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CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1025-1 and 1025-2

FTV 1616; JX-28

May 20, 1966

Approved [redacted]
Mgr.
Advanced Projects

Approved [redacted]
[redacted] Mgr.
[redacted] rogram

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No. [redacted]

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1616.

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 1025-1 and 1025-2 which was launched on 5 October 1965.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1025-1 and 1025-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the JX-28 payload system and to identify the source of in-flight anomalies.

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, 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 1025, placed into orbit by Flight Test Vehicle #1616 and LV-2A booster #433, 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 JX-28 payload system. This Corona "J" system is designed to acquire search, reconnaissance and mapping photography of selected areas of the earth from orbital altitudes. The planned mission was two, 5 day photographic periods with no inactive period. This mission was flown in a nose forward attitude.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 1745:58 Z (1045:58 PDT) on 5 October 1965. 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 [redacted] under central control of the Satellite Test Center at Sunnyvale, California. Mission 1025-1 consisted of a 5 day operation and was completed by air recovery on 10 October 1965. Mission 1025-2 completed a five day operation and was air recovered on 15 October 1965.

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM

MISSION 1025

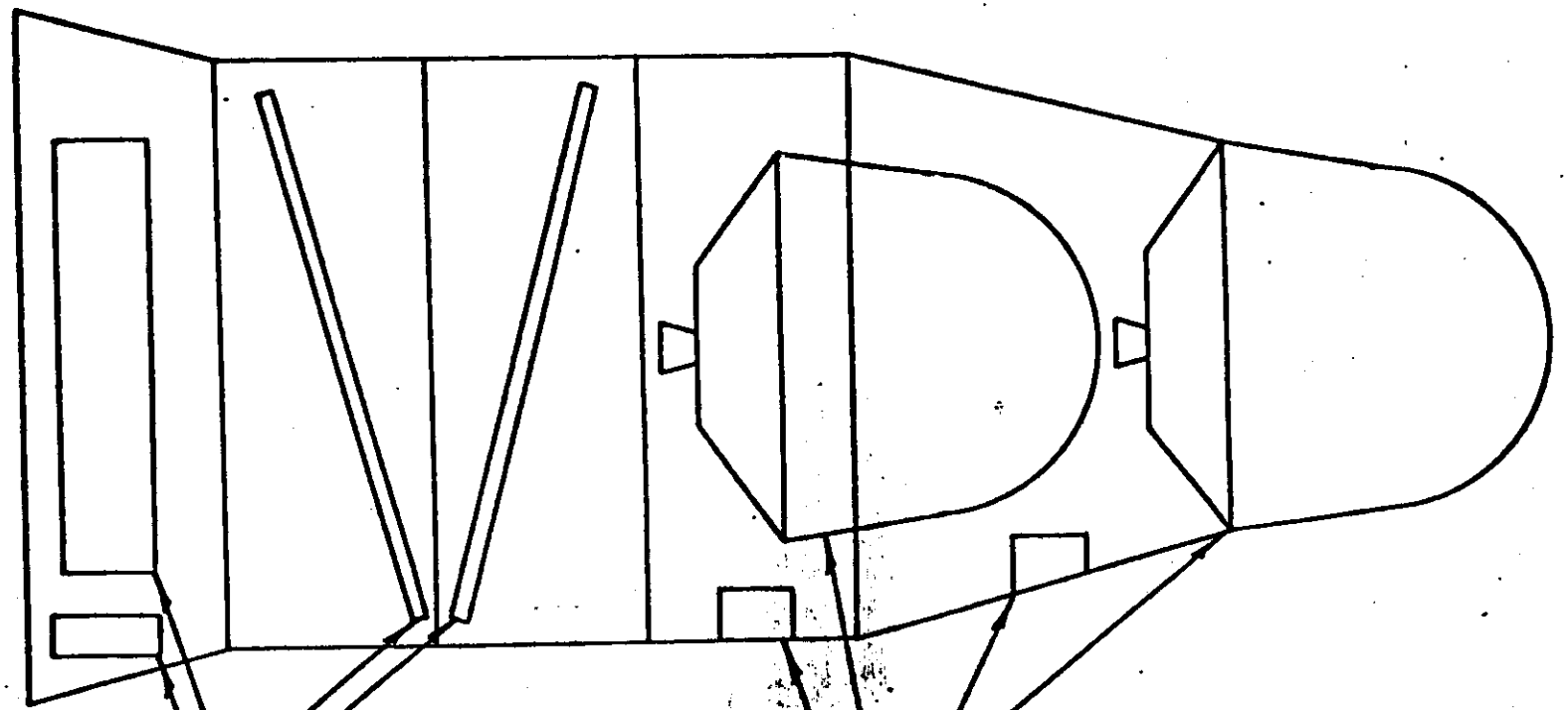


FIGURE 1-1

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 1 Actuals
Period (Min.)	89.87	89.78
Perigee (N.M.)	109.4	112.4
Apogee (N.M.)	184.2	180.8
Inclination (Deg.)	75.01	75.03
Perigee Latitude (Deg. N.)	26	41
Eccentricity	0.0105	0.0095

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 observed in the photography averaged 30% for the entire flight.

D. STELLAR-INDEX CAMERAS

The cameras operated normally throughout both missions. The Index photography quality ranks with the best to date. The Stellar film ran out before the Index film on both missions.

E. OTHER SUBSYSTEMS

The clock, instrumentation, command and thermal control subsystems performed satisfactorily on both missions.

F. CONCLUSIONS

The panoramic and S/I photography acquired in orbit during Mission 1025-1 and 1025-2 was of high quality and adequate to meet the search, surveillance and mapping objective of the "J" Program.

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 susceptibility to corona discharge. Such discharge fogs the film thus degrading the operational photography.

2. Test Summary

The JX-28 payload system was subjected to an environmental test in the Hivos chamber at Sunnyvale from 7-7-65 to 7-13-65. The test encompassed 3 days of operation in the "A" mode and 2 days of operation in the "B" mode. The payload operation was limited to daytime operation only.

Both panoramic cameras operated satisfactorily throughout the test.

Both the A and B phase stellar/index cameras operated satisfactorily.

The clock system functioned normally throughout the test. Due to power failures and IRIG "C" time resets, the clock accuracy check was limited to the A phase. A clock system error of approximately 33 milliseconds was observed in 3 days of operation in the "A" phase.

Both A and B recovery sequences were satisfactory including proper transfer to the B phase.

A deactivate sequence was conducted in the B phase with all functions occurring properly.

Numerous current transients occurred during both phases of the test while initiating RTC commands and at instrument "on-off" times.

Both Phillips gages indicated good correlation with the alphatron gage.

The pressure make-up system operated satisfactorily throughout the test.

3. Panoramic Camera Performance

Both panoramic cameras operated satisfactorily throughout the test.

The cycle periods for instrument No. 1 were approximately 1.33% slow to 2.00% fast in the A phase and 0.96% slow to 0.91% fast in the B phase. Instrument No. 2 ran 2.12% slow to 0.15% fast in the A phase and 1.98% slow to 0.34% slow in the B phase.

The 99/101 percent clutch ratios averaged 6/6 for instrument No. 1 and 7/6 for instrument No. 2.

The cut and wrap operation was normal with both instruments operating 5 cycles and the lens stopping in the stowed position. However, instrument No. 1 shutdown faster than instrument No. 2. The timer length had an 8.0 second delay with 26 seconds of instrument operate time, as compared to the acceptance test timer length of 8.0 seconds delay with 25 seconds of instrument operate time.

A deactivate sequence was performed in the B phase with both instruments operating 6 cycles and the lens stopping in the stowed position. However, instrument No. 1 shutdown faster than instrument No. 2.

4. Stellar/Index Performance

The stellar/index camera operated satisfactorily throughout the A phase with normal camera slewing during the cut and wrap operation.

The B phase stellar/index camera operated satisfactorily with normal camera slewing during the B recovery sequence.

5. Clock System Performance

The clock system operated satisfactorily throughout the A and B phase. However, due to power failures and reset of the IRIG "C" time generator during the B phase, the clock accuracy check was limited to the A phase only. The clock system error was approximately 33 milliseconds in 3 days of operation in the A phase.

6. Temperature Summary

A tabulation of the temperature environment encountered during the test follows:

Average Temperature Environment

A Phase	Orbit 1	Orbit 6	Orbit 15
Instr. No. 1	79	92	99
Instr. No. 2	77	85	92

B Phase	Orbit 1	Orbit 6	Orbit 10
Instr. No. 1	81	70	82
Instr. No. 2	80	70	82

NOTE: The temperatures have not been corrected for self-heating.

7. Pressure Make-up System Performance

The pressure make-up system operated satisfactorily throughout the test. The average gas consumption was approximately 6.2 lbs./minute of instrument operate time. The maximum pressure attained with the PMU was approximately 40 to 55 microns during instrument operation.

The minimum pressure attained during the test was approximately 1.3 microns during a static condition.

Approximate System Pressures

Orbit	Alphatron Gage "A" Phase	Alphatron Gage "B" Phase
1	13 microns	1.8 microns
2	12	1.6
3	10	1.3
4	8	1.4
5	8	2.2
6	5	1.8
7	7	1.6
8	7	2.7
9	6	2.3
10	8	2.8

No corona discharge marks were observed that would disqualify either camera for flight.

B. RESOLUTION TEST

The dynamic resolution test of the JX-28 payload system was performed at the A/P facility on 20 July 1965. 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 3401 film threaded in the JX-28 system, during the 30 minute soak light leak test, determined that no film fogging was present. The light tight integrity of the system was considered acceptable for flight.

D. FLIGHT LOADING AND CERTIFICATION

Film from JX-28 pad run and flight readiness was examined at VAFB on 28 September 1965. No significant difference could be detected between this film and film from previous operations at A/P.

Camera 127 binary "1" bit, (least significant bit) was partially obscured in the readiness run but not in the pad run. This was assumed to be foreign matter picked up from the film and was blown out prior to final system assembly. This same camera has always had an occasional extra timing PIP. It has always appeared between 2 regular PIPS and clearly identified as extra.

"A" index reseau exhibited a large piece of foreign matter on the pad run film. The reseau was removed and a chip was found which matched the shadow on the film.

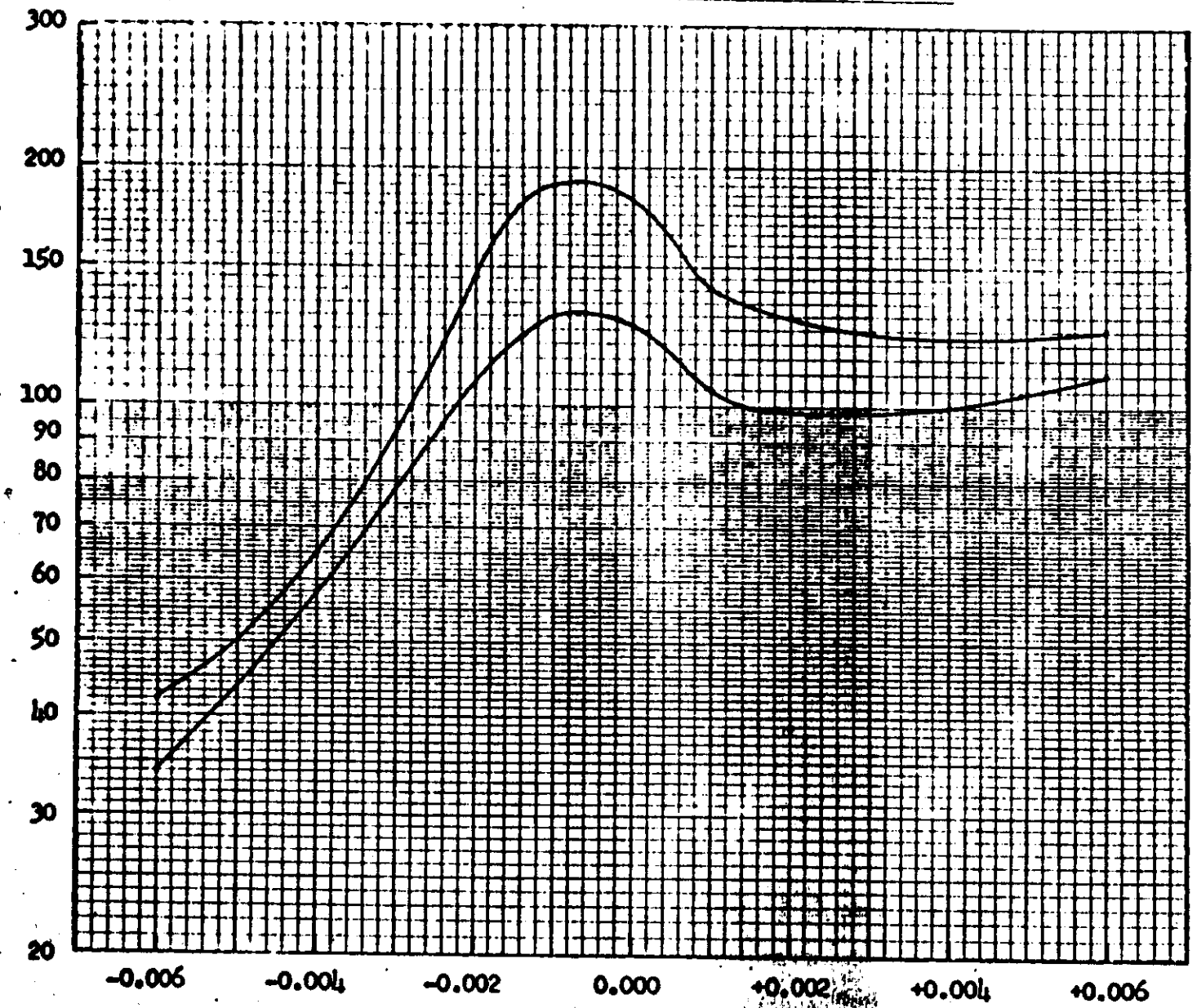
These two cases of foreign material were taken care of during the normal cleaning prior to flight loading. Nothing was done to compromise the integrity of the system and, therefore, an additional flight readiness operation was considered unnecessary.

All other data was present and acceptable.

Flight loading occurred 30 September. Confidence run and audit was held 1 October 1965.

In summary, system JX-28 meets all established criteria for flight readiness.

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 142

Payload No: JX-28

Resolution (1/mm)

High Contrast: 190

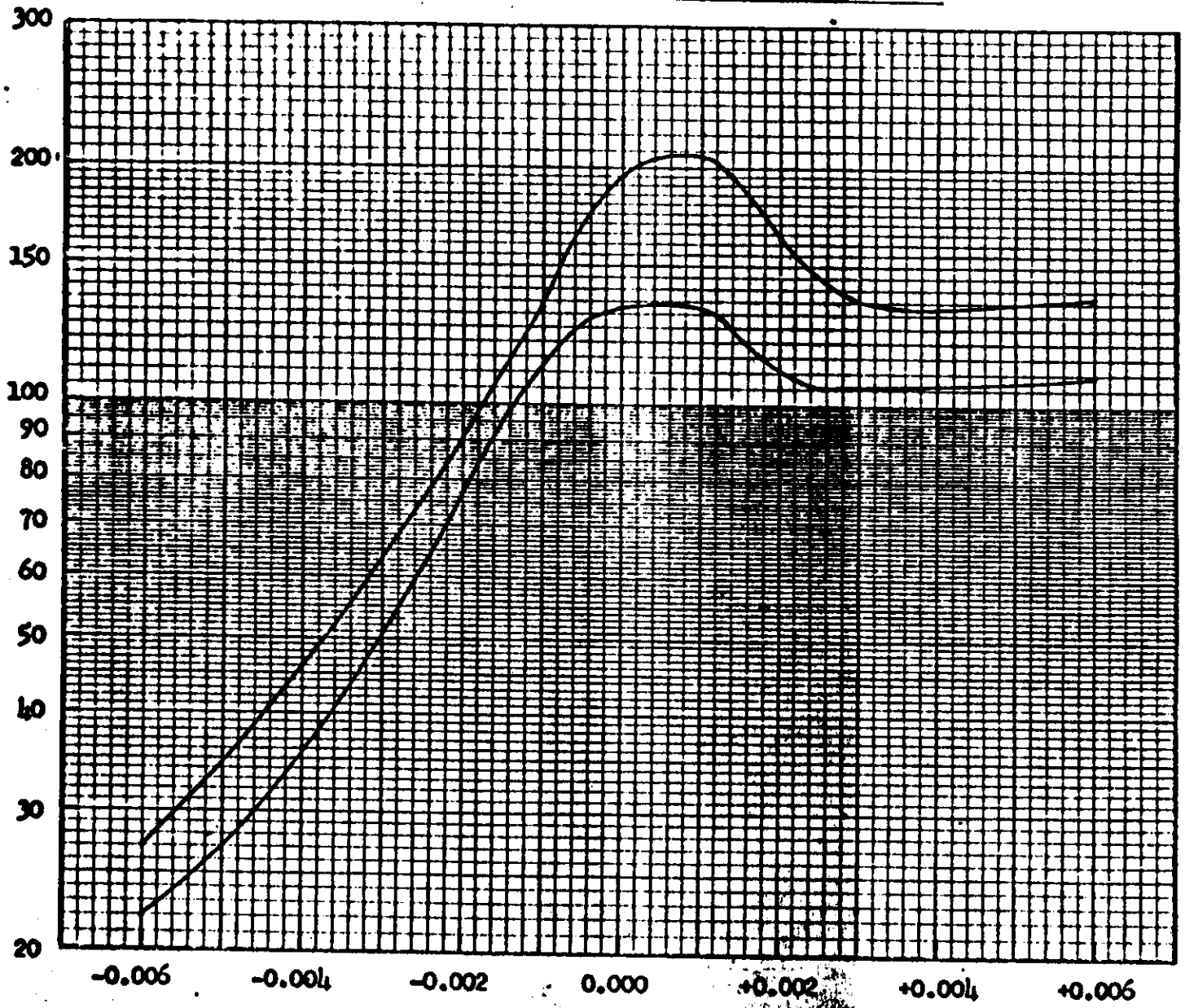
Low Contrast: 130

Film Type: 3404

Test Date: 7/17/65

FIGURE 2-1

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 127

Payload No: JX-28

Resolution (l/mm)

High Contrast: 205

Low Contrast: 132

Film Type: 3404

Test Date: 7/17/65

FIGURE 2-2

SECTION 3

FLIGHT OPERATIONS

A. INSTRUMENTATION AND COMMAND PERFORMANCE

The No. 1 temperature sensor on the supply spool was inoperative at launch. The rotation monitor in the - 2 cassette for the master camera was intermittent during the cut and wrap operation. No other instrumentation anomalies were noted in the engineering pass data.

On Rev. 1 at [redacted] the camera system was programmed on for 14 cycles. The system completed 16 cycles on this operation. Review on the data indicated the actual operation was 6.84 seconds longer than the tape verification times. A 7 second reset was given prior to the operation causing the tape to advance to a point 5.85 seconds prior to the programmed On time for the operation. It appears from the sequence of events that the camera system was turned on at the reset time not at the programmed On time.

Tracking station hardware and software (Auggie) malfunctions occurred several times during the flight resulting in prelort/analog commanding problems. These problems did not impair the operation of the camera system but necessitated additional commanding to obtain the desired command setups.

No other anomalies were noted in either the real time or stored commands.

Due to initial orbit dispersions a V/h programmer start delay step change was necessary on Rev. 7. This change was made, and for the balance of the first mission as well as during the entire second mission there was less than 3 percent V/h ramp-to-orbit mismatch.

B. PANORAMIC CAMERA PERFORMANCE

Both panoramic cameras operated normally throughout the flight. The cycle periods for the engineering passes monitored are tabulated in Table 3-1. Camera system dynamic operation, 99/101% clutch operation, start-up, shut-down and transport functions were normal for all passes monitored. Cut and wrap and transfer to the -2 Mission occurred as programmed with no evidence of any dynamic problems in the data.

JX28/1616 MISSION: 1025 CYCLE RATE DATA-ENGINEERING OPERATIONS.

REV/MODE	RAMP	T.U.R.	INST 142 ACT.	INST 142 CAL.	INST 142 DEV.	INST 127 ACT.	INST 127 CAL.	INST 127 DEV.	142/127 DIFF.
9 A	7 7	.360	3.540	3.524	0.46S	3.540	3.538	0.06S	-0.00
16 A	7 7	1850	2.520	2.477	1.72S	2.535	2.490	1.82S	0.60
32 A	7 7	1890	2.520	2.474	1.85S	2.530	2.486	1.76S	0.40
63 A	7 7	2020	2.519	2.480	1.57S	2.530	2.492	1.52S	0.44
79 A	7 7	2068	2.509	2.488	0.82S	2.546	2.501	1.81S	1.47
89 B	7 7	473	3.467	3.456	0.32S	3.519	3.470	1.40S	1.50
95 B	7 7	2042	2.520	2.483	1.47S	2.555	2.496	2.38S	1.39
111 B	7 7	2000	2.510	2.477	1.31S	2.530	2.490	1.62S	0.80
127 B	7 7	2050	2.510	2.485	1.01S	2.545	2.497	1.92S	1.39
136 B	7 7	598	3.355	3.367	0.36F	3.432	3.382	1.49S	2.30
143 B	7 7	2100	2.520	2.496	0.96S	2.560	2.508	2.06S	1.59
159 B	7 7	2140	2.530	2.508	0.89S	2.560	2.520	1.59S	1.19

DEV. AND DIFF. ARE IN PERCENT
THE (-) SIGN INDICATES THAT INST 1 IS SLOWER THAN INST 2
F=FAST AND S=SLOW

TABLE 3-1

Panoramic Film Consumption - Frames

These data are based on cycle counters and nominal supply length.

	Nominal	Actual	
		Master	Slave
Pre-Flight Samples	18	19	17
Pre-Launch	100	100	100
-1 Mission	2982	2939	2904
-2 Mission	2940	2982	3019
Total	6040	6040	6040

C. STELLAR INDEX PERFORMANCE

Both the -1 and 12 stellar index cameras operated properly during the entire mission. Stellar index events were observed on all engineering passes. Shutter pulses were observed on all daytime engineering passes. Telemetry data indicated index film was depleted during slew on both missions.

D. CLOCK PERFORMANCE

Good correlation was obtained between the clock and [redacted] tracking station system time. Table 3-2 contains the clock/system time correlation.

E. PRESSURE MAKE-UP SYSTEM PERFORMANCE

The overall average PMU system consumption rate was 7.9 PSIA per minute of operate time. This compares favorably with previous systems. The pressure of the PMU supply at launch was 2675 PSIA and was down to 550 PSIA at the end of the -2 mission.

A Phillips gauge was used to monitor the internal pressure of the system. Figure 3-1 is a plot of the pressure profile for the flight. Included on the plot is a typical pressure profile from Pirani gauges flown on J-3, J-11, J-12 and J-13 systems and Phillips gauge data for J-24. These data follow the same basic envelope, however, the Phillips gauge pressure data for this mission is higher by approximately 3 microns than the data for J-24.

CLOCK SUMMARY Jx-28/1616 Mission 1025

ORDER FIT 1

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DFLTA ST	REV	STA
0.643928700 05	0.3803931790 06	0.6439287370 05	-0.0037	0	
0.246958680 05	0.4270962120 06	0.2469589760 05	-0.0096	9	
0.639899130 05	0.4663902330 06	0.6398991090 05	0.0021	16	
0.244783030 05	0.5132786150 06	0.2447828370 05	0.0193	25	
0.637709480 05	0.1570038100 05	0.6377095410 05	-0.0061	32	
0.242526760 05	0.6258211800 05	0.2425268190 05	-0.0059	41	
0.581503230 05	0.9647977100 05	0.5815032830 05	-0.0053	47	
0.240129780 05	0.1487424270 06	0.2401297400 05	0.0040	57	
0.579433780 05	0.1826728330 06	0.5794337340 05	0.0046	63	
0.183748830 05	0.2295043450 06	0.1837487620 05	0.0068	72	
0.576885130 05	0.2688179830 06	0.5768850650 05	0.0065	79	
0.234936300 05	0.3210231260 06	0.2349363930 05	-0.0093	89	
0.574142680 05	0.3549437570 06	0.5741426370 05	0.0043	95	
0.178350730 05	0.4017645770 06	0.1783507450 05	-0.0015	104	
0.570932430 05	0.4410227620 06	0.5709325190 05	-0.0069	111	
0.175455730 05	0.4878750980 06	0.1754557870 05	-0.0057	120	
0.567945330 05	0.5271240550 06	0.5679452800 05	0.0050	127	
0.172427280 05	0.3710134400 05	0.1724271990 05	-0.0081	136	
0.565231630 05	0.7638179600 05	0.5652316420 05	-0.0012	143	
0.169245530 05	0.1231831890 06	0.1692454800 05	0.0050	152	
0.562272780 05	0.1624859350 06	0.5622728630 05	-0.0083	159	

A0=-0.31600023090 06 A1= 0.99999980441900 00
SIGMA=0.00710 NO. POINTS= 21
RATIO OF CLOCK TIME TO SYS TIME= 0.10000001955800 01

ORDER FIT 2

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DFLTA ST	REV	STA
0.643928700 05	0.3803931790 06	0.6439287180 05	-0.0018	0	
0.246958680 05	0.4270962120 06	0.2469589630 05	-0.0063	9	
0.639899130 05	0.4663902330 06	0.6398991010 05	0.0029	16	
0.244783030 05	0.5132786150 06	0.2447828340 05	-0.0196	25	
0.637709480 05	0.1570038100 05	0.6377095410 05	-0.0061	32	
0.242526760 05	0.6258211800 05	0.2425268230 05	-0.0063	41	
0.581503230 05	0.9647977100 05	0.5815032890 05	-0.0059	47	
0.240129780 05	0.1487424270 06	0.2401297490 05	0.0031	57	
0.579433780 05	0.1826728330 06	0.5794337440 05	0.0036	63	
0.183748830 05	0.2295043450 06	0.1837487730 05	-0.0057	72	
0.576885130 05	0.2688179830 06	0.5768850770 05	0.0053	79	
0.234936300 05	0.3210231260 06	0.2349364040 05	-0.0104	89	
0.574142680 05	0.3549437570 06	0.5741426470 05	-0.0033	95	
0.178350730 05	0.4017645770 06	0.1783507540 05	-0.0024	104	
0.570932430 05	0.4410227620 06	0.5709325250 05	-0.0095	111	
0.175455730 05	0.4878750980 06	0.1754557910 05	-0.0061	120	
0.567945330 05	0.5271240550 06	0.5679452810 05	0.0049	127	
0.172427280 05	0.3710134400 05	0.1724271950 05	0.0085	136	
0.565231630 05	0.7638179600 05	0.5652316340 05	-0.0004	143	
0.169245530 05	0.1231831890 06	0.1692454670 05	0.0063	152	
0.562272780 05	0.1624859350 06	0.5622728440 05	-0.0064	159	

A0=-0.31600024070 06 A1= 0.99999983137700 00
A2=-0.16643315695500-13
SIGMA=0.00704 NO. POINTS= 21

TABLE 3-2

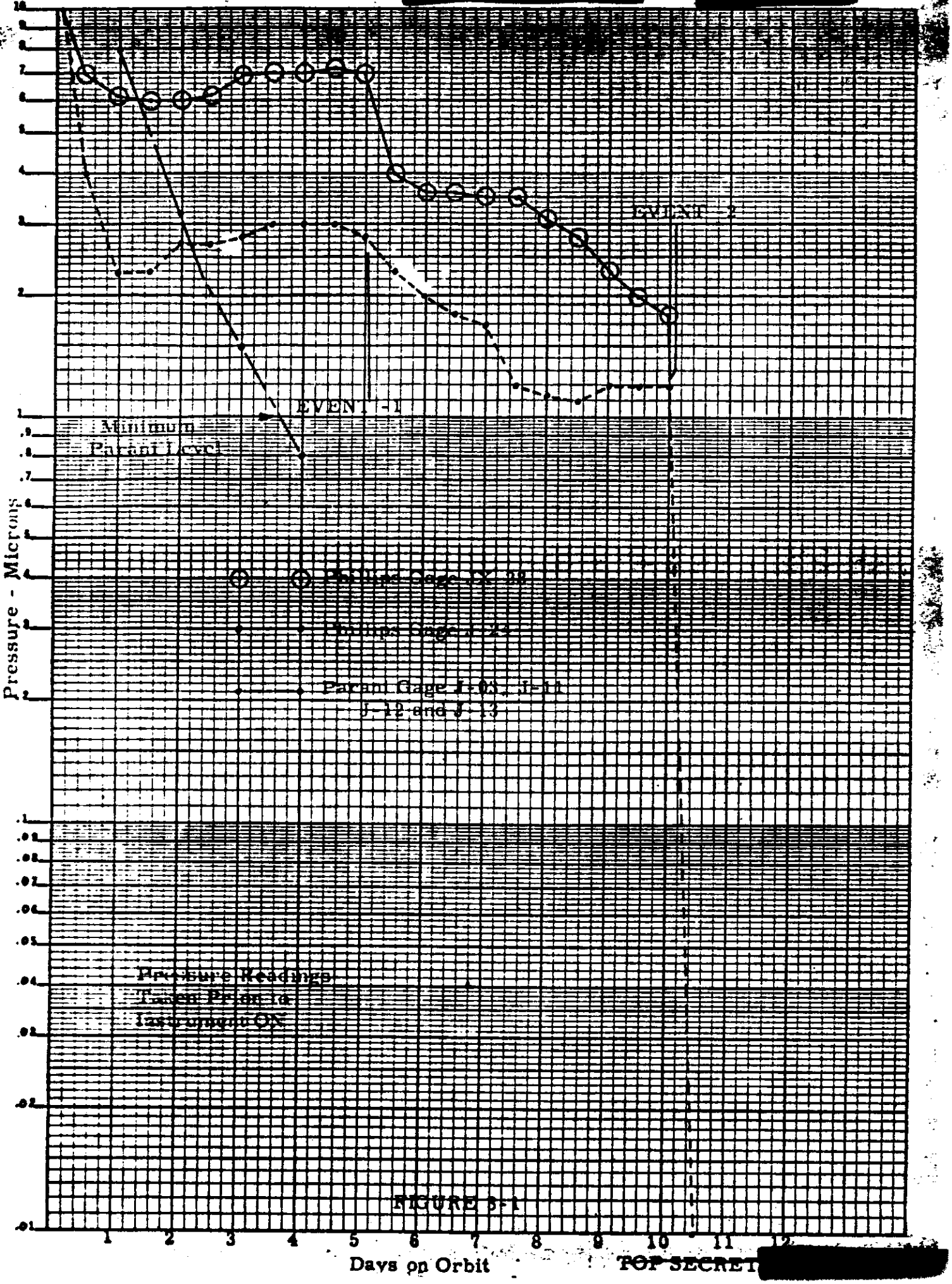


FIGURE 3-1

F. THERMAL ENVIRONMENT

Temperature data for the [redacted] acquisitions are included in Table 3-3. These data have been corrected for self-heating per data obtained in pre-flight environmental testing. Actual versus predicted temperatures for major components are plotted and included as Figures 3-2 to 3-4.

TABLE 3-3

Jx-28 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																				
Master Camera	0	9	16	25	32	41	47	57	63	72	79	89	95	104	111	120	127	136	143	152	15
3	69	74	70	74	72	74	71	76	74	77	75	71	70	70	70	71	71	71	72	70	7
4	75	79	76	80	78	80	77	82	80	84	82	77	77	78	77	79	77	78	81	80	8
5	73	83	79	84	81	84	80	88	85	87	86	83	81	83	81	84	84	85	85	87	8
6	67	81	79	84	81	84	82	87	86	87	87	83	83	83	84	85	86	87	89	88	9
7	65	74	73	78	78	76	77	79	79	83	80	75	76	77	77	75	77	77	80	77	8
8	72	83	79	86	81	84	82	88	85	89	86	83	81	84	81	85	84	87	83	87	8
9	71	84	80	86	84	87	83	89	86	91	89	87	86	89	84	90	87	92	89	91	8
10	68	73	73	76	76	75	76	77	77	80	79	72	72	75	74	74	75	75	87	75	8
11	98	74	70	77	75	78	76	80	76	82	75	77	71	78	75	78	75	70	75	78	7
12	76	79	74	80	76	79	75	82	78	81	79	77	74	77	73	77	76	78	87	77	7
13	74	74	72	76	76	75	77	79	78	80	87	73	73	73	75	74	75	76	77	76	7
AVG.		78	75	80	78	80	73	83	80	84	82	78	77	79	78	79	79	80	82	81	8
Slave Camera																					
3	67	73	69	77	73	77	73	81	77	82	77	80	76	80	81	84	80	86	82	86	8
4	70	73	69	76	72	77	72	80	66	82	81	78	74	79	75	81	77	84	80	84	8
5	69	76	73	80	76	78	76	81	79	85	77	78	76	79	79	79	79	82	81	81	8
6	64	72	70	74	73	73	72	77	76	77	81	71	72	71	70	72	73	74	74	73	7
7	64	75	74	79	76	78	76	80	80	82	80	77	75	77	75	78	77	79	79	79	8
8	69	73	71	78	74	76	74	78	76	81	79	75	73	77	75	77	75	77	79	77	8
9	67	72	70	74	72	73	72	77	74	77	76	72	70	72	70	73	73	74	73	73	7
10	69	70	68	73	72	71	73	75	73	79	74	70	69	73	70	72	71	73	73	75	7
11	95	65	65	70	67	70	70	74	72	76	76	69	70	71	68	71	70	73	73	75	7
12	71	74	69	77	72	78	73	81	76	83	79	80	75	81	76	84	79	86	80	86	8
13	69	66	64	67	67	67	68	70	71	72	72	66	68	65	66	67	68	69	70	69	7
AVG.		71	69	75	72	74	73	77	75	80	78	75	73	75	74	76	75	78	77	78	7
Supply Spool																					
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	68	59	63	68	66	70	68	72	71	75	73	71	69	72	69	72	71	75	73	75	7

NOTE: All data corrected for self-heating, except injection.

TABLE 3-3

Jx-28 TEMPERATURE SUMMARY

SENSOR	ORBITS ACQUIRED																			
	0	9	16	25	32	41	47	57	63	72	79	89	95	104	111	120	127	136	143	152	15
Fair ("A") Barrel #1 ("B")																					
1	-	30	61	30	61	33	58	36	61	36	61	24	20	24	17	20	20	24	20	20	2
2	-	10	10	10	7	13	3	13	7	13	0	61	45	61	42	61	45	58	45	55	4
3	211	3	3	03	3	3	3	6	6	6	3	84	84	24	75	87	78	89	78	82	7
4	217	58	58	55	58	55	58	58	65	62	65	68	95	75	95	81	98	84	104	87	10
5		48	83	58	89	55	86	58	99	64	102	61	85	70	88	73	99	73	102	77	10
6	-	-	95	143	97	230+	103	OBH	108	OBH	140	-	-	-	-	-	-	-	-	-	-
Barrel #2																					
1	145	30	57	54	63	60	67	63	73	63	76	54	79	60	85	63	93	66	66	67	10
2	162	10	68	56	71	59	74	62	84	62	86	62	83	71	83	74	89	78	92	77	9
3	218	3	85	73	82	76	82	79	85	76	85	73	76	76	70	79	70	76	70	76	7
4	185	55	56	68	56	68	52	68	56	65	56	59	46	59	43	59	46	56	46	49	4
5	195	48	55	58	58	62	54	62	58	58	58	36	33	39	33	39	33	39	33	33	2
Conic Adapter																					
1	166	50	61	56	72	60	75	63	84	63	87	56	90	63	93	66	99	72	99	72	10
Clock																					
1	99	27	75	75	77	79	77	81	81	81	81	73	70	75	70	77	73	75	75	77	7
2	103	80	73	78	78	80	78	82	80	82	82	71	71	71	69	76	73	75	73	76	7
Thrust Cone "A" to "B" SRV																					
1	-	48	38	41	40	42	37	44	39	44	40	67	65	70	65	68	69	69	68	68	6
2	60	65	55	58	58	59	55	61	59	63	61	77	76	82	76	80	80	82	80	81	8
Stellar/Index "A" to "B"																					
1	85	57	51	54	54	57	54	57	57	61	57	69	66	69	66	72	69	72	72	69	7
2	74	59	49	52	53	56	53	59	59	59	59	66	66	70	63	70	66	70	70	66	7
Recovery Battery "B" SRV																					
1	75	73	71	71	72	74	74	76	76	78	80	81	82	82	81	81	85	81	82	80	8
Master Cassette "A" SRV																					
2	90	73	70	70	69	70	69	71	70	70	73	-	-	-	-	-	-	-	-	-	-

NOTE: Only Thrust Cone Data corrected for Self-heating.

JX-28 FLIGHT vs PREDICTED TEMPERATURE DATA

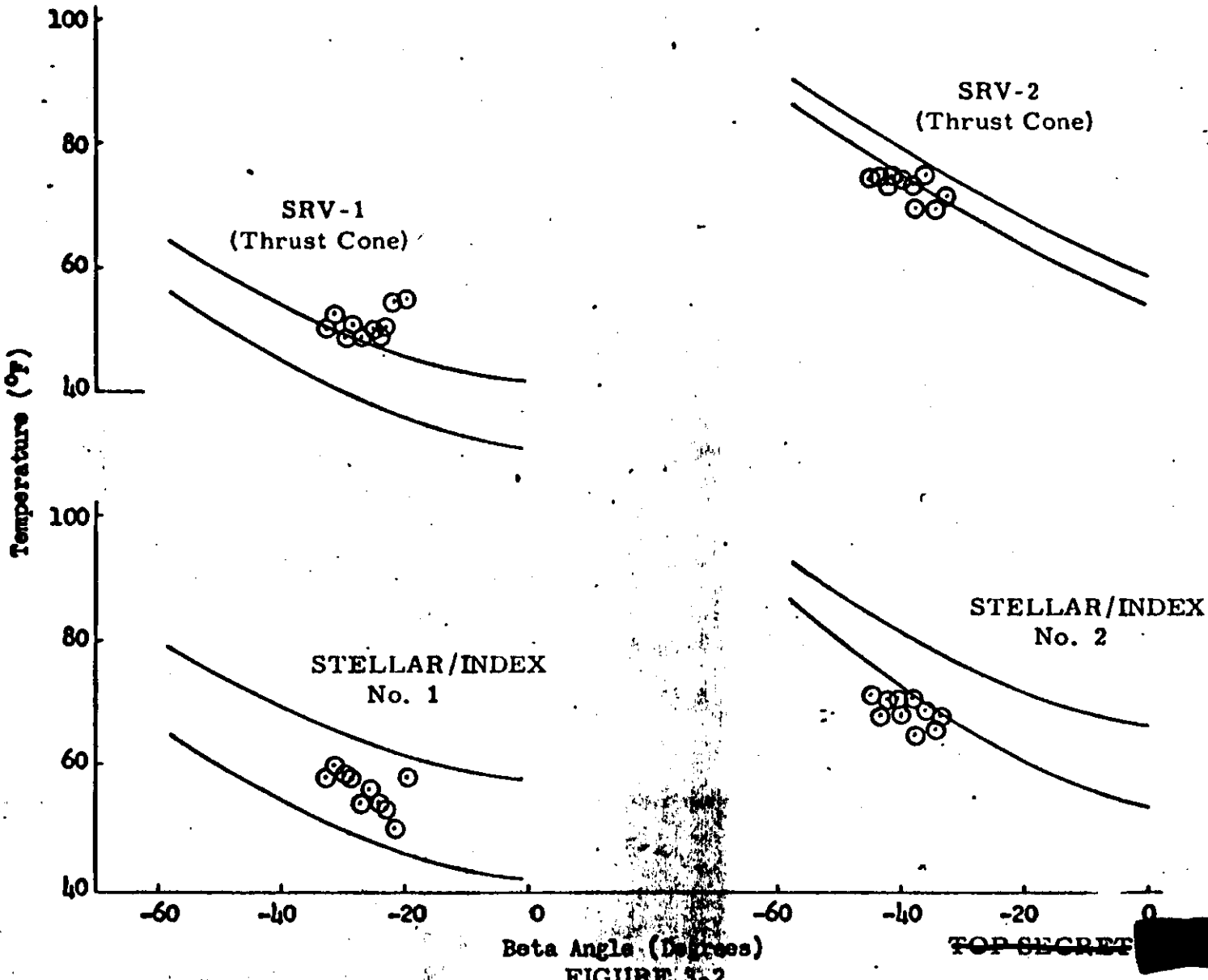


FIGURE 3.2

JX-28 FLIGHT vs PREDICTED TEMPERATURE DATA

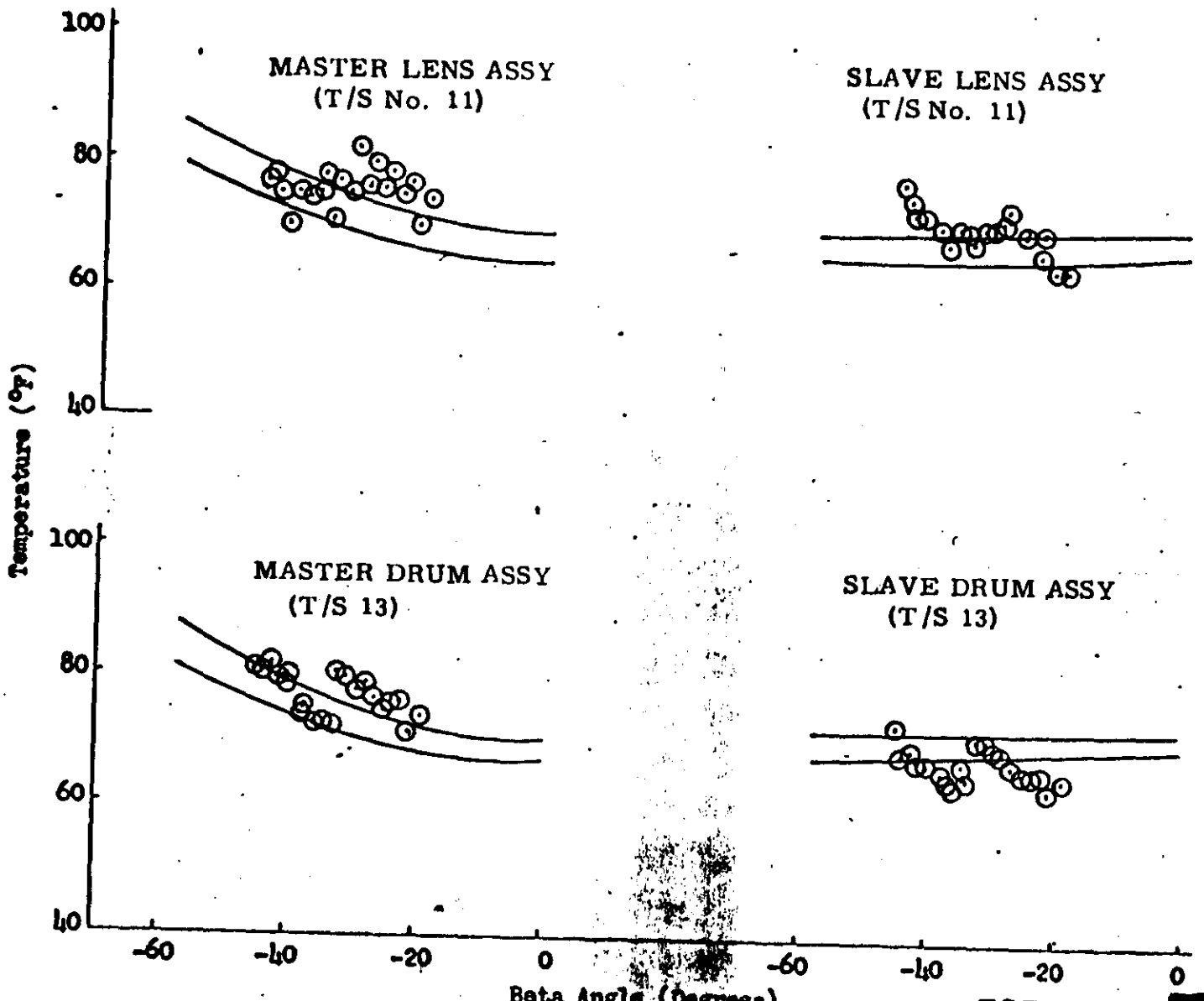


FIGURE 3-8

JX-28 FLIGHT vs PREDICTED TEMPERATURE DATA

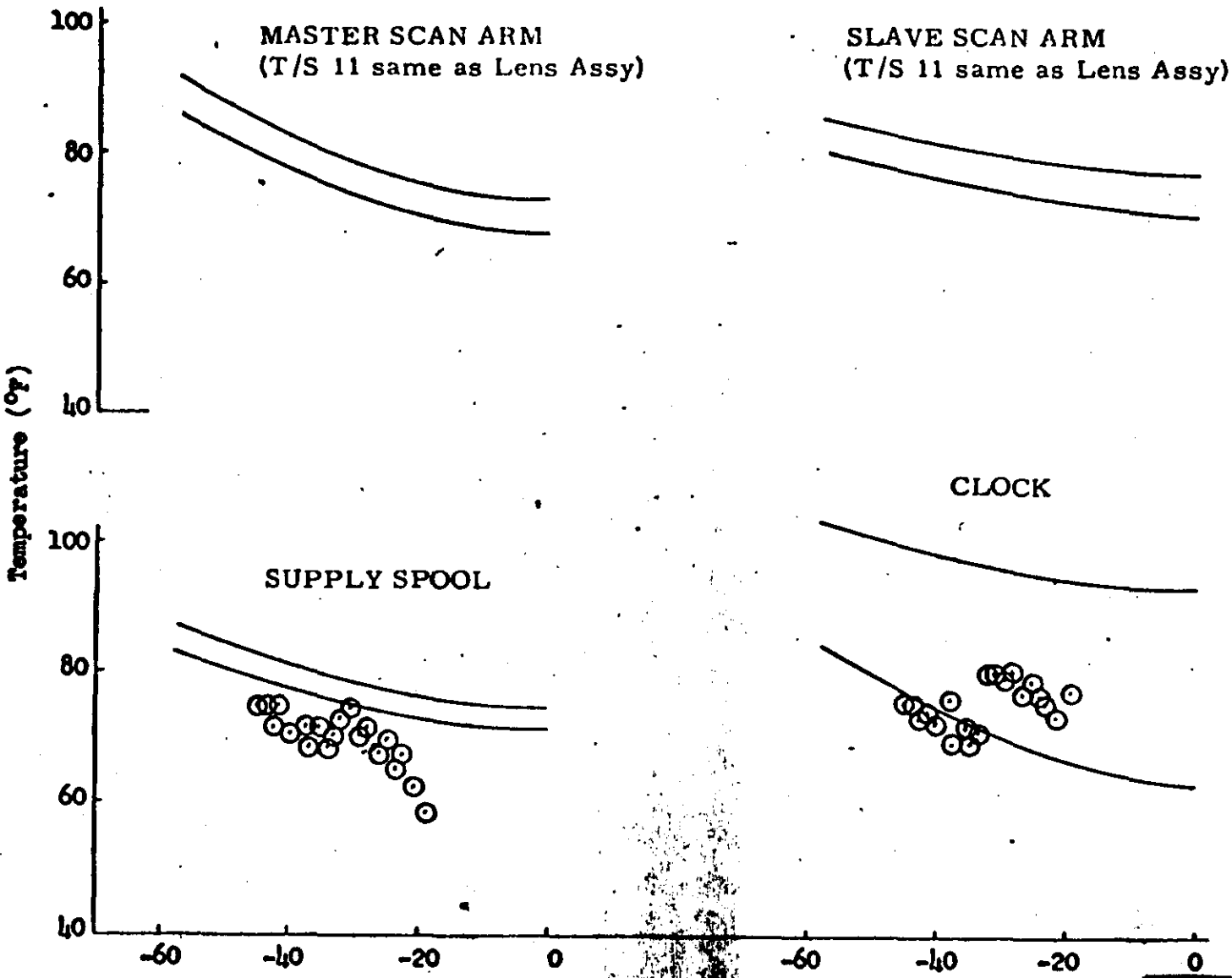


FIGURE 3-4