CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1010-1 and 1010-2

FTV 1178; J-11

28 May 1965

Approved: [redacted]
Mgr.
Advanced Projects

Approved: [redacted]
Mgr.
Program

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1178.

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 1010-1 and 1010-2 which was launched on 14 September 1964.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1010-1 and 1010-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-1 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 AFSPPL. 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 AFSPPL. 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 1010, placed into orbit by Flight Test Vehicle #1178 and SLV-2A booster #405, 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-11 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 two, four day photographic periods separated by a seven day inactive period.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 2253:43 Z (3:53:43 PDT) on 14 September 1964. Ascent and injection were normal and the achieved orbit 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. Mission 1010-1 consisted of four days operation and was completed by air recovery on 18 September 1964. Mission 1010-2 was completed with an air recovery on 23 September 1964 following five days of photographic operations. Mission 1010 was the first nine day Corona operation.

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

SCHEMATIC PEDOARD PROFILE - CORONA J SYSTEM

MISSION 1010

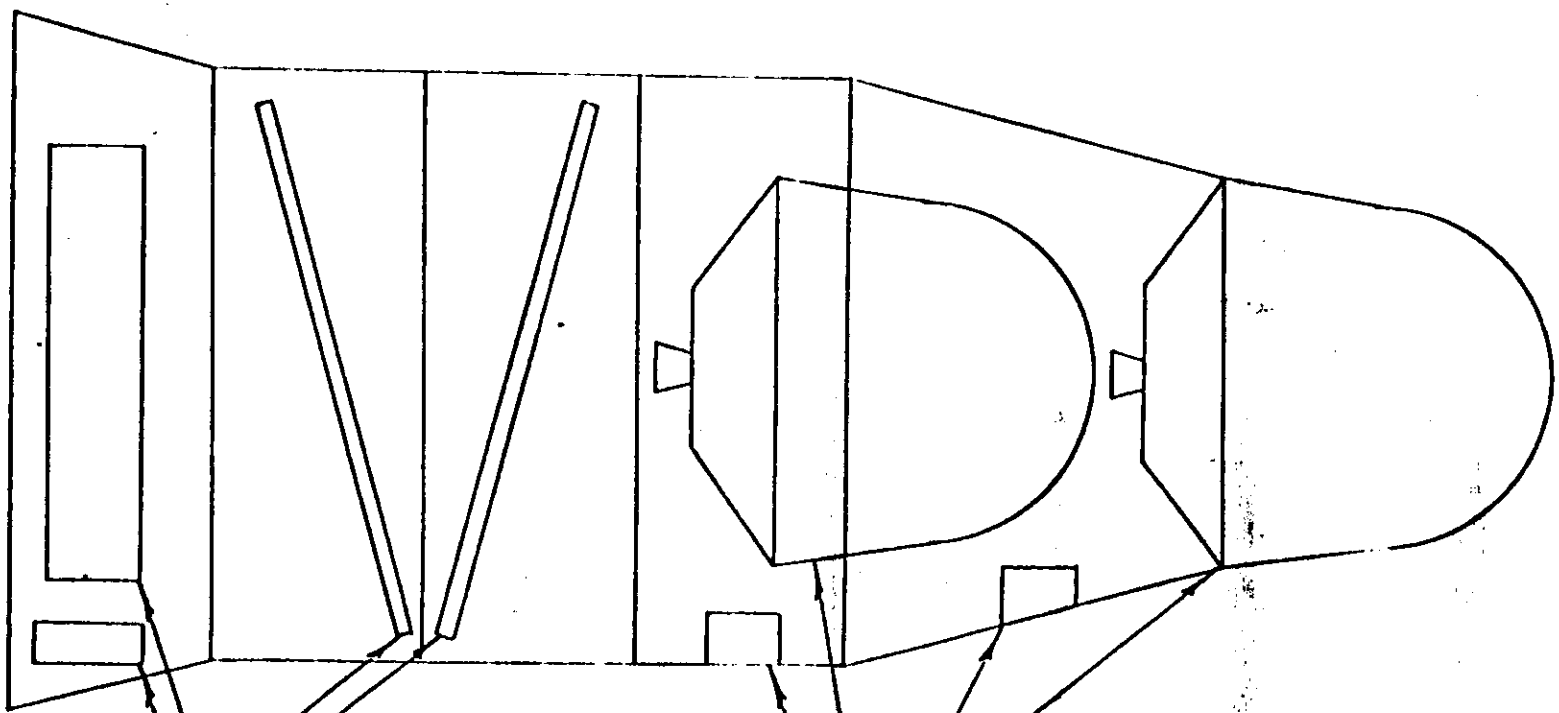


FIGURE 1-1

ORBIT PARAMETERS

Parameter	Predicted	Orbit 1 Actuals
Period (Min.)	91.06	90.97
Perigee (N.M.)	99.98	97.45
Apogee (N.M.)	206.29	259.19
Inclination (Deg.)	84.99	84.96
Perigee Latitude (Deg.N.)	39.99	42.58
Eccentricity	0.02221	0.02236

The achieved orbit was within the 3 sigma dispersions from nominal. The Agena vehicle was not deactivated after the completion of Mission 1010-2. VHF command exercises were conducted until the vehicle power was depleted. All contact was lost by orbit 166.

C. PANORAMIC CAMERAS

The Master and Slave panoramic cameras operated throughout both missions with no significant problems and produced excellent photographic coverage. The cloud cover and atmospheric haze observed in the photography was high. A small area on the Master camera formats of Mission 1010-1 contained a small soft focus area which was not present during Mission 1010-2.

D. STELLAR-INDEX CAMERAS

The Stellar-Index cameras operated properly through both missions. Double star images were observed intermittently during both missions. This anomaly has been traced to the unbalance of the panoramic cameras during non-synchronous operation. The unbalance imparts a small roll motion to the satellite.

E. OTHER SUB-SYSTEMS

The clock, instrumentation, pressure make-up, command and thermal control sub-systems performed satisfactorily through both missions.

F. CONCLUSIONS

Mission 1010-1 and 1010-2 achieved the objective of acquiring high quality search and reconnaissance photography from orbital altitudes.

G. RECOMMENDATIONS

The evaluation and analysis of the data produced by both missions has resulted in the following recommendations:

1. Continue the analysis of the cause of soft focus areas in the panoramic photography.

2. Utilize the higher level exposure criteria on future Corona missions.

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-11 payload system was tested for pressure, thermal and corona discharge effects in the TASC chamber starting May 20, 1964. The test consisted of three days active operation with the "A" bucket; one day of de-active soak and three days of active operation with the "B" bucket. The J-11 system contained the first flight type pressure make-up system and corona markings were reported to be acceptable for flight.

Several abnormalities in system performance were evident during the test. Component replacement after the completion of the environmental test corrected all observed problems.

3. Thermal Environment

The TASC chamber thermal environment was programmed to simulate the on-orbital temperature conditions that the J-11 payload system would experience in flight. Typical instrument temperatures recorded through the test are as follows:

Orbit	Master Camera	Slave Camera
6	78°	81°
17	83°	86°
33	84°	87°
48	82°	87°
59	67°	67°
69	61°	62°
79	51°	52°

Two self-heating tests were conducted during the soak period. One test was deemed invalid due to a change in the steady state temperature in the chamber, but the other test was valid and the results are included in Figure 2-1.

4. Pressure Environment

The pressure environment of the instruments was less than 0.5 micron in a non-operating condition. The pressure would increase to a nominal 1 micron during operation when the pressure make-up system was not used. The pressure make-up system would cause the pressure to increase to a nominal 40 microns during an operate. The pressure make-up system was active only during the "B" mode operations.

5. Panoramic Camera Performance

Evaluation of the test film showed that both the Master and Slave cameras produced intermittent start-up corona discharge. The resulting fogging was well within the acceptance criteria hence the J-11 system was recommended for flight.

The panoramic cameras operated normally during the test phase with the exception that the cycle rate errors were excessive. Component replacement and adjustment corrected this anomaly.

6. Stellar-Index Camera Performance

The Stellar-Index Cameras installed in the J-11 system during

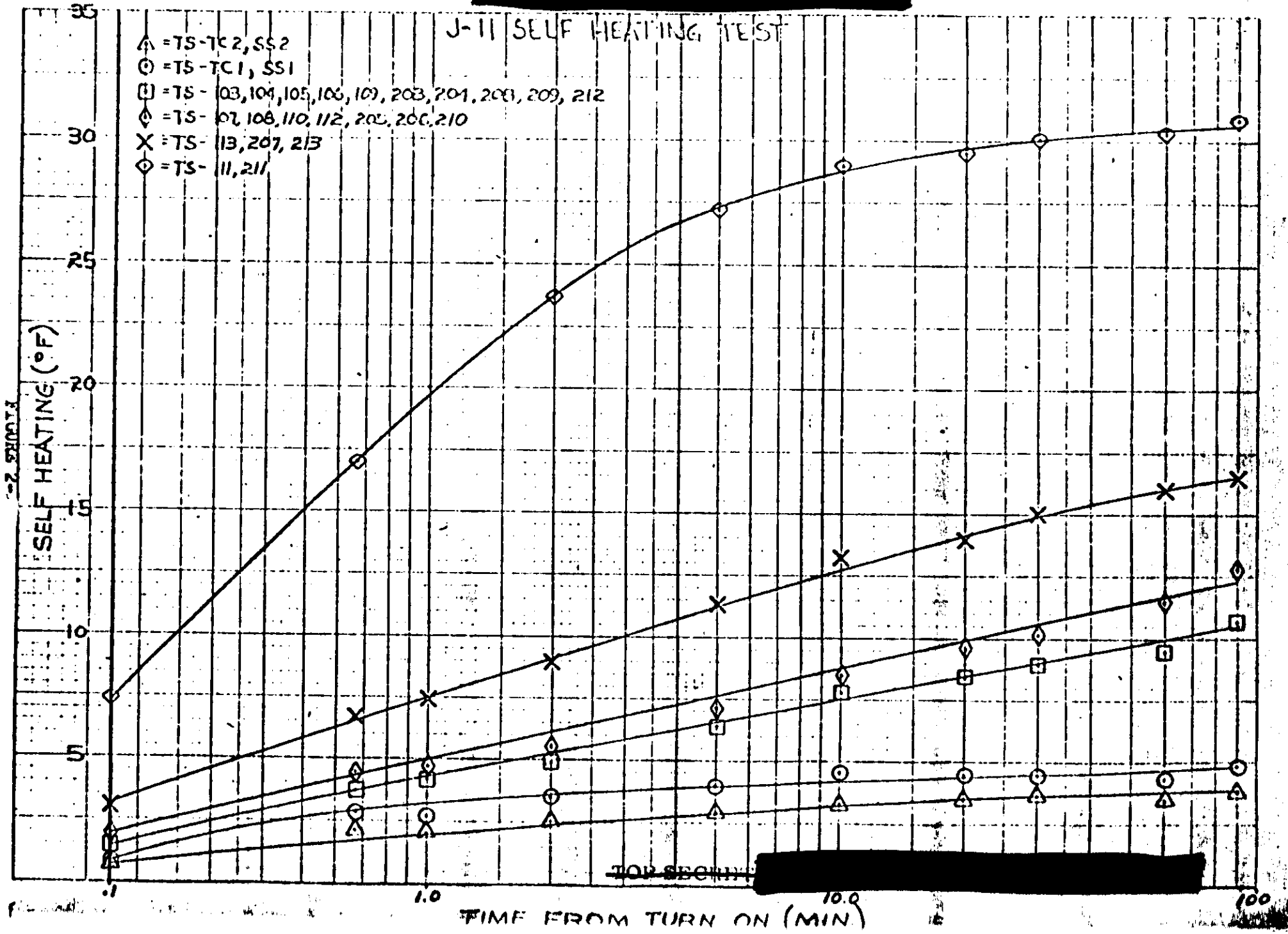
the environmental test were replaced prior to flight. The flight cameras were environmentally tested as components and found acceptable for flight.

B. RESOLUTION TEST

The dynamic resolution test of the J-11 payload system was performed at the A/P facility on 5 June 1964. Each panoramic camera photographed high and low contrast resolution targets. The resulting through focus resolution data is shown in Figure 2-2 for the Master camera and in Figure 2-3 for the Slave camera.

C. LIGHT LEAK TEST

The examination of the film threaded in the J-11 system during the light leak test determined that no film fogging was present. The light tight integrity of the system was considered acceptable for flight.



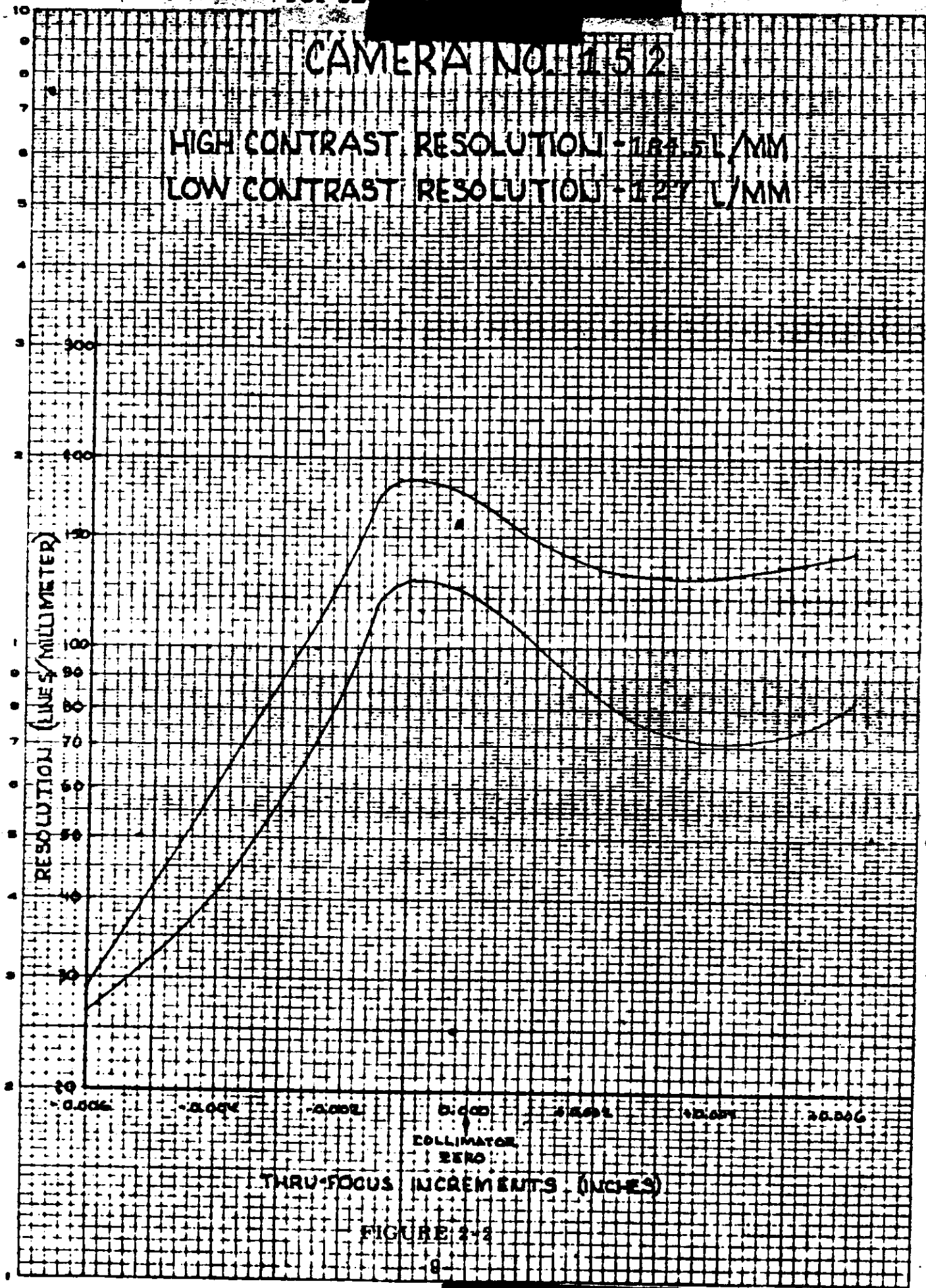

CAMERA NO. 1512
HIGH CONTRAST RESOLUTION = 114.5 L/MM
LOW CONTRAST RESOLUTION = 127 L/MM
RESOLUTION (LINES/MILLIMETER)
COLLIMATOR ZERO
THRU-FOCUS INCREMENTS (INCHES)

FIGURE 2-2

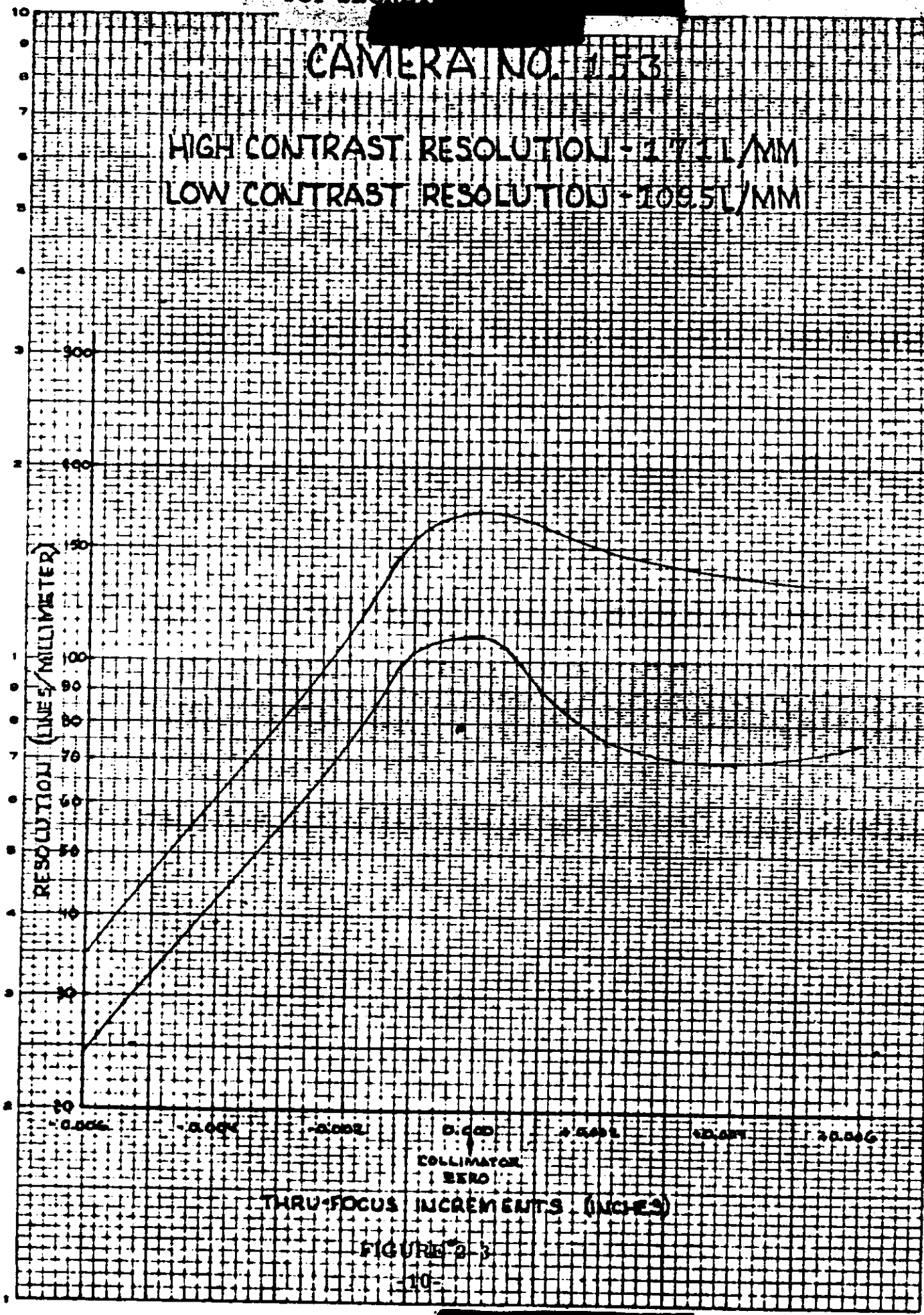

CAMERA NO. 1E3
HIGH CONTRAST RESOLUTION = 171 L/MM
LOW CONTRAST RESOLUTION = 109.5 L/MM
RESOLUTION (LINES/MILLIMETER)
300
200
150
100
90
80
70
60
50
40
30
20
-0.006
-0.004
-0.002
0.000
+0.002
+0.004
+0.006
COLLIMATOR ZERO
THRU-FOCUS INCREMENTS (INCHES)

FIGURE 2-5

SECTION 3

FLIGHT OPERATIONS

A. COMMAND & INSTRUMENTATION PERFORMANCE

No commanding problems of serious consequence were encountered during the mission. There was one instance in which an H-timer reset deleted a V/H programmer start delay step. This deletion caused the V/H programmer to start late. The reset deletion occurred during the [redacted] orbit 9 acquisition. The orbit 1 [redacted] tracking station data was bad, and due to communications problems during orbits 5 and 6 the [redacted] tracking station was unable to provide tracking data.

Acquisitions during orbit 8 resulted in revisions in the ephemeris predictions. The earlier STC computer predictions for the ephemeris were heavily weighted with poor orbit 1 data and nominal orbital predictions. The revised orbital predictions necessitated a 35-second reset during the orbit 9 [redacted] acquisition. During the 35-second reset two functions were missed: A V/H programmer delay step and a clock interrogate. The deletion of the delay step caused the V/H programmer to start a maximum of 50 seconds late. This late start was not deleterious to system performance during orbit 9. The IMC error introduced by the late programmer start was less than .5%.

B. PANORAMIC CAMERA PERFORMANCE

Telemetry data, acquired during the engineering operations over [redacted] indicated nominal panoramic camera operations.

Three flight ramps were used: 8-3, 8-2, and 7-2. The nominal flight plan called for the 8-3 ramp for launch. In orbit 6 the flight ramp was changed from 8-3 to 8-2. In orbit 71 the flight ramp was changed from 8-2 to 7-2. The changes in the V/H ramp settings were made to allow the V/H programmer to better match the vehicle orbit. Camera cycle rate performance is summarized as follows:

DEVIATIONS BETWEEN PREDICTED AND ACTUAL PANORAMIC INSTRUMENT CYCLE RATES

ORBIT NUMBER	RAMP	TIME UP RAMP	PERCENTAGE ERROR MASTER	PERCENTAGE ERROR SLAVE
9 (Night)	8-2	445 Secs.	- 1.6	- 2.0
31 (Day)	8-2	2130 Secs.	- 0.7	- 1.6
47 (Day)	8-2	2160 Secs.	- 0.4	- 2.0
56 (Night)	8-2	645 Secs.	- 0.5	- 2.0
71 (Night)	8-2	705 Secs.	- 0.7	- 2.2
103 (Night)	7-2	785 Secs.	- 0.3	- 2.4

Approximately 6080 frames were exposed by the master and slave cameras during the nine-day mission.

C. STELLAR/INDEX CAMERA PERFORMANCE

The T/M data from the engineering operations over [redacted] indicated satisfactory performances from the two S/I units. Daytime and nighttime acquisitions were included in these engineering operations. All S/I metering and shutter pulses appeared to be normal.

D. PRESSURE MAKE-UP SYSTEM PERFORMANCE

Pressure make-up system (PMU) performance was monitored by two functions: a pressure monitor that showed the pressure in the nitrogen supply bottle; and a pirani gage that measured the pressure in the vicinity of the panoramic instruments. The PMU system was commanded ON and OFF by camera ON/OFF commands. This was the second PMU system employed in the Corona J reconnaissance program.

The pirani gage T/M data from the engineering operations are presented in Figures 3-1 through 3-3. The nitrogen supply pressure is shown in Figure 3-4. These data indicate satisfactory PMU system performance.

E. CLOCK PERFORMANCE

The performance of the clock was satisfactory for the 9-day mission. Table 3-1 presents the clock/systems time correlation data.

F. THERMAL ENVIRONMENT SUMMARY

All thermal data from the [redacted] acquisitions are presented in Tables 3-2 and 3-3. The panoramic cameras, supply spools, and thrust cone temperatures were corrected for self-heating. The self-heating characteristics for the aforementioned sensors were determined from the results of a special temp sensor self-heating test conducted in the TASC chamber.

Table 3-4 presents these calibration data. The predicted and in-flight temperatures for Mission 1010-1 are compared in Figures 3-5 through 3-7.

G. RECOVERY SYSTEM PERFORMANCE

A. Mission 1010-1 Recovery

The Mission 1010-1 recovery capsule was retrieved with a successful air catch on orbit 65. The physical condition of the capsule and the recovery sequence indicated the recovery events were normal in all aspects.

B. Mission 1010-2 Recovery

The Mission 1010-2 recovery capsule was retrieved with a successful air catch on orbit 144. The recovery events were normal in all aspects.

No deactivation period was initiated after the Mission 1010-2 recovery. VHF command exercises were conducted until the vehicle power was depleted. All contact was lost by orbit 166. All A/P tape events were utilized by orbit 144.

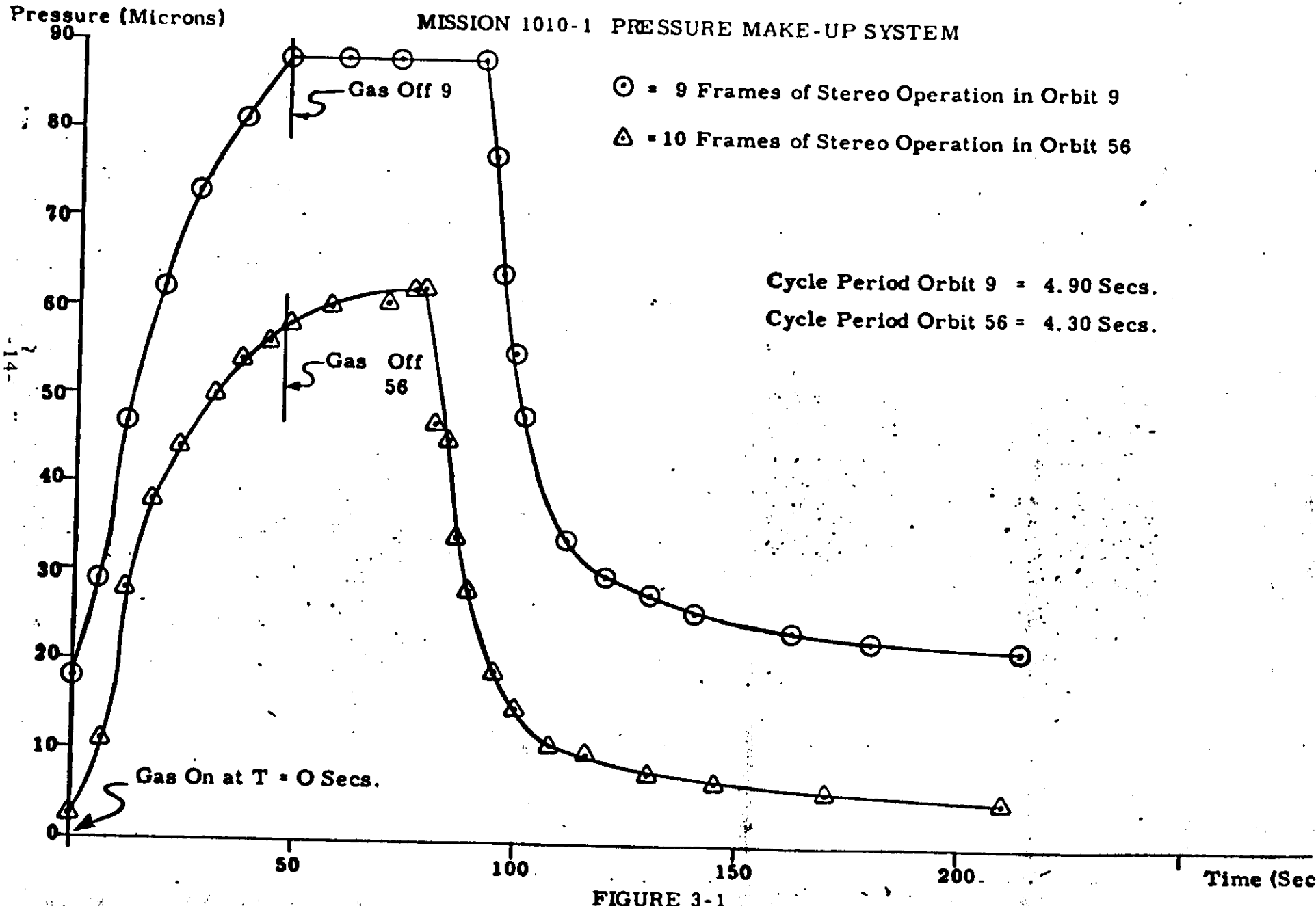
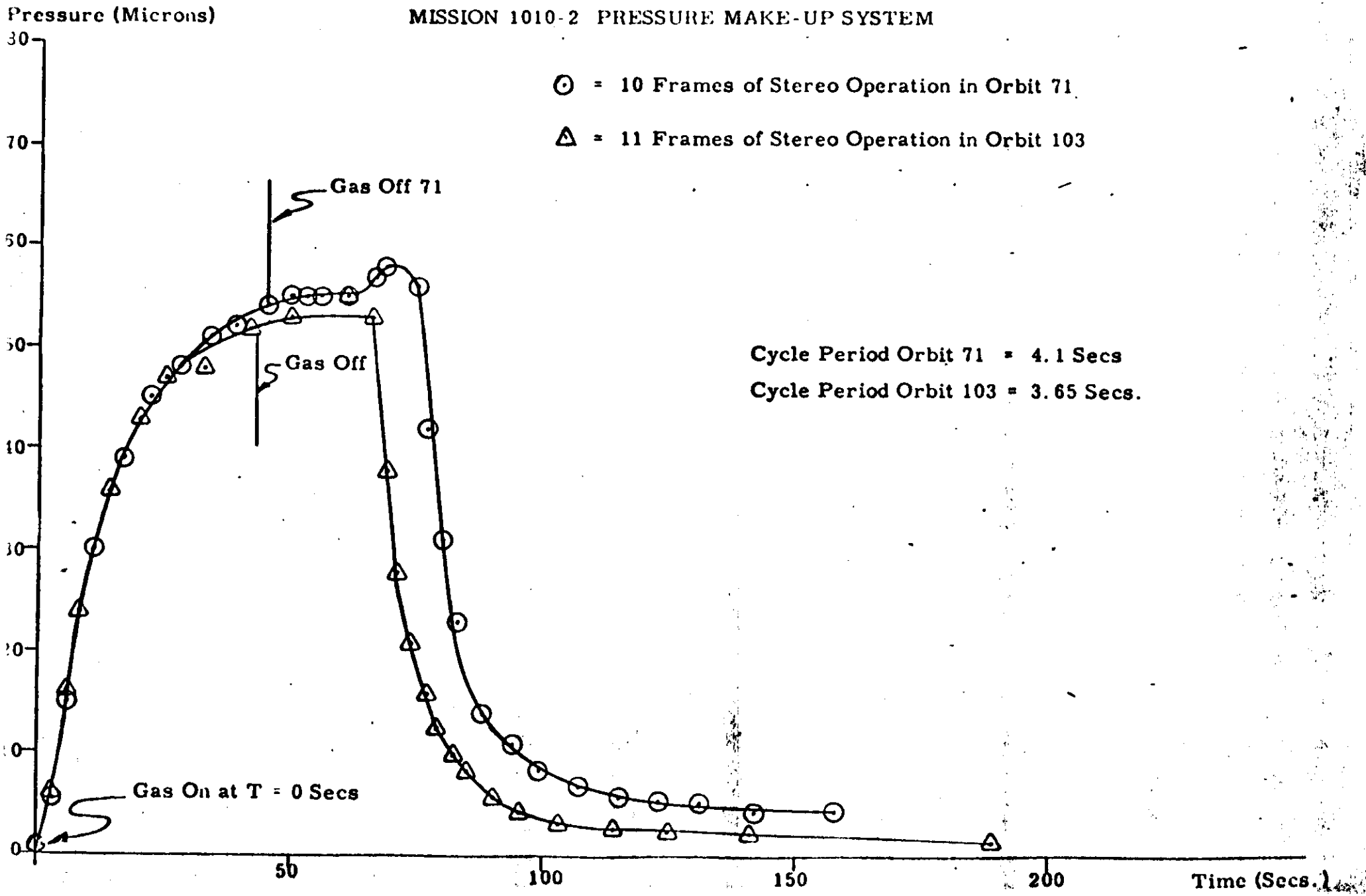

Pressure (Microns)
MISSION 1010-1 PRESSURE MAKE-UP SYSTEM
⊙ = 9 Frames of Stereo Operation in Orbit 9
△ = 10 Frames of Stereo Operation in Orbit 56
Cycle Period Orbit 9 = 4.90 Secs.
Cycle Period Orbit 56 = 4.30 Secs.
Gas Off 9
Gas Off 56
Gas On at T = O Secs.
90
80
70
60
50
40
30
20
10
0
50
100
150
200
Time (Secs.)

FIGURE 3-1

MISSION 1010-2 PRESSURE MAKE-UP SYSTEM



MISSION 1010 PRESSURE SUMMARY

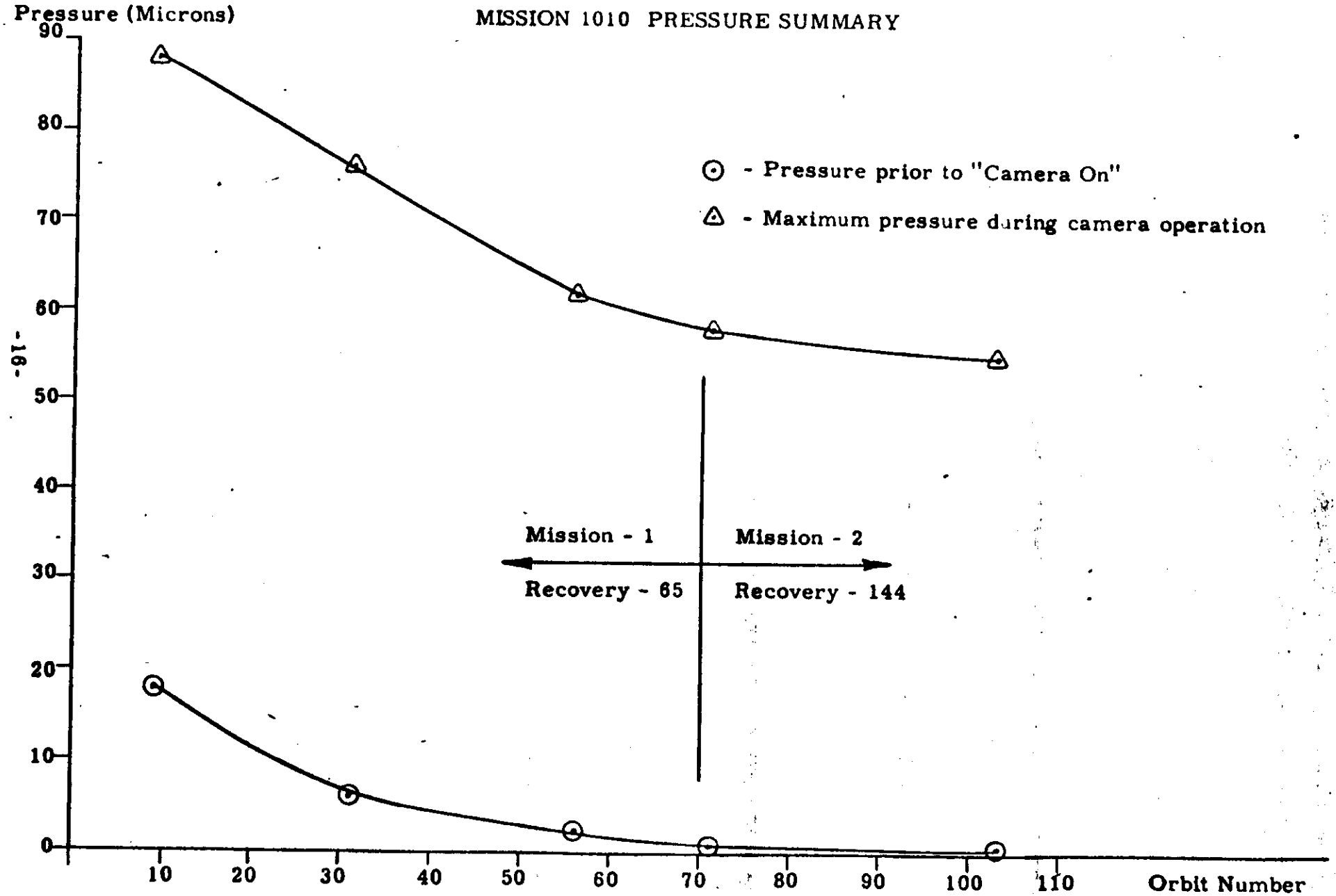


FIGURE 3-3

MISSION 1010 NITROGEN SUPPLY PRESSURE

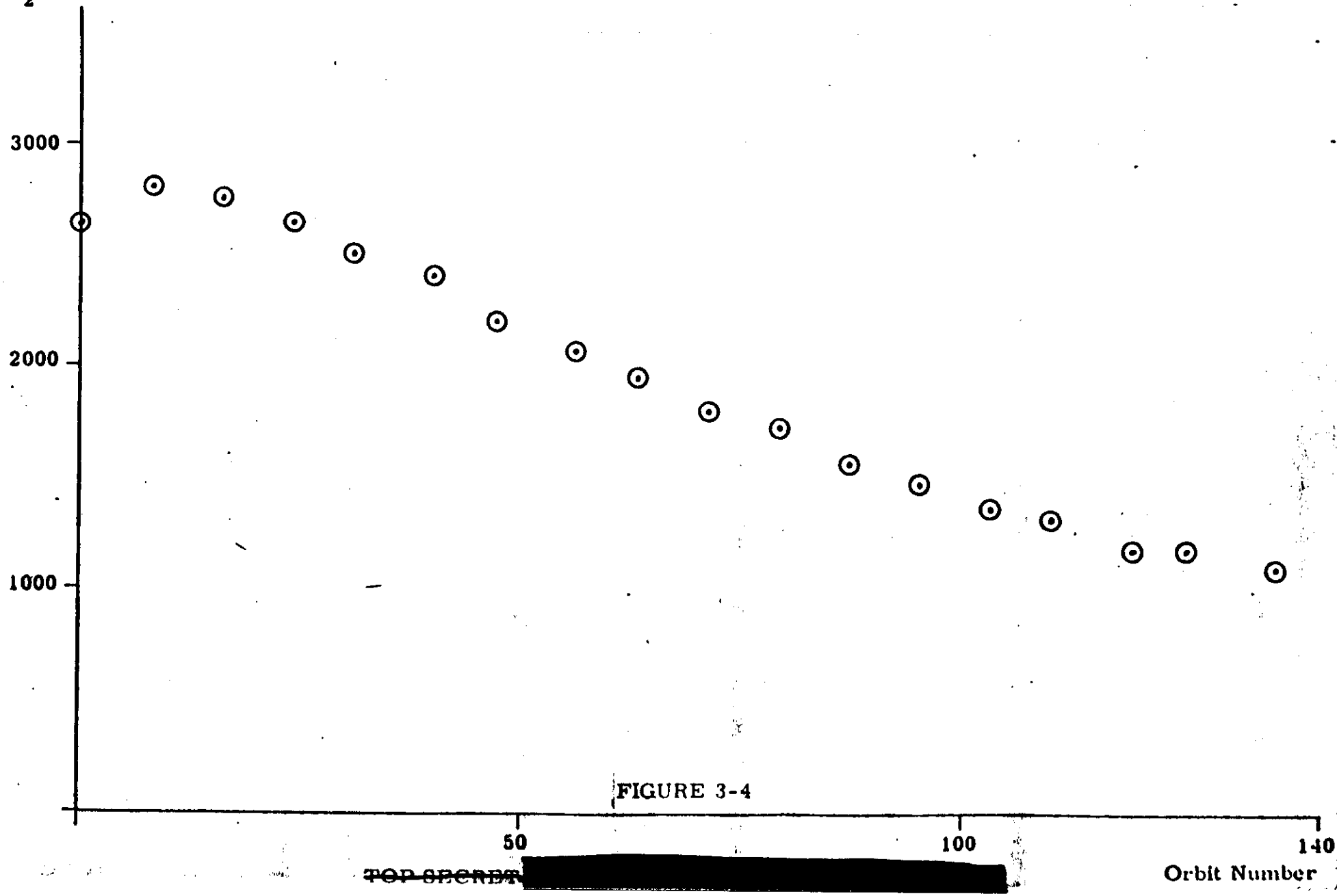


FIGURE 3-4

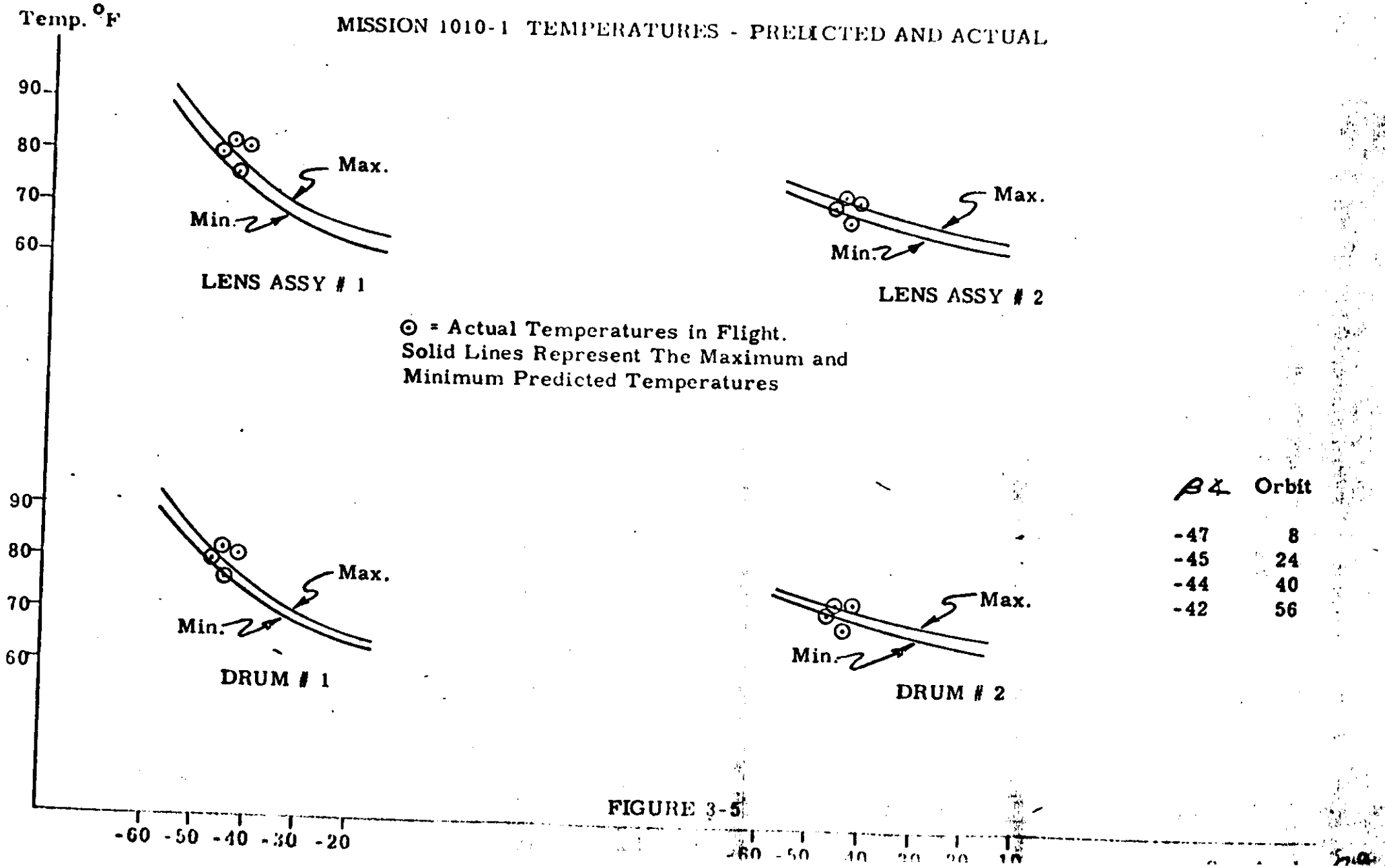

MISSION 1010-1 TEMPERATURES - PREDICTED AND ACTUAL
Temp. °F
90
80
70
60
Max.
Min.
LENS ASSY # 1
Max.
Min.
LENS ASSY # 2
⊙ = Actual Temperatures in Flight.
Solid Lines Represent The Maximum and
Minimum Predicted Temperatures
90
80
70
60
Max.
Min.
DRUM # 1
Max.
Min.
DRUM # 2
β4 Orbit
-47 8
-45 24
-44 40
-42 56
-60 -50 -40 -30 -20

FIGURE 3-5

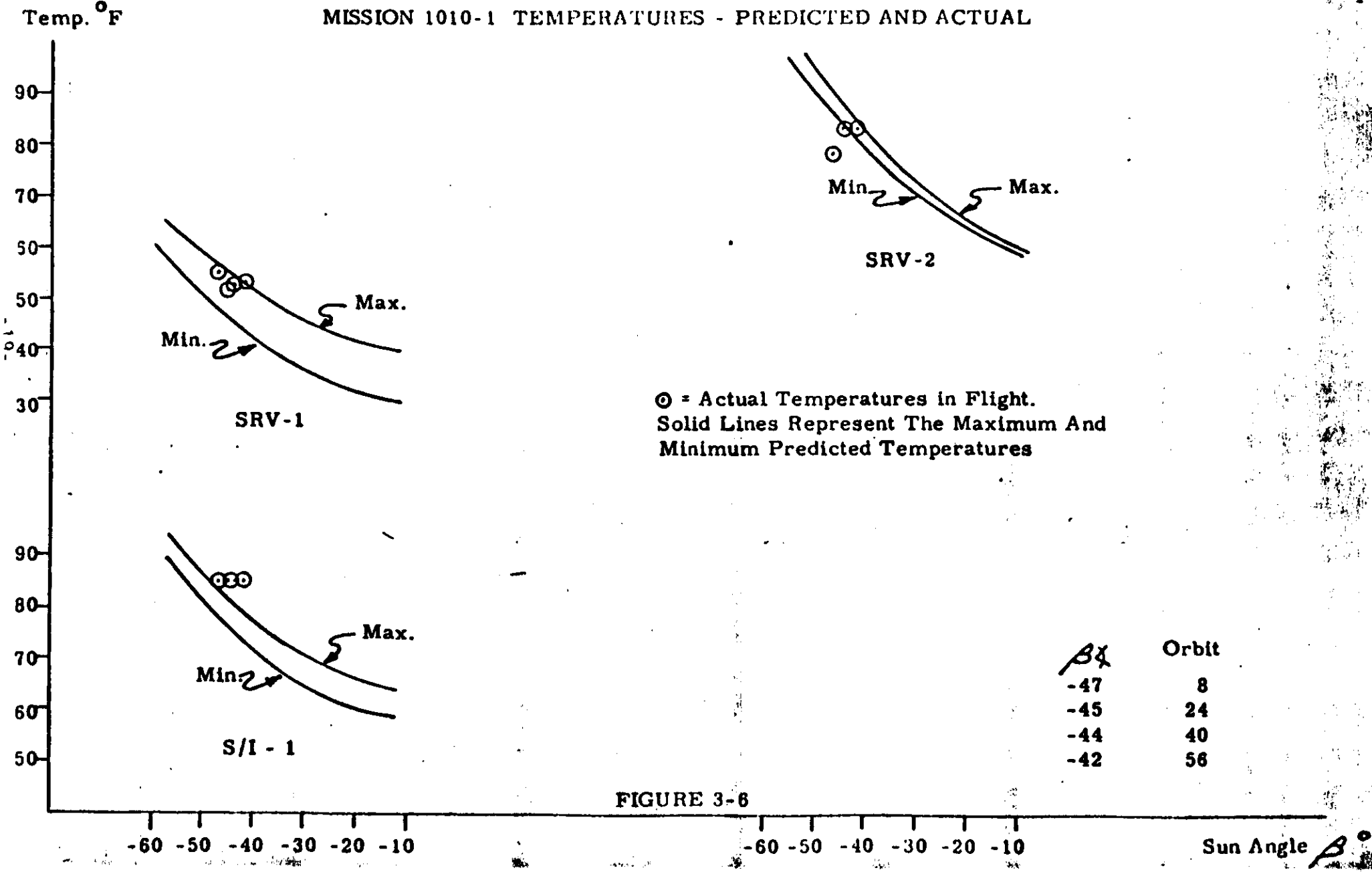

Temp. °F
MISSION 1010-1 TEMPERATURES - PREDICTED AND ACTUAL
90
80
70
60
50
40
30
Max.
Min.
SRV-1
Min
Max.
SRV-2
⊙ = Actual Temperatures in Flight.
Solid Lines Represent The Maximum And
Minimum Predicted Temperatures
90
80
70
60
50
Max.
Min.
S/I - 1
βX
Orbit
-47
8
-45
24
-44
40
-42
56
-60 -50 -40 -30 -20 -10
-60 -50 -40 -30 -20 -10
Sun Angle β°

FIGURE 3-6

MISSION 1010-2 TEMPERATURES - PREDICTED AND ACTUAL

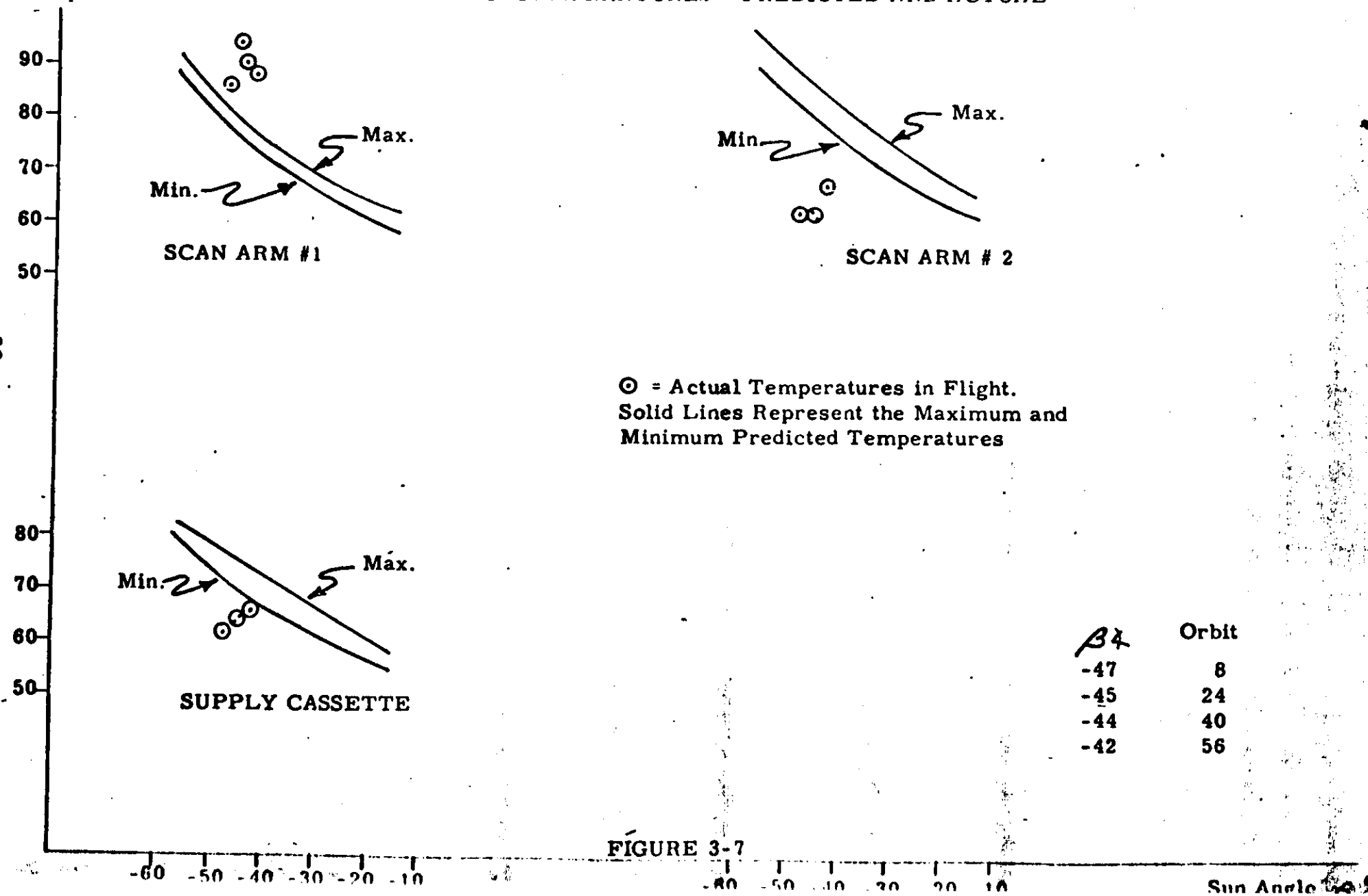


FIGURE 3-7

TABLE 3-1

J-11 CLOCK/SYSTEM TIME CORRELATION

ORBIT	SYSTEM TIME RAW DATA	CLOCK TIME	SMOOTHED SYSTEM TIME	DELTA DIFFERENCE
	MISSION 1			
1	1350.885	207900.436	1350.895	.010 +
8	38009.975	244559.533	38009.983	.008 +
9	43827.135	250376.691	43827.139	.004 +
16	83682.870	290232.430	83682.868	.002 -
24	39183.430	332133.002	39183.430	.000
31	79059.551	372009.132	79059.550	.001 -
40	40256.317	419605.907	40256.313	.004 -
47	79901.820	459251.416	79901.812	.008 -
56	41024.535	506774.146	41024.531	.004 -
63	80804.910	9683.618	80804.905	.005 -
	MISSION 2			
71	36047.032	51325.748	36047.025	.007 -
79	81666.305	96945.037	81666.302	.003 -
87	36833.560	138512.302	36833.557	.003 -
95	82471.728	184150.486	82471.730	.002 +
103	38027.710	226106.472	38027.705	.005 -
110	77807.472	265886.248	77807.472	.000
119	38865.991	313344.785	38865.997	.006 +
126	78273.005	352751.807	78273.009	.004 +
135	39496.435	400375.253	39496.443	.008 +

Smoothed System Time = -206549.490 + .999999752917070 x Clock Time

Delta Difference = Smoothed System Time - Raw System Time

TABLE 3-2

J-11 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																	
Master Camera	0	9	16	24	31	40	47	56	63	71	79	87	95	103	110	119	126	135
3	66	60	57	63	56	59	54	62	52	53	48	50	47	47	47	49	45	58
4	72	69	66	72	65	68	64	72	61	62	56	59	53	56	56	58	52	56
5	68	75	70	77	69	74	67	76	67	68	61	66	60	63	60	64	58	62
6	65	85	80	85	80	82	78	85	74	77	71	74	67	70	67	71	66	68
7	66	78	73	78	73	74	72	79	69	69	65	67	64	63	64	64	62	62
8	71	76	71	77	71	73	68	78	66	67	60	64	59	62	59	62	58	60
9	69	84	78	84	77	79	63	82	72	75	68	72	65	70	66	70	64	66
10	66	71	70	71	67	66	65	72	63	59	59	59	58	54	58	57	56	54
11	100	86	91	94	86	90	83	88	86	75	79	80	78	69	62	75	73	77
12	73	65	60	67	60	63	58	68	57	57	51	55	50	53	51	53	49	52
13	68	80	78	82	76	76	73	81	73	67	67	63	65	60	59	61	62	58
AVG.	68	74	70	76	69	71	66	77	65	65	61	63	59	60	59	61	57	60
Slave Camera																		
3	62	80	77	81	76	78	73	81	72	74	70	73	68	69	66	69	64	66
4	63	74	69	77	70	74	66	77	66	71	64	69	62	67	61	67	59	63
5	64	71	67	73	66	69	66	76	64	67	62	65	60	61	58	62	58	60
6	60	66	61	66	63	64	62	68	58	60	56	58	54	54	54	55	53	53
7	62	69	66	71	56	66	63	71	63	61	60	59	58	55	58	57	56	54
8	64	70	63	71	64	69	62	72	62	66	59	63	57	61	56	62	56	59
9	67	63	58	65	57	62	57	66	57	59	55	57	52	54	52	56	51	54
10	65	70	68	71	68	65	64	71	64	62	61	59	59	56	59	58	56	55
11	94	63	57	63	60	62	60	68	58	62	56	58	57	60	65	60	56	55
12	66	75	69	77	69	73	68	78	65	69	64	68	62	65	60	65	60	62
13	67	72	69	74	70	69	68	74	68	66	66	63	63	62	68	63	62	59
AVG.	64	70	67	73	66	68	65	73	63	65	61	63	59	60	59	61	57	58
Supply Spools																		
1	60	58	57	61	61	62	61	64	59	61	58	58	56	56	56	57	56	55
2	60	66	63	67	64	68	64	68	63	65	62	64	59	63	58	62	58	59

Notes: All data corrected for self-heating except injection.
Camera averages do not include sensor #11.

TABLE 3-3

J-11 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																	
Fairing ("A")																		
Barrel #1 ("B")	0	9	16	24	31	40	47	56	63	71	79	87	95	103	110	119	126	1
1	OBH	48	76	51	70	48	67	51	70	4	78	1	14	1	14	4	7	
2	OBH	18	15	21	15	18	12	18	12	3	-4	-1	-7	-1	-4	-1	-7	-
3	OBH	2	15	5	15	2	12	5	12	19	58	19	61	19	64	16	35	1
4	OBH	83	88	88	86	83	86	86	83	67	122	67	122	63	119	60	97	6
5	OBH	120	153	126	142	120	139	120	134	62	98	65	92	62	86	58	83	5
6	OBH	91	154	94	143	88	138	91	135	-	-	-	-	-	-	-	-	
Barrel #2																		
1	163	67	111	67	106	64	103	64	100	58	97	61	92	54	86	54	83	5
2	158	62	139	65	131	62	126	62	126	62	120	62	120	55	118	55	95	5
3	186	22	66	22	60	19	57	22	60	22	57	22	63	19	63	19	38	1
4	194	4	4	7	4	7	0	7	0	4	0	4	0	4	-3	4	-3	
5	191	16	25	16	22	19	22	19	22	12	19	9	16	9	19	9	12	
Conic Adapter																		
1	162	64	94	67	89	61	86	64	83	55	83	58	80	55	77	52	64	5
Clock																		
1	91	75	71	75	71	77	71	75	71	69	64	66	64	69	62	66	60	5
2	95	75	73	77	73	77	73	77	71	71	64	69	64	69	62	66	62	6
Thrust Cone "A" to "B" SRV																		
1	119	62	58	62	57	60	56	60	56	68	64	65	63	64	62	63	61	6
2	76	86	81	86	80	84	79	84	77	79	74	74	72	72	71	69	67	7
Stellar-Index Camera																		
1	86	92	89	92	89	92	86	92	83	76	70	70	67	67	64	64	64	6
2	64	79	76	79	73	79	73	79	70	69	62	65	59	62	59	62	59	5
Recovery Battery "B" SRV																		
1	68	79	81	84	84	84	82	84	82	81	81	81	79	80	82	80	84	8
Master Cassette																		
1	90	55	48	52	48	53	50	53	50	-	-	-	-	-	-	-	-	

TABLE 3-4

VEHICLE 1177 PAYLOAD J-11 SELF-HEATING TEST

SUMMARY OF SELF-HEATING CORRECTION CURVES

No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No.
TS TC2 TS SS2	TS TC1 TS SS1	TS 203 TS 209 TS 106 TS 109 TS 105 TS 104 TS 208 TS 204	TS 212 TS 103 TS 206 TS 205 TS 108 TS 112 TS 107	TS 110 TS 210 TS 213	TS 207 TS 113	TS 2 TS 1

Time (Min)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No.
0.10	0.5	0.5	0.9	1.1	1.3	2.0	4.
0.13	0.6	0.6	1.1	1.4	1.6	2.6	5.
0.16	0.7	0.8	1.4	1.8	2.0	3.2	6.
0.20	0.9	1.0	1.6	2.0	2.3	3.6	7.
0.25	1.0	1.2	1.8	2.3	2.5	3.9	9.
0.32	1.1	1.4	2.1	2.5	2.9	4.4	10.
0.40	1.3	1.7	2.4	2.9	3.3	4.9	12.
0.50	1.6	2.0	2.8	3.4	3.8	5.6	14.
0.63	1.9	2.5	3.4	3.9	4.5	6.4	16.
0.79	2.1	2.8	3.7	4.3	5.0	7.0	18.
1.00	2.2	3.0	4.1	4.7	5.4	7.6	20.
1.26	2.3	3.1	4.4	5.0	5.7	8.1	21.
1.58	2.5	3.3	4.7	5.4	6.1	8.6	22.
2.00	2.6	3.5	5.1	5.8	6.6	9.3	23.
2.51	2.7	3.6	5.3	6.1	6.9	9.6	24.
3.16	2.8	3.7	5.6	6.4	7.3	10.1	24.
3.98	2.9	3.8	6.0	6.8	7.7	10.7	25.
5.01	3.0	4.0	6.4	7.3	8.3	11.4	27.
6.31	3.1	4.1	6.7	7.6	8.6	11.8	27.
7.94	3.1	4.1	7.0	7.9	9.1	12.3	28.
10.00	3.2	4.3	7.4	8.4	9.6	13.0	28.
12.59	3.3	4.3	7.6	8.7	9.9	13.4	29.
15.85	3.3	4.4	7.9	9.0	10.4	13.8	29.
19.95	3.4	4.4	8.3	9.5	10.9	14.5	29.
25.12	3.4	4.5	8.6	9.8	11.3	14.9	30.
31.62	3.5	4.5	8.9	10.2	11.8	15.4	30.
39.81	3.5	4.5	9.2	10.5	12.2	15.7	30.
50.12	3.6	4.6	9.5	10.9	12.7	16.2	30.
63.10	3.6	4.6	9.8	11.3	13.2	16.7	30.
79.43	3.7	4.6	10.1	11.7	13.7	17.1	30.
100.00	3.7	4.7	10.4	12.2	14.3	17.7	30.

SECTION 4

MISSION 1010-1 RECOVERY SYSTEM

SRV #644 was received at A/P on 4 October 1963. The receiving weight was 147 pounds. After modifications and incorporation of outstanding E.O.'s, the SRV was delivered to systems test for incorporation into the J-11 system.

The following major modifications were made to SRV #644 during the testing phase at A/P:

1. 10/4/63 - The electronic components in the thrust cone were flowcoated.

2. 10/5/63 - The W-4 cable was found to be damaged at the plug and was replaced.

3. 6/2/64 - FEDR 1310; the water seal gasket was replaced as it had lifted out of its groove.

4. 6/30/64 - The mating studs were reworked as they were not shorted to the thrust cone ring.

The capsule was delivered for shipment to VAFB on 13 July 1964. No components were replaced or repaired at VAFB.

A successful air catch of the capsule was made on orbit 65. The impact point was within normal tolerances. All capsule re-entry events occurred within tolerance. Table 4-1 lists the sequence of monitored re-entry and recovery event times.

The condition of the recovered capsule was satisfactory with damage limited to normal paint blistering. Post flight inspection and test showed no anomalies.

MISSION 1010-1

RECOVERY SEQUENCE OF EVENTS

Event	System Time	Delta Time Actual	Delta Time Nominal
Transfer	-	-	-
Electrical Disconnect	-	-	$0.90^{+.43}_{-.40}$
*Separation	4875.50	-	$2.00 \pm .25$
**Spin	4878.00	-	$3.40 \pm .30$
Retro	4885.00	7.00	$7.55 \pm .45$
Despin	-	-	$10.75 \pm .54$
T/C Separation	4897.00	-	$1.50 \pm .15$
Voltage Mon. Closed	4972.32	75.32	$104.00 \pm 44.$
"G" Switch Open	5405.52	433.20	-
Parachute Cover Off	5439.80	34.28	34.00 ± 1.5
Drogue Chute Deployed	5440.54	0.74	$0.75 \pm .08$
Drogue Chute Release	5450.62	10.08	10.05 ± 1.0
Main Chute Deployed	5451.42	0.80	$0.80 \pm .20$
Main Chute Disreefed	5455.61	4.19	4.00 ± 1.7

* From Transfer

** From Elect. Disc.

The event times not recorded were not available due to noise on the T/M channels.

TABLE 4-1

SECTION 5

MISSION 1010-2 RECOVERY SYSTEM

SRV #652 was received at A/P on 30 December 1963 at a receiving weight of 154 pounds. After modification and incorporation of outstanding E.O.'s the capsule was delivered to systems test for incorporation into the J-13 system. The original SRV assigned to J-11B produced a soft wrap during the TASC test. SRV #652 was assigned to J-11 on 19 June 1964.

The following modifications were made to SRV #652 during the test phase at A/P:

1. 6/24/64 - The mating studs were reworked to short to the thrust cone ring.

2. 6/30/64 - A lanyard hole was drilled in the forebody to comply with T22-720, revision B.

The capsule was delivered for shipment to VAFB on 13 July 1964. Testing at VAFB was completed without problems.

The second recovery unit was successfully recovered by air catch on orbit 144. The impact point was within normal tolerances. Table 5-1 is a tabulation of the sequence of monitored re-entry and recovery event times.

Post flight inspections and tests showed all events to be normal. Damage to the recovery system was limited to normal blistering of paint.

MISSION 1010-2

RECOVERY SEQUENCE OF EVENTS

Event	System Time	Delta Time Actual	Delta Time Nominal
Transfer	3266.00	-	-
Electrical Disconnect	3266.94	0.94	$0.90^{+.43}_{-.40}$
*Separation	3268.00	2.00	$2.00 \pm .25$
**Spin	3270.35	3.41	$3.40 \pm .30$
Retro	3277.90	7.55	$7.55 \pm .45$
Despin	3288.62	10.72	$10.75 \pm .54$
T/C Separation	3290.20	1.58	$1.50 \pm .15$
Voltage Mon. Closed	3364.22	74.02	$104.00 \pm .44$
"G" Switch Open	3841.14	476.92	-
Parachute Cover Off	3875.28	34.14	34.00 ± 1.5
Drogue Chute Deployed	3876.00	0.72	$0.75 \pm .08$
Drogue Chute Release	3886.00	10.00	10.05 ± 1.0
Main Chute Deployed	3886.62	0.62	$0.80 \pm .20$
Main Chute Disreefed	3890.75	4.13	4.00 ± 1.7

* From Transfer

** From Elect. Disc.

TABLE 5-1

SECTION 6

MASTER (FWD) PANORAMIC CAMERA

A. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	152
Main Camera Lens	1252435
Supply Horizon Camera	132B
Supply Horizon Camera Lens	812279
Take-up Horizon Camera	132A
Take-up Horixon Camera Lens	812267
Supply Cassette	SC-26

B. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:

Lens	24" f/3.5
Slit Width	0.175"
Filter Type	Wratten
Film Type	Eastman Type 3404

Supply (Port) Horizon Camera:

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

Take-up (Starboard) Horizon Camera:

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

C. POST FLIGHT PERFORMANCE EVALUATION

The quality of the photography produced by the Master camera was very good throughout both missions. The information content of the photography was considered excellent. The missions were considered approximately equal to Mission 1009. A small soft area was present at the take-up end of the format during Mission 1010-1 however it was not present during Mission 1010-2.

The electro-mechanical operation of the camera system was normal during both missions. Light leaks affected the third frame from start and fifth frame from end of most passes. The magnitude of the fog caused by the leaks correlates with the length of camera sit time. These frames are located between the shutter and input metering roller and near the Recovery Barrel-Fairing interface.

Emulsion scratches were present at each end of the format during both missions. A fine scratch, about two inches long, was at the take-up end near the camera number edge and a series of short scratches were near both format edges under the data block. The data lost by this degradation is exceedingly small however the released emulsion can produce minus density streaks if it becomes deposited on the field flattener or filter. This streaking was observed during thirty-nine frames pass D88.

The emulsion scratches near the data block are attributed to sharp edges on the scan head rollers. Steps have been taken to hone the roller edges on future cameras.

The horizon camera and associated fiducials operated satisfactorily throughout both missions as did the data block, end-of-pass mark and time track. The time track was too close to the format but was usable.

Minor edge static was observed at random intervals through both missions. The character of the static pattern indicated that it could have been produced either on the ground or in flight. No corona discharge was observed.

SECTION 7

SLAVE (AFT) PANORAMIC CAMERA

A. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	153
Main Camera Lens	1282435
Supply Horizon Camera	164B
Supply Horizon Camera Lens	813527
Take-up Horizon Camera	166A
Take-up Horizon Camera Lens	814014
Supply Cassette	SC-26

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 3404

Supply (Starboard) Horixon Camera:

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

Take-up (Port) Horizon Camera:

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

C. POST FLIGHT PERFORMANCE EVALUATION

The photographic quality and information content of the imagery produced by the Slave camera during both missions was comparable to the Master camera photography. The photography was degraded by the minor effects of the usual light leaks and minus density streaks.

The formats were also degraded by emulsion scratching but to a lesser degree than the Master camera. Scratching was limited to the take-up end, data block edge, where fine scratches and some abrasion was present. The largest scratch was about four inches long.

A minus density streak of variable length was present from pass D04 to D07. It was about 1/2 inch wide and varied from six to thirty inches long however the photographic effect was minor. It is postulated that a piece of material became lodged in the filter area and was in the slit area intermittently through pass D07 when it fell away.

Intermittent dendritic static was noted in a few random frames originating at the film edge. As in the case of the Master camera, the marking could have been created in flight or on the ground.

The horizon cameras and fiducials operated satisfactorily throughout both missions. The data block functioned properly during the missions as did the end-of-pass mark.

The time track was very good during both missions with the exception of the first frame of passes D06, D07 and A09E. In these cases the time track was continuous for the first frame however the 200 cycle pulse could be detected.

SECTION 8

PANORAMIC CAMERA EXPOSURE

The exposure parameters for both cameras were a 0.175 inch wide slit and a Wratten 21 filter. Historically a 0.200 inch wide slit has been incorporated in cameras flown during September. The narrower slit was selected to achieve a better match of camera and film processing as well as reducing the sensitivity of the system to image motion.

The illumination conditions during both missions were slightly lower than experienced during recent missions. The frequency distributions of the solar elevations and solar azimuths encountered during the photographic operations are shown in Figures 8-1 to 8-4.

The nominal exposure times are shown as a function of latitude for passes D-08, D-72 and D-136 in Figures 8-5 to 8-7. 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
1010-1	FWD	Predicted	0	21	79
		Reported	0	13	87
1010-1	AFT	Predicted	0	21	79
		Reported	0	19	81
1010-2	FWD	Predicted	0	50	50
		Reported	0	16	84
1010-2	AFT	Predicted	0	50	50
		Reported	0	23	77