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CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1103-1 and 1103-2

FTV 1643, CR-3

Approved [redacted] ager
Advanced Projects

Approved [redacted] Manager
Program [redacted]

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ENCLOSURE TO [redacted]

14 February 1969

TO: [redacted]

THRU:

FROM:

SUBJECT: MISSION 1103 FINAL REPORT (CR-3)

Enclosed is the Final Evaluation Report for Mission 1103.

[redacted]ager
Advanced Projects

FOREWORD

This report details the performance of the payload system during the operational phase of the [redacted] Flight Test Vehicle 1643.

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

This document constitutes the final payload test and performance evaluation report for Mission 1103 which was launched on 1 May 1968.

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INTRODUCTION

This report presents the final performance evaluation of Corona Mission 1103. The purpose of this report is to define the performance characteristics of the CR-3 payload system and to evaluate the technical characteristics of the Mission, including analysis of any in-flight anomalies.

The payload system was assembled, tested, and certified for flight at the Advanced Projects (A/P) facility of Lockheed Missiles and Space Company (LMSC). A/P also provided services including pre-flight mission parameter planning, preparation of the flight program, in-flight support, and mission reports to the community. The initial evaluation of the recovered film was made by NPIC personnel at the processing facility. The full Performance Evaluation Team (PET) meeting at NPIC included representatives of LMSC, ITEK Corporation, Eastman Kodak Company, and cognizant government organizations. Off-line evaluation, using engineering photography acquired over the United States, was performed at facilities of individual contractors.

The quantitative data summarized in this report is originated by government and contractor organizations. Diffuse Density measurements are produced by the Air Force Special Projects Production Facility. Vehicle altitude readings and frame correlation times are provided by NPIC. The Processing Summary report is published by [redacted]

These quantitative data are used by A/P computer programs to provide processed information allowing correlation of operational photographic conditions with image quality. Analyses are made of image smear components and limiting ground resolution, and also of illumination/exposure/processing components in order to investigate exposure criteria.

SECTION 1

MISSION SUMMARY

A. MISSION DESCRIPTION

Corona Satellite Mission 1103 was planned to acquire search, cartographic, and reconnaissance photography of selected terrain areas. Two mission segments were planned to total fifteen days of orbital operation. Both segments nominally would return over 6,000 panoramic frames, each covering approximately 1,130 square miles.

The flight configuration included a THORAD booster and AGENA satellite vehicle. The on-orbit support provided by the AGENA includes real-time command and telemetry links, electrical power, stored payload program timer, and attitude stabilization and control.

The payload was a J-3 configuration, consisting of a space structure containing two panoramic cameras, one DISIC system and associated control/support equipment, with separate recovery sub-systems for each mission segment.

The flight was launched from Vandenberg AFB during the afternoon of 1 May 1968. All ascent and injection events were normal; the orbit achieved had parameters very close to nominal. Nine Orbit Adjust rockets were fired during the mission, which held the ground track dispersion to less than 12 nautical miles. Thus, near optimum usage of the pre-flight program operations was made possible.

The first mission segment was successfully completed, after seven days of flight, with an air catch of the recovery capsule. The second segment was similarly terminated after the fourteenth day.

Photographic performance by all cameras was good. The best of the panoramic record was the best yet produced on the CORONA program. The variability of quality was somewhat greater than that of recent systems.

B. FLIGHT CONFIGURATION

Mission No.	1103
Vehicle No.	1643
System No.	CR-3
Forward Looking Camera Serial No.	307
Aft Looking Camera Serial No.	306
DISIC Camera Serial No.	5

Lens Data

Forward Looking Camera (Main Lens)	
Lens Serial No.	I-192
Measured Slit Width (Inches)	
Position 1	0.195
Position 2	0.320
Position 3	0.320
Position 4	0.100
Failsafe	0.300
Optics Filter Type	
Primary	W/25
Alternate	W/12
E. O. Focal Length (Inches)	24.000
Resolution	
Static (Lines/Millimeter)	
Filter	W/21

High Contrast	245
Low Contrast	144
Dynamic (Lines/Millimeter)	
ITEK Post-Vibration	
Filter	W/21
High Contrast	196
Low Contrast	132
A/P Test	
Filter	W/21
High Contrast	234
Low Contrast	147
Distortion/Pincushion (MM)	
Angle Off Axis (Deg.)	
3	0.002
2	0.001
1	0.000
0	0.000
359	0.000
358	0.001
357	0.003
Aft Looking Camera (Main Lens)	
Lens Serial No.	I-166
Measured Slit Width (Inches)	
Position 1	0.135
Position 2	0.185
Position 3	0.260

Position 4	0.135
Failsafe	0.160
Optics Filter Type	
Primary	W/21
Alternate	SF-05
E.O. Focal Length (Inches)	24.000
Resolution	
Static (Lines/Millimeter)	
Filter	W/21
High Contrast	269
Low Contrast	152
Dynamic (Lines/Millimeter)	
ITEK Post-Vibration	
Filter	W/21
High Contrast	205
Low Contrast	137
A/P Test	
Filter	W/21
High Contrast	205
Low Contrast	136
Distortion/Pincushion (MM)	
Angle Off Axis (Deg.)	
3	0.001
2	0.000
1	0.000

0	0.000
359	0.000
358	0.000
357	0.001

Horizon Optics

Forward Looking Camera

Take-up (Starboard)

Lens Serial No.	E-23752
Exposure Time (Sec.)	1/100
Aperture	F/8.0
Filter Type	W/25
Oper. Focal Length (MM)	55
Radial Distortion (MM)	
10 Deg. Off Axis	0.02
20 Deg. Off Axis	0.05
Tangential Distortion	0.015
Resolution (Lines/MM)	

Angle Off Axis (Deg.)	0	5	10	15	20	25	30
(Radial)	209	208	184	160	136	150	45
(Tangential)	187	185	161	138	130	96	70

Supply (Port)

Lens Serial No.	E-23772
Exposure Time (Sec.)	1/100
Aperture	F/6.3
Filter Type	W/25

Oper. Focal Length (MM) 55

Radial Distortion (MM)

10 Deg. Off Axis 0.01

20 Deg. Off Axis 0.03

Tangential Distortion 0.029

Resolution (Lines/MM)

Angle Off Axis (Deg.)	0	5	10	15	20	25	30
(Radial)	209	208	206	181	175	134	57
(Tangential)	166	164	161	174	130	96	70

Aft Looking Camera

Take-up (Port)

Lens Serial No. E-23812

Exposure Time (Sec.) 1/100

Aperture F/6.3

Filter Type W/25

Oper. Focal Length (MM) 55

Radial Distortion (MM)

10 Deg. Off Axis 0.02

20 Deg. Off Axis 0.05

Tangential Distortion 0.029

Resolution (Lines/MM)

Angle Off Axis (Deg.)	0	5	10	15	20	25	30
(Radial)	209	208	206	202	88	150	57
(Tangential)	187	185	161	155	116	96	62

Supply (Starboard)

Lens Serial No. E-23792

Exposure Time (Sec.)	1/100						
Aperture	F/8.0						
Filter Type	W/25						
Oper. Focal Length (MM)	55						
Radial Distortion (MM)							
10 Deg. Off Axis	0.01						
20 Deg. Off Axis	0.04						
Tangential Distortion	0.013						
Resolution (Lines/MM)							
Angle Off Axis (Deg.)	0	5	10	15	20	25	30
(Radial)	209	208	184	181	175	134	51
(Tangential)	187	185	161	155	130	96	62

DISIC Camera

Port Stellar Camera

Lens Serial No.	8P
Reseau Serial No.	8P
Aperture	F/2.8
Exposure Time (Sec.)	1.5
Nominal Focal Length (In.)	3.0
Filter	None

Starboard Stellar Camera

Lens Serial No.	3
Reseau Serial No.	3
Aperture	F/2.8
Exposure Time (Sec.)	1.5
Nominal Focal Length (In.)	3.0
Filter	None

Terrain Camera

Lens Serial No.	106		
Reseau Serial No.	106		
Filter Type	W/12		
Aperture	F/6.3		
Exposure Time (Sec.)	1/500		
Nominal Focal Length (In.)	3.0		
Resolution (Hi Contrast L/MM)			
Angle Off Axis (Deg.)	0	17	34
Radial	82	75	63
Tangential	79	65	48
Film Type	3400		
Filter	W/12		

Film Types

Forward Looking Camera

Split Load	Yes
Film Type	3404/SO-380 (UTB)
Length (Ft.)	16,500
Splices	6
Length Between Splices (Ft.)	4700-2370-5925-2005-(1240-260)C
Emulsion Data	SO-380-49-1-12-7
Payload Weight (Lbs.)	86.9-79.3
Spool No.	1978
Box Serial No.	45

Aft Looking Camera

Split Load	Yes
Film Type	3404/SO-380 (UTB)
Length (Ft.)	16,500
Splices	4
Length Between Splices (Ft.)	3880-5920-5200-(1500)C
Emulsion Data	SO-380-49-1-12-7
Payload Weight (Lbs.)	86.6-79.2
Spool No.	184T
Box Serial No.	45

DISIC Camera

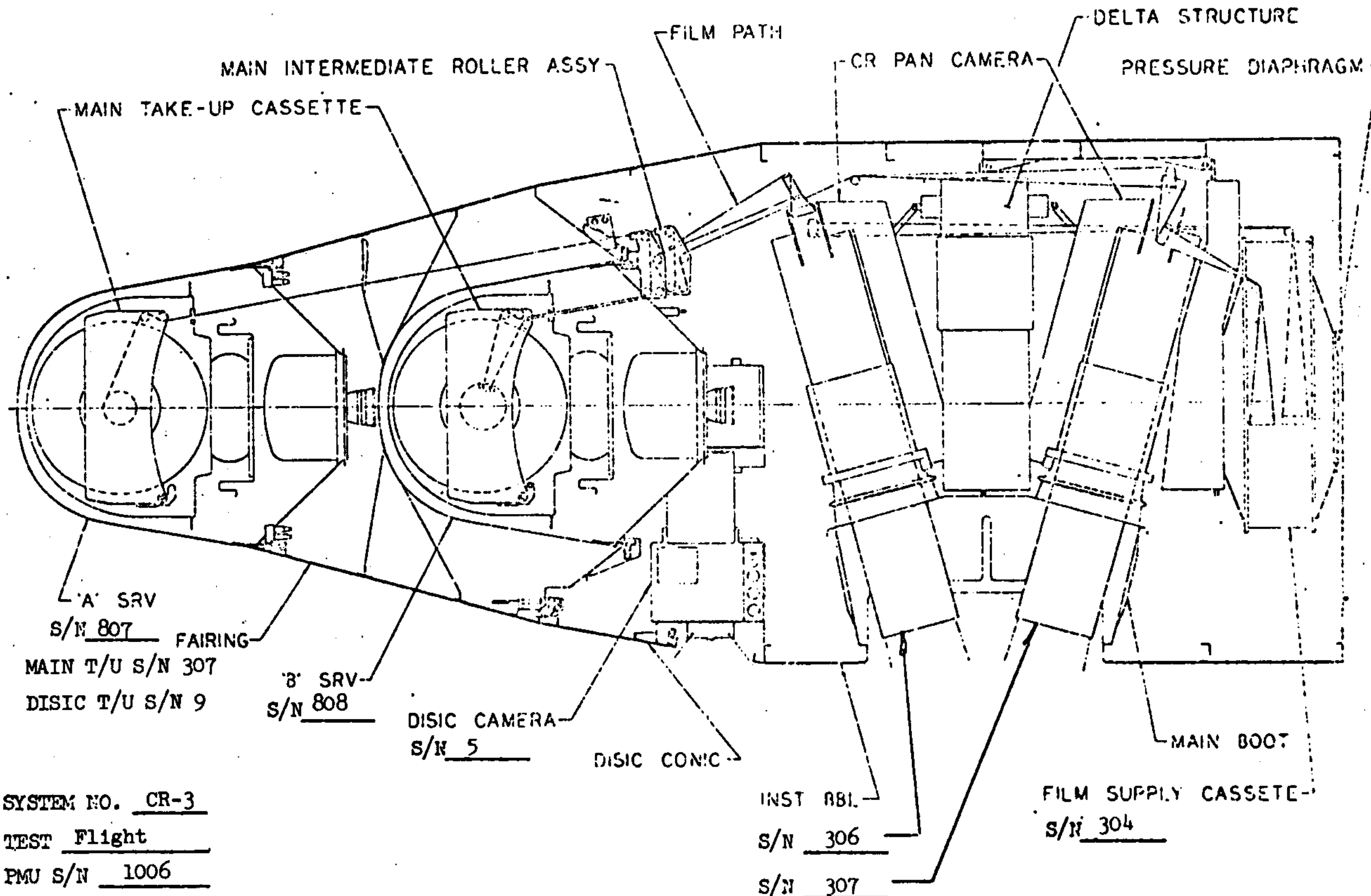
Stellar Camera

Split Load	Yes
Film Type	3401/(3400)
Length (Ft.)	2000
Splices	
Length Between Splices (Ft.)	1800(200)
Emulsion Data	3401-162-3/3400-252-13-3-8
Payload Weight (Lbs.)	6.9-1.6

Terrain Camera

Split Load	No
Film Type	50 JC-1-2000
Length (Ft.)	2000
Splices	None
Length Between Splices (Ft.)	2000
Emulsion Data	173-1-3-8
Total Film Wt. (Lbs.)	20.4-18.0

PAYLOAD PROFILE AND SERIAL NUMBERS



SYSTEM NO. CR-3

TEST Flight

PMU S/N 1006

SLOPE PROGRAMMER S/N 203

CLOCK S/N 621

SWITCH PROGRAMMER S/N 203

FIGURE 1-1

C. PANORAMIC CAMERAS

Both instruments operated satisfactorily throughout the mission. The Performance Evaluation Team (PET) judged the general quality of the imagery to be fair, and not as good as Mission 1102. However, the best of the panoramic photography was the best yet produced on the CORONA program. CORN mobile targets showed 8 foot ground resolution and one fixed target showed 7 foot ground resolution both in-track and cross-track and by both cameras. In almost every case, the forward looking camera performed better than the aft looking camera.

D. DISIC CAMERA

The stellar cameras functioned properly throughout the mission and recorded a full field of stars on both port and starboard cameras. All aspects of the DISIC system operated normally.

SECTION 2

PREFLIGHT SYSTEMS TEST

A. SUMMARY

The J payload systems are subjected to extensive preflight testing and preparation by A/P, in order to demonstrate resolution of any system problems, and to provide confidence in system capability to reliably perform the flight mission. Standard tests include vibration environment, thermal/altitude environment, photographic resolution, light leak, and a test series for flight preparation. Additional tests are performed as required.

The CR-3 system successfully passed all aspects of the testing operations, providing acceptable performance and a high degree of operational confidence.

B. ENVIRONMENTAL TESTING

The CR-3 thermal/altitude environmental test was performed at the Sunnyvale HIVOS facility from December 12, 1967 to December 21, 1967. During this period, internal temperature ranged from a low of 35°F to a high of 102°F measured at the main camera Delta frame. Nose cone temperature ranged from 59°F to 95°F and supply cassette from 42°F to 96°F. Internal pressure for both operate and non-operate periods ranged from 1 to 200 microns.

PANORAMIC CAMERAS

Panoramic camera operation was satisfactory, except for the No. 1 cycle counter. The "hundreds" position on the No. 1 counter failed to advance from Position 9. The unit was replaced. The correlation between the footage pots of the No. 1 and No. 2 Pan instruments and the actual count was satisfactory. The cycle rate errors were obtained using the Dymec equipment and were less than 1 percent from calibration during the entire test.

The Exposure Control System operated satisfactorily except during Rev. 2 of the -1 mission. UHF-101 failed to reset the "FAILSAFE" on Pan camera No. 1 during Rev. 2 operations. Post chamber analysis of the switch programmer (UHF-101) revealed a bent stepper switch wiper. The wiper was straightened and correct operation was verified. Very little corona marking was found on the processed film, none of any significance from either camera.

Several minor anomalies were found, none of which were related to the operating environment, and all were resolved on subsequent tests. For example, the rail hole adjacent to the data block is normally blocked out to prevent interference in reading the binary time. This is the 10th hole from the center double hole. This dot was present in every data block on both cameras and instead, the 10th hole on the other side of the double dot was obscured. This could only have its source at the factory. No attempt was made to clear the obstructed holes, but the proper hole was obscured before the next live film test.

Several instances of double interrogate and data drop-out occurred. These were traced to the signal conditioners. Suitable modifications were effected, and verified by subsequent testing.

The forward motion compensation system performance was satisfactory.

The major portion of the HIVOS test was performed using 3404 film. The last 1500 feet of film in each camera was Ultra-Thin Base SO-380. Both cameras made the transition from standard to thin-base in beautiful fashion. No evidence of mistracking could be found at the splices or anywhere in the 1500 feet of operation.

DISIC

The DISIC camera performed normally during the -1 Mission but did not operate during the -2 Mission due to a failure in the Cut and Splice mechanism. The C&S platen release mechanism rebounded fast enough to relatch before the platen could move. A modification has been incorporated on all existing C&S assemblies to prevent recurrence of this problem.

Terrain film contained only 2 instances of corona. Both were low density and occurred in connection with start-up. No other significant marking was detected.

SLP images were unsatisfactory, ranging from soft, low density to indistinguishable. New York personnel advised that they found a mechanical binding situation, not HIVOS related.

Stellar film contained a skew bead roller mark its entire length but outside the active format. It would not degrade operational stellar photograph utility.

Another series of marks, found throughout the test, between this bead mark and the film edge, like the bead mark, were the only marks that did not disappear during the pressure sweep above 40 microns. It was not considered to be significant from the utility viewpoint.

A plus density streak was detected in approximately 30% of the test, down the middle. However, it had undefined edges and wherever detected and measured, did not exceed +.02 D above base plus fog or above reseau fog.

A snake-like band of corona marking 1/4" wide, running along one edge and ending 10 or 11 frames later in the middle and between frames, was found in 10 places. Of these, 6 occurrences were associated with a camera-off period.

The density of all 10 fell in the range of +.54 D to +.78 D above a base plus fog of +.22 D. Only a small percentage of the total area affected was inside the active format area.

A number of roller sit marks were found but none measured higher than +.08 D above base plus fog.

A series of very small +D spots was found in approximately 150 frames. They were too small to measure accurately with the available densitometer and were visually estimated to be approximately +.4D. The location and character suggests the retrieval fixture as the probable source.

Two instances of heavy dendritic discharge were found. Both affected 15 frames each, and were on the last 35 feet of film. One was only 6 feet from the end and both were probably related to the retrieval handling. No other evidence of dendritic discharge was found.

These markings exceed the limits imposed by the J-3 requirements specifications. However, only 107 formats of more than 7,000 exceeded the +.4 D limit on density, not counting the skew roller marks and the very low density streak down the middle.

In general, the appearance of this DISIC film was better than either CR-1 or CR-2 as accepted for flight. Although no film was produced for the B bucket, previous testing of CR-1 and CR-2 showed no significant change from the A bucket film.

The clock system performance was satisfactory. The average error was -.015 seconds in 24 hours.

The instrumentation and command systems performed satisfactorily.

C. RESOLUTION TEST

Resolution and theodolite tests were performed and evaluated on 8 February 1968. Results of the thru-focus resolution tests of pan instruments 306 and 307 showed the following characteristics:

Master Pan Instrument No. 306

Maximum high contrast resolution 205 lines/mm at 0.000 focal position.

Maximum low contrast resolution 136 lines/mm at 0.000 focal position.

Slave Instrument No. 307

Maximum high contrast resolution 234 lines/mm at 0.000 focal position.

Maximum low contrast resolution 147 lines/mm at 0.000 focal position.

These readings were biased for 0.014 inch vacuum shift.

D. LIGHT LEAK TEST

The CR-3 system was tested for light leaks on 20 March 1968. A minor leak was indicated on the side of Instrument 306 drum seal. This leak was present only when the system was in the vertical position required for this test. The horizontal position for the photomultiplier search indicated a light leak only when finger pressure was applied to the side of the drum.

E. FLIGHT LOADING AND CERTIFICATION

Loading of flight film was completed on 23 April 1968. Sensitometric measurements made on samples of the flight film for both pan cameras and DISIC stellar and index verified satisfactory photographic characteristics. Film types evaluated were 3400, 3401 and 3404.

Film tracking was acceptable during dynamic operations. Though the rail scratching was moderately heavy on the emulsion side from both pan cameras, no interference with mission performance was expected.

Final photometer check for light leakage showed no leaks other than the expected slight leak at the drums. Previous live film tests showed the drum leaks to be minor.

The photographic performance of the CR-3 system was certified for flight on 24 April 1968.

SECTION 3

FLIGHT OPERATIONS

A. SUMMARY

Lift-off occurred at 14:31 PDT on 1 May 1968 from SLC-3, West pad. All launch, ascent, and injection events occurred as programmed. The orbit achieved was within 3 Sigma predicted dispersions.

Both Panoramic cameras operated satisfactorily throughout the flight. Average cycle periods for both cameras were within 1% of the pre-flight calibrations.

The DISIC system operated normally throughout the flight as indicated by telemetry monitors.

Clock and A/P command systems operated satisfactorily throughout the flight.

Anomalies were noted on the FMC programmer, Exposure Control programmer, pressure makeup, instrumentation, and vehicle command systems. These anomalies are presented in detail in Paragraphs D, E and F of this section.

Ascent vibrations appeared normal and were within qualification levels.

The thermal environment of the Panoramic cameras was within the predicted tolerances and ranged from an average high of 78°F for the -1 mission to an average low of 57°F for the -2 mission. The temperature of the FMC programmer was higher than predicted and ranged from a high of 97°F to a low of 77°F. Temperatures recorded during the -2 mission of the Exposure Control programmer and DISIC system were lower than predicted. The temperature environment of the aft power box was lower than predicted throughout both missions.

Panoramic camera take-up switchover was commanded on Rev. 104. Cut, wrap, and transfer from the -1 to the -2 recovery system occurred normally.

DISIC camera take-up switchover was commanded on Rev. 105. Cut, splice, and transfer to the -2 recovery system occurred normally.

Both recovery systems were successfully recovered by air-catch with all events near nominal. Impact was within predicted limits for both systems. The -1 SRV tape recorder system functioned satisfactorily throughout the mission. The -2 SRV tape recorder performance was acceptable after the first 20 minutes of recorded data. Further explanation is given in Paragraph E of this section.

The post-recovery testing consisted of the following: Exercising the command system to assure that all commands not used in flight were operational, operating the Panoramic cameras in the mono mode to evaluate Agena response, operating the DISIC camera to evaluate jamming characteristics, and to accumulate running time on the camera system.

The primary test objectives were achieved and the Panoramic cameras logged approximately 85 and 88 thousand cycles from manufacture for the #1 and #2 instruments respectively.

B. ASCENT PERFORMANCE

All ascent events were normal with In-Flight Reset (door ejection), A/P to Orbit Mode, instrumentation switchover, and Panoramic camera to Orbit Mode occurring on time and as programmed. There was no evidence of Panoramic camera rotation during ascent.

Lift-off vibrations experienced by CR-3 were considerably less than those experienced by CR-1 or CR-2 with a maximum disturbance of 10.65 g's along the Y-axis at the forward instrument barrel interface. Vibration values during Transonic flight and THOR Pogo effect fell between those of CR-1 and CR-2.

C. ORBIT

The orbit achieved was very close to the nominal parameters. The comparison of the planned and actual orbit parameters is tabulated as follows:

Parameter	Planned	Orbit 6 Actual	Orbit 110 Actual	Orbit 220 Actual
Period (Min.)	88.71	88.69	88.64	88.63
Perigee (N.M.)	84.7	87.28	84.35	85.76
Apogee (N.M.)	144.9	141.1	148.4	146.8
Inclination (Deg.)	83.3	83.03	83.03	83.03
Perigee Latitude (Deg. N.)	18.0	18.29	43.02	43.53

Four OAS rockets were fired on Mission 1103-1 and five on 1103-2. The small deviation from the desired ground track allowed near maximum flexibility in the selection of operations from the pre-flight program. At no time did the ground track error exceed 12 miles after the first OAS was fired.

The chart on the following page summarizes deviations from the nominal orbit.

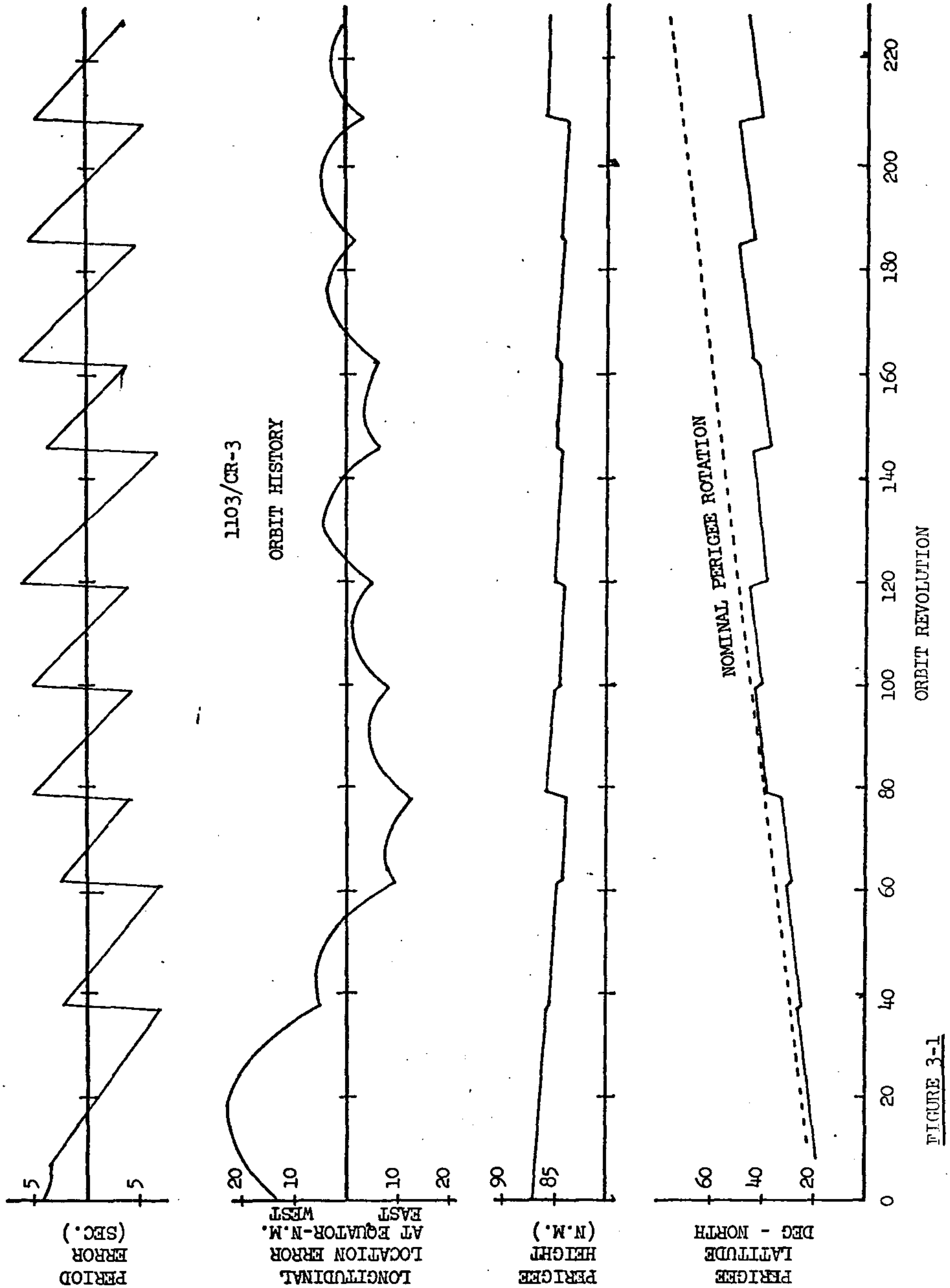

1103/CR-3
ORBIT HISTORY
PERIOD ERROR (SEC.)
5
5
LONGITUDINAL LOCATION ERROR AT EQUATOR-N.M.
WEST
EAST
20
10
10
20
PERIGEE HEIGHT (N.M.)
90
85
PERIGEE LATITUDE DEG - NORTH
60
40
20
NOMINAL PERIGEE ROTATION
0
20
40
60
80
100
120
140
160
180
200
220
ORBIT REVOLUTION
FIGURE 3-1

FIGURE 3-1

D. FIRST MISSION

Photographic operations began with a short stereo confidence run during the [redacted]cquisition. Telemetry indicated normal performance and payload status. Normal photographic operations commenced on Rev. 3; 2876 frames were taken by the #1 Panoramic camera and 2891 frames by the #2 thru the end of the first mission segment. On Rev. 104 while northbound over Ontario, Canada, the film takeup was commanded into the second recovery vehicle. The first recovery system operated normally during Rev. 115 southbound, resulting in an air-catch of the film capsule 30 miles from the predicted impact point, approximately 360 miles northwest of Hawaii.

In addition to pre-flight material, there were 64 in-flight operations during this mission segment. This included 2 engineering operations for status checks on Revs. 1 and 9. Also included are 7 domestic passes on Revs. 16, 32, 48, 63, 64, 79 and 97. Operation on Rev. 48 was a mono operation of the forward camera only. The experiments performed on these domestic operations will be discussed in Section 4, Photographic Performance.

Both Panoramic cameras operated normally throughout the flight. Camera system dynamic operation, 99/101 percent clutch operation, start-up, and transport functions were normal for all passes indicated by available telemetry data. The #1 instrument center of format switch failed on one Operate during Rev. 8. This resulted in three extra "creep frames" with missing H.O.'s and fiducials. A similar occurrence was found on two camera cycles of Rev. 6.

Cycle periods were within 1% of the pre-flight calibrations.

Satisfactory control of image motion compensation was maintained throughout this mission segment. The ramp-to-orbit match error did not exceed 3% at any time after Rev. 1. The yaw programmer operated satisfactorily.

The exposure control system performance was generally acceptable; however, two anomalies were noted. The first occurred during Rev. 7 and again during Rev. 8 in which the exposure programmer T/M data indicated an incorrect command condition. The second abnormality occurred during the last camera operation of the first mission. At this time the programmer commanded the Panoramic camera slits to change from Position 2 to Position 1; however, both slits moved to an abnormal position between 3 and 4. This position resulted from receiving a Slit 1 plus a Slit 3 command.

Both the above anomalies can be attributed to a malfunction of Relay K4 in the exposure programmer. The malfunction of the K4 relay is attributed to a foreign particle in the relay housing and is assumed to be an isolated incident.

No anomalies were detected in the operation of the filter change device on either camera.

Telemetry monitors indicated the DISIC system operated normally throughout the flight. Cut, splice, and transfer to second recovery system was initiated during Rev. 105. All events occurred as programmed and were satisfactory.

The 1/250 second exposure control change mechanism in the DISIC was disabled prior to flight and only the 1/500 second exposure time was utilized. The telemetry monitor, for both exposure settings, was not disabled and T/M indicated correct response to the switch programmer output.

The clock system operated normally throughout the flight. Satisfactory correlation between clock time and system time was obtained. However, higher than normal drift was noticed throughout the flight.

The pressure make-up system did not function properly. Data from the [redacted] tracking station indicated that the high pressure nozzle was not functioning. This resulted in a slower than normal pressure rise.

Average gas consumption was 10.8 Δ psi per minute of instrument operation. The first mission consumed an average of 12.5 Δ psi per minute.

The instrumentation system operated satisfactorily throughout the flight. However, the No. 1 output platen position monitor intermittently failed to indicate the "platen down" position.

Temperature data from [redacted] tracking station indicate the camera system temperatures were near pre-flight predictions. Other component sensors deviated slightly from predicted. The data indicates that temperature change, due to Beta angle shift, was more severe than predicted.

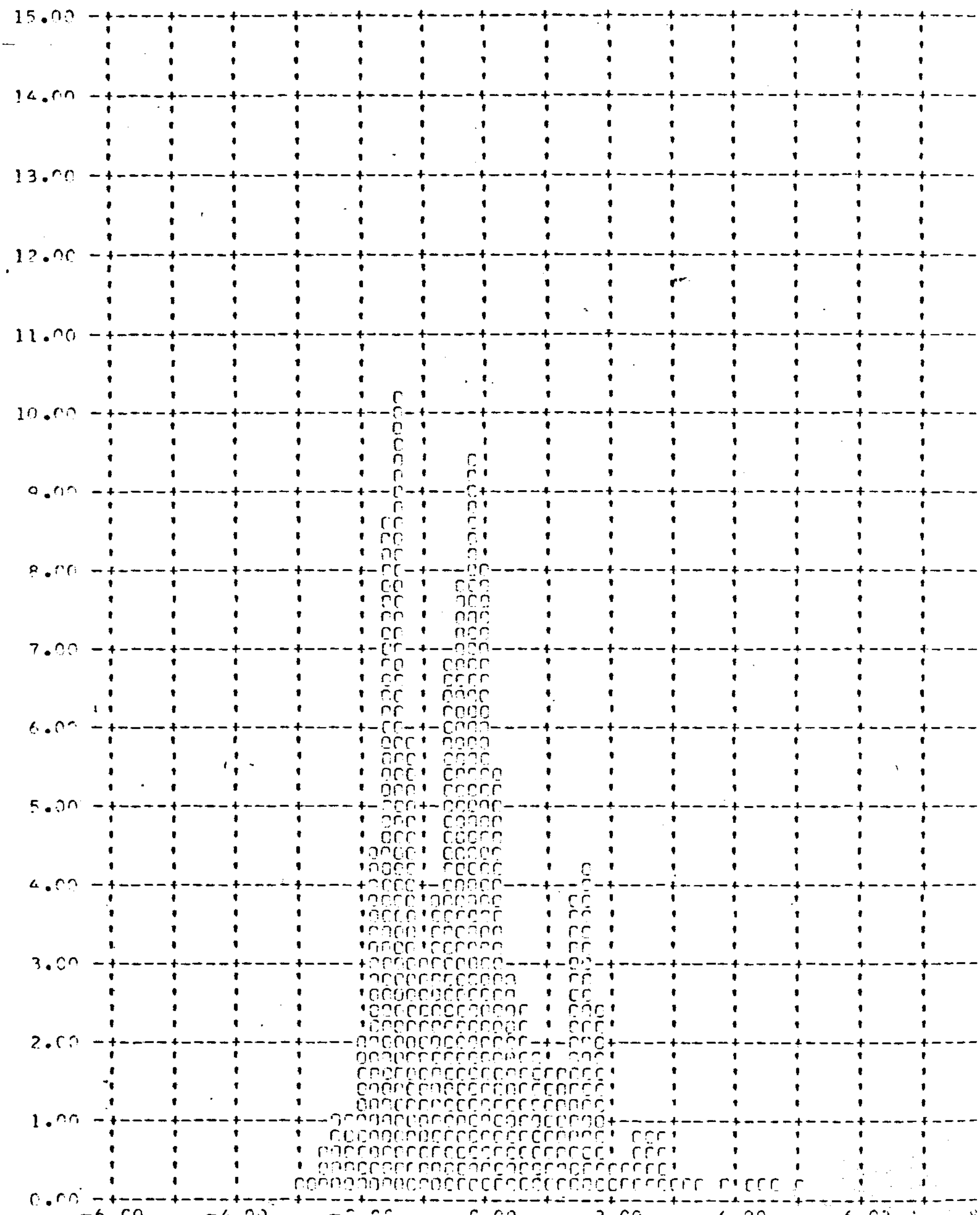
The re-entry capsule was recovered by air-catch during Rev. 115. All re-entry events occurred as programmed and within tolerance except for the deceleration chute deployment. This event occurred .10 second early and .02 second out of tolerance. The predicted versus actual impact points were as follows:

Predicted Impact	26°0'N/162°33.4'W
Actual Impact	26°27'N/162°23'W

The tape recorder subsystem performed satisfactorily during the first mission. There were occasional erroneous center of format indications at startup and shutdown. This condition has been prevalent with other J3 tape recorder systems and the data was manually interpreted to obtain the customer output tape.

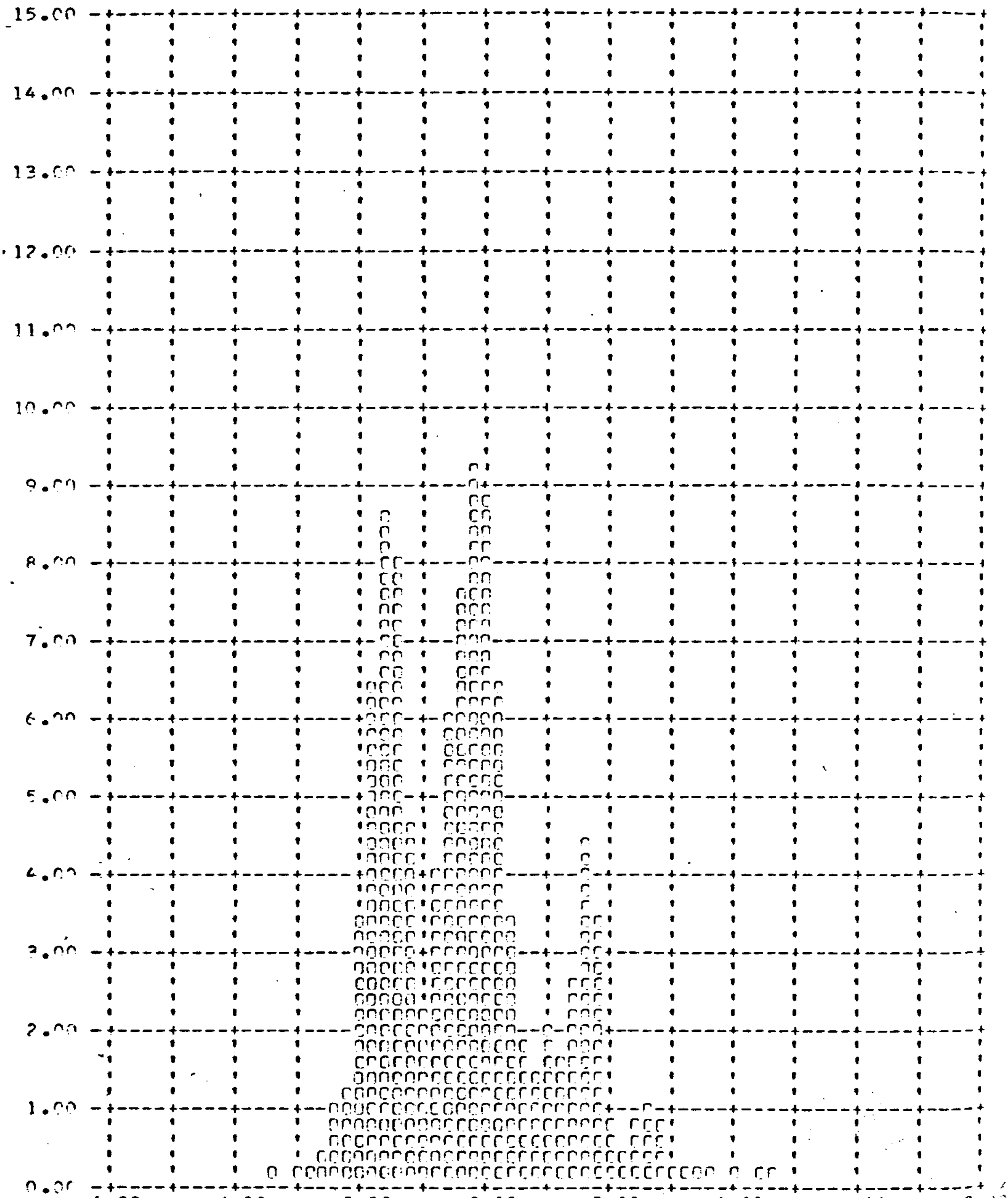
The radiation film pack carried in the recovery capsule indicated a very light radiation environment for this mission. Fogging due to radiation was less than 10% of the level necessary to degrade the imagery.

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



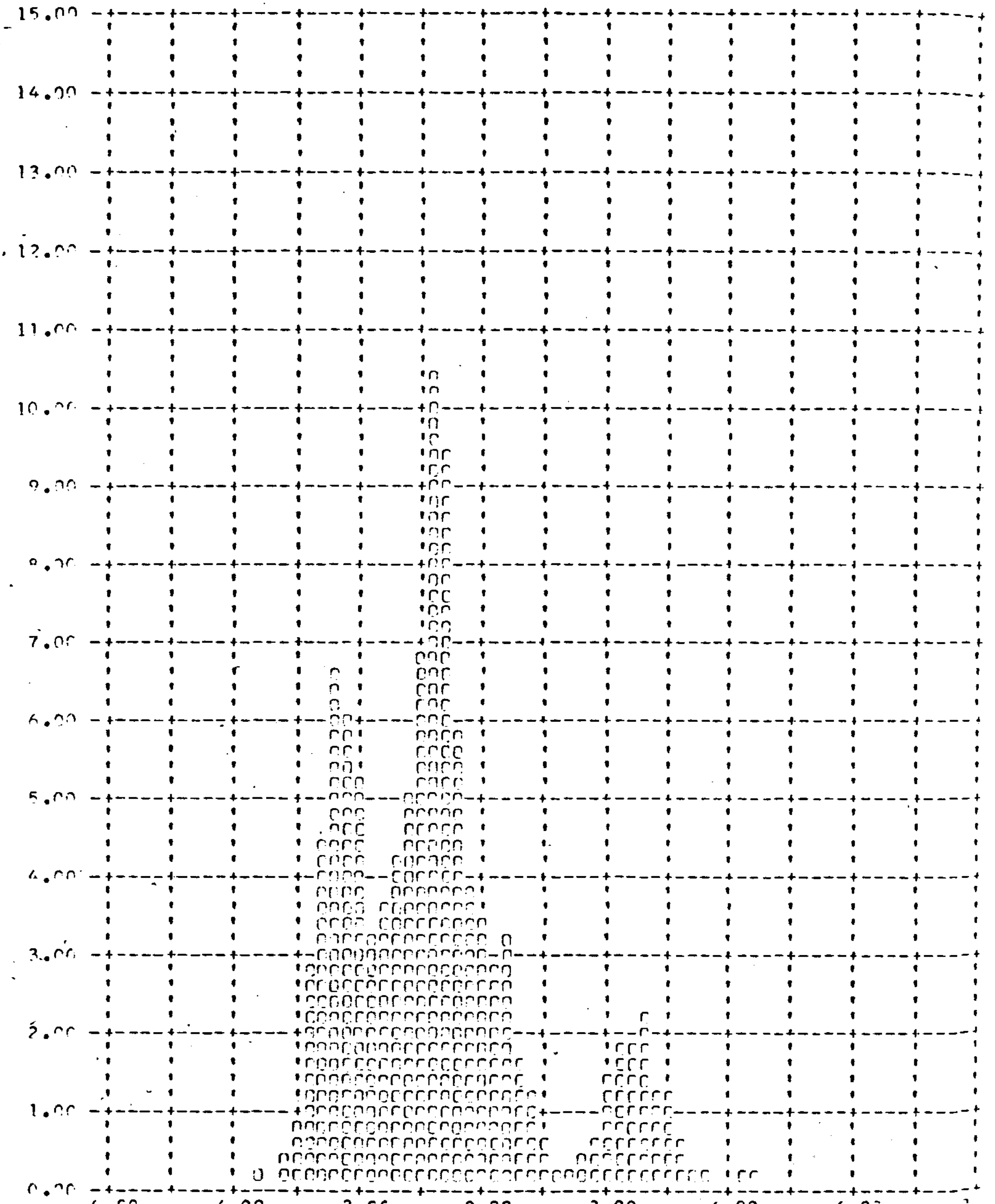
MISSION 1103A1 ~~TOP SECRET~~ C[redacted] - CONTROL NO. [redacted]

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

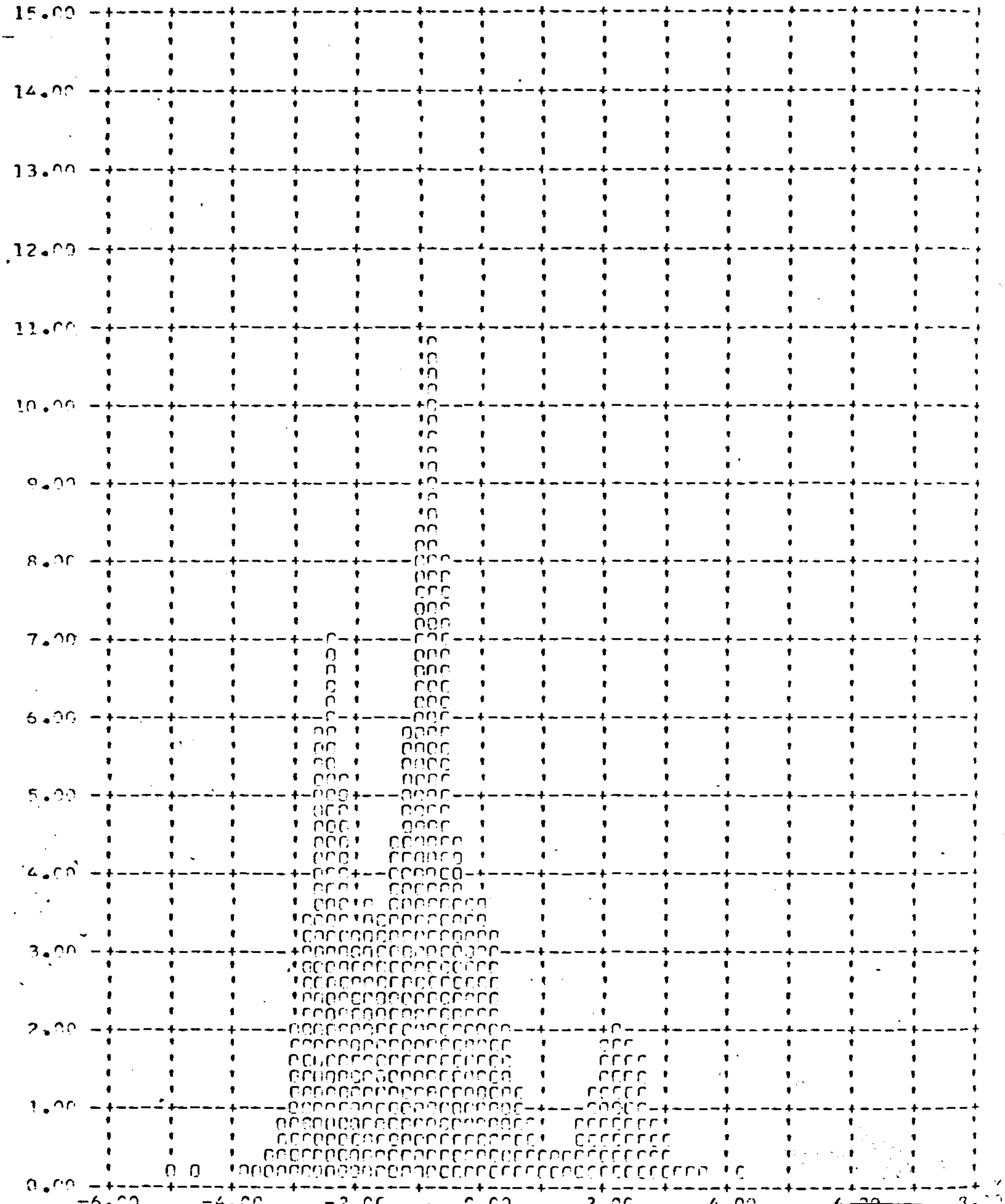


FRAMES 1-6 IN EACH [illegible] OMITTED [illegible] PERCENT = [illegible]

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



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



E. SECOND MISSION

Photographic operations continued to be satisfactory during the second mission segment.

The ramp-to-orbit error continued to be under 3%, except for Rev. 184 where the FMC programmer failed to start. As a result, the operation had a 36% error in the ramp-to-orbit match. This failure recurred on Rev. 220, however a satisfactory match was obtained by commanding the programmer to match one position in the orbit. The maximum error was less than 1%.

This programmer also failed to start on Revs. 143, 190, 204 and 207. Since no operations occurred on these revs., photographic performance was not at issue.

Gas consumption of the pressure make-up system for the second mission was 9.4 Δpsi per minute. The total camera operate time for both missions was 211.1 minutes. The bottle pressure was 740 psi at the end of the second mission.

No other abnormalities occurred and the second mission recovery took place on Rev. 228. The predicted versus actual impact points were as follows:

Predicted	25°3.27'N/160°46.8'W
Actual	25°19'N/160°50'W

The tape recorder malfunctioned during the first twenty minutes of operation during the second mission. The malfunction occurred on the first track of recorder and resulted in loss of the center of format information. The first twenty minutes of customer data processing was delayed until the center of format data could be interpreted manually and measures taken to generate the customer tape. Approximately 10% of the center of format times, in the first twenty minutes of the second mission, were hand generated and may have contained errors as high as twenty-five milliseconds. The highest errors would be present on the first and second center of format pulses of an operate.

The radiation film pack carried on the second recovery indicated that no excessive radiation was encountered. The fog density was double that of the first mission, as expected, and well below the level necessary to degrade the image.

F. COMPONENT OPERATION

Clock system operation was normal throughout the flight. Satisfactory correlation between clock time and system time was obtained, however, higher than normal drift rate was observed. The ratio of clock units to system time was 0.999999839323:1.0.

Instrumentation and command system operated satisfactorily. However, the No. 1 output platen position monitor intermittently failed to indicate the "platen down" position. This anomaly was first noticed during the post-mate confidence check and did not adversely affect flight operations.

The payload command system operated satisfactorily throughout the flight. Several anomalies were noted in the Agena command system performance, but did not affect mission requirements. Anomalies noted were as follows: One (1) spurious Analog 15 command during Rev. 5[redacted]while sending Analog 7 commands, two (2) spurious Analog 1, Analog 7, and Analog 3 commands during Rev. 101 Guam, while sending Analog 9 and Analog 14 commands.

The UNCLE command system was then utilized as the primary command link after Rev. 101[redacted] due to the spurious Analog command problem.

Yaw programmer performed normally throughout the mission. Post-flight analysis of the stellar data indicated 90% of the sample measurements to have less than 0.65° error.

G. POST MISSION TEST RESULTS

A post event 2 test plan was initiated by A/P for Rev. 229 through Rev. 244. The main objective of this test was to exercise all payload command systems not utilized during the first or second mission. The secondary objective was to life cycle the Panoramic cameras to 100,000 cycles and attempt to operate the system for a twenty day flight.

The primary objective was met. All commands were exercised and functioned without any abnormalities. Prior to "H" timer tape depletion three twenty minute operates were run to verify that specification requirements of a twenty minute operate could be met. This verification was achieved during station acquisitions and post analysis of recorded data indicated that no anomalies occurred.

During Rev. 244 the Payload command system was positioned to operate the camera system independent of "H" timer tape control and dependent only on Real Time Commands for system operations.

The secondary objective required the Panoramic camera system to be activated for ninety minute operates. Data indicated no anomalies occurred during any of these complete orbit operates. However, the life cycle test of 100,000 cycles, and twenty day system operation was not achieved due to battery depletion after 18½ days of orbit life. The pre-launch power prediction was 15 days with a 9.6% margin. The entire post event 2 test plan was made possible by the extra 3½ days of active life provided by the Agena vehicle. At power depletion the #1 instrument had logged a total of 85,446 cycles. Of these, 28,064 cycles were exercised in orbit. The #2 instrument had logged a total of 88,659 cycles, of which 22,481 cycles were exercised in orbit.

All systems operated normally up to power depletion except that the slope programmer failed to start during Rev. 237. This problem also occurred during the primary missions.

The DISIC camera operated normally during post recovery testing. A wrap-up and stall occurred as expected, resulting from film which remained in the system after the primary missions. The automatic power removal function of the DISIC control circuit performed as designed following the wrap-up.

The following table lists the number of cycles the Panoramic cameras experienced since manufacture.

	No . 1	No. 2
Test	57,382	66,178
-1 Mission	3,001	3,017
-2 Mission	3,279	3,256
Post event 2 to "H" timer tape depletion	1,968	2,000
Rev. 297 "fade" ($18\frac{1}{2}$ days)	19,816	14,208
Total	85,446	88,659

The vehicle post event 2 test plan was completed. DMU #10 and #11 were fired successfully, however, DMU #11 appeared to have fired for approximately 7 seconds with only 1/3 of the nominal impulse. The Lifeboat exercise was enabled during Rev. 258 with the execution occurring during Rev. 259 over the [redacted] tracking station. The [redacted] tracking station during Rev. 260

observed the vehicle in an unstable state; and it was not until Rev. 263 that the [redacted] tracking station reported vehicle stability. This was initially reported as an anomaly and later learned that when Lifeboat is utilized, the pitch rate will take approximately three revs. to stabilize.

The vehicle re-entered during Rev. 304 on 20 May 1968. Predicted impact was 59.9°S/91.6°E.

SECTION 4

PHOTOGRAPHIC PERFORMANCE

A. SUMMARY

1. Normal Operations

Photography from the Panoramic cameras was judged by the Performance Evaluation team as fair, and not as good as Mission 1102. There was a significant variability in image quality, ranging from rather good to poor. The forward was judged to be superior to the aft. Though the mission was severely affected by haze, the best imagery was comparable to the best yet obtained on the CORONA program. An MIP rating of 95 was assigned to both segments of this mission.

DISIC performance was satisfactory. Point type images appeared in most stellar frames. The image quality of the Index camera was good, and slightly better than observed on Mission 1102.

2. Special Purpose Operations - Main Cameras

The use of presently available multi-layer full color film is almost always accompanied by a substantially lower resolution than is achievable with film types 3404 or SO-380 in use on the CORONA program. However, for the purposes of photographic reconnaissance, if some color were added to the usual black and white photos with little or no loss of resolution, the possible increase in the information content might be important.

If selected filters are used with the usual films and the resultant photographs later recombined to form a bi-spectral image, the advantages of both high resolution and added information due to color might be achieved.

A bi-spectral filter experiment was performed on Mission 1102, using an SF-05 filter (green) intermittently on the aft camera in conjunction with a Wratten 25 filter (red) on the forward camera. The results showed sufficient promise to warrant testing during mission operations.

During Mission 1103, the above combination was used operationally on 25 orbits. The information thus yielded has not been disseminated by the photo interpreters.

B. PANORAMIC CAMERAS

1. Image Quality

The performance capability of this mission was indicated by resolution attained from ground targets. The CORN mobile targets were the best yet recorded, producing 8 foot ground resolution. The best fixed CORN target was resolved to 7 feet. These readings were indicative only of the best performance and not the general performance.

Focus variability appears to have been the major cause of image degradation. However, severe haze, thermal gradients, focus and smear often combined to produce imagery poorer than that attributable to focus alone. At other times these factors appeared to be minimized in a manner that produced good results.

An area of soft focus was found at the start of scan throughout the mission on both cameras. In the forward formats it ranged from 1 to 5 inches from the start on the first 5 frames of an operation. A similar but smaller area was found in the aft frames. Although this condition improved after the film which had been in the film path during a sit period had been passed through the camera system, a smaller soft focus area persisted throughout the mission. Approximately 1.75% of the frames and 0.2% of the total area coverage was affected by this anomaly.

The image quality using the green (SF-05) filter on the aft camera was not as good as when the Wratten 21 filter was in use. Also, it was not as good as the corresponding material from Mission 1102. Furthermore, the differences in quality between the SF-05 and Wratten 21 film from this mission appeared to be greater than the difference between the results from Mission 1102.

One thousand five hundred feet of SO-380 (UTB) film were used on each pan camera. The performance evaluation team (PET) considered that UTB results were nearly identical to 3404.

2. Quality Measurements

Performance analysis by SPPF using edge scan techniques is shown below, comparing the 3 CR systems flown to date.

	Forward Camera		Aft Camera	
Mission	Cycles/mm	Ground Reso.	Cycles/mm	Ground Reso.
1103	87	10.8'	80	12'
1102	79	13.3'	99	9.4'
1101	64	16.3'	47	22.6'

Three mobile and one fixed CORN targets were photographed on Mission 1103-1, although 10 mobile and 2 CORN targets were scheduled for Mission 1103-2, none were photographed.

A comparison of ground resolution values from the edge analysis targets by the interim MTF/AIM program and the military standard 3-bar and

51/51 "T" bar targets by subjective analysis are shown below:

Location/Coverage	Orientation	MTF/AIM Resolution	Target	Resolution Range	Resolution Average
Edwards Air Force Base, Calif.					
Pass D16 Frame 6 Fwd	Scan		B1	10'	10'
	IMC		B1	9'	9'
	Scan		B2	9'	9'
	IMC		B2	8'	8'
Pass D16 Frame 7 Fwd	Scan		B1	8'-9'	8.3'
	IMC		B1	9'	9'
	Scan		B2	7.2'	7.2'
	IMC		B2	7.2'-8'	7.5'
Pass D16 Frame 13 Aft	Scan		B1	9'	9'
	IMC		B1	11.4'	11.4'
	Scan		B2	9'	9'
	IMC		B2	8'-9'	8.7'
Riverside, Calif.					
Pass D16 Frame 14 Fwd	Scan		51/51	12'-16'	14.7'
	IMC		"	16'	16'
Pass D16 Frame 21 Aft	Scan		"	16'	16'
	IMC		"	12'-16'	13.3'
Napa, Calif.					
Pass D97 Frame 7 Fwd	Scan	9.0'	51/51	12'-16'	13.3'
	IMC	7.0'	"	8'-12'	9.3'
Pass D97 Frame 13 Aft	Scan	13.6'	"	12'-16'	13.3'
	IMC	8.6'	"	12'	12'
Mountain View, Calif.					
Pass D97 Frame 13 Fwd	Scan	12.3'	51/51	12'	12'
	IMC	6.7'	"	12'	12'
Pass D97 Frame 14 Fwd	Scan	10.1'	"	12'-16'	13.3'
	IMC	10.5'	"	12'	12'
Pass D97 Frame 20 Aft	Scan	12.8'	"	12'	12'
	IMC	8.1'	"	12'	12'

TABLE 4-1

Edge analysis MTF/AIM data indicates that results from Missions 1102 and 1103 achieved similar image quality; however, subjective comparison of the 51/51 "T" bar targets between these two missions indicates that Mission 1102 had slightly better ground resolution than Mission 1103.

3. Data Recording

In general, all binary data blocks were satisfactory. A total of 4 on the whole mission were missing on the aft camera only. A majority of the blocks appeared slightly fuzzy, but all were readable.

All scan lines were well defined and operational throughout the mission.

All rail hole images were sharp except #27 on the binary edge on both panoramic cameras. These holes were plugged in error during manufacture.

All timing tracks and serial numbers were satisfactory.

4. Anomalies

The photo interpreters rated the overall mission interpretability as fair. However, they also judged the interpretability of the image quality to be more variable than that from Missions 1101 and 1102.

Although this mission was severely affected by haze, some part of this variability appears to be from an out-of-focus condition, as described in Section 4, Paragraph B. This situation has been encountered on other systems and investigation and tests are continuing at Boston to better understand this anomaly.

The aft camera lost the data block H/O's and fiducials on three camera cycles in Mission 1103-1 and one cycle in 1103-2. The probable cause of this condition was a marginal center-of-format switch overtravel adjustment. All subsequent systems and procedures will be reviewed for correct switch adjustments.

Some minor corona fog was found, usually associated with camera start-up. Real-time T/M data indicated an abnormal delay in pressure buildup and was due to a malfunction of the PMU high pressure valve.

Very small +D dots were found throughout Mission 1103-2 on the forward material. These dots were at a 6-1/4" interval and were caused by a foreign particle picked up by a metering roller sometime after film transfer.

C. HORIZON CAMERAS

In general, all horizon cameras functioned normally. All horizon arcs were sharp and well defined.

Four panoramic frames from Part 1 and one from Part 2 of the mission were without their associated H/O frames and fiducials. This has been discussed under main camera anomalies.

D. DISIC

1. Stellar Cameras

The stellar cameras functioned normally throughout the mission and recorded a full field of stars on both the port and starboard cameras. A modified boot baffle was used which did not vignette or flare like Mission 1102. The baffle design as used on this mission is therefore considered suitable for future missions.

Skew bead marking was present throughout the mission, but did not enter the format area.

Some dendritic and corona type fog patterns were present intermittently throughout the mission, but seldom entered the active format. The image quality was not degraded.

2. Terrain Camera

The terrain image quality was good with better definition than was obtained on Mission 1102. The terrain lens employed a modified shutter which provided a relative aperture of f/6.3. This change is considered to be the reason for the improved performance.

A few dendritic type fog patterns were found emanating from the film edge. This is characteristic of unspooling or roller flange discharge and did not enter the active format.

SECTION 5

PANORAMIC CAMERA EXPOSURE

The present series (CR) of cameras provides variable exposure capability by changing the slit width in accordance with pre-flight selected widths. For Mission 1103 the selection was as follows.

	Fwd Looking	Aft Looking
Position 1	0.195"	0.135"
Position 2	0.320"	0.185"
Position 3	0.320"	0.260"
Position 4	0.100"	0.135"
Failsafe	0.300"	0.160"

Filters were selected as follows.

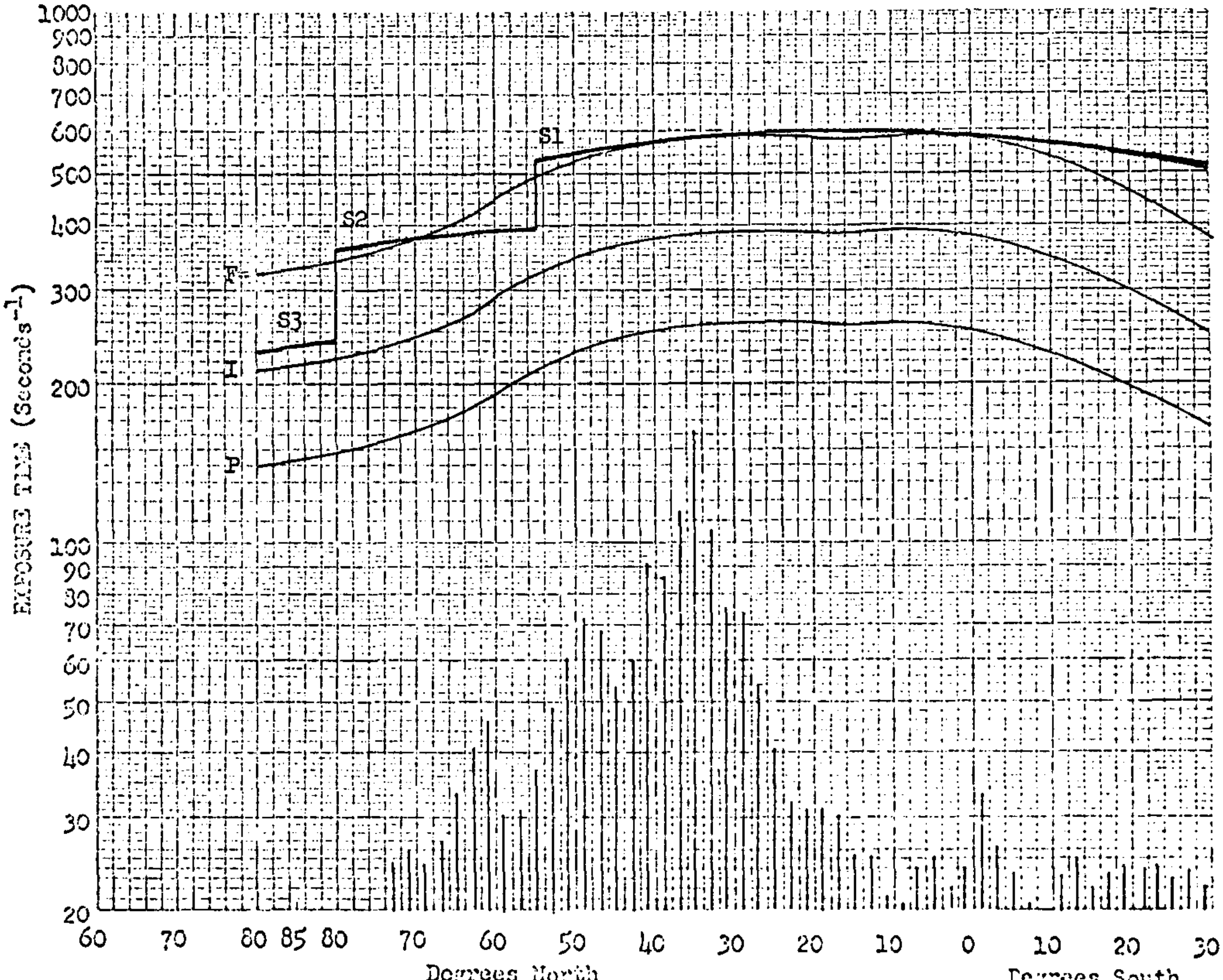
	Fwd Looking	Aft Looking
Primary	W/25	W/21
Alternate	W/12	SF-05

Figures 5-1 to 5-6 show the nominal exposure times for the aft and forward looking cameras as a function of latitude for passes D-40, D-120 and D-200.

Plotted against these nominal curves are the actuals as computed by the post-flight exposure analysis.

Superimposed on these graphs is the relative frequency distribution of photographic operations by latitude.

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 306

Pass No: D40

Launch Date: 1 May 1968

Launch Time: 21:31Z

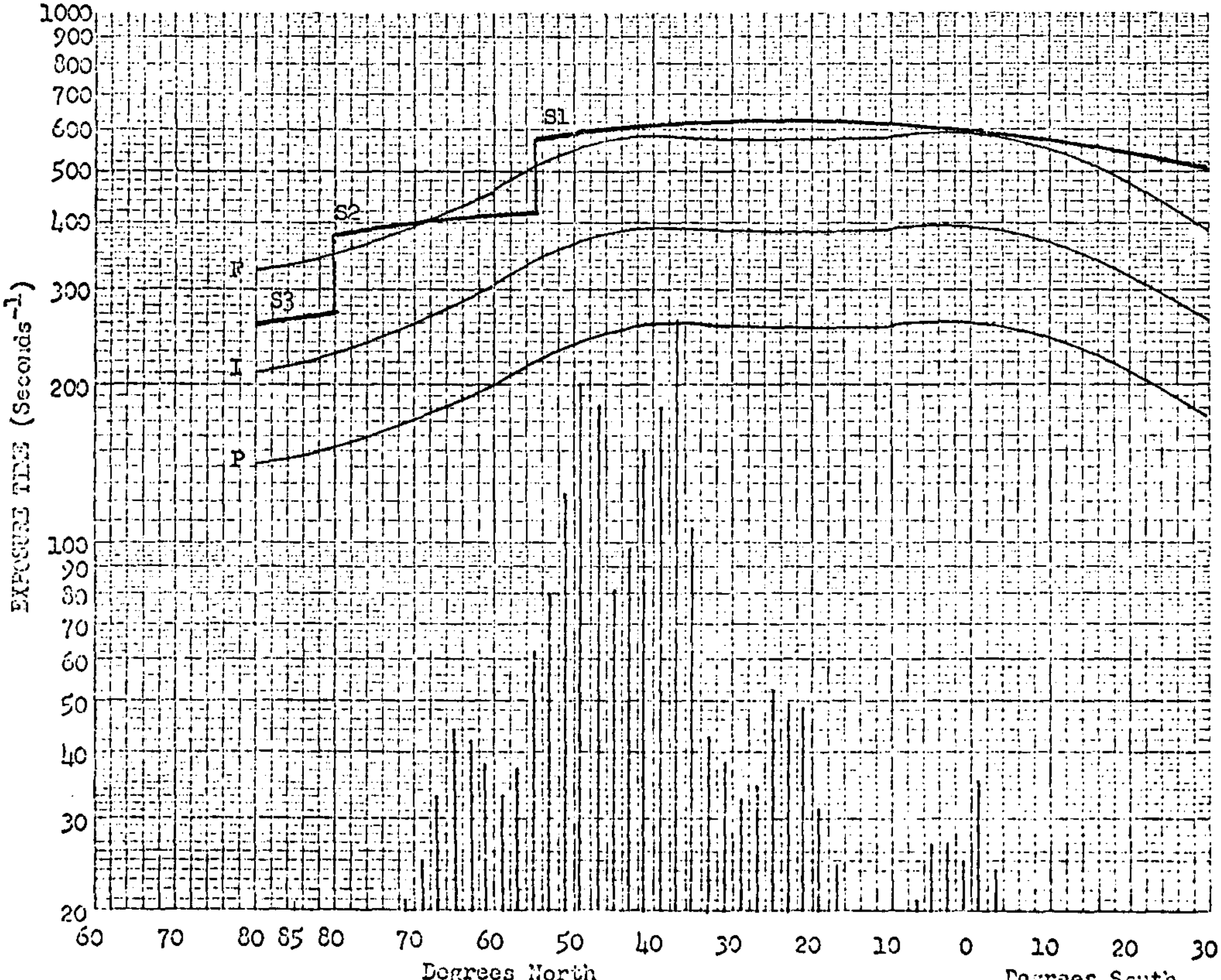
Slit Width: .250 .185 .135

Filter Type: W/21

Film Type: 3404

Revs. 1-10

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 306

Pass No: D120

Launch Date: 1 May 1968

Launch Time: 21:312

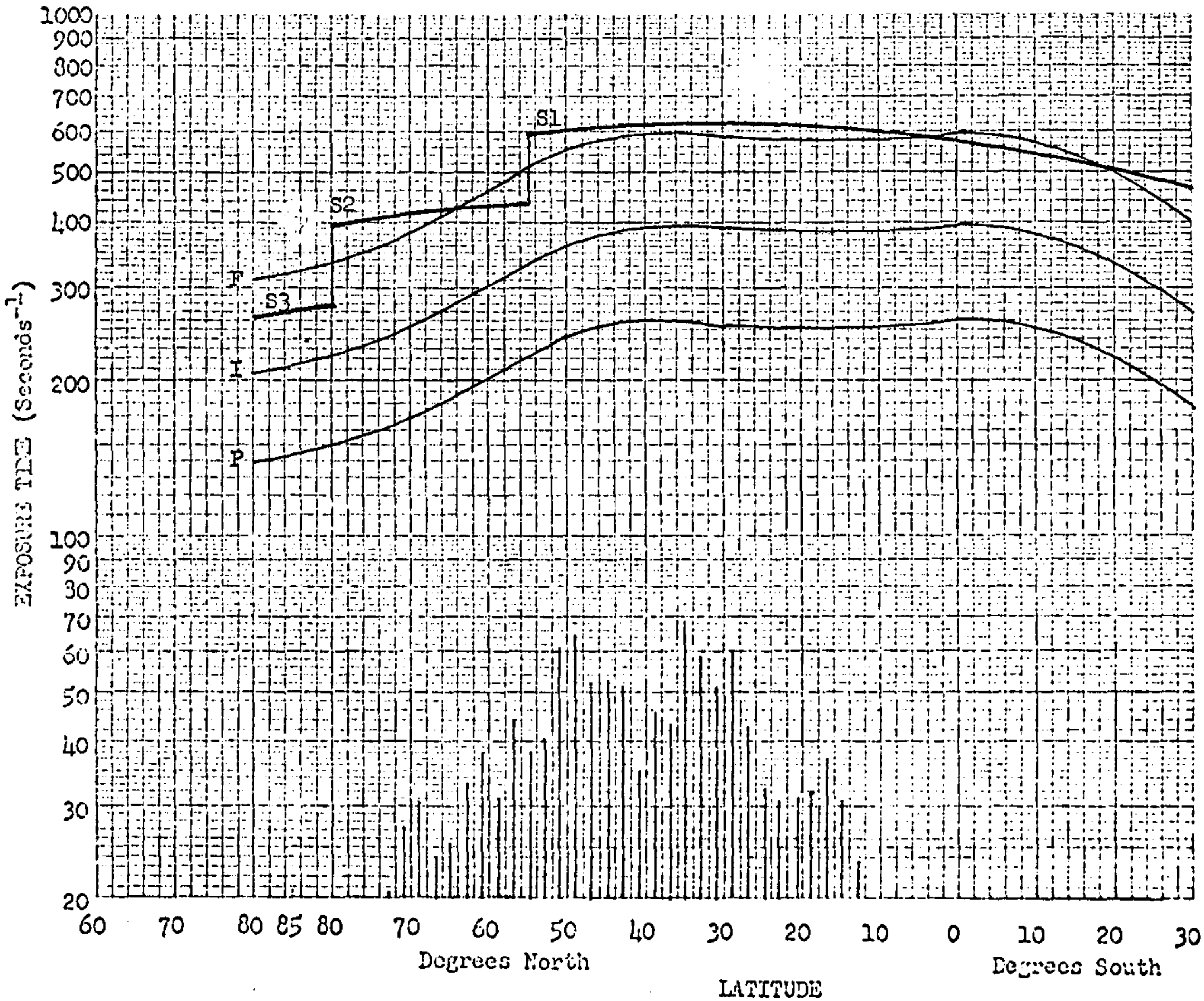
Slit Width: .260 .185 .135

Filter Type: W/21

Film Type: 3404

Revs. 81-160

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 306

Pass No: D200

Launch Date: 1 May 1968

Launch Time: 21:31Z

Slit Width: .200 .165 .135

Filter Type: W/21

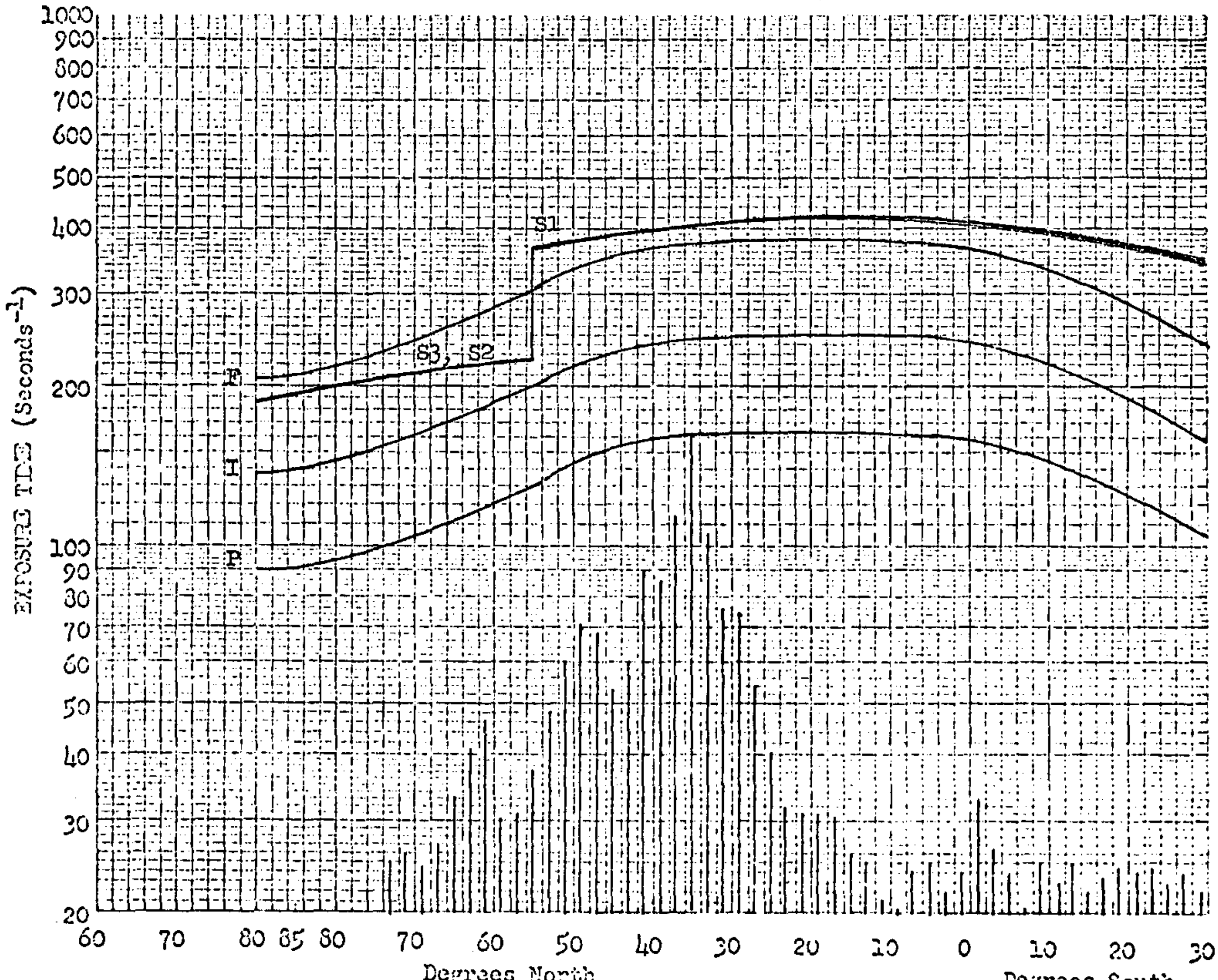
Film Type: 3404

Revs. 1?1-2?0

TOP SECRET

C/[redacted]

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 307

Pass No: D40

Launch Date: 1 May 1968

Launch Time: 21:31Z

Slit Width: .320 .195

Filter Type: W/25

Film Type: 3404

Revs. 1-40

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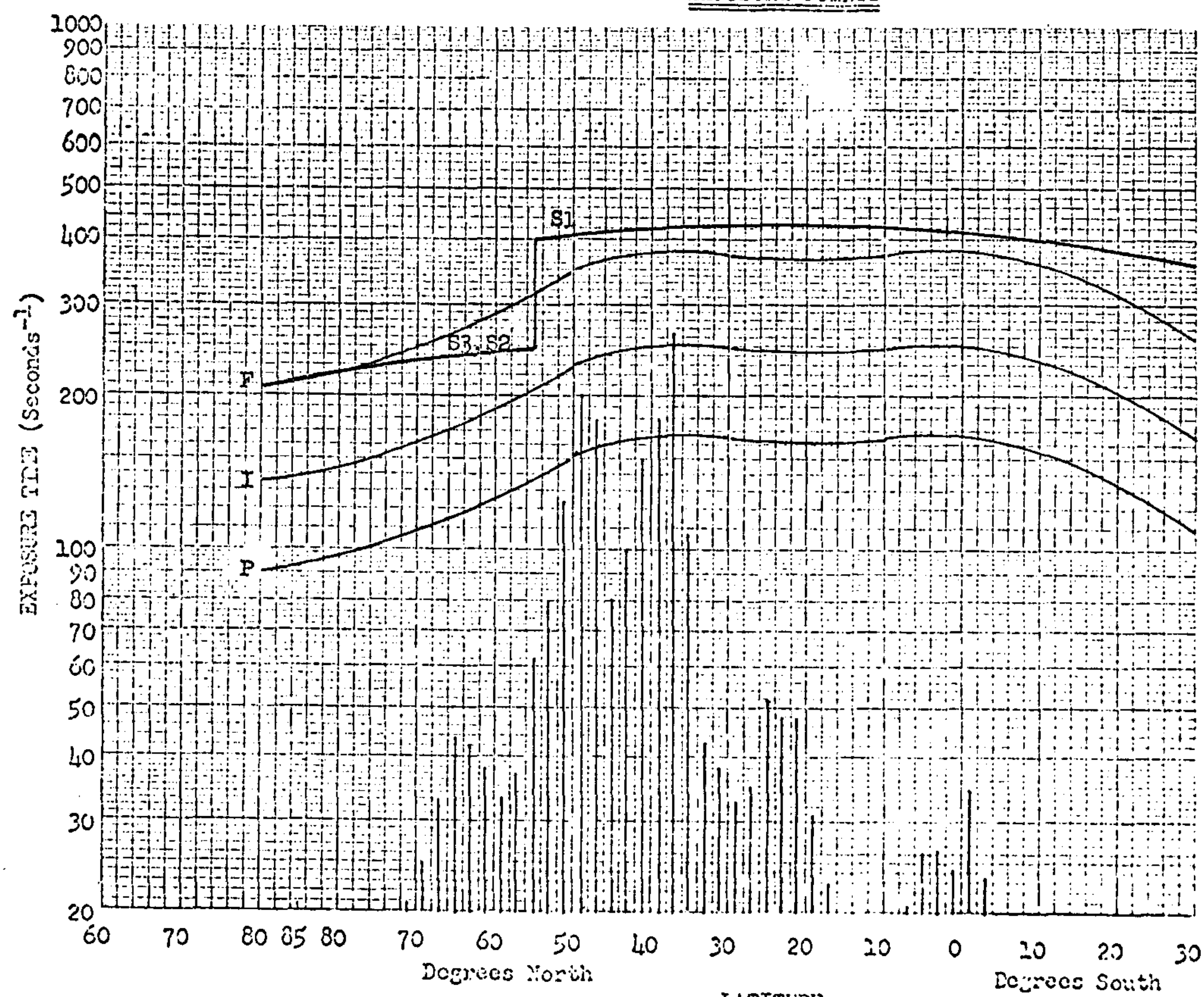
FIGURE 5-4

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 307

Pass No: D120

Launch Date: 1 May 1968

Launch Time: 21:31Z

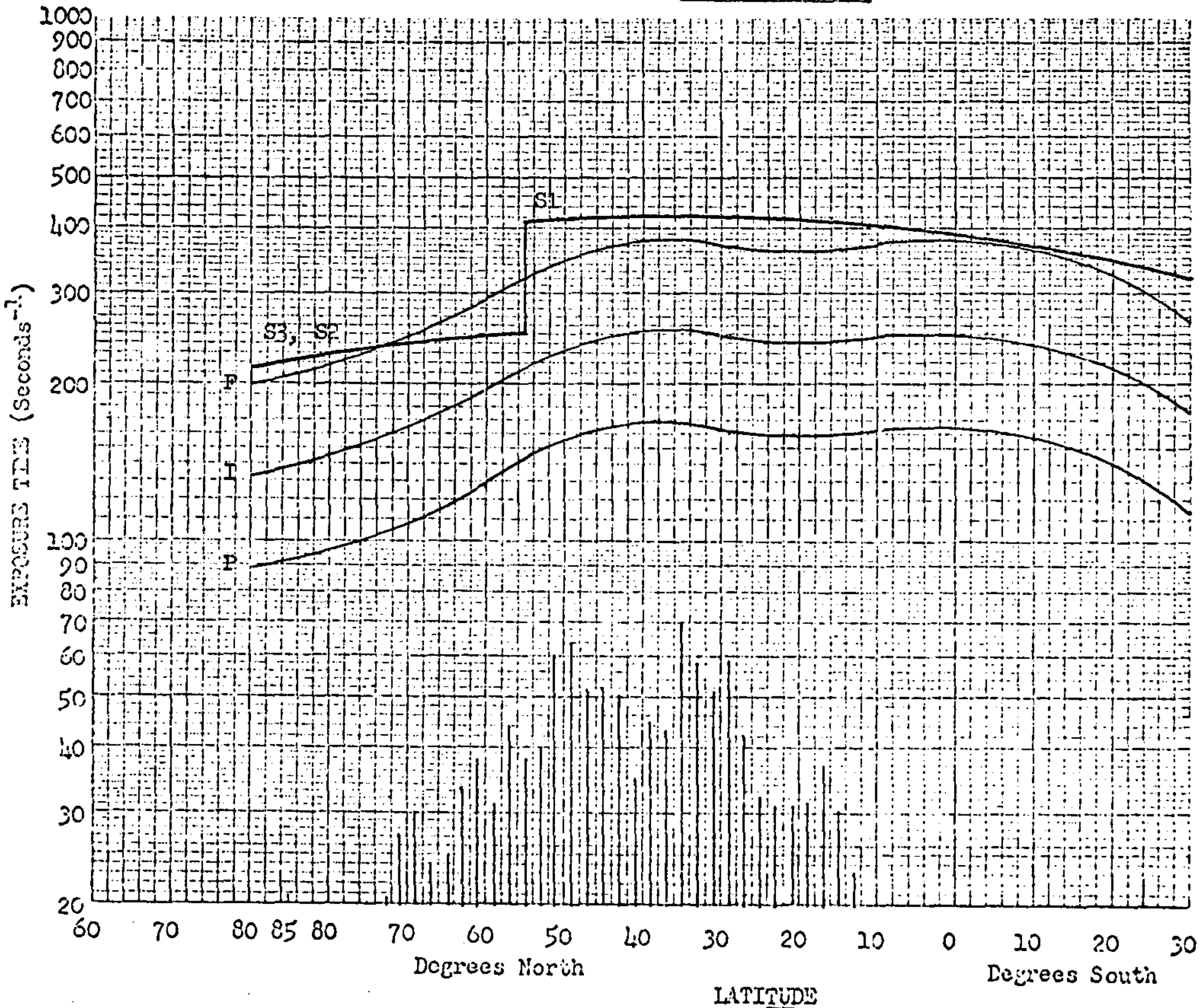
Slit Width: .320 .195

Filter Type: W/25

Film Type: 3404

Revs. 81-160

EXPOSURE POINTS



Mission No: 1103

Payload No: CR-3

Camera No: 307

Pass No: D200

Launch Date: 1 May 1968

Launch Time: 21:31Z

Slit Width: .320 .195

Filter Type: W/25

Film Type: 3404

Revs. 161-220

FIGURE [redacted]

SECTION 6

DIFFUSE DENSITY MEASUREMENTS

The diffuse density measurements made by AFSPPF were computer sorted at A/P to permit analysis of the density ranges resulting from the three levels of conventional processing and from the dual gamma process experiment. The sorting technique utilizes the base plus fog density values for the conventionally processed materials where measurements up to 0.09 density are considered as having received primary processing, 0.10 to 0.17 as intermediate, and above 0.17 density as full. The percentage of this material that was processed at each level, based on the computer sort, is tabulated below with the reported processing percentages.

			PROCESS LEVEL			
Mission	Camera		Primary	Intermediate	Full	Transition
1103-1	Fwd Looking	Reported	12	10	61	17
		Computed	0	26	74	--
1103-1	Aft Looking	Reported	14	10	61	15
		Computed	0	27	73	--
1103-2	Fwd Looking	Reported	14	13	61	12
		Computed	0	30	70	--
1103-2	Aft Looking	Reported	8	11	69	12
		Computed	0	19	81	--

The standard process control curves for primary, intermediate, and full processing are shown in Figure 6-1.

The extent of under, correct, and overexposure and processing is shown in Table 6-1.

[redacted]

Figure 6-1

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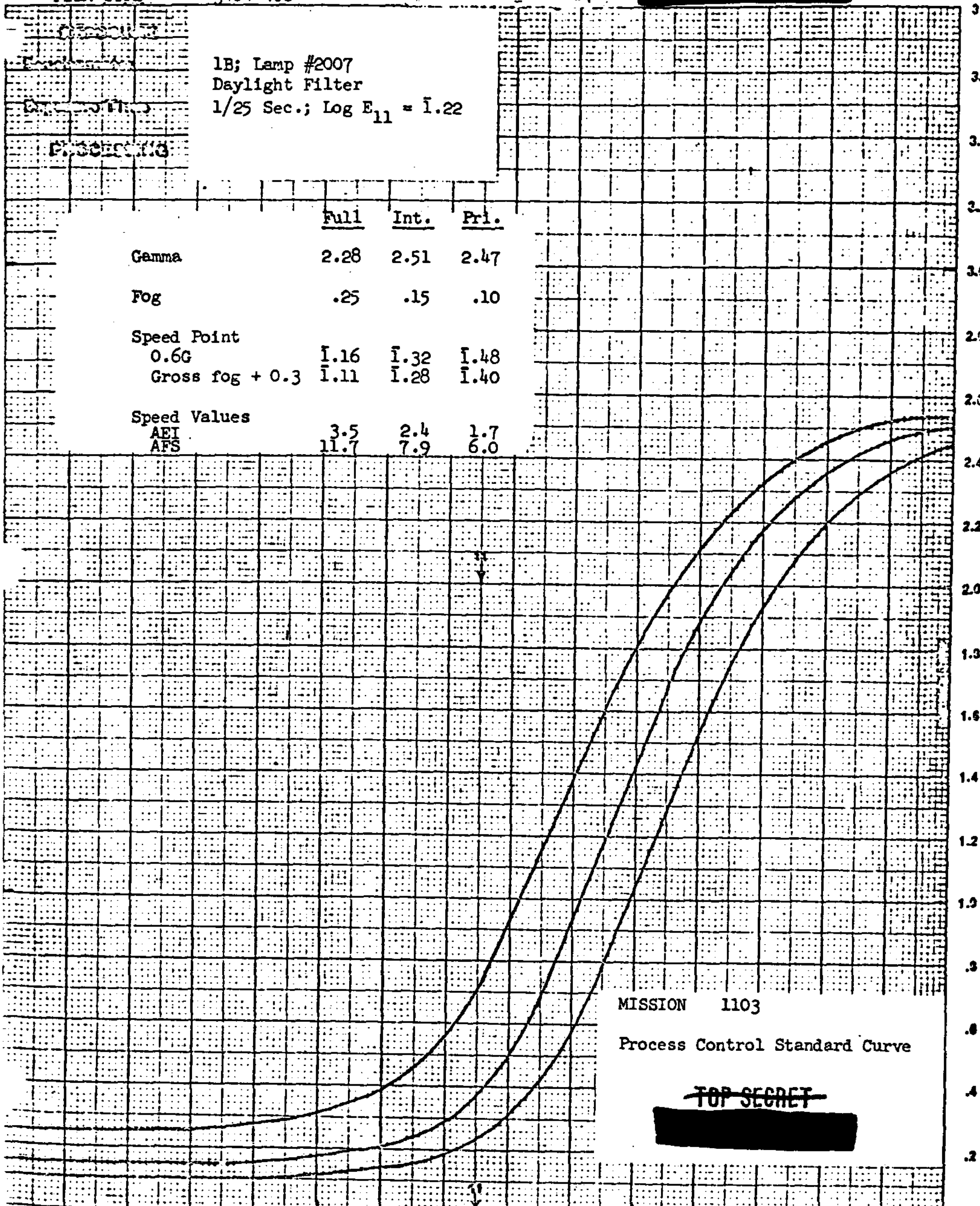
[redacted]

FILM TYPE 3404-406

1B; Lamp #2007
Daylight Filter
1/25 Sec.; Log $E_{11} = \bar{1}.22$

	Full	Int.	Pri.
Gamma	2.28	2.51	2.47
Fog	.25	.15	.10
Speed Point			
0.6G	$\bar{1}.16$	$\bar{1}.32$	$\bar{1}.48$
Gross fog + 0.3	$\bar{1}.11$	$\bar{1}.28$	$\bar{1}.40$
Speed Values			
AEI	3.5	2.4	1.7
AFS	11.7	7.9	6.0



MISSION 1103

Process Control Standard Curve

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[redacted]

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MISSION 1103-1 INSTR - FWD 7/1/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	PC	PC
INTERMEDIATE	59	0 PC	10 PC	64 PC	17 PC	8 PC
FULL	167	20 PC	0 PC	72 PC	8 PC	0 PC
ALL LEVELS	226	15 PC	3 PC	70 PC	11 PC	2 PC

MISSION 1103-1 INSTR - AFT 7/1/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	PC	PC
INTERMEDIATE	65	0 PC	11 PC	46 PC	37 PC	6 PC
FULL	178	10 PC	0 PC	95 PC	6 PC	0 PC
ALL LEVELS	243	7 PC	3 PC	74 PC	14 PC	2 PC

MISSION 1103-2 INSTR - FWD 7/1/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	PC	PC
INTERMEDIATE	85	0 PC	18 PC	64 PC	16 PC	2 PC
FULL	203	49 PC	0 PC	50 PC	0 PC	0 PC
ALL LEVELS	288	35 PC	5 PC	54 PC	5 PC	1 PC

MISSION 1103-2 INSTR - AFT 7/1/68 PROCESSING AND EXPOSURE ANALYSIS

PROCESS LEVEL	SAMPLE SIZE	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0	0 PC	0 PC	0 PC	PC	PC
INTERMEDIATE	56	0 PC	18 PC	79 PC	4 PC	0 PC
FULL	230	13 PC	0 PC	81 PC	5 PC	0 PC
ALL LEVELS	286	10 PC	3 PC	81 PC	5 PC	0 PC

PROCESS LEVEL	BASE & FOG	UNDER EXPOSED	UNDER PROCESSED	CORRECT EXP&PROC	OVER PROCESSED	OVER EXPOSED
PRIMARY	0.01-0.09	0.01-0.13	0.14-0.39	0.40-0.90	---------	0.91 AND UP
INTERMED	0.10-0.17	0.01-0.20	0.21-0.39	0.40-0.90	0.91-1.34	1.35 AND UP
FULL	0.18 AND UP	0.01-0.39	---------	0.40-0.90	0.91-1.69	1.70 AND UP

~~TOP SECRET~~ C [redacted]

TABLE 6-1

SECTION 7

VEHICLE ATTITUDE

The vehicle attitude errors for both Mission 1103-1 and 1103-2 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.

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 1103-1		Mission 1103-2	
Value	90%	Range	90%	Range
Pitch Error (°)	0.25	-0.35 to +0.35	0.24	-0.40 to +0.34
Roll Error (°)	0.31	-0.46 to +0.20	0.31	-0.46 to +0.20
Yaw Error (°)	0.69	-0.00 to +1.65	0.68	-0.00 to +1.05
Pitch Rate (°/hr.)	27.37	-50 to +70	27.48	-40 to +70
Roll Rate (°/hr.)	38.78	-75 to +75	38.76	-80 to +75
Yaw Rate (°/hr.)	30.74	-50 to +75	32.80	-60 to +60

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.

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 startup is not representative of the overall system operations.

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.

MISSION 1103

IMC RATIO AND RESOLUTION LIMITS

VALUE	UNITS	CAMERA	MISSION 1103-1		MISSION 1103-2	
			90%	RANGE	90%	RANGE
IMC Ratio Error	%	Fwd	2.07	-3.0 to +3.0	2.88	-3.6 to +3.2
		Aft	2.05	-3.0 to +3.0	2.67	-3.4 to +3.2
Along Track Resolution Limit	Feet	Fwd	1.29	0.2 to 2.1	1.93	0.2 to 3.2
		Aft	1.06	0.2 to 1.5	2.37	0.2 to 5.0
Cross Track Resolution Limit	Feet	Fwd	0.86	0.2 to 1.5	0.83	0.2 to 1.4
		Aft	0.76	0.2 to 1.3	1.18	0.2 to 1.7

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 DISIC camera operation.

Panoramic Camera Reliability

Sample size - 211 opportunities to operate

Two failures - S/I programmer on System J-19

Film transport on System J-42

Assume - 3000 cycles per camera per mission

Estimated reliability - 98.7% at 50% confidence level

Main Camera Door Reliability

Sample size - 66 vehicles x 2 doors = 132 opportunities to operate

Estimated reliability - 99.5% at 50% confidence level

Payload Command and Control

Sample size - 12,768 hours operation in sample

Two failures

Estimated reliability - 96.5% at 50% confidence level

Payload Clock Reliability

Sample size - 12,768 hours operation in sample

No failures

Estimated reliability - 99.1% at 50% confidence level

Estimated reliability of payload functioning on orbit - 96.9% at 50% confidence level

Recovery System Reliability

97 opportunities to recover

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

Estimated reliability - 98.3% at 50% confidence level

Horizon Camera Reliability

Sample begins with J5 - 127,000

Estimated reliability of single camera - 99.2% at 50% confidence level

Estimated reliability of four horizon cameras at a parallel redundant system - 99.9% at 50% confidence level

Stellar Index (DISIC) Camera Reliability

Sample begins with CR-1

Sample size - 13,420

One failure

Estimated reliability - 69.9% confidence level

DISTRIBUTION:

COPY NO.

[redacted]