CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1014-1 and 1014-2

FTV 1180; J-16

8 April 1966

Approved: [redacted]
Advanced Projects

Approved: [redacted]

~~TOP SECRET~~ [redacted]

NO. [redacted]

5 May 1966

TO: V. Webb
C. Murphy
A. Johnson
[redacted]

THRU: [redacted]

FROM: [redacted]

SUBJECT: MISSION 1014-1 AND 1014-2 FINAL REPORT

Enclosed is the Final Performance Evaluation Report for Mission 1014-1 and 1014-2.

[redacted]
Advanced Projects

IF ENCLOSURES ARE WITHDRAWN OR NOT ATTACHED THE CLASSIFICATION OF THIS DOCUMENT WILL BE CHANGED TO UNCLASSIFIED.

~~TOP SECRET~~ [redacted]

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1180.

Lockheed Missiles and Space Company has the responsibility for evaluating payload performance under the Systems Integration and "J" System contracts.

This document is the final payload test and performance evaluation report for Missions 1014-1 and 1014-2 which was launched on 18 November 1964.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1014-1 and 1014-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-16 payload system, to identify the source of in-flight anomalies and recommend the appropriate corrective action.

The performance evaluation was jointly conducted by representatives of Lockheed Missiles and Space Company (LMSC) and ITEK at the facilities of NPIC and AFSPPF. The off-line evaluation using Corona engineering photography acquired over the United States was performed at the individual contractors plants.

The quantitative data used for this report is obtained from government organizations. The diffuse density data, visual RES values and MTF/AIM resolution are produced by AFSPPF. The vehicle attitude error values, frame correlation times are made at NPIC who also supply the Processing Summary and MTF/AIM resolution reports published by [redacted]

Computer programs developed by A/P are utilized to calculate and plot the frequency distribution of the various contributors to image smear to permit analysis and correlation of the conditions of photography to the information content and quality of the acquired pictures. Computer analysis of the exposure, processing and illumination data provides the necessary data to analyze the exposure criteria selected for the mission.

SECTION 1

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1014, placed into orbit by Flight Test Vehicle #1180 and LV-2A booster #416, consisted of two panoramic cameras, two Stellar-Index cameras, two Mark 5A recovery capsules and a space structure to enclose the cameras and provide mounting surfaces for all equipments. Figure 1-1 presents an inboard profile of the J-16 payload system. This Corona "J" system is designed to acquire search and reconnaissance photography of selected areas of the earth from orbital altitudes. The planned mission was a 5 day Phase 1 and a 4 day Phase 2.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 2035:54 Z (1235:54 PST) on 18 November 1964. Ascent and injection were normal and the achieved orbit was within nominal tolerances. Tracking and command support was effected by the Air Force Satellite Control Facility consisting of tracking and command stations at [redacted] under central control of the Satellite Test Center at Sunnyvale, California. The planned mission was successfully accomplished.

The comparison of the planned and actual orbit parameters is tabulated as follows:

ORBIT PARAMETERS

Parameter	Predicted	Orbit 1 Actuals
Period (Min.)	89.77	89.80
Perigee (N. M.)	104.93	103.25
Apogee (N. M.)	197.18	200.75
Inclination (Deg.)	70.00	70.03
Perigee Latitude (Deg. N.)	65.017	65.645
Eccentricity	0.01286	0.01359

C. PANORAMIC CAMERAS

The Master and Slave panoramic cameras operated throughout both missions with no significant problems. The cloud cover observed in the photography averaged 40% for the entire flight. The photographic quality was lower than the best missions due to atmospheric conditions, low sun elevations and a 10 to 20% decrease in scale.

D. STELLAR-INDEX CAMERAS

The Phase I Stellar/Index camera operated satisfactorily. The Phase II Stellar/Index camera metering became erratic during the operation on orbit 116 and remained in this condition for the duration of the mission.

This failure was first observed on the engineering operation on orbit 127. The stellar/index was programmed for 3 metering cycles but the first metering cycle did not occur. The last two metering cycles of the operation were normal. The cause of this condition is unknown.

E. OTHER SUB-SYSTEMS

The instrumentation and command systems performance was satisfactory. The clock and the pressure make-up system operated successfully on both missions. The PMU used more gas than normally probably due to a leak. Both recovery units were air recovered.

F. CONCLUSIONS

The acquired panoramic photography was of acceptable quality. The Stellar/Index photography was satisfactory except instrument D50 produced some multiple exposures after frame 118 in the B mission.

The objective of improving image contrast from the Master camera through the use of a Wratten 25 filter appears to have been successful.

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM

MISSION 1014

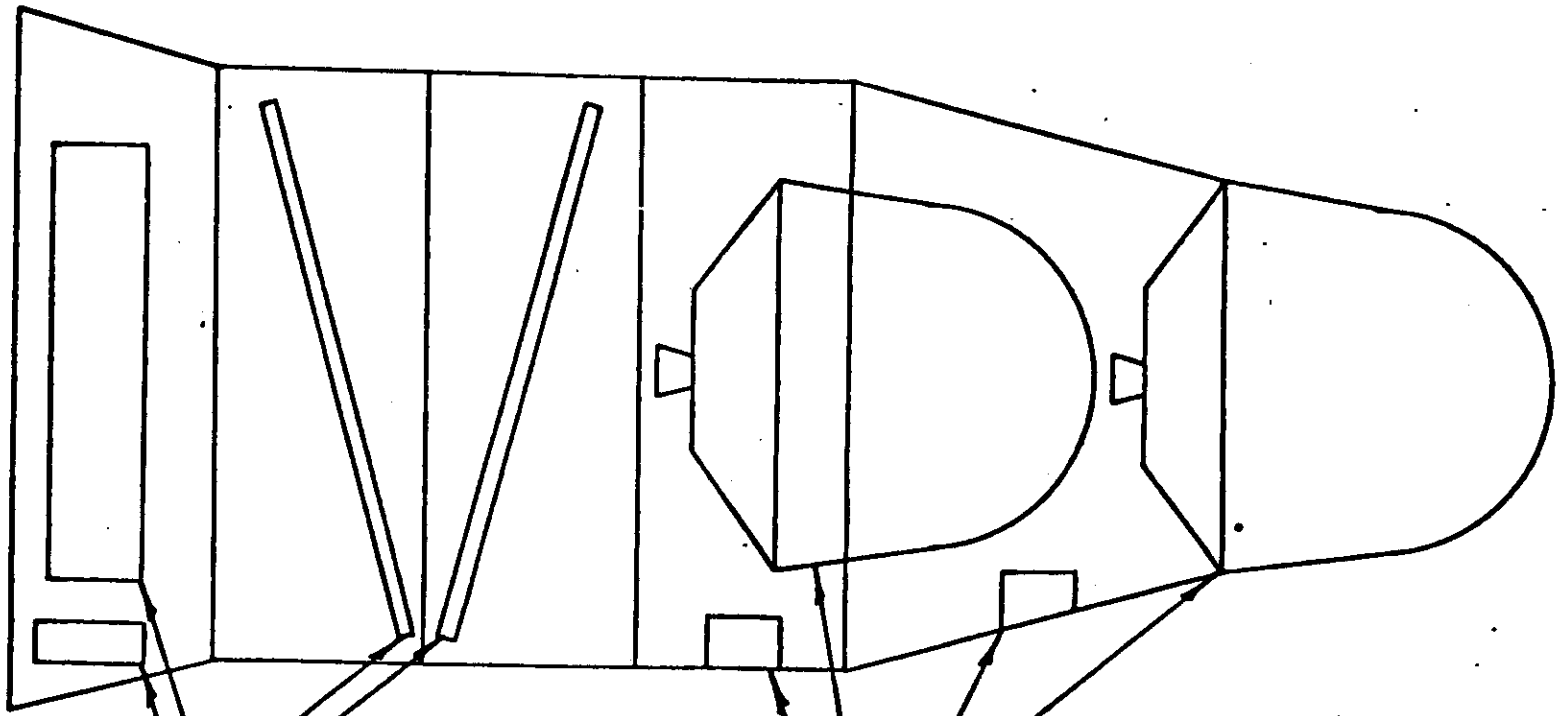


FIGURE 1-1

SECTION 2

PRE-FLIGHT SYSTEMS TESTS

A. ENVIRONMENTAL TESTING

1. Test Objective

As a standard procedure, the J payload systems are subjected to thermal/altitude environmental testing which simulates orbital environment. One of the purposes of this test is to demonstrate the system susceptability to corona discharge. Such discharge fogs the film thus degrading the operational photography.

2. Test Summary

The J-16 payload system was subjected to a Special Corona Test in the HIVOS Chamber on 31 August 1964. A three-day operational program was utilized with the instrument system operated between the hours of 0800 and 1700 of each day and soaked from 1700 to 0800 each night. The test was originally scheduled for four days of operation, but was aborted after three days due to an oil leak from the diffusion pumps of the altitude chamber.

The test was considered unsatisfactory because the payload system failed to achieve the internal payload pressure of 0.5 microns, which was the desired test objective.

J-16 was again altitude tested from 18 through 22 October to determine the Corona susceptibility of a new film metering roller design not heretofore tested as part of any J system. The metering roller design improvements consisted of a rubber covered pressure roller installed on the master instrument only. In previous J systems, the pressure roller has had a metallic surface with a corrosion resistant coating.

During test, J-16 film metering roller Corona was limited to the camera start-up variety for both the master and slave instruments. The film from the master instrument exhibited less than a maximum of six inches of electrostatic Corona fog for most camera starts.

Some master instrument starts contained no Corona. The slave instrument generally exhibited 2 to 3 cycles of start-up Corona for most camera operations. The last slave instrument operation contained 5 cycles of Corona. The 3rd, 4th, 5th, 9th, and 23rd frames of slave photography from the last operation were Corona marked to a density of 0.18 above the base and fog level. Both instruments were tested down to 0.7 microns pressure.

J-16 master and slave Corona was rated acceptable.

3. Panoramic Camera Performance

Both instruments operated satisfactorily throughout the test.

B. RESOLUTION TEST

The dynamic resolution test of the J-16 payload system was performed at the A/P facility on 5 October 1964. Each panoramic camera photographed high and low contrast resolution targets. The resulting through focus resolution data is shown in Figure 2-1 for the Master camera and in Figure 2-2 for the Slave camera.

C. LIGHT LEAK TEST

The examination of the film threaded in the J-16 system during the light leak test determined that the light tight integrity of the system was acceptable for flight.

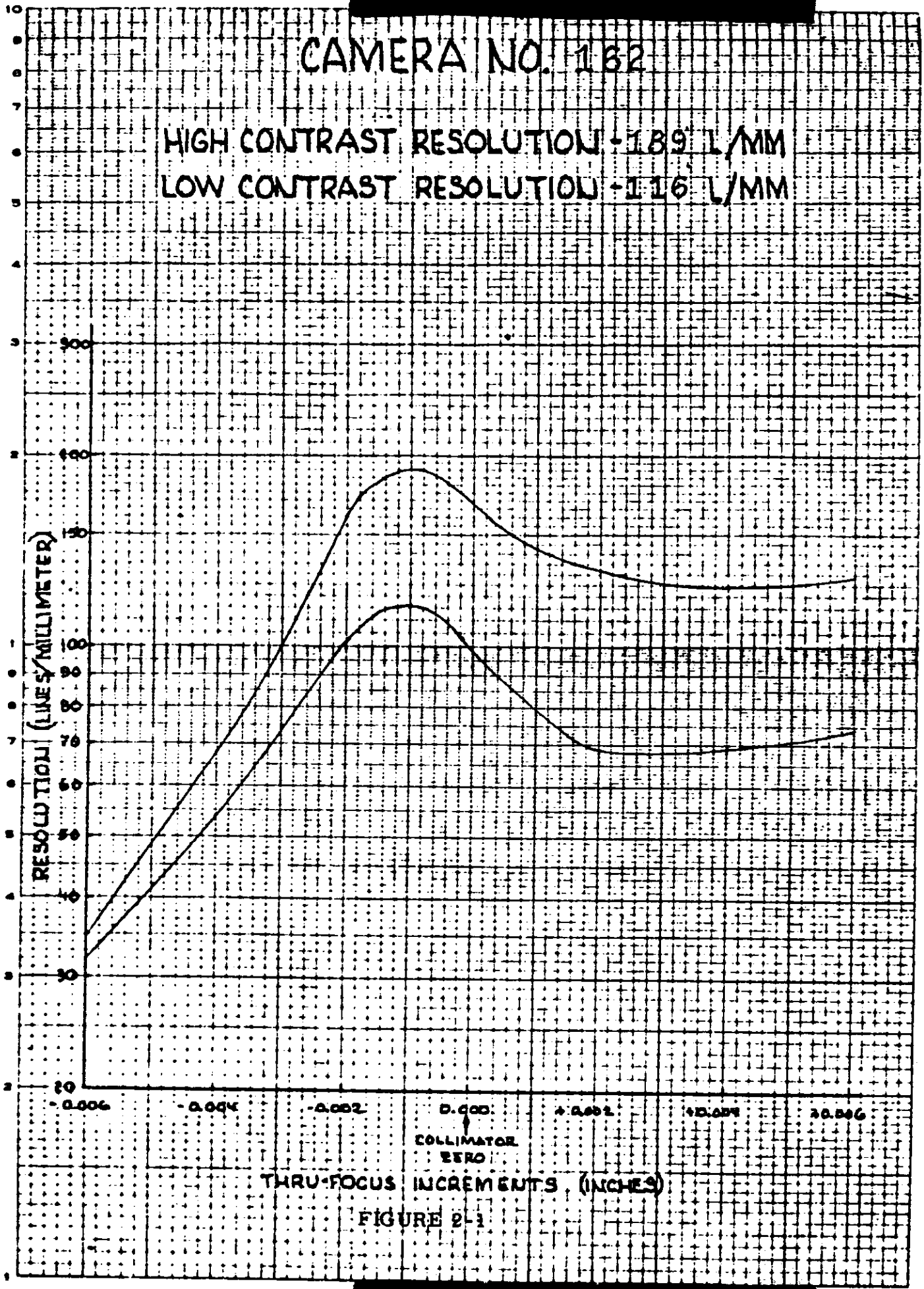

CAMERA NO. 162
HIGH CONTRAST RESOLUTION - 189 L/MM
LOW CONTRAST RESOLUTION - 116 L/MM
RESOLUTION (LINES/MILLIMETER)
300
200
150
100
90
80
70
60
50
40
30
20
-0.006
-0.004
-0.002
0.000
COLLIMATOR ZERO
+0.002
+0.004
+0.006
THRU-FOCUS INCREMENTS (INCHES)

FIGURE 2-1

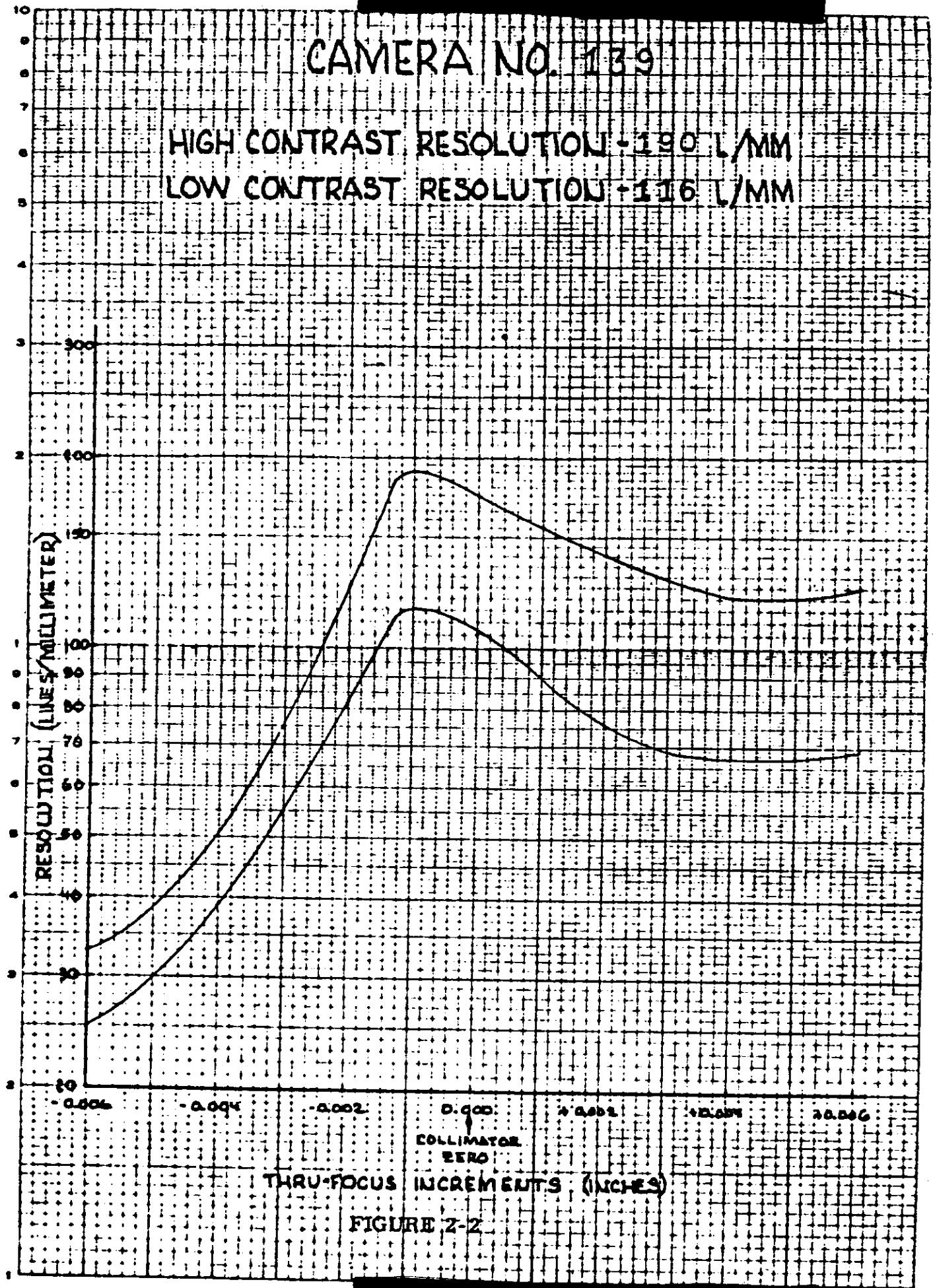


FIGURE 2-2

SECTION 3

FLIGHT OPERATIONS

A. INSTRUMENTATION AND COMMAND PERFORMANCE

All instrumentation systems operated satisfactorily throughout both phases of the mission. All monitors operated properly with the exception of the following:

1) The fairing separation monitor (13-1-49) changed from a normal voltage of 1.3 volts to 4.7 volts at T+94 seconds. This monitor remained in this condition until T+170 seconds, then changed to the normal 1.3 volts. This condition indicates that the switch was sensitive to vibration.

2) The pressure make-up system operated satisfactorily for the duration of the flight. However, the rate of gas consumption for this mission was higher than expected. By comparison with the J-missions, it is concluded that a leak occurred in the system.

A comparative analysis of this system and previous J systems indicated that a difference of approximately 500 lbs. PSIA existed between J-16 and previous J-systems after a comparable period of operating time. The J-16 PMU gas would have been depleted after approximately 250 minutes of operation.

B. PANORAMIC CAMERA PERFORMANCE

Both panoramic cameras operated satisfactorily throughout Phase 1 and Phase 2 of the mission. Camera operation was observed on 10 engineering operations during Phase 1 and 6 engineering operations during Phase 2 of the mission. No camera anomalies were present in either Phase 1 or Phase 2. The following camera observations are significant:

1) The maximum cycle rate deviations were 0.9% slow to 1.3% fast on the master camera and 3.0% slow to 0.4% slow on the slave camera.

2) The cut and wrap operation was normal.

3) The Total film consumption for Phase 1 was 2932 frames on the master instrument and 2853 frames on the slave instrument. The total film consumption for Phase 2 was 2950 frames for the master instrument and 2889 frames for the slave instrument.

Utilizing nominal values for payload consumption, the cycle counters on the master instrument indicated that the master camera payload should have been depleted during the last operation of Phase 2. However, the film supply was not depleted during the last operation on orbit 143. This is attributed to the supply spool length being greater than the nominal value of 16000 ft (± 80 ft.).

The slave camera did not deplete the film supply. Approximately 368 feet of film was left on orbit after the last camera operation on orbit 143. The total film supply was based on the total film supply of the master camera.

The following is a tabulation of camera payload consumption for this mission:

	Master	Slave
Off Spool	0	0
Control Sample	93	93
Phase 1 - Recovered	8193	7985
Phase 2 - Recovered	7814	7654
Left on Orbit	*	368
Total	16,100	16,100**

Note: All categories are listed in feet. Nominal supply spool length is 16000 ft. ± 80 ft.

* Unknown

** Total film length is based on total film length of master camera.

Table 3-1 is a tabulation of cycle rate errors observed on all engineering passes during Phase 1 and Phase 2 of the mission.

CYCLE RATE DATA FOR RAMP 6 AMPLITUDE 6

Orbit & Station	Time Up The Ramp	Nominal	Actual No. 1	Actual No. 2	% Error No. 1	% Error No. 2
			PHASE 1			
01 [redacted]	2060	2.322	2.320	2.340	0	0.8S
09 [redacted]	825	3.137	3.095	3.150	1.3 F	0.4S
16 [redacted]	2275	2.412	2.412	2.448	0	1.5S
32 [redacted]	2290	2.421	2.425	2.460	0.2S	1.6S
41 [redacted]	875	3.084	3.060	3.120	0.8F	1.2S
48 [redacted]	2313	2.437	2.440	2.470	0.1S	1.4S
57 [redacted]	904	3.057	3.034	3.094	0.8F	1.2S
64 [redacted]	2325	2.444	2.465	2.490	0.9S	1.9S
73 [redacted]	925	3.032	3.025	3.090	0.2F	1.9S
79 [redacted]	2452	2.540	2.536	2.580	0.2F	1.6S
			PHASE 2			
89 [redacted]	948	3.007	3.012	3.084	0.2S	2.6S
95 [redacted]	2391	2.491	2.500	2.510	0.4S	0.8S
111 [redacted]	2428	2.519	2.525	2.586	0.2S	2.7S
127 [redacted]	2513	2.598	2.620	2.672	0.8S	2.8S
137 [redacted]	1007	2.956	2.968	3.040	0.4S	2.8S
143 [redacted]	2469	2.563	2.580	2.640	0.7S	3.0S

F = FAST S = SLOW

TABLE 3-1

The vehicle was not de-activated after the Phase 2 recovery. The stored orbital program was depleted one day after the Phase 2 recovery. This precluded instrument operation after the Phase 2 recovery in order to monitor camera payload depletion.

The vehicle battery was depleted between orbit 177 and orbit 181.

The vehicle re-entered on orbit 281 on 6 December 1964.

C. STELLAR/INDEX PERFORMANCE

The Phase 1 Stellar/Index camera operated satisfactorily. The Phase 2 Stellar/Index camera metering became erratic during the operation on orbit 116 and remained in this condition for the duration of the mission.

This failure was first observed on the engineering operation on orbit 127. The stellar/index was programmed for 3 metering cycles but the first metering cycle did not occur. The last two metering cycles of the operation were normal. The cause of this condition is unknown.

The Index camera film supply was depleted during the last engineering operation of Phase 1.

The Phase 2 slewing of the Stellar/Index camera was observed on orbit 145 over the [redacted] Tracking Station. The telemetry monitors indicated that film was available after completion of the slewing operation. It is unknown how much payload was left on orbit.

D. CLOCK PERFORMANCE

The clock system operation was satisfactory throughout the mission.

Time correlation was made utilizing the slant range to correct for T/M transmission time. The correction for each readout is included in Table 3-2.

The data was fitted to a first and second degree polynomial which is included in Table 3-3 and Table 3-4. By comparison of the two sigma values, it was concluded that the linear fit data was preferable.

AYLOAD J-16 VEH 1180 MISSIONS 1014-1,-2 TIME CORRELATION

S. T. INPUT		COR SYS TIME		R ST COR	RANGE	REV	S
0.35026075000000000	05	0.35026069942391340	05	.00505761	818.66	9	
0.74148570999999990	05	0.74148569615194540	05	.00138481	224.15	16	
0.34690472999999990	05	0.34690470295665340	05	.00270433	437.74	25	
0.73898960000000000	05	0.73898957804890950	05	.00219511	355.31	32	
0.34523997999999990	05	0.34523994209429630	05	.00379057	613.57	41	
0.73628281999999990	05	0.73628278980491410	05	.00301951	488.76	48	
0.34229196999999990	05	0.34229193997646970	05	.00300235	485.98	57	
0.73334064999999990	05	0.73334061139312610	05	.00386069	624.92	64	
0.33937685000000000	05	0.33937682054672590	05	.00294533	476.75	73	
0.67733269999999990	05	0.67733266035467400	05	.00396453	641.72	79	
0.33607922000000000	05	0.33607919210442920	05	.00278956	451.54	89	
0.67085619999999990	05	0.67085614909583050	05	.00509042	823.97	95	
0.32960869999999990	05	0.32960864653561090	05	.00534644	865.41	105	
0.67032236999999980	05	0.67032234072433850	05	.00292757	473.87	111	
0.32870781000000000	05	0.32870777994994450	05	.00300501	486.41	121	
0.66643768999999990	05	0.66643766446641340	05	.00255336	413.30	127	
0.32466892999999990	05	0.32466889649536000	05	.00335046	542.33	137	
0.66232632999999990	05	0.66232630494401310	05	.00250560	405.57	143	

TABLE 3-2

YLGAD J-16 VEH 1180 MISSIONS 1014-1,-2 TIME CORRELATION

ORDER FIT 1

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
68994.7579	310459.3679	68994.7599	-0.001912	0	1
69081.6479	310546.2559	69081.6479	0.000093	0	1
35026.0699	362890.6819	35026.0709	-0.001023	9	1
74148.5696	402013.1799	74148.5667	0.002849	16	1
34690.4702	448955.0859	34690.4701	0.000167	25	1
73898.9578	488163.5759	73898.9579	-0.000120	32	1
34523.9942	535188.6069	34523.9862	0.007928	41	1
73628.2789	37421.9939	73628.2830	-0.004103	48	1
34229.1939	84422.9059	34229.1924	0.001555	57	1
73334.0611	123527.7789	73334.0632	-0.002105	64	1
33937.6820	170531.4059	33937.6876	-0.005548	73	1
67733.2660	204326.9879	67733.2677	-0.001668	79	1
33607.9192	256601.6419	33607.9187	0.000445	89	1
67085.6149	290079.3349	67085.6098	0.005026	95	1
32960.8646	342354.6049	32960.8769	-0.012292	105	1
67032.2340	376425.9569	67032.2270	0.007041	111	1
32870.7779	428664.5069	32870.7740	0.003900	121	1
66643.7664	462437.4989	66643.7641	0.002250	127	1
32466.8896	514660.6279	32466.8902	-0.000612	137	1
66232.6304	11555.4599	66232.6323	-0.001870	143	1

A0=-0.24146459060 06 A1= 0.9999999437970 00

SIGMA=0.00427 NO. POINTS= 20

RATIO OF CLOCK TIME TC SYS TIME= 0.1000000056200 01

TABLE 3-3

AYLOAD J-16 VEH 1180 MISSIONS 1014-1,-2 TIME CORRELATION

ORDER FIT 2

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
68994.7579	310459.3679	68994.7601	-0.002142	0	1
69081.6479	310546.2559	69081.6481	-0.000137	0	1
35026.0699	362890.6819	35026.0710	-0.001149	9	1
74148.5696	402013.1799	74148.5668	0.002789	16	1
34690.4702	448955.0859	34690.4701	0.000176	25	1
73898.9578	488163.5759	73898.9578	-0.000063	32	1
34523.9942	535188.6069	34523.9861	0.008031	41	1
73628.2789	37421.5939	73628.2829	-0.003971	48	1
34229.1939	84422.9059	34229.1922	0.001711	57	1
73334.0611	123527.7789	73334.0630	-0.001940	64	1
33937.6820	170531.4059	33937.6874	-0.005382	73	1
67733.2660	204326.9879	67733.2675	-0.001509	79	1
33607.9192	256601.6419	33607.9186	0.000581	89	1
67085.6149	290079.3349	67085.6097	0.005138	95	1
32960.8646	342354.6049	32960.8768	-0.012228	105	1
67032.2340	376425.9569	67032.2270	0.007065	111	1
32870.7779	428664.5069	32870.7741	0.003850	121	1
66643.7664	462437.4989	66643.7643	0.002144	127	1
32466.8896	514660.6279	32466.8904	-0.000817	137	1
66232.6304	11555.4599	66232.6326	-0.002147	143	1

A0=-0.24146458950 06 A1= 0.9999999399480 00
A2= 0.28023914209170-14

SIGMA=0.00427 NO. POINTS= 20

TABLE 3-4

E. TEMPERATURE ENVIRONMENT

Temperature data was obtained from real time orbits acquired by the [redacted] Tracking Station. The self heating corrections utilized were established from data acquired during Environmental Testing in the HIVOS Chamber. All temperatures were corrected for errors due to voltage biases in the supply voltage.

This system was the fourth payload system to utilize the universal paint pattern. After temperature stabilization, the master instrument temperature average for Phase 1 and Phase 2 was 61°F and 50°F respectively. The slave instrument temperature average for Phase 1 and Phase 2 was 58°F and 46°F. Refer to Table 3-5 and 3-6.

A comparison of the actual versus the predicted temperature environment is included in Figures No. 3-1 to 3-3.

The recovery cassette temperature sensor in Phase 1 indicated the recovery system was approximately 28°F. This temperature was approximately 10 - 15°F cooler than previously encountered by other systems. However, this condition apparently did not degrade the system performance. The temp sensor was subjected to a post flight ground test and the original flight calibration was verified to be correct.

TABLE 3-5

J-16 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																		
Master Camera	0	9	16	25	32	42	48	57	64	73	79	89	95	105	111	121	127	137	143
3	67	57	55	58	53	55	52	53	51	51	50	46	45	45	44	46	44	46	44
4	71	65	62	66	60	63	59	59	56	59	55	53	52	51	51	52	50	51	50
5	68	66	64	68	61	65	59	59	58	58	56	53	51	51	49	51	49	51	48
6	67	73	72	72	68	69	66	66	63	63	62	46	55	55	54	54	53	52	52
7	66	69	67	68	64	67	63	63	61	62	60	55	54	55	53	54	53	53	53
8	72	67	66	70	62	67	60	62	59	61	58	55	52	54	50	52	50	52	50
9	65	70	67	69	63	67	61	63	59	61	58	54	52	51	50	51	48	50	48
10	66	63	62	63	59	61	58	58	55	56	54	51	50	50	48	50	47	48	47
11	98	77	72	78	66	70	66	68	61	65	60	58	53	60	53	55	53	55	52
12	72	56	54	61	53	58	51	53	50	53	49	48	44	48	43	47	43	48	42
13	69	70	69	71	63	65	63	62	60	62	59	54	53	50	52	49	52	50	50
AVG	68	65	64	67	61	64	59	61	57	59	56	51	51	51	49	50	49	50	48
Slave Camera																			
3	66	72	66	69	62	66	60	60	56	56	53	51	46	49	43	45	41	43	42
4	67	69	63	69	59	64	58	59	52	57	52	51	45	49	43	46	41	44	41
5	66	64	60	65	57	61	56	56	51	54	51	49	45	49	44	46	42	44	43
6	68	62	60	62	58	59	57	57	52	56	53	50	48	49	47	48	45	47	47
7	72	61	62	67	60	62	59	61	56	59	55	53	50	55	50	51	48	50	48
8	66	65	58	63	55	60	55	56	52	54	51	49	45	48	43	45	43	45	43
9	67	59	53	58	51	55	51	52	50	51	47	46	43	45	42	44	42	45	42
10	67	59	58	60	56	57	54	56	51	53	51	48	46	50	44	44	44	45	43
11	90	61	61	61	58	58	56	56	55	54	53	49	47	47	46	47	45	46	45
12	67	71	63	69	60	66	58	60	55	58	52	53	46	51	43	46	42	45	42
13	67	60	62	62	59	59	58	57	56	55	56	49	49	45	47	44	47	45	47
AVG	67	64	60	64	58	61	57	57	53	55	52	50	46	50	45	46	44	46	44
Supply Spool																			
1	69	53	56	58	56	55	52	53	52	52	50	48	44	48	42	43	41	43	41
2	67	62	60	63	58	61	57	58	56	56	53	49	46	49	42	44	43	43	42

TABLE 3-6

J-16 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																		
	0	9	16	25	32	42	48	57	64	73	79	89	95	105	111	121	127	137	143
Fairing (A) Barrel #1 (B)																			
1		43	27	43	24	40	21	40	80	40	24	-7	0	0	-3	0	0	3	0
2		9	-4	9	-4	9	-4	9	-4	12	-4	0	-7	7	-3	10	3	13	3
3		-1	2	2	2	-1	-1	-1	-4	2	2	22	18	28	19	22	18	22	18
4	206	56	47	53	47	50	44	47	40	50	40	28	25	28	22	22	16	19	9
5	220	79	72	79	66	72	60	69	53	66	50	28	28	28	21	24	21	21	18
6	199	66	66	66	57	60	47	57	41	54	38	-	-	-	-	-	-	-	-
Barrel #2																			
1	133	49	59	49	56	43	46	36	40	36	33	24	20	20	17	17	14	17	14
2	127	49	71	49	62	43	53	36	46	33	43	27	27	27	21	21	17	14	11
3	161	17	27	20	23	17	20	14	17	14	24	11	14	20	24	14	17	14	14
4	194	0	-6	0	-10	0	-10	0	-6	3	-3	0	-10	3	-3	7	0	10	3
5	174	13	13	13	13	13	13	13	13	16	13	0	6	6	6	10	6	16	6
Conic Adapter																			
1	145	76	73	76	66	70	60	60	51	57	48	38	28	35	25	32	22	28	19
Clock																			
1	95	75	71	75	71	73	69	71	69	71	67	60	56	58	56	58	54	60	54
2	97	73	69	73	69	71	67	69	65	67	65	58	54	56	52	56	50	56	52
Thrust Cone "A" to "B" SRV																			
1	116	47	42	44	39	41	39	42	36	41	37	56	55	54	54	54	54	55	54
2	78	66	60	61	56	56	54	55	51	52	50	57	55	55	54	52	52	52	52
Stellar/Index "A" to "B"																			
1	82	66	61	64	61	61	58	54	54	54	54	46	49	52	46	46	46	49	46
2	75	63	60	60	57	60	57	57	54	54	54	47	47	43	43	47	47	43	43
Recovery Battery "B" SRV																			
1	72	74	73	72	71	71	71	69	69	66	67	92	88	81	85	92	94	83	81
Master Cassette "A" SRV																			
2	89	38	31	32	25	29	25	30	26	28	26	-	-	-	-	-	-	-	-

J-16
PREDICTED AND ACTUAL TEMPERATURES

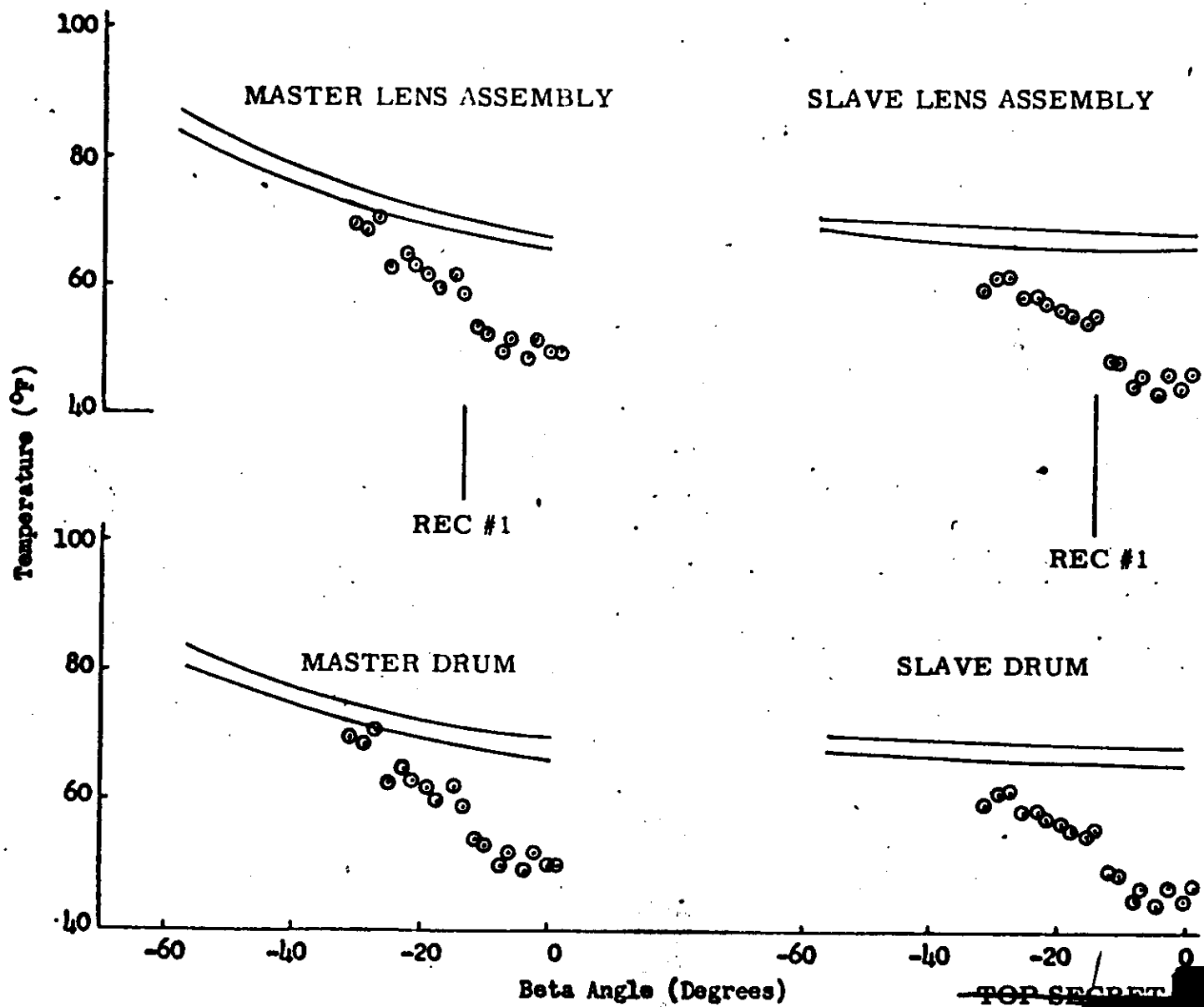


FIGURE 3-1

J-16
PREDICTED AND ACTUAL TEMPERATURES

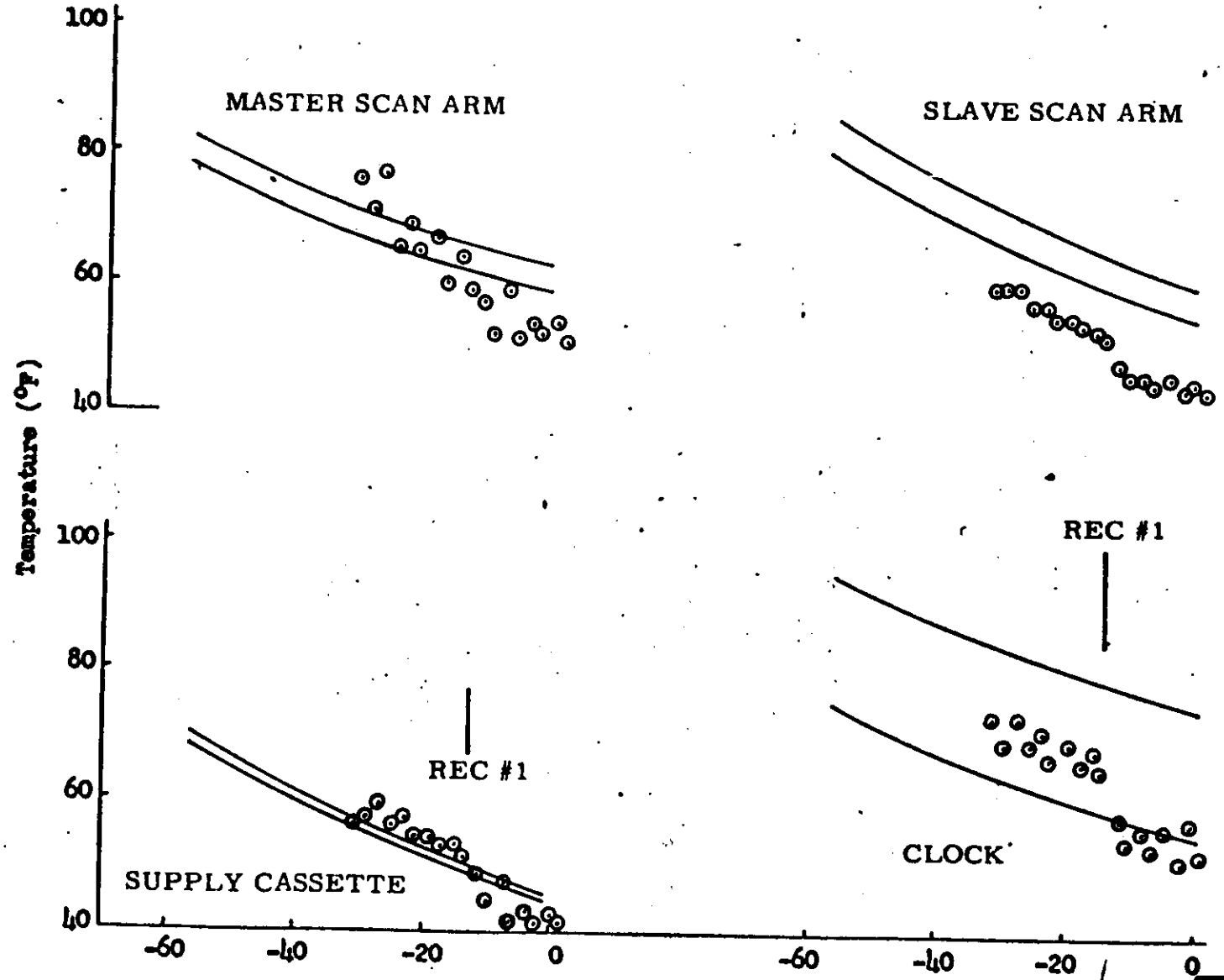


FIGURE 3-2

J-16
PREDICTED AND ACTUAL TEMPERATURES

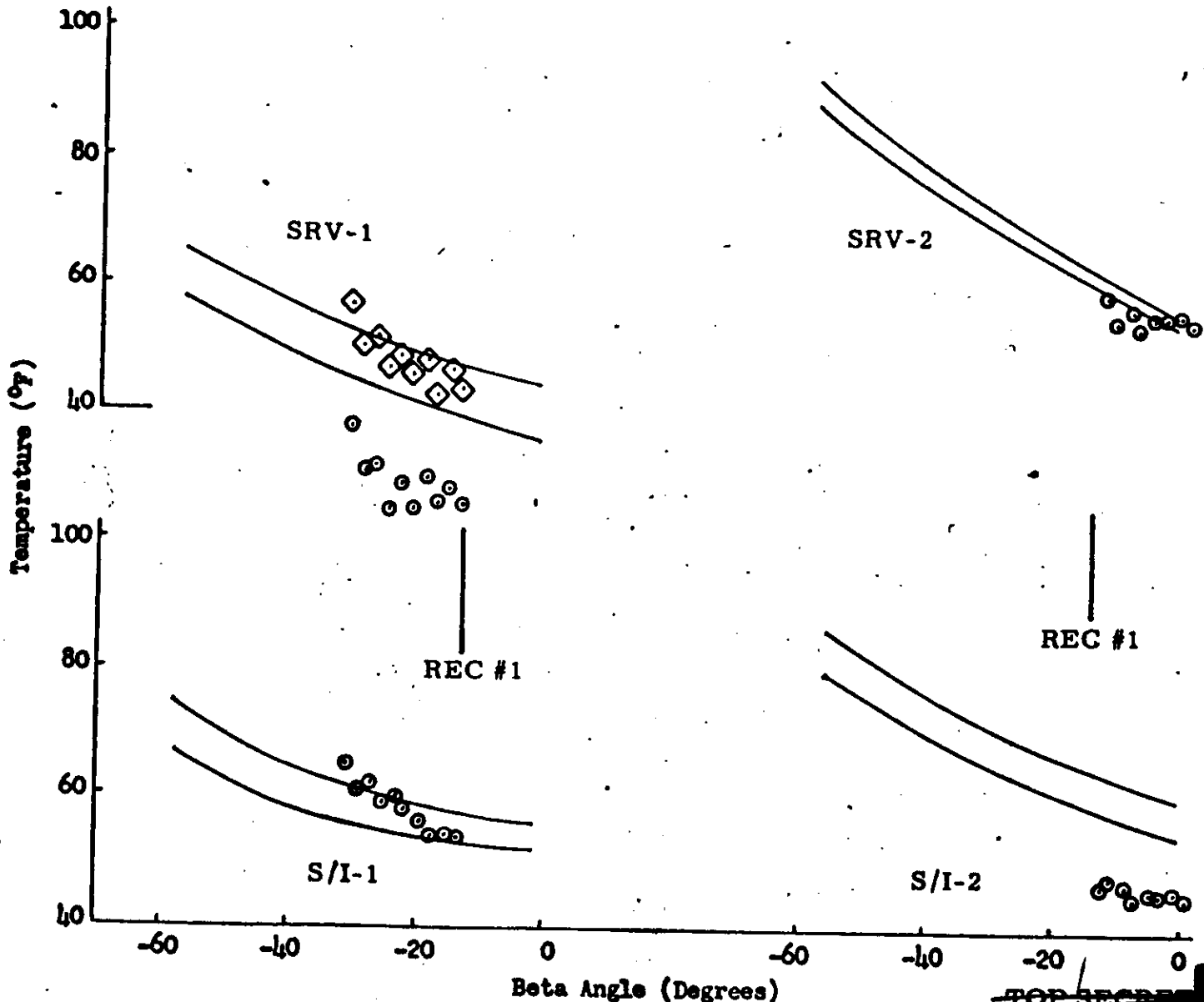


FIGURE 3-3

SECTION 4

MISSION 1014-1 RECOVERY SYSTEM

SRV #659 was received at A/P on 4 June 1964. The receiving weight was 159.5 pounds. After modification and incorporation of outstanding E.O.'s, the SRV was delivered to Systems Test for mating to the J-16 system. The capsule was delivered to VAFB on 26 October 1964.

A successful air catch was accomplished on orbit 81. The impact point was approximately 50 miles south of the predicted impact point. However, this distance is within the normal prediction tolerances. The payload weights utilized in the calculation of the predicted impact point were verified to be correct. All capsule re-entry events were within the prediction tolerances for each event. The sequence of events is contained in Table 4-1.

The amplitude of Channel 7 changed during retro from 2.1 to 3.3 volts. The amplitude also decreased to 3.0 volts at the initial firing of the "thrust cone" separate bolts. This condition is indicative of a possible grounding of the de-spin monitor line at the firing of the "thrust cone" bolts.

A ground test was conducted to duplicate the aforementioned condition, but this condition could not be duplicated.

Post flight inspection indicated that normal paint blistering was the only damage of the recovered capsule. Refer to Figures Nos. 4-1 and 4-2 for the temperature environment encountered during re-entry.

MISSION 1014-1

RECOVERY SEQUENCE OF EVENTS

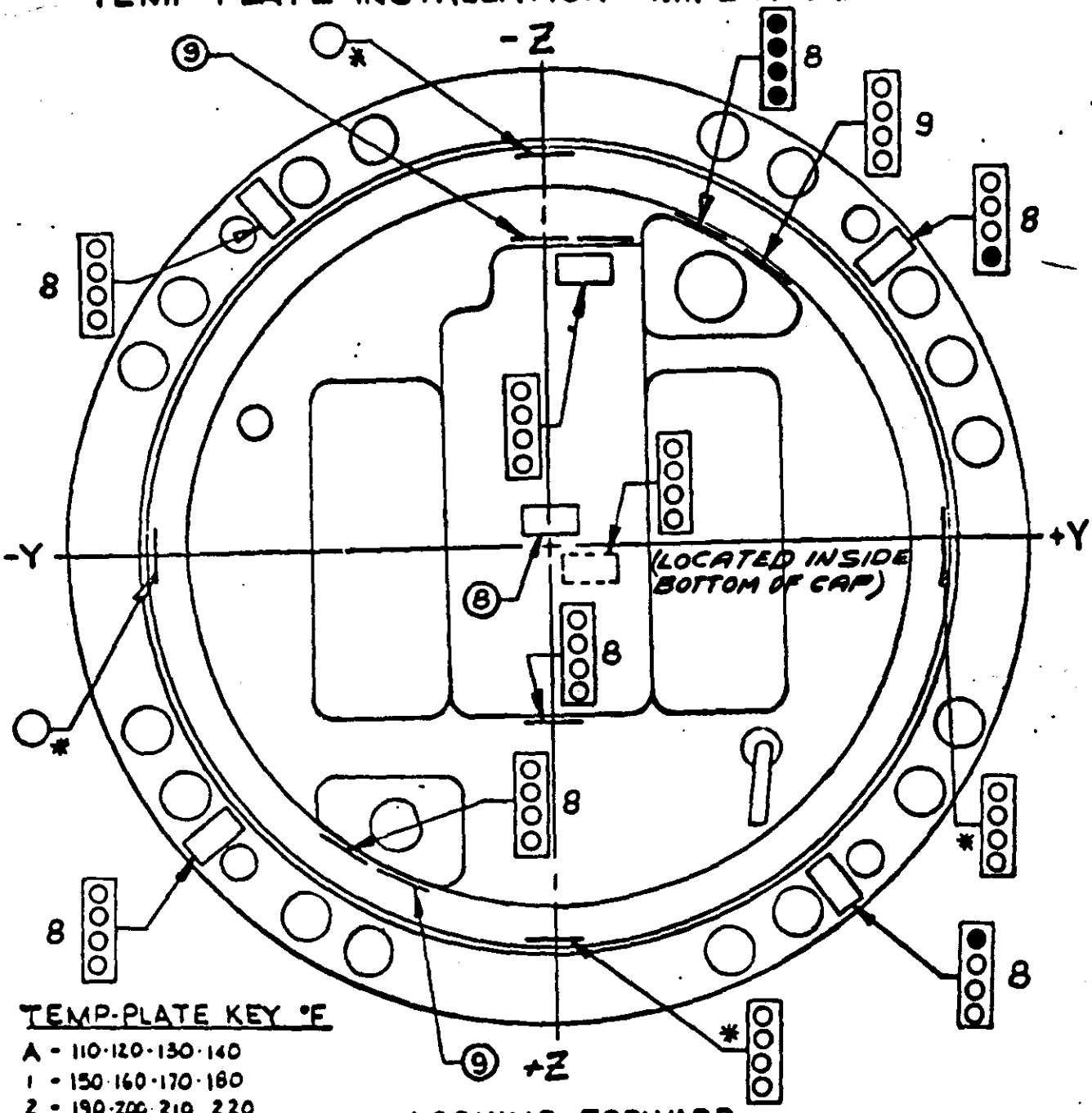
Event	Delta Time (Seconds) Actual	Nominal Events + ΔT
Transfer		
Electrical Disconnect	0.94	0.900 $^{+0.430}_{-0.400}$
* Separation	1.96	2.0 ± 0.250
** Spin	3.60	3.4 ± 0.30
Retro	7.32	7.55 ± 0.45
Despin	10.74	10.75 ± 0.54
T/C Separation	1.50	1.5 ± 0.15
"G" Switch Open	567.77	514.0 $^{+65.0}_{-50.0}$
Parachute Cover Off	32.88	34.0 ± 1.5
Drogue Chute Deployed	0.66	0.63 $^{+0.08}_{-0.06}$
Drogue Chute Release	10.09	10.14 $^{+.48}_{-.40}$
Main Chute Deployed	0.55	0.52 $^{+.13}_{-.12}$
Main Chute Disreefed	4.79	4.46 $^{+.49}_{-.29}$

* From Transfer
** From Electrical Disconnect

Spin Rate: 66 RPM
Despin Rate: 4.1 RPM
Retro Velocities: 1059.2 Ft/Sec.

TABLE 4-1

TEMP-PLATE INSTALLATION - Mk V-A CAPSULE



LOOKING FORWARD

TEMP-PLATE KEY °F

A - 110·120·130·140
1 - 150·160·170·180
2 - 190·200·210 220
3 - 230 240·250·260
4 - 270 280 290·300
5 - 310·320 330 340
6 - 350 360·370 380
7 - 390 410·435·450
8 - 100·150·200·250
9 - 300·350·400·450

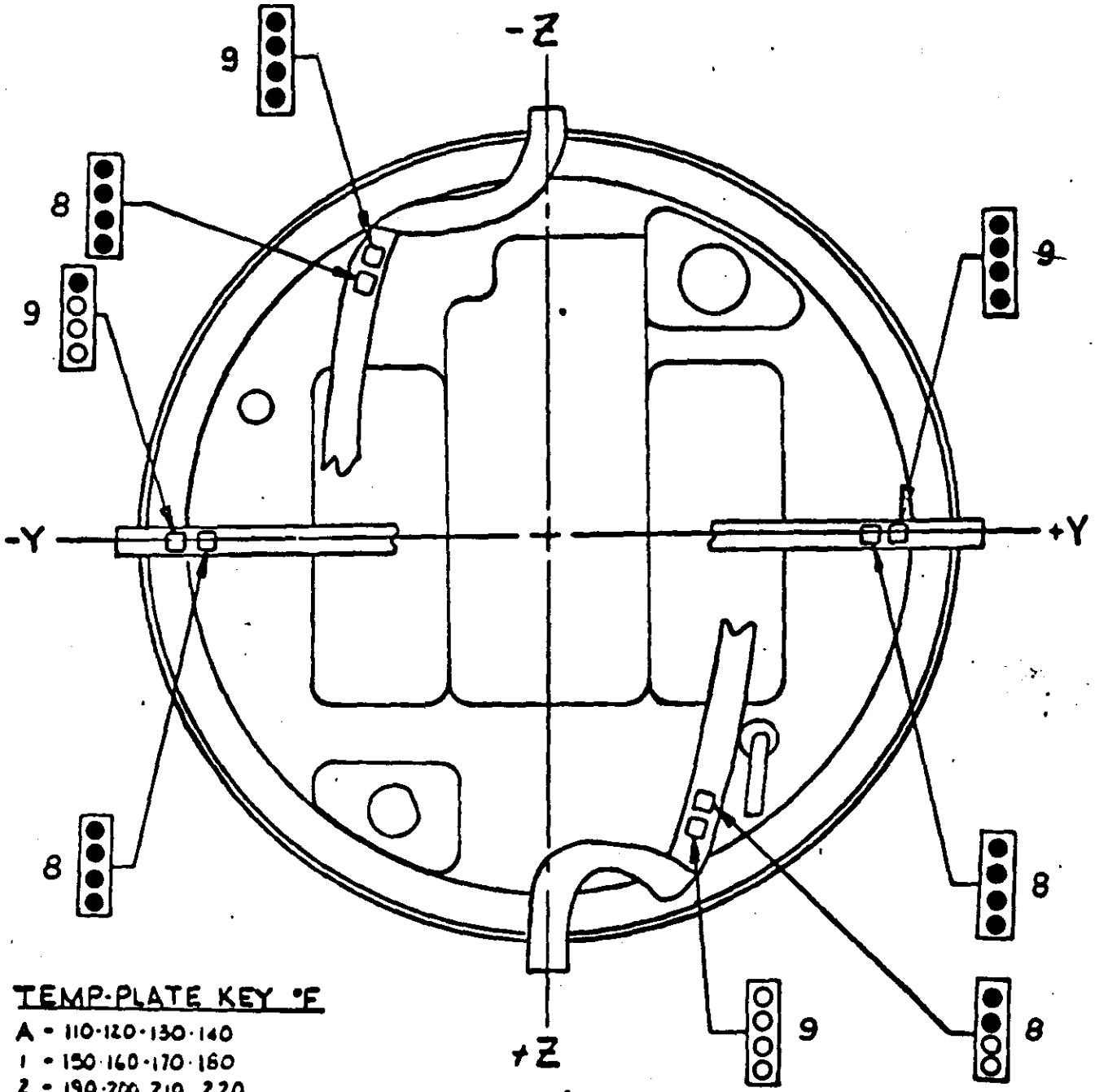
*LOCATED [illegible]

● INDICATOR TURNED BLACK TEMP REACHED OR EXCEEDED INDICATED LEVEL

1014-1

FIGURE 4-1

TEMP·PLATE INSTALLATION - Mk V·A CAPSULE



TEMP-PLATE KEY °F

A - 110·120·130·140
1 - 150·160·170·180
2 - 190·200 210 220
3 - 230·240·250·260
4 - 270 280·290·300
5 - 310·320 330 340
6 - 350·360·370 380
7 - 390·410·435·450
8 - 100·150·200·250
9 - 300·350·400·450

LOOKING FORWARD

USE OF TEMP PLATES ON PARACHUTE SHROUDS

● INDICATOR TURNED BLACK TEMP REACHED OR EXCEEDED INDICATED LEVEL

1014-1

FIGURE 4-2

SECTION 5

MISSION 1014-2 RECOVERY SYSTEM

SRV #660 was received at A/P on 14 August 1964. The receiving weight was 152.1 pounds. After modification and incorporation of outstanding E.O.'s the SRV was delivered to Systems Test for mating to the J-16 system. The capsule was delivered to VAFB on 4 November 1964.

A successful air catch was accomplished on orbit 145. The point of impact was nominal. All capsule re-entry events occurred within the specified tolerances for each event, with the exception of main chute separation which occurred 0.55 seconds early. See Table 5-1.

The Channel 7 condition present during Phase 1 was also present during Phase 2. A ground test was conducted to try and duplicate the aforementioned condition, but this condition could not be duplicated.

Post flight inspection indicated that normal paint blistering was the only damage of the recovered capsule. Refer to Figure Nos. 5-1 and 5-2 for the temperature environment encountered during re-entry.

MISSION 1014-2

RECOVERY SEQUENCE OF EVENTS

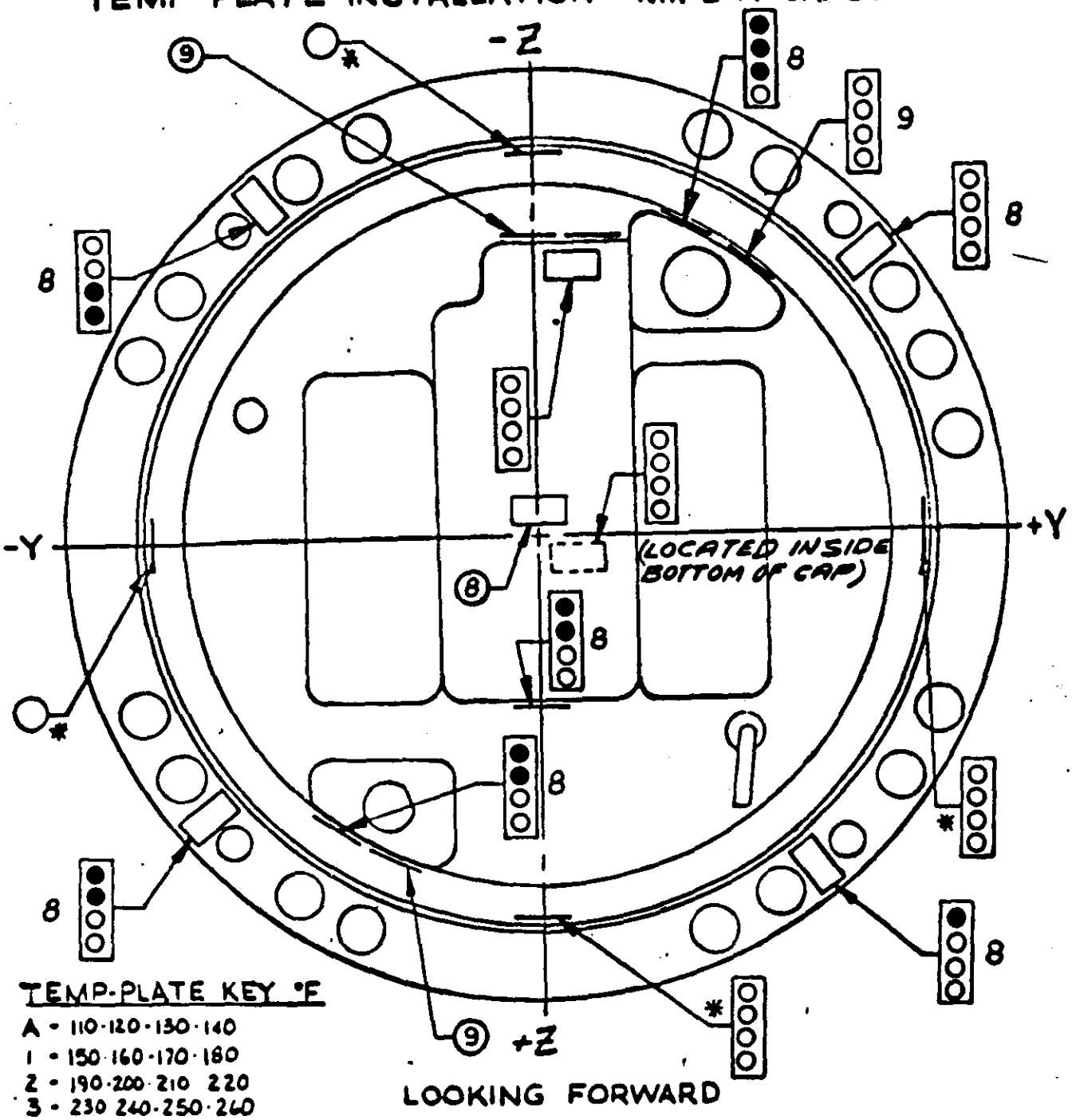
Event	Delta Time (Seconds) Actual	Nominal Events + ΔT
Transfer		
Electrical Disconnect	0.98	0.900 + 0.430 - 0.400
* Separation	2.0	2.0 ± 0.250
** Spin	3.45	3.4 ± 0.30
Retro	7.55	7.55 ± 0.45
Despin	10.68	10.75 ± 0.54
T/C Separation	1.50	1.5 ± 0.15
"G" Switch Open	567.50	514.0 + 65.0 - 50.0
Parachute Cover Off	33.09	34.0 ± 1.5
Drogue Chute Deployed	0.68	0.63 + .08 - .06
Drogue Chute Release	9.59	10.14 + .48 - .40
Main Chute Deployed	0.56	0.52 + .13 - .12
Main Chute Disreefed	4.33	4.46 + .49 - .29

* From Transfer
** From Electrical Disconnect

Spin Rate: 66 RPM
Despin Rate: 6.0 RPM
Retro Velocity: 1088 Ft/Sec.

TABLE 5-1

TEMP-PLATE INSTALLATION - Mk V-A CAPSULE



TEMP-PLATE KEY °F

A - 110-120-130-140
1 - 150-160-170-180
2 - 190-200-210-220
3 - 230-240-250-260
4 - 270-280-290-300
5 - 310-320-330-340
6 - 350-360-370-380
7 - 390-410-435-450
8 - 100-150-200-250
9 - 300-350-400-450

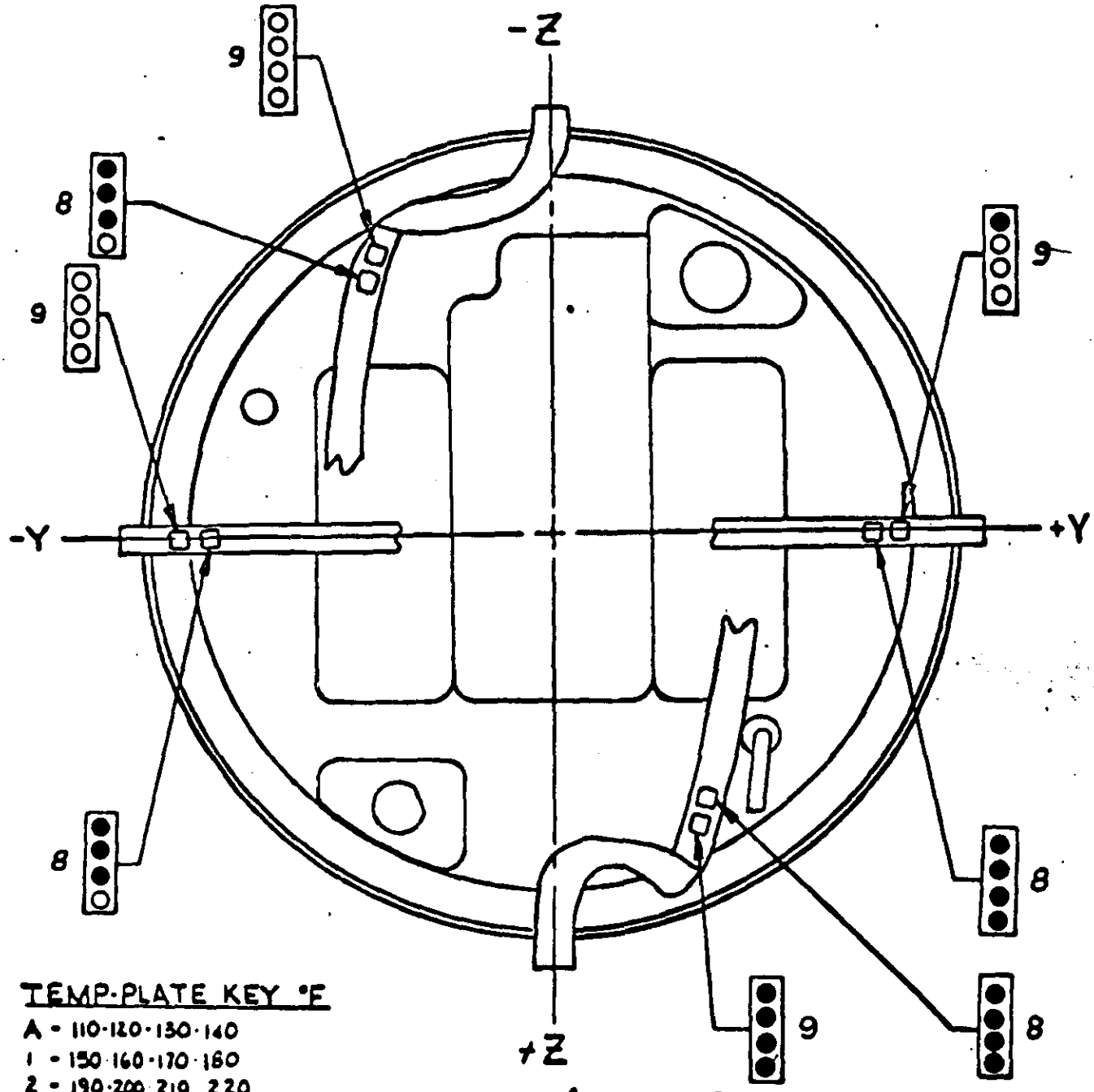
1014-2

*LOCATED INSIDE CAPSULE ON NOSE WALL

●INDICATOR TURNED BLACK TEMP REACHED OR EXCEEDED INDICATED LEVEL

FIGURE 5-1

TEMP-PLATE INSTALLATION - Mk V-A CAPSULE



TEMP-PLATE KEY °F

A - 110-120-130-140
1 - 150-160-170-180
2 - 190-200-210-220
3 - 230-240-250-260
4 - 270-280-290-300
5 - 310-320-330-340
6 - 350-360-370-380
7 - 390-410-435-450
8 - 100-150-200-250
9 - 300-350-400-450

LOOKING FORWARD

USE OF TEMP PLATES ON PARACHUTE SHROUDS

● INDICATOR TURNED BLACK TEMP REACHED OR EXCEEDED INDICATED LEVEL

1014-2

FIGURE 5-2

SECTION 6

MASTER PANORAMIC CAMERA

A. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	162
Main Camera Lens	1372435
Supply Horizon Camera	169B
Supply Horizon Camera Lens	814016
Take-up Horizon Camera	169A
Take-up Horizon Camera Lens	812284
Supply Cassette	SC-21

B. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:

Lens	24" f/3.5
Slit Width	0.250"
Filter Type	Wratten 25
Film Type	Eastman Type 4404

Supply (Port) Horizon Camera:

Lens	55 mm f/6.8
Aperture Setting	f/6.8
Exposure Time	1/100 second
Filter Type	Wratten 25

Take-up (Starboard) Horizon Camera:

Lens	55 mm f/6.8
Aperture Setting	f/8.0
Exposure Time	1/100 second
Filter Type	Wratten 25

C. POST FLIGHT PERFORMANCE EVALUATION - FWD Camera

This camera produced 2932 frames (8193 feet, including preflight test footage) of photography during Mission 1014-1, and 2950 frames (7814 feet) of photography during Mission 1014-2. The overall photographic quality was judged to be about the same for both missions, but somewhat lower than the best missions observed to date.

Image contrast of the Master camera was slightly greater than that of the Slave camera but the increase in information content did not appear to be very significant. Customer personnel using the material expressed a general preference for that from the Master camera. This preference is unique among winter missions to date.

The principal reasons for the less than optimum image quality appear to be: (1) an increased orbit altitude producing image scales generally 5% or more, less than those usually encountered, (2) poor atmospheric conditions over most of the coverage areas, and (3) an unusually large portion of the coverage was at very low sun angles. Although the orbit was designed for low latitude coverage, most of the material was exposed at the usual higher latitudes. The three conditions enumerated above combined in such a way that none of the exposure conditions would produce imagery with maximum ground detail. Thus coverage at higher latitudes had poor atmospheric conditions and low sun angles producing low image contrasts although vehicle altitudes were near normal. At low latitudes where solar elevations were adequate and atmospheric conditions might be presumed to be good, vehicle altitudes were 20% and more higher than recent missions.

Several additional factors have been identified as possible sources of image degradation and will be investigated as appropriate information becomes available. One of these factors, focal shifts due to temperature changes has already received preliminary examination due to an indicated decline in temperature through the missions (mid-sixties on early orbits to low fifties and high forties at the end of 1014-2). There is no apparent basis for believing temperature conditions did adversely affect image quality since the quality obtained from both pan cameras is very consistent throughout the mission. In the opinion of both customer and contractor evaluators, if any quality trend exists, it is toward an improvement in quality toward the end of the mission. Other factors to be examined include forward motion compensation, vehicle attitude, and instrument dynamics. The effects of filters, slit widths, and processing are discussed in Part VII Panoramic Camera Exposure.

The master panoramic camera and its auxiliary equipment operated in a generally normal and satisfactory manner throughout both missions. The 200 cycle timing marks were clearly readable and functioned normally until pass D-101 of Mission 1014-2, when a malfunction of the stellar-index equipment caused erratic smear pulses intermittently to the end of the mission. Rail scratches were continuous throughout both missions. Also on both missions there were scratches in the format near the data block edge, apparently caused by the end of a scan head roller. These scratches were in the vicinity of the take-up end and the serial number. Minus density streaks were observed intermittently throughout both missions. Such streaks are probably caused by scraped emulsion material in the exposure slit. Light leaks on the master panoramic camera film were very minor, being confined to the immediate vicinity of the instrument during shutdown periods.

SECTION 7

SLAVE PANORAMIC CAMERA

A. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	139
Main Camera Lens	1232435
Supply Horizon Camera	172B
Supply Horizon Camera Lens	814024
Take-up Horizon Camera	159A
Take-up Horizon Camera Lens	812305
Supply Cassette	SC-21

B. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:

Lens	24" f/3.5
Slit Width	0.175
Filter Type	Wratten 21
Film Type	Eastman Type 4404

Supply (Starboard) Horizon Camera:

Lens	55 mm f/6.8
Aperture Setting	f/8.0
Exposure Time	1/100 second
Filter Type	Wratten 25

Take-up (Port) Horizon Camera:

Lens	55 mm f/6.8
Aperture Setting	f/6.8
Exposure Time	1/100 second
Filter Type	Wratten 25

C. POST FLIGHT PERFORMANCE EVALUATION - AFT Camera

This camera produced 2853 frames (7985 feet, including preflight test footage) of photography during Mission 1014-1 and 2889 frames (7654 feet) of photography during Mission 1014-2. The overall photographic quality was judged to be about the same for both missions, but somewhat lower than the best missions to date. A discussion of the factors affecting image quality is presented in Section 6, Master Panoramic Camera #162.

Operation of the slave panoramic camera system was generally normal. the binary data block, serial number, fiducial marks, timing marks, and horizon cameras operated normally throughout both missions. There was some vignetting of both horizon blocks apparently caused by the vehicle frame, but this effect was not functionally significant. A double end of pass mark appeared for most operations, that is, at shut-down and at start. Rail scratches were continuous throughout both missions. Other scratches were noted in the format near the data block and in the region of the timing marks opposite the data block. Minus density streaks, apparently caused by scraped emulsion in the exposure slit, were observed intermittently throughout both missions.

Several small light leaks were noted in association; with camera off periods between most passes. These leaks occurred on the first five and last four frames of passes indicating some light leaks in both the frame and instrument.

SECTION 8

PANORAMIC CAMERA EXPOSURE

The Master camera contained a 0.250 inch slit with a Wratten 25 filter while the Slave camera used a 0.175 inch slit with a Wratten 21 filter. The nominal exposure times for the Master and Slave instruments are shown as a function of latitude for passes 1, 8, 40, 72, 104, 136 and 143 in Figures 8-5 to 8-18. The frequency distributions of the solar elevations and solar azimuths encountered during photographic operations are shown in Figures 8-1 to 8-4.

The predicted level of processing for the original negative is based on the in-flight performance estimate and is tabulated below with the processing levels reported by [redacted]

Mission/Camera		Primary	Intermediate	Full
1014-1/Master	Predicted	0%	21%	79%
	Actual	0.6%	38.4%	61%
1014-1/Slave	Predicted	0%	31%	69%
	Actual	0%	13%	87%
1014-2/Master	Predicted	0%	21%	79%
	Actual	0%	26%	74%
1014-2/Slave	Predicted	0%	29%	71%
	Actual	0%	5%	95%

The original negative was not available at the time of evaluation. However, examination of duplicate positives and preliminary review of sensitometric data indicates that the density was good, considering the specific conditions of the missions. The Wratten 25 filter on the Master camera was used to improve image contrast for the condition of the subsolar point directly ahead of the vehicle path. This objective was achieved. The missions were unusual for the large percentage of coverage programmed for solar elevations below 10 degrees. The resulting underexposed coverage produced better image quality than had been expected.