41	1.41	1.39
13133	Servo Volt	(%)	49.97	49.60	49.80	49.48
13134	+5.6 VDC	(VDC)	5.47	5.64	5.58	5.59

Table 15-2. Function Values by Mode in Orbit

Function/Description	Orbits 913	2379	3781	4876	7385	7953	9866
13029 - Input P/B Voltage							
Record	0	0	0	0	0	0	0
Playback	0.40	0.45	0.58	0.53	0.48	0.48	0.67
Rewind	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0
13028 - Capstan Motor Current							
Record	0.23	0.24	0.26	0.23	0.26	0.25	0.25
Playback	0.25	0.25	0.26	0.26	0.28	0.23	0.28
Rewind	0.23	0.20	0.20	0.17	0.17	0.18	0.18
Standby	0	0	0	0	0	0	0
13030 - Headwheel Motor Current							
Record	0.58	0.55	0.58	0.58	0.58	0.58	0.60
Playback	0.56	0.55	0.62	0.56	0.55	0.58	0.59
Rewind	0.47	0.44	0.46	0.45	0.43	0.45	0.46
Standby	0.47	0.44	0.44	0.44	0.44	0.44	0.44
13031 - Recorder Input Current							
Record	3.70	3.63	3.46	3.40	3.40	3.30	3.30
Playback	3.85	3.89	3.74	3.76	3.69	3.56	3.59
Rewind	2.20	2.18	2.07	1.89	1.94	1.85	1.85
Standby	1.96	2.08	1.78	1.73	1.88	1.98	1.85
13033 - Servo Voltage							
Record	0	0	0	0	0	0	0
Playback	50.30	50.37	50.70	50.78	50.76	50.96	50.86
Rewind	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0
13026 - Capstan Motor Speed							
Record	98.50	96.70	102.88	103.41	103.41	105.09	104.53
Playback	98.40	97.20	101.3	102.40	101.16	104.53	103.41
Rewind	101.70	101.1	99.20	98.90	99.48	98.36	98.36
Standby	0	0	0	0	0	0	0
13027 - Headwheel Motor Speed							
Record	97.10	100.0	94.23	93.64	93.06	91.88	91.88
Playback	97.10	97.80	93.69	92.93	93.06	90.70	91.29
Rewind	100.72	100.70	95.10	93.60	93.64	91.88	91.88
Standby	100.70	102.80	95.41	96.00	95.41	90.12	93.65

SECTION 16

RETURN BEAM VIDICON SYSTEM

SECTION 16

RETURN BEAM VIDICON

The Return Beam Vidicon (RBV) Subsystem operated normally fron turn-on in Orbit 19 to Orbit 196 when it failed to respond to a turn-off command because of a probable failure of a relay in the Power Switching Module. The RBV itself was not the cause of the failure, nor was it affected by the failure. 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. For completeness and convenience, the telemetry values are repeated in Table 16-1.

Table 16-1. RBV Telemetry Values

FUNCTION			ORBITS			
NO.	NAME	T/V VALUE	26	85	149	196
14001	CCC Board Temp. (DgC)	(1)	18.61	20.04	19.30	19.53
14002	CCC Pwr. Sup. Temp (DgC)	(1)	19.93	21.58	20.70	21.21
14003	±15 VDC Sup. (TMV)	3.95	3.69	3.95	3.78	3.95
14004	∓6V-5.25 VDC Sup. (TMV)	3.05	2.84	2.93	2.98	3.05
14100	VID OUT CAM 1 (TMV)	1.06	1.04	1.15	1.13	1.12
14200	VID OUT CAM 2 (TMV)	1.09	1.05	1.26	1.23	1.24
14300	VID OUT CAM 3 (TMV)	1.05	1.03	1.21	1.19	1.20
14102	Comb. Align I Com 1 (TMV)	3.95	3.67	3.94	3.87	3.94
14202	Comb. Align I Com 2 (TMV)	3.92	3.90	3.91	3.89	3.91
14302	Comb. Align I Com 3 (TMV)	4.04	3.75	4.03	3.80	4.03
14103	Cam 1 Elec Temp. (DgC)	(1)	20.84	23.37	22.64	25.38
14203	Cam 2 Elec Temp. (DgC)	(1)	18.64	21.06	20.62	22.87
14303	Cam 3 Elec Temp. (DgC)	(1)	21.05	23.61	23.23	25.57
14104	Cam 1 LV Pwr Sup T. (DgC)	(1)	21.71	23.94	23.49	25.92
14204	Cam 2 LV Pwr Sup T. (DgC)	(1)	18.38	20.63	19.40	23.30
14304	Cam 3 LV Pwr Sup T. (DgC)	(1)	20.75	23.02	22.73	25.67
14105	Cam 1 Def. + 10 VDC (TMV)	4.01	3.73	4.00	3.77	4.00
14205	Cam 2 Def. + 10 VDC (TMV)	4.00	3.71	3.98	3.77	3.98
14305	Cam 3 Def. + 10 VDC (TMV)	3.97	3.95	3.95	4.02	3.95
14106	Cam 1 + 6V -6.3 VDC (TMV)	3.71	3.45	3.70	3.61	3.70
14206	Cam 2 + 6V -6.3 VDC (TMV)	3.69	3.42	3.67	3.49	3.67
14306	Cam 3 +6V -6.3 VDC (TMV)	3.73	3.47	3.72	3.47	3.72
14107	Cam 1 Telec I (TMV)	2.62	2.50	2.54	2.55	2.64
14207	Cam 2 Telec I (TMV)	2.65	2.53	2.56	2.41	2.64
14307	Cam 3 Telec I (TMV)	2.64	2.54	2.51	2.45	2.61
14108	Cam 1 Vid Fil I (TMV)	2.47	2.30	2.36	2.38	2.46
14208	Cam 2 Vid Fil I (TMV)	2.54	2.37	2.52	2.39	2.52
14308	Cam 3 Vid Fil I (TMV)	2.61	2.44	2.60	2.53	2.60
14110	Cam 1 TARVOLT (TMV)	3.43	3.42	3.42	3.45	3.42
14210	Cam 2 TARVOLT (TMV)	3.36	3.13	3.22	3.26	3.32
14310	Cam 3 TARVOLT (TMV)	3.47	3.23	3.46	3.45	3.47
14113	Cam 1 Vert Def V (TMV)	2.96	2.75	2.90	2.85	2.97
14213	Cam 2 Vert Def V (TMV)	3.00	2.86	2.98	2.86	3.01
14313	Cam 3 Vert Def V (TMV)	3.45	3.45	3.47	3.37	3.45
14114	Cam 1 Vid FPT (DgC)	(1)	18.15	20.77	17.91	20.99
14214	Cam 2 Vid FPT (DgC)	(1)	20.62	20.11	20.52	20.62
14314	Cam 3 Vid FPT (DgC)	(1)	18.54	20.88	19.08	20.20
14115	Cam 1 Foc Coil T (DgC)	(1)	17.71	21.67	18.74	19.70
14215	Cam 2 Foc Coil T (DgC)	(1)	17.70	21.60	19.25	19.97
14315	Cam 3 Foc Coil T (DgC)	(1)	18.03	22.09	19.88	20.56

(1) Thermo-Vacuum temperatures for these functions were not reported.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem (MSS) has operated satisfactorily since initial turn-on in Orbit 20. The MSS has imaged over 27% of the earth's surface between the latitudes of 81.42°, including over 78% of the land masses, and 7% of the oceans with a cloud cover of 30% or less. Many of these scenes were repeatedly imaged, some in the United States as many as 40 times, although the cloud cover of some of these repetitive scenes exceeded 30%. A very large percentage of every continent has been imaged. Figure 17-1 is a computer derived map showing how many scenes were imaged at each geographic location since launch. Along the right-hand edge of the map is listed the frame number - frame 1 being at the northern-most extreme, frame 61 centered on the equator, and frame 121 at the southernmost extreme, thus giving latitude. Along the top of the map is the number of the reference orbit which fixes longitude. The land masses are distorted to fit this map projection.

Figure 17-2 shows how many scenes were acquired during this reporting period.

Table 17-1 shows typical telemetry values during this quarter. All functions are normal. The maximum MUX temperature to date has been $33.25^{\circ}C$ which occurred in August 1973, when the MSS was accidentally left ON at LOS, and was turned OFF by the 32-minute back-up timer. The calibration lamp current has remained at 1.12 TMV from pre-launch to the present.

Time Code extracted from de-muxed data was observed and found normal.

The response history of each sensor to a selected input radiance level is shown in Figure 17-3 (1) thru (8). Only one radiance level for each sensor has been selected for graph presentation, but the other five levels selected in the computer program to determine the cal wedge shape have been analyzed and found to be consistent with the data presented.

In general, the graphs show an early gradual decrease in sensor response from launch to Orbit 1000, and essentially unchanged response thereafter. The notable exception is sensor 13.

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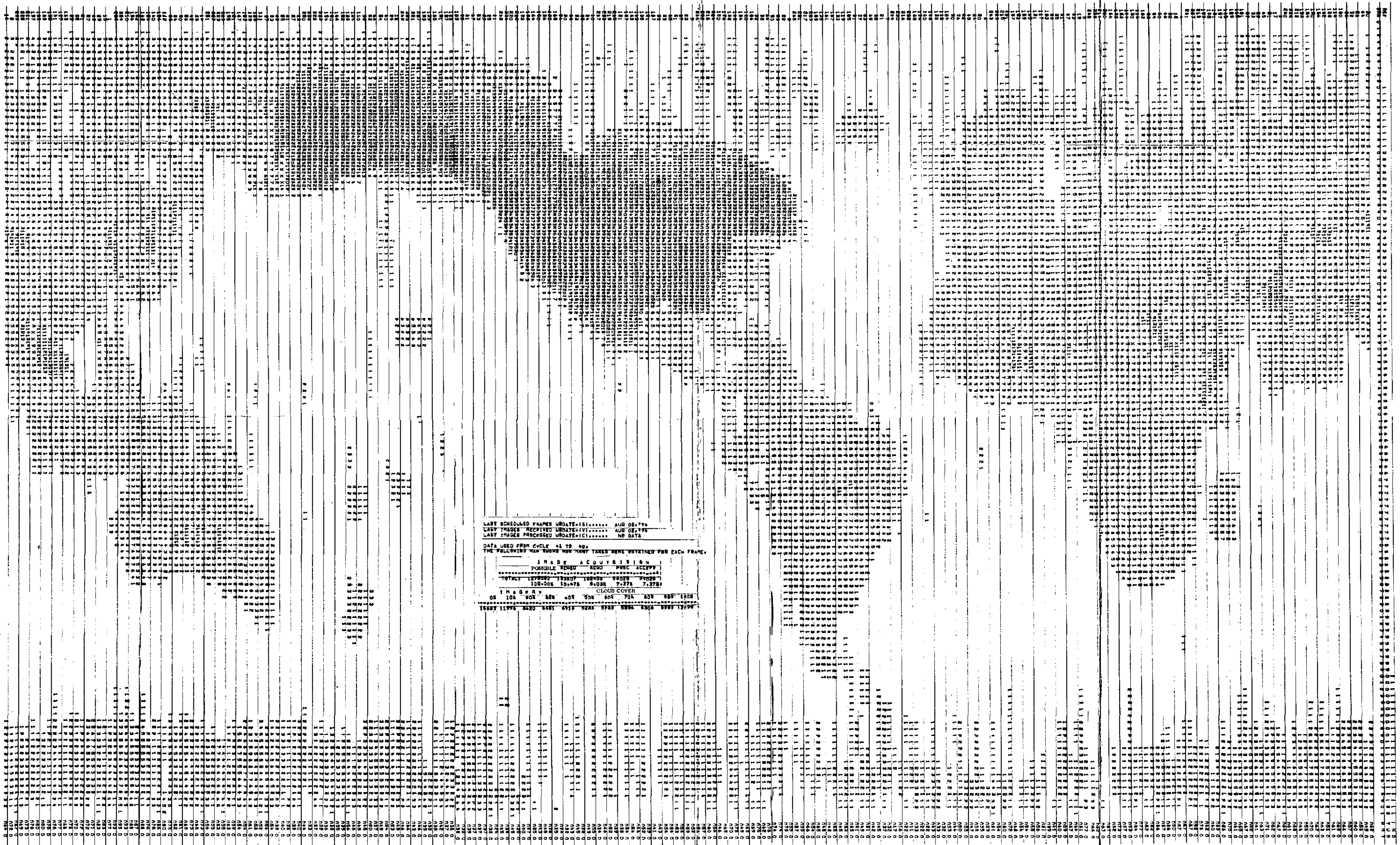

Figure 17-1. Number of Scenes Taken Since Launch at Each Geographic Location

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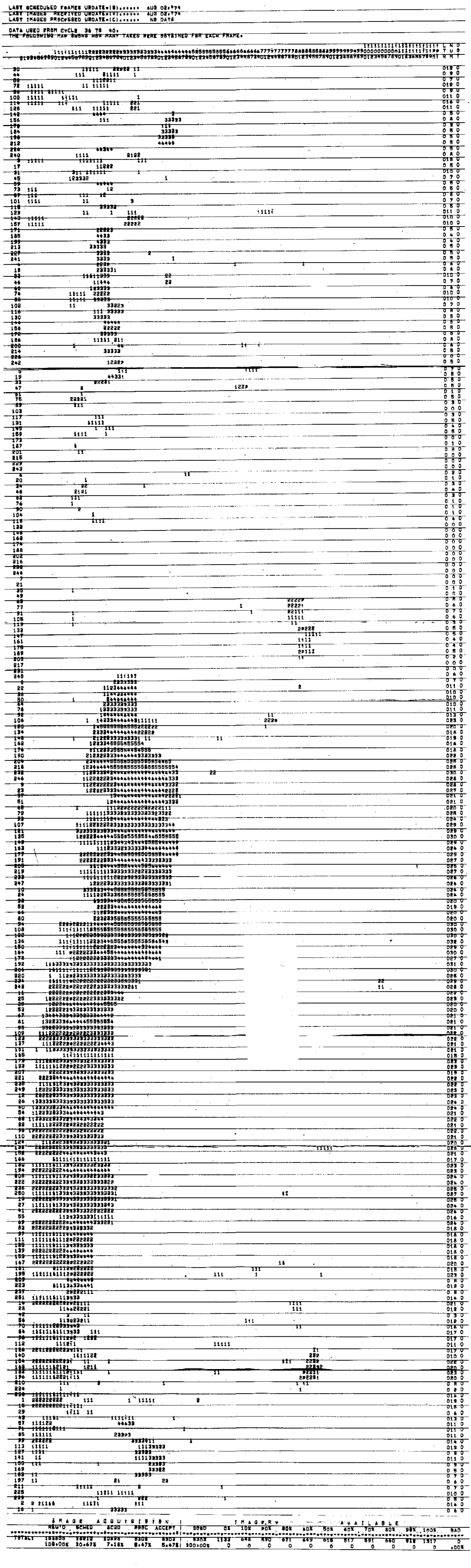

Figure 17-2. Number of Scenes Taken This Quarter at Each Geographic Location

Table 17-1. MSS Telemetry Values

Function No.	Name		Telemetry Values in Orbits						
			20	2599	5060	7650	9335	9752	10182
15044	FOPT 2 T	(DGC)	17.46	21.03	19.84	21.78	20.13	20.10	20.46
15046	ELEC CVR T	(DGC)	19.37	23.53	21.83	24.39	22.00	22.13	22.73
15048	SCAN MIR REG T	(DGC)	16.35	22.84	19.77	23.06	20.08	20.02	21.18
15050	SCAN MIR DR. COIL T	(DGC)	15.94	21.97	19.30	22.47	19.58	19.71	20.65
15052	ROT SHUT HSG T	(DGC)	16.91	20.88	20.07	22.11	20.52	20.54	20.68
15043	FOPT 1 T	(DGC)	17.67	21.17	20.01	21.90	20.31	20.28	20.65
15045	MUX PWR CASE T	(DGC)	21.19	26.84	22.03	25.91	21.93	22.43	24.09
15047	PWR SUP T	(DGC)	17.41	21.95	20.00	22.26	20.22	20.25	21.00
15049	SCAN MIR DR. ELC T	(DGC)	16.12	22.76	19.41	22.74	19.66	19.79	20.98
15051	SCAN MIR HSG T	(DGC)	15.60	21.46	19.05	22.29	19.32	19.22	20.16
15040	MUX -6 VDC	(TMV)	4.03	4.03	4.03	4.03	4.03	4.03	4.03
15042	AVE DENS DATA	(TMV)	1.67	2.52	2.13	1.99	2.05	2.09	2.27
15054	CAL IAMP CUR A	(TMV)	1.12	1.12	1.12	1.12	1.12	1.12	1.12
15056	BAND 2 ± 15 VDC	(TMV)	5.10	5.10	5.10	5.10	5.10	5.10	5.10
15058	BAND 4 ± 15 VDC	(TMV)	5.10	5.10	5.10	5.10	5.10	5.10	5.10
15060	+ 12 -6 VDC REG	(TMV)	4.82	4.92	5.02	5.02	4.77	4.75	4.90
15062	+ 19 VDC REC OUT	(TMV)	4.80	4.90	4.90	5.03	4.77	4.77	4.89
15064	BAND 1 HV A	(TMV)	5.10	5.12	5.16	5.12	5.12	5.12	5.12
15066	BAND 2 HV A	(TMV)	4.50	4.52	4.52	4.52	4.52	4.52	4.52
15068	BAND 3 HV A	(TMV)	4.60	4.63	4.62	4.62	4.62	4.62	4.62
15070	SHUT MOT CON OUT	(TMV)	2.43	2.46	2.44	2.49	2.37	2.33	2.44
15041	S/D CONV REF V	(TMV)	5.93	5.82	5.93	5.78	5.67	5.93	5.80
15053	SCAN MIR REG V	(TMV)	4.42	4.53	4.51	4.59	4.39	4.35	4.49
15055	BAND 1 ± 15V	(TMV)	4.97	4.97	4.97	4.97	4.97	4.97	4.97
15057	BAND 3 ± 15V	(TMV)	5.00	5.00	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
15061	± 5 VDC LOGIC REG	(TMV)	4.82	4.80	4.81	4.86	4.84	4.85	4.79
15063	-19 VDC REG OUT	(TMV)	3.43	3.50	3.39	3.57	3.57	3.38	3.48
15071	SCAN MIR DR. CLK	(TMV)	1.93	1.97	1.97	2.03	1.92	1.92	1.96

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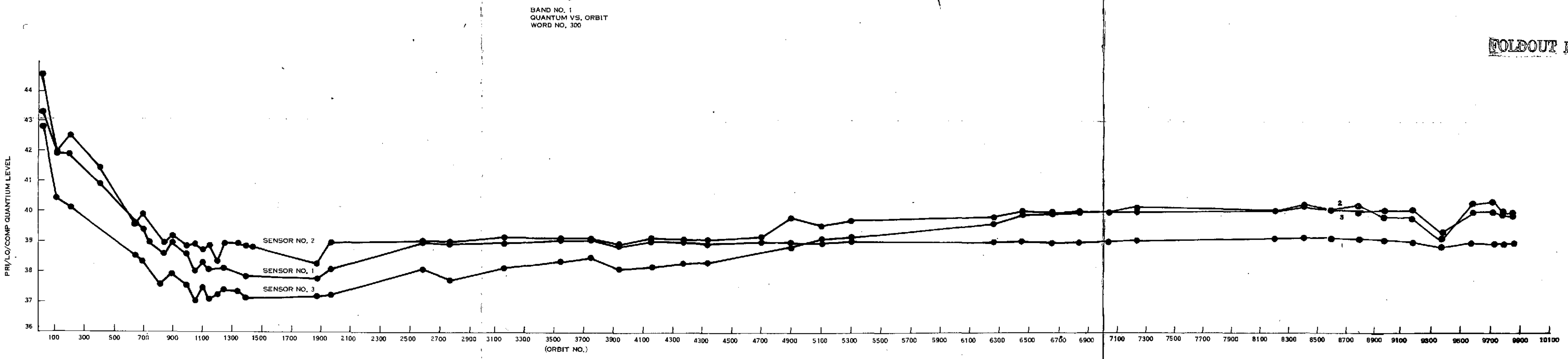

Figure 17-3(1). Quantum vs. Orbit

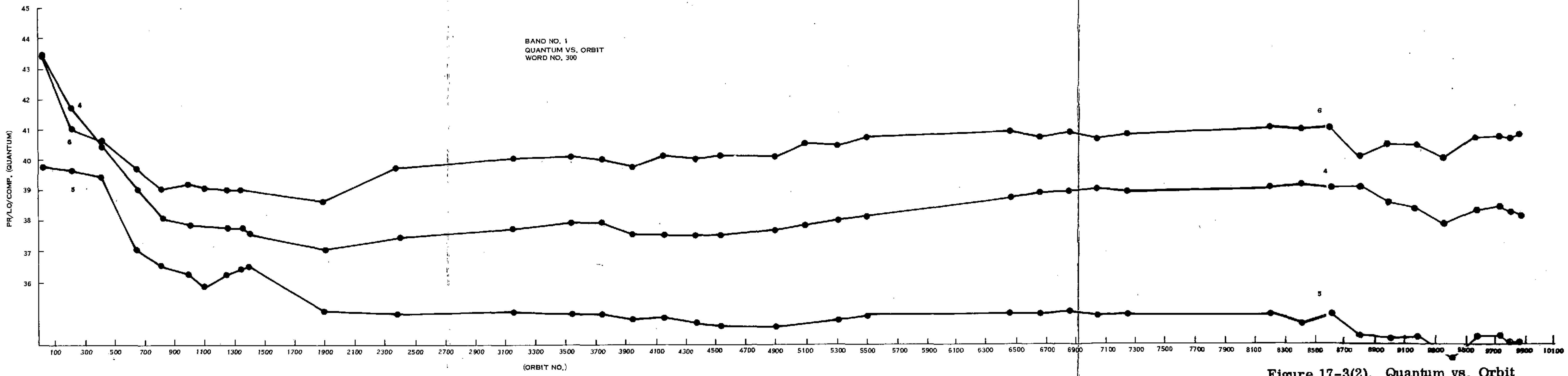

Figure 17-3(2). Quantum vs. Orbit

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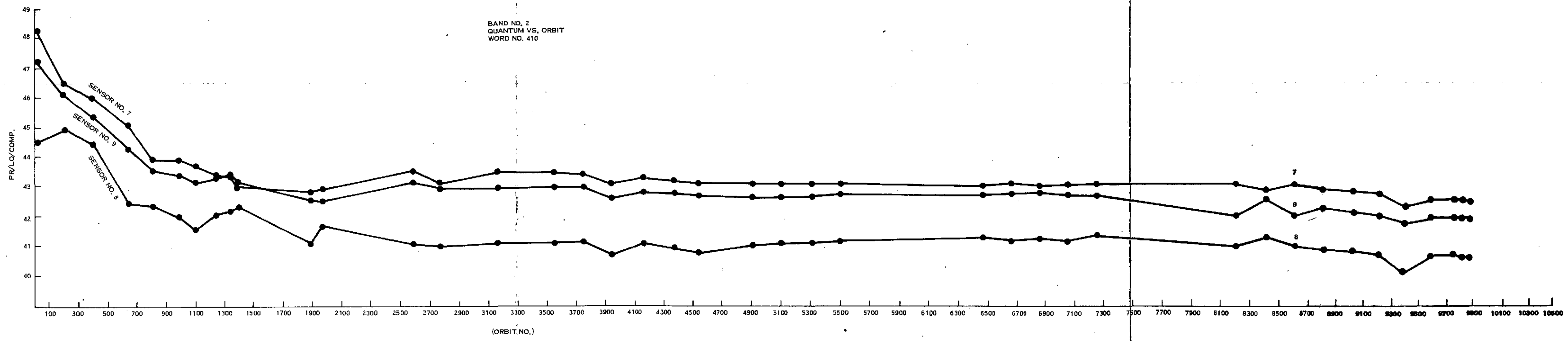

Figure 17-3(3). Quantum vs. Orbit

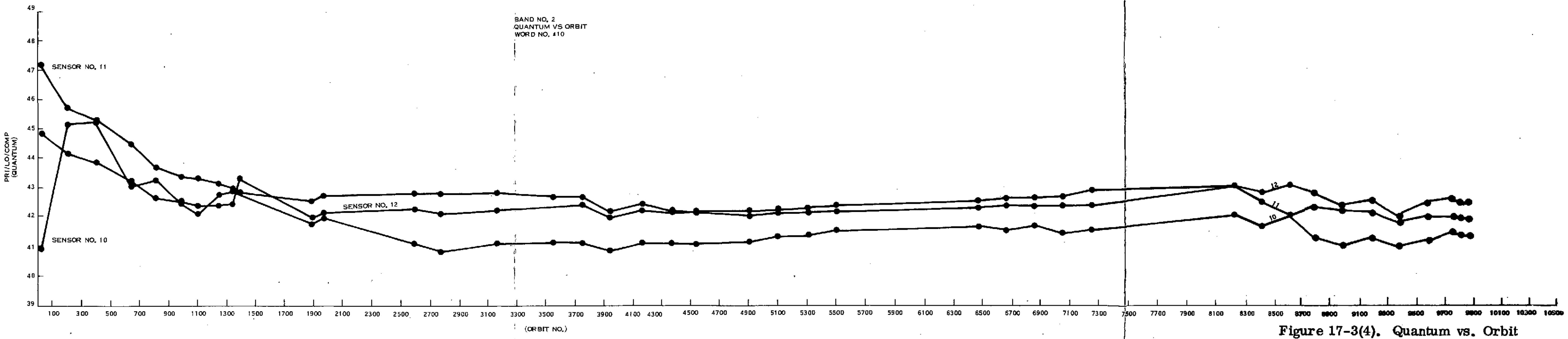

Figure 17-3(4). Quantum vs. Orbit

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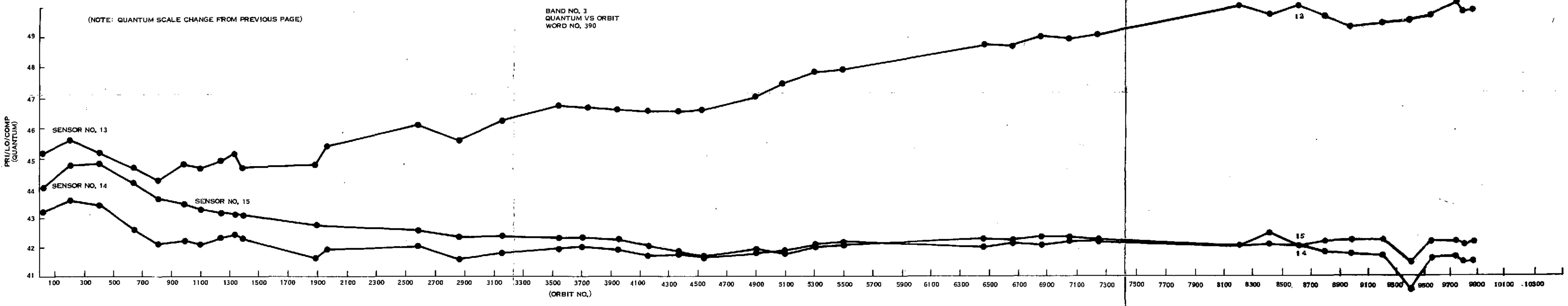

Figure 17-3(5). Quantum vs. Orbit

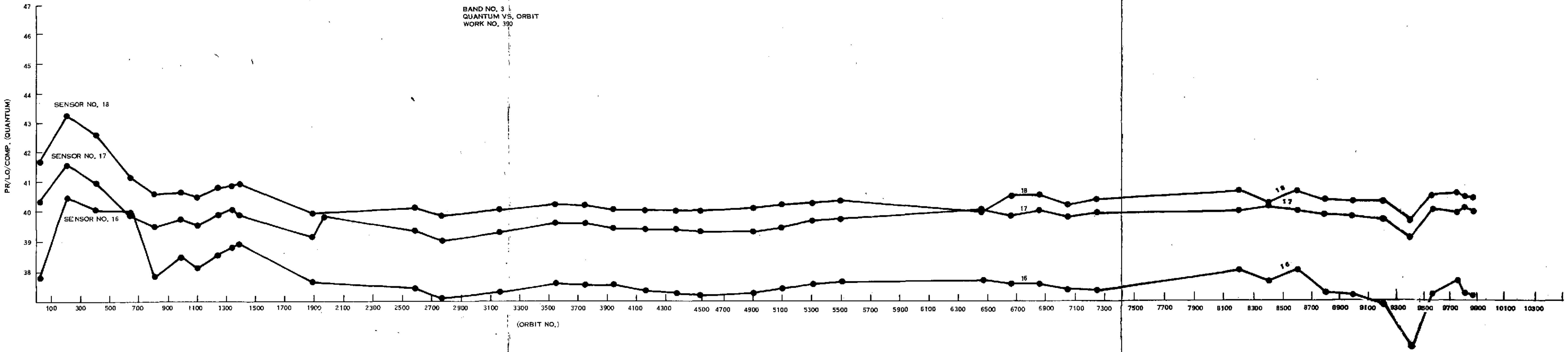

Figure 17-3(6). Quantum vs. Orbit

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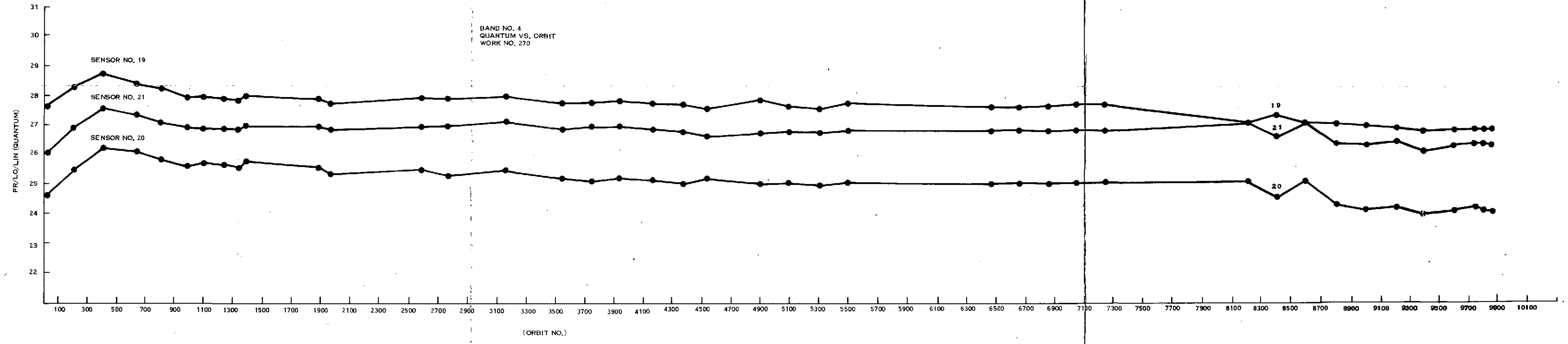

Figure 17-3(7). Quantum vs. Orbit

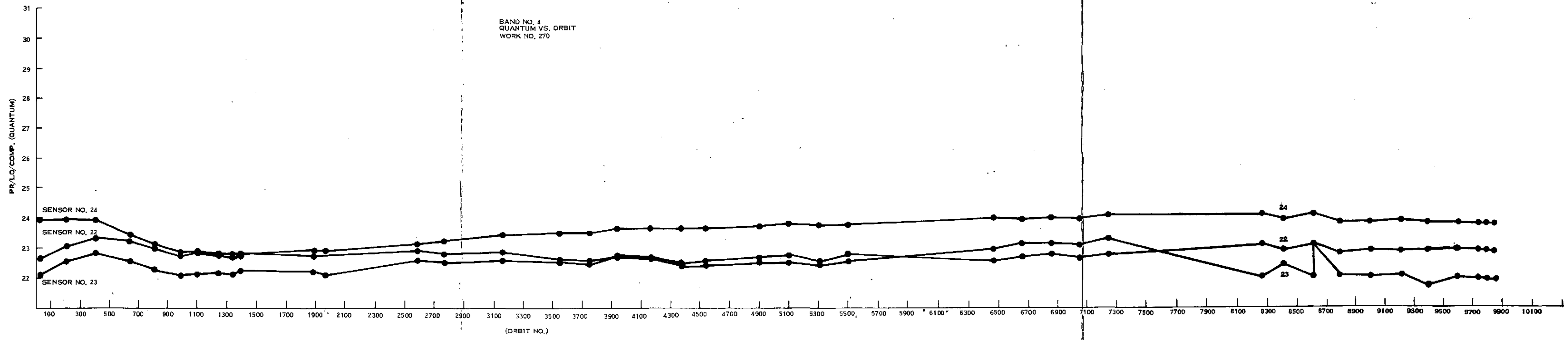

Figure 17-3(8). Quantum vs. Orbit

The response of this sensor has gradually increased about 10%, so that it saturates at a lower radiance level than the other sensors, posing a processing problem for high radiance scenes (clouds, snow and sometimes desert).

The history of the Line Length Word vs. Orbit Number is shown in Figure 17-4. It is satisfactory and stable.

Sun calibrations are performed every two weeks (see Table 17-2) and continue to show normal performance. The 76 Sun Calibration Orbits are listed in Table 17-2.

Table 17-2. Sun Calibration Orbits

21	1012	2278	4161	6657	8943
47	1207	2375	4370	6852	8999
89	1303	2389	4537	7047	9208
103	1400	2473	4705	7242	9389
131	1497	2585	4900	7437	9585
214	1595	2668	5095	7633	9724
326	1692	2766	5304	7829	9766
423	1790	2964	5499	8038	9808
521	1877	3159	5861	8220	9850
619	1985	3351	5891	8413	9892
730	2082	3543	6072	8608	9975
814	2166	3742	6268	8803	10171
915	2180	3938	6463		

A study (PIR-1H05-EA-434 dated 8/5/74) conducted by Dan Schwartz at GE Valley Forge examines the performance of the MSS Subsystem during the sun-cal orbits since Orbit 5000. It concludes that, except for a temporary decrease of cal wedge sensitivity in the vicinity of Orbits 9200/9400, performance has been exceptional. There may have been a decrease in SNM (signal-to-noise at level 63) for some of the sensors over time in orbit, but even if true, the decrease is small and must be examined further in terms of possible quantization microstructure effects. There are no factors evident which would preclude continued use of the data with confidence.

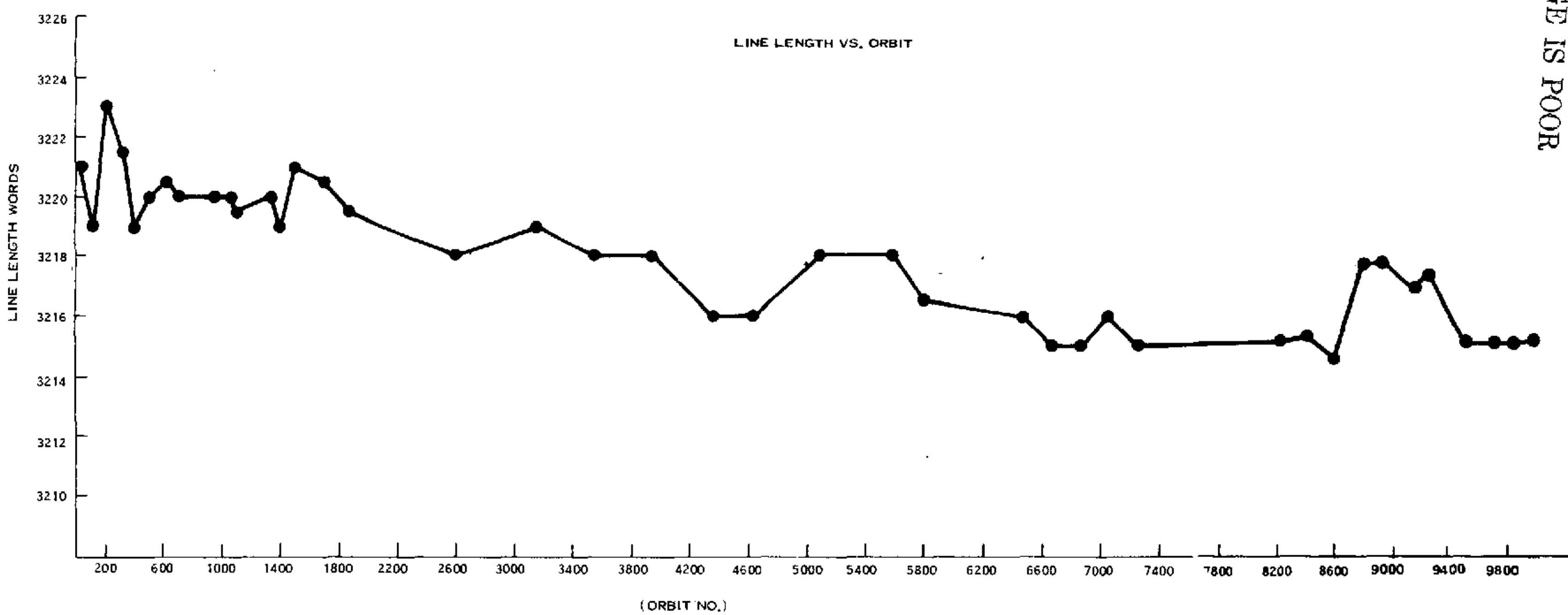

Figure 17-4. Line Length vs Orbit

SECTION 18

DATA COLLECTION SYSTEM

SECTION 18

DATA COLLECTION SUBSYSTEM

The Data Collection Subsystem (DCS) has operated satisfactorily since turn-ON in Orbit 5. External interference is minimal and has not affected data collection during this reporting period.

Only Receiver 1 has been used to date. Since turn ON this receiver has operated continuously for over 17,516 hours.

Since turn-ON in Orbit 5, this subsystem has received 945,451 messages, of which 871,009 (92.1%) have been perfect. Periods of heavy interference have added false messages to both "total" messages and "imperfect" messages, diluting the apparent "error" rate, and making the percent perfect figure an unreliable figure of merit.

All telemetry functions have been normal as shown in the typical values of Table 18-1.

Figure 18-1 shows the total number of DCS messages received per 18-day cycle since launch. The number of active platforms is also plotted on the same time scale. It can be seen that when the number of active platforms reached about 100, the DCS messages received per 18 day cycle reached 28 thousand.

After cycle 31 there was a drop in the number of DCS messages received to the level of 23 thousand per 18-day cycle. This drop is explained by the drop in USB transmitter power as shown in the lower right hand portion of Figure 18-1. The USB provides the down-link in the DCS relay chain. When its power dropped to below 0.25 watts, the USB/DCS coverage began shrinking back from the horizon reducing the area coverage to about 80%, corresponding to the percentage message loss from 28 to 23 thousand. This loss of area coverage is described in Appendix C. There it is pointed out that the up-link comprising the DCP and the ERTS DCS receiver showed no loss of range, operating daily to distances in excess of 2000 miles. The link even operated to 2260 statute miles (3637 kilometers), 1° below the horizon.

Though there was reduced coverage of possible DCS messages the DCS subsystem has exceeded specification requirements at all times as messages from each DCS platform were received at ground stations each day and the data link was established at antenna angles below 5° elevation. In Orbit 10068 the USB subsystem was switched from side A to side B. Power output of the USB side B transmitters is 1.58 watts. When sufficient data is accumulated it is expected that the USB/DCS coverage will show expanded coverage similar to initial flight conditions observed in earlier life of the spacecraft when power output was 1.5 watts.

Table 18-2 shows the qualitative performance of the DCS subsystem and Table 18-3 gives statistics of messages received.

Table 18-1. DCS Telemetry Values

No.	Name	Units	Value in Orbits						
			15	2599	4811	7650	9335	9752	10182
16001	Revr 1 Sig Str	(DBM)	-124.09	-124.39	-123.36	-123.01	-124.49	-123.64	-123.63
16002	Revr 1 Temp	(DGC)	22.72	24.07	23.74	24.62	23.84	23.66	23.71
16003	Revr 1 Inp Volt	(VDC)	12.02	12.02	12.01	12.01	12.01	12.02	12.02

Table 18-2. DCS Qualitative Performance

System Threshold	3500 km
Grazing Angle Effects	Not discernible
Adjacent DCP Interference	Not seen
Ground Transmission System	Satisfactory
Probability of Perfect Reception of any Messages During Window*	98.9%

*Window means "at times when the spacecraft is simultaneously within the horizon of the DCP and the ground receiving station".

Table 18-3. DCS Statistics

Through Orbit 10182	
DCS Platforms (DCP's) Shipped	220
Maximum DCP's Received per Day	110
Total Messages Received at OCC	945,451
Total Messages Rejected at OCC	74,422
For This Quarter	
Maximum Messages per Day (5/25/74)	1523
Number of Orbits with Message Counts Exceeding:	
400	27
500	0
Number of Current Users	43

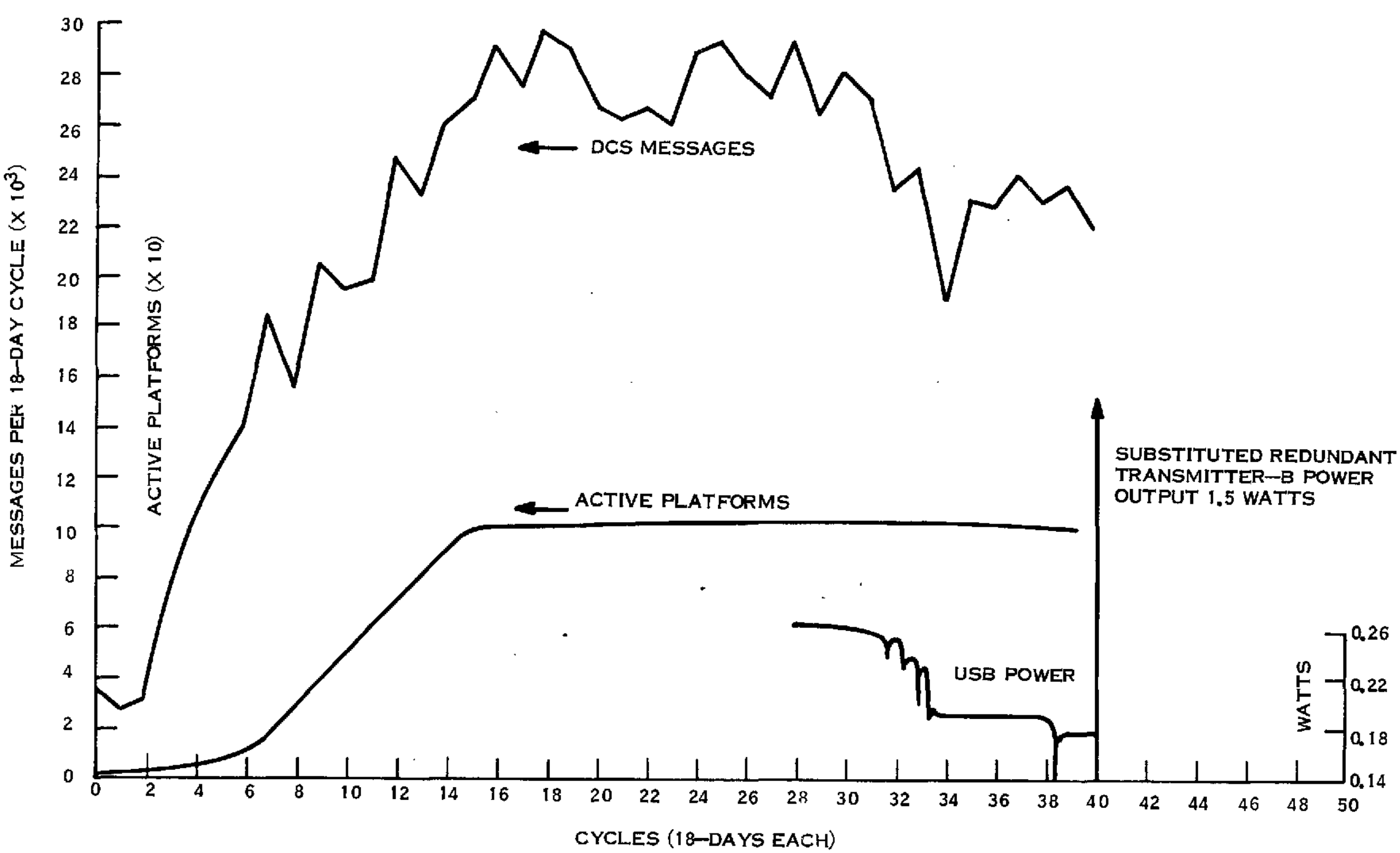

Figure 18-1. DCS Message Receipt History

APPENDIX A

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OBSERVATORY ANOMALIES AND OBSERVATIONS

Date	Anomaly/Observation	How Observed	Comments
7/24/72	Sun Sensor Temperature High	Off-Line	No Action Required For ERTS-1; ERTS-B Redesigned
7/24/72	Solar Paddle Temperature Excursions Greater Than Expected	Off-Line	No Action Required For ERTS-1; Math Model Corrected
7/25/72	USB Power Output Decreasing	Off-Line	Will Switch to Side B When Necessary; Under Investigation for ERTS-B
8/03/72	WBVTR No. 2 Power Converter Shorted	Real Time & Off-Line	Turned All P/L Off During Pass. Formed NASA/GE/RCA Evaluation Committee. Disconnected since Anomaly. Redesigned For ERTS-B
8/03/72	Decrease in Solar Array Current	Off-Line	Evaluate Degradation Effect Due to Solar Flare Activity
8/06/72	RBV Power Transient PSM Turn-Off Failure	Real Time	Turned off PRM. NASA/GE, RCA Evaluation Committee Formed; Disconnected Since Anomaly; Redesign PSM For ERTS-B
8/10/72	DCS Reject Messages Rose to Over 40% of Total Messages for 15 Days	Off-Line	External Interference; Located Source; No Serious Interference Since.
8/10/72	MSS Cal Wedge Levels Decreasing	Off-Line	Leveled Off After Orbit 1000; At Or About 5% Below Earlier Values
8/03/72	Incorrect Time Tags in Comstor 'B' Cell 12	Real Time	Reload Comstors and Verify; (Discontinued Actuve Use of Cell 12)
12/04/72 12/06/72	Pitch Roll Yaw Motor Drive Duty Cycles Increased for Short Period	Off-Line	Evaluate - Prepared Contingency Plan Under Investigation For ERTS-B
3/29/73	WBVTR NO. 1; High BER	Real Time	Formed NASA/GE/RCA Committee; Lapped Heads; Now in Operational Use. Temporarily Restricted to Last 600 Feet (600 Seconds) of Tape
4/08/72	Slow Leak in Forward IR Scanner Pressure	Off-Line	Not Expected to Interfere with Normal Operations
5/20/72	Defect in Signal of Left Cosine Pot at S/C Midmight	Off-Line	Not Expected to Interfere with Normal Operations
6/03/73	Failure of Integrated Circuit Chip and TLM of Functions 6012, 1011, 12238 and 7010	Real Time & Off-Line	Tlm Failure only. S/C Operations Normal
11/5/73	WBVTR-1 Tape Unit Pressure Drop	Real Time	Defect in Pressure Instrumentation which Causes Occasional Rapid Pressure Drop in TLM - Returns to Normal
11/13/73	Solar Array Drive	Real Time	Slight Peaks on Drive Voltage Ripple which Picked up Limit Flag - Returned to Normal
11/28/73	High Head Wheel Current, WBVTR-1, During Rewind	Real Time	Resumed Operations After Investigation WBVTR-1 Performed in a Nominal Manner
12/20/73	Pitch Motor Driver Duty Cycle Increased	Real Time	Similar to Entry 12/4/72 except more Sustained
12/22/73	RMP-1 and RMP-2 Showed Excessive Noise/Output	Real Time	Condition Lasted for Several Orbits and Returned to Normal
2/20/74	Pitch Wheel Stopped During Sun Transient	Off-Line	During a sun transient in orbit 8040 the pitch flywheel was changing directions. As it passed thru zero speed, the pitch flywheel stopped and did not resume operation until 2 minutes had elapsed in spite of application of 100% clockwise pitch motor driver duty cycle during that interval.
3/5/74	WBTR #1 High BER HIGH HW-1	Real Time & Off-Line	Limited Usage of Tape Footage
3/7/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/21/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/27/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
4/2/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
5/21/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Simillar to 12/4/72 entry. Returned to normal.
7/2/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Simillar to 12/4/72 entry. Returned to normal.
7/2/74	WBVTR-1-high HWI and MFSE	Real Time & Off-Line	Suspended operation pending study

APPENDIX B

SPACECRAFT ORBIT REFERENCE TABLES

FROM JULY 1972 THRU SEPTEMBER 1975

ORBIT 0 THRU 15928

FLIGHT DAY 0 THRU 1142

JULY 1972

Date	GMT Day	Flight Day	Spacecraft Orbit	Reference Orbit	Ref Day	Cycle
23	205	0	0-3	150-153	11	
24	206	1	4-17	154-167	12	
25	207	2	18-31	168-181	13	
26	208	3	32-45	168-181*	13	
27	209	4	46-59	182-195	14	0th
28	210	5	60-73	196-209	15	
29	211	6	74-87	210-223	16	
30	212	7	88-101	224-237	17	
31	213	8	102-115	238-251	18	

*Shift due to initial orbit (prior to orbit adjustments)

AUG, 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	214	9	116- 129	1- 14	1	1
2	215	10	130- 143	15- 28	2	1
3	216	11	144- 157	29- 42	3	1
4	217	12	158- 171	43- 56	4	1
5	218	13	172- 185	57- 70	5	1
6	219	14	186- 199	71- 84	6	1
7	220	15	200- 213	85- 98	7	1
8	221	16	214- 226	99-111	8	1
9	222	17	227- 240	112-125	9	1
10	223	18	241- 254	126-139	10	1
11	224	19	255- 268	140-153	11	1
12	225	20	269- 282	154-167	12	1
13	226	21	283- 296	168-181	13	1
14	227	22	297- 310	182-195	14	1
15	228	23	311- 324	196-209	15	1
16	229	24	325- 338	210-223	16	1
17	230	25	339- 352	224-237	17	1
18	231	26	353- 366	238-251	18	1
19	232	27	367- 380	1- 14	1	2
20	233	28	381- 394	15- 28	2	2
21	234	29	395- 408	29- 42	3	2
22	235	30	409- 422	43- 56	4	2
23	236	31	423- 436	57- 70	5	2
24	237	32	437- 450	71- 84	6	2
25	238	33	451- 464	85- 98	7	2
26	239	34	465- 477	99-111	8	2
27	240	35	478- 491	112-125	9	2
28	241	36	492- 505	126-139	10	2
29	242	37	506- 519	140-153	11	2
30	243	38	520- 533	154-167	12	2
31	244	39	534- 547	168-181	13	2

SEP, 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	245	40	548- 561	182-195	14	2
2	246	41	562- 575	196-209	15	2
3	247	42	576- 589	210-223	16	2
4	248	43	590- 603	224-237	17	2
5	249	44	604- 617	238-251	18	2
6	250	45	618- 631	1- 14	1	3
7	251	46	632- 645	15- 28	2	3
8	252	47	646- 659	29- 42	3	3
9	253	48	660- 673	43- 56	4	3
10	254	49	674- 687	57- 70	5	3
11	255	50	688- 701	71- 84	6	3
12	256	51	702- 715	85- 98	7	3
13	257	52	716- 728	99-111	8	3
14	258	53	729- 742	112-125	9	3
15	259	54	743- 756	126-139	10	3
16	260	55	757- 770	140-153	11	3
17	261	56	771- 784	154-167	12	3
18	262	57	785- 798	168-181	13	3
19	263	58	799- 812	182-195	14	3
20	264	59	813- 826	196-209	15	3
21	265	60	827- 840	210-223	16	3
22	266	61	841- 854	224-237	17	3
23	267	62	855- 868	238-251	18	3
24	268	63	869- 882	1- 14	1	4
25	269	64	883- 896	15- 28	2	4
26	270	65	897- 910	29- 42	3	4
27	271	66	911- 924	43- 56	4	4
28	272	67	925- 938	57- 70	5	4
29	273	68	939- 952	71- 84	6	4
30	274	69	953- 966	85- 98	7	4

OCT, 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	275	70	967- 979	99-111	8	4
2	276	71	980- 993	112-125	9	4
3	277	72	994- 1007	126-139	10	4
4	278	73	1008- 1021	140-153	11	4
5	279	74	1022- 1035	154-167	12	4
6	280	75	1036- 1049	168-181	13	4
7	281	76	1050- 1063	182-195	14	4
8	282	77	1064- 1077	196-209	15	4
9	283	78	1078- 1091	210-223	16	4
10	284	79	1092- 1105	224-237	17	4
11	285	80	1106- 1119	238-251	18	4
12	286	81	1120- 1133	1- 14	1	5
13	287	82	1134- 1147	15- 28	2	5
14	288	83	1148- 1161	29- 42	3	5
15	289	84	1162- 1175	43- 56	4	5
16	290	85	1176- 1189	57- 70	5	5
17	291	86	1190- 1203	71- 84	6	5
18	292	87	1204- 1217	85- 98	7	5
19	293	88	1218- 1230	99-111	8	5
20	294	89	1231- 1244	112-125	9	5
21	295	90	1245- 1258	126-139	10	5
22	296	91	1259- 1272	140-153	11	5
23	297	92	1273- 1286	154-167	12	5
24	298	93	1287- 1300	168-181	13	5
25	299	94	1301- 1314	182-195	14	5
26	300	95	1315- 1328	196-209	15	5
27	301	96	1329- 1342	210-223	16	5
28	302	97	1343- 1356	224-237	17	5
29	303	98	1357- 1370	238-251	18	5
30	304	99	1371- 1384	1- 14	1	6
31	305	100	1385- 1398	15- 28	2	6

NOV,1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	306	101	1399- 1412	29- 42	3	6
2	307	102	1413- 1426	43- 56	4	6
3	308	103	1427- 1440	57- 70	5	6
4	309	104	1441- 1454	71- 84	6	6
5	310	105	1455- 1468	85- 98	7	6
6	311	106	1469- 1481	99-111	8	6
7	312	107	1482- 1495	112-125	9	6
8	313	108	1496- 1509	126-139	10	6
9	314	109	1510- 1523	140-153	11	6
10	315	110	1524- 1537	154-167	12	6
11	316	111	1538- 1551	168-181	13	6
12	317	112	1552- 1565	182-195	14	6
13	318	113	1566- 1579	196-209	15	6
14	319	114	1580- 1593	210-223	16	6
15	320	115	1594- 1607	224-237	17	6
16	321	116	1608- 1621	238-251	18	6
17	322	117	1622- 1635	1- 14	1	7
18	323	118	1636- 1649	15- 28	2	7
19	324	119	1650- 1663	29- 42	3	7
20	325	120	1664- 1677	43- 56	4	7
21	326	121	1678- 1691	57- 70	5	7
22	327	122	1692- 1705	71- 84	6	7
23	328	123	1706- 1719	85- 98	7	7
24	329	124	1720- 1732	99-111	8	7
25	330	125	1733- 1746	112-125	9	7
26	331	126	1747- 1760	126-139	10	7
27	332	127	1761- 1774	140-153	11	7
28	333	128	1775- 1788	154-167	12	7
29	334	129	1789- 1802	168-181	13	7
30	335	130	1803- 1816	182-195	14	7

DEC, 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	336	131	1817- 1830	196-209	15	7
2	337	132	1831- 1844	210-223	16	7
3	338	133	1845- 1858	224-237	17	7
4	339	134	1859- 1872	238-251	18	7
5	340	135	1873- 1886	1- 14	1	8
6	341	136	1887- 1900	15- 28	2	8
7	342	137	1901- 1914	29- 42	3	8
8	343	138	1915- 1928	43- 56	4	8
9	344	139	1929- 1942	57- 70	5	8
10	345	140	1943- 1956	71- 84	6	8
11	346	141	1957- 1970	85- 98	7	8
12	347	142	1971- 1983	99-111	8	8
13	348	143	1984- 1997	112-125	9	8
14	349	144	1998- 2011	126-139	10	8
15	350	145	2012- 2025	140-153	11	8
16	351	146	2026- 2039	154-167	12	8
17	352	147	2040- 2053	168-181	13	8
18	353	148	2054- 2067	182-195	14	8
19	354	149	2068- 2081	196-209	15	8
20	355	150	2082- 2095	210-223	16	8
21	356	151	2096- 2109	224-237	17	8
22	357	152	2110- 2123	238-251	18	8
23	358	153	2124- 2137	1- 14	1	9
24	359	154	2138- 2151	15- 28	2	9
25	360	155	2152- 2165	29- 42	3	9
26	361	156	2166- 2179	43- 56	4	9
27	362	157	2180- 2193	57- 70	5	9
28	363	158	2194- 2207	71- 84	6	9
29	364	159	2208- 2221	85- 98	7	9
30	365	160	2222- 2234	99-111	8	9
31	366	161	2235- 2248	112-125	9	9

JAN, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	162	2249- 2262	126-139	10	9
2	2	163	2263- 2276	140-153	11	9
3	3	164	2277- 2290	154-167	12	9
4	4	165	2291- 2304	168-181	13	9
5	5	166	2305- 2318	182-195	14	9
6	6	167	2319- 2332	196-209	15	9
7	7	168	2333- 2346	210-223	16	9
8	8	169	2347- 2360	224-237	17	9
9	9	170	2361- 2374	238-251	18	9
10	10	171	2375- 2388	1- 14	1	10
11	11	172	2389- 2402	15- 28	2	10
12	12	173	2403- 2416	29- 42	3	10
13	13	174	2417- 2430	43- 56	4	10
14	14	175	2431- 2444	57- 70	5	10
15	15	176	2445- 2458	71- 84	6	10
16	16	177	2459- 2472	85- 98	7	10
17	17	178	2473- 2485	99-111	8	10
18	18	179	2486- 2499	112-125	9	10
19	19	180	2500- 2513	126-139	10	10
20	20	181	2514- 2527	140-153	11	10
21	21	182	2528- 2541	154-167	12	10
22	22	183	2542- 2555	168-181	13	10
23	23	184	2556- 2569	182-195	14	10
24	24	185	2570- 2583	196-209	15	10
25	25	186	2584- 2597	210-223	16	10
26	26	187	2598- 2611	224-237	17	10
27	27	188	2612- 2625	238-251	18	10
28	28	189	2626- 2639	1- 14	1	11
29	29	190	2640- 2653	15- 28	2	11
30	30	191	2654- 2667	29- 42	3	11
31	31	192	2668- 2681	43- 56	4	11

FEB, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	193	2682- 2695	57- 70	5	11
2	33	194	2696- 2709	71- 84	6	11
3	34	195	2710- 2723	85- 98	7	11
4	35	196	2724- 2736	99-111	8	11
5	36	197	2737- 2750	112-125	9	11
6	37	198	2751- 2764	126-139	10	11
7	38	199	2765- 2778	140-153	11	11
8	39	200	2779- 2792	154-167	12	11
9	40	201	2793- 2806	168-181	13	11
10	41	202	2807- 2820	182-195	14	11
11	42	203	2821- 2834	196-209	15	11
12	43	204	2835- 2848	210-223	16	11
13	44	205	2849- 2862	224-237	17	11
14	45	206	2863- 2876	238-251	18	11
15	46	207	2877- 2890	1- 14	1	12
16	47	208	2891- 2904	15- 28	2	12
17	48	209	2905- 2918	29- 42	3	12
18	49	210	2919- 2932	43- 56	4	12
19	50	211	2933- 2946	57- 70	5	12
20	51	212	2947- 2960	71- 84	6	12
21	52	213	2961- 2974	85- 98	7	12
22	53	214	2975- 2987	99-111	8	12
23	54	215	2988- 3001	112-125	9	12
24	55	216	3002- 3015	126-139	10	12
25	56	217	3016- 3029	140-153	11	12
26	57	218	3030- 3043	154-167	12	12
27	58	219	3044- 3057	168-181	13	12
28	59	220	3058- 3071	182-195	14	12

MAR, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	221	3072- 3085	196-209	15	12
2	61	222	3086- 3099	210-223	16	12
3	62	223	3100- 3113	224-237	17	12
4	63	224	3114- 3127	238-251	18	12
5	64	225	3128- 3141	1- 14	1	13
6	65	226	3142- 3155	15- 28	2	13
7	66	227	3156- 3169	29- 42	3	13
8	67	228	3170- 3183	43- 56	4	13
9	68	229	3184- 3197	57- 70	5	13
10	69	230	3198- 3211	71- 84	6	13
11	70	231	3212- 3225	85- 98	7	13
12	71	232	3226- 3238	99-111	8	13
13	72	233	3239- 3252	112-125	9	13
14	73	234	3253- 3266	126-139	10	13
15	74	235	3267- 3280	140-153	11	13
16	75	236	3281- 3294	154-167	12	13
17	76	237	3295- 3308	168-181	13	13
18	77	238	3309- 3322	182-195	14	13
19	78	239	3323- 3336	196-209	15	13
20	79	240	3337- 3350	210-223	16	13
21	80	241	3351- 3364	224-237	17	13
22	81	242	3365- 3378	238-251	18	13
23	82	243	3379- 3392	1- 14	1	14
24	83	244	3393- 3406	15- 28	2	14
25	84	245	3407- 3420	29- 42	3	14
26	85	246	3421- 3434	43- 56	4	14
27	86	247	3435- 3448	57- 70	5	14
28	87	248	3449- 3462	71- 84	6	14
29	88	249	3463- 3476	85- 98	7	14
30	89	250	3477- 3489	99-111	8	14
31	90	251	3490- 3503	112-125	9	14

APR, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	252	3504- 3517	126-139	10	14
2	92	253	3518- 3531	140-153	11	14
3	93	254	3532- 3545	154-167	12	14
4	94	255	3546- 3559	168-181	13	14
5	95	256	3560- 3573	182-195	14	14
6	96	257	3574- 3587	196-209	15	14
7	97	258	3588- 3601	210-223	16	14
8	98	259	3602- 3615	224-237	17	14
9	99	260	3616- 3629	238-251	18	14
10	100	261	3630- 3643	1- 14	1	15
11	101	262	3644- 3657	15- 28	2	15
12	102	263	3658- 3671	29- 42	3	15
13	103	264	3672- 3685	43- 56	4	15
14	104	265	3686- 3699	57- 70	5	15
15	105	266	3700- 3713	71- 84	6	15
16	106	267	3714- 3727	85- 98	7	15
17	107	268	3728- 3740	99-111	8	15
18	108	269	3741- 3754	112-125	9	15
19	109	270	3755- 3768	126-139	10	15
20	110	271	3769- 3782	140-153	11	15
21	111	272	3783- 3796	154-167	12	15
22	112	273	3797- 3810	168-181	13	15
23	113	274	3811- 3824	182-195	14	15
24	114	275	3825- 3838	196-209	15	15
25	115	276	3839- 3852	210-223	16	15
26	116	277	3853- 3866	224-237	17	15
27	117	278	3867- 3880	238-251	18	15
28	118	279	3881- 3894	1- 14	1	16
29	119	280	3895- 3908	15- 28	2	16
30	120	281	3909- 3922	29- 42	3	16

MAY,1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	282	3923- 3936	43- 56	4	16
2	122	283	3937- 3950	57- 70	5	16
3	123	284	3951- 3964	71- 84	6	16
4	124	285	3965- 3978	85- 98	7	16
5	125	286	3979- 3991	99-111	8	16
6	126	287	3992- 4005	112-125	9	16
7	127	288	4006- 4019	126-139	10	16
8	128	289	4020- 4033	140-153	11	16
9	129	290	4034- 4047	154-167	12	16
10	130	291	4048- 4061	168-181	13	16
11	131	292	4062- 4075	182-195	14	16
12	132	293	4076- 4089	196-209	15	16
13	133	294	4090- 4103	210-223	16	16
14	134	295	4104- 4117	224-237	17	16
15	135	296	4118- 4131	238-251	18	16
16	136	297	4132- 4145	1- 14	1	17
17	137	298	4146- 4159	15- 28	2	17
18	138	299	4160- 4173	29- 42	3	17
19	139	300	4174- 4187	43- 56	4	17
20	140	301	4188- 4201	57- 70	5	17
21	141	302	4202- 4215	71- 84	6	17
22	142	303	4216- 4229	85- 98	7	17
23	143	304	4230- 4242	99-111	8	17
24	144	305	4243- 4256	112-125	9	17
25	145	306	4257- 4270	126-139	10	17
26	146	307	4271- 4284	140-153	11	17
27	147	308	4285- 4298	154-167	12	17
28	148	309	4299- 4312	168-181	13	17
29	149	310	4313- 4326	182-195	14	17
30	150	311	4327- 4340	196-209	15	17
31	151	312	4341- 4354	210-223	16	17

JUN, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	313	4355- 4368	224-237	17	17
2	153	314	4369- 4382	238-251	18	17
3	154	315	4383- 4396	1- 14	1	18
4	155	316	4397- 4410	15- 28	2	18
5	156	317	4411- 4424	29- 42	3	18
6	157	318	4425- 4438	43- 56	4	18
7	158	319	4439- 4452	57- 70	5	18
8	159	320	4453- 4466	71- 84	6	18
9	160	321	4467- 4480	85- 98	7	18
10	161	322	4481- 4493	99-111	8	18
11	162	323	4494- 4507	112-125	9	18
12	163	324	4508- 4521	126-139	10	18
13	164	325	4522- 4535	140-153	11	18
14	165	326	4536- 4549	154-167	12	18
15	166	327	4550- 4563	168-181	13	18
16	167	328	4564- 4577	182-195	14	18
17	168	329	4578- 4591	196-209	15	18
18	169	330	4592- 4605	210-223	16	18
19	170	331	4606- 4619	224-237	17	18
20	171	332	4620- 4633	238-251	18	18
21	172	333	4634- 4647	1- 14	1	19
22	173	334	4648- 4661	15- 28	2	19
23	174	335	4662- 4675	29- 42	3	19
24	175	336	4676- 4689	43- 56	4	19
25	176	337	4690- 4703	57- 70	5	19
26	177	338	4704- 4717	71- 84	6	19
27	178	339	4718- 4731	85- 98	7	19
28	179	340	4732- 4744	99-111	8	19
29	180	341	4745- 4758	112-125	9	19
30	181	342	4759- 4772	126-139	10	19

JUL,1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	343	4773- 4786	140-153	11	19
2	183	344	4787- 4800	154-167	12	19
3	184	345	4801- 4814	168-181	13	19
4	185	346	4815- 4828	182-195	14	19
5	186	347	4829- 4842	196-209	15	19
6	187	348	4843- 4856	210-223	16	19
7	188	349	4857- 4870	224-237	17	19
8	189	350	4871- 4884	238-251	18	19
9	190	351	4885- 4898	1- 14	1	20
10	191	352	4899- 4912	15- 28	2	20
11	192	353	4913- 4926	29- 42	3	20
12	193	354	4927- 4940	43- 56	4	20
13	194	355	4941- 4954	57- 70	5	20
14	195	356	4955- 4968	71- 84	6	20
15	196	357	4969- 4982	85- 98	7	20
16	197	358	4983- 4995	99-111	8	20
17	198	359	4996- 5009	112-125	9	20
18	199	360	5010- 5023	126-139	10	20
19	200	361	5024- 5037	140-153	11	20
20	201	362	5038- 5051	154-167	12	20
21	202	363	5052- 5065	168-181	13	20
22	203	364	5066- 5079	182-195	14	20
23	204	365	5080- 5093	196-209	15	20
24	205	366	5094- 5107	210-223	16	20
25	206	367	5108- 5121	224-237	17	20
26	207	368	5122- 5135	238-251	18	20
27	208	369	5136- 5149	1- 14	1	21
28	209	370	5150- 5163	15- 28	2	21
29	210	371	5164- 5177	29- 42	3	21
30	211	372	5178- 5191	43- 56	4	21
31	212	373	5192- 5205	57- 70	5	21

AUG, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	374	5206- 5219	71- 84	6	21
2	214	375	5220- 5233	85- 98	7	21
3	215	376	5234- 5246	99-111	8	21
4	216	377	5247- 5260	112-125	9	21
5	217	378	5261- 5274	126-139	10	21
6	218	379	5275- 5288	140-153	11	21
7	219	380	5289- 5302	154-167	12	21
8	220	381	5303- 5316	168-181	13	21
9	221	382	5317- 5330	182-195	14	21
10	222	383	5331- 5344	196-209	15	21
11	223	384	5345- 5358	210-223	16	21
12	224	385	5359- 5372	224-237	17	21
13	225	386	5373- 5386	238-251	18	21
14	226	387	5387- 5400	1- 14	1	22
15	227	388	5401- 5414	15- 28	2	22
16	228	389	5415- 5428	29- 42	3	22
17	229	390	5429- 5442	43- 56	4	22
18	230	391	5443- 5456	57- 70	5	22
19	231	392	5457- 5470	71- 84	6	22
20	232	393	5471- 5484	85- 98	7	22
21	233	394	5485- 5497	99-111	8	22
22	234	395	5498- 5511	112-125	9	22
23	235	396	5512- 5525	126-139	10	22
24	236	397	5526- 5539	140-153	11	22
25	237	398	5540- 5553	154-167	12	22
26	238	399	5554- 5567	168-181	13	22
27	239	400	5568- 5581	182-195	14	22
28	240	401	5582- 5595	196-209	15	22
29	241	402	5596- 5609	210-223	16	22
30	242	403	5610- 5623	224-237	17	22
31	243	404	5624- 5637	238-251	18	22

SEP,1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	405	5638- 5651	1- 14	1	23
2	245	406	5652- 5665	15- 28	2	23
3	246	407	5666- 5679	29- 42	3	23
4	247	408	5680- 5693	43- 56	4	23
5	248	409	5694- 5707	57- 70	5	23
6	249	410	5708- 5721	71- 84	6	23
7	250	411	5722- 5735	85- 98	7	23
8	251	412	5736- 5748	99-111	8	23
9	252	413	5749- 5762	112-125	9	23
10	253	414	5763- 5776	126-139	10	23
11	254	415	5777- 5790	140-153	11	23
12	255	416	5791- 5804	154-167	12	23
13	256	417	5805- 5818	168-181	13	23
14	257	418	5819- 5832	182-195	14	23
15	258	419	5833- 5846	196-209	15	23
16	259	420	5847- 5860	210-223	16	23
17	260	421	5861- 5874	224-237	17	23
18	261	422	5875- 5888	238-251	18	23
19	262	423	5889- 5902	1- 14	1	24
20	263	424	5903- 5916	15- 28	2	24
21	264	425	5917- 5930	29- 42	3	24
22	265	426	5931- 5944	43- 56	4	24
23	266	427	5945- 5958	57- 70	5	24
24	267	428	5959- 5972	71- 84	6	24
25	268	429	5973- 5986	85- 98	7	24
26	269	430	5987- 5999	99-111	8	24
27	270	431	6000- 6013	112-125	9	24
28	271	432	6014- 6027	126-139	10	24
29	272	433	6028- 6041	140-153	11	24
30	273	434	6042- 6055	154-167	12	24

OCT,1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	435	6056- 6069	168-181	13	24
2	275	436	6070- 6083	182-195	14	24
3	276	437	6084- 6097	196-209	15	24
4	277	438	6098- 6111	210-223	16	24
5	278	439	6112- 6125	224-237	17	24
6	279	440	6126- 6139	238-251	18	24
7	280	441	6140- 6153	1- 14	1	25
8	281	442	6154- 6167	15- 28	2	25
9	282	443	6168- 6181	29- 42	3	25
10	283	444	6182- 6195	43- 56	4	25
11	284	445	6196- 6209	57- 70	5	25
12	285	446	6210- 6223	71- 84	6	25
13	286	447	6224- 6237	85- 98	7	25
14	287	448	6238- 6250	99-111	8	25
15	288	449	6251- 6264	112-125	9	25
16	289	450	6265- 6278	126-139	10	25
17	290	451	6279- 6292	140-153	11	25
18	291	452	6293- 6306	154-167	12	25
19	292	453	6307- 6320	168-181	13	25
20	293	454	6321- 6334	182-195	14	25
21	294	455	6335- 6348	196-209	15	25
22	295	456	6349- 6362	210-223	16	25
23	296	457	6363- 6376	224-237	17	25
24	297	458	6377- 6390	238-251	18	25
25	298	459	6391- 6404	1- 14	1	26
26	299	460	6405- 6418	15- 28	2	26
27	300	461	6419- 6432	29- 42	3	26
28	301	462	6433- 6446	43- 56	4	26
29	302	463	6447- 6460	57- 70	5	26
30	303	464	6461- 6474	71- 84	6	26
31	304	465	6475- 6488	85- 98	7	26

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

NOV, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	466	6489- 6501	99-111	8	26
2	306	467	6502- 6515	112-125	9	26
3	307	468	6516- 6529	126-139	10	26
4	308	469	6530- 6543	140-153	11	26
5	309	470	6544- 6557	154-167	12	26
6	310	471	6558- 6571	168-181	13	26
7	311	472	6572- 6585	182-195	14	26
8	312	473	6586- 6599	196-209	15	26
9	313	474	6600- 6613	210-223	16	26
10	314	475	6614- 6627	224-237	17	26
11	315	476	6628- 6641	238-251	18	26
12	316	477	6642- 6655	1- 14	1	27
13	317	478	6656- 6669	15- 28	2	27
14	318	479	6670- 6683	29- 42	3	27
15	319	480	6684- 6697	43- 56	4	27
16	320	481	6698- 6711	57- 70	5	27
17	321	482	6712- 6725	71- 84	6	27
18	322	483	6726- 6739	85- 98	7	27
19	323	484	6740- 6752	99-111	8	27
20	324	485	6753- 6766	112-125	9	27
21	325	486	6767- 6780	126-139	10	27
22	326	487	6781- 6794	140-153	11	27
23	327	488	6795- 6808	154-167	12	27
24	328	489	6809- 6822	168-181	13	27
25	329	490	6823- 6836	182-195	14	27
26	330	491	6837- 6850	196-209	15	27
27	331	492	6851- 6864	210-223	16	27
28	332	493	6865- 6878	224-237	17	27
29	333	494	6879- 6892	238-251	18	27
30	334	495	6893- 6906	1- 14	1	28

DEC, 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	496	6907- 6920	15- 28	2	28
2	336	497	6921- 6934	29- 42	3	28
3	337	498	6935- 6948	43- 56	4	28
4	338	499	6949- 6962	57- 70	5	28
5	339	500	6963- 6976	71- 84	6	28
6	340	501	6977- 6990	85- 98	7	28
7	341	502	6991- 7003	99-111	8	28
8	342	503	7004- 7017	112-125	9	28
9	343	504	7018- 7031	126-139	10	28
10	344	505	7032- 7045	140-153	11	28
11	345	506	7046- 7059	154-167	12	28
12	346	507	7060- 7073	168-181	13	28
13	347	508	7074- 7087	182-195	14	28
14	348	509	7088- 7101	196-209	15	28
15	349	510	7102- 7115	210-223	16	28
16	350	511	7116- 7129	224-237	17	28
17	351	512	7130- 7143	238-251	18	28
18	352	513	7144- 7157	1- 14	1	29
19	353	514	7158- 7171	15- 28	2	29
20	354	515	7172- 7185	29- 42	3	29
21	355	516	7186- 7199	43- 56	4	29
22	356	517	7200- 7213	57- 70	5	29
23	357	518	7214- 7227	71- 84	6	29
24	358	519	7228- 7241	85- 98	7	29
25	359	520	7242- 7254	99-111	8	29
26	360	521	7255- 7268	112-125	9	29
27	361	522	7269- 7282	126-139	10	29
28	362	523	7283- 7296	140-153	11	29
29	363	524	7297- 7310	154-167	12	29
30	364	525	7311- 7324	168-181	13	29
31	365	526	7325- 7338	182-195	14	29

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

JAN,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	527	7339- 7352	196-209	15	29
2	2	528	7353- 7366	210-223	16	29
3	3	529	7367- 7380	224-237	17	29
4	4	530	7381- 7394	238-251	18	29
5	5	531	7395- 7408	1- 14	1	30
6	6	532	7409- 7422	15- 28	2	30
7	7	533	7423- 7436	29- 42	3	30
8	8	534	7437- 7450	43- 56	4	30
9	9	535	7451- 7464	57- 70	5	30
10	10	536	7465- 7478	71- 84	6	30
11	11	537	7479- 7492	85- 98	7	30
12	12	538	7493- 7505	99-111	8	30
13	13	539	7506- 7519	112-125	9	30
14	14	540	7520- 7533	126-139	10	30
15	15	541	7534- 7547	140-153	11	30
16	16	542	7548- 7561	154-167	12	30
17	17	543	7562- 7575	168-181	13	30
18	18	544	7576- 7589	182-195	14	30
19	19	545	7590- 7603	196-209	15	30
20	20	546	7604- 7617	210-223	16	30
21	21	547	7618- 7631	224-237	17	30
22	22	548	7632- 7645	238-251	18	30
23	23	549	7646- 7659	1- 14	1	31
24	24	550	7660- 7673	15- 28	2	31
25	25	551	7674- 7687	29- 42	3	31
26	26	552	7688- 7701	43- 56	4	31
27	27	553	7702- 7715	57- 70	5	31
28	28	554	7716- 7729	71- 84	6	31
29	29	555	7730- 7743	85- 98	7	31
30	30	556	7744- 7756	99-111	8	31
31	31	557	7757- 7770	112-125	9	31

FEB,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	558	7771- 7784	126-139	10	31
2	33	559	7785- 7798	140-153	11	31
3	34	560	7799- 7812	154-167	12	31
4	35	561	7813- 7826	168-181	13	31
5	36	562	7827- 7840	182-195	14	31
6	37	563	7841- 7854	196-209	15	31
7	38	564	7855- 7868	210-223	16	31
8	39	565	7869- 7882	224-237	17	31
9	40	566	7883- 7896	238-251	18	31
10	41	567	7897- 7910	1- 14	1	32
11	42	568	7911- 7924	15- 28	2	32
12	43	569	7925- 7938	29- 42	3	32
13	44	570	7939- 7952	43- 56	4	32
14	45	571	7953- 7966	57- 70	5	32
15	46	572	7967- 7980	71- 84	6	32
16	47	573	7981- 7994	85- 98	7	32
17	48	574	7995- 8007	99-111	8	32
18	49	575	8008- 8021	112-125	9	32
19	50	576	8022- 8035	126-139	10	32
20	51	577	8036- 8049	140-153	11	32
21	52	578	8050- 8063	154-167	12	32
22	53	579	8064- 8077	168-181	13	32
23	54	580	8078- 8091	182-195	14	32
24	55	581	8092- 8105	196-209	15	32
25	56	582	8106- 8119	210-223	16	32
26	57	583	8120- 8133	224-237	17	32
27	58	584	8134- 8147	238-251	18	32
28	59	585	8148- 8161	1- 14	1	33

MAR, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	586	8162- 8175	15- 28	2	33
2	61	587	8176- 8189	29- 42	3	33
3	62	588	8190- 8203	43- 56	4	33
4	63	589	8204- 8217	57- 70	5	33
5	64	590	8218- 8231	71- 84	6	33
6	65	591	8232- 8245	85- 98	7	33
7	66	592	8246- 8258	99-111	8	33
8	67	593	8259- 8272	112-125	9	33
9	68	594	8273- 8286	126-139	10	33
10	69	595	8287- 8300	140-153	11	33
11	70	596	8301- 8314	154-167	12	33
12	71	597	8315- 8328	168-181	13	33
13	72	598	8329- 8342	182-195	14	33
14	73	599	8343- 8356	196-209	15	33
15	74	600	8357- 8370	210-223	16	33
16	75	601	8371- 8384	224-237	17	33
17	76	602	8385- 8398	238-251	18	33
18	77	603	8399- 8412	1- 14	1	34
19	78	604	8413- 8426	15- 28	2	34
20	79	605	8427- 8440	29- 42	3	34
21	80	606	8441- 8454	43- 56	4	34
22	81	607	8455- 8468	57- 70	5	34
23	82	608	8469- 8482	71- 84	6	34
24	83	609	8483- 8496	85- 98	7	34
25	84	610	8497- 8509	99-111	8	34
26	85	611	8510- 8523	112-125	9	34
27	86	612	8524- 8537	126-139	10	34
28	87	613	8538- 8551	140-153	11	34
29	88	614	8552- 8565	154-167	12	34
30	89	615	8566- 8579	168-181	13	34
31	90	616	8580- 8593	182-195	14	34

APR, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	617	8594- 8607	196-209	15	34
2	92	618	8608- 8621	210-223	16	34
3	93	619	8622- 8635	224-237	17	34
4	94	620	8636- 8649	238-251	18	34
5	95	621	8650- 8663	1- 14	1	35
6	96	622	8664- 8677	15- 28	2	35
7	97	623	8678- 8691	29- 42	3	35
8	98	624	8692- 8705	43- 56	4	35
9	99	625	8706- 8719	57- 70	5	35
10	100	626	8720- 8733	71- 84	6	35
11	101	627	8734- 8747	85- 98	7	35
12	102	628	8748- 8760	99-111	8	35
13	103	629	8761- 8774	112-125	9	35
14	104	630	8775- 8788	126-139	10	35
15	105	631	8789- 8802	140-153	11	35
16	106	632	8803- 8816	154-167	12	35
17	107	633	8817- 8830	168-181	13	35
18	108	634	8831- 8844	182-195	14	35
19	109	635	8845- 8858	196-209	15	35
20	110	636	8859- 8872	210-223	16	35
21	111	637	8873- 8886	224-237	17	35
22	112	638	8887- 8900	238-251	18	35
23	113	639	8901- 8914	1- 14	1	36
24	114	640	8915- 8928	15- 28	2	36
25	115	641	8929- 8942	29- 42	3	36
26	116	642	8943- 8956	43- 56	4	36
27	117	643	8957- 8970	57- 70	5	36
28	118	644	8971- 8984	71- 84	6	36
29	119	645	8985- 8998	85- 98	7	36
30	120	646	8999- 9011	99-111	8	36

MAY, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	647	9012- 9025	112-125	9	36
2	122	648	9026- 9039	126-139	10	36
3	123	649	9040- 9053	140-153	11	36
4	124	650	9054- 9067	154-167	12	36
5	125	651	9068- 9081	168-181	13	36
6	126	652	9082- 9095	182-195	14	36
7	127	653	9096- 9109	196-209	15	36
8	128	654	9110- 9123	210-223	16	36
9	129	655	9124- 9137	224-237	17	36
10	130	656	9138- 9151	238-251	18	36
11	131	657	9152- 9165	1- 14	1	37
12	132	658	9166- 9179	15- 28	2	37
13	133	659	9180- 9193	29- 42	3	37
14	134	660	9194- 9207	43- 56	4	37
15	135	661	9208- 9221	57- 70	5	37
16	136	662	9222- 9235	71- 84	6	37
17	137	663	9236- 9249	85- 98	7	37
18	138	664	9250- 9262	99-111	8	37
19	139	665	9263- 9276	112-125	9	37
20	140	666	9277- 9290	126-139	10	37
21	141	667	9291- 9304	140-153	11	37
22	142	668	9305- 9318	154-167	12	37
23	143	669	9319- 9332	168-181	13	37
24	144	670	9333- 9346	182-195	14	37
25	145	671	9347- 9360	196-209	15	37
26	146	672	9361- 9374	210-223	16	37
27	147	673	9375- 9388	224-237	17	37
28	148	674	9389- 9402	238-251	18	37
29	149	675	9403- 9416	1- 14	1	38
30	150	676	9417- 9430	15- 28	2	38
31	151	677	9431- 9444	29- 42	3	38

JUN, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	678	9445- 9458	43- 56	4	38
2	153	679	9459- 9472	57- 70	5	38
3	154	680	9473- 9486	71- 84	6	38
4	155	681	9487- 9500	85- 98	7	38
5	156	682	9501- 9513	99-111	8	38
6	157	683	9514- 9527	112-125	9	38
7	158	684	9528- 9541	126-139	10	38
8	159	685	9542- 9555	140-153	11	38
9	160	686	9556- 9569	154-167	12	38
10	161	687	9570- 9583	168-181	13	38
11	162	688	9584- 9597	182-195	14	38
12	163	689	9598- 9611	196-209	15	38
13	164	690	9612- 9625	210-223	16	38
14	165	691	9626- 9639	224-237	17	38
15	166	692	9640- 9653	238-251	18	38
16	167	693	9654- 9667	1- 14	1	39
17	168	694	9668- 9681	15- 28	2	39
18	169	695	9682- 9695	29- 42	3	39
19	170	696	9696- 9709	43- 56	4	39
20	171	697	9710- 9723	57- 70	5	39
21	172	698	9724- 9737	71- 84	6	39
22	173	699	9738- 9751	85- 98	7	39
23	174	700	9752- 9764	99-111	8	39
24	175	701	9765- 9778	112-125	9	39
25	176	702	9779- 9792	126-139	10	39
26	177	703	9793- 9806	140-153	11	39
27	178	704	9807- 9820	154-167	12	39
28	179	705	9821- 9834	168-181	13	39
29	180	706	9835- 9848	182-195	14	39
30	181	707	9849- 9862	196-209	15	39

JUL, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	708	9863- 9876	210-223	16	39
2	183	709	9877- 9890	224-237	17	39
3	184	710	9891- 9904	238-251	18	39
4	185	711	9905- 9918	1- 14	1	40
5	186	712	9919- 9932	15- 28	2	40
6	187	713	9933- 9946	29- 42	3	40
7	188	714	9947- 9960	43- 56	4	40
8	189	715	9961- 9974	57- 70	5	40
9	190	716	9975- 9988	71- 84	6	40
10	191	717	9989-10002	85- 98	7	40
11	192	718	10003-10015	99-111	8	40
12	193	719	10016-10029	112-125	9	40
13	194	720	10030-10043	126-139	10	40
14	195	721	10044-10057	140-153	11	40
15	196	722	10058-10071	154-167	12	40
16	197	723	10072-10085	168-181	13	40
17	198	724	10086-10099	182-195	14	40
18	199	725	10100-10113	196-209	15	40
19	200	726	10114-10127	210-223	16	40
20	201	727	10128-10141	224-237	17	40
21	202	728	10142-10155	238-251	18	40
22	203	729	10156-10169	1- 14	1	41
23	204	730	10170-10183	15- 28	2	41
24	205	731	10184-10197	29- 42	3	41
25	206	732	10198-10211	43- 56	4	41
26	207	733	10212-10225	57- 70	5	41
27	208	734	10226-10239	71- 84	6	41
28	209	735	10240-10253	85- 98	7	41
29	210	736	10254-10266	99-111	8	41
30	211	737	10267-10280	112-125	9	41
31	212	738	10281-10294	126-139	10	41

AUG,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	739	10295-10308	140-153	11	41
2	214	740	10309-10322	154-167	12	41
3	215	741	10323-10336	168-181	13	41
4	216	742	10337-10350	182-195	14	41
5	217	743	10351-10364	196-209	15	41
6	218	744	10365-10378	210-223	16	41
7	219	745	10379-10392	224-237	17	41
8	220	746	10393-10406	238-251	18	41
9	221	747	10407-10420	1- 14	1	42
10	222	748	10421-10434	15- 28	2	42
11	223	749	10435-10448	29- 42	3	42
12	224	750	10449-10462	43- 56	4	42
13	225	751	10463-10476	57- 70	5	42
14	226	752	10477-10490	71- 84	6	42
15	227	753	10491-10504	85- 98	7	42
16	228	754	10505-10517	99-111	8	42
17	229	755	10518-10531	112-125	9	42
18	230	756	10532-10545	126-139	10	42
19	231	757	10546-10559	140-153	11	42
20	232	758	10560-10573	154-167	12	42
21	233	759	10574-10587	168-181	13	42
22	234	760	10588-10601	182-195	14	42
23	235	761	10602-10615	196-209	15	42
24	236	762	10616-10629	210-223	16	42
25	237	763	10630-10643	224-237	17	42
26	238	764	10644-10657	238-251	18	42
27	239	765	10658-10671	1- 14	1	43
28	240	766	10672-10685	15- 28	2	43
29	241	767	10686-10699	29- 42	3	43
30	242	768	10700-10713	43- 56	4	43
31	243	769	10714-10727	57- 70	5	43

SEP, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	770	10728-10741	71- 84	6	43
2	245	771	10742-10755	85- 98	7	43
3	246	772	10756-10768	99-111	8	43
4	247	773	10769-10782	112-125	9	43
5	248	774	10783-10796	126-139	10	43
6	249	775	10797-10810	140-153	11	43
7	250	776	10811-10824	154-167	12	43
8	251	777	10825-10838	168-181	13	43
9	252	778	10839-10852	182-195	14	43
10	253	779	10853-10866	196-209	15	43
11	254	780	10867-10880	210-223	16	43
12	255	781	10881-10894	224-237	17	43
13	256	782	10895-10908	238-251	18	43
14	257	783	10909-10922	1- 14	1	44
15	258	784	10923-10936	15- 28	2	44
16	259	785	10937-10950	29- 42	3	44
17	260	786	10951-10964	43- 56	4	44
18	261	787	10965-10978	57- 70	5	44
19	262	788	10979-10992	71- 84	6	44
20	263	789	10993-11006	85- 98	7	44
21	264	790	11007-11019	99-111	8	44
22	265	791	11020-11033	112-125	9	44
23	266	792	11034-11047	126-139	10	44
24	267	793	11048-11061	140-153	11	44
25	268	794	11062-11075	154-167	12	44
26	269	795	11076-11089	168-181	13	44
27	270	796	11090-11103	182-195	14	44
28	271	797	11104-11117	196-209	15	44
29	272	798	11118-11131	210-223	16	44
30	273	799	11132-11145	224-237	17	44

OCT,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	800	11146-11159	238-251	18	44
2	275	801	11160-11173	1- 14	1	45
3	276	802	11174-11187	15- 28	2	45
4	277	803	11188-11201	29- 42	3	45
5	278	804	11202-11215	43- 56	4	45
6	279	805	11216-11229	57- 70	5	45
7	280	806	11230-11243	71- 84	6	45
8	281	807	11244-11257	85- 98	7	45
9	282	808	11258-11270	99-111	8	45
10	283	809	11271-11284	112-125	9	45
11	284	810	11285-11298	126-139	10	45
12	285	811	11299-11312	140-153	11	45
13	286	812	11313-11326	154-167	12	45
14	287	813	11327-11340	168-181	13	45
15	288	814	11341-11354	182-195	14	45
16	289	815	11355-11368	196-209	15	45
17	290	816	11369-11382	210-223	16	45
18	291	817	11383-11396	224-237	17	45
19	292	818	11397-11410	238-251	18	45
20	293	819	11411-11424	1- 14	1	46
21	294	820	11425-11438	15- 28	2	46
22	295	821	11439-11452	29- 42	3	46
23	296	822	11453-11466	43- 56	4	46
24	297	823	11467-11480	57- 70	5	46
25	298	824	11481-11494	71- 84	6	46
26	299	825	11495-11508	85- 98	7	46
27	300	826	11509-11521	99-111	8	46
28	301	827	11522-11535	112-125	9	46
29	302	828	11536-11549	126-139	10	46
30	303	829	11550-11563	140-153	11	46
31	304	830	11564-11577	154-167	12	46

NOV, 1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	831	11578-11591	168-181	13	46
2	306	832	11592-11605	182-195	14	46
3	307	833	11606-11619	196-209	15	46
4	308	834	11620-11633	210-223	16	46
5	309	835	11634-11647	224-237	17	46
6	310	836	11648-11661	238-251	18	46
7	311	837	11662-11675	1- 14	1	47
8	312	838	11676-11689	15- 28	2	47
9	313	839	11690-11703	29- 42	3	47
10	314	840	11704-11717	43- 56	4	47
11	315	841	11718-11731	57- 70	5	47
12	316	842	11732-11745	71- 84	6	47
13	317	843	11746-11759	85- 98	7	47
14	318	844	11760-11772	99-111	8	47
15	319	845	11773-11786	112-125	9	47
16	320	846	11787-11800	126-139	10	47
17	321	847	11801-11814	140-153	11	47
18	322	848	11815-11828	154-167	12	47
19	323	849	11829-11842	168-181	13	47
20	324	850	11843-11856	182-195	14	47
21	325	851	11857-11870	196-209	15	47
22	326	852	11871-11884	210-223	16	47
23	327	853	11885-11898	224-237	17	47
24	328	854	11899-11912	238-251	18	47
25	329	855	11913-11926	1- 14	1	48
26	330	856	11927-11940	15- 28	2	48
27	331	857	11941-11954	29- 42	3	48
28	332	858	11955-11968	43- 56	4	48
29	333	859	11969-11982	57- 70	5	48
30	334	860	11983-11996	71- 84	6	48

DEC,1974

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	861	11997-12010	85- 98	7	48
2	336	862	12011-12023	99-111	8	48
3	337	863	12024-12037	112-125	9	48
4	338	864	12038-12051	126-139	10	48
5	339	865	12052-12065	140-153	11	48
6	340	866	12066-12079	154-167	12	48
7	341	867	12080-12093	168-181	13	48
8	342	868	12094-12107	182-195	14	48
9	343	869	12108-12121	196-209	15	48
10	344	870	12122-12135	210-223	16	48
11	345	871	12136-12149	224-237	17	48
12	346	872	12150-12163	238-251	18	48
13	347	873	12164-12177	1- 14	1	49
14	348	874	12178-12191	15- 28	2	49
15	349	875	12192-12205	29- 42	3	49
16	350	876	12206-12219	43- 56	4	49
17	351	877	12220-12233	57- 70	5	49
18	352	878	12234-12247	71- 84	6	49
19	353	879	12248-12261	85- 98	7	49
20	354	880	12262-12274	99-111	8	49
21	355	881	12275-12288	112-125	9	49
22	356	882	12289-12302	126-139	10	49
23	357	883	12303-12316	140-153	11	49
24	358	884	12317-12330	154-167	12	49
25	359	885	12331-12344	168-181	13	49
26	360	886	12345-12358	182-195	14	49
27	361	887	12359-12372	196-209	15	49
28	362	888	12373-12386	210-223	16	49
29	363	889	12387-12400	224-237	17	49
30	364	890	12401-12414	238-251	18	49
31	365	891	12415-12428	1- 14	1	50

JAN,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	892	12429-12442	15- 28	2	50
2	2	893	12443-12456	29- 42	3	50
3	3	894	12457-12470	43- 56	4	50
4	4	895	12471-12484	57- 70	5	50
5	5	896	12485-12498	71- 84	6	50
6	6	897	12499-12512	85- 98	7	50
7	7	898	12513-12525	99-111	8	50
8	8	899	12526-12539	112-125	9	50
9	9	900	12540-12553	126-139	10	50
10	10	901	12554-12567	140-153	11	50
11	11	902	12568-12581	154-167	12	50
12	12	903	12582-12595	168-181	13	50
13	13	904	12596-12609	182-195	14	50
14	14	905	12610-12623	196-209	15	50
15	15	906	12624-12637	210-223	16	50
16	16	907	12638-12651	224-237	17	50
17	17	908	12652-12665	238-251	18	50
18	18	909	12666-12679	1- 14	1	51
19	19	910	12680-12693	15- 28	2	51
20	20	911	12694-12707	29- 42	3	51
21	21	912	12708-12721	43- 56	4	51
22	22	913	12722-12735	57- 70	5	51
23	23	914	12736-12749	71- 84	6	51
24	24	915	12750-12763	85- 98	7	51
25	25	916	12764-12776	99-111	8	51
26	26	917	12777-12790	112-125	9	51
27	27	918	12791-12804	126-139	10	51
28	28	919	12805-12818	140-153	11	51
29	29	920	12819-12832	154-167	12	51
30	30	921	12833-12846	168-181	13	51
31	31	922	12847-12860	182-195	14	51

FEB,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ØRBITS	REFERENCE ØRBITS	REF DAY	CYCLE NØ.
1	32	923	12861-12874	196-209	15	51
2	33	924	12875-12888	210-223	16	51
3	34	925	12889-12902	224-237	17	51
4	35	926	12903-12916	238-251	18	51
5	36	927	12917-12930	1- 14	1	52
6	37	928	12931-12944	15- 28	2	52
7	38	929	12945-12958	29- 42	3	52
8	39	930	12959-12972	43- 56	4	52
9	40	931	12973-12986	57- 70	5	52
10	41	932	12987-13000	71- 84	6	52
11	42	933	13001-13014	85- 98	7	52
12	43	934	13015-13027	99-111	8	52
13	44	935	13028-13041	112-125	9	52
14	45	936	13042-13055	126-139	10	52
15	46	937	13056-13069	140-153	11	52
16	47	938	13070-13083	154-167	12	52
17	48	939	13084-13097	168-181	13	52
18	49	940	13098-13111	182-195	14	52
19	50	941	13112-13125	196-209	15	52
20	51	942	13126-13139	210-223	16	52
21	52	943	13140-13153	224-237	17	52
22	53	944	13154-13167	238-251	18	52
23	54	945	13168-13181	1- 14	1	53
24	55	946	13182-13195	15- 28	2	53
25	56	947	13196-13209	29- 42	3	53
26	57	948	13210-13223	43- 56	4	53
27	58	949	13224-13237	57- 70	5	53
28	59	950	13238-13251	71- 84	6	53

MAR,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ØRBITS	REFERENCE ØRBITS	REF DAY	CYCLE NØ.
1	60	951	13252-13265	85- 98	7	53
2	61	952	13266-13278	99-111	8	53
3	62	953	13279-13292	112-125	9	53
4	63	954	13293-13306	126-139	10	53
5	64	955	13307-13320	140-153	11	53
6	65	956	13321-13334	154-167	12	53
7	66	957	13335-13348	168-181	13	53
8	67	958	13349-13362	182-195	14	53
9	68	959	13363-13376	196-209	15	53
10	69	960	13377-13390	210-223	16	53
11	70	961	13391-13404	224-237	17	53
12	71	962	13405-13418	238-251	18	53
13	72	963	13419-13432	1- 14	1	54
14	73	964	13433-13446	15- 28	2	54
15	74	965	13447-13460	29- 42	3	54
16	75	966	13461-13474	43- 56	4	54
17	76	967	13475-13488	57- 70	5	54
18	77	968	13489-13502	71- 84	6	54
19	78	969	13503-13516	85- 98	7	54
20	79	970	13517-13529	99-111	8	54
21	80	971	13530-13543	112-125	9	54
22	81	972	13544-13557	126-139	10	54
23	82	973	13558-13571	140-153	11	54
24	83	974	13572-13585	154-167	12	54
25	84	975	13586-13599	168-181	13	54
26	85	976	13600-13613	182-195	14	54
27	86	977	13614-13627	196-209	15	54
28	87	978	13628-13641	210-223	16	54
29	88	979	13642-13655	224-237	17	54
30	89	980	13656-13669	238-251	18	54
31	90	981	13670-13683	1- 14	1	55

APR, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	982	13684-13697	15- 28	2	55
2	92	983	13698-13711	29- 42	3	55
3	93	984	13712-13725	43- 56	4	55
4	94	985	13726-13739	57- 70	5	55
5	95	986	13740-13753	71- 84	6	55
6	96	987	13754-13767	85- 98	7	55
7	97	988	13768-13780	99-111	8	55
8	98	989	13781-13794	112-125	9	55
9	99	990	13795-13808	126-139	10	55
10	100	991	13809-13822	140-153	11	55
11	101	992	13823-13836	154-167	12	55
12	102	993	13837-13850	168-181	13	55
13	103	994	13851-13864	182-195	14	55
14	104	995	13865-13878	196-209	15	55
15	105	996	13879-13892	210-223	16	55
16	106	997	13893-13906	224-237	17	55
17	107	998	13907-13920	238-251	18	55
18	108	999	13921-13934	1- 14	1	56
19	109	1000	13935-13948	15- 28	2	56
20	110	1001	13949-13962	29- 42	3	56
21	111	1002	13963-13976	43- 56	4	56
22	112	1003	13977-13990	57- 70	5	56
23	113	1004	13991-14004	71- 84	6	56
24	114	1005	14005-14018	85- 98	7	56
25	115	1006	14019-14031	99-111	8	56
26	116	1007	14032-14045	112-125	9	56
27	117	1008	14046-14059	126-139	10	56
28	118	1009	14060-14073	140-153	11	56
29	119	1010	14074-14087	154-167	12	56
30	120	1011	14088-14101	168-181	13	56

MAY, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	1012	14102-14115	182-195	14	56
2	122	1013	14116-14129	196-209	15	56
3	123	1014	14130-14143	210-223	16	56
4	124	1015	14144-14157	224-237	17	56
5	125	1016	14158-14171	238-251	18	56
6	126	1017	14172-14185	1- 14	1	57
7	127	1018	14186-14199	15- 28	2	57
8	128	1019	14200-14213	29- 42	3	57
9	129	1020	14214-14227	43- 56	4	57
10	130	1021	14228-14241	57- 70	5	57
11	131	1022	14242-14255	71- 84	6	57
12	132	1023	14256-14269	85- 98	7	57
13	133	1024	14270-14282	99-111	8	57
14	134	1025	14283-14296	112-125	9	57
15	135	1026	14297-14310	126-139	10	57
16	136	1027	14311-14324	140-153	11	57
17	137	1028	14325-14338	154-167	12	57
18	138	1029	14339-14352	168-181	13	57
19	139	1030	14353-14366	182-195	14	57
20	140	1031	14367-14380	196-209	15	57
21	141	1032	14381-14394	210-223	16	57
22	142	1033	14395-14408	224-237	17	57
23	143	1034	14409-14422	238-251	18	57
24	144	1035	14423-14436	1- 14	1	58
25	145	1036	14437-14450	15- 28	2	58
26	146	1037	14451-14464	29- 42	3	58
27	147	1038	14465-14478	43- 56	4	58
28	148	1039	14479-14492	57- 70	5	58
29	149	1040	14493-14506	71- 84	6	58
30	150	1041	14507-14520	85- 98	7	58
31	151	1042	14521-14533	99-111	8	58

JUN, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	1043	14534-14547	112-125	9	58
2	153	1044	14548-14561	126-139	10	58
3	154	1045	14562-14575	140-153	11	58
4	155	1046	14576-14589	154-167	12	58
5	156	1047	14590-14603	168-181	13	58
6	157	1048	14604-14617	182-195	14	58
7	158	1049	14618-14631	196-209	15	58
8	159	1050	14632-14645	210-223	16	58
9	160	1051	14646-14659	224-237	17	58
10	161	1052	14660-14673	238-251	18	58
11	162	1053	14674-14687	1- 14	1	59
12	163	1054	14688-14701	15- 28	2	59
13	164	1055	14702-14715	29- 42	3	59
14	165	1056	14716-14729	43- 56	4	59
15	166	1057	14730-14743	57- 70	5	59
16	167	1058	14744-14757	71- 84	6	59
17	168	1059	14758-14771	85- 98	7	59
18	169	1060	14772-14784	99-111	8	59
19	170	1061	14785-14798	112-125	9	59
20	171	1062	14799-14812	126-139	10	59
21	172	1063	14813-14826	140-153	11	59
22	173	1064	14827-14840	154-167	12	59
23	174	1065	14841-14854	168-181	13	59
24	175	1066	14855-14868	182-195	14	59
25	176	1067	14869-14882	196-209	15	59
26	177	1068	14883-14896	210-223	16	59
27	178	1069	14897-14910	224-237	17	59
28	179	1070	14911-14924	238-251	18	59
29	180	1071	14925-14938	1- 14	1	60
30	181	1072	14939-14952	15- 28	2	60

JUL,1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	1073	14953-14966	29- 42	3	60
2	183	1074	14967-14980	43- 56	4	60
3	184	1075	14981-14994	57- 70	5	60
4	185	1076	14995-15008	71- 84	6	60
5	186	1077	15009-15022	85- 98	7	60
6	187	1078	15023-15035	99-111	8	60
7	188	1079	15036-15049	112-125	9	60
8	189	1080	15050-15063	126-139	10	60
9	190	1081	15064-15077	140-153	11	60
10	191	1082	15078-15091	154-167	12	60
11	192	1083	15092-15105	168-181	13	60
12	193	1084	15106-15119	182-195	14	60
13	194	1085	15120-15133	196-209	15	60
14	195	1086	15134-15147	210-223	16	60
15	196	1087	15148-15161	224-237	17	60
16	197	1088	15162-15175	238-251	18	60
17	198	1089	15176-15189	1- 14	1	61
18	199	1090	15190-15203	15- 28	2	61
19	200	1091	15204-15217	29- 42	3	61
20	201	1092	15218-15231	43- 56	4	61
21	202	1093	15232-15245	57- 70	5	61
22	203	1094	15246-15259	71- 84	6	61
23	204	1095	15260-15273	85- 98	7	61
24	205	1096	15274-15286	99-111	8	61
25	206	1097	15287-15300	112-125	9	61
26	207	1098	15301-15314	126-139	10	61
27	208	1099	15315-15328	140-153	11	61
28	209	1100	15329-15342	154-167	12	61
29	210	1101	15343-15356	168-181	13	61
30	211	1102	15357-15370	182-195	14	61
31	212	1103	15371-15384	196-209	15	61

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

AUG, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	†104	15385-15398	210-223	16	61
2	214	†105	15399-15412	224-237	17	61
3	215	†106	15413-15426	238-251	18	61
4	216	†107	15427-15440	1- 14	1	62
5	217	†108	15441-15454	15- 28	2	62
6	218	†109	15455-15468	29- 42	3	62
7	219	†110	15469-15482	43- 56	4	62
8	220	†111	15483-15496	57- 70	5	62
9	221	†112	15497-15510	71- 84	6	62
10	222	†113	15511-15524	85- 98	7	62
11	223	†114	15525-15537	99-111	8	62
12	224	†115	15538-15551	112-125	9	62
13	225	†116	15552-15565	126-139	10	62
14	226	†117	15566-15579	140-153	11	62
15	227	†118	15580-15593	154-167	12	62
16	228	†119	15594-15607	168-181	13	62
17	229	†120	15608-15621	182-195	14	62
18	230	†121	15622-15635	196-209	15	62
19	231	†122	15636-15649	210-223	16	62
20	232	†123	15650-15663	224-237	17	62
21	233	†124	15664-15677	238-251	18	62
22	234	†125	15678-15691	1- 14	1	63
23	235	†126	15692-15705	15- 28	2	63
24	236	†127	15706-15719	29- 42	3	63
25	237	†128	15720-15733	43- 56	4	63
26	238	†129	15734-15747	57- 70	5	63
27	239	†130	15748-15761	71- 84	6	63
28	240	†131	15762-15775	85- 98	7	63
29	241	†132	15776-15788	99-111	8	63
30	242	†133	15789-15802	112-125	9	63
31	243	†134	15803-15816	126-139	10	63

SEP, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	1135	15817-15830	140-153	11	63
2	245	1136	15831-15844	154-167	12	63
3	246	1137	15845-15858	168-181	13	63
4	247	1138	15859-15872	182-195	14	63
5	248	1139	15873-15886	196-209	15	63
6	249	1140	15887-15900	210-223	16	63
7	250	1141	15901-15914	224-237	17	63
8	251	1142	15915-15928	238-251	18	63

APPENDIX C

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

PIR NO.	*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
	U	— 1N23	— ERTS	— 118	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K.S. Rizk	T.W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
6/28/74			

SUBJECT
Shrinkage of USB/DCS Coverage

References:
1) PIR-U-1TH6-ERTS-87 dated 3-27-73
2) PIR-ERTS-1T23-100 dated 11-21-73

INFORMATION REQUESTED/RELEASED

Introduction

Although the USB has declined in power repeatedly since launch (see Reference 1), until recently there was no observable decrease in its ability to perform its functions. A sensitive technique for detecting incipient operational deterioration is described in Reference 2, using the USB/DCP link from Iceland. Reference 2 showed no deterioration at that time, even though the USB power had declined since launch from 1.6 watts (telemetry-indicated) to 0.264 watts, a decline of 7.8 db.

Objective of this Study

Since issuance of Reference 2, the USB power output has continued to decline, reaching 0.192 watts in Orbit 8424 on 19 March 1974.

This study is to determine whether the USB performance has shown deterioration at this lower power output level.

Summary

Incipient deterioration of USB/DCS relay is evident. Prior to Orbit 8420 on 19 March 1974, the demonstrated range of USB relay of DCS messages was 2157 statute miles (3471 kilometers), essentially the optical horizon of the ERTS spacecraft. After Orbit 8424, the demonstrated range was 1900 statute miles (3060 kilometers), 88% of the original range and 78% of the original area coverage of the USB.

When the power output dropped below a telemetry-indicated value of 0.25 watts, coverage begins to shrink from the ERTS-horizon. This loss of USB coverage was detected by a sensitive technique, even though there is no observable effects as yet, on any of the USB functions: telemetry transmissions, ranging, and DCS operations all seem normal. The "cushion" in the signal-to-noise ratio of these links conceal the incipient deterioration.

Recommendations

Switchover to the redundant B-section of the USB subsystem is recommended for the near future. Unused heretofore, the B-section is available, with a transmitter power output expected to be about 1.3 watts.

Dist: B. Phucas, H. Boys, R. Pahmeier, S. Sanders (2), Oper. Supr., J. Seitner, R. Devlin, L. Gonzales, L. Smith, K. Rizk (5), E. Painter, J. Pandelides, J. Williamson, F. Kallmeyer

PAGE NO. ____ OF ____

✓ RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
1 MO.	3 MOS.
3 MOS.	6 MOS.
6 MOS.	12 MOS.
MOS.	MOS.
	DO NOT DESTROY

Discussion

Figure 0 shows the history of the USB power output since January 1, 1974. Five 18-day periods are shown as Zones 1 to 5 for later analysis. The USB power has dropped over 2 db from a power output level shown to be adequate in Reference 2. To analyze the effects of this power decline, using the technique of Reference 2, a computer program was prepared by J. Williamson of NASA, to plot the location of the ERTS Satellite at time of reception of messages from a remote DCP (6315) in Iceland. Superimposed on the printout are the horizons of the DCP and of the Greenbelt ground station ENT. Figures 1 thru 36 display this data. The first 18 figures display the data span in Zone 1 on Figure 0 from Orbit 7339 on 1 January thru Orbit 7598 on 19 January 1974, when the USB power output was 0.26 watts. The other 18 figures display the data span in Zone 5 from Orbit 8748 on 12 April thru Orbit 8993 on 29 April 1974, when the USB power output was 0.19 watts.

At the top of each of these printouts, data are shown for each message received for that day. The columns show: time of message reception; interval between messages; geographic location of ERTS; orbit number; slant range (statute miles); azimuth and elevation from Greenbelt; slant range (st. mi.) of ERTS horizon; "reference" orbit in the 18-day cycle; time and longitude of descending node; and a letter-identifier for all messages in each orbit.

The plot is bordered by identifications of latitude and longitude. The dots represent Goldstone ground station location and coverage. For purposes of this study they may be ignored. The crosses represent Greenbelt location and coverages. The area of interest is the upper right hand side, where the Greenbelt coverage "circle" intersects the coverage circle of DCP-6315 (Iceland) shown with asterisks. The letters between these intersecting coverage circles geographically locate message receptions. If all similar letters are connected, the sub-satellite paths will be traced. These paths are NE to SW in the day time, and SE to NW at night. Of particular in interest for this study is determination of whether the extreme letter on the side of the Greenbelt horizon (crosses) is close enough to the horizon to preclude room enough for another letter, after projecting the spacing, adjusted for latitude. The geographic location of message receptions are a dual function of ERTS location (i.e. reference orbit), and time of DCP transmission, which for DCP-6315 consists of 38 millisecond bursts of dat space 84 seconds apart. Statistical treatment is therefore necessary to derive extreme range.

Tables 1 thru 5 were prepared corresponding to Zones 1 thru 5 in Figure 0.

A comparison of the ranges demonstrated in the first and last tables (1 and 5) is shown in Figure 37. The solid line shows the ranges and elevation angles at which DCP messages were received when the USB power was 0.19 watts. The crosses at the lower end of this curve shows the additional ranges that were achieved when the power output was 0.26 watts.

Figure 38 shows the range at which the extreme (most remote from ENT) message was received for each of the 5 zones in Figure 0. Comparing Zone 1 to Zone 2, it can be seen that the drop from 0.260 to 0.255 watts caused no significant range-shift of the extreme messages. In Zone 3 as the power continued to drop, the range-shift becomes significantly reduced. It can be seen that after the power dropped to 0.192 watts (Zones 4 and 5) there was a large range-shift to shorter distances.

(con't. on p. 52)

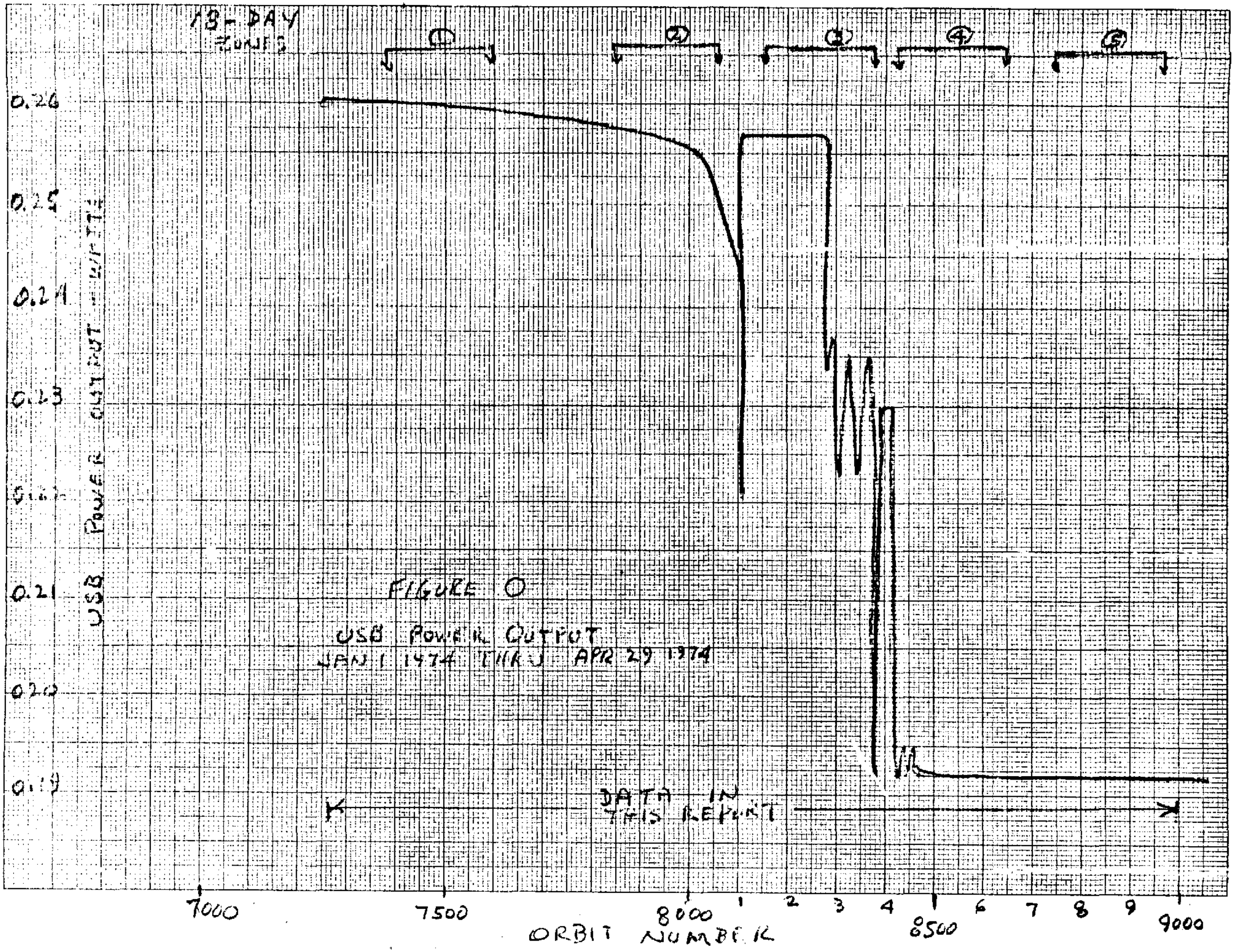
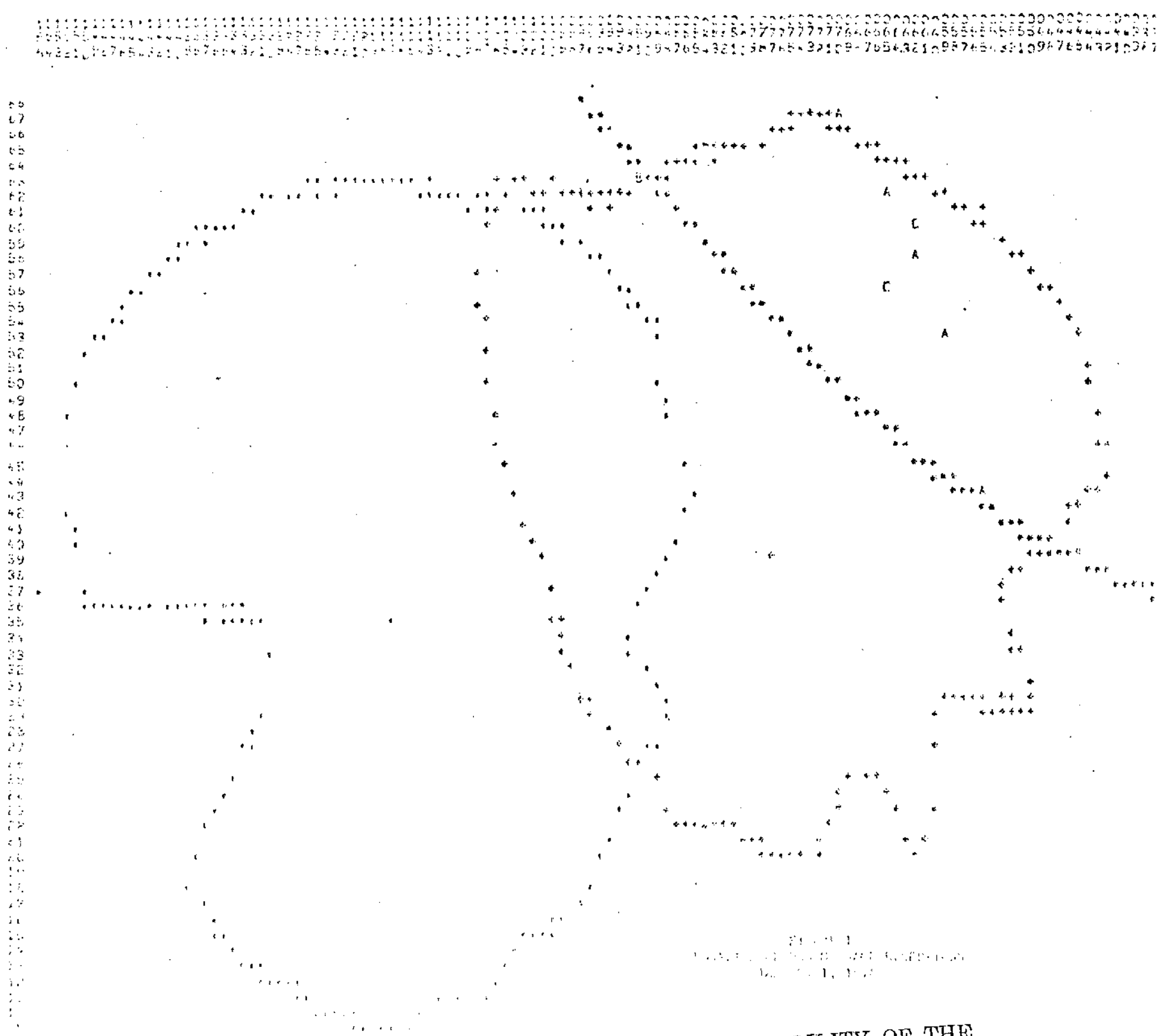


FIGURE O
USB POWER OUTPUT
JAN 1 1974 THRU APR 29 1974

[illegible]	UNIT	NODE TIME DDD HHMM SS	NODE LONG	PASS
[illegible]	1.6	001 0126 27	123.84	A
[illegible]	1.6	001 0126 27	123.84	A
[illegible]	1.6	001 0126 27	123.84	A
[illegible]	1.6	001 0126 27	123.84	A
[illegible]	1.6	001 0126 27	123.84	A
[illegible]	1.7	001 0307 43	58.02	B
[illegible]	2.4	001 1516 34	-62.70	C
[illegible]	2.4	001 1516 34	-62.70	C
[illegible]	2.5	001 1659 52	-108.51	D

DAY=001 MSG= 9 TOTAL= 18

WEST LONGITUDE



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	MSG TIME DDD HHMM SS	NODE LOSS	FLAG
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.3	2.0	002 013- 10	122.40	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	002 013- 10	122.40	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.7	[illegible]	002 013- 10	122.40	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	002 013- 10	[illegible]	A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17.1	[illegible]	002 1514 17	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	002 1514 17	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.9	[illegible]	002 1514 17	[illegible]	B

DAY=002 MSG= 7 TOTAL= 26

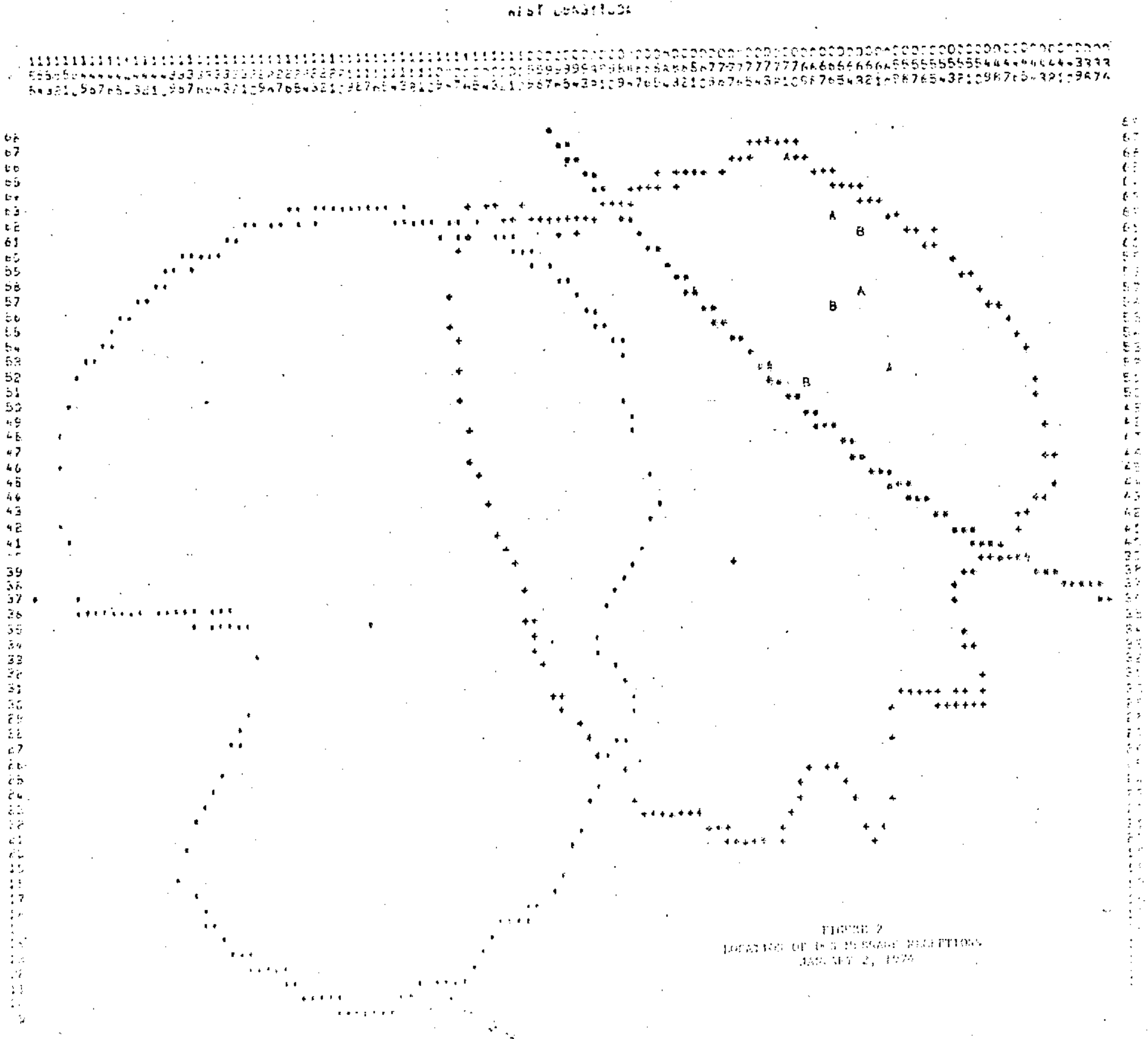


FIGURE 2
LOCATION OF D-S MESSAGE REJECTIONS
JANUARY 2, 197[illegible]

											ORBIT	GGG HHMM SS	LONG	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 0196 52	120.97	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 0196 52	120.97	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 0196 52	120.97	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 0196 52	120.97	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 1524 56	65.56	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 1524 56	65.56	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	003 1524 56	65.56	B

DAY=003 MSG= 7 TOTAL= [illegible]

WEST LONGITUDE

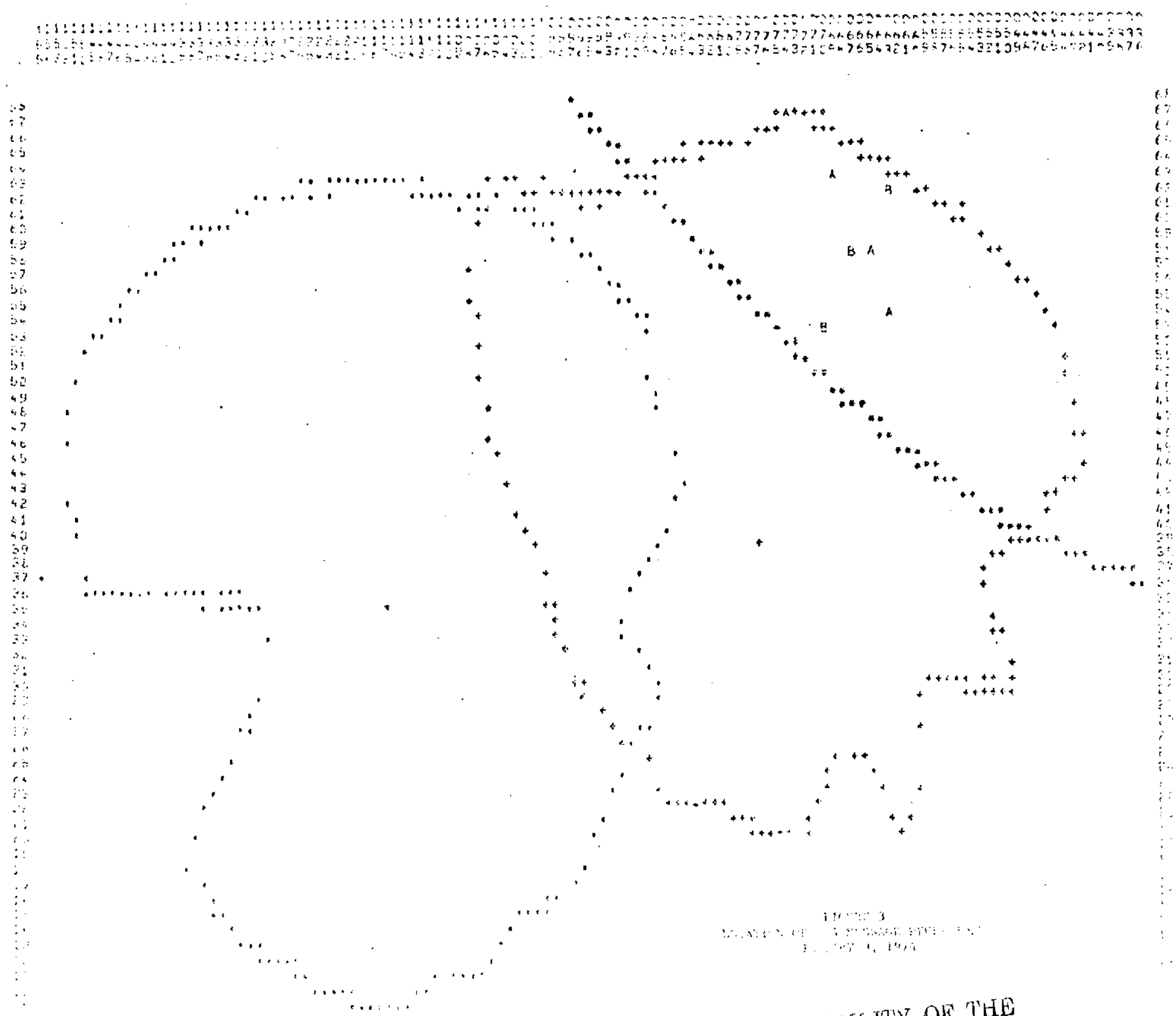


FIGURE 3

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] DDD HHMM SS	[illegible] LONG	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	004 0144 31	119.54	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	255	004 0144 33	119.54	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245	004 1344 25	-61.17	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245	004 1344 25	-61.17	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245	004 1344 25	-61.17	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	246	004 1527 41	-55.99	C

DAY=004 [illegible]SS= 6 TOTAL= [illegible]

WEST LONGITUDE

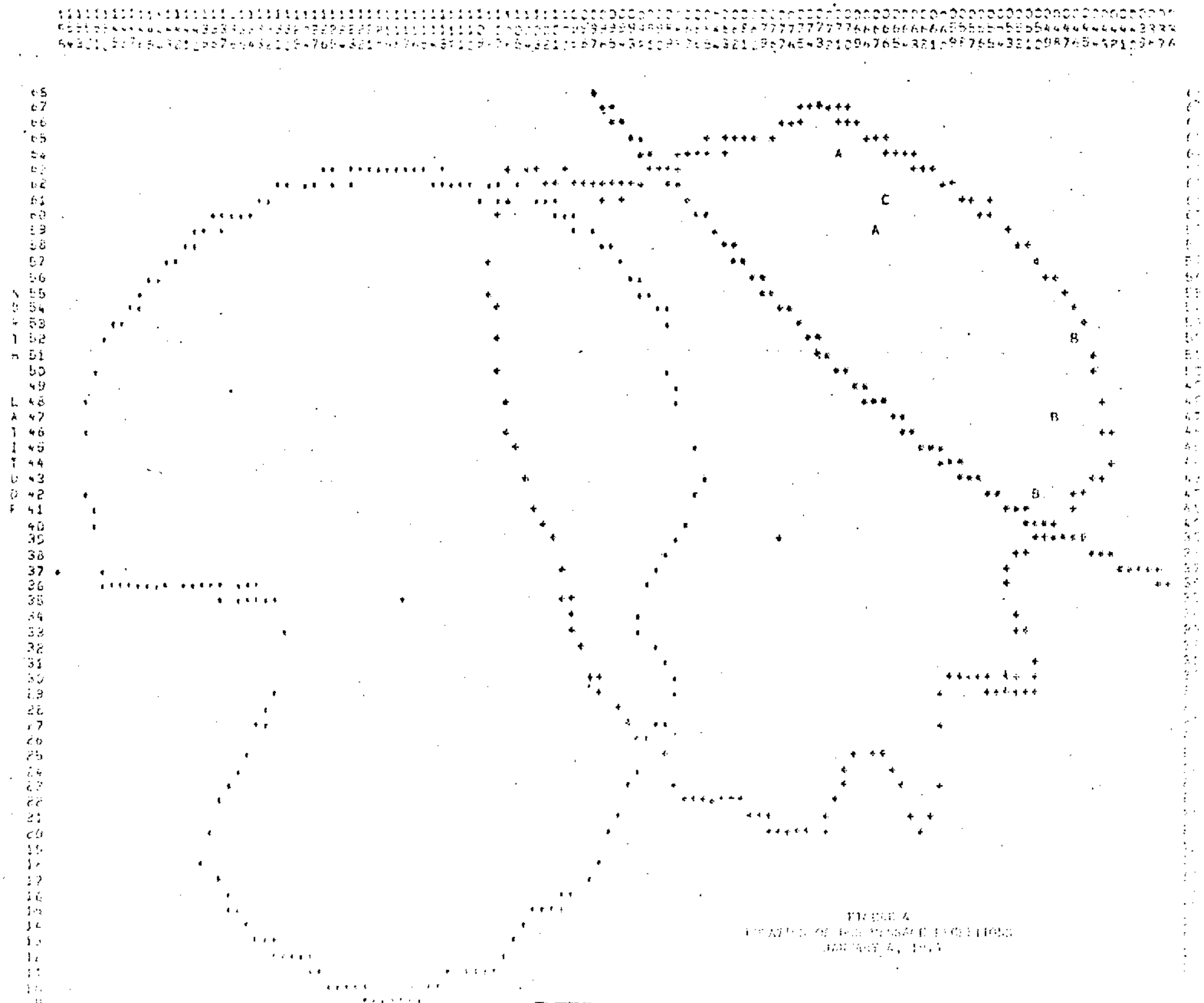


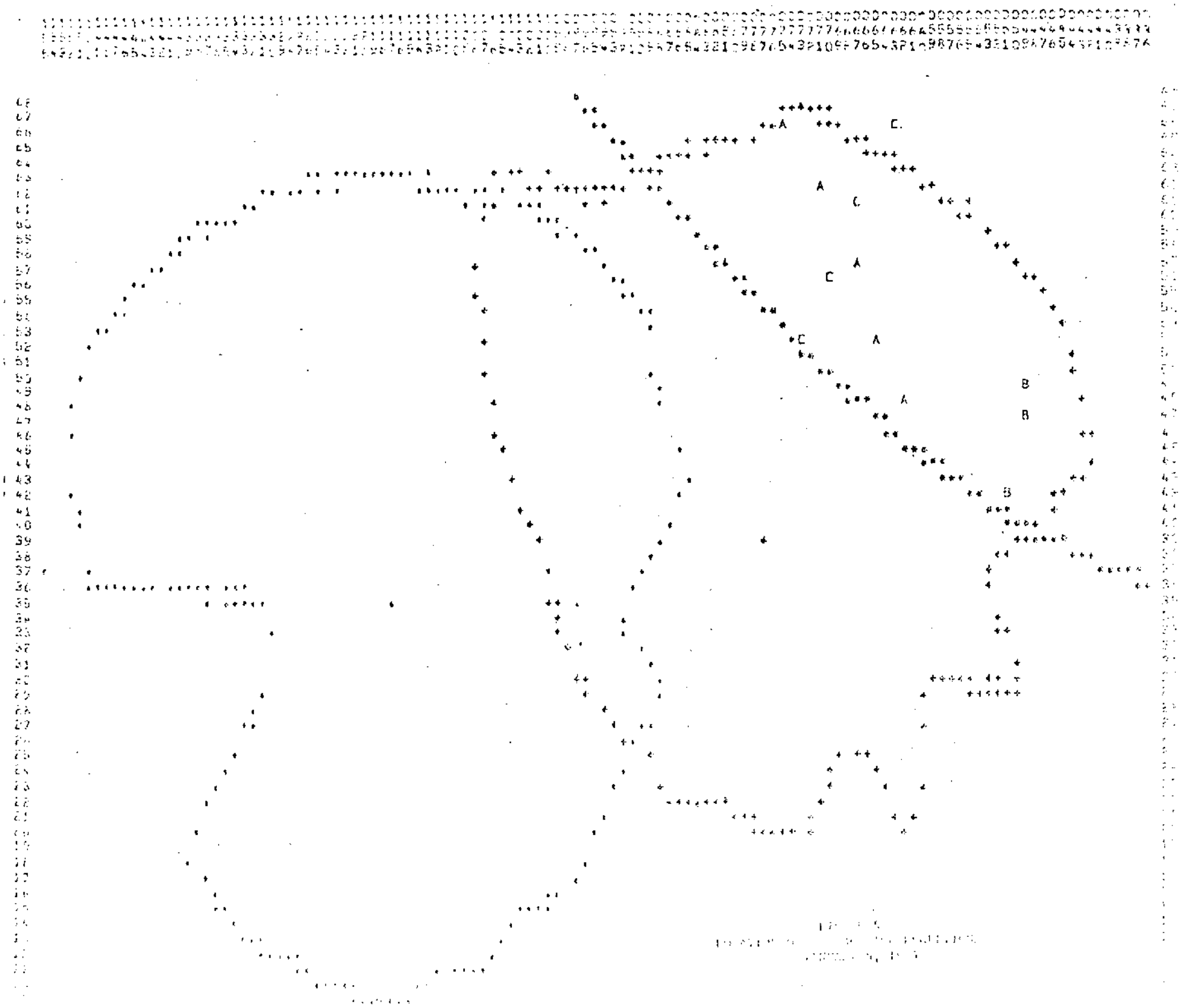
FIGURE 4

[illegible]

	ORBIT	TIME	LONG	PLOT
[illegible]	1	005 0147 16	115.1[illegible]	A
[illegible]	1	005 0147 16	115.1[illegible]	A
[illegible]	1	[illegible] 0147 16	115.1[illegible]	A
[illegible]	1	005 0147 16	115.1[illegible]	A
[illegible]	1	005 0147 16	115.1[illegible]	A
[illegible]	6	005 1356 07	62.6[illegible]	B
[illegible]	6	005 1356 07	62.6[illegible]	B
[illegible]	6	005 1356 07	62.6[illegible]	B
[illegible]	9	005 1632 23	15.42	C
[illegible]	9	005 1632 23	15.42	C
[illegible]	9	005 1632 23	15.42	C
[illegible]	9	005 1632 23	15.42	C

DAY=005 MSG= 12 TOTAL= 5[illegible]

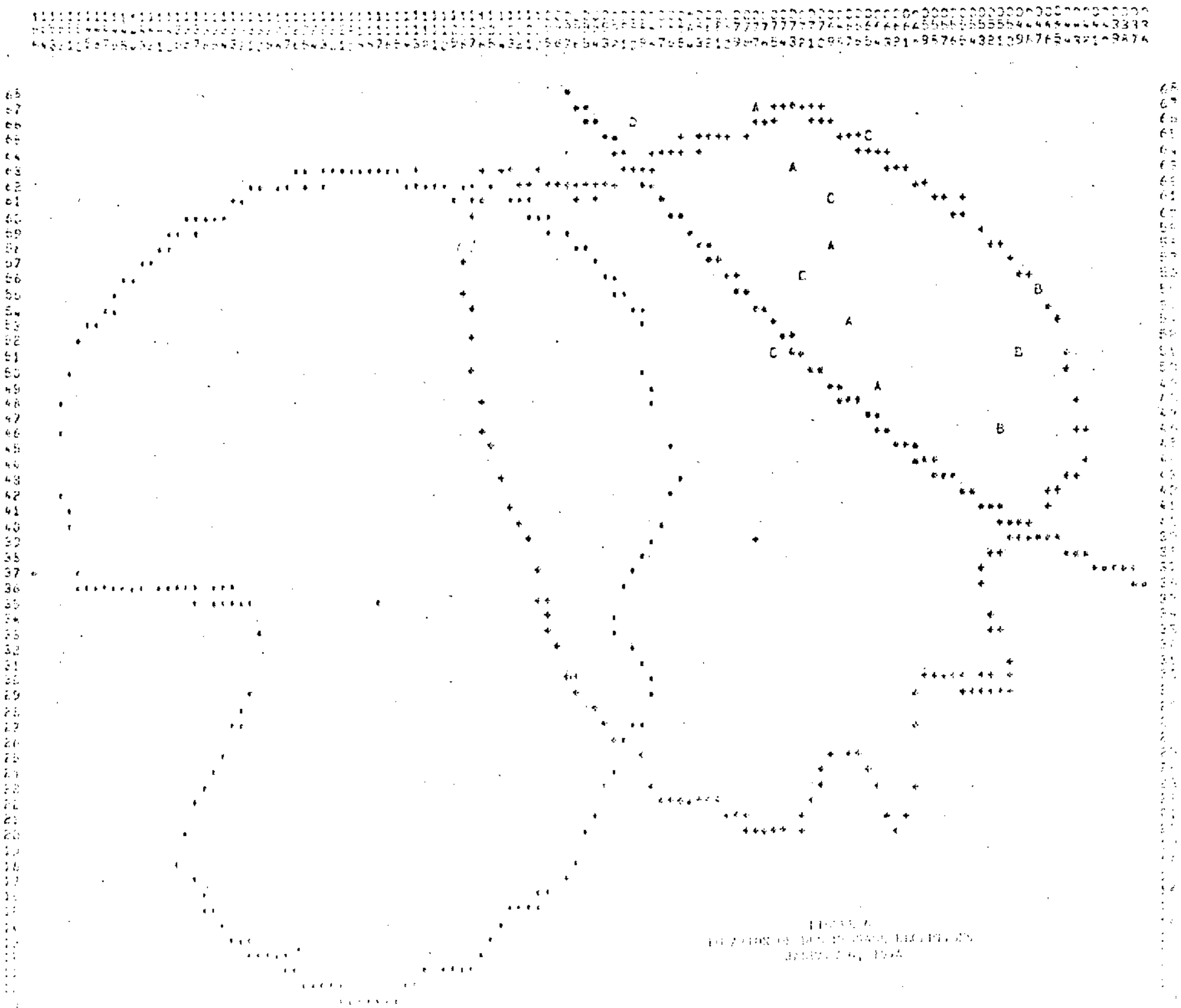
WEST LONGITUDE



[illegible]	13	[illegible]	116*65 A
[illegible]	15	[illegible]	116*66 A
[illegible]	15	[illegible]	116*66 A
[illegible]	15	[illegible]	116*65 A
[illegible]	[illegible]	[illegible]	116*66 A
[illegible]	22	226 1356 49	*64*23 B
[illegible]	22	226 1356 49	*64*23 B
[illegible]	22	226 1356 49	*64*23 B
[illegible]	23	226 1530 05	*69*65 C
[illegible]	23	226 1530 05	*69*65 C
[illegible]	23	226 1530 05	*69*65 C
[illegible]	23	226 1530 05	*69*65 C
[illegible]	24	226 1722 21	*115*67 D

DAY=226 MSG= 13 TOTAL= 63

WEST LONGITUDE



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ORIGINAL PAGE IS POOR

										REF	NSDL TIME	NSDL LONG	
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1441	[illegible]	027 [illegible] 41	115.26	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	027 [illegible] 41	115.26	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	027 0152 41	115.26	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4241	36	027 1404 32	65.47	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5146	[illegible]	027 1404 32	65.47	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6442	36	027 1404 32	65.47	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	447	37	027 1546 46	91.28	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	027 1546 46	91.28	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	027 1546 46	91.28	C

DAY=0[illegible]7 MSG= 10 TOTAL= [illegible]

WEST LONGITUDE

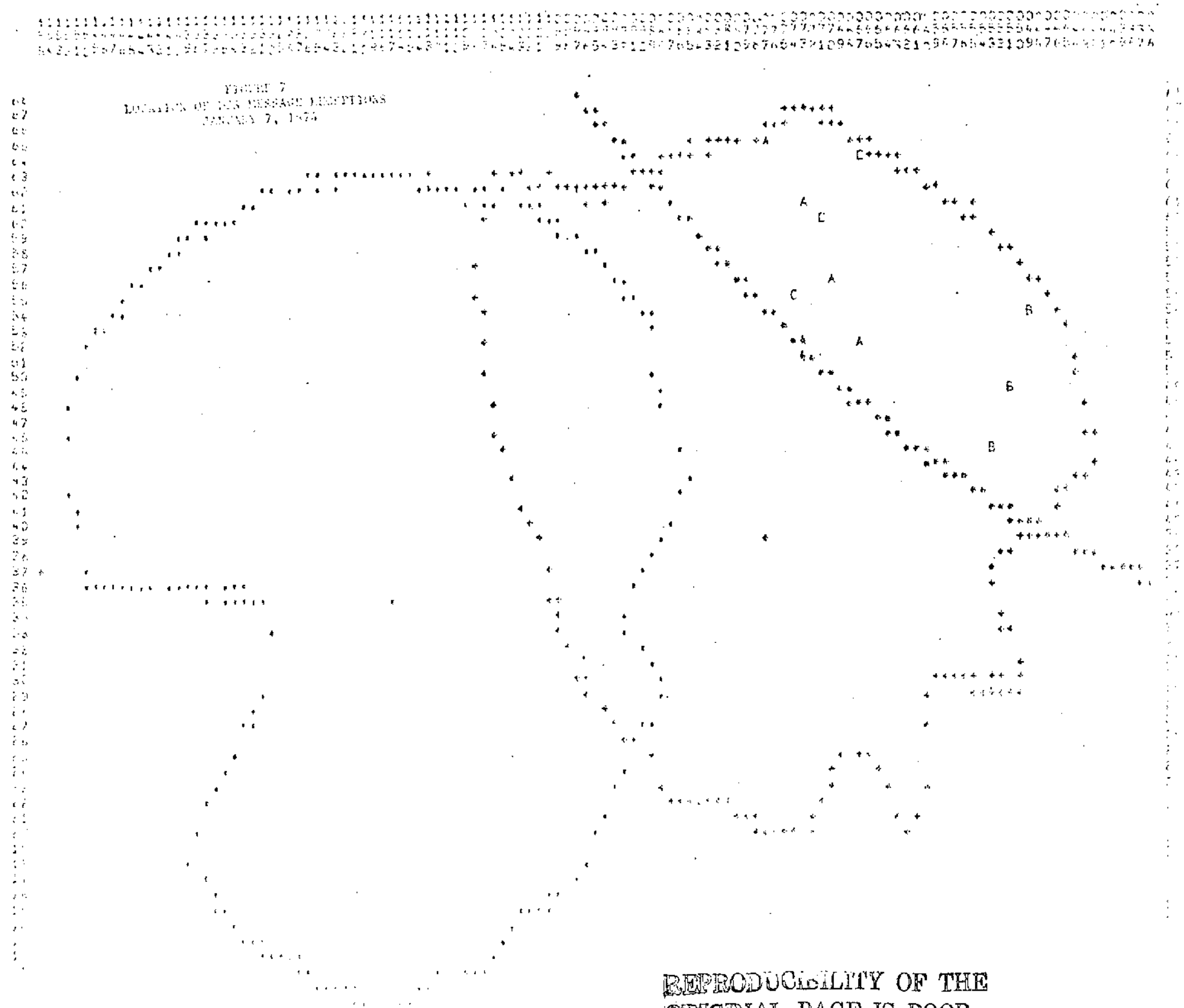


FIGURE 7
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 7, 1974

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C

DAY=008 MSG= 11 TOTAL= 84

WEST LONGITUDE

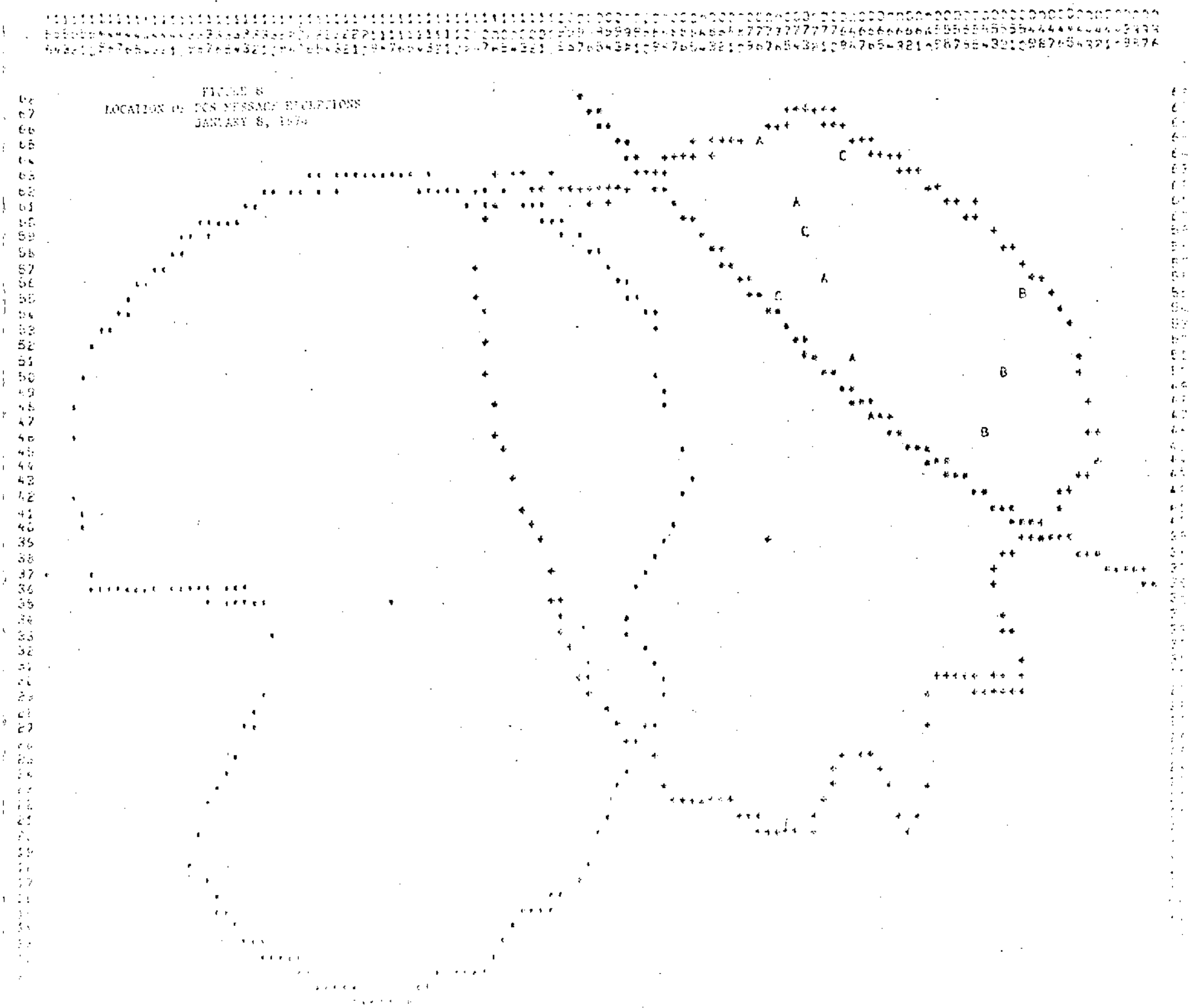


FIGURE 8
LOCATION OF DCS MESSAGE EXCEPTIONS
JANUARY 8, 1974

[illegible]	2.9	47	009 0216 26	112.39	A
[illegible]	1.7	47	009 0216 26	112.39	A
[illegible]	[illegible]	47	009 0216 26	112.39	A
[illegible]	3.7	44	009 1412 57	65.33	B
[illegible]	4.2	44	009 1412 57	65.33	B
[illegible]	5.5	44	009 1412 57	65.33	B
[illegible]	2.7	45	009 1554 13	94.16	C
[illegible]	[illegible]	45	009 1554 13	94.16	C
[illegible]	[illegible]	45	009 1554 13	94.16	C

DAY=009 MSG= 9 TOTAL= 83

WEST LONGITUDE

FIGURE 9
LOCATION OF EVS MESSAGE RECEPTIONS
JANUARY 9, 1974

MSG TIME	ALT (FEET)	LAT (DEG)	LONG (DEG)	SC ORBIT	[illegible]	SRANGE (KM)	[illegible]	ELEV (DEG)	AZIMUTH (DEG)	REF ORBIT	NODE TIME DDD HHMM SS	NODE LONG	PLOT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.2	[illegible]	71	010 0216 46	110.96	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2179.	[illegible]	1.7	[illegible]	71	010 0216 46	110.96	A
[illegible]	[illegible]	[illegible]	[illegible]	7472	[illegible]	[illegible]	[illegible]	6.7	37.2	75	010 1418 39	-69.76	B
[illegible]	[illegible]	[illegible]	[illegible]	7472	[illegible]	[illegible]	[illegible]	11.9	[illegible]	75	010 1418 39	-69.76	B
[illegible]	[illegible]	[illegible]	[illegible]	7472	[illegible]	[illegible]	[illegible]	17.2	[illegible]	75	010 1418 39	-69.76	B
[illegible]	[illegible]	[illegible]	[illegible]	7473	[illegible]	[illegible]	[illegible]	[illegible]	5.5	79	010 1601 55	-55.56	C

DAY=010 MSG= 6 TOTAL= 99

WEST LONGITUDE

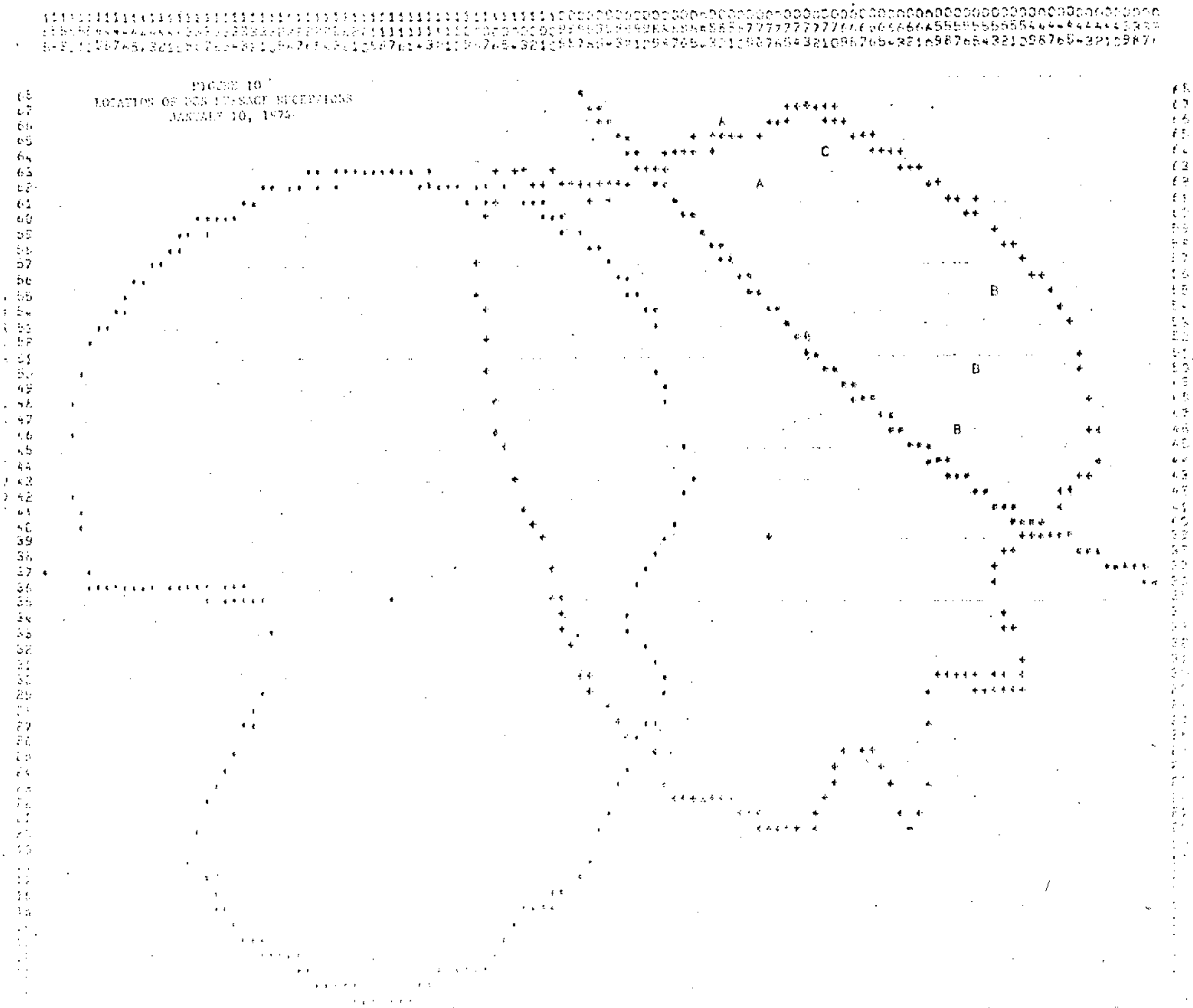


FIGURE 10
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 10, 1974

									AZIMUTH		NODE TIME	NODE	PLT
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.9	1?.1	65	011 022. 30	109.52	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65	011 022. 30	109.52	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65	011 022. 30	109.52	A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57.6	62	011 142. 22	71.25	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57.6	62	011 142. 22	71.25	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47.1	62	011 142. 22	71.25	B

DAY=011 MSG= 6 TOTAL= [illegible]

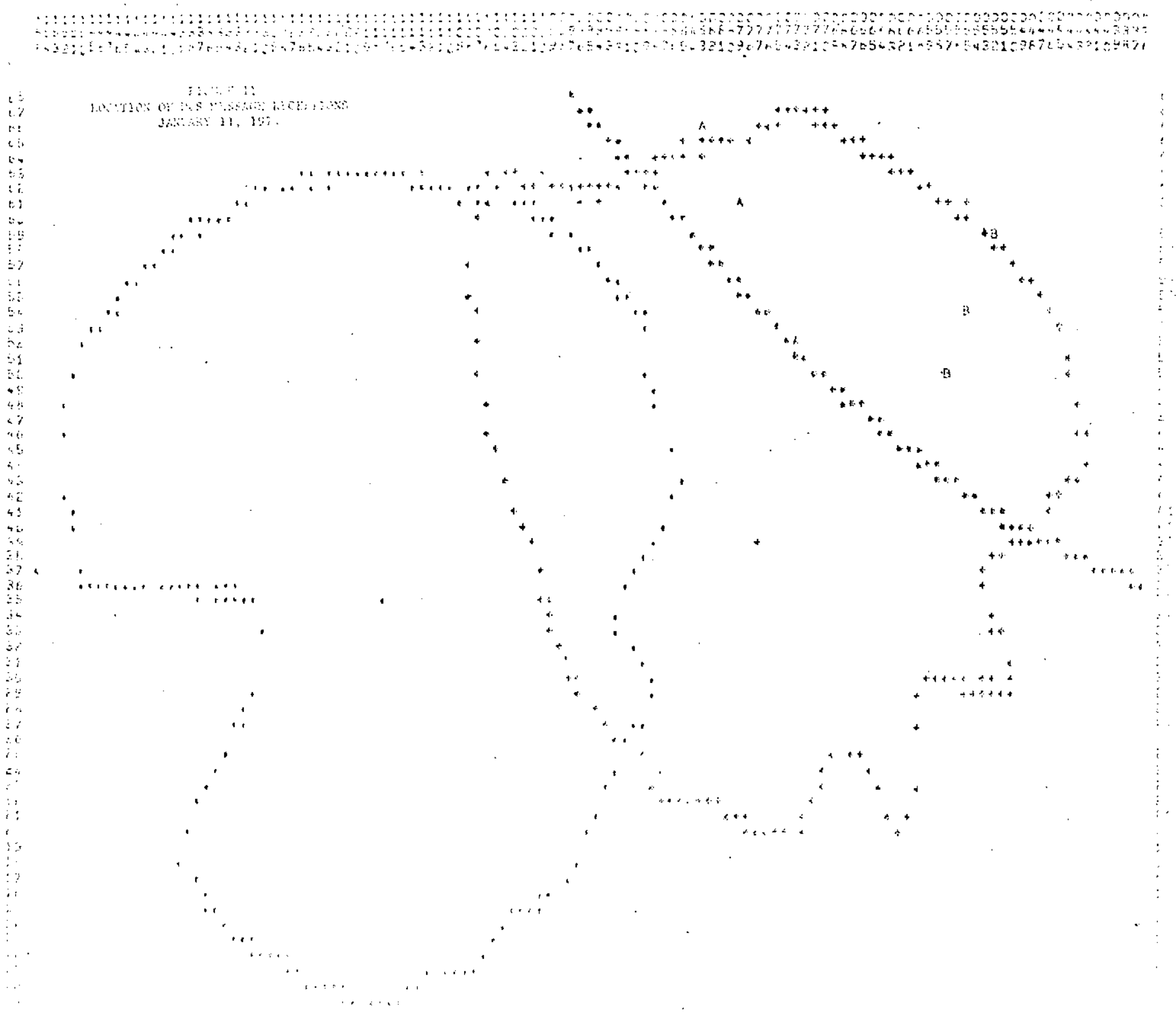


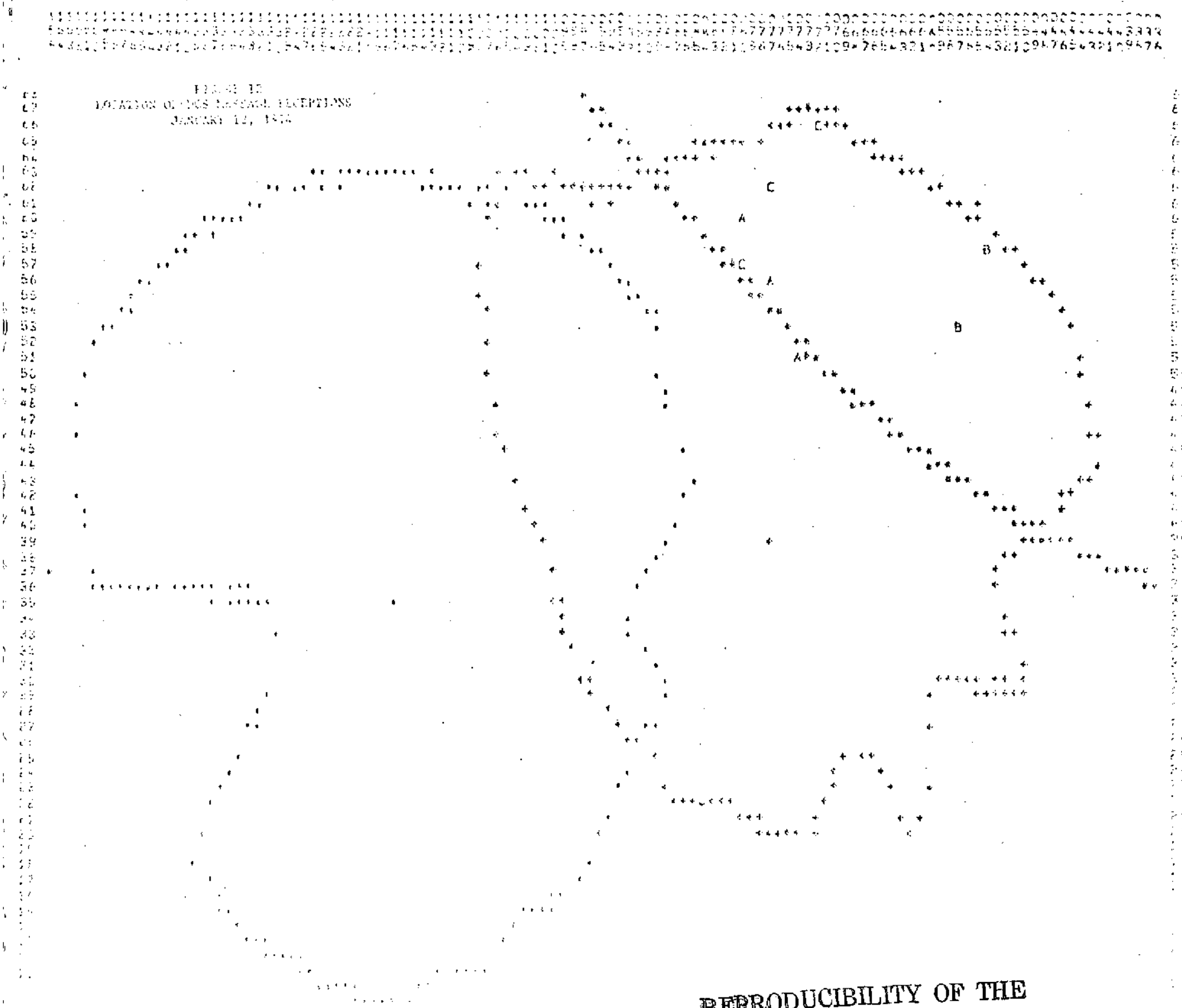
FIGURE 11
LOCATION OF ... MESSAGE RECEPTIONS
JANUARY 11, 197.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 0227 13	106.09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 0227 13	106.09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 0227 13	106.09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 0227 13	106.09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 1434 04	-72.63	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 1434 04	-72.63	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 1613 20	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 1613 20	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	012 1613 20	[illegible]	C

DAY=012 MSG= 9 TOTAL= 114

WEST LONGITUDE

FIGURE 12
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 12, 1976



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	ORBIT	NODE TIME DDD HHMM SS	NODE LONG	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	113	013 0232 55	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	113	013 0232 55	106+66	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	113	013 0232 55	106+66	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120	013 1435 46	+74+06	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120	013 1435 46	+74+06	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120	013 1435 46	+74+06	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	121	013 1619 02	+03+86	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	121	013 1619 02	+03+86	C

DAY=013 MSG= 8 TOTAL= 122

WEST LONGITUDE

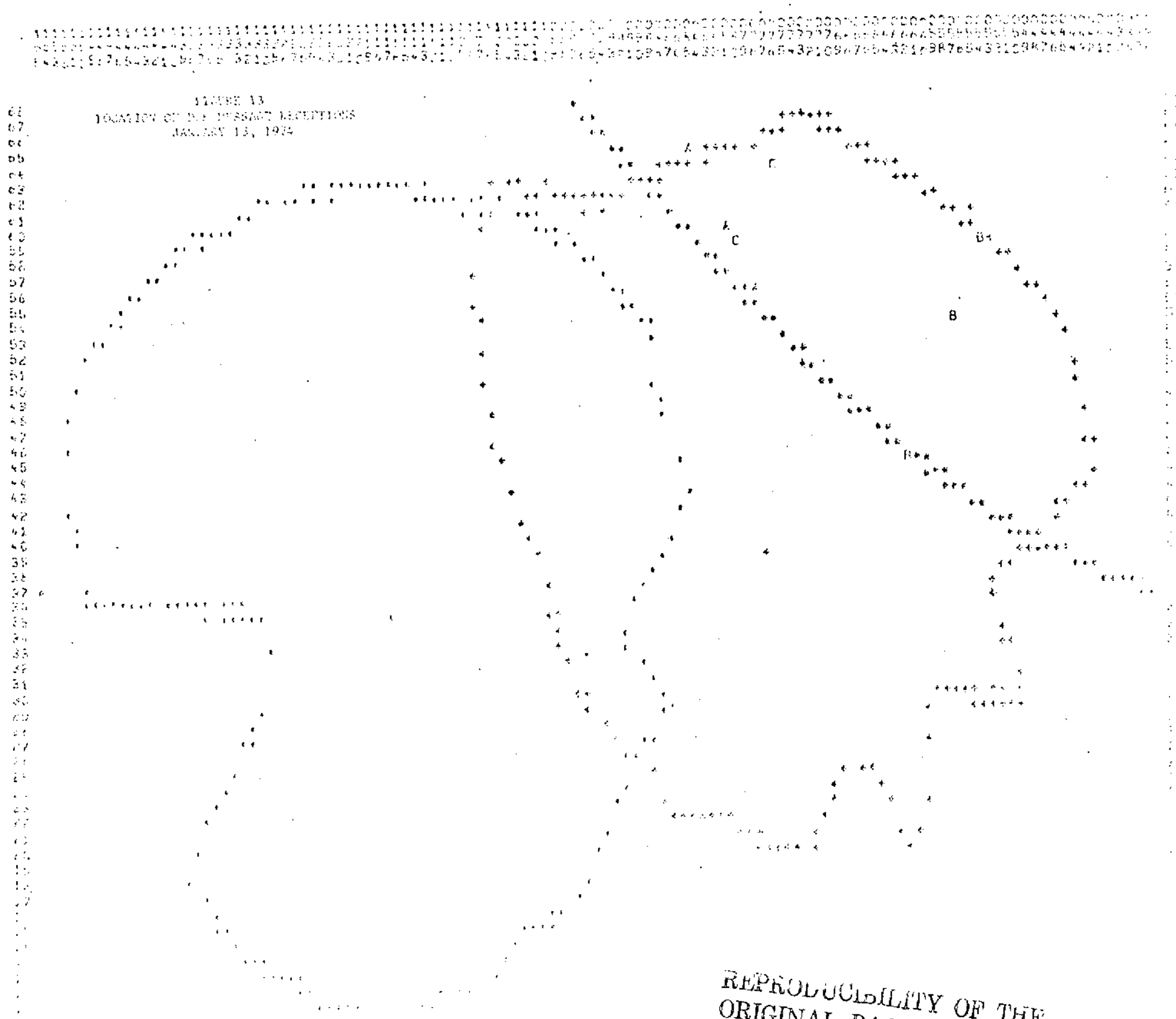


FIGURE 13
LOCATION OF ... MESSAGE RECEPTIONS
JANUARY 13, 1974

[illegible]	142	015 0101 04	1?3.61	A
[illegible]	142	015 0101 04	1?3.61	A
[illegible]	142	015 0101 04	1?3.61	A
[illegible]	142	015 0101 04	174.61	A
1.2	142	015 0101 04	123.61	A
[illegible]	141	015 0744 20	103.79	B
[illegible]	141	015 0744 20	103.79	B
2..	145	015 1447 11	-76.92	C
[illegible]	148	015 1634 27	-102.76	D

DAY.015 MSG. 9 TOTAL. 1??

WEST LONGITUDE

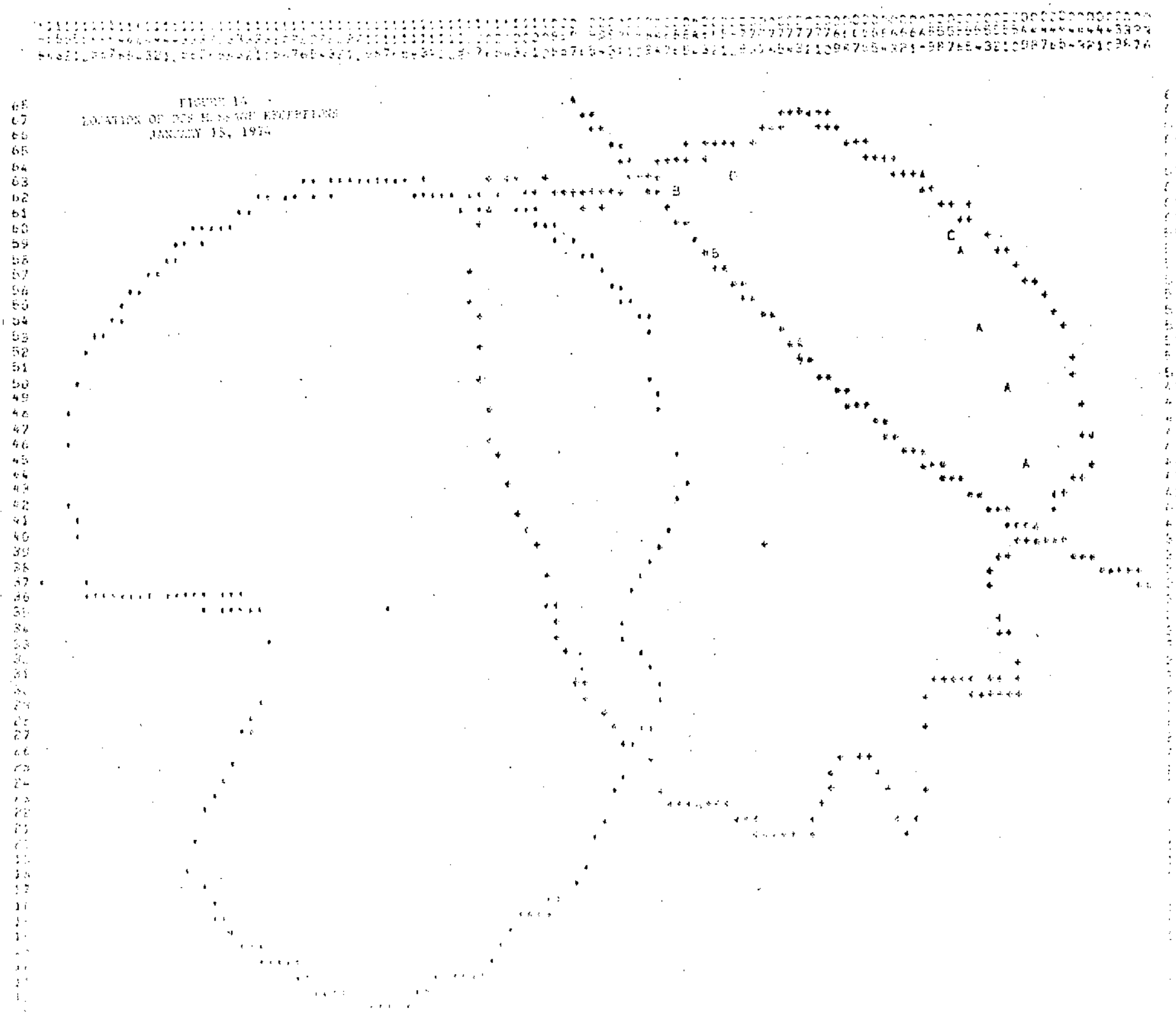


FIGURE 15
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 15, 1975

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AZIMUTH	RET	NODE TIME	NODE LONG	PLOT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1-4	016 0106 46	175.16	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1-4	016 0106 46	175.15	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1-4	016 0106 46	175.19	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.7	[illegible]	1-4	016 0106 46	175.18	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.7	22.4	1-2	016 1452 51	-78.35	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1-2	016 1452 51	-78.35	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.2	[illegible]	1-3	016 1636 27	-104.17	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1-3	016 1636 27	-114.17	C

DAY=016 MSG= 8 TOTAL= 139

WEST LONGITUDE

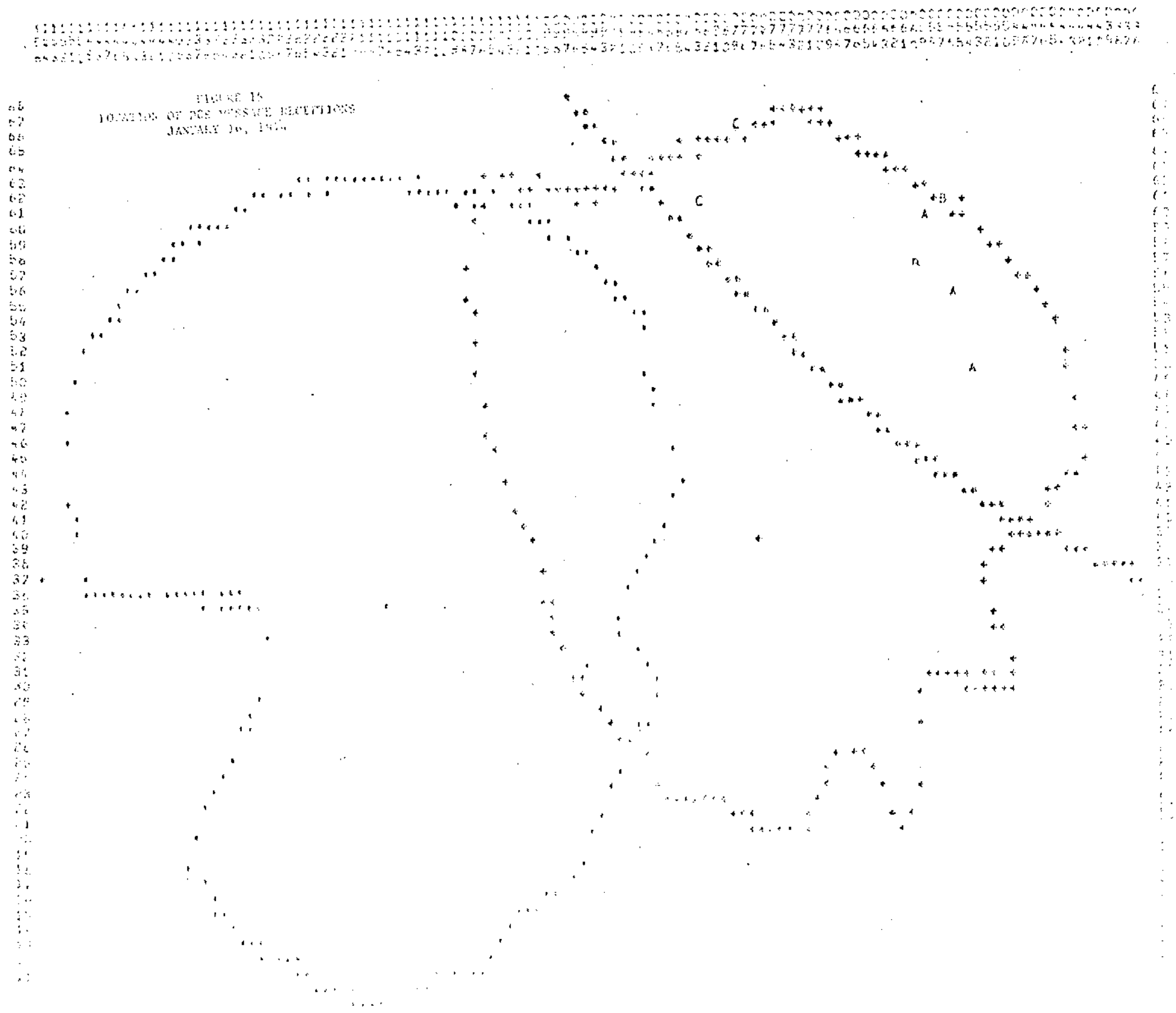


FIGURE 15
LOCATION OF DRS MESSAGE RECEPTIONS
JANUARY 16, 1976

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AZIMUTH	[illegible]	NOMT TIME	NOMI LONG	FLT
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.5	1.5	017 0112 26	126.75	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.5	1.5	017 0112 26	126.75	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	39.6	1.5	017 0112 26	126.75	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.1	1.5	017 0112 26	126.75	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17.1	1.5	017 0112 26	126.75	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.0	1.6	017 0112 26	126.75	A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-12.6	1.7	017 0256 42	100.94	B
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.7	176	017 1456 33	-79.78	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20.5	176	017 1456 33	-79.78	C
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-3.1	177	017 1644 49	-105.60	D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-9.5	177	017 1644 49	-105.60	D

DAY=017 MSG= 11 TOTAL= 150

WEST LONGITUDE

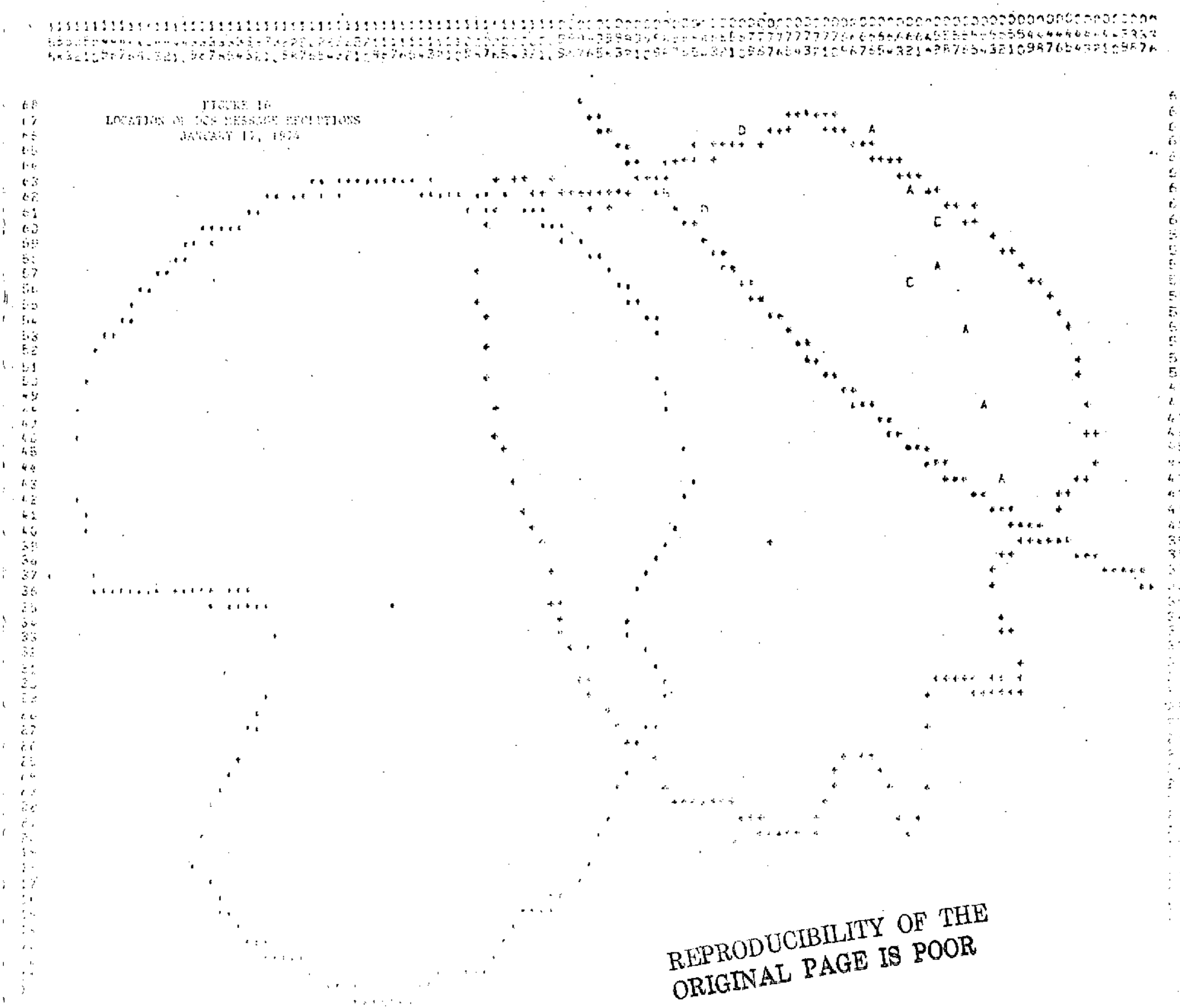


FIGURE 16
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 17, 1974

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 26	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 26	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 26	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 26	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 26	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 24	99.5[illegible]	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 15	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 15	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 31	-107.[illegible]	D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	018 [illegible] 31	-107.[illegible]	D

DAY.018 [illegible] 10 TOTAL= 1[illegible]

WEST LONGITUDE

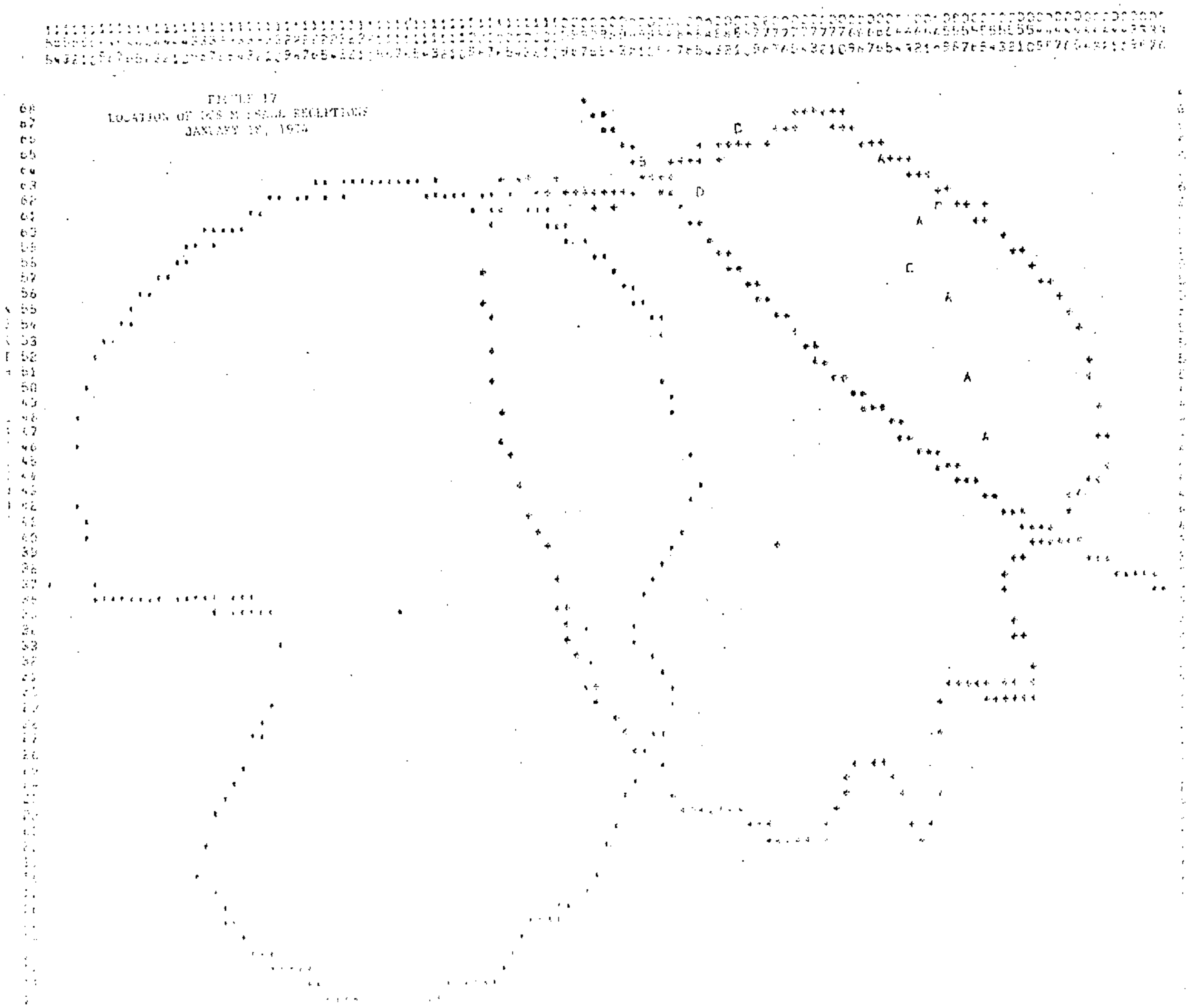


FIGURE 17
LOCATION OF DCS M [illegible] RECEPTIONS
JANUARY 18, 1974

										REF ORBIT	GMT TIME (DDD HHMM SS)	NODE LONG	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61.3	196	019 0129 51	123.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	019 0129 51	123.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	019 0129 51	123.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	196	019 0129 51	123.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	196	019 0129 51	123.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	197	019 0307 06	98.07	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19.2	[illegible]	019 1509 55	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	019 1509 56	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	019 1509 58	[illegible]	C

DAY=019 PAGE 9 TOTAL= 149

WEST LONGITUDE

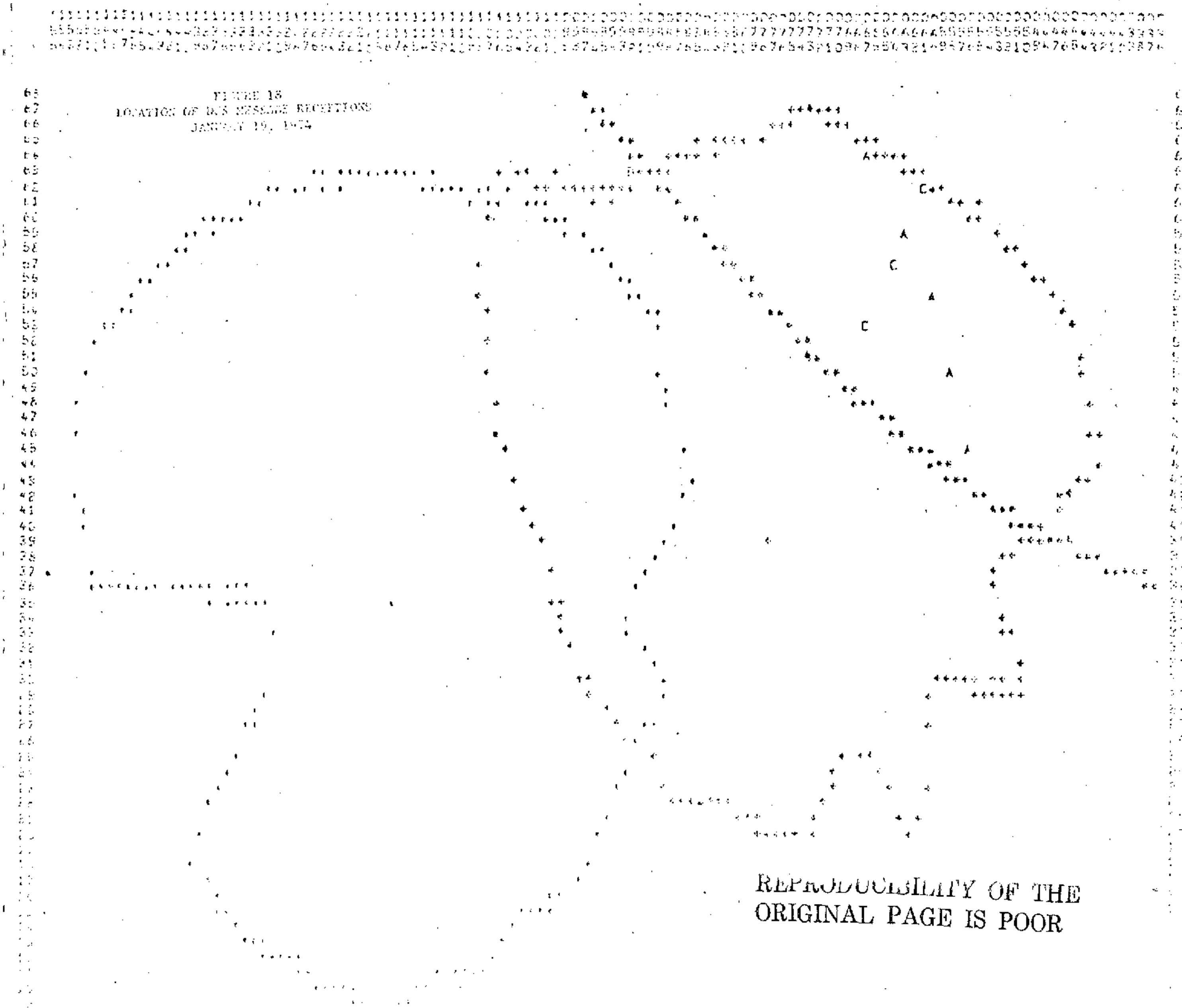
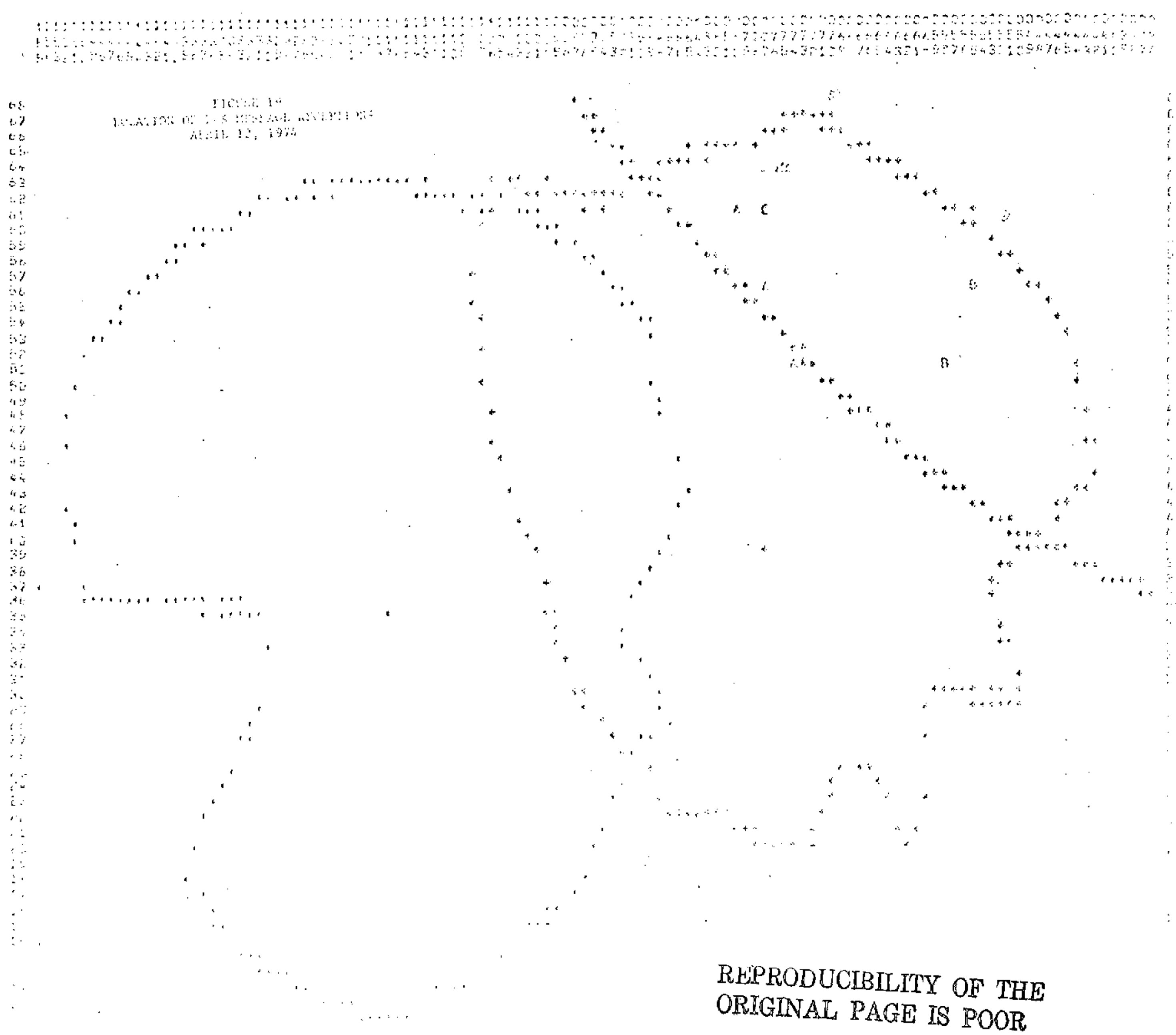


FIGURE 18
LOCATION OF DCS MESSAGE RECEPTIONS
JANUARY 19, 1974

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 0026 09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 0026 09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 0026 09	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 1426 00	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 1426 00	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102 1611 16	C

DAY=102 [illegible] 6 TOTAL= [illegible]



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	LAT [illegible]	LONG [illegible]	[illegible]	[illegible]	SRANGE [illegible]	VISIBLE [illegible]	ELEV [illegible]	AZIMUTH [illegible]	REF ORBIT	NODE TIME DDD HHMM SS	NODE LONG	PART
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]3	123 0234 51	105.62	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]3	123 0234 51	105.62	A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120	123 1435 43	-74.10	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37.7	120	123 1435 43	-74.10	B
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	121	123 1616 59	-98.99	C

DAY=123 ... 5 TOTAL= [illegible]

WEST LONGITUDE

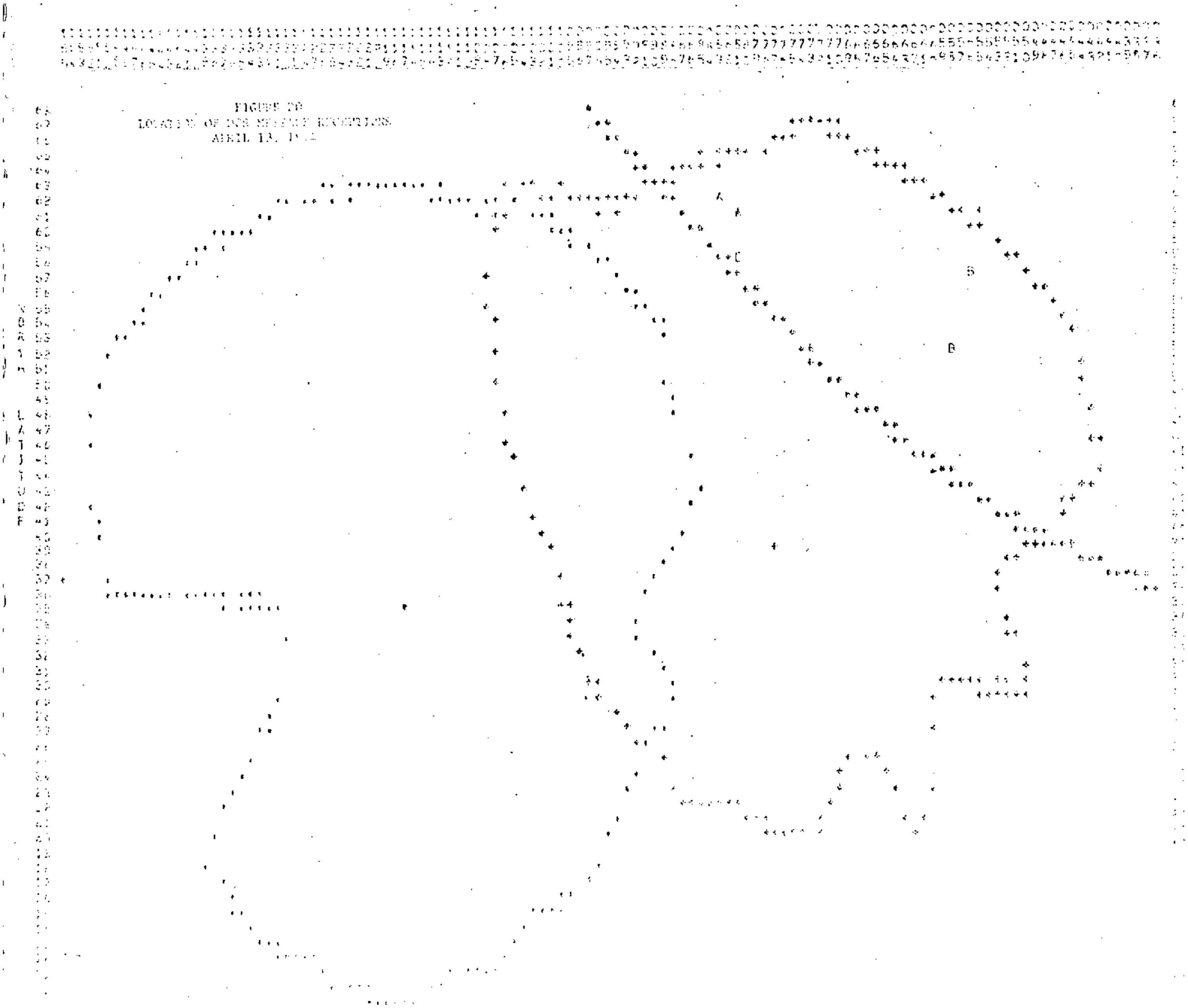


FIGURE 28
LOCATION OF [illegible]
APRIL 13, 19[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FLT DAY	[illegible]	[illegible]	[illegible]	AZIMUTH	[illegible]	[illegible]	NDPF LONG	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	127	104 [illegible] 34	105.15	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	127	104 [illegible] 34	105.1[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	134	104 [illegible] 26	-75.53	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	134	104 [illegible] 26	-75.53	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	134	104 [illegible] 26	-75.53	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	135	104 [illegible]	-101.36	C

DAY=104 [illegible] 6 TOTAL [illegible]

WEST LONGITUDE

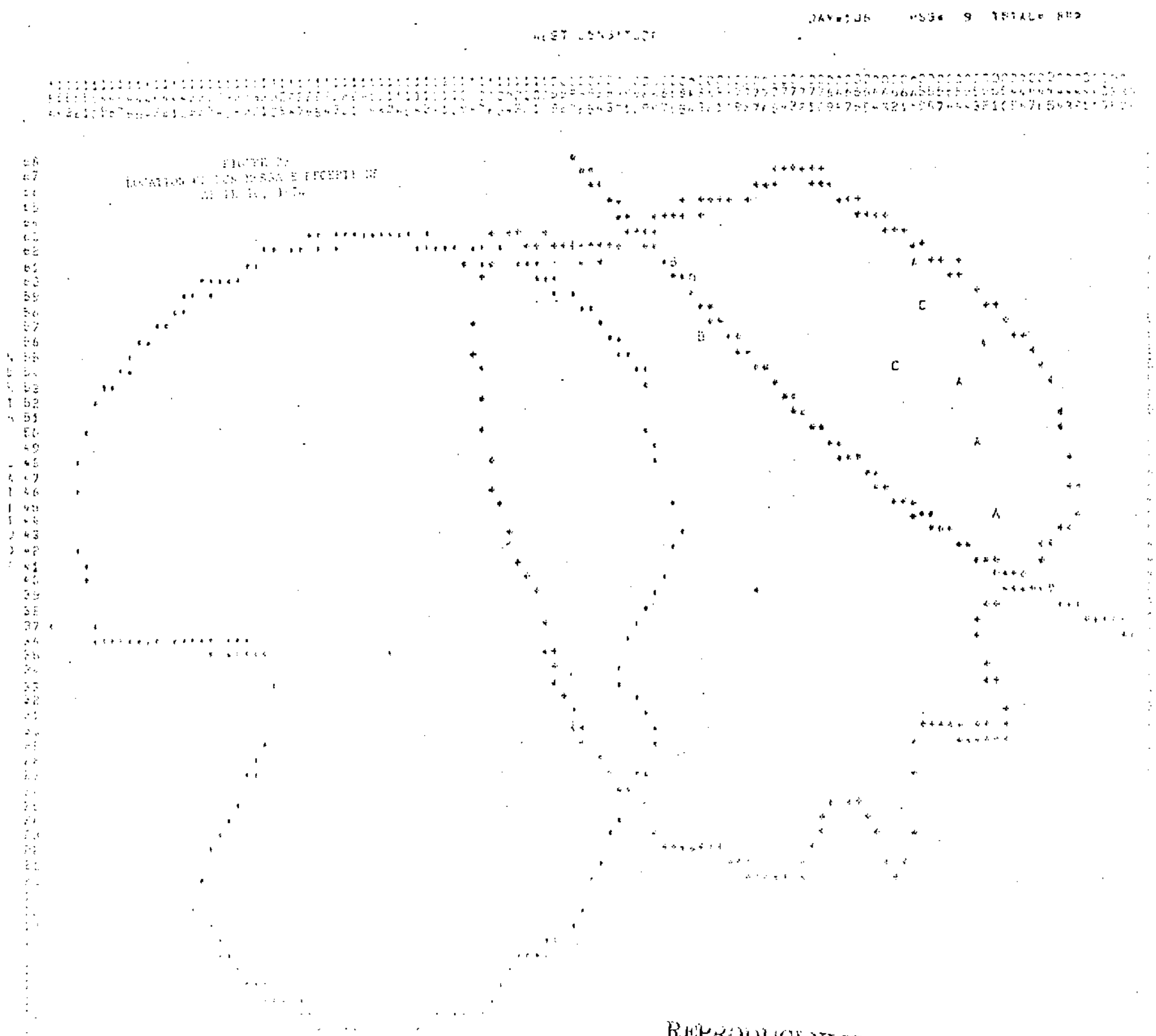
FIGURE [illegible]
LOCATION OF [illegible] RECEPTIONS
APRIL 14, 197[illegible]

												LONG	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	105 0064 21	129.56	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	123.76	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	105 0242 17	123.76	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76.97	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76.97	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76.97	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102.79	D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	102.79	D

DAY=105 [illegible] 11 TOTAL= [illegible]

WEST LONGITUDE

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126 09.. 00	102.31	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126 09.. 00	102.31	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126 16.. 51	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126 16.. 51	[illegible]	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126 163. 07	[illegible]	D



[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219..	[illegible]	6..1	1.8	107 011. 27	126.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	107 [illegible] 27	126.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2...	[illegible]	107 011. 27	126.69	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17.1.	219...	.3	2...	1.8	107 011. 27	126.69	A
27 [illegible]		[illegible]	[illegible]	.18	[illegible]	[illegible]	219...	..2	.17..	1.9	107 0... .3	122.69	B
27 [illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219...	[illegible]	21..	176	107 1... 3.	.79.6.	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219...	[illegible]	2...	176	107 1... 3.	.79.6.	C
27 [illegible]	[illegible]	.7.11	.66.37	[illegible]	[illegible]	[illegible]	219...	[illegible]	3...	176	107 1... 3.	.79.6.	C

DAY 107 MSG 6 TOTAL 660

WEST LONGITUDE

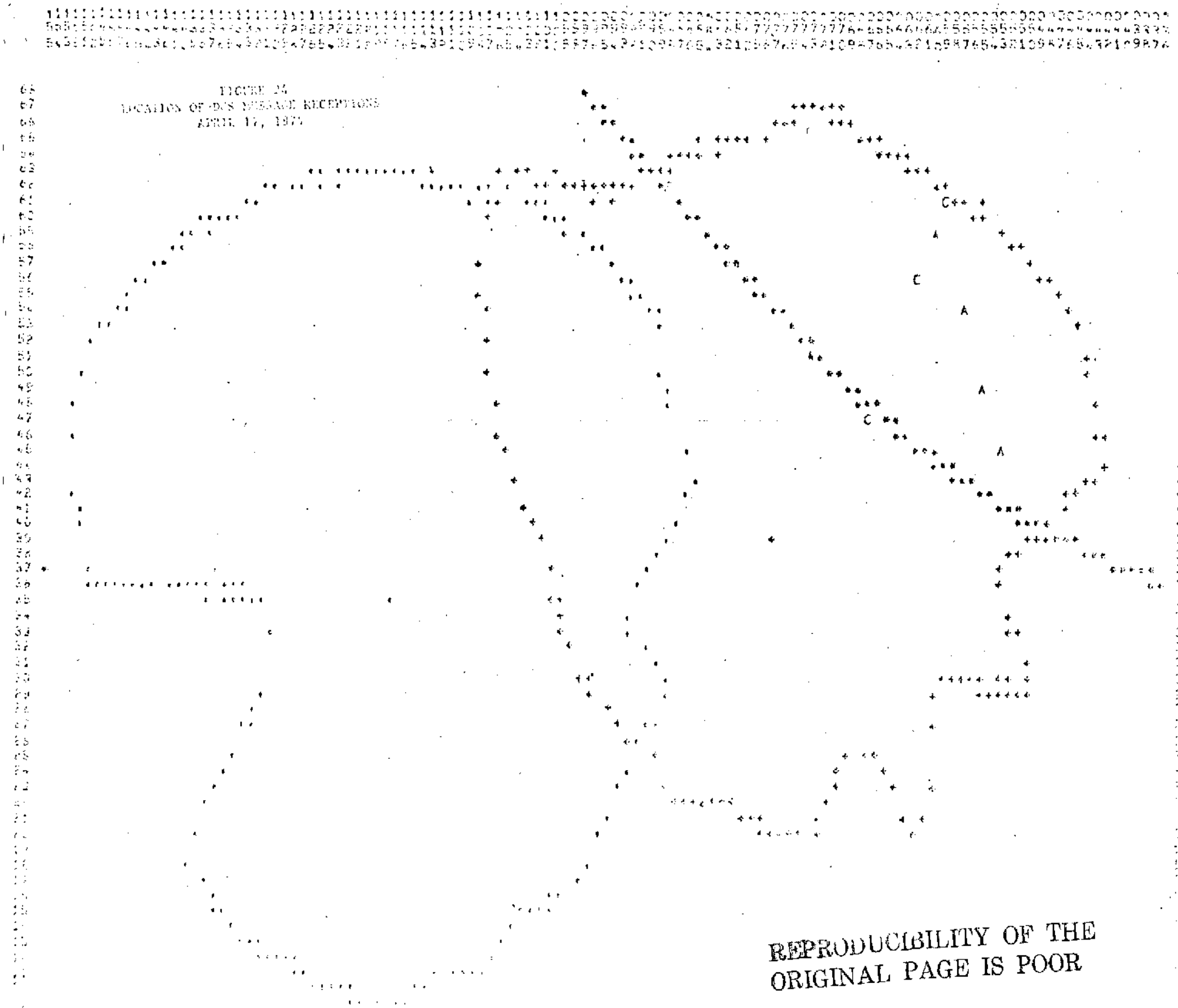


FIGURE 24
LOCATION OF D/S MESSAGE RECEPTIONS
APRIL 17, 1975

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(DO HHMM SS)	LONG	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.3	[illegible]	1.2	108 0114 09	125.26	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	108 0114 09	125.26	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	108 0114 09	125.26	A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.3	108 0259 25	93.44	B
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	108 1502 16	61.27	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	108 1502 16	61.27	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	108 1502 16	61.27	C
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.3	[illegible]	1.1	108 1646 33	127.09	D

DAY 108 MSG 8 TOTAL [illegible]

WEST LONGITUDE

FIGURE [illegible]
LOCATION OF PCS MESSAGE RECEPTIONS
APRIL 18, 1974

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5...	1-6	109 0127 52	123.62	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	109 0127 52	123.62	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15...	219...	[illegible]	24.2	1-6	109 0127 52	123.62	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17...	219...	[illegible]	1...	1-6	109 0127 52	123.62	A
[illegible]	[illegible]	[illegible]	[illegible]	...6	[illegible]	15...	219...	..7	.15..	1-7	109 0325 55	95.01	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219...	[illegible]	1...	2..	109 1627 59	.62.71	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	219...	[illegible]	21..	2 .	109 1627 59	.62.71	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12...	219...	[illegible]	2...	2 .	109 1627 59	.62.71	C

DAY=109 MSG= 8 TOTAL= 876

WEST LONGITUDE

FIGURE 25
LOCATION OF DCS MESSAGE RECEPTIONS
APRIL 19, 1974

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	RANGE (KM)	VISIBLE (KM)	[illegible]	AZIMUTH (DEG)	[illegible]	SAMP TIME DDD HHMM SS	NODE LONG	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57.1	[illegible]	111 0193 17	120.96	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	111 0193 17	120.96	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	111 0193 17	120.96	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	111 1519 25	65.58	B

DAY 111 MSG 4 TOTAL [illegible]

WEST LONGITUDE

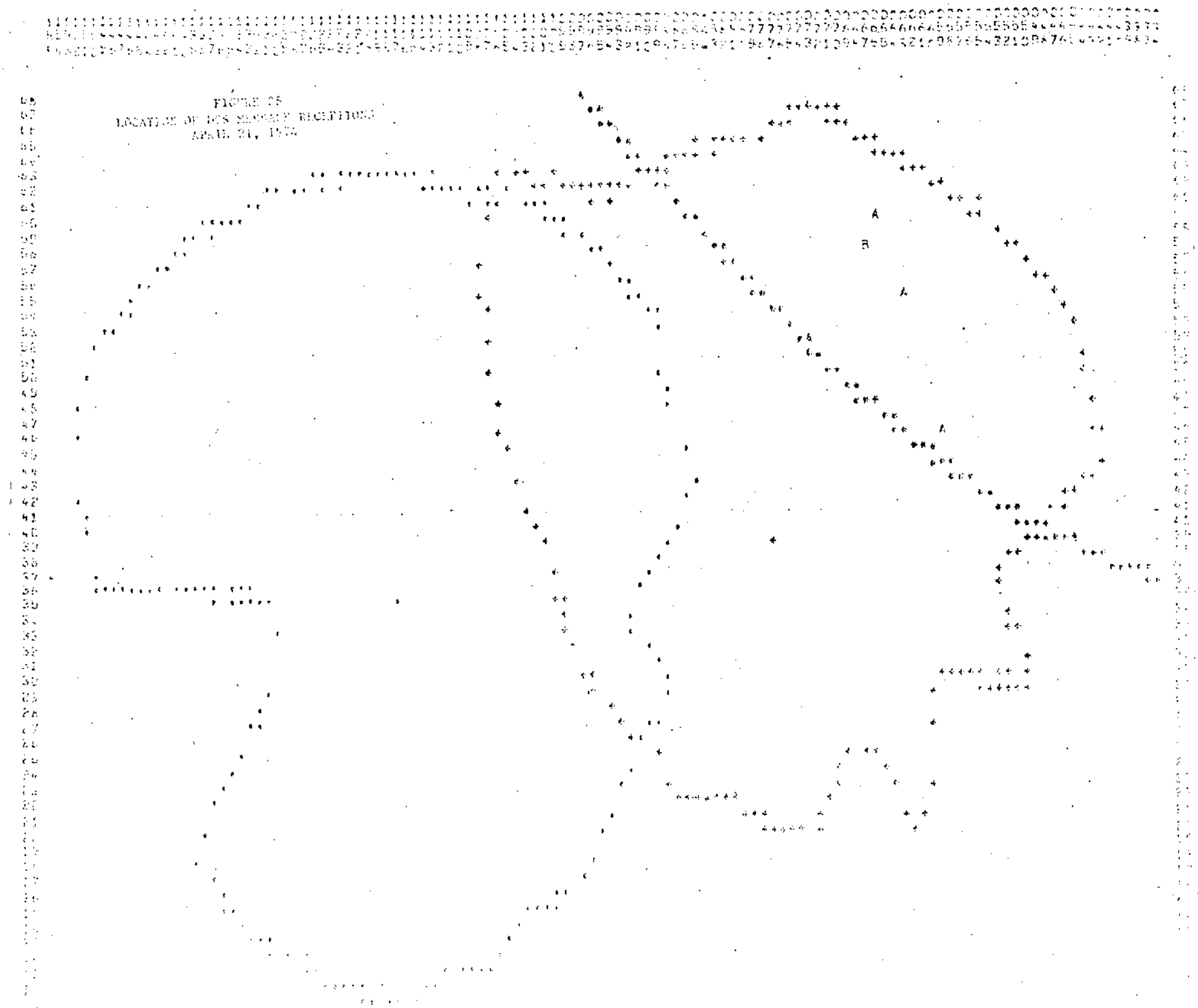


FIGURE 25
LOCATION OF DCS MESSAGE RECEPTIONS
APRIL 21, 1974

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]										REV	NODE TIME	NODE LONG	PART
[illegible]										1	113 0144	116.29	[illegible]
[illegible]										1	113 0144	[illegible]	[illegible]
[illegible]										1	113 0144	[illegible]	A
[illegible]										9	113 1530	[illegible]	[illegible]
[illegible]										9	113 1530	[illegible]	[illegible]

DAY=113 PSS= 5 TOTAL= 697

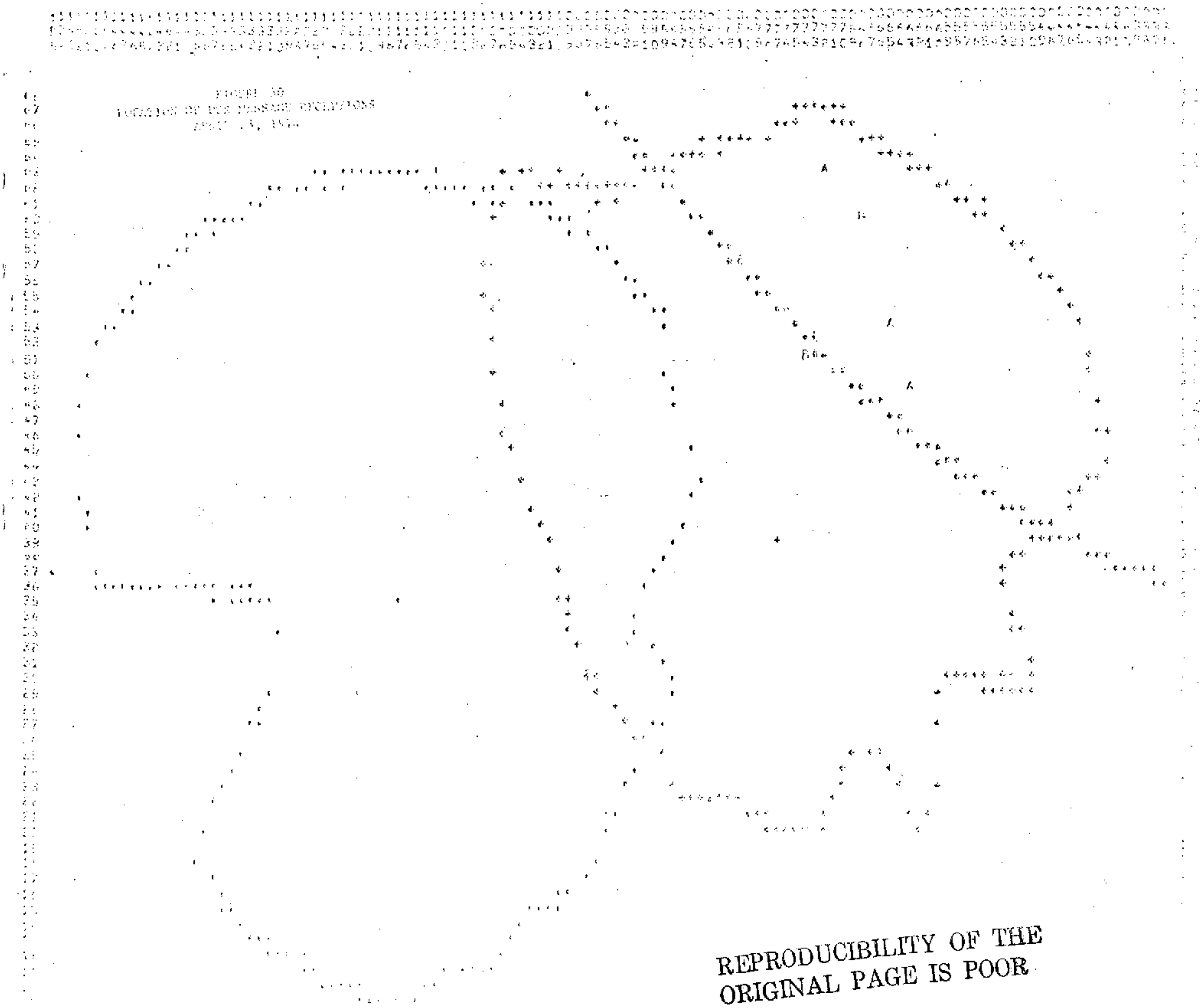


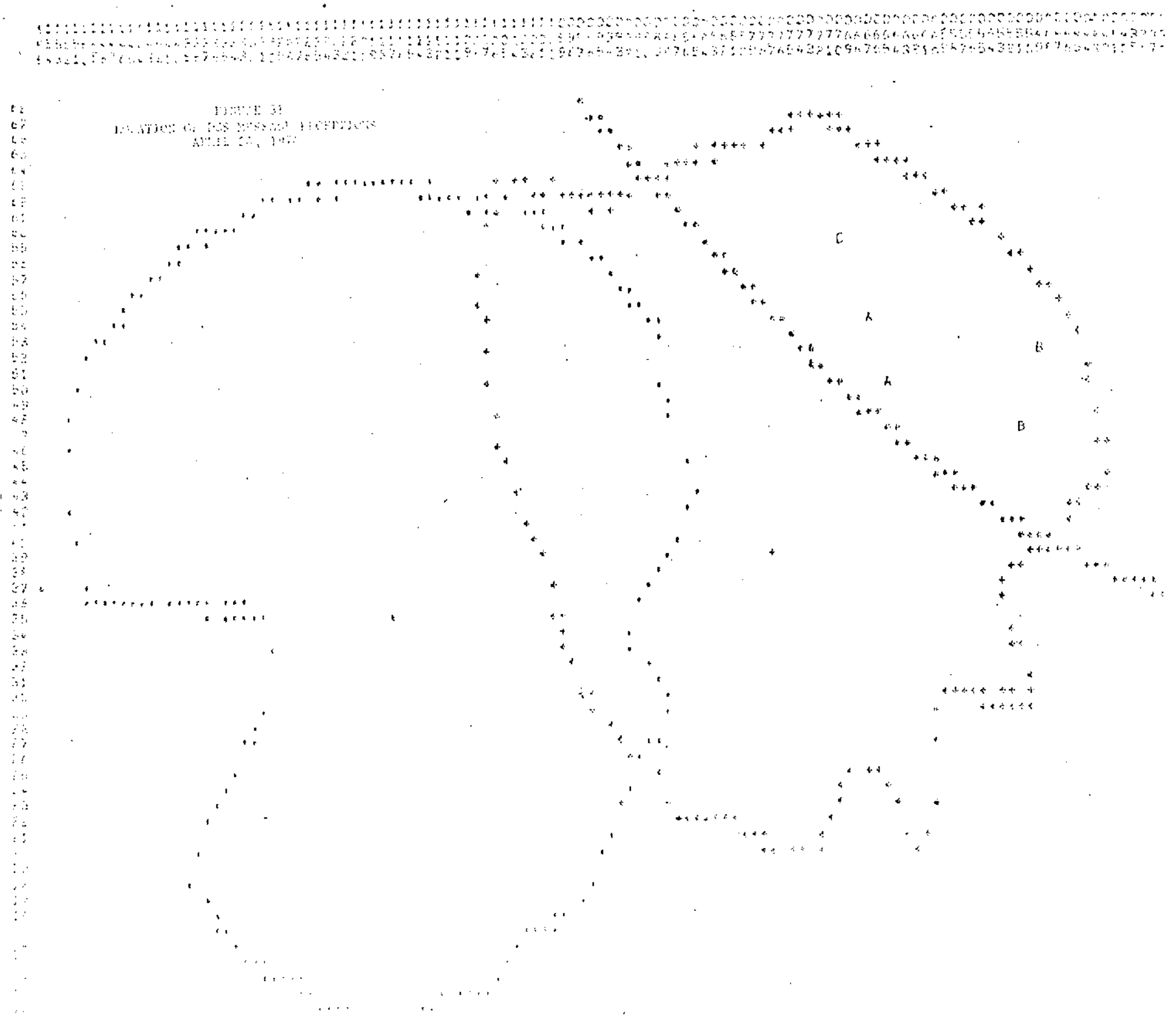
FIGURE 30

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3[illegible]	15	114 [illegible] 26	116+[illegible] A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2[illegible]	15	114 [illegible] 26	115+[illegible] A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	15	114 [illegible] 26	[illegible] A
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47[illegible]	22	114 [illegible] 17	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57.2	22	114 1355 17	[illegible] B
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	23	114 [illegible] 33	[illegible] C

DAY=114 MSG= 6 TOTAL= [illegible]

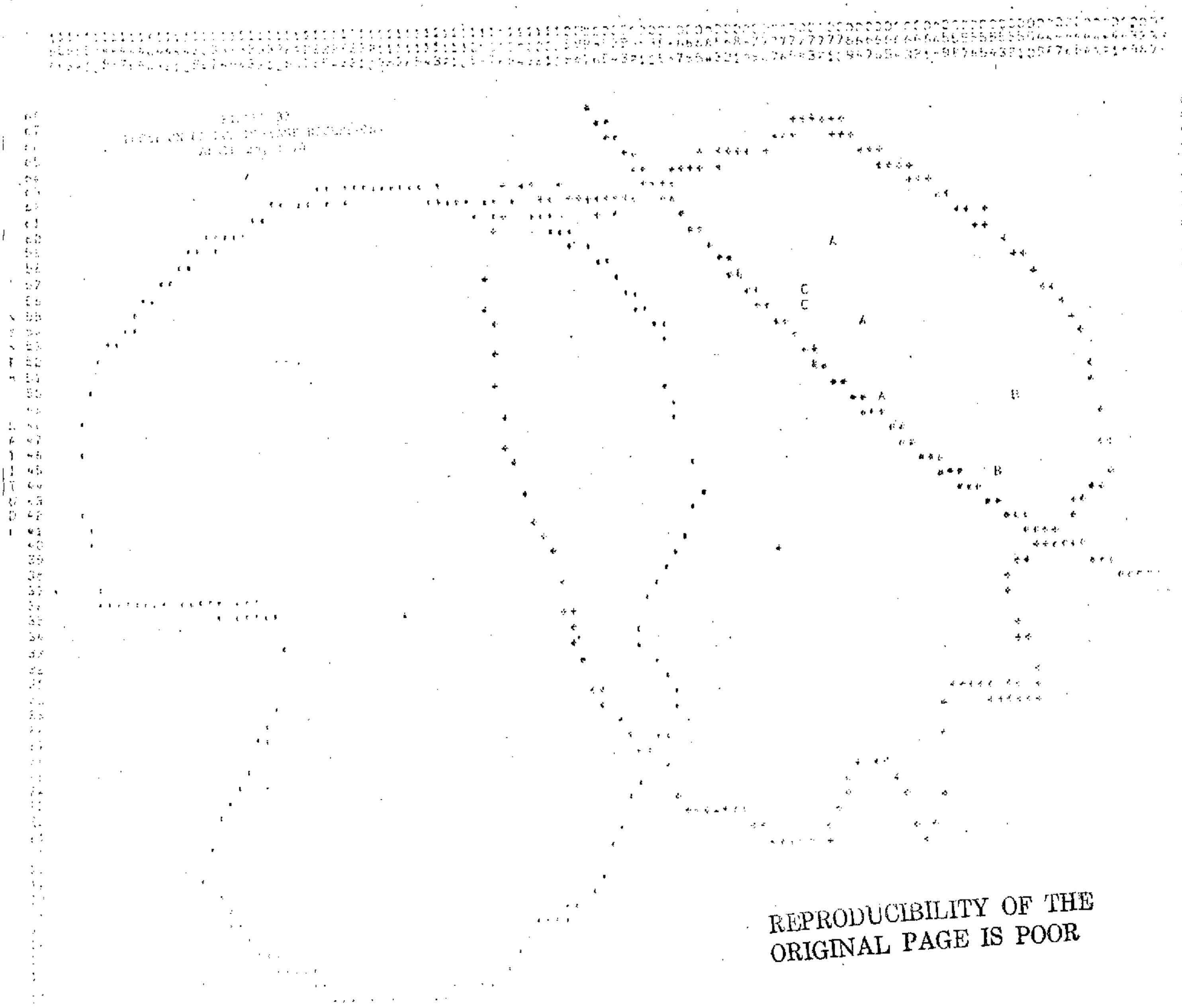
WEST LONGITUDE



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.7	29	115 0154 59	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29	115 0154 59	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29	115 0154 59	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.6	46	115 1359 00	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.7	46	115 1359 00	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47	115 1542 16	C
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47	115 1542 16	C

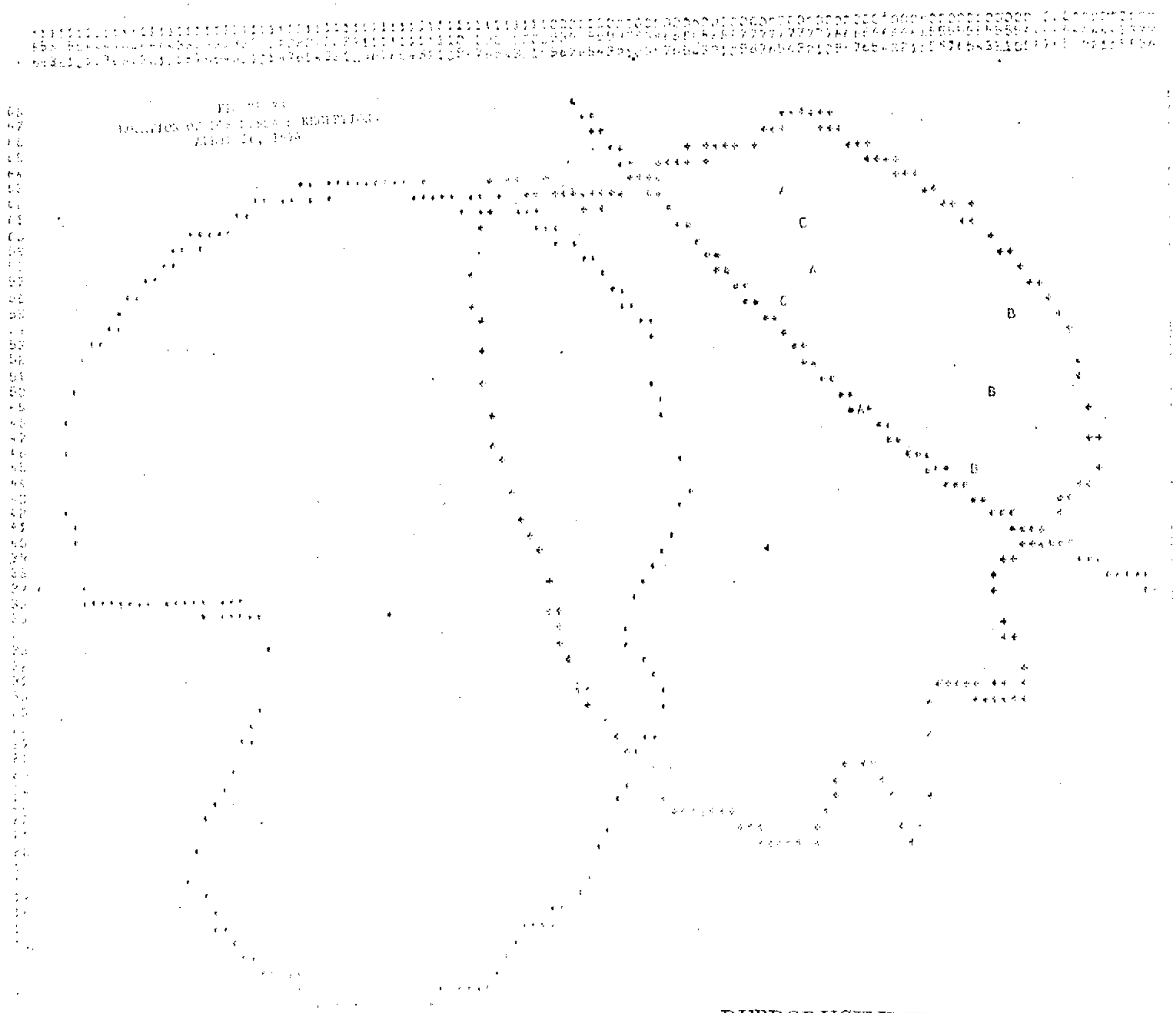
DAY 115 PASS 7 TOTAL 915



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

DAY=116 53 8 TOTAL

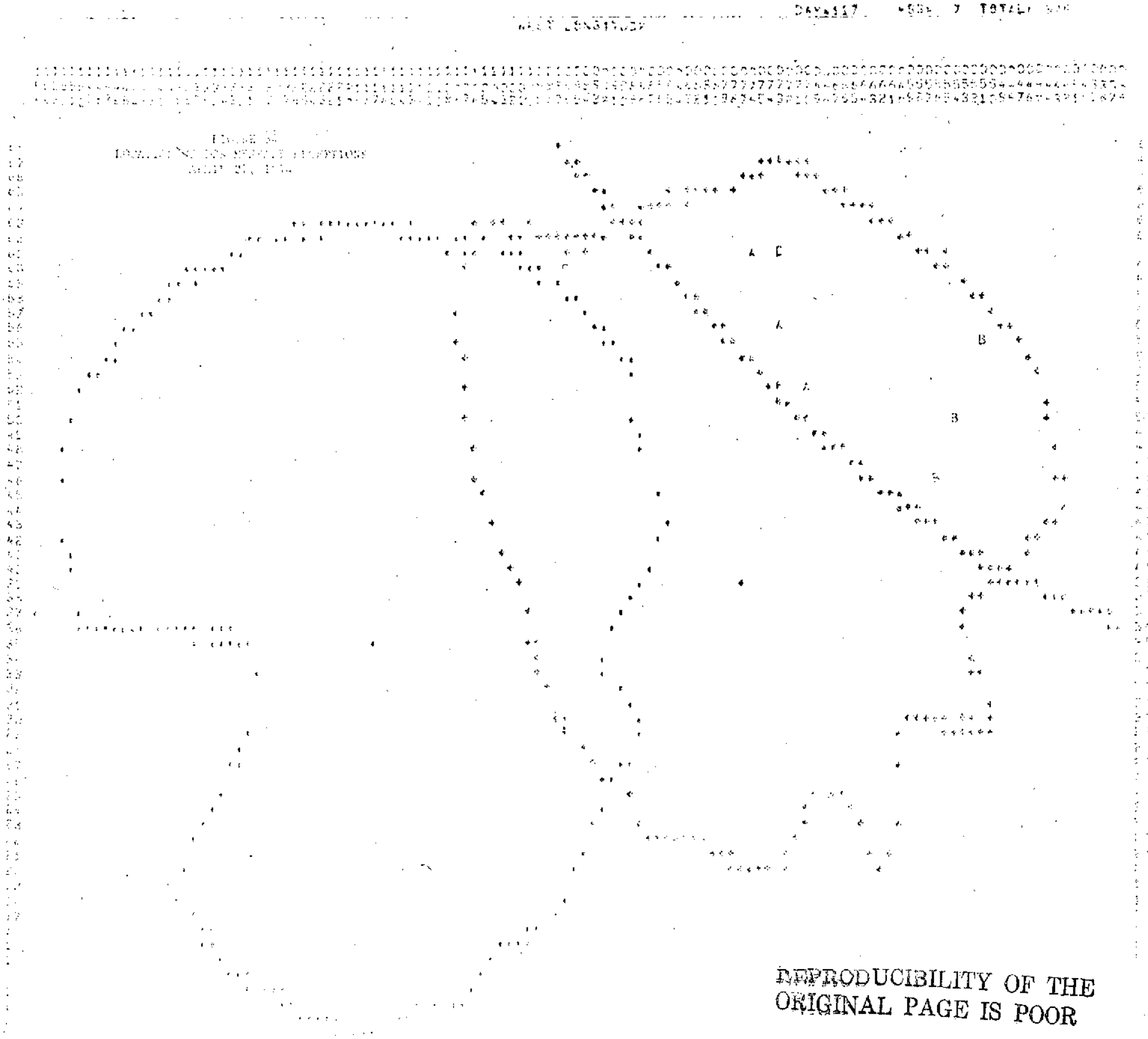
WEST LONGITUDE



REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67	117 0827 34	112+34	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67	117 0827 34	112+34	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67	117 0827 34	112+34	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3+7	[illegible]	117 1414 26	+65+37	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47+9	[illegible]	117 1414 26	+65+37	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6+9	[illegible]	117 1414 26	+66+37	6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65	117 1553 41	+94+19	0

DAY=117 ... TOTAL ...



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.7	[illegible]	119 [illegible] 59	119.45	A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	119 [illegible]	-71.24	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	97.5	[illegible]	119 [illegible]	-71.24	B
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	119 [illegible]	-67.04	C

DAY=339 [illegible] TOTAL= [illegible]

WEST LONGITUDE

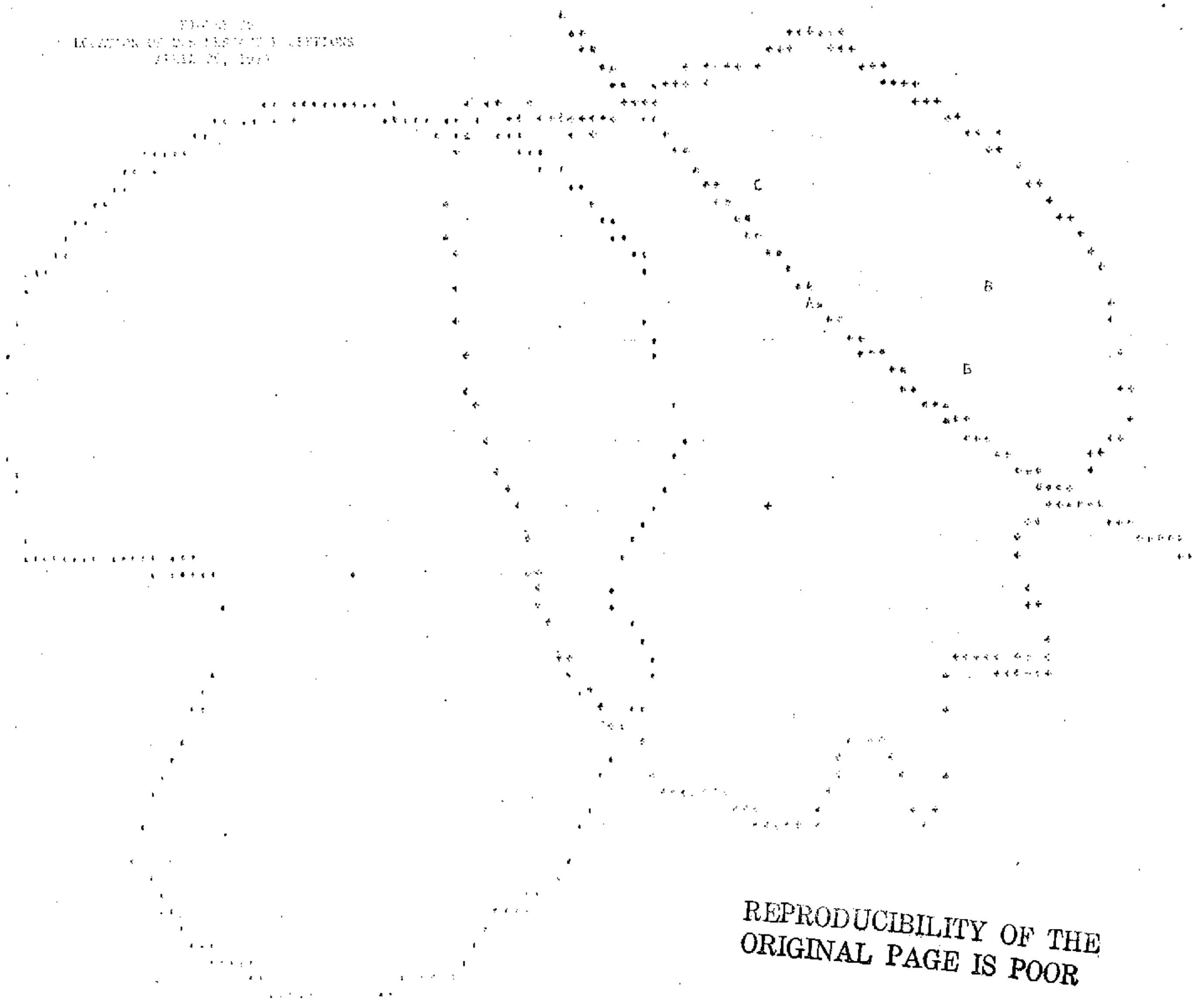


TABLE 1

UBS PERFORMANCE
at 0.260 watts
using DCP 6315 in Iceland

			ENT				
				Last Msg Rec			
Day	Hour	Orbit	Misses at Horizon	Range St. Mi.	Elev. Deg.	Num. of Msgs	Comments
001	00	7339	0	2125	1.0	5	
	02	7340	0	1928	4.1	1	
	14	7347	0	1800	6.4	2	
	16	7348	0	1991	3.1	1	
002	00	7353	0	2084	1.6	4	
	14	7361	0	1800	6.4	3	
003	00	7367	0	2157	0.6	4	
	15	7375	0	1899	4.6	3	
004	01	7381	0	1919	4.3	2	Masking
	13	7388	0	1929	4.1	3	
	15	7389	0	1800	6.4	1	
005	01	7395	0	2070	1.9	5	Masking
	13	7402	1	1751	7.3	3	
	15	7403	0	2113	1.2	4	
006	01	7409	0	2130	1.0	5	Masking
	13	7416	0	1977	3.3	3	
	15	7417	0	2061	2.0	4	
	17	7418	0	2102	1.4	1	
007	01	7423	0	2016	2.7	4	Masking
	13	7430	0	1872	5.1	3	
	15	7431	0	1991	3.1	3	
008	01	7437	0	1991	3.1	5	Masking
	13	7444	0	1860	5.3	3	
	15	7445	0	1939	4.0	3	
009	01	7451	0	1898	4.6	3	Masking
	13	7458	0	1922	4.3	3	
	15	7459	0	2112	1.2	3	
010	01	7465	0	2079	1.7	2	Masking
	14	7472	0	1780	6.7	3	
	15	7473	0	1960	3.6	1	
011	01	7479	0	2066	1.9	3	Masking
	14	7486	0	1958	3.7	3	
012	01	749[illegible]	0	1999	3.0	4	Masking
	14	7500	0	1842	5.6	2	
	15	7501	0	2092	1.5	3	

TABLE 1
Cont.

Day	Hour	Orbit	Misses at Horizon	ENT Last Msg Rec Range St. Mi.	ENT Last Msg Rec Elev. Deg.	Num. of Msgs	Comments
013	01	7507	0	2016	2.7	3	Masking
	14	7514	0	1889	4.8	3	
	16	7515	0	1902	4.6	2	
(Day 14 omitted: no data)							
015	00	7534	0	1969	3.5	5	
	02	7535	0	1844	5.6	2	Masking
	14	7542	0	1801	6.4	1	
	16	7543	0	1872	5.1	1	
016	00	7548	0	2019	2.7	4	
	14	7556	0	1952	3.7	2	
	16	7557	0	2047	2.2	2	Masking
017	00	7562	0	2123	1.1	6	
	02	7563	0	1821	6.0	1	Masking
	14	7570	0	1862	5.3	2	
	16	7571	0	2029	2.5	2	Masking
018	00	7576	0	2000	3.0	5	
	02	7577	0	1984	3.2	1	Masking
	14	7584	0	1893	4.7	2	
	16	7585	0	2085	1.6	2	Masking
019	00	7590	0	1962	3.6	5	
	02	7591	0	1984	3.2	1	Masking
	14	7598	0	1904	4.6	3	

Total Msgs Received in 18 day: 160

TABLE 2

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
196	037	00	7841	0	1851	5.5	2
204		14	7849	0	1992	3.1	4
205		16	7850	0	2017	2.7	1
210	038	00	7855	0	1751	7.3	2
218		14	7863	0	1750	7.3	3
219		16	7864	0	1913	4.4	1
224	039	00	7869	0	1935	4.0	3
232		15	7877	0	1869	5.2	2
233		16	7878	0	1864	5.2	1
238	040	01	7883	0	2056	2.1	4
245		13	7890	0	1853	5.4	1
246		15	7891	0	1825	5.9	2
1	041	01	7897	0	1996	3.0	4
8		13	7904	0	1964	3.5	2
9		15	7905	0	1961	3.6	2
15	042	01	7911	1	1719	7.9	2
22		13	7918	0	1897	4.7	3
23		15	7919	0	1957	3.7	2
29	043	01	7925	0	2068	1.9	4
37		15	7933	0	1875	5.0	3
43	044	01	7939	0	1961	3.6	4
50		13	7646	0	1890	4.8	2
51		15	7647	0	1928	4.2	2
57	045	01	7953	0	1834	5.8	2
64		13	7960	0	1829	5.8	3
65		15	7961	0	2116	1.2	3
71	046	01	7967	0	1924	4.2	2
78		14	7974	0	1963	3.6	3
79		15	7975	0	1933	4.1	2
85	047	01	7981	0	1847	5.5	3
92		14	7988	0	1753	7.2	3
93	048	01	7995	0	2007	2.9	3
99	048	01	7995	0	2007	2.9	3
106		14	8002	0	1917	4.3	3
107		15	8003	0	2088	1.6	3
113	049	01	8009	0	1877	5.0	3
120		14	8016	0	1595	10.4	1
121		15	8017	0	2187	0.1	2
127	050	02	8023	0	1753	7.2	1
134		14	8030	0	2129	1.0	3
135		16	8031	0	1673	8.8	3
140	051	00	8036	0	1991	3.1	5
141		02	8037	0	1843	5.6	2
148		14	8044	0	1964	3.5	4
149		16	8045	0	2027	2.5	2
154	052	00	8050	0	2154	0.6	6
155		02	8051	0	1809	6.2	2

TABLE 2
Cont.

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
162		14	8058	0	1907	4.5	4
163		16	8059	0	1972	3.4	1
168	053	00	8064	0	2094	1.5	4
169		02	8065	0	1958	3.7	1
176		14	8072	0	1913	4.4	3
177		16	8073	0	1983	3.2	1
182	054	00	8078	0	2119	1.1	4
183		02	8079	0	1939	4.0	4
190		14	8086	0	1988	3.2	4
191		16	8087	0	1837	5.7	1

TABLE 3

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
224	057	00	8120	0	2116	3.6	5
232		15	8128	0	1874	6.7	3
233		16	8129	0	1964	3.6	1
238	058	01	8134	1	1762	7.1	3
245		13	8141	0	2030	2.5	3
246		15	8142	0	1905	4.5	3
247		16	8143	0	1879	5.0	1
1	059	01	8148	0	1874	5.1	4
8		13	8155	0	2021	2.6	3
9		15	8156	0	2021	2.6	4
10		16	8157	0	2024	2.6	1
15	060	01	8162	0	1928	4.2	3
33		15	8170	0	1925	4.2	2
29	061	01	8176	0	1881	4.9	3
36		13	8183	0	1994	3.1	4
37		15	8184	0	1991	3.1	4
43	062	01	8190	0	2096	1.5	3
50		13	8197	0	1962	3.6	3
51		15	8198	0	2027	2.5	3
57	063	01	8204	0	1970	3.4	4
64		13	8211	0	1716	7.9	2
65		15	8212	0	1858	5.3	2
71	064	01	8218	0	1947	3.8	4
78		14	8225	1	1308	17.5	1
79		15	8226	1	1592	10.5	1
85	065	01	8232	0	2046	2.2	4
92		14	8239	0	1869	5.1	3
93		15	8240	0	2118	1.1	3
99	066	01	8246	0	2007	2.9	4
106		14	8253	0	1871	5.1	3
107		15	8254	0	2119	1.1	3
113	067	01	8260	0	1941	3.9	3
120		14	8267	0	1959	3.6	4
121		15	8268	0	2026	2.6	3
127	068	02	8274	0	2011	2.8	3
134		14	8281	0	1694	8.4	3
135		16	8282	0	1946	3.8	3
140	069	00	8287	0	1934	4.1	4
141		02	8288	0	2020	2.6	3
148		14	8295	0	1734	7.6	3
149		16	8296	0	1879	5.0	2
154	070	00	8301	0	1740	7.5	4
155		02	8302	0	2079	1.7	2
162		14	8309	0	1983	3.2	4
163		16	8310	0	1873	5.1	1

TABLE 3
Cont.

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
168	071	00	8315	0	1752	7.3	1
169		02	8316	0	1866	5.2	1
176		14	8323	0	1803	6.3	2
177		16	8324	0	1734	7.6	1
182	072	00	8329	1	1672	8.8	3
183		02	8330	0	1835	5.7	1
190		14	8337	1	1604	10.2	3
191		16	8338	0	1850	5.5	1
196	073	00	8343	1	1656	9.1	4
197		02	8344	0	1904	4.6	1
204		14	8351	0	1856	5.4	3
205		16	8352	0	1826	5.9	1
210	074	00	8357	0	2045	2.3	3
218		14	8365	1	1642	9.4	2

TABLE 4

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
29	079	01	8427	0	1813	6.1	4
36		13	8434	1	1460	13.5	1
37		15	8435	0	1783	6.7	3
43	080	01	8441	0	1787	6.6	4
50		13	8448	0	1875	5.0	3
51		15	8449	1	1583	5.9	2
64	081	13	8462	0	1703	8.2	2
65		15	8463	0	1819	6.0	2
71	082	01	8467	1	1533	11.7	3
78		14	8476	0	1717	7.9	2
79		15	8477	1	1551	11.4	1
85	083	01	8483	1	1652	9.2	3
92		14	8490	0	1747	7.3	3
93		15	8491	1	1678	8.7	2
106	084	14	8504	0	1845	5.6	2
107		15	8505	1	1514	12.2	1
113	085	01	8511	0	1953	3.7	3
120		14	8518	0	1756	7.2	3
121		15	8519	1	1666	8.9	1
127	086	02	8525	0	1952	3.8	3
134		14	8532	0	1725	7.8	3
135		16	8533	1	1728	7.7	1
140	087	00	8538	0	1928	4.1	5
141		02	8539	0	1780	6.7	2
148		14	8546	0	1782	6.7	3
149		16	8547	0	1832	5.8	1
154	088	00	8552	0	1819	6.0	5
155		02	8553	0	1754	7.2	1
162		14	8560	0	1768	7.0	3
163		16	8561	1	1612	10.0	1
168	089	00	8566	0	1872	5.1	4
169		02	8567	0	1786	6.6	1
176		14	8574	0	1783	6.7	3
177		16	8575	1	1665	8.9	1
182	090	00	8580	1	1648	9.3	4
183		02	8581	0	2114	1.2	2
190		14	8588	0	1638	9.5	3
191		16	8589	0	1854	5.4	1
196	091	00	8594	1	1540	11.6	3
197		02	8595	0	2057	2.1	1
204		14	8602	1	1639	9.5	2
205		16	8603	0	1863	5.3	1
210	092	00	8608	0	1905	4.5	5
218		14	8616	1	1630	9.7	3
219		16	8617	0	1878	5.0	1
224	093	00	8622	0	1829	5.1	4

TABLE 4
Cont.

Ref. Orb.	Day	Hour	Orbit	Misses	Range	Elev. Angle	No. of Msg.
232		15	8630	1	1560	11.2	2
233		16	8631	0	1846	5.5	1
238	094	01	8636	1	1739	7.5	4
245		13	8643	0	1815	6.1	2
246		15	8644	1	1635	9.5	2
247		16	8645	0	2018	2.7	1
1	095	01	8650	1	1723	7.8	3
8		13	8657	0	1919	4.3	3
9		15	8658	1	1590	10.5	2
15	096	01	8664	1	1732	7.6	4
22		13	8671	1	1664	9.0	2
23		15	8672	1	1652	9.2	2

C-3

TABLE 5

USB PERFORMANCE
at 0.192 watts
using DCP 6315 in Iceland

Day	Hour	Orbit	ENT: Misses at Horizon	ENT: Last Msg Rec: Range St. Mi.	ENT: Last Msg Rec: Elev. Deg.	Num. of Msgs.	Comments
102	01	8748	0	1690	8.5	3	Masking
	14	8755	0	1734	7.6	2	
	15	8756	1	1745	7.4	1	
103	01	8762	0	1806	6.3	2	Masking
	14	8769	0	1766	7.0	2	
	15	8770	1	1534	11.7	1	
104	02	8776	0	1796	6.4	2	Masking
	14	8783	0	1886	4.9	3	
	16	8784	0	1717	7.9	1	Masking
105	00	8789	0	1847	5.5	4	
	02	8790	0	1844	5.6	2	Masking
	14	8797	0	1711	8.0	3	
	16	8798	0	1861	5.3	2	Masking
106	00	8803	0	1878	5.0	4	
	02	8804	0	1754	7.2	2	Masking
	14	8811	0	1729	7.7	2	
	16	8812	1	1680	8.6	1	
107	00	8817	1	1751	7.3	4	
	02	8818	0	1866	5.2	1	Masking
	14	8825	0	1903	4.6	3	
108	00	8831	1	1773	6.9	3	
	02	8832	0	1888	4.8	1	Masking
	14	8839	0	1845	5.6	3	
	16	8840	0	1860	5.3	1	Masking
109	00	8845	1	1738	7.5	4	
	02	8846	0	1896	4.7	1	Masking
	14	8853	0	1800	6.4	3	
110	00	8859	1	1856	5.4	3	
	14	8867	1	1629	9.7	2	
111	00	8873	1	1704	8.2	3	
	15	8881	1	1653	11.1	1	
112	01	8887	1	1826	5.9	3	
	13	8894	1	1780	6.7	2	
	15	8895	2	1386	15.3	2	

TAFLE 5
Cont.

			ENT				
				Last Msg Kec			
			Misses at	Range	Elev.	Num. of	
Day	Hour	Orbit	Horizon	St. Mi.	Deg.	Msgs.	Comments
113	01	8901	1	1843	5.6	3	
	15	8909	1	1690	8.4	2	
114	01	8915	2	1596	10.4	3	
	13	8922	1	1821	6.0	2	
	15	8923	1	1631	9.6	1	
115	01	8929	1	1567	11.0	3	
	13	8936	1	1615	10.0	2	
	15	8937	2	1381	15.5	2	
116	01	8943	1	1773	6.9	3	Masking
	13	8950	0	1393	6.6	3	
	15	8951	1	1645	9.3	2	
117	01	8957	1	1712	8.0	3	Masking
	13	8964	0	1813	6.1	3	
	15	8965	1	1689	8.5	1	
118	01	8971	1	1730	7.7	1	Masking
	14	8978	1	1728	7.7	2	
	15	8979	1	1630	9.7	1	
119	01	8985	3	1100	24.5	1	Masking
	14	8992	1	1561	11.1	2	
	15	8993	1	1514	12.2	1	

Total Msgs Received in 18 day: 118

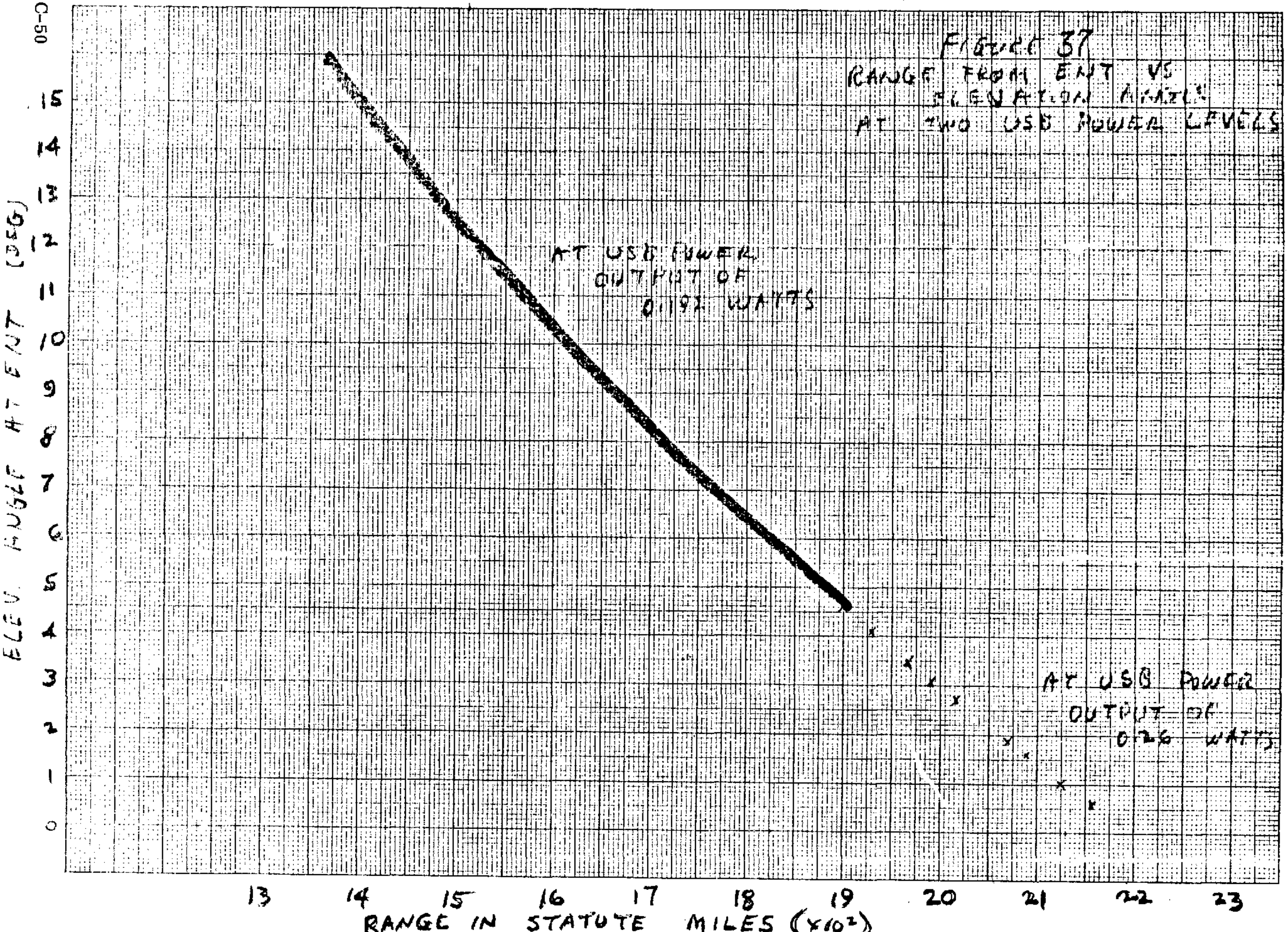


FIGURE 37
RANGE FROM ENT VS ELEVATION ANGLE AT TWO USB POWER LEVELS
AT USB POWER OUTPUT OF 0.192 WATTS
AT USB POWER OUTPUT OF 0.26 WATTS
ELEV. ANGLE AT ENT (DEG)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
13
14
15
16
17
18
19
20
21
22
23
RANGE IN STATUTE MILES (x10²)

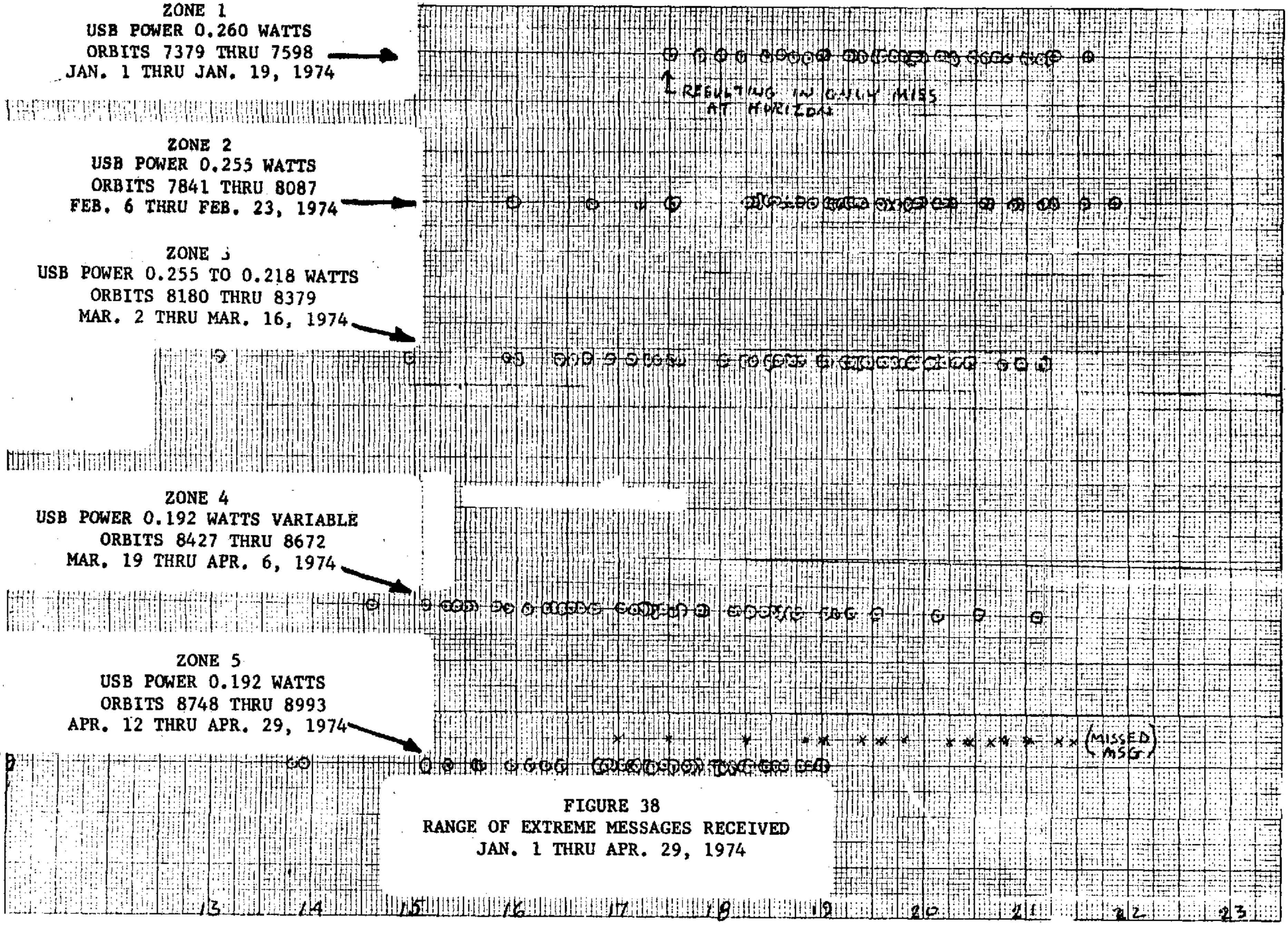


FIGURE 38
RANGE OF EXTREME MESSAGES RECEIVED
JAN. 1 THRU APR. 29, 1974

In Zone 5, in addition to the extreme ranges shown as circles, crosses are also shown to designate the range, within the ERTS horizon, at which expected messages were missed. These were derived from Figures 39 and 40. In Figure 39 are plotted the slant range from ENT for the last two messages received from each orbit of Table 1. These data were replotted in Figure 40 to derive the relationship of the range of the last message received to the range of the next expected message.

There is a large spread in the data plotted in Figure 40 because the range is dependent on the relative direction of the orbit trace. Using a conservative approach, the worse case is used, resulting in fewer attributions of missed messages. Figure 41 shows the ERTS positions A to C which permit DCS relay operations. Other positions do not fulfill the prerequisite of being simultaneously within the horizons of both the DCP and the ground station. The data in Tables 1 and 2 show that with USB power output in excess of 0.25 watts, messages from position C were received consistantly at Greenbelt. Position C represents the extreme range (horizon) for the USB portion of the relay chain. Consistant reception at this range is evidence that all previous power drops had no adverse effect on USB operational performances.

The data in Tables 3, 4, and 5 however show that with the USB power output below 0.25 watts, messages can no longer be received from C, but only from some intermediate point B.

No longer can the USB relay DCP messages out to the horizon of ENT. The operational range has been reduced. It began shrinking from the horizon at some telemetry-indicated USB transmitter power output level which the data in Tables 1 to 5 and in Figure 38 suggest is about 0.25 watts.

Because the evidence clearly shows a contraction of USB/DCS coverage, it was of interest to determine the degree to which other functions of the USB were affected. The USB transmitter is turned ON by a stored command before the spacecraft rises above the ground station horizon. Using the same reference orbits to assure identical conditions of azimuth, elevation and range, AOS locations were plotted for orbits from 7500 thru 9760. There was no visible difference in the location of AOS.

Figure 42 shows USB AOS locations unaffected by the power drop. Note that the dots (USB at 0.25 watts) and circles (USB at 0.19 watts) are at almost identical locations (68°N70°W and 61°N51.5°W) before and after power step down. The link continued to operate effectively even though the signal strength is significantly lower. The signal-to-noise level has not yet subsided to the level at which the output will be noticeably deteriorated.

Ground Stations do not report signal level at acquisition, but only at maximum signal strength. These maximum levels show about a 2 db drop after the power step down. Clearly the signal-to-noise level at launch was so large that even at these reduced values no adverse effect can yet be seen.

In Figure 42, the effect of the power drop on DCS reception is also displayed for the identical orbits. Note that the crosses (DCS at 0.25 watts) and squares (DCS at 0.19 watts) are clearly displaced. The squares are closer to the ground station, ENT. That is, the range has shortened.

However, even with this shortening of the range, it was not apparent to DCS observers that the coverage was diminished. Systematic fluctuations during the 18-day cycle, different for each DCP, together with occasional ground station and DCP problems, can obscure for weeks a minor decline in coverage.

(con't. on p. 56)

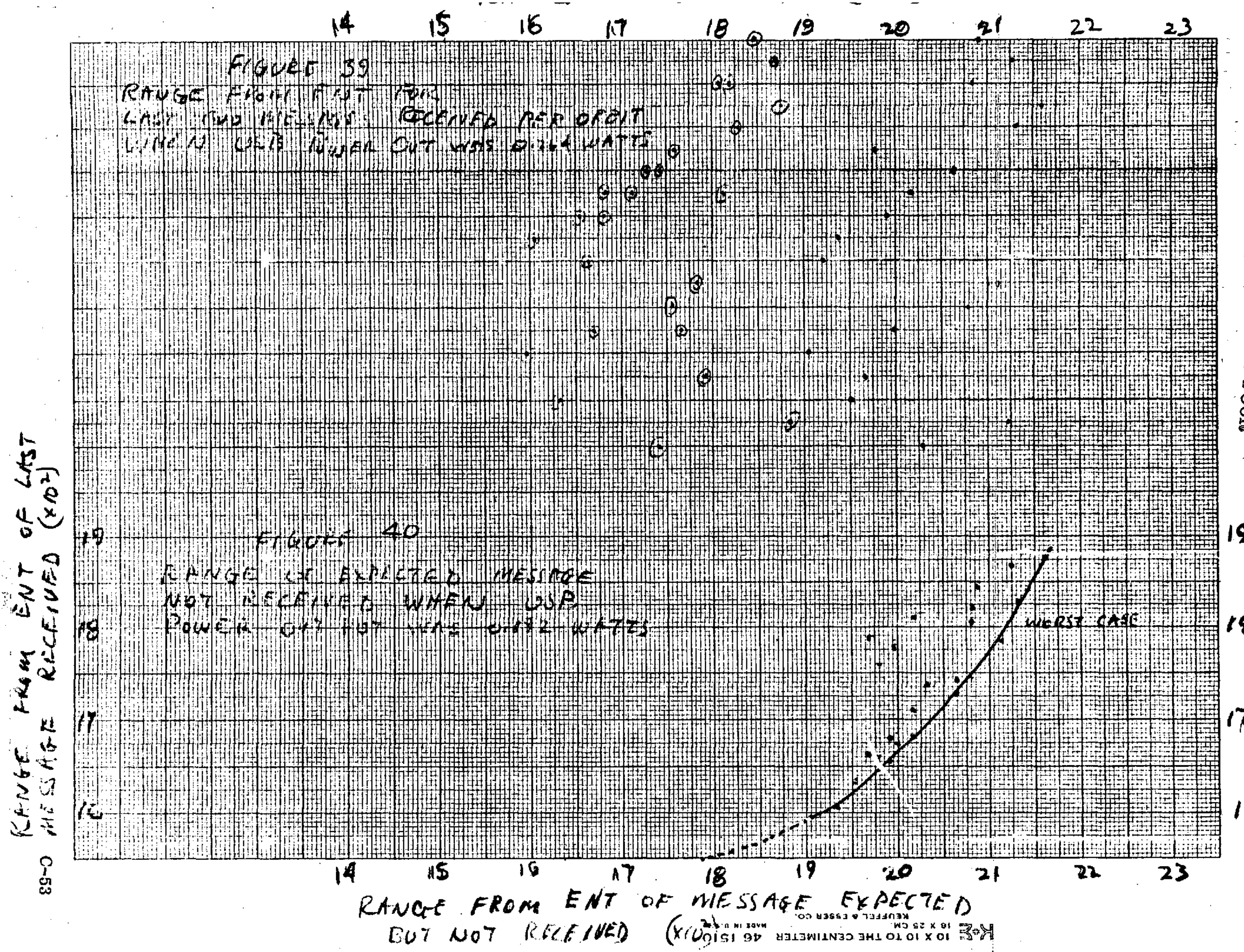


FIGURE 39
RANGE FROM ENT FOR
LAST TWO MESSAGES RECEIVED PER ORBIT
FIGURE 40
RANGE OF EXPECTED MESSAGE
NOT RECEIVED WHEN GSP
WORST CASE
14 15 16 17 18 19 20 21 22 23
16 17 18 19
RANGE FROM ENT OF LAST MESSAGE RECEIVED (x10²)
RANGE FROM ENT OF MESSAGE EXPECTED BUT NOT RECEIVED (x10²)

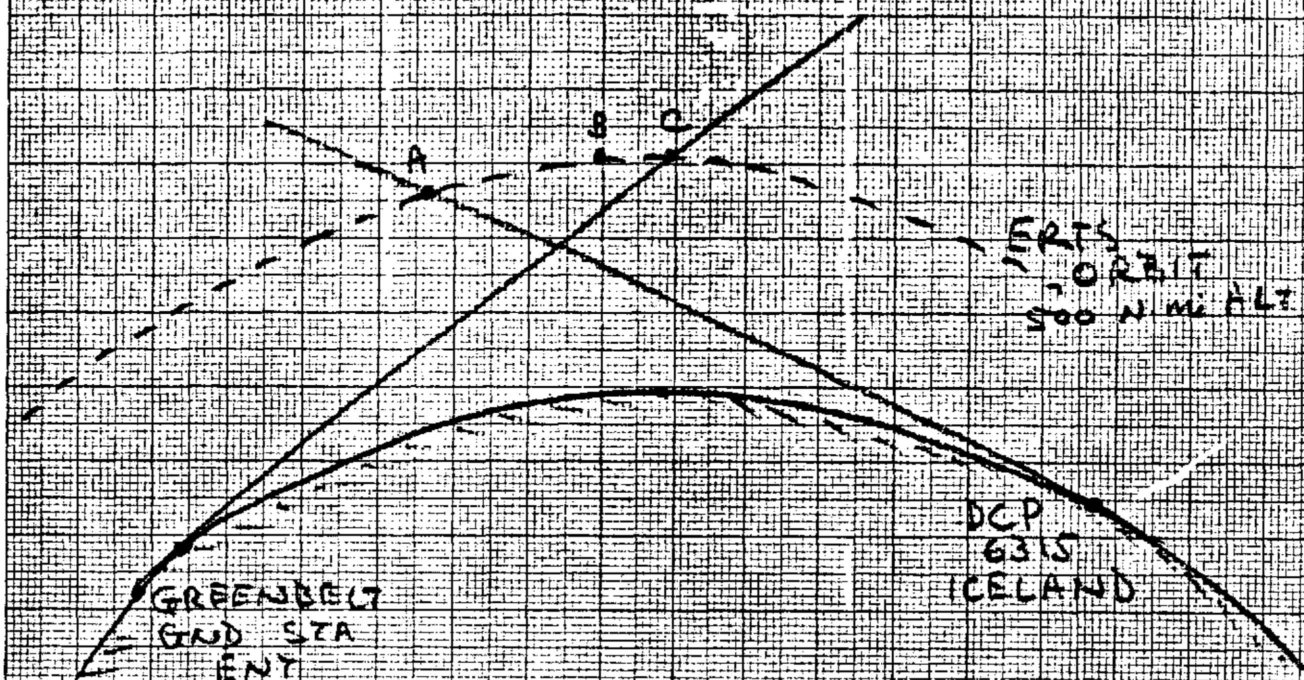


FIGURE 41
POSSIBLE POINTS IN ERTS ORBIT
FOR DCS RELAY
OF DCP-6315 DATA

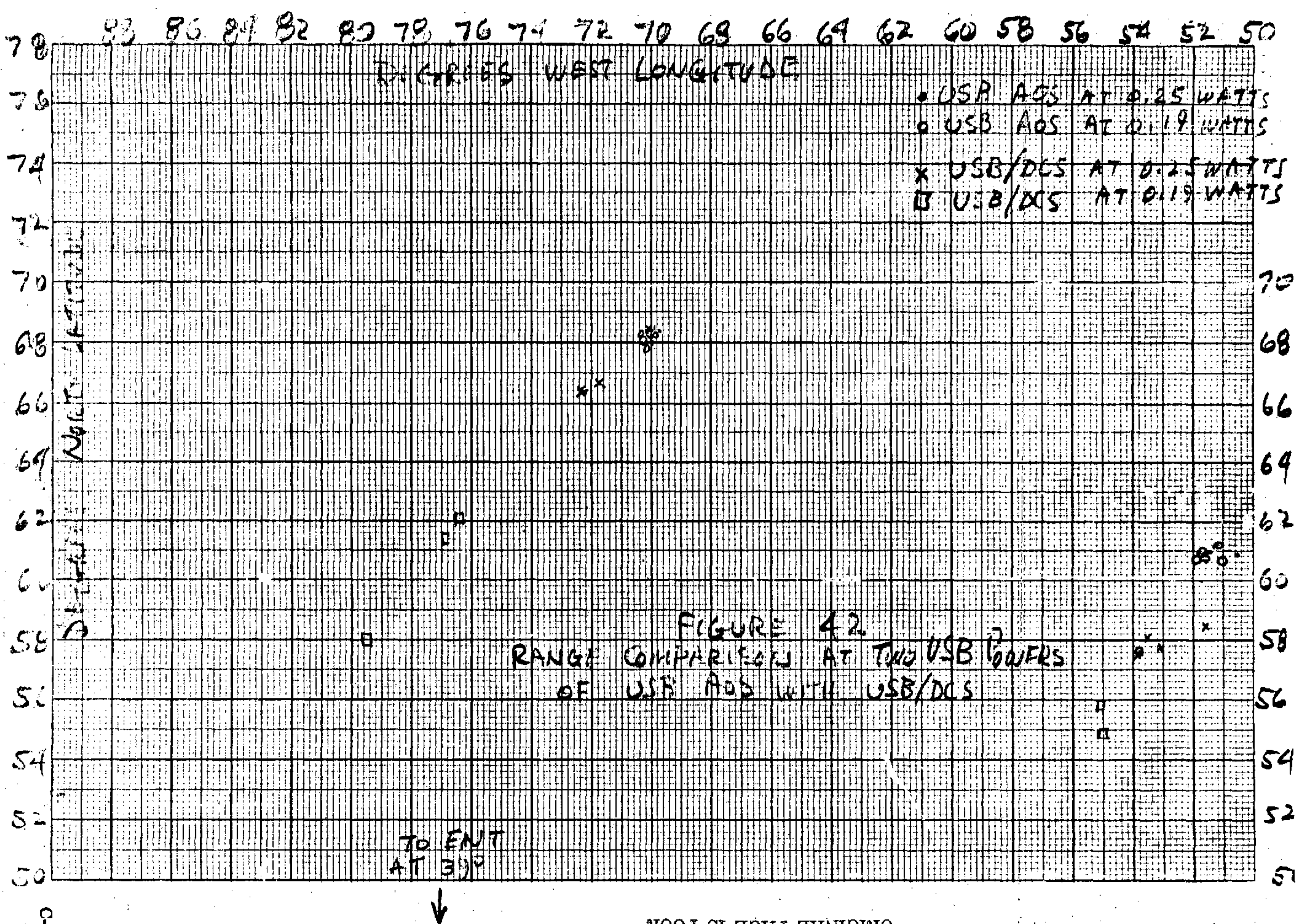


FIGURE 42
RANGE COMPARISON AT TWO USB POWERS
OF USB AOS WITH USB/DCS

Good telemetry and ranging continue to be provided.

As long as the power output was above 0.25 watts, the USB/DCS range was demonstrated to 2157 statute miles. The area coverage would consequently be $\pi(2157)^2$ square miles. With power output down to 0.192 watts, the demonstrated range was 1900 miles and the area coverage was $\pi(1900)^2$ square miles.

The range loss was then

$$\frac{2157 - 1900}{2157} = 12\%$$

and the area loss was

$$\frac{2157^2 - 1800^2}{2157^2} = 22\%$$

It should be remembered that, as described in Reference 1, when the pre-launch calibration curve for the USB was derived, the single low value point was at about 0.4 watts. The true value of USB power output may therefore be somewhat different than that derived from the telemetry of ERTS.

It is interesting to note that the same data above when reprogrammed to display data on the maximum range of the DCP transmitter (6315) showed no loss of range thruout this time period exceeding 2000 miles every day in the period of Zone 5, and achieving values of over 2260 statute miles, an elevation angle of 1^{o} below the horizon!

K. S. Rizk

K.S. Rizk
Systems Engineer

APPENDIX D

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

PIR NO.	*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
	U	— ERTS	— 1N23 —	109	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K.S. Rizk	T.W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
5/2/74			

SUBJECT

Prince Albert Horizon for MSS Reception

INFORMATION REQUESTED/RELEASED

Introduction:

The Prince Albert ERTS ground station requested earlier than normal MSS on-times to permit mapping the Queen Elizabeth Islands in the Arctic Ocean west of Greenland. Data was taken from these early on-times to derive an empirical MSS horizon for the Prince Albert station. The Prince Albert Station is located at 105°56'W 53°13'N at an elevation of 1610 meters.

Discussion:

For a complete 18 day cycle, from orbit 8477 on 23 March 1974 thru orbit 8728 on 10 April 1974, Prince Albert reported the earliest time when good MSS data was being received.

Table 1 lists this data. Also included are the times when Link 3 (Wideband Power Amplifier), Link 4 (USB) and MSS were on, warmed-up and operating properly. Only that data are used which have ERTS data "ready" time earlier than Prince Albert's actual acquisition time. In the last column is listed the location of ERTS-1 at the times reported.

Figure 1 shows the horizon of the Prince Albert ground station for ERTS MSS data. The horizon flattens at 80.9°N because the orbital inclination of ERTS-1 limits the northward movement to that latitude.

The empirical MSS horizon as calculated from Figure 1 is 1847 n. mi. (3421 Km) along the earth's surface. This corresponds to a slant range of 3705 Km, at an elevation angle of 0.8° below zero at the Prince Albert antenna.

It is interesting to note the reception at 40°W 80°N which corresponds to a distance along the earth's surface of 1980 n. miles. This was probably due to a ducting anomaly.

K. S. Rizk

K.S. Rizk
Systems Engineer

/pkp

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FORM 1020B REV. (9-70)

Table 1

Prince Albert MSS Acquisition Times

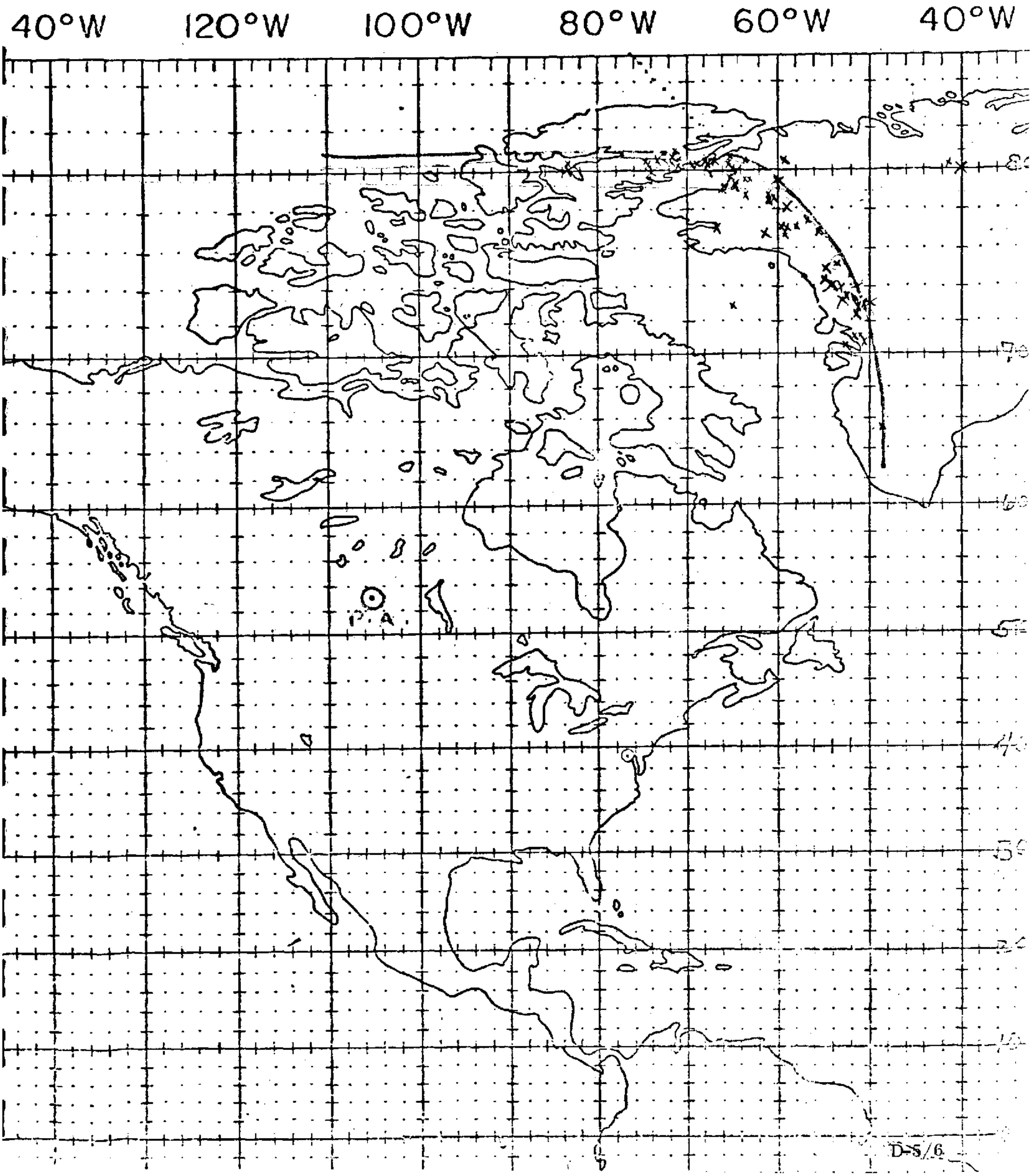
Date	Orbit	P.A. Start Time	Effective Start Of			ERTS Position	
			Link 3	Link 4	MSS	Long.	Lat.
3/23	8477	15:38:04	15:34:48	15:36:00	15:36:30	54	74
3/23	8478	17:20:12	17:16:47	17:17:00	17:18:31	67	78
3/23	8479	19:01:49	18:59:10	19:00:55	19:01:45	72	80
3/24	8493	19:07:30	19:05:48	19:07:00	19:07:30	64	80
3/25	8505	15:49:56	15:49:58	15:49:58	15:50:48		
3/25	8506	17:30:56	17:29:55	17:29:57	17:30:45	64	80
3/25	8507	19:13:12	19:12:21	19:11:57	19:13:11	66	80
3/26	8519	15:55:16	15:55:17	15:55:00	15:56:07		
3/26	8520	17:36:35	17:35:13	17:36:00	17:36:02	69	79
3/26	8521	19:18:50	19:18:04	19:18:45	19:18:53	74	80
3/27	8532	14:22:18	14:22:19	14:21:06	14:23:		
3/27	8533	16:01:47	16:01:50	16:01:00	16:02:40		
3/27	8534	17:42:11	17:40:31	17:41:00	17:41:19	60	79
3/27	8535	19:24:29	19:23:47	19:24:00	19:24:37	60	81
3/28	8546	14:27:13	14:27:12	14:26:42	14:28:04		
3/28	8547	16:07:06	16:07:08	16:07:00	16:08:00	65	73
3/28	8548	17:47:51	17:47:00	17:46:39	17:47:31	66	79
3/28	8549	19:30:05	19:29:55	19:30:03	19:30:47		
3/29	8560	14:31:10	14:30:00	14:30:00	14:30:52	49	68
3/29	8561	16:11:32	16:10:21	16:10:00	16:11:13	55	77
3/29	8562	17:53:31	19:51:57	19:51:00	19:52:49	63	79
3/29	8563	19:35:47	19:35:13	19:34:00	19:36:05	72	81
3/30	8574	14:36:57	14:36:58	14:37:00	14:37:34		
3/30	8575	16:18:32	16:18:34	16:18:00	16:19:26		
3/30	8576	17:59:09	17:58:30	17:59:00	17:59:22	62	80
3/30	8577	19:41:27	19:40:56	19:41:22	19:41:48	73	81

Table 1
(continued)

Date	Orbit	P.A. Start Time	Effective Start Of Link 3	Link 4	MSS	ERTS Position Long.	Lat.
3/31	8588	14:41:59	14:41:30	14:40:00	14:42:18	50	70
3/31	8589	16:22:46	16:21:47	16:20:00	16:22:39	53	77
3/31	8590	18:04:48	18:03:48	18:02:00	18:04:40	65	80
3/31	8591	19:47:05	19:47:04	19:44:58	19:47:56		
4/1	8602	14:47:32	14:46:44	14:46:00	14:47:36	50	71
4/1	8603	16:28:26	16:27:30	16:27:00	16:28:22	58	77
4/1	8604	18:10:29	18:09:06	18:08:00	18:09:58	65	79
4/1	8605	19:52:47	19:52:22	19:50:00	19:53:14	71	81
4/2	8616	14:53:01	14:52:27	14:52:00	14:53:19	51	71
4/2	8617	16:34:02	16:33:13	16:33:00	16:34:05	58	78
4/2	8618	18:16:08	18:15:14	18:15:00	18:13:06	64	80
4/2	8619	19:58:34	19:58:05	19:57:00	19:55:56	68	80
4/3	8630	14:58:42	14:58:10	14:57:00	14:59:02	51	71
4/3	8631	16:39:45	16:38:56	16:38:00	16:39:48	58	79
4/3	8632	18:21:48	18:20:32	18:20:00	18:21:24	66	80
4/3	8633	20:04:05	20:03:48	20:02:00	20:04:40	77	80
4/4	8644	15:04:06	15:02:13	15:02:00	15:03:03	51	73
4/4	8645	16:45:19	16:43:24	19:43:00	16:44:14	59	78
4/4	8646	18:27:27	18:26:15	18:26:00	18:27:05	68	81
4/5	8658	15:09:37	15:08:21	15:08:00	15:09:11	50	73
4/5	8659	16:50:56	16:48:42	16:48:	16:49:32	70	76
4/5	8660	18:33:06	18:31:57	18:31:00	18:32:47	65	80
4/6	8672	15:15:10	15:13:28	15:13:00	15:14:30	53	73
4/6	8673	16:55:35	16:54:24	16:54:00	16:55:16	40	80
4/6	8674	18:38:45	18:37:40	18:37:00	18:38:22	65	80
4/6	8675	20:21:01	20:20:56	20:20:00	20:21:48	72	81
4/7	8686	15:20:42	15:20:06	15:20:00	15:20:56	51	74
4/7	8687	17:02:14	17:00:32	17:00:00	17:01:22	63	78
4/7	8688	18:44:24	18:43:48	18:44:00	18:44:38	70	80

Table 1
(continued)

Date	Orbit	P.A. Start Time	Effective Start Of			ERTS Position	
			Link 3	Link 4	MSS	Long.	Lat.
4/8	8700	15:26:19	15:25:54	15:26:00	15:26:46	53	74
4/8	8701	17:09:10	17:09:10	17:07:00	17:10:02		
4/8	8702	18:50:04	18:49:31	18:48:00	18:50:23	67	81
4/8	8703	20:32:50	20:32:47	20:32:16	20:33:39	63	80
4/9	8714	15:32:02	15:29:57	15:30:00	15:30:49	54	74
4/9	8715	17:13:31	17:12:23	17:12:00	17:13:15	60	79
4/9	8716	18:55:55	18:54:49	18:54:00	18:55:41	74	80
4/9	8717	20:38:05	20:38:05	20:37:00	20:38:56		



D-5/6

APPENDIX E

GENERAL ELECTRIC
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PROGRAM INFORMATION REQUEST / RELEASE

PIR NO.	*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
	U	— 1N23	— ERTS	— 121	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K.S. Rizk	T.W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
8/16/74			PIR-U-ERTS-1N23-108 dated April 30, 1974

SUBJECT

Deepening Twilight of Wideband Video Tape Recorder

INFORMATION REQUESTED/RELEASED

Introduction

The reference PIR describes the history of Wide Band Video Tape Recorder No. 1 (WBVTR-1) from launch to Orbit 9000. This report updates the history thru Orbit 10500.

Discussion

The history of WBVTR-1 for the last 1500 orbits is summarized in Table 1. The corrective actions employed were:

a) a change in the Record input current attenuator during Orbit 9342 (change from 7 db insertion loss to 6 db) and again in Orbit 10207 (change from 6 db insertion loss to 5 db).
b) LAP operation in Orbit 9998.
c) Headwheel shoe multiple cycling (in and out) in Orbit 10373.
d) repetitive Test, Records and Playbacks after Orbit 10373.

In general these corrective actions have not as yet produced major improvements. Figures 1, 2, & 3 are strip charts of selected WBVTR-1 functions for tape recorder performance since Orbit 10373. The sequence of orbits is from right-to-left . Time increases left-to-right in each orbit, with the single exception of right to left in Orbit 10375 of Figure 1.

A comparison of the values shown in Figures 1, 2, and 3 with that of the recent past (Orbit 9530) and with the normal since launch is shown in Table 2.

During Orbit 10421, WBR was accidentally left in Standby both before and after the Rewind preceding the two Record operations (see Figure 3). During this 15 minutes of Standby, the Headwheel current declined from 450 ma to 430 ma, showing there was no headwheel contact with the tape (such as would occur in a broken pivot) in this condition.

Table 2 shows that during the orbits since 10393, there is a trend toward improvement in Headwheel Current. Record and Playbacks will be continued for about 10 more cycles after which a study of the resultant data will be made to seek effective corrective action.

K. S. Rizk

K.S. Rizk, Systems Engineer

Distribution: L. Smith, J. Hayes (2), R. Stauffer, D. Schwartz, B. Phucas, H. Boys, K. Rizk (3)

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TABLE 1

STATE	1974 DATE	ORBIT	ACTIVITY	ACTION TAKEN	PERT. RESULTS	FOOTAGE
LIM OPNS	APR 30 MAY 24	9001 to 9341	Rec & P/B	Repetitions	HWI upper 600 ma. P/B V upper 500 mv MFSE 50 to 250	1050-1250
TEST	MAY 24	9342	Rec. Current Adj.	Changed Insert. loss from 7 db to 0 to 6 db	P/B V gradually climbed to upper 600 ma	1050-1250
LIM OPNS	MAY 24 JULY 2	9343 9880	Rec & P/B	Resumed opns	HWI up to .66 MFSE 75-400	1050-1250
LIM OPNS	JULY 2	9881	HWI rose rapidly to 730 MFSE up to 5000	Suspended opn		1050-1250
STUDY	JULY 2 JULY 10	9882 9997	None			
TEST	JULY 10	9998		LAP		
TEST	JULY 10 JULY 11	9999 - 10003	Rec & P/B		HWI 660-710 MFSE 3000	950-1000
TEST	JULY 11 JULY 17	10004 10087	Rec & P/B		HWI 680-720 MFSE ~5000	1100-1200
STUDY	JULY 17 JULY 25	10088 10206	None	Study at GE, NASA and RCA		
TEST	JULY 25	10207	Rec Current Adj	Changed Insert. loss from 6 db to 7 to 0 to 5 db		
TEST	JULY 25	10212			HWI 660-710 ma MFSE ~ 10000 P/B V 270 to 490 mv	1100-1220
STUDY	JULY 25 AUG 5	10212 10361	NONE	Study at GE, NASA and RCA		
TEST	AUG 5	10362	R/W to 8 (footage)			8
TEST	AUG 6	10373		33 Shoe Cycling in/out		8-91
TEST	AUG 6 AUG 10	10375 10422	twice per day Double Rec & P/B	total of 11 cycles	HWI slowly dropping to 580 ma MFSE above 12000	9-108
STUDY	AUG 10 AUG 15	10422 10500	NONE	Study at GE, NASA and RCA		

TABLE 2

COMPARISON OF WBR FUNCTION VALUES

FUNC	DESCRIPTION	MODE	Norm Launch to Orb 9000	Orb 9530	Recent Range Orb 10275-10392	Recent Range Orb 10393-10422	Units
13031	Recorder Input Current	Rec	3.48	3.50	3.50	3.50	amperes
		P/B	3.75	3.76	3.76	3.76	
		Rew	2.02	2.04	2.04	2.04	
		Stby	1.90	1.71	1.52-1.65	1.52-1.65	
13030	Headwheel Motor Current	Rec	575	557	610-690	530-640	m.a.
		P/B	570	525	560-670	550-640	
		Rew	450	450	450-460	450-460	
		Stby	445	445	450	430-450	
13026	Capstan Motor Current	Rec	245	260	210-280	210-280	m.a.
		P/B	255	260-310	210-280	210-310	
		Rew	192	220	220-260	230-280	
13023	Playback Voltage	P/B	420	520-580	350-700	430-720	m.v.
	MFSE Counts	P/B	10	80	~15000	~15000	-

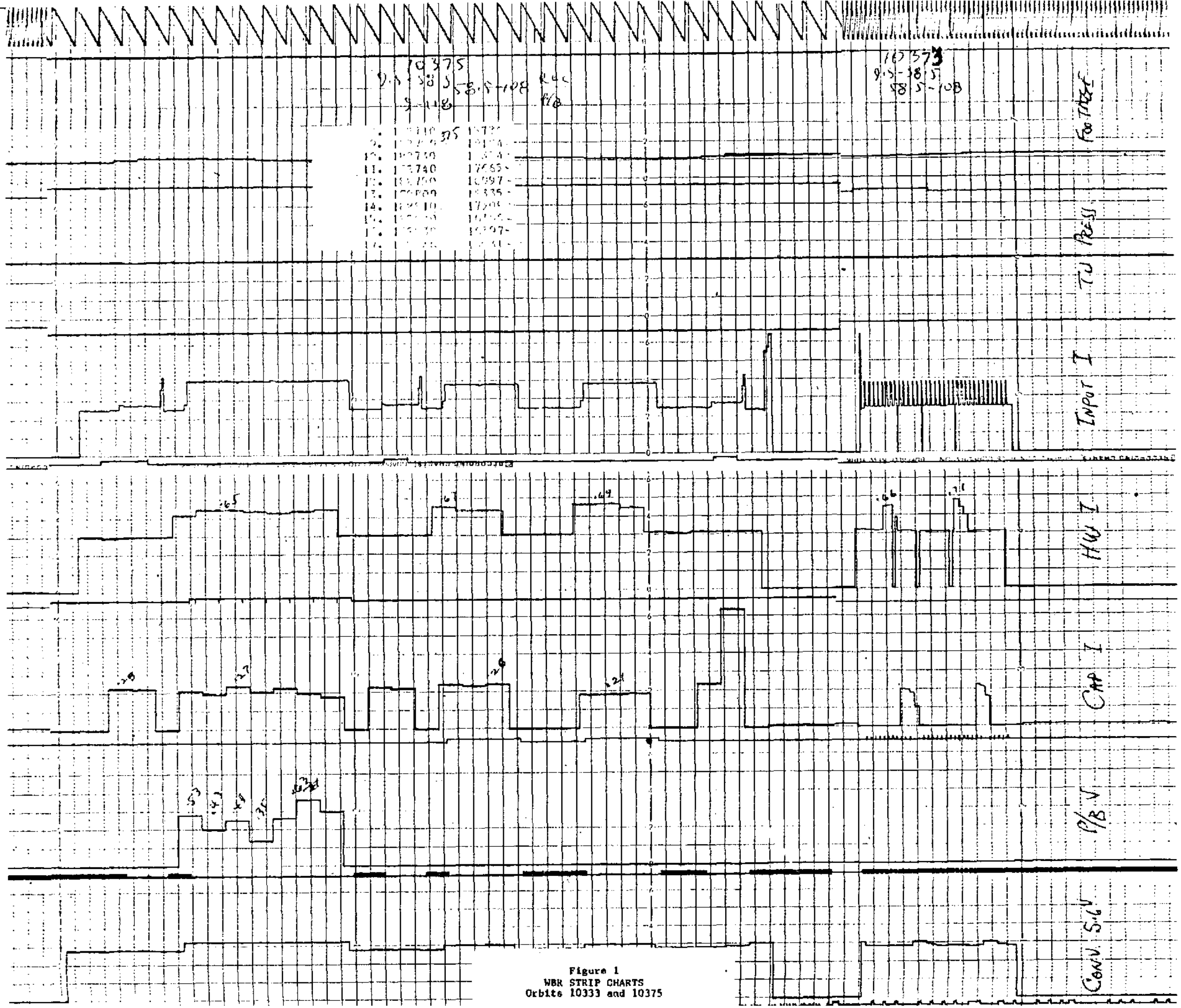

Figure 1
WBR STRIP CHARTS
Orbits 10333 and 10375

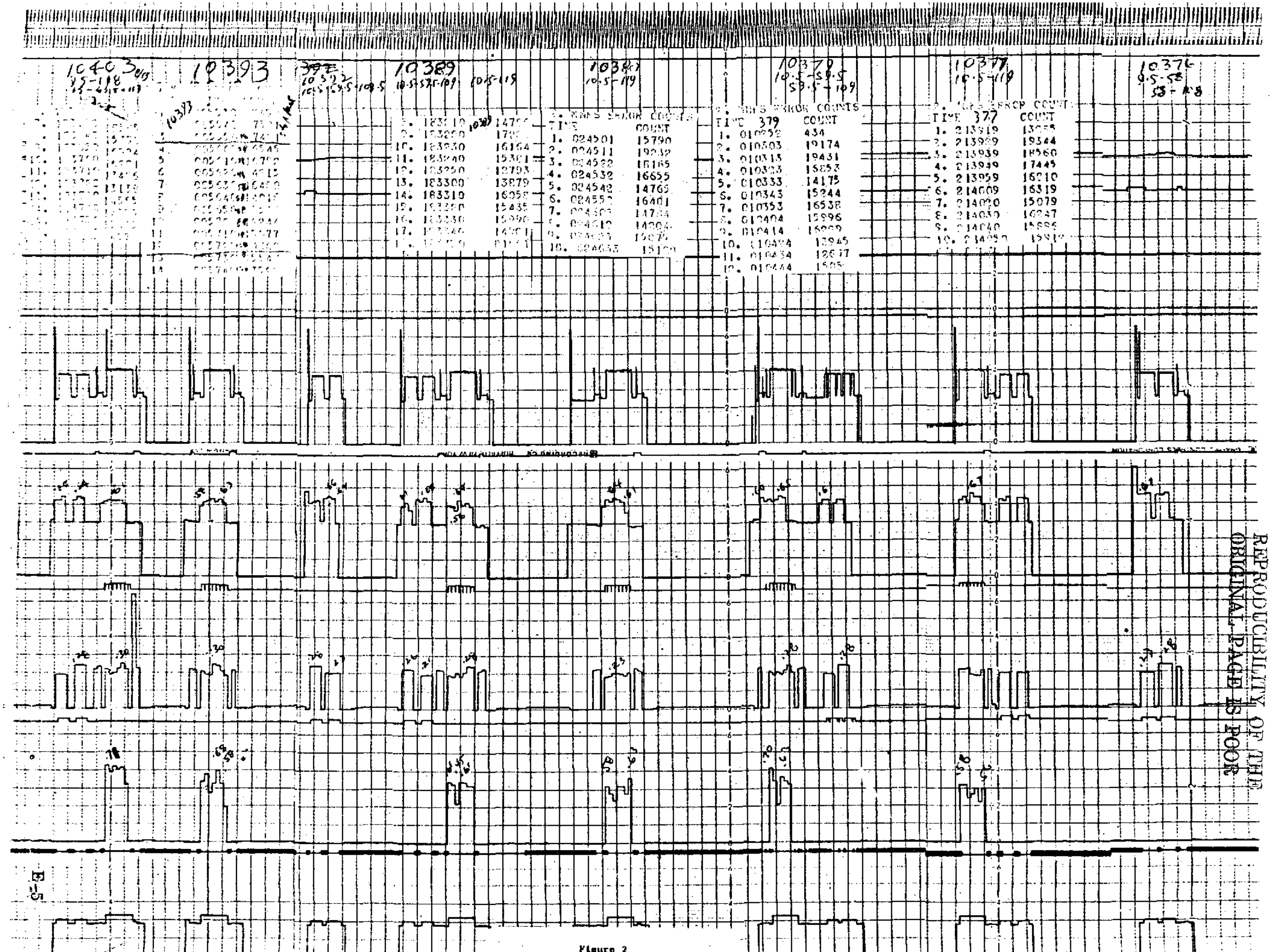

Figure 2
WBR STRIP CHARTS
Orbits 10376 thru 10403

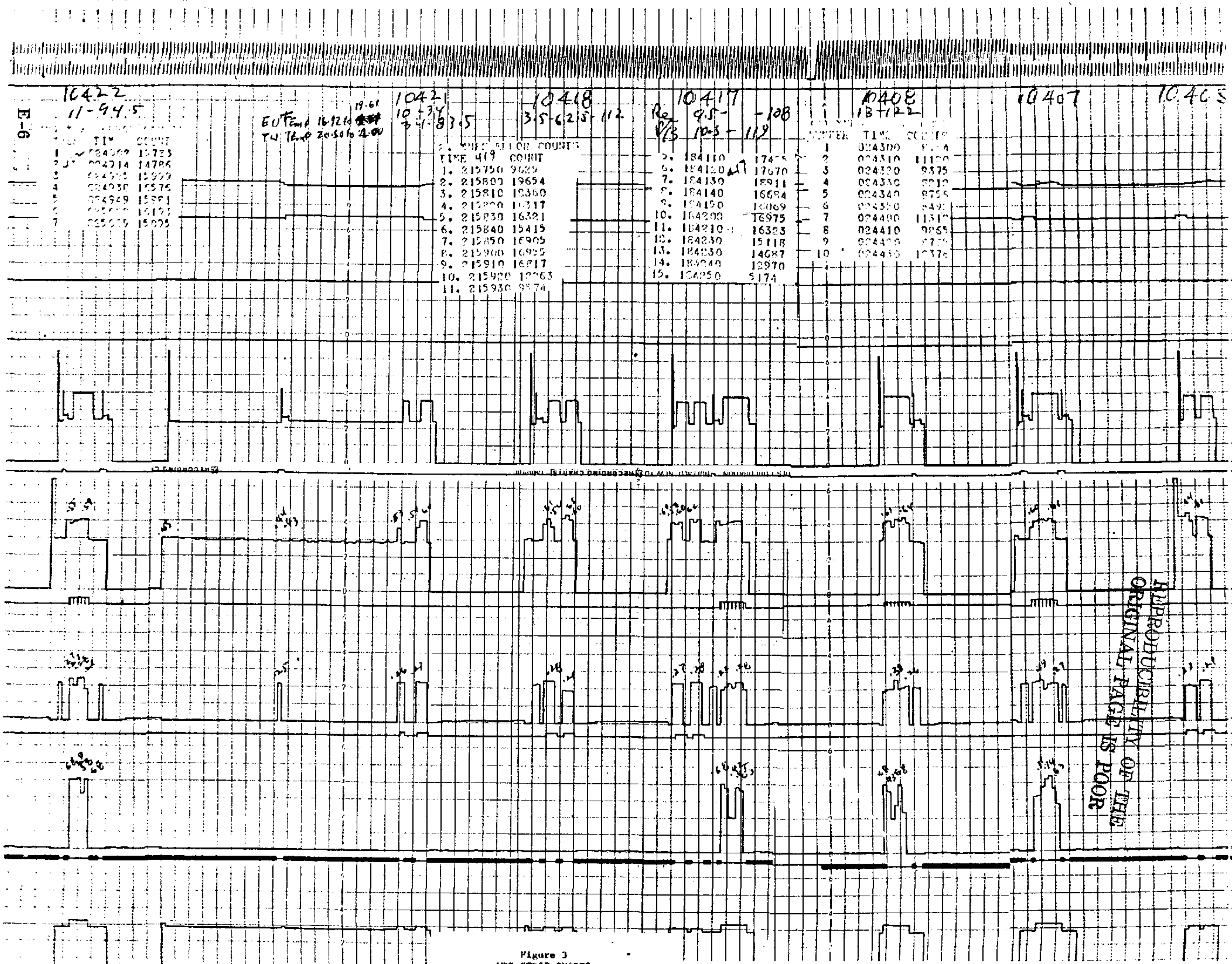

Figure 3
UBR STRIP CHARTS
1040[redacted] 1042[redacted]