CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1051-1 and 1051-2

FTV 1649, J-44

Approved [redacted]ager
Advanced Projects

Approved [redacted] Manager
Program [redacted]

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1649.

Lockheed Missiles and Space Company has the responsibility for evaluating payload performance under the Level of Effort and "J" System contracts.

This document is the final payload test and performance evaluation report for Missions 1051-1 and 1051-2 which was launched on 1 May 1969.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1051-1 and 1051-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-44 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 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.

This report contains certain data summarized from [redacted] Processing Summary, [redacted] and from AFSPPF TERO Report, [redacted]

SECTION 1

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1051, placed into orbit by Flight Test Vehicle #1649 and THORAD Booster #544 (S/N 69-037), 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 equipment. Figure 1-1 presents an inboard profile of the J-44 payload system. This Corona "J" system is designed to acquire search and reconnaissance photography of selected areas of the earth from orbital altitudes. A seven day -1 mission and an eight day -2 mission was planned.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 0146:58Z(1846:58 PDT) on 1 May 1969. 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. Mission 1051-1 consisted of a 7 day operation and was completed by air recovery on 8 May 1969. Mission 1051-2 was completed with an air recovery on 17 May 1969 following a 9 day photographic operation.

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

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 65 Actuals
Period (Min.)	89.60	89.537
Perigee (N.M.)	100.39	98.368
Apogee (N.M.)	190.88	188.720
Inclination (Deg.)	64.98	64.995
Perigee Latitude (Deg. N.)	59.53	58.840
Eccentricity	0.0126	0.01262

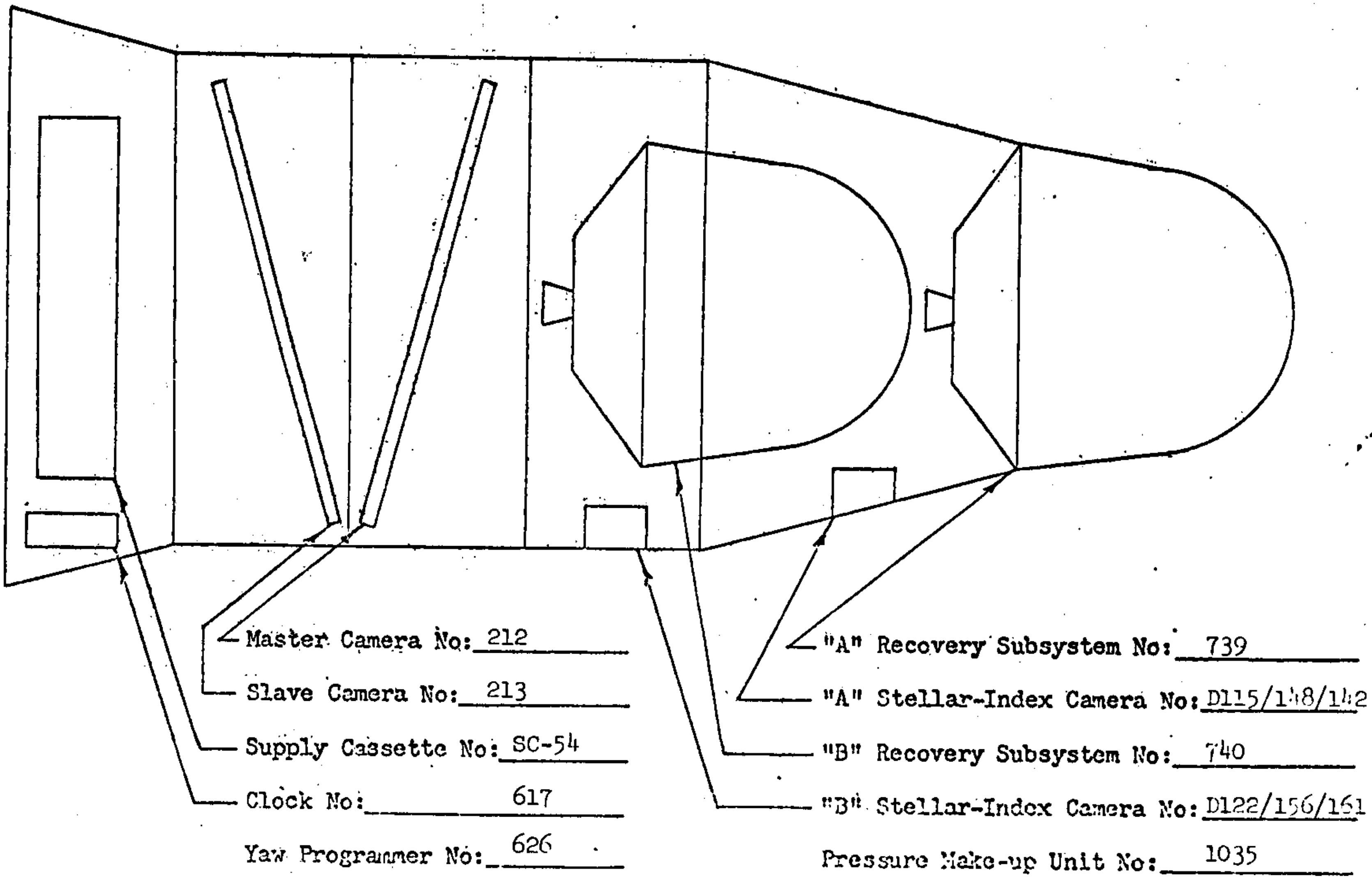
Two DMU rockets were fired during Mission 1051-1, and three during 1051-2. Two additional rockets were fired after the second recovery.

C. PANORAMIC CAMERAS

Both instruments operated satisfactorily throughout both missions, and produced fair to good image quality. Both instruments suffered severe "soft" spots, as well as more subtle focal gradients. Atmospherics were considered a major degrading factor.

SCHEMATIC INBOARD PROFILE - CORONA J-44 SYSTEM

MISSION 1051



FIGU 1-1

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D. STELLAR-INDEX CAMERAS

Both the "A" and "B" S/I's operated satisfactorily and most Stellar images appear as points rather than the common odd shaped patterns.

E. OTHER SUB-SYSTEMS

The clock, pressure make-up, command and thermal control subsystems performed satisfactorily throughout the flight. The instrumentation experienced intermittent discrepancies which were minor and had no degrading influence on system performance.

F. COMPONENT IDENTIFICATION AND SETTINGS

1. MASTER PANORAMIC CAMERA

a. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	212
Main Camera Lens	1742435
Supply Horizon Camera	310-G6
Supply Horizon Camera Lens	12878
Take-Up Horizon Camera	314-G5
Take-Up Horizon Camera Lens	19093
Supply Cassette	SC-54

b. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:

Lens	24"f/3.5
Slit Width	0.140"
Filter Type	Wratten 21
Film Type	Eastman Type 3404

Supply (Port) Horizon Camera:

Lens	55 mm f/6.3
Aperture Setting	f/6.3
Exposure Time	1/100 second
Filter Type	Wratten 25

Take-Up (Starboard) Horizon Camera:

Lens	55 mm f/6.3
Aperture Setting	f/8.0
Exposure Time	1/100 second
Filter Type	Wratten 25

2. SLAVE PANORAMIC CAMERA

a. COMPONENT ASSIGNMENT

Component	Serial Number
Main Camera	213
Main Camera Lens	1732435
Supply Horizon Camera	311-G6
Supply Horizon Camera Lens	19094
Take-Up Horizon Camera	294-G5
Take-Up Horizon Camera Lens	19097
Supply Cassette	SC-54

b. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:

Lens	24"f/3.5
Slit Width	0.140"
Filter Type	Wratten 21
Film Type	Eastman Type 3404

Supply (Starboard) Horizon Camera:

Lens	55 mm f/6.3
Aperture Setting	f/8.0
Exposure Time	1/100 second
Filter Type	Wratten 25

Take-Up (Port) Horizon Camera:

Lens	55 mm f/6.3
Aperture Setting	f/6.3
Exposure Time	1/100 second
Filter Type	Wratten 25

3. MISSION 1051-1 STELLAR-INDEX CAMERA

a. COMPONENT ASSIGNMENT

Component	Serial Number
Camera	D-115
Index Reseau	148
Stellar Reseau	142

b. CAMERA DATA AND FLIGHT SETTINGS

Stellar Camera:

Lens	85 mm f/1.8
Exposure Time	2 seconds
Filter Type	None
Film Type	Eastman Type 3401

Index Camera:

Lens	38 mm f/4.5
Exposure Time	1/500 second
Filter Type	Wratten 21
Film Type	Eastman Type 3400

4. MISSION 1051-2 STELLAR-INDEX CAMERA

a. COMPONENT ASSIGNMENT

Component	Serial Number
Camera	D-122
Index Reseau	156
Stellar Reseau	161

b. CAMERA DATA AND FLIGHT SETTINGS

Stellar Camera:

Lens	85 mm f/1.8
Exposure Time	1 second
Filter Type	None
Film Type	Eastman Type 3401

Index Camera:

Lens	38 mm f/4.5
Exposure Time	1/500 second
Filter Type	Wratten 21
Film Type	Eastman Type 3400

SECTION 2

PRE-FLIGHT SYSTEMS TESTS

As a standard procedure, the J payload systems are subjected to a series of tests which demonstrates a satisfactory level of confidence that the systems will indeed perform as required in their respective missions. The tests include an operational type exposure to simulate thermal/altitude environment, a light leak evaluation, and a dynamic measure of the photographic performance capabilities. After being subjected to these tests, the J-44 system was held in storage in flight-ready condition. This period of storage exceeded the calendar life limitations for reliable system operation in a flight mission. In order to re-establish the required confidence level, the system was refurbished and resubjected to the entire series of preflight tests. Significant baseline levels and anomalies experienced with this system during this latter series of tests are as follows:

A. ENVIRONMENTAL TEST

The J-44 system was subjected to an environmental HIVOS chamber test from 17 January through 24 January 1969. Minor corona marking was experienced on the panoramic and the S/I instruments, but was not potentially degrading to imagery and was accepted for flight without further modification. The test films consisted of SO-230 in the main instruments, and 3400 and 3401 in the S/I units. Mission 1051 actually used type 3404 film in the main instruments, rather than SO-230.

Instrument operation was satisfactory except for the following conditions:

1. The film was pulled off the rails of the slave camera at the beginning of the "B" mission portion of the test, but was apparently associated with

the cut-and-wrap procedures rather than the operation of the camera proper. The cameras operated for 33 cycles in this condition before the slave instrument failsafed. The chamber door was lowered, the film placed in the rails, and the system was placed back in the chamber. The test was resumed with no further problems.

2. The panoramic camera's cycle rate errors exceeded the specified tolerance of one percent deviation from the calibration values. A subsequent recalibration of the instruments was performed.

An apparent excessive clock error was detected during the HIVOS test. However, the test facility IRIG time base used proved to be unreliable, thus preventing an accurate check. Subsequent testing verified a deficiency in the clock performance, and the unit was replaced.

The pressure make-up system functioned normally throughout test. At the request of the camera manufacturer, the maximum temperature in the chamber was restricted to 90°F. This temperature limitation was exceeded only once during the test; namely, a temperature of 93°F for a thirty-minute period. The instrumentation suffered instances of noisy monitors, but indicated correctly throughout. The noise appeared to be caused by dirty contacts, which was corrected by subsequent cleaning.

The command system functioned properly for both bucket tests with no evidence of any equipment malfunctions.

B. RESOLUTION TEST

Initial resolution and theodolite tests were performed on 13 January 1967. Results of the thru-focus resolution tests of pan instruments 212 and 213 show the following characteristics:

Master Pan Instrument No. 212

Maximum high contrast resolution 183 lines/mm at 0.000 focal position.

Maximum low contrast resolution 118 lines/mm at -0.001 focal position.

Slave Instrument No. 213

Maximum high contrast resolution 186 lines/mm at 0.000 focal position.

Maximum low contrast resolution 120 lines/mm at -0.001 focal position.

Additional Boston investigations indicated that optimum focus position would be attained by adding 0.002" shim to the scan head of each instrument. The modified instruments were retested as a part of the reacceptance testing sequence on 21 March 1969, with the following results:

Master Pan Instrument No. 212

Maximum high contrast resolution 179 lines/mm at -0.003 focal position.

Maximum low contrast resolution 117 lines/mm at -0.003 focal position.

Slave Pan Instrument No. 213

Maximum high contrast resolution 189 lines/mm at -0.003 focal position.

Maximum low contrast resolution 122 lines/mm at -0.003 focal position.

The final test data for both instruments is shown in Figures 2-1 and 2-2. Both instruments met the system requirements specification.

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PRE-FLIGHT DYNAMIC RESOLUTION

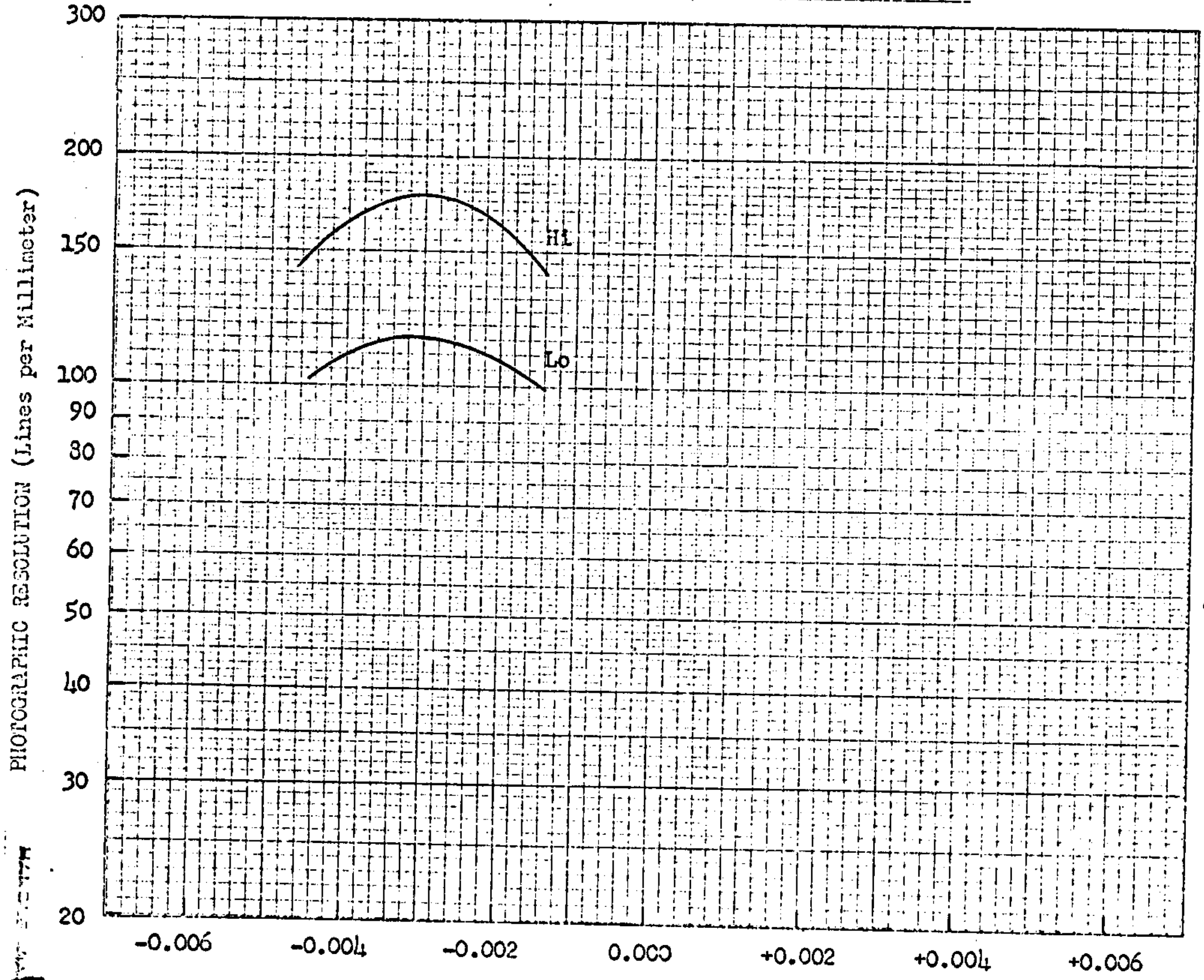

FIGURE 2-1

Camera No: 212

Payload No: J-44

Resolution (1/mm)

High Contrast: 179

Low Contrast: 117

Film Type: 3404

Test Date: 3/21/69

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[redacted]

PRE-FLIGHT DYNAMIC RESOLUTION

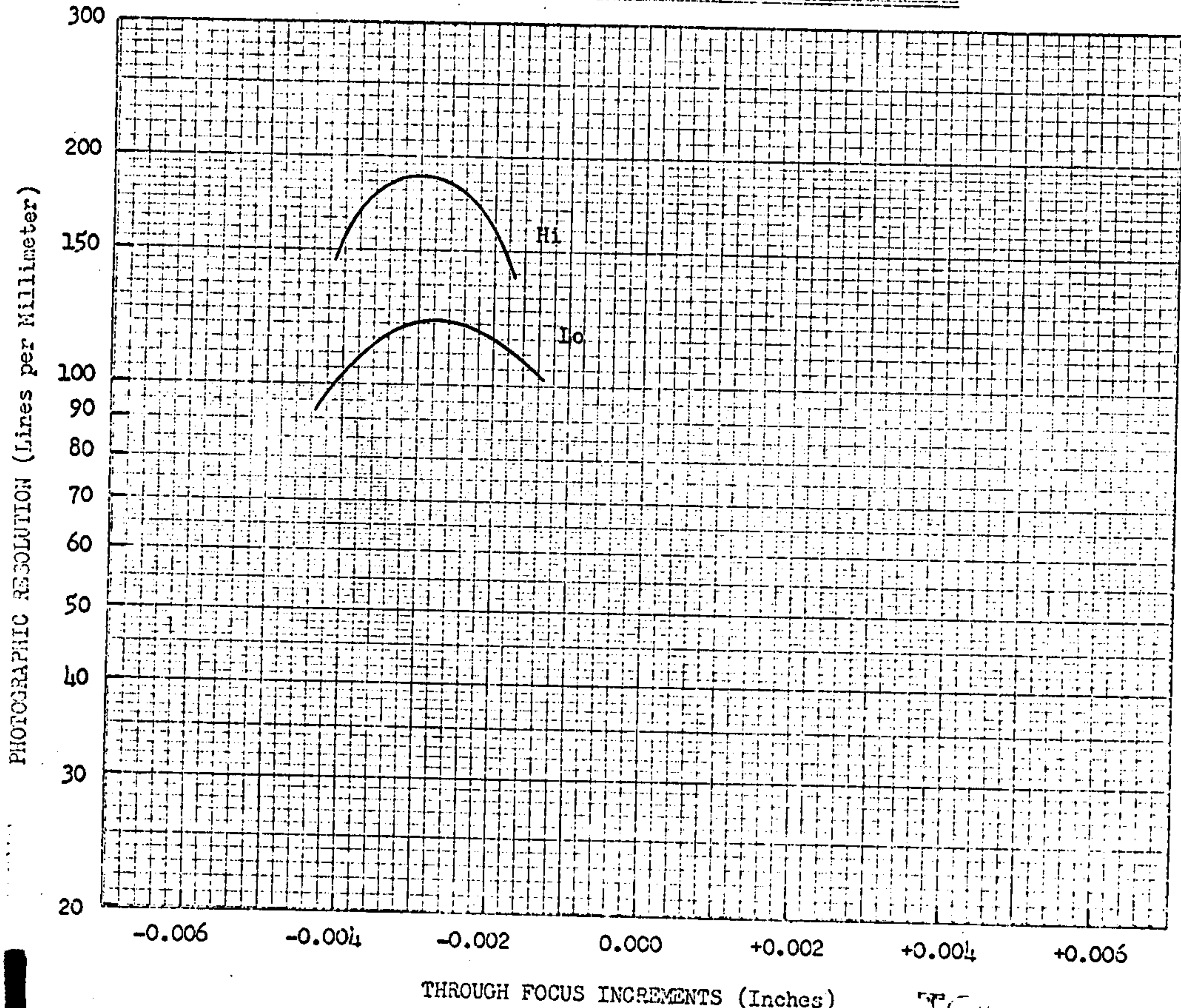

FIGURE 2-2

Camera No: 213

Payload No: J 44

Resolution (1/mm)

High Contrast: 189

Low Contrast: 122

Film Type: 3404

Test Date: 3/21/69

[redacted]

C. LIGHT LEAK TEST

A light leak test was performed on the J-44 system 13 January 1969 as a part of the testing recycle procedures for this system. The test material indicated leaks at the Master instrument drum seal and at the interface of the instrument barrel sections, plus a very light fogging at the "A" SRV cover. The drum seals were examined, and the leak reduced as much as possible within the limitations of the design. The structural interface leaks were associated with residual pieces of tape trapped in the joint during system assembly prior to the test. The interface surfaces were carefully cleaned and examined. The mission results indicate that this anomaly did not recur. However, the drum seal leaks were evident in varying degrees in the flight material.

The apparently minor fog noted on the Master record at the SRV cover is of unique interest in that similar levels of fogging at the same location during the light leak test in past systems produced major obscuration during the subsequent mission. Repainting the forebody in the area suspected had provided a reasonable solution to this characteristic in the past, and was recommended as a preventative measure for this system.

D. READINESS TESTS

An initial readiness test was performed 18 April 1969, demonstrating satisfactory recording of lamps and auxiliary data. However, films from both cameras showed distinct patterns of scratches along the 200 pps timing marks opposite the data block. These scratches were also observed in previous testing, and were expected to be diminished as a result of the pre-readiness cleaning procedures. Investigation of the continued occurrence of these marks revealed undesirable clearance conditions at the ends of the formats, and these conditions were corrected. However, it was established that the scratch marks were a result of an interaction with the scan head rollers during film metering. Similar conditions have been observed in other J-1 systems but have not degraded image quality.

A subsequent rerun of the readiness test (19 April 1969) produced film records virtually identical to the first test. On the basis of the results of the investigation, the cameras were considered acceptable for flight.

E. S/I CAMERAS FINAL BASELINE TEST

The final processed film exhibits from S/I cameras #D-115 and #D-122 revealed acceptable camera performance. All auxiliary data such as imagery of the correlation lamp, reseau, reseau serial no., and shutter operation were present. The stellar cameras employed film type 3401; the index cameras, type 3400.

F. FLIGHT LOADING AND CERTIFICATION

The supply cassette of panoramic cameras #212 and #213 was loaded with flight film on 21 April 1969. The loading proceeded without incident. Film samples from each spool were removed for standard distribution. A/P samples were exposed on the EGG sensitometer, processed and evaluated. Sensitometric characteristics, including film speed, were acceptable.

When the flight systems were assembled, it was discovered that the film was dragging over the "B" bucket water seal structure. The systems were disassembled and the "B" capsule cover reworked to provide the proper clearances. The systems were reassembled, electrically checked and shipped to VAFB for final preparations. On 25 April 1969 the panoramic cameras were operated in final flight configuration. All functions were normal, with proper film tracking. Typical rail scratching on the emulsion side of both panoramic films was observed. No other marks or discrepancies were evident from the visual inspection.

On 28 April 1969 the final system light leak search demonstrated that the J-44 system is effectively sealed in accordance with the system requirement specification.

Throughout the testing of the J-44 camera systems the Slave instrument exhibited an apparently minor variation in the 200 pps marks, giving a somewhat out-of-focus appearance for a distance of 3 to 4 inches. No mechanical or electrical discrepancies could be detected, and the system was accepted for flight. The suspected association of this characteristic with the "soft spot" experienced in mission photography (see Section 4) brings emphasis to the fact that the normal testing procedures instituted at A/P are inadequate for the analysis and evaluation of the system dynamic performance.

SECTION 3

FLIGHT OPERATIONS

A. SUMMARY

Launch, ascent, and injection events occurred as programmed. A velocity meter shutdown was observed and the orbit attained was within three (3) sigma dispersions.

Both panoramic cameras operated satisfactorily throughout the flight.

Both stellar/index cameras operated normally during the flight.

The instrumentation system, command system, clock system, pressure make-up system, and the on-orbit yaw function generator performed normally for the duration of the flight.

The thermal environment was within the pre-flight predictions.

Kik-Zorro 38 (early -1 to -2 switchover) was performed on Rev. 100[redacted] and all transfer functions were normal.

Both recovery systems were successful air-catches, with all events ocurring as programmed. The impact point was within predicted limits for both systems.

Five DMU rockets were fired during the flight for period control to satisfactorily control the ground track error.

Rocket No.	Pass	Period Seconds	Velocity Change ft/sec	Impulse lb/sec
1	10	10.24	16.30	2044
2	70	10.55	16.65	2082
3	137	11.01	17.35	1975
4	193	11.29	17.80	2002
5	238	11.72	18.45	2073

DMU rockets No. 6 and 7 were fired successfully after event No. 2.

The ground track error was limited to 20 nautical miles east and 1 nautical mile west of nominal at the equator. Figure 3-1 graphically depicts the mission orbit history.

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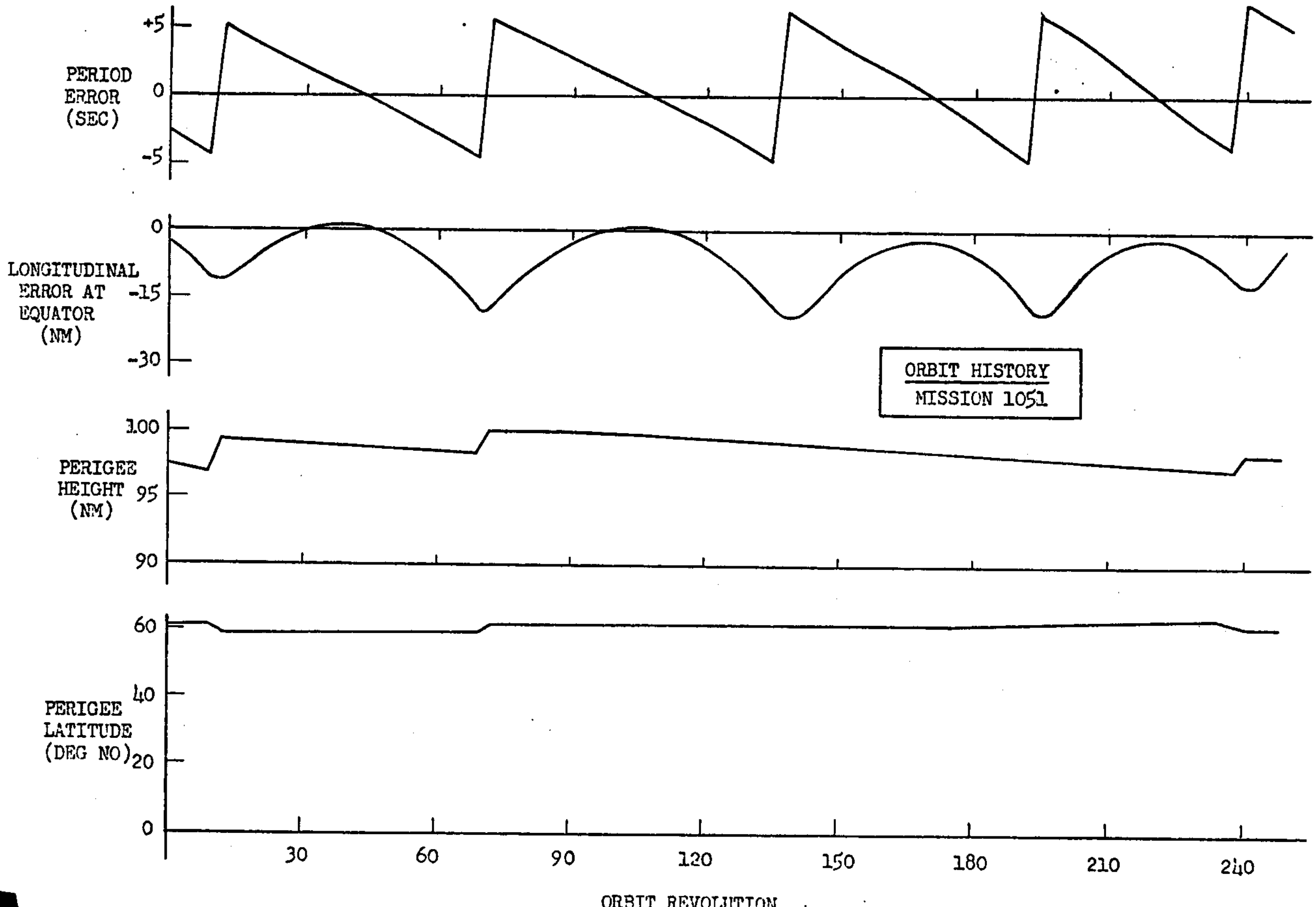

FIGURE 3-1

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[redacted]

B. PANORAMIC CAMERA PERFORMANCE

Both panoramic cameras indicated normal operation throughout the flight. Camera system dynamics, 99/101 clutch, start-up, shut-down, and film transport were normal on the observed engineering operations over the [redacted] tracking station.

The cycle rates obtained from the engineering operations over the [redacted] tracking station indicated the panoramic cameras were running approximately 3-4% from the calibrated value. The rate errors appeared to be fast during the first third of the ramp profile and slow during the last half of the ramp profile. Unfortunately, the time-up-ramp of the engineering operations were nearly always the same which precluded evaluation of cycle rate errors throughout the ramp profile. Attempts were made to provide compensating commands so as to achieve nominal performance. The net results are statistically summarized in Figures 3-2 through 3-5.

The cut and wrap operation and transfer to the -2 recovery system was normal on Rev. 100 over the [redacted] tracking station. The Kik-Zorro 38 command (early -1 to -2 switchover) was utilized.

The panoramic film on both instruments was exhausted prior to engineering operation over the [redacted] tracking station on Rev. 248.

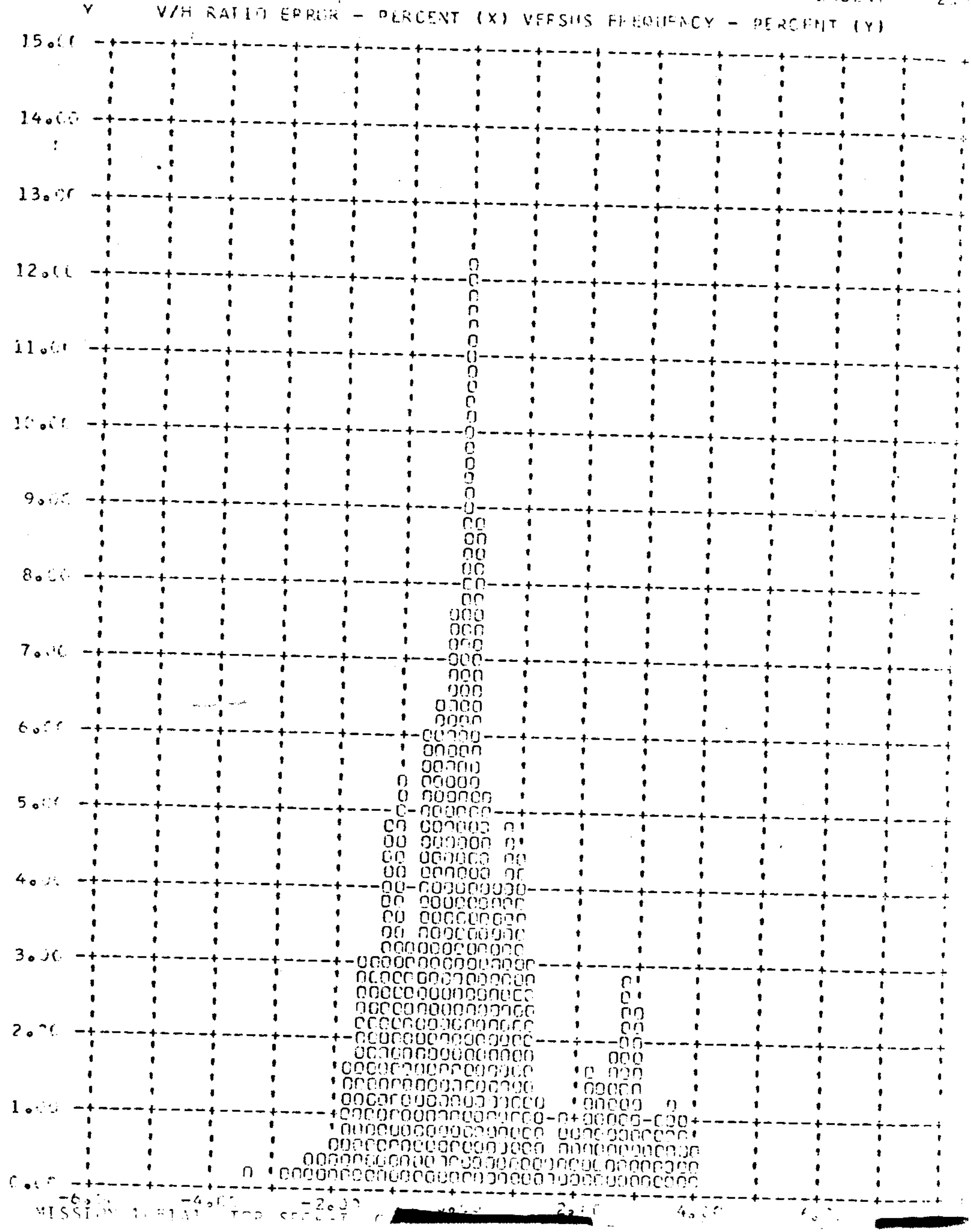
Panoramic Film Consumption

	Actual	
	Master	Slave
Pre-Launch	80	80
-1 Mission	2987	2972
-2 Mission	3085	3097
Total	6152	6149

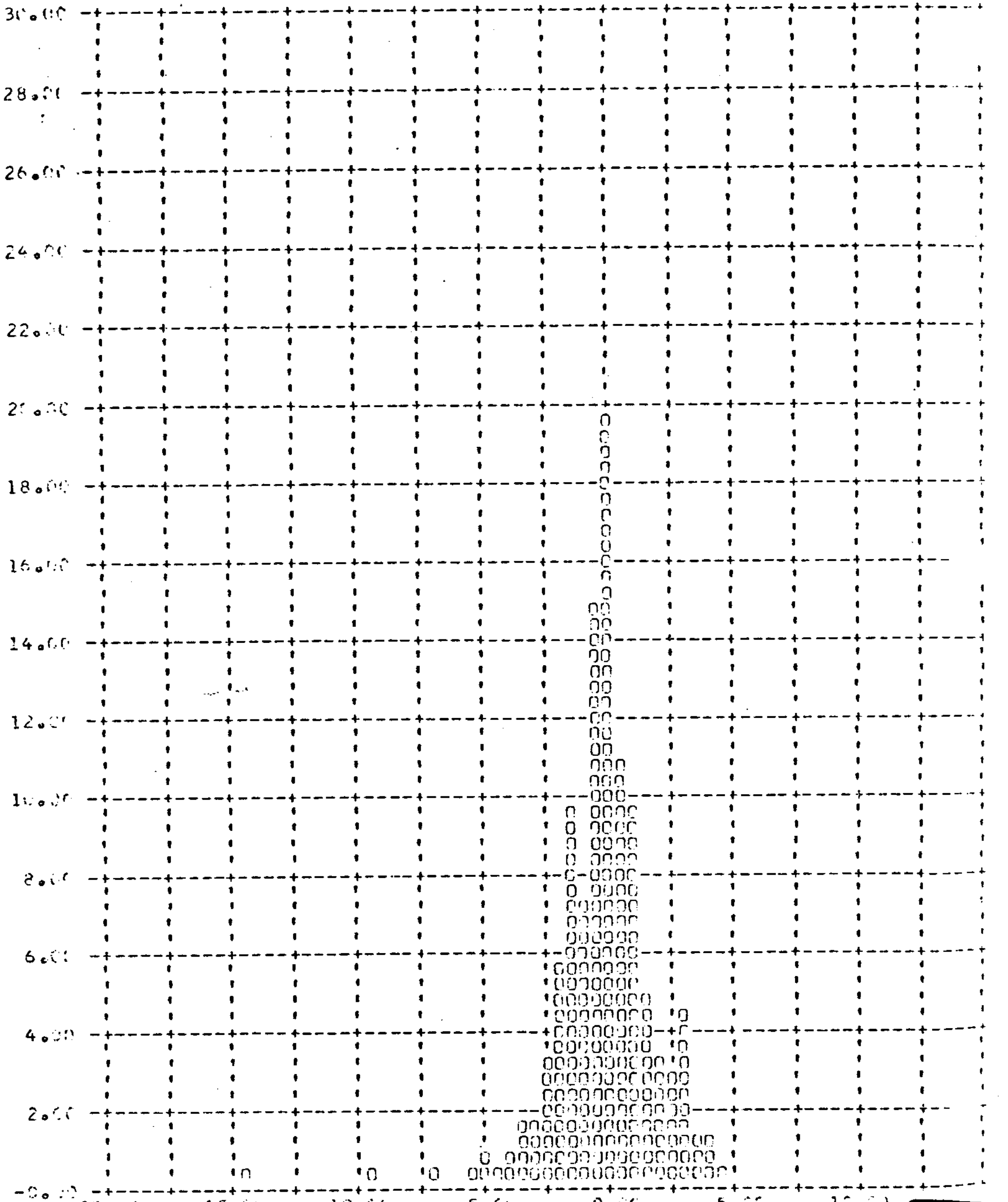
Note: The master cycle counter lost approximately 85 counts in the -1 mission and 16 counts in the -2 mission which are included in the total.

FRAMES 1-5 OF EACH OP OMITTED 9? PERCENT = [illegible]

V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



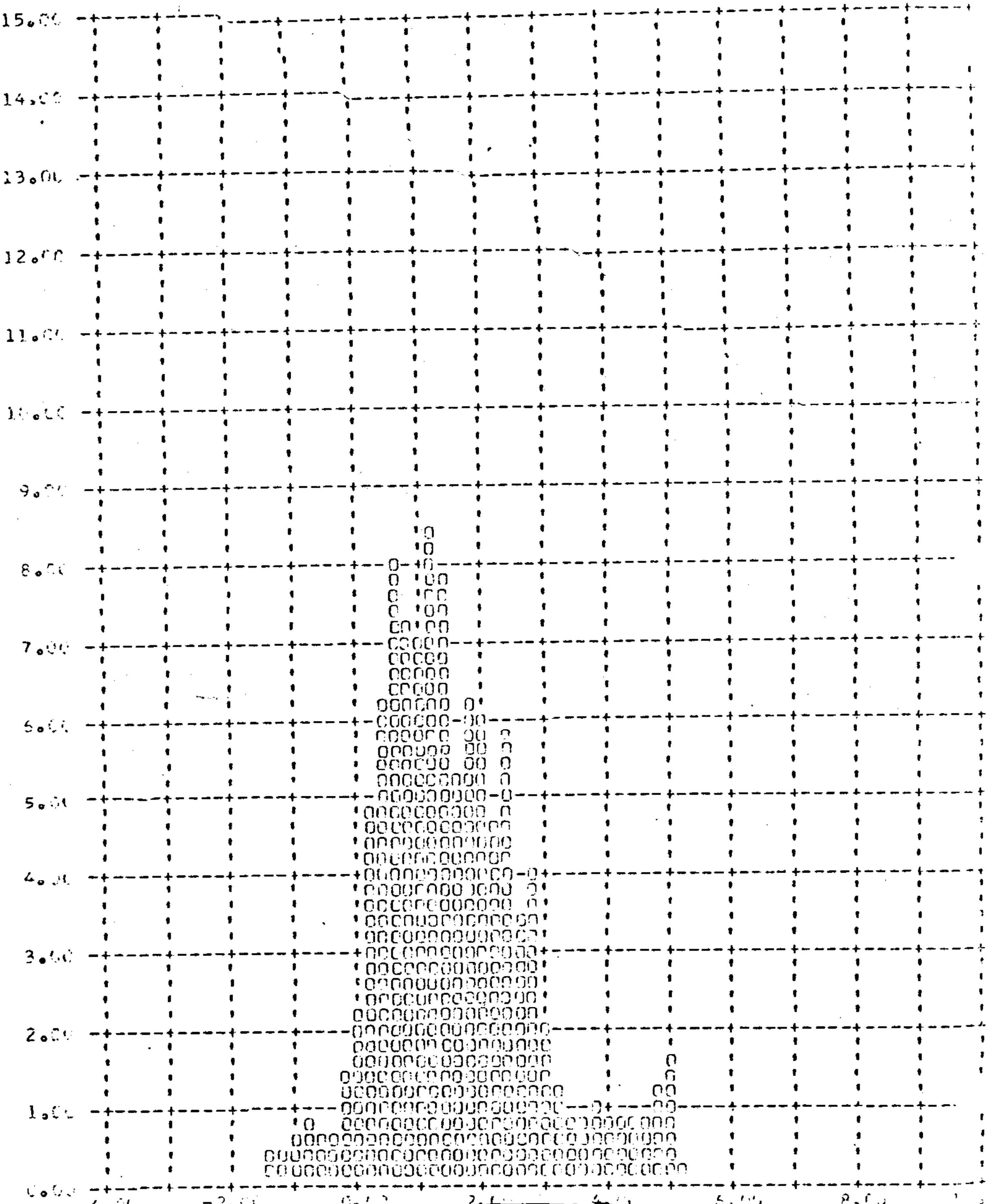
Y V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



[redacted]

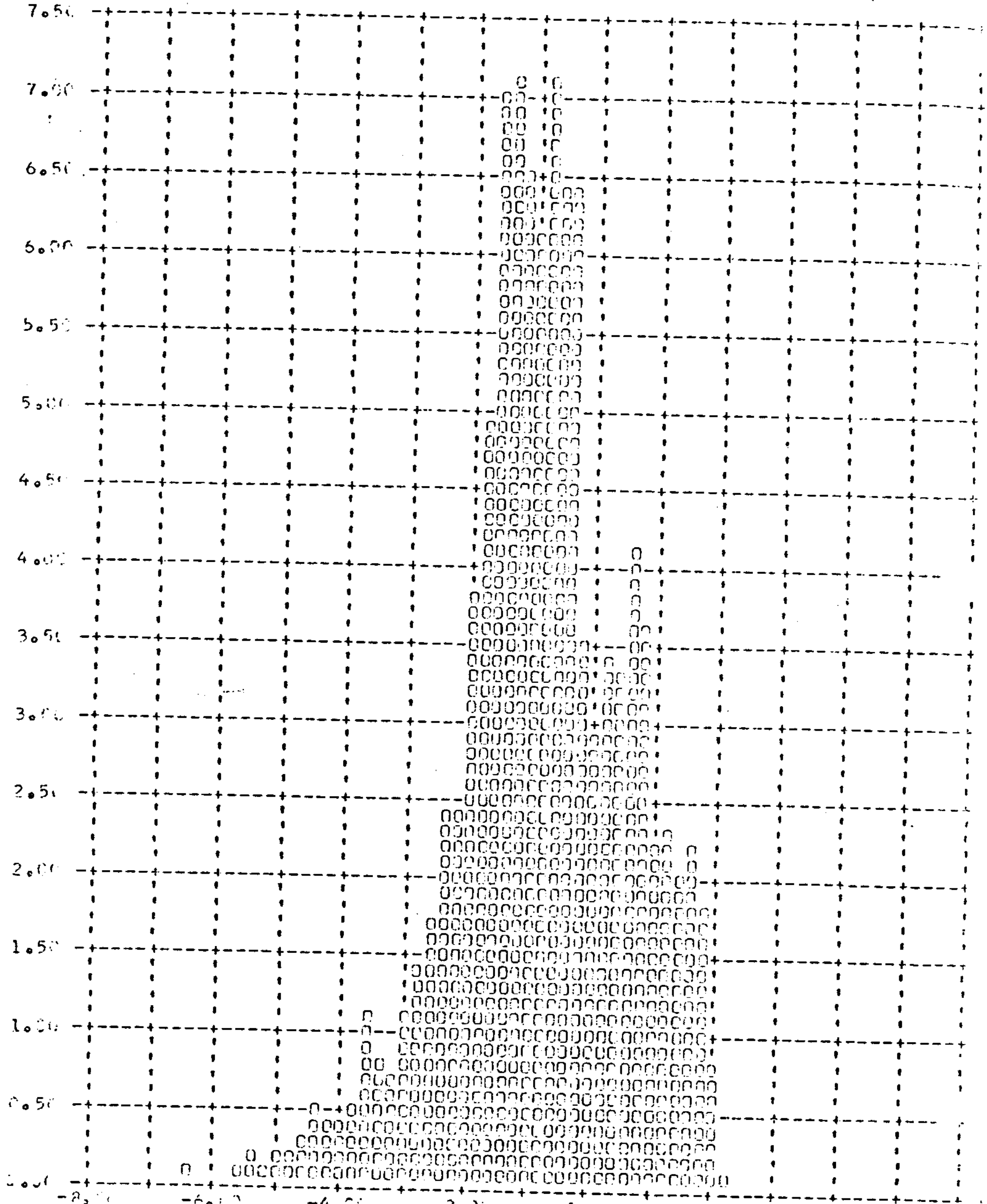
MISSION 1(5181- ~~TOP SECRET~~ C [redacted] FRAMES 1-6 [redacted] OMITTED 9? PERCENT =

Y V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



FRAMES 1-6 OF EACH OP OMITTED [illegible] PERCENT = [illegible]

Y V/H RATIO ERROR - PERCENT (X) VERSUS FREQUENCY - PERCENT (Y)



C. STELLAR/INDEX CAMERA PERFORMANCE

The -1 and -2 stellar/index cameras functioned normally throughout the flight. Telemetry data indicated the programmer and metering functions performed satisfactorily on the observed engineering passes. The stellar/index shutter telemetry monitor failed to operate properly on three engineering operations in the -2 mission. However, the shutter functioned properly.

The index camera film supply was not exhausted because the normal film supply is in excess of the normal programming requirements.

D. INSTRUMENTATION AND COMMAND SYSTEM PERFORMANCE

The payload command system performed satisfactorily throughout the flight. The Uncle command link was utilized as the primary system with no reported anomalies.

The payload instrumentation system operation was normal except for the intermittent failure of the stellar/index shutter monitor and the intermittent failure of the master camera cycle counter. The counter failed to advance for 85 counts in the -1 mission and for 16 counts in the -2 mission.

E. CLOCK SYSTEM PERFORMANCE

The clock system operation was normal throughout the flight. Satisfactory time correlation between the flight clock and the [redacted] tracking station was obtained. The ratio of clock time to system time was 1.00000005633.

F. PRESSURE MAKE-UP SYSTEM PERFORMANCE

The pressure make-up system operated satisfactorily throughout the flight. The total operate time was 245 minutes with 153 camera operates. The PMU flow rate was consistent throughout at about 6.0 ΔPSI/min of camera operating time. A surplus of 770 lbs. of gas existed at the end of the -2 mission.

G. THERMAL ENVIRONMENT

The thermal environment achieved with this system was near the pre-flight predictions. The actual system temperatures were 85° and 81°F for the master and slave cameras respectively for the beginning of the -1 mission and 86°F for both at the end of the -1 mission. The -2 mission system temperatures were 77°F and 77°F for the start and 57°F and 57°F for the end of the mission for the master and slave cameras respectively. The engineering pass temperature data is contained in Tables 3-1 through 3-4. The average camera temperatures versus predicted temperatures is graphically depicted in Figure 3-6.

The J-44 payload system was the first unit to have the high gain temperature sensor installed in the drum assembly near temperature sensor No. 13. The temperature sensor which previously was installed on the scan arm assembly of each instrument was removed.

The Agena tape recorder temperature data was obtained to determine orbit temperature profiles of these new temperature sensors. The data for four representative orbits are included in Figures 3-7 through 3-10.

A comparison of the new temperature sensor versus temperature sensor No. 13 on each instrument is included in Figures 3-11 and 3-12.

The above data indicates a good correlation was achieved between the two different types of temperature sensors installed on each instrument.

H. YAW PROGRAMMER

The vehicle Yaw Programming functioned properly throughout the mission.

REAL TI DATA
TEMPERATURE SUMMARY
DEGREES - FAIR

PAYLOAD

VEHICLE 1649

ORBIT NO.	TK-4	10	16	26	32	41	47	58	63	73	79	89	95	105	(-1) 111	(-2) 121	12[illegible]
Beta Angle	NA	-47.5	-48	-48.5	-48.5	-49	-49.5	-49	-48.5	-48.3	-47.5	-47.5	-46.5	-45.5	-45	-44	-4[illegible]
3 — Master	58	71	74	75	76	76	77	78	76	78	76	78	76	78	75	66	[illegible]
4	57	76	80	80	80	80	80	81	80	80	80	80	80	81	79	69	[illegible]
5	58	85	88	88	89	89	90	91	89	90	89	90	88	91	88	80	[illegible]
6	60	93	97	97	98	98	97	99	97	98	97	98	95	99	94	85	[illegible]
7	60	86	89	90	90	90	91	92	90	91	90	91	90	92	89	79	[illegible]
8 — Master	59	83	87	88	89	89	89	90	89	90	89	90	87	91	86	79	[illegible]
9	58	88	94	92	96	92	94	94	94	93	94	93	92	94	91	83	[illegible]
11	63	91	92	94	94	94	91	96	94	96	93	94	94	94	91	82	[illegible]
12	59	75	79	79	80	80	81	81	80	81	80	81	79	82	79	70	[illegible]
13 — Master	58	87	89	92	91	92	94	94	91	93	91	93	91	94	89	80	[illegible]
G. INSTR. TEMP.		85°	87	87	88	88	88	89.5	88	89	88	88.7	87	89.6	86	77.3	[illegible]
Slave																	
3 — Slave	59	91	97	95	97	96	95	97	97	96	97	97	97	96	97	84	[illegible]
4	60	82	89	87	91	88	89	90	90	90	90	89	89	80	83	79	[illegible]
5	58	79	83	84	85	85	86	86	86	86	86	86	85	87	84	77	[illegible]
6	59	77	79	81	80	82	83	84	82	84	82	84	82	85	81	72	[illegible]
7	59	82	85	86	86	86	88	88	86	87	87	88	87	88	86	77	[illegible]
8 — Slave	59	80	84	84	86	86	87	87	87	87	87	87	85	88	85	78	[illegible]
9	58	74	77	79	79	80	81	82	80	82	81	82	80	83	79	72	[illegible]
11	65	79	82	84	85	86	83	88	87	88	87	87	87	87	86	75	[illegible]
12	59	85	94	88	96	90	94	92	95	91	94	91	92	92	91	82	[illegible]
13 — Slave	59	76	78	80	79	81	82	83	82	83	82	83	81	84	81	72	[illegible]
G. INSTR. TEMP.		81°	84	85	86	86	86	87.8	87	87.4	87	87.4	85	88	86	76.8	[illegible]
pply Spool																	
1	58	62	66	71	73	74	74	77	77	77	77	78	76	79	76	70	[illegible]
2	61	72	80	80	83	82	84	84	85	85	85	85	84	86	83	76	[illegible]

C[redacted] TEMPERATU SUMMARY [redacted] Page 33 of 69

DEGREES - FAHR

VEHICLE 1649

ORBIT NO.	TK-4	10	16	26	32	41	47	58	63	73	79	89	95	105	111	121	1[illegible]
Beta Angle	NA	-47	-48	-48	-48	-49	-49	-49	-48	-48	-47	-47	-46	-45	-45	-44	[illegible]
T/S 1	48	36	103	36	103	29	95?	29	103	20	100	26	97	20	94	10	[illegible]
2	51	-4	17	-1	17	-1	15	-1	14	-1	11	-1	11	+2	11	32	[illegible]
3	50	4	22	7	22	4	30	7	22	1	22	4	22	1	22	51	1[illegible]
4	54	51	72	54	72	54	76	57	69	54	72	54	66	54	69	81	1[illegible]
5 Fairing/Barrel #1	51	92	137	95	140	95	135	98	122	92	119	92	110	89	107	89	[illegible]
6 ("A") ("B")	50	108	185	108	188	99	180	102	182	87	176	93	170	75	164	—	[illegible]
Barrel No. 2														←	—1	—2→	
1	50	106	127	112	127	112	125	112	118	106	118	106	109	98	106	86	[illegible]
2	50	122	174	119	171	110	172	113	171	95	168	104	162	86	159	77	15
3	52	82	136	79	130	67	136	70	139	55	136	64	136	49	136	46	13
4	51	36	51	42	54	42	55	42	54	42	51	42	48	45	48	33	[illegible]
5	49	46	67	52	67	48	70	52	67	48	67	49	64	49	64	22	[illegible]
Conic Adapter																	
1	48	96	129	99	132	96	126	99	123	93	123	96	117	90	111	75	10[illegible]
Press. Make-Up Bottle																	
1	56	113	122	116	122	119	124	119	122	116	119	116	116	119	113	101	10[illegible]
2	56	115	133	121	133	118	130	118	127	118	127	118	121	118	118	98	10[illegible]
Clock																	
1	70	84	90	88	92	88	88	90	92	90	92	90	90	90	90	74	7[illegible]
Thrust Cone "A" to "B"																	
1 (Skin)	60	43	46	42	48	43	48	46	48	46	48	46	48	49	47	66	.6
2 (Retro)	62	68	66	66	69	69	70	70	69	70	70	70	68	100[B]	98[B]	84	8[illegible]
Aster Cassette "A" SRV																	
2	80	62	59	62	56	63	60	64	63	65	66	67	65	67	64	--	--
Recovery Batt. "B" SRV																	
1	70	[redacted]	77	81	83	85	[illegible]	87	87	87	87	87	86	87		80	[illegible]

REAL TI[illegible] DATA
TEMPERATURE SUMMARY
DEGREES - FAHR

[redacted] Page 34 of 69

...YLC... J-...

VEHICLE 1649

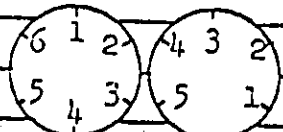
ORBIT NO.	137	143	152	158	168	174	184	190	200	206	216	222	232	238	248	254
Beta Angle	-42	-40	-39	-37	-36	-35.2	-32.5	-32	-31.25	-29	-27	-26	-24	-22	-20	-18
3	61	59	61	59	59	57	58	56	57	56	56	54	56	51	55	50
4	65	64	66	63	63	60	62	59	61	58	59	56	59	54	57	52
5	75	73	75	72	71	70	71	68	70	67	68	64	66	60	64	59
6	79	77	79	77	75	72	73	70	72	69	69	66	67	61	64	59
7	75	74	75	73	71	70	70	67	68	67	66	65	65	61	62	60
8 — Master	74	72	75	71	71	68	70	66	69	65	66	63	66	60	64	58
9	77	77	78	76	74	73	74	71	73	69	71	67	69	62	66	61
11	78	75	76	72	74	72	72	70	70	66	68	65	66	63	64	60
12	66	64	66	64	65	61	63	60	63	59	61	58	61	56	60	55
13	74	72	74	70	70	69	68	66	67	64	64	62	63	58	60	56
G. INSTR. TEMP.	73	71	73	70	69	67	68	65	67	64	64	62	64	59	62	57
Slave																
3	79	81	78	80	74	75	75	72	70	69	67	67	64	61	62	58
4	75	75	76	73	72	69	71	66	69	65	67	63	65	59	62	56
5	72	70	73	69	69	68	69	66	68	65	66	62	65	59	63	58
6	68	66	68	67	66	64	64	61	63	61	61	60	60	56	59	55
7	71	71	71	70	69	68	67	66	66	65	64	64	63	60	61	58
8 — Slave	73	71	73	71	72	68	70	66	68	65	66	63	66	59	64	57
9	68	66	68	66	67	64	65	62	64	61	63	60	63	57	61	56
11	72	72	71	71	70	68	68	66	66	63	66	65	63	62	62	61
12	77	78	78	76	74	72	73	69	71	68	69	66	67	61	64	58
13	67	66	66	66	64	63	63	61	62	61	61	61	59	55	57	55
. INSTR. TEMP.	72	72	71	71	71	68	68	66	67	64	65	63	64	59	61	57
..ply Spool																
1	64	63	64	63	62	60	60	58	59	58	58	56	58	53	56	52
2	70	68	70	68	68	65	66	63	65	62	63	60	62	56	60	54

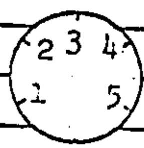
C[redacted]

TEMPERATU SUMMARY [redacted]
DEGREES - FAHR

VEHICLE 1649

ORBIT NO.	137	143	152	158	168	174	184	190	200	206	216	222	232	238	248	254
Beta Angle	-42	-40	-39	-37	-36	-35.2	-32.5	-32	-31.25	-29	-27	-26	-24	-22	-20	-18
T/S 1	7	36	4	36	4	33	5	33	8	35	8	31	5	25	4	31
2	29	37	29	36	29	32	29	32	29	39	29	45	32	39	32	48
3	48	137	42	135	39	126	41	126	41	131	41	133	41	122	39	140
4	72	147	48	138	42	126	30	117	30	117	24	111	24	90	18	90
5 Fairing/Barrel #1	80	86	60	83	51	71	33	66	27	63	21	57	21	45	15	42
6 ("A") ("B")	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
rrel No. 2																
1	80	86	59	80	53	68	32	62	26	62	23	56	20	44	17	41
2	71	141	47	131	41	119	32	110	29	107	26	104	26	89	19	86
3	42	127	36	124	36	118	39	118	39	121	39	133	42	115	39	133
4	30	36	33	39	30	36	33	36	36	39	36	45	36	39	36	51
5	22	43	19	43	16	40	19	40	22	43	19	43	19	37	19	43
onic Adapter																
1	69	93	54	87	51	75	45	69	45	66	42	60	39	48	36	42
ess. Make-Up Bottle																
1	95	92	98	95	95	89	92	83	89	83	86	80	83	71	77	65
2	92	95	95	98	92	89	92	83	89	80	83	77	80	68	74	62
Clock																
1	72	74	70	76	70	70	70	70	70	70	68	70	68	66	66	66
rust Cone "A" to "B"																
1 (Skin)	62	59	60	59	58	57	57	54	55	56	54	53	53	52	52	51
2 (Retro)	78	75	76	75	72	71	70	69	69	70	66	67	64	63	64	60
ter Cassette "A" SRV																
2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
covery Batt. "B" SRV																
1	81	86	85	83	79	80		83	89	81	83	89	89	89		86





[redacted]

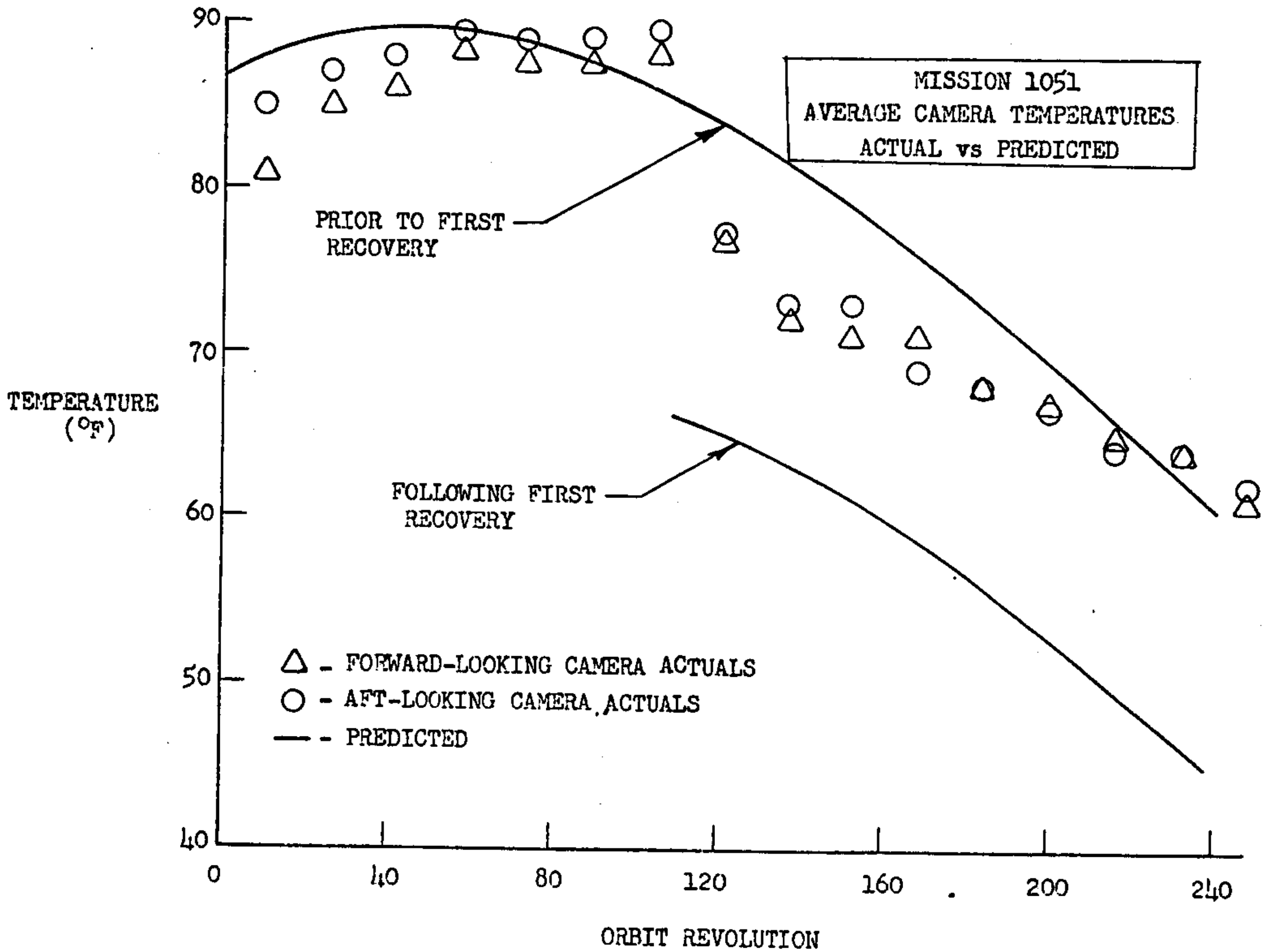

MISSION 1051
AVERAGE CAMERA TEMPERATURES
ACTUAL vs PREDICTED
TEMPERATURE (°F)
90
80
70
60
50
40
0
40
80
120
160
200
240
ORBIT REVOLUTION
PRIOR TO FIRST RECOVERY
FOLLOWING FIRST RECOVERY
△ - FORWARD-LOOKING CAMERA ACTUALS
○ - AFT-LOOKING CAMERA ACTUALS
— - PREDICTED

FIGURE 3-6

TOP SECRET/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY
AFT-LOOKING CAMERA SENSOR #13

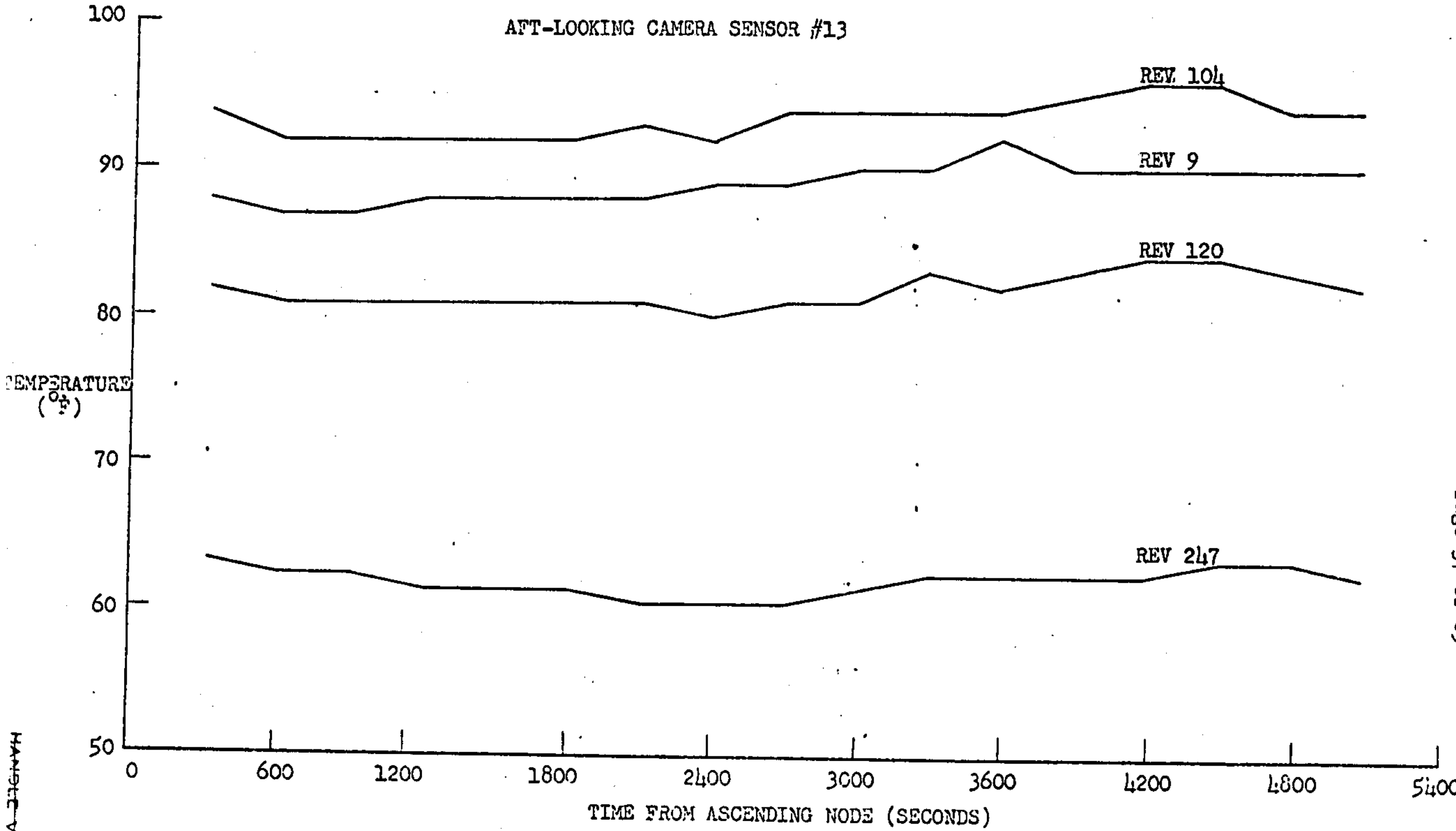


FIGURE 3-7

TOP SECRET/C

HANDLE VIA [redacted]

~~TOP SECRET~~/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY

AFT-LOOKING CAMERA SENSOR # 11

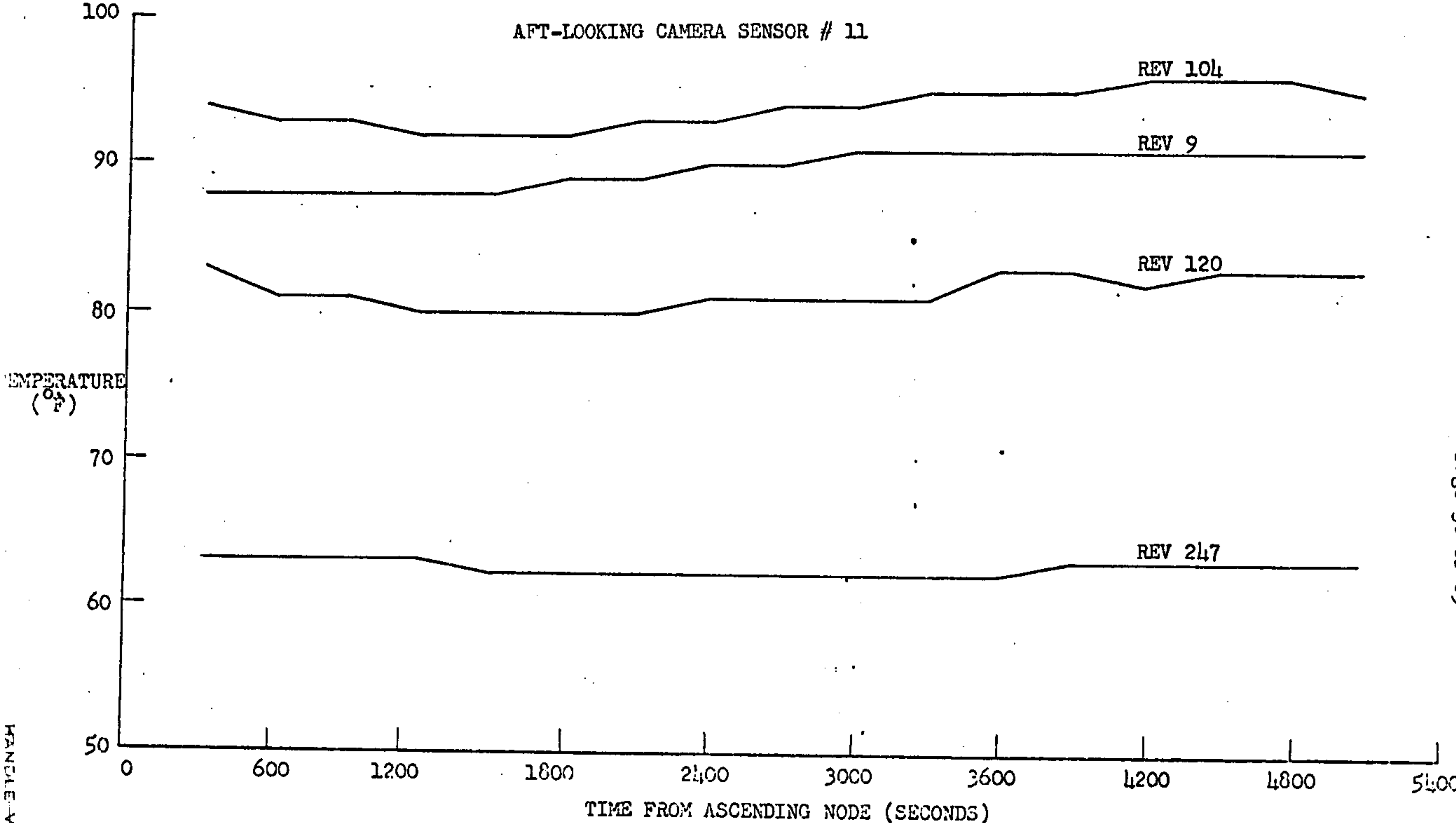


FIGURE 3-8

~~TOP SECRET~~/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY

FWD-LOOKING CAMERA SENSOR #13

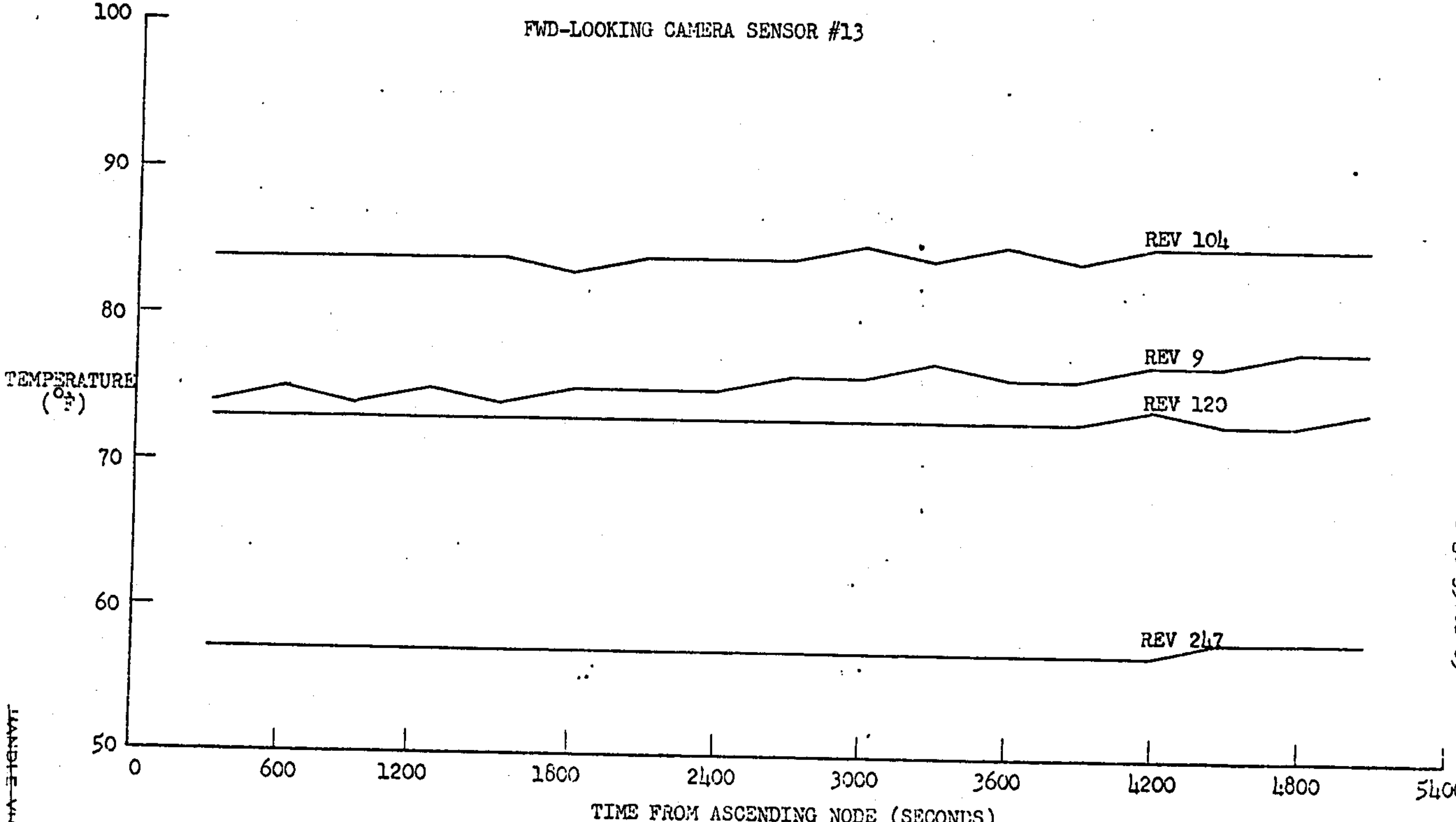


FIGURE 3-9

TOP SECRET/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY
FWD-LOOKING CAMERA SENSOR #11

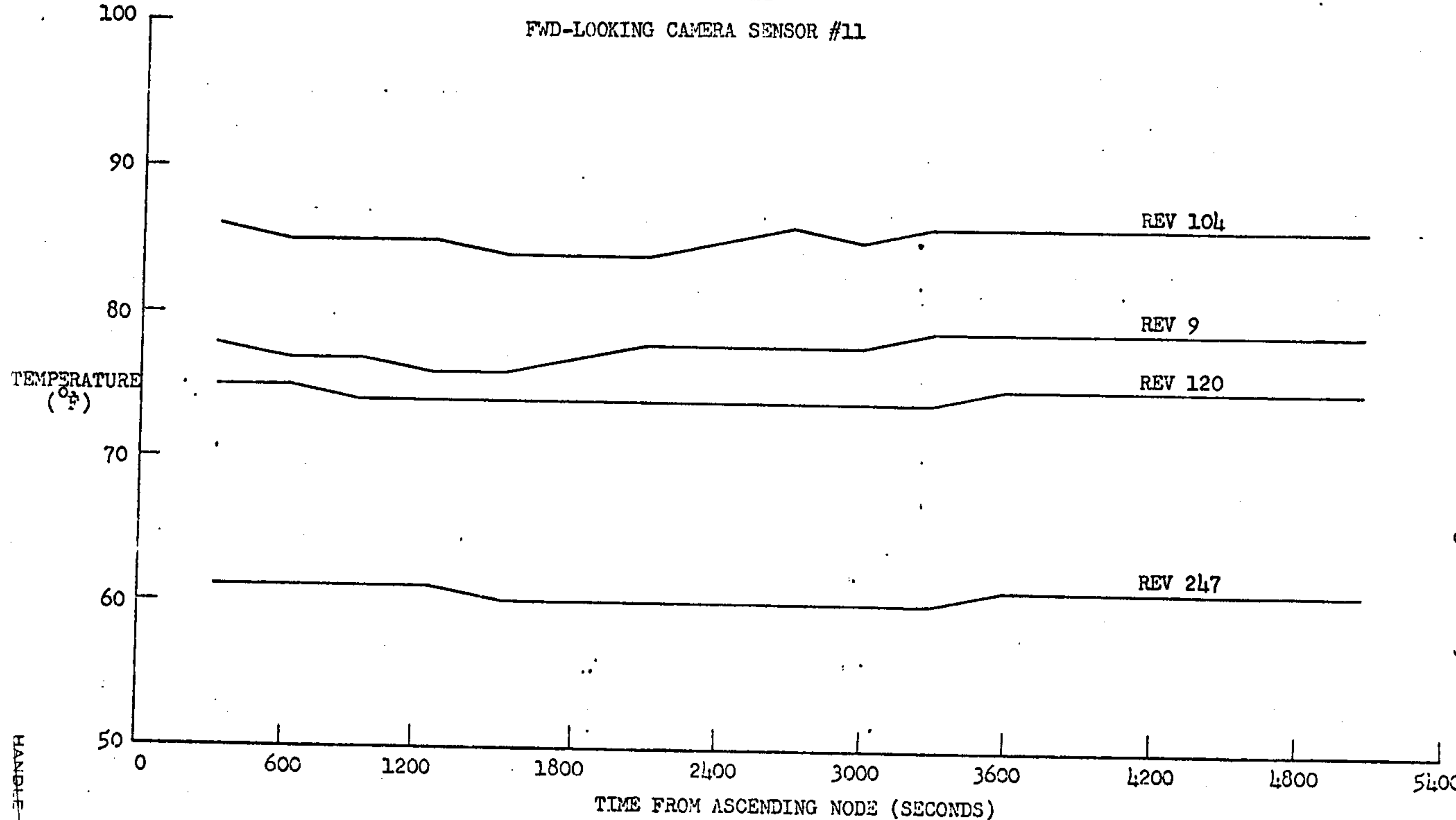


FIGURE 3-10

TOP SECRET/C

TOP SECRET/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY
AFT-LOOKING CAMERA

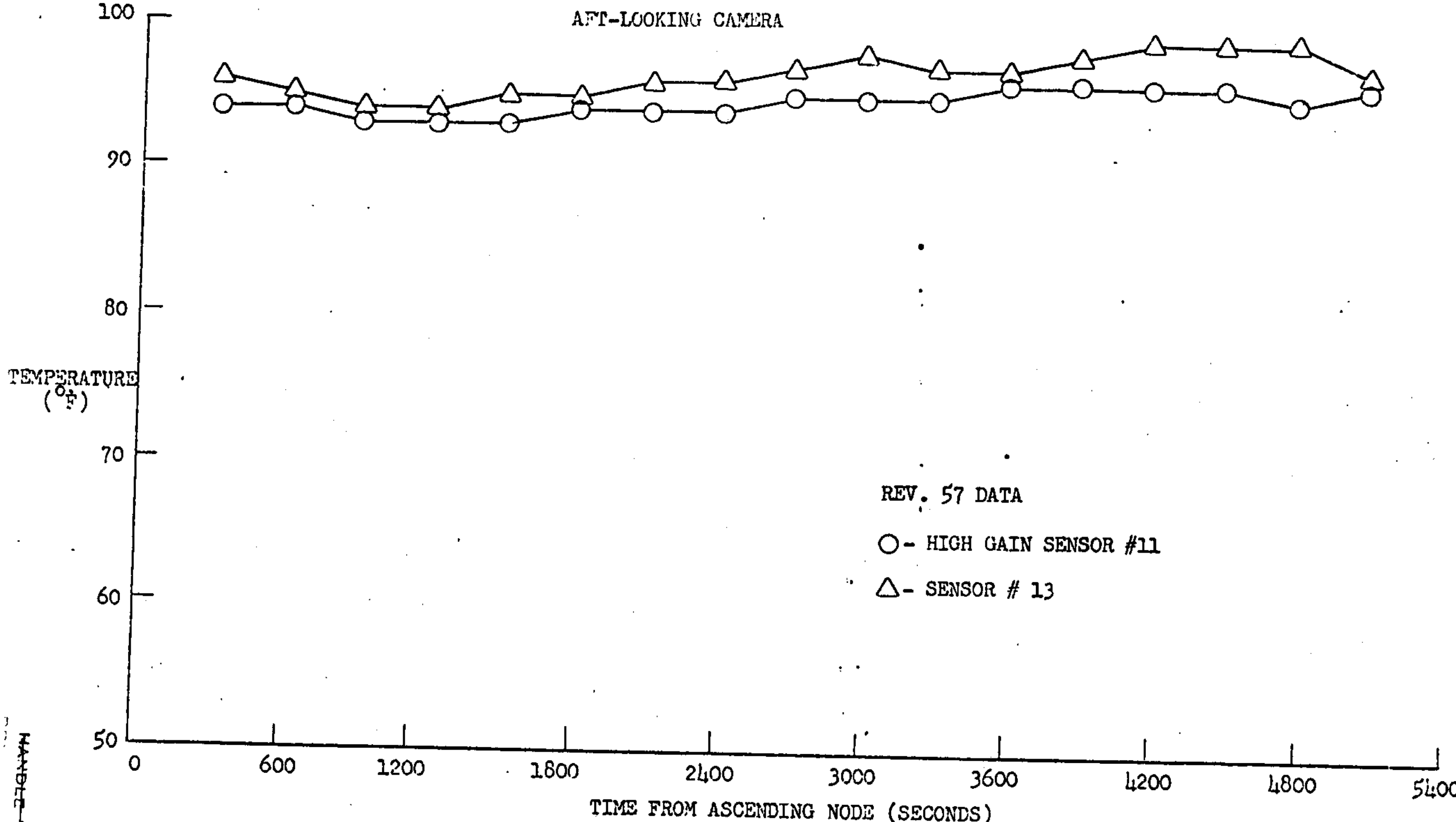


FIGURE 3-11

TOP SECRET/C

HANDLE [redacted]

TOP SECRET/C

MISSION 1051
FLIGHT TEMPERATURE DATA
DRUM ASSEMBLY
FWD-LOOKING CAMERA

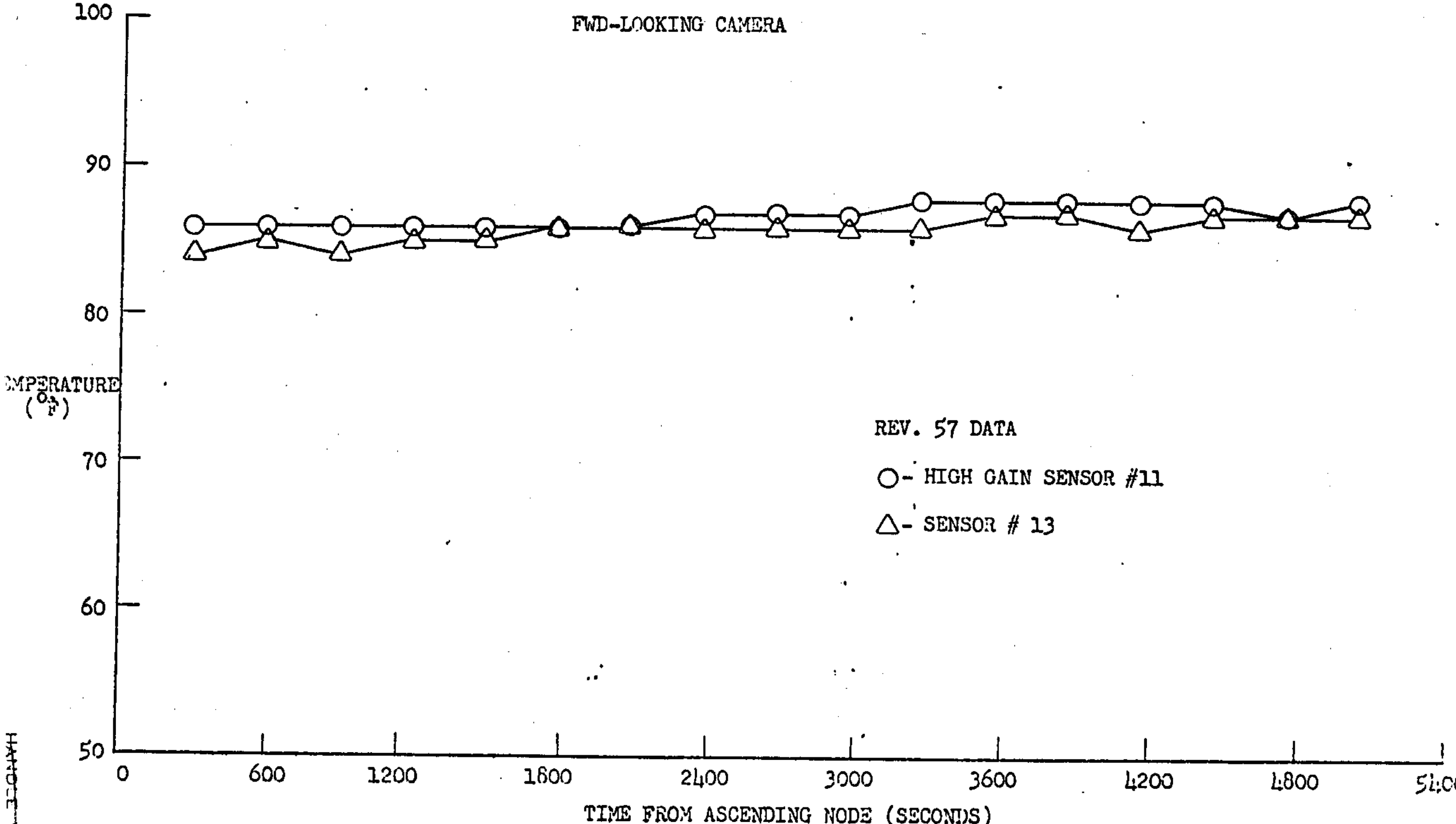


FIGURE 3-12

TOP SECRET/C

HANDLE VIA [redacted]

The unique orbit parameters utilizing both ascending and descending operations required a much broader yaw function match than usually experienced in Corona missions. The actual yaw performance achieved was quite nominal (see Section 7).

I. RECOVERY SYSTEM

An early switchover from the A to the B Recovery systems was performed on Pass 100, with all functions appearing normal. The 1051-1 recovery capsule was successfully recovered by air-catch on Rev 113 at 2012 PDT on 8 May 1969. Capsule impact was approximately 47 N.M. south of the predicted impact. All available data has been analyzed and all functions appeared to have occurred normally. All re-entry events appeared normal and close to the predictions except for deceleration chute deployment which occurred 0.03 seconds late.

	Latitude	Longitude
Predicted	17° 56.8' N	156° 6.9' W
Actual	17° 07.0' N	155° 35.0' W

The 1051-2 recovery capsule was successfully recovered by air-catch on Rev 256 at 1753 PDT on 17 May 1969. Capsule impact was approximately 31 miles north of the predicted. All re-entry events appeared normal and close to the predictions.

	Latitude	Longitude
Predicted	25° 58.0' N	164° 39.1' W
Actual	26° 26.0' N	164° 41.0' W

J. POST EVENT II TESTING

The J-44 payload system operation during the flight indicated all hardware operation was satisfactory. However, in order to investigate the system cycle rate errors, verification of the V/H programmer delay start operation was required.

The H-timer speed was changed on Rev. 267 [redacted] so that the V/H programmer delay start Brushes could be monitored on Rev. 268 [redacted] This would also provide verification of the V/H programmer start time in conjunction with the proper V/H programmer start delay position.

The V/H programmer delay start Brushes were observed and the V/H programmer was verified to have started at the prescribed time. On this basis, the V/H programmer delay start function was eliminated as a possible cause of the system cycle rate errors.

No other testing was done and the vehicle power was depleted on Rev. 316.

K. RADIATION DOSAGE

Each recovery system flown on a Corona mission contains a sealed packet of Eastman Type 3401 and Royal X Pan emulsions to determine the total radiation received at the take-up cassette. Both film types have been irradiated by LMSC at various levels and the base plus fog densities recorded after controlled processing.

Following recovery the film dosimeter packets are removed at A/P and processed with a pre-flight sample of the same film type and sensitometric film. The resulting base plus fog density measurement of the dosimeter strips is used to ascertain the total radiation level.

The table below presents the base plus fog readings for the dosimeter strips and the radiation level equivalents.

	Mission 1051-1		Mission 1051-2	
Emulsion	B + F Density	Radiation	B + F Density	Radiation
Type 3401	0.11	0.2 R	0.15	0.4 R
Royal X Pan	0.24	0.4 R	0.29	0.6 R

These levels are below that which will degrade the photography.

SECTION 4

PHOTOGRAPHIC PERFORMANCE

The quality of the Mission 1051 photography was typified by areas of extreme image variability, with the overall performance of the forward-looking camera being poorer than an average Corona (J-1) mission, and that of the aft-looking camera just about average. In general, the imagery of both cameras was described as soft, lacking crispness and overall edge sharpness. The interpretation suitability of Mission 1051-1 photography ranged from good to poor with the majority in the fair to poor category. Mission 1051-2 suitability ranged from good to poor with the majority in the fair category. Weather was considered to be a major degrading factor.

A. PANORAMIC INSTRUMENTS

The Master camera produced 2987 frames (8073 feet) of photography during Mission 1051-1, and 3085 frames (8130 feet) during Mission 1051-2. The Slave camera produced 2972 frames (8031 feet) during Mission 1051-1, and 3097 frames (8165 feet) during Mission 1051-2. The quality of the photography produced by the two cameras was very similar, and was rated as only fair with an MIP of 80 assigned

Two arrays of fixed resolution targets at Edwards AFB, California (Pilot Knob and Cuddeback), were recorded during Mission 1051-1. Although even the largest elements of each array (representing ground resolution distances of 5 feet and 4 feet, respectively) were not resolvable in the engineering prints, the larger groups in each target were separate and well defined and appeared to be very close to the resolution threshold. The quality of this coverage appears to be the best ever obtained of these targets with a Corona system.

Unfortunately, this desirable performance is not representative of the overall photography which was characterized by repeated "soft spots" and quality gradients across the format. Both instruments demonstrated a lower quality performance along the binary edge than along the timing mark edge. The gradients were compounded by severe "soft spots" (areas grossly out of focus) systematically located near the end-of-scan end (supply end) of the format extending from the binary edge for the forward-looking camera, and from the timing mark edge for the aft. Additional severely degraded areas occurred sporadically throughout the format.

The 200 pps timing marks adjacent to the severe soft spot area in the aft-looking photography also appear to be repeatedly out of focus, implying a significant recurrent dynamic film disturbance. This characteristic was noted in pre-flight testing (ref. Section 2); however, the normal flight preparations systems tests are totally inadequate to detect or evaluate these dynamics and gradients as experienced by the J-44 system. The out-of-focus timing marks are the first hint of an indicator of undesirable camera dynamics; however, in the case of the forward-looking camera, where the equally severe film disturbance emanated from the binary edge, there is no corresponding indicator available.

Both instruments exhibited characteristic anomalies of rail scratches, fog patterns from drum light leaks and minor dirt-induced streaks and spots. In addition, the system experienced minor anomalies common to the Corona J-1 mission; i.e., a phenomenon referred to as "veiling" of the horizon imagery for a portion of the mission, and an erratic behavior of a switch negating the function of the aft-looking horizon cameras for approximately ten cycles. Because of the nature of these anomalies, and the limited future application of the J-1 type system, no investigative or corrective action was taken.

B. STELLAR/INDEX CAMERAS

The Stellar/Index film recovered consisted of 464 frames of photography from each film path of S/I D115/148/142 (Mission 1051-1), and 492 frames from each path of S/I D122/156/161 (Mission 1051-2). The cameras operated normally throughout the respective mission. There were approximately 12 stellar images detectable on most frames, and were good, point-type images. There was an appearance of corona static marking occurring along the reseau number edge intermittently throughout the Mission 1051-2 stellar record. The Mission 1051-1 record did not experience corona static marking, but exhibited roller pressure induced "sit" fog marks. Neither of these conditions were extensive enough to hinder reduction of stellar attitude data.

The index cameras produced good quality imagery through each of the respective missions. The reseaus were sharp and well defined in both instruments. Several instances of dendritic static were recorded near the format center intermittently throughout the Mission 1051-2 index record.

C. OBSERVED DATA

Detailed evaluation of the engineering materials available at A/P indicated that the apparent out-of-focus dynamics were very erratic and variable. The major areas previously described occurred on every frame, but the extent and pattern of degradation was not constant. There were instances in the forward-looking photography of rapidly alternating sharp and severely degraded imagery the entire length of the format (scan direction). These variations were limited to the binary edge of the format. No instances of such dramatic variations were noted in the aft-looking material.

The forward-looking record exhibits a complex characteristic pattern of focus/film dynamics at the end-of-scan portion of the format (supply end). Between the severe out-of-focus area previously noted and the supply end of the format proper is a band of reasonably sharp imagery. Near the supply end shrinkage marker the imagery has become quite soft again; however, halfway through the bonus area the imagery becomes very sharp for a band approximately 1/4-inch wide, and then falls off very rapidly in the typical manner. The significance of this pattern is confusing, but may be explained by the hypothesis that the focus/film dynamic relationships are such that the bonus area transition passes through the peak focus distance, rather than starting at the peak and smoothly degrading.

D. PERFORMANCE MEASUREMENTS

A summary of MTF/AIM resolution values measured by SPPF is tabulated below. The microdensitometer slit used was 1 micron by 80 microns.

Mission	Camera	Cycles/mm	Avg	Resolution
1051-1	Fwd	58	58	19.7 Ft.
1051-2	Fwd	57		
1051-1	Aft	63	62	18.8 Ft.
1051-2	Aft	61		

The details of the measurement and computing techniques, targets measured and target locations are fully reported in the evaluation report published by AFSPPF and are not included in this report. These values were determined by using the Interim MTF/AIM Program" technique.

The only readable resolution targets recorded were the fixed "C" type array at Edwards AFB, California, on Pass A105. The target image appeared on the edge of the bonus area in both instruments and was notably affected by the previously discussed focus anomalies as well as a very low exposure level. Even so, the target indicated 18-20 foot ground resolution, which is a typical Corona J-1 system performance for that scan angle.

SECTION 5

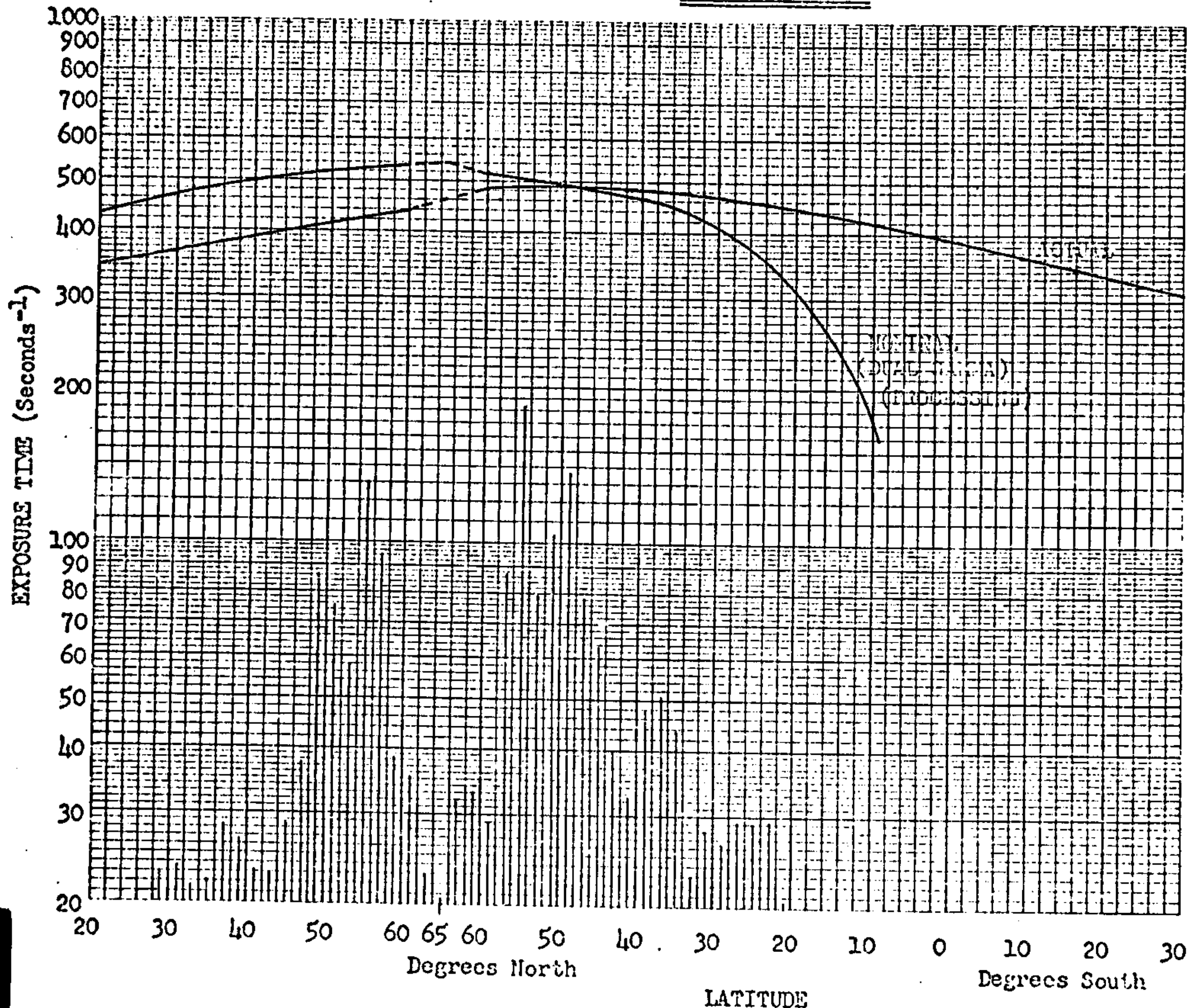
PANORAMIC CAMERA EXPOSURE

Because of the flight parameters for this mission which provide both ascending and descending photographic coverage, the two pan cameras encounter similar illumination geometries. Therefore the same filters and slit widths (Wratten 21, 0.140 inch) were used on each. The exposure level was determined from a specially prepared apparent luminance model based on Project Sunny data for the month of May. This exposure was about 30 percent less than that indicated by the September 1966 criterion, which was used prior to Mission 1049. Although the density data in Section 6 shows significant percentages of minimum densities outside the 0.40 to 0.90 density control range, the frequency distribution of minimum densities closely approximate those expected and desired on the basis of detailed target density studies. This successful experience with Project Sunny data as a basis for exposure criteria has led to its use for this purpose in planning subsequent Corona missions.

The nominal exposure times of the panoramic cameras are shown as a function of latitude for passes D-40, D-120, and D-200 in Figures 5-1 to 5-3. Superimposed on these plots are relative distributions of camera operations for the portion of the mission represented by each plot. It should be noted that the proportion of descending operations became more dominant as the mission progressed, a condition necessitated by the rapid changes in allowable exposure environment, which is graphically demonstrated in the exposure plots.

[redacted]

EXPOSURE POINTS



5-1

Mission No: 1051

Payload No: J44

Camera No: 212/213

Pass No: 40

Launch Date: 5/02/69

Launch Time: 0147 Z

Slit Width: 0.140

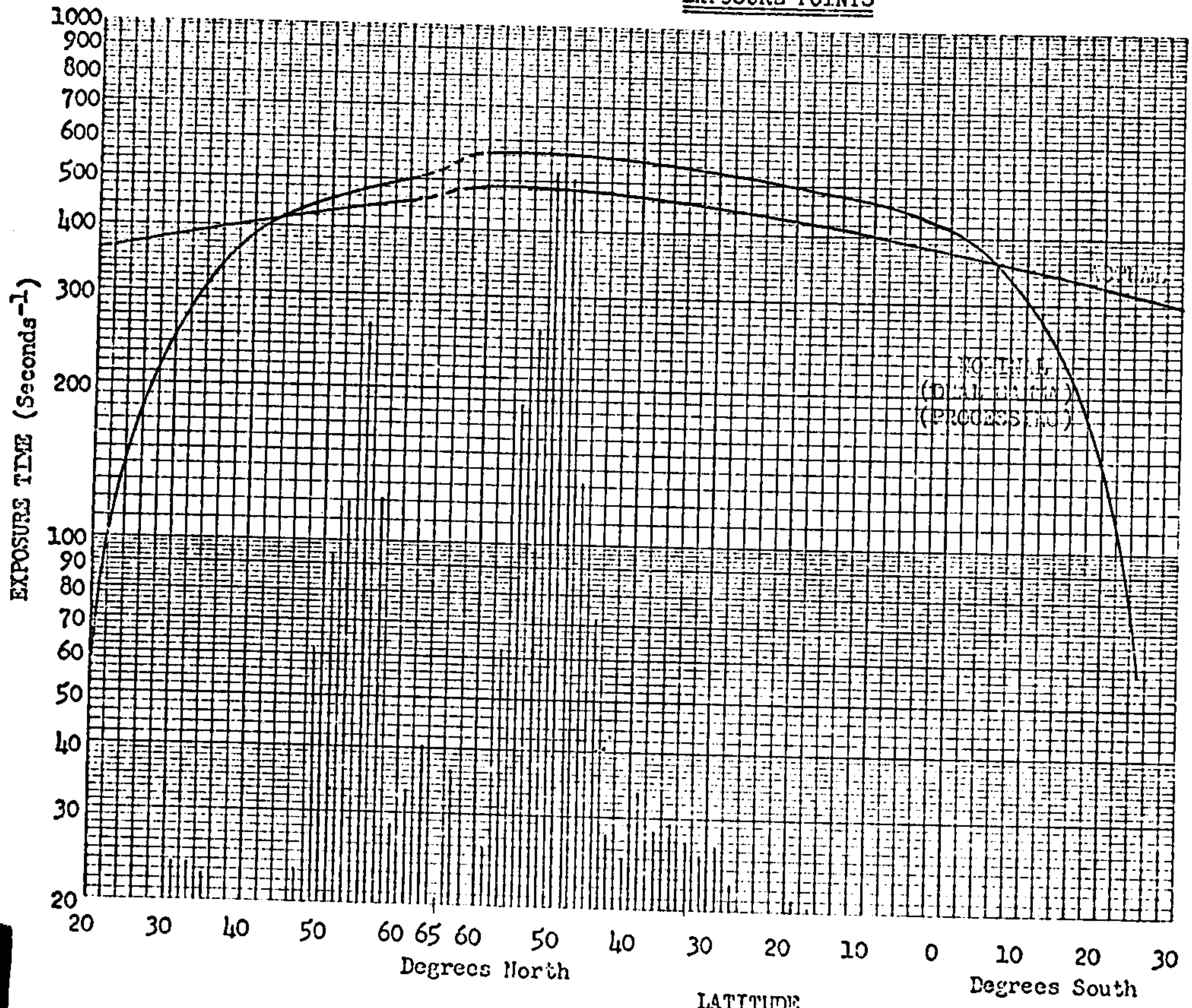
Filter Type: W/21

Film Type: 3404

[redacted]

TOP SECRET/C

EXPOSURE POINTS



Mission No: 1051

Payload No: J44

Camera No: 212/213

Pass No: 120

Launch Date: 5/02/69

Launch Time: 0147Z

Slit Width: 0.140

Filter Type: W/21

Film Type: 3404

FIGURE 5-2

[redacted]

TOP SECRET/C

EXPOSURE POINTS

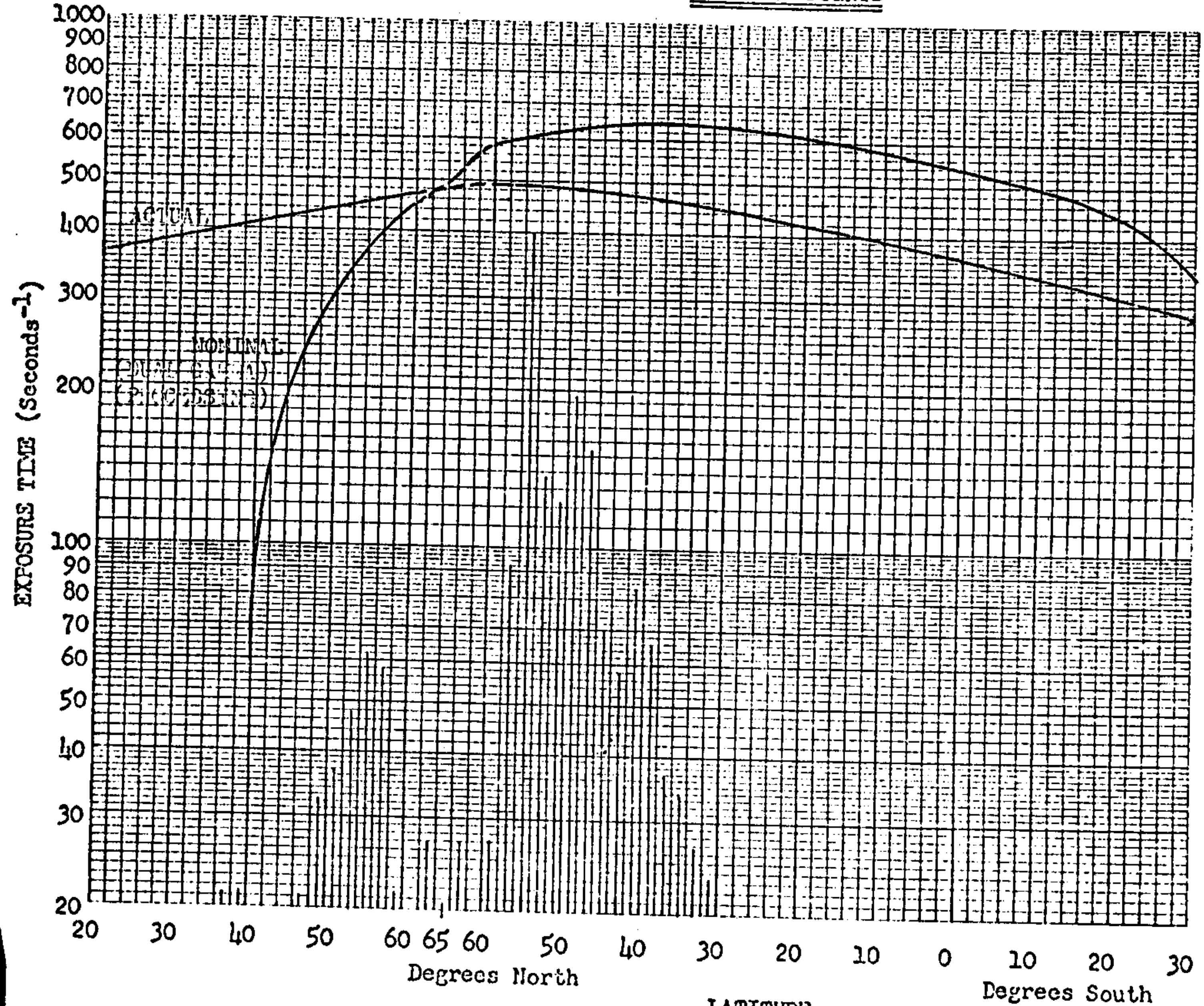


FIGURE 5-3

Mission No: 1051

Payload No: J44

Camera No: 212/213

Pass No: 200

Launch Date: 5/02/69

Launch Time: 0147 Z

Slit Width: 0.140

Filter Type: W/21

Film Type: 3404

SECTION 6

DENSITY MEASUREMENTS

Beginning with Mission 1104 the Corona program has employed a viscous, single level, dual gamma processing for all non-color panoramic materials. Coincident with this, the processing agency discontinued reporting of terrain diffuse densities, and instituted a procedure for systematic reporting of select target microdensitometer readings. Effective with Mission 1051, the AFSPPF has accepted the responsibility of this target density reporting procedure; however, because of the delicate transition of techniques, facilities and personnel, the initial data is not considered representative of the desired procedure, and is omitted from this report. The AFSPPF has continued to compile terrain diffuse density measurements which are summarized in this report, as usual.

As illustrated in Section 5, the actual exposure achieved was quite close to the nominal desired criteria used for Mission 1051. The only major deviations occurred near the end of the mission when there were attempts for ascending photography long after reasonable limits of exposure tolerance were surpassed. This condition is evidenced by the density analysis summarized in Table 6-1.

The curves illustrated in Figure 6-2 describe an apparent disparity in the dual-gamma process which has yet to be resolved. Comparison of these curves with those in Figure 6-1 indicates that the mission material indeed exhibited sensitometric properties very close to the control standard; however, the R-2 samples show significant deviations, with the fog level being much closer to the conventional full process than the higher dual-gamma standard. These undesirable performance and control characteristics have been observed and reported in the past. It appears appropriate to instigate a more rigorous development of this relatively new process so that satisfactory constancy of performance in continued operational applications may be attained.

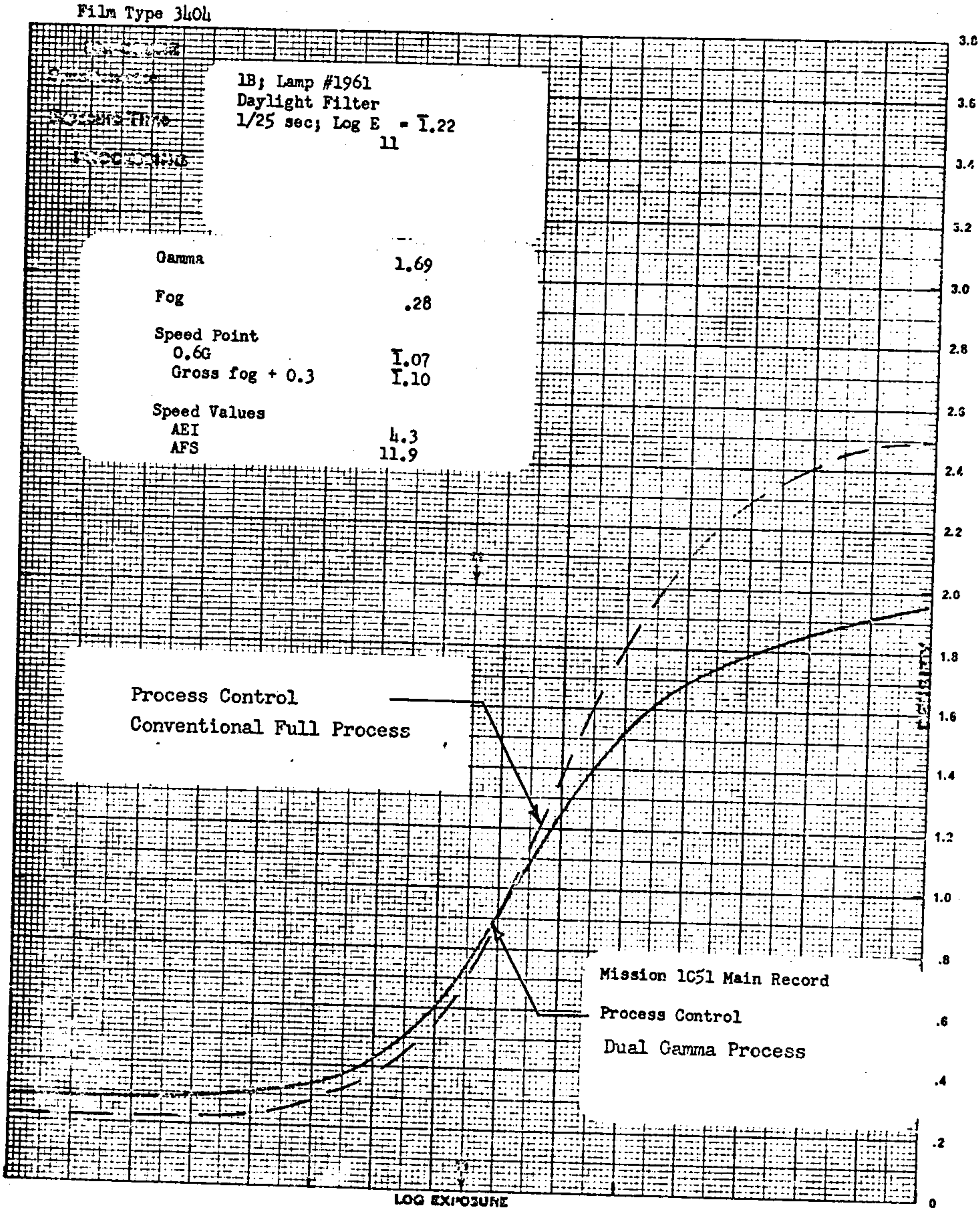

Film Type 3404
1B; Lamp #1961
Daylight Filter
1/25 sec; Log E 11 = Ī.22
Gamma 1.69
Fog .28
Speed Point
0.6G Ī.07
Gross fog + 0.3 Ī.10
Speed Values
AEI 4.3
AFS 11.9
Process Control
Conventional Full Process
Mission 1051 Main Record
Process Control
Dual Gamma Process
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
LOG EXPOSURE

FIGURE 6-1

Film Type 3404

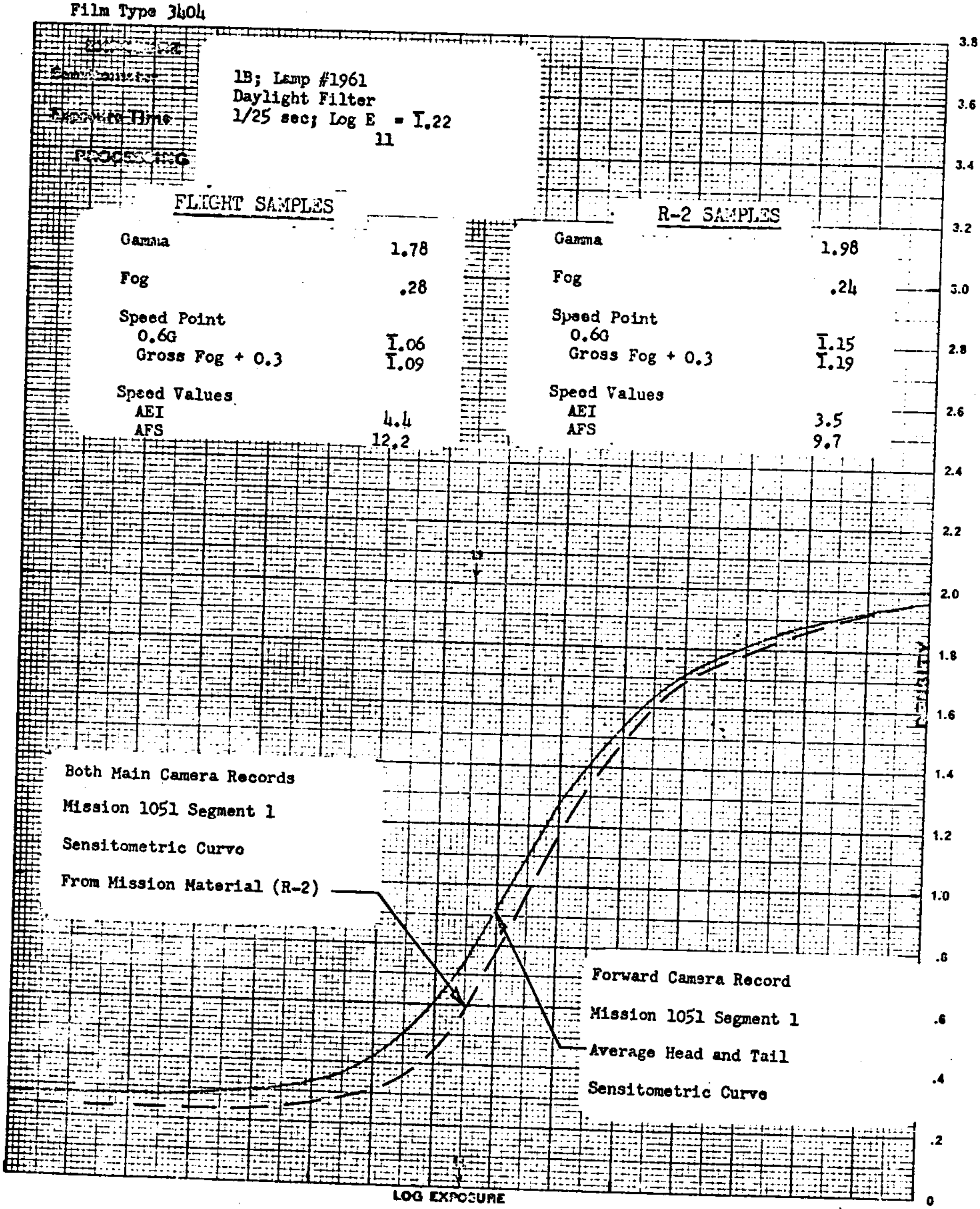


FIGURE 6-2

TABLE 6-1

TERRAIN DENSITY ANALYSIS OF EXPOSURE

Instrument	Sample Size	Percent Underexposed (D_{min} <0.4)	Correct Exposure	Percent Overexposed (D_{min} >0.9)
1051-1 Fwd	294	31.6	59.5	7.5
1051-1 Aft	282	30.8	60.6	6.0
1051-2 Fwd	287	23.0	67.9	7.7
1051-2 Aft	291	18.9	70.1	10.3

[redacted]

SECTION 7

VEHICLE ATTITUDE

The vehicle attitude errors for both Mission 1051-1 and 1051-2 were derived from the reduction of the Stellar camera photography. This attitude data is supplied to A/P by NPIC.

The attitude errors for each frame and the attitude control rates are calculated at the A/P computer facility. The computer also plots the frequency distribution of the rates and errors. These plots are no longer included as a part of this report, but are maintained at A/P and are available for reference as desired.

The summary table below lists the maximum attitude errors and rates that were experienced during 90 percent of the forward camera photographic operations, excluding the first six frames of each operation, and the total range of the errors and rates.

	Mission 1051-1		Mission 1051-2	
Value	90%	Range	90%	Range
Pitch Error (°)	-0.64	-0.80 to -0.01	-0.58	-0.80 to -0.06
Roll Error (°)	-0.39	-0.70 to + 0.0	-0.46	-0.57 to -0.13
Yaw Error (°)	0.46	-0.30 to +0.60	0.27	-0.13 to +0.40
Pitch Rate (°/hr.)	30.59	-45 to +95	27.28	-60 to +70
Roll Rate (°/hr.)	17.78	-40 to +40	20.68	-45 to +50
Yaw Rate (°/hr.)	21.67	-35 to +25	25.74	-50 to +15

The yaw angle error represents the difference between the actual vehicle yaw attitude and the ideal yaw angle that would provide correct ground image motion. Because of the unique orbit utilizing both ascending and descending photographic operations, the yaw steering performance assumes a characteristic profile not commonly experienced in the Corona system. Figure 7-1 graphically depicts this pattern, and also illustrates the relatively nominal matching of the actual yaw angle achieved with that desired.

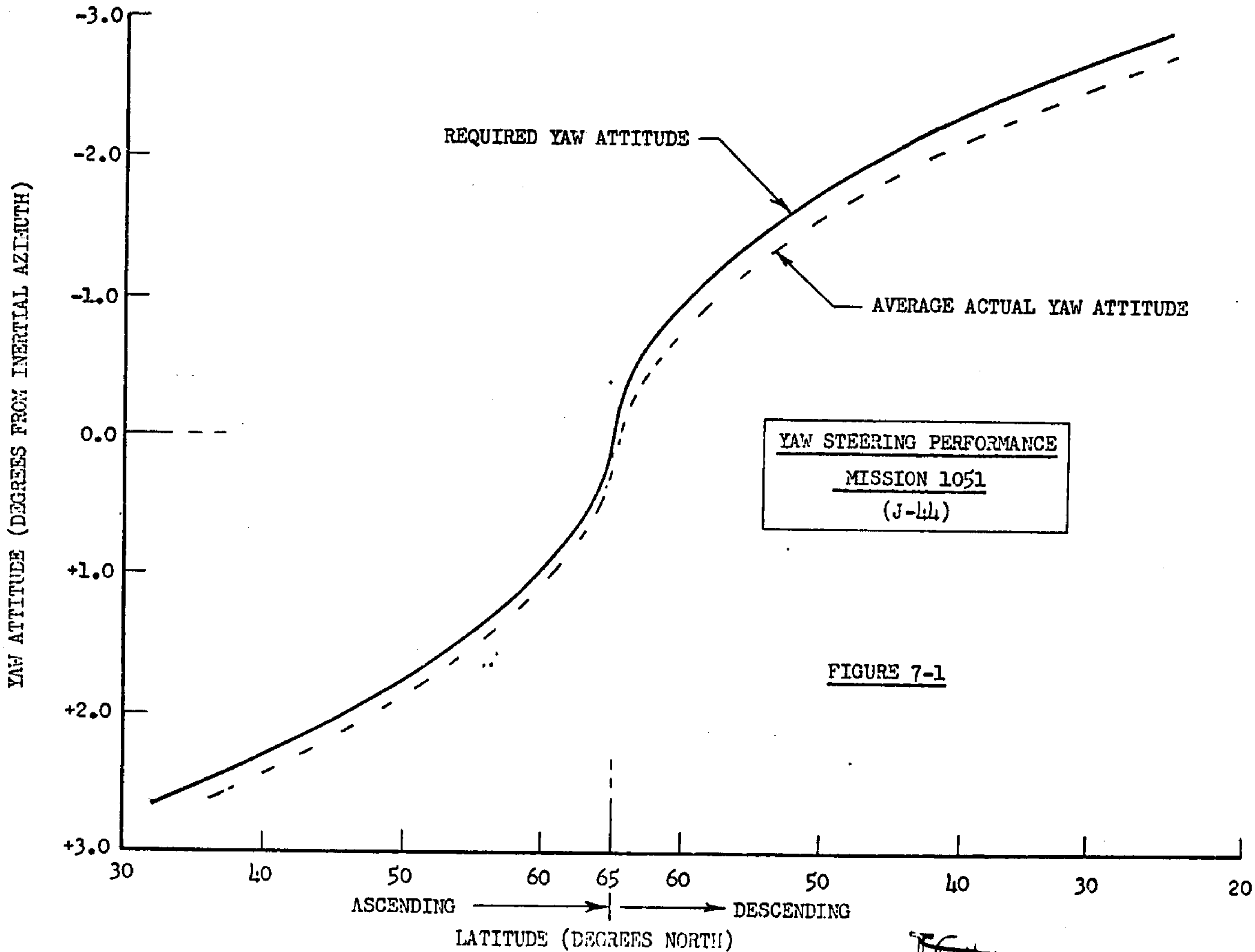

YAW STEERING PERFORMANCE
MISSION 1051
(J-44)
REQUIRED YAW ATTITUDE
AVERAGE ACTUAL YAW ATTITUDE
YAW ATTITUDE (DEGREES FROM INERTIAL AZIMUTH)
-3.0
-2.0
-1.0
0.0
+1.0
+2.0
+3.0
30
40
50
60
65
60
50
40
30
20
ASCENDING
DESCENDING
LATITUDE (DEGREES NORTH)

FIGURE 7-1

SECTION 8

IMAGE SMEAR ANALYSIS

The frame correlation tape supplied to A/P by NPIC contains the binary time word of each frame of photography. A computer program has been assembled at A/P which calculates the exposure time of each frame and compares the camera cycle rate with the ephemeris to calculate the V/h mismatch (Section 3), which is then combined with the vehicle attitude error and rate values of each frame and the crab error caused by earth rotation at the latitude of each frame. The program outputs the net IMC error and the total along track and cross track limit of ground resolution that can be acquired by a camera regardless of focal length and system capabilities.

The computer rejects the first six frames of all operations as the large V/h error induced by camera start-up is not representative of the overall system operations. The computer plotted frequency distribution of the IMC errors and resolution limits are no longer included in this report, but are maintained at A/P for reference, as desired.

The summary table 8-1 presents the maximum IMC errors and resolution limits that existed during 90% of the photographic operations and the total range of values during all operations that were computed.

The relative uniformity of calculated limits between the forward and aft-looking instruments is a result of the extraordinary character of this mission, in which both instruments employed identical slit widths and filters. The variation between instruments shown for Mission 1051-1 reflects the minor V/h control difficulties experienced early in the flight (see Section 3).

MISSION 1051

IMC RATIO AND RESOLUTION LIMITS

VALUE	UNITS	CAMERA	MISSION 1051-1 90%	MISSION 1051-1 RANGE	MISSION 1051-2 90%	MISSION 1051-2 RANGE
IMC Ratio Error	%	Fwd	2.27	-3.4 to +3.6	2.58	-2.0 to +5.0
		Aft	3.05	-5.0 to +5.0	2.33	-5.4 to +3.0
Along Track Resolution Limit	Feet	Fwd	1.64	0.2 to 3.0	1.82	0.2 to 3.6
		Aft	2.25	0.2 to 4.2	1.72	0.2 to 4.4
Cross Track Resolution Limit	Feet	Fwd	0.76	0.2 to 1.2	0.45	0.2 to 0.8
		Aft	0.57	0.2 to 1.1	0.35	0.2 to 0.7

TABLE 8-1

SECTION 9

SYSTEM RELIABILITY

Reliability calculations for the payload are based on a sample beginning with M-7. Hence both the major part of the Mural program and the "J" program are covered in the calculation. For certain auxiliaries, i.e., the stellar/index camera and the horizon cameras, the sample size is changed to recognize incorporation of modified equipment or new designs where reliability was one of the principal reasons for the modification. However, for primary mission function, the sample size is consistent with reliability reporting for the vehicle.

The reliability estimates of this section deal exclusively with the payload. Failures to achieve orbit or vehicle induced failures are thereby excluded. Recoveries before a complete mission has been completed are considered as full missions providing that early termination was caused by reasons not connected with payload operation. Film quality is not considered in the reliability estimate calculation. Hence, only electrical and mechanical functioning are considered.

The reliability estimate is also divided into primary and secondary functions. The primary functions are operation of the panoramic cameras, main camera door operation, operation of the payload clock, and recovery operations. The secondary mission functions are horizon camera operation excluding catastrophic open shutter failure mode, auxiliary data recording, and stellar/index camera operation.

Panoramic Camera Reliability

Sample Size - 242 opportunities to operate.

Three failures - S/I Programmer on System J-19

Film Transport on System J-42

Main Drive on System J-49

Assume - 3000 cycles per camera per mission.

Estimated Reliability = 98.5 at 50% confidence level

Main Camera Door Reliability

Sample Size - 142 door operations

Estimated Reliability = 99.5 at 50% confidence level

Payload Command and Control

Sample Size - 15,168 hours operation in sample

Two failures

Estimated Reliability = 97.1% at 50% confidence level

Payload Clock Reliability

Sample Size - 15,168 hours operation in sample

No failures

Estimated Reliability - 99.2% at 50% confidence level

Estimated Reliability of payload functioning on orbit = 97.1% at 50% confidence level

Recovery System Reliability

113 opportunities to recover

1 failure - improper separation due to water seal - cutter failure

Estimated Reliability - 98.5% at 50% confidence level

Stellar/Index Camera Reliability

Sample begins with J5 (Does not include DISIC units in 1100 systems)

Sample Size = 34,080 cycles

Five failures

Estimated Reliability = 93.2% at 50% confidence level

Horizon Camera Reliability

Sample begins with J5 - 151,000

Estimated Reliability of Single Camera - 99.3% at 50% confidence level

Estimated Reliability of Four Horizon Cameras at a Parallel Redundant System = 99.9% at 50% confidence level

SECTION 10

SUMMARY DATA

The comparison of the operating parameters and the performance achieved by previous missions has been difficult due to the large volume of data that results from each mission. Some of the pertinent characteristics from prior missions are summarized in tables previously included in this section. At the request of the A/P ROTS office, these tables have been deleted as a routine item in the final reports. However, these tables will be maintained and included in reports at approximately six-month intervals.

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