CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1034-1 and 1034-2

FTV 1626, J-31

16 June 1967

Approved[redacted] Manager
Advanced Projects

Approved[redacted] Mgr.
Program

~~TOP SECRET~~ C[redacted]
No. [redacted]

6 September 1967

TO: [redacted]

THRU:

FROM:

SUBJECT: MISSION 1034-1 AND 1034-2 FINAL REPORT

Enclosed is the Final Performance Evaluation Report for Mission 1034-1 and 1034-2.

[redacted] Manager
Advanced Projects

~~TOP SECRET~~ C[redacted]

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1626.

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 1034-1 and 1034-2 which was launched on 21 June 1956.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1034-1 and 1034-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-31 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.

SECTION 1

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1034, placed into orbit by Flight Test Vehicle #1626 and LV-2A booster #466, consisted of two panoramic cameras, two Stellar-Index cameras, two Mark 5A recovery capsules and a space structure to enclose the cameras and provide mounting surfaces for all equipments. Figure 1-1 presents an inboard profile of the J-31 payload system. This Corona "J" system is designed to acquire search and reconnaissance photography of selected areas of the earth from orbital altitudes. The planned mission was a 4 day and a 5 day photographic period with no deactivate.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 2131:00 Z (1431:00 PDT) on 21 June 1966. 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 1034-1 consisted of a 5 day operation and was completed by air recovery on 26 June 1966. Mission 1034-2 was completed with an air recovery on 1 July 1966 following a 5 day photographic operation.

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

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 40 Actuals	Orbit 130 Actuals
Period (Min.)	90.07	90.148	90.028
Perigee (N.M.)	109.5	105.37	106.591
Apogee (N.M.)	192.5	199.59	188.410
Inclination (Deg.)	80.00	80.106	80.104
Perigee Latitude (Deg. N.)	19.00	18.245	38.170
Eccentricity	0.0116	0.01310	0.01278

C. PANORAMIC CAMERAS

The image quality was not up to J system standards. Sources of degradation were a decrease in scale, V/h programmer failure and atmospheric conditions.

The master instrument starboard horizon imagery was veiled from pass 8 to 35.

D. STELLAR-INDEX CAMERAS

Both units produced star imagery adequate to determine the vehicle attitude. The terrain frames were of acceptable quality.

The hot wire film cutter on the -2 mission operated prematurely in the recovery sequence.

E. OTHER SUBSYSTEMS

The clock instrumentation, command and thermal control systems performed satisfactorily. The pressure make-up system developed a leak and the gas supply was depleted by Rev 38.

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM

MISSION 1034

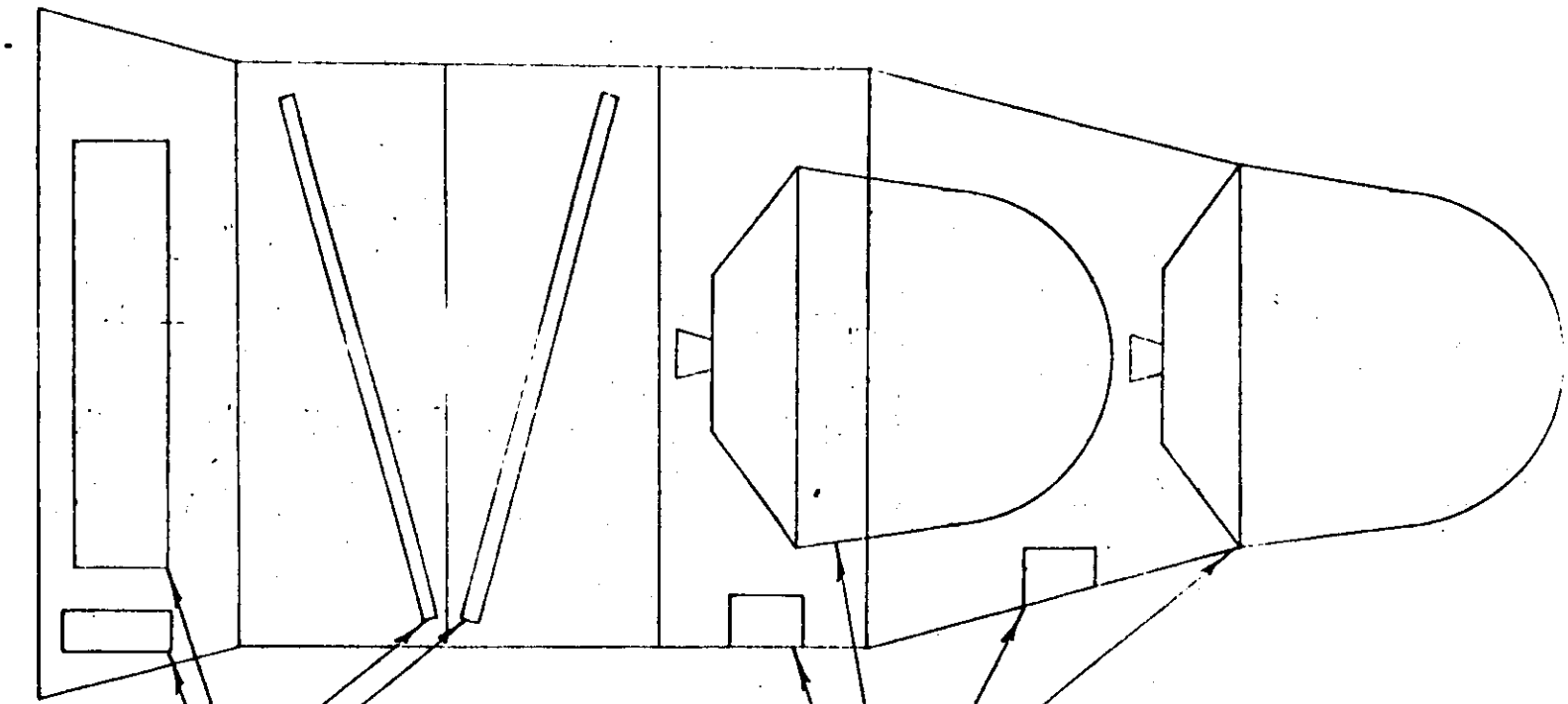


FIGURE 1-1

[redacted]

SECTION 2

PRE-FLIGHT SYSTEMS TEST

A. ENVIRONMENTAL TESTING

1. Test Objective

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

2. Test Summary

The J-31 payload system was sent to the Sunnyvale TASC chamber for a simulated orbital test. The test was conducted from December 7, 1965 to December 14, 1965. On the seventh of December a special sub-test was initiated in which the "A" bucket heaters were allowed to raise the bucket and system internal temperatures to slightly over one hundred degrees. Normally programmed instrument operations were conducted during the first portion of this special test. The average instrument temperatures during this time ranged from 86 and 82 to approximately 98 and 93 for the master and slave instruments respectively. During this special sub-test approximately 400 cycles of instrument operation were taken in ramps 4-1, 5-8, and 7-7. The maximum average bucket temperature during this time was about 88 degrees. The instruments were not operated for the next two regularly scheduled orbits and the temperatures continued to increase. From the afternoon of the seventh the heating program was altered to allow the bucket temperatures to continue to rise and to allow the average instrument temperatures to drop. During the morning of the eighth the bucket temperatures rose to an average of 99 degrees - the peak temperature during the test - and the instrument temperatures were in the low eighties. Four stereo operations of approximately 350 cycles were performed during this period of maximum bucket temperatures. System performance during the elevated bucket temperatures was normal.

An additional innovation to the TASC test plan was the monitoring of +28 reg current and +24 unreg current. J-31 was the first payload system to monitor the current demands on the system for simulated orbital operations.

Analysis of the panoramic camera data indicates cycle rate errors which were fast and exceeding 2% deviation from the calibrated values. These excessive cycle rate errors were confined predominantly to the master instrument. The master and slave instruments on many occasions had excessive coasting after an instrument off command. On more than one occasion after an off command the lens cells coasted into the clamp position of the next operation's first frame.

The slave instrument failed-safe during orbit 11 in the "B" mode.

Prior to the fail-safe the panoramic instruments had been cycling slightly faster than the calibrated data, but the T/M data indicated normal mechanical and electrical operations until approximately 19 secs prior to the fail-safe. At this time the slave instrument take-up idler indicated an inexplicably brief slowdown, then a very fast take-up. The lens rotation time duration was approximately one-third of the preceding normal lens rotation time durations. The slave instruments supply and take-up idlers metered erratically from this time. Four seconds prior to the fail-safe the slave instrument's supply and take-up idlers stopped metering. One second prior to the fail-safe the take-up and supply idlers started metering until the fail-safe switch was encountered and power was removed.

The tape recorder status and temp data were recorded satisfactorily; however, during the cut and wrap the master and slave take-up idlers, channels AP 9 and AP 10, were attenuated.

The J-31 payload system is the second system to incorporate the new film footage pot design. The T/M output voltage is characteristically a hump backed curve. Only the "A" bucket master and slave take-up spools have the new pot characteristics.

Table 2-1 shows the cycle rates, times up ramp, ramp amplitude settings, and cycle rate percentage deviations from calibrated data. Table 2-2 shows the clock correlation with IRIG time.

The current monitors installed in the J-31 test console were monitored on Sanborn 4 during the latter part of the "A" mode and during the "B" mode of the test.

The following are current levels observed for certain functions of the system operation. They were derived from commands given in the "A" mode; and from a mono 1 and mono 2 operation of orbit 9 in the "B" mode.

Commands	Unreg.
Brush 27 and delay	0.8A
Brush 17	0.2A
Brush 29	0.2A
RTC 6	1.0A
RTC 8, 9, 10, 11, 12	0.8A
RTC 15	.4A Spike

	Reg.	Unreg.
Ascent		5A
Standby (7 Sec.)	.95A	5.75A
Power No. T/M No. Op.	.5A	1.0A
T/M On	.65A	1.2A

Instrument #1

Cycle period approximately 2.20 seconds.

Event	+24 Reg.	+24 Unreg.
Turn-on	1.05A	3.2A
Clamp	-	1.2A
Center Format		
Horizon Optics Fiducials	0.86A	4.8A
H.O. Shutter	0.6A	-
Pan Data Block	0.85A	-
Pan Fiducials	0.85A	-
S/I Fiducials	-	0.8A
S/I Commands	-	1.6A
Drive Current	-	0-4.0A
Maximum During M1 OP	4.1	14.2
Minimum During M1 OP	1.3	3.2

Instrument #2

Cycle period approximately 2.25 seconds.

Event	+28 Reg.	+24 Reg.
Turn-on	1.05A	1.6A
Clamp	-	1.2A
Center Format		
Horizon Optics Fiducials	0.8A	4.8A
Horizon Optic Shutter	0.6A	-
Pan Data Block	0.85A	-
Pan Fiducials	0.85A	-
Drive Current	-	0-4.3
Maximum During M2 OP	4.2	10.4
Minimum During M2 OP	1.5	1.6

An 83 CPS noise was present on the unregulated current monitor during either instrument motor drive current demand. The maximum amplitude of the noise signal .8A peak to peak.

Upon return of the J-31 payload system from the first TASC test, series of tests were conducted to simulate the conditions that resulted in the "fail-safe" in the chamber. Conclusions drawn from the results of the first TASC test and the special post-TASC tests indicated an erratic magnetic amplifier unit in the slave instrument. The magnetic amplifier was then replaced and the master and slave instrument cycle rates were readjusted.

The J-31 payload system was returned to the TASC chamber on January 3, 1966. The second test was conducted from January 4, and the cut and wrap was performed on January 5, 1966 after 8 orbits and approximately 1300 stereo cycles of payload. The "B" mode was initiated and completed on January 6, 1966, after 5 orbits and approximately 600 stereo cycles of payload. The "failsafe" problem encountered in the first TASC test was not present in the second test.

The cycle rates for both instruments present the following problems. Numerous instances in which the cycle rate errors exceed 2% fast; and on four occasions the 2.15 second cycle period limit was exceeded. An examination of the temperatures shows that the first three occasions in which the master and slave instruments exceeded 2.15 seconds during the "A" mode - the master instrument was at approximately 95°F. and the slave instrument was at approximately 99°F. The fourth occasion was in the "B" mode, and the master instrument was at approximately 76°F., and the slave instrument was at approximately 72°F. Table 2-1 tabulates the cycle rates for the test.

The clock - system time correlation is not as consistent as the first TASC test, but there were some power interrupts that introduce some instability in the initial reference readings of each delta correlation period. Table 2-2 shows the clock-system time correlation. The clock is considered to be acceptable for flight.

Examination of the TASC payload from both altitude tests indicate that instrument #187, S/I 85/109/76 and S/I 87/107/105 are acceptable for flight relative to tracking, cut and wrap, frame length and metered pitch, electrostatic corona and auxiliary data recording.

B. RESOLUTION TEST

Resolution and theodolite tests were performed on 14 January 1966. Results of the thru-focus resolution tests of pan instruments 186 and 187 show the following characteristics:

Master Pan Instrument No. 186

Maximum high contrast resolution 162 lines/mm at 0.000 focal position.

Maximum low contrast resolution 104 lines/mm at 0.000 focal position.

Slave Instrument No. 187

Maximum high contrast resolution 168 lines/mm at +.001 focal position.

Maximum low contrast resolution 109 lines/mm at +.001 focal position.

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

C. LIGHT LEAK TEST

J-31 was subjected to the system light leak test on 4 February 1966 and again on 9 February 1966 using 3401 type film.

The first light leak test revealed acceptable master and slave instrument drum light leak fog. In addition, the slave film from instrument 187 exhibited heavy fogging attributed to the output horizon camera rubber boot. Visual examination of the suspect boot revealed a fairly large hole between the boot and horizon door interface. The boot leak was repaired. A second system light leak test demonstrated that the subject horizon boot leak had been repaired as evidenced by the absence of light fog.

D. FLIGHT CERTIFICATION

Processed film from the flight readiness operation of J-31 contained a minus density line 1/8" wide the full length of each fogged format from the master camera (186). No anomalies were found in film from the slave camera (187).

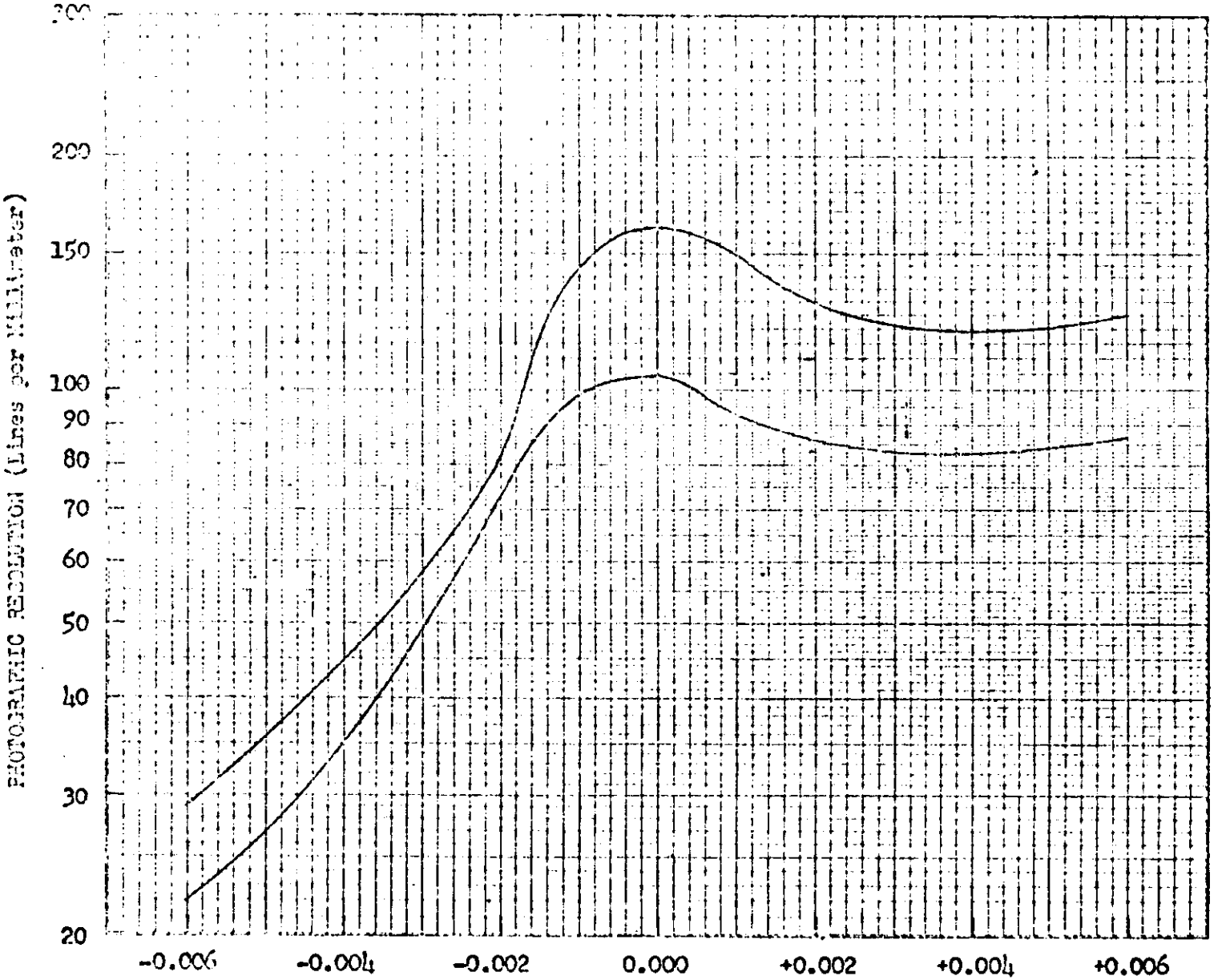
Boston personnel inspected the master camera and found some foreign matter on the filter. After cleaning the filter, a second flight readiness operation was performed on the master camera only with satisfactory results.

In accordance with a formal request from Performance Evaluation, the slave camera starboard H/O boot was painted with "velvet" paint. After drying, the surface gave the appearance of black velvet with no smooth or bright spots. The adjacent master camera H/O boot did show some reflected light.

Flight loading of film and stray voltage and resistance checks were accomplished on 16 June 1966.

Tracking checks were performed on 17 June 1966 and the system was certified for flight.

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 186

Payload No: J-31

Resolution (1/mm)

High Contrast: 162

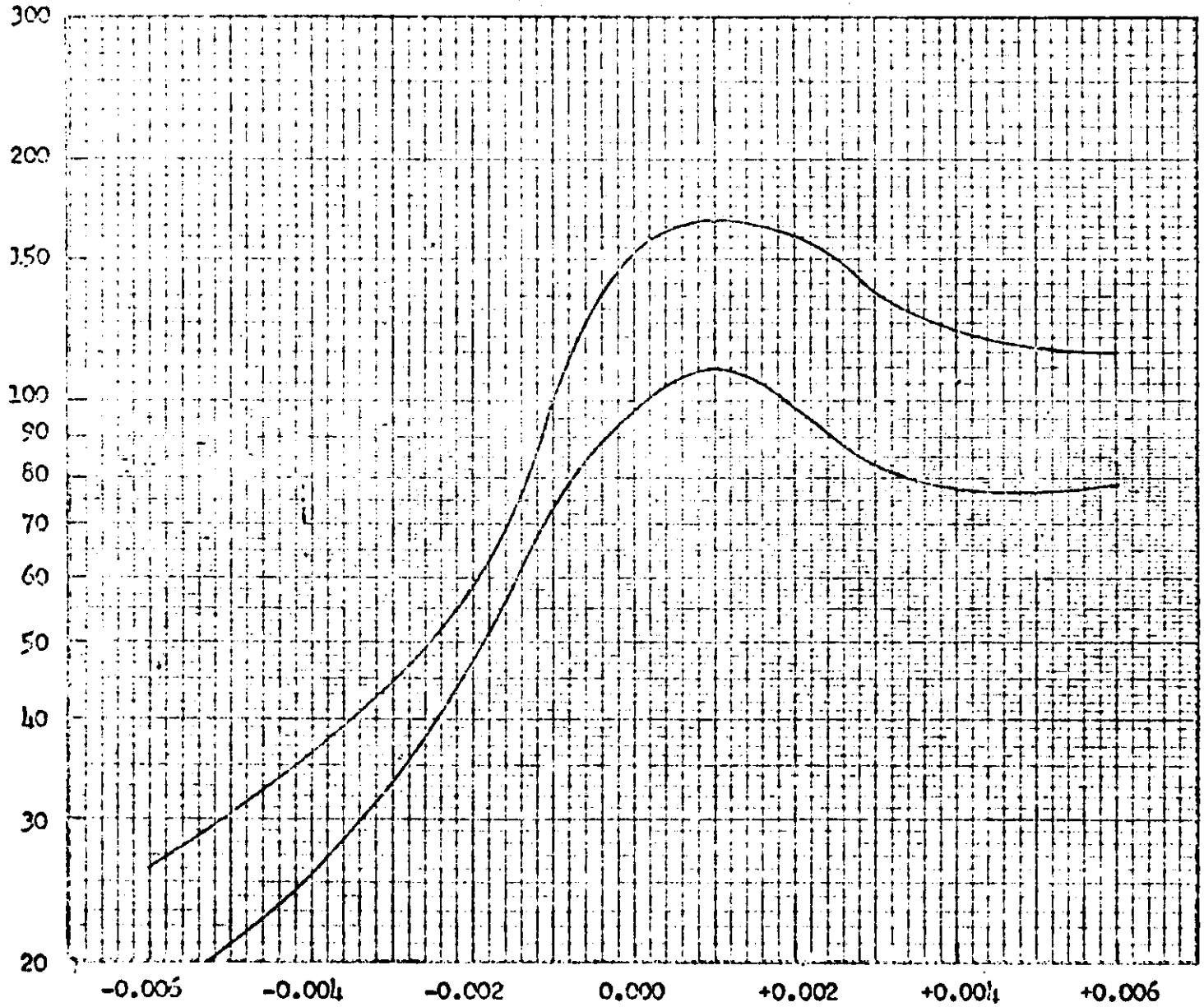
Low Contrast: 104

Film Type: 3404

Test Date: 1/14/66

Figure 2-1

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 187

Payload No: J-31

Resolution (1/mm)

High Contrast: 168

Low Contrast: 109

Film Type: 3404

Test Date: 1/14/66

J-31 186/187 TASC TEST 2

REV/MODE	RAMP	T.U.R.	INST 186 ACT.	CAL.	DEV.	INST 187 ACT.	CAL.	DEV.	186/187 DIFF.
C0 A	10 2	0	6.625	6.571	0.82S	6.575	6.547	0.43S	-0.75
C0 A	7 7	0	3.565	3.610	1.24F	3.558	3.603	1.25F	-0.20
C0 A	7 7	0	3.540	3.610	1.93F	3.568	3.603	0.97F	0.79
C1 A	7 7	392	3.400	3.488	2.52F	3.418	3.482	1.84F	0.53
C1 A	7 7	2215	2.487	2.509	0.86F	2.499	2.512	0.51F	0.48
C2 A	4 1	1427	2.140	2.194	2.47F				
C2 A	4 1	1617				2.162	2.191	1.31F	
C2 A	4 1	2027	2.110	2.168	2.68F	2.143	2.184	1.86F	1.56
C3 A	5 8	0	2.983	3.085	3.30F	3.020	3.083	2.03F	1.24
C4 A	7 7	2462	2.587	2.649	2.32F	2.627	2.650	0.88F	1.55
C4 A	7 7	3532	3.415	3.530	3.25F	3.460	3.524	1.81F	1.32
C4 A	8 2	237	5.050	5.294	4.62F	5.135	5.276	2.68F	1.68
C5 A	8 2	1727	2.163	2.206	1.94F				
C5 A	8 2	2247				2.220	2.243	1.04F	
C5 A	11 1	1452	2.590	2.623	1.27F	2.607	2.625	0.70F	0.66
C6 A	11 1	1932	2.223	2.240	0.77F	2.233	2.246	0.58F	0.45
C6 A	5 8	1090	2.624	2.647	0.87F	2.650	2.649	0.04S	0.99
C6 A	5 8	1441	2.420	2.456	1.46F	2.440	2.459	0.79F	0.83
C7 A	7 7	1173	2.783	2.830	1.66F	2.803	2.830	0.96F	0.72

Table 2-1

REV/MODE	RAMP	T.U.R.	INST 186 ACT.	CAL.	DEV.	INST 187 ACT.	CAL.	DEV.	186/18 DIFF.
07 A	7 7	1586	2.483	2.530	1.86F	2.507	2.533	1.02F	0.97
08 A	7 7	2426	2.587	2.623	1.38F	2.613	2.625	0.47F	1.01
08 A	4 1	1009	2.610	2.692	3.05F	2.633	2.694	2.25F	0.88
08 A	4 1	1739	2.112	2.171	2.71F	2.130	2.185	2.53F	0.85
08 B	6 6	1970	2.207	2.249	1.85F	2.240	2.254	0.63F	1.50
01 B	6 6	0	3.613	3.642	0.81F	3.625	3.636	0.29F	0.33
01 B	7 7	383	3.425	3.493	1.95F	3.455	3.486	0.94F	0.88
01 B	7 7	2213	2.500	2.508	0.31F	2.507	2.511	0.16F	0.28
02 B	4 1	1425	2.154	2.194	1.84F				
02 B	4 1	1617				2.150	2.191	1.86F	
02 B	4 1	2025	2.128	2.168	1.85F	2.148	2.184	1.63F	0.94
03 B	8 2	0	5.340	5.502	2.95F	5.410	5.483	1.32F	1.31
03 B	7 7	0	3.520	3.610	2.48F	3.560	3.603	1.20F	1.14
B	8 2	239	5.158	5.291	2.51F	5.173	5.273	1.89F	0.29
03 B	8 2	1724	2.163	2.206	1.95F				
03 B	8 2	2259				2.235	2.253	0.81F	

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

Table 2-1

J-31 TASC 2 CLOCK CHECK

REV	IRIG DAY-HR-MIN-SEC	IRIG SECONDS	CLOCK SECONDS	DELTA IRIG	DELTA CLOCK	ERRO
001	4 9 25 38.275	379538.275	52735.513	---	---	---
003	4 15 56 13.310	384973.310	58170.558	5435.035	5435.045	0.01
003	4 15 12 43.390	393163.390	66360.670	8190.080	8190.112	0.03
004	4 13 59 43.395	395983.395	69180.641	2820.005	2819.971	-0.03
005	4 15 32 8.560	401528.560	74725.809	5545.165	5545.168	0.00
	0 6 0 30.285-DELTA TIME			TOTAL ACCUM. ERROR		0.01
006	5 9 21 56.045	465716.045	240905.578	---	---	---
007	5 11 1 41.100	471701.100	246890.640	5985.055	5985.062	0.00
008	5 11 43 51.040	474231.040	249420.552	2529.940	2529.912	-0.02
	0 2 21 54.995-DELTA TIME			TOTAL ACCUM. ERROR		-0.02
001	6 7 59 26.795	547166.795	115218.570	---	---	---
4	6 14 4 36.595	569076.595	137128.403	21909.800	21909.833	0.03
5	6 14 33 26.560	570806.560	138858.372	1729.965	1729.969	0.00
6	6 15 16 3.730	573363.730	141415.504	2557.170	2557.132	-0.03
	0 7 16 36.935-DELTA TIME			TOTAL ACCUM. ERROR		-0.00

Table 2-2

SECTION 3

FLIGHT OPERATIONS

A. SUMMARY

All launch, ascent, and injection events occurred as programmed which resulted in achieving the desired orbit. For the first time, the tape recorder was turned on during the ascent sequence to record the payload system temperature environment.

Both panoramic cameras operated satisfactorily throughout the flight. Average cycle rates on both instruments deviated from the pre-flight calibrated values by less than 2 per cent.

The V/h programmer failed on the end of Rev 4 or the beginning of Rev 5 and did not operate for the remainder of the flight. This resulted in FMC match errors greater than 5 percent.

The pressure make-up system developed a high pressure leak and gas depletion occurred on Rev 32.

The -1 and -2 stellar/index cameras operated satisfactorily throughout the flight. The clock, instrumentation, and command system functioned properly throughout the flight.

The thermal environment was within tolerance. The ascent temperature data from the tape recorder is included in Figure 3-1 and 3-2.

Both recovery systems operated satisfactorily with the exception of the -2 flashing light. This was the second -2 recovery system which the flashing light equipment was inoperative.

B. PANORAMIC CAMERA PERFORMANCE

Camera system dynamics were normal throughout the -1 and -2 missions. The film transport of both camera systems were normal. Cycle rate data (Table 3-1) indicates that the camera systems were generally less than 2.0 per cent from the calibrated systems value. The master and slave instruments were generally less than 1.0 percent apart throughout most of the flight. The 99/101

average clutch ratio was 6/6 for the master instrument and 6/6 for the slave instrument. Film depletion on the slave camera occurred prior to the engineering operation on Rev 159.

Panoramic Film Consumption (Frames)

	Actual	
	Master	Slave
Pre-launch	102	105
-1 Mission	2896	2930
-2 Mission	3039	2995
Total	6037	6030

FMC Match

The V/h programmer failed to cycle after Rev 04 of the mission. Telemetry indicated that the programmer started properly on the beginning of Rev 04 but was inoperative during Rev 05. This failure caused the two panoramic camera systems to operate at a constant cycle rate regardless of the time up ramp position.

Telemetry data indicated the V/h programmer had stopped at a position equivalent to the Reference Level voltage (see Figure 3-3). With the programmer in this position the Amplitude Command setting had no effect on the output voltage and only the Reference Command settings could be used to minimize FMC errors. Operational control under the above restrictions produced FMC errors of generally less than 10 per cent. However, FMC error on a few operations exceeded 20 per cent.

Analysis of this failure indicated that the most probable cause was the failure of the programmer self-energize switch (S201), See Figure 3-3. Failure of this switch to make contact resulted in loss of 400 cps voltage to the drive motor at the time S-202 applied reset voltage to the start relay. With S-202 retaining voltage on the reset coil, subsequent start commands were ineffective. This drive design has been used since the start of the Corona Program without a failure and this failure was considered to be random. The only corrective action was to review test procedures to assure proper operation of S-201.

C. STELLAR/INDEX CAMERA PERFORMANCE

The -1 stellar/index camera operation was normal throughout the mission with telemetry indicating proper metering and shutter operation.

The -2 stellar/index camera operation was also normal throughout the mission with no abnormalities noted on telemetry.

D. INSTRUMENTATION AND COMMAND SYSTEM PERFORMANCE

The instrumentation and command systems operated satisfactorily throughout the -1 and -2 missions with no abnormalities evident. The mono delay time was within the specified tolerance and operated satisfactorily.

E. CLOCK SYSTEM PERFORMANCE

The payload clock system performed satisfactorily during both phases of the mission. The clock/system time correlation data obtained from the [redacted] acquisitions are included in Table 3-2 and 3-3.

F. PRESSURE MAKE-UP SYSTEM PERFORMANCE

The pressure make-up system (PMU) developed a high pressure leak and gas depletion occurred on Rev 32 as indicated by Figure 3-4. This high pressure leak most probably occurred on the supply side of the on-off solenoid.

A review of the PMU design and the performance from the previous 25 flight units indicated the design was adequate. This failure was considered to be random and no further corrective action was taken.

G. THERMAL ENVIRONMENT

The temperature data obtained from the [redacted] acquisitions are contained in Table 3-4. Average panoramic camera temperatures for the master camera varied from 77° F to 61°F and the slave camera varied from 71° F to 55°F during the mission.

The ascent thermal environment was recorded on the tape recorder and is included in Figures 3-1 and 3-2.

U-31 FLIGHT

REV. NOS.	OP	RAMP R	RAMP A	TUR SECS	SYSTEM CALIB.	INST. 186 ACTUAL	INST. 186 UNIT DEV.	INST. 186 SYSTEM DEV.	INST. 187 ACTUAL	INST. 187 UNIT DEV.	INST. 187 SYSTEM DEV.	186/187 DIFF.
09	A	7	6	2740	2.890	2.893	0.10S	0.11S	2.909	0.67S	0.66S	0.55
20	A	5	11	2740	2.638	2.650	0.50S	0.47S	2.680	1.57S	1.60S	1.13
32	A	3	11	2740	2.427	2.440	0.61S	0.52S	2.451	0.90S	0.98S	0.45
47	A	3	11	2740	2.427	2.450	1.02S	0.94S	2.450	0.85S	0.94S	-0.00
63	A	3	11	2740	2.427	2.426	0.03S	0.05F	2.443	0.57S	0.65S	0.70
79	A	3	11	2740	2.427	2.455	1.22S	1.14S	2.445	0.65S	0.73S	-0.41
96	B	5	11	2740	2.638	2.672	1.34S	1.30S	2.665	1.00S	1.03S	-0.26
96	B	3	11	2740	2.427	2.451	1.06S	0.98S	2.430	0.03S	0.11S	-0.86
111	B	3	11	2740	2.427	2.465	1.64S	1.55S	2.453	0.98S	1.06S	-0.49
127	B	2	11	2740	2.336	2.380	1.90S	1.79S	2.380	1.69S	1.79S	-0.00
143	B	2	11	2740	2.338	2.390	2.32S	2.22S	2.370	1.26S	1.36S	-0.84
159	B	2	11	2740	2.338	2.369	1.43S	1.32S	2.367	1.13S	1.24S	-0.08

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

Table 3-1

J-31 1626 1034

ORDER FIT -1

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
C.3851144380 05	C.1971769910 06	C.3851144910 05	-0.0111	9	[redacted]
C.7796399780 05	C.1966295390 06	C.7796399030 05	-0.0123	16	
C.3321981810 05	C.2382853730 06	C.3321981710 05	0.0009	24	
C.7812167210 05	C.2831872340 06	C.7812167040 05	0.0006	32	
C.3338768830 05	C.3248532550 06	C.3338768420 05	-0.0012	40	
C.7287216880 05	C.3643377390 06	C.7287216140 05	0.0066	47	
C.3351907600 05	C.4113846600 06	C.3351907430 05	0.0017	56	
C.7299264120 05	C.4508682290 06	C.7299263650 05	0.0045	63	
C.3364495480 05	C.4979105530 06	C.3364495240 05	-0.0044	72	
C.7309412000 05	C.4888040000 03	C.7309410860 05	0.0114	79	
C.3373715500 05	C.4753185100 05	C.3373714750 05	0.0075	88	
C.7312674800 05	C.8692144000 05	C.7312672970 05	0.0183	95	
C.3380808930 05	C.1340028060 06	C.3380808760 05	0.0054	104	
C.7319934880 05	C.1733940740 06	C.7319934880 05	-0.0008	111	
C.3387461100 05	C.2204693490 06	C.3387461570 05	-0.0047	120	
C.7306295930 05	C.2596576980 06	C.7306295790 05	-0.0049	127	
C.3390140500 05	C.3068961560 06	C.3390140780 05	-0.0028	136	
C.7330647500 05	C.3463012350 06	C.7330648000 05	-0.0050	143	
C.3390983630 05	C.3933045970 06	C.3390983390 05	-0.0009	152	
C.7325305000 05	C.4326478290 06	C.7325305910 05	-0.0091	159	

A0=-0.1186551480 06 A1= 0.9999998277000 00

SIGMA=0.00716 NO. POINTS= 20

RATIO OF CLOCK TIME TO SYS TIME= 0.1000000172300 01

Table 3-2

J-31 1626 1C34

ORDER FIT 2

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
0.3851143800 05	C.1571769910 06	C.3851143910 05	-0.0011	9	[redacted]
0.7796397780 05	C.1966295390 06	0.7796398330 05	-0.0053	16	
0.3321981600 05	C.2382853730 06	0.3321981290 05	0.0051	24	
0.7812166710 05	C.2831872340 06	C.7812166880 05	0.0022	32	
0.3336768830 05	C.3248532550 06	0.3336768470 05	-0.0017	40	
0.7287216880 05	C.3643377390 06	C.7287216350 05	0.0045	47	
0.3351907760 05	C.4113846600 06	0.3351907800 05	-0.0020	56	
0.7299264100 05	C.4508582290 06	C.7299264120 05	-0.0002	63	
0.3364495480 05	C.4979105530 06	C.3364495790 05	-0.0099	72	
0.7309412000 05	C.4888040000 03	C.7309411450 05	0.0055	79	
0.3373715500 05	C.4753185100 05	C.3373715340 05	0.0016	88	
0.7312674800 05	C.8692144000 05	C.7312673530 05	0.0127	95	
0.3380809300 05	C.1340028060 06	0.3380809240 05	0.0006	104	
0.7319935480 05	C.1733940740 06	C.7319935260 05	-0.0046	111	
0.3387461100 05	C.2204e93490 06	0.3387461800 05	-0.0070	120	
0.7306295300 05	C.2596576980 06	C.7306295860 05	-0.0056	127	
0.3390140500 05	C.3068561560 06	0.3390140610 05	-0.0011	136	
0.7330647500 05	C.3463012350 06	0.7330647600 05	-0.0010	143	
0.3390983300 05	C.3933045970 06	C.3390982680 05	0.0062	152	
0.7325305000 05	C.4326478290 06	C.7325304910 05	0.0009	159	

A0=-0.1186655395D 06 A1= 0.9999999364040 00
A2=-0.9657944836711D-13

SIGMA=0.00499 NO. POINTS= 20

Table 3-3

TABLE 3-4

J-31 TEMPERATURE SUMMARY

SENSOR

ORBITS ACQUIRED

Master Camera	L/O Pad	09	16	24	32	40	47	56	63	72	79 A	88 B	95	104	111	120	127	135	143	152
3	65	70	68	70	67	70	68	69	66	67	65	65	60	63	58	64	57	63	59	63
4	64	76	71	75	71	74	72	74	69	70	68	69	64	67	62	68	61	66	62	66
5	64	80	76	79	75	78	75	77	73	74	71	71	66	70	65	70	64	69	65	67
6	59	78	74	77	74	76	74	74	72	71	70	69	65	66	62	67	61	64	61	62
7	59	78	76	77	75	76	76	75	73	72	72	69	66	67	64	67	63	66	65	65
8	64	78	75	77	74	77	75	76	72	73	70	72	65	70	63	69	63	68	63	67
9	63	80	76	77	75	78	76	76	72	73	71	71	67	70	64	69	63	69	63	66
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	67	78	76	82	76	77	75	75	71	69	69	67	62	64	59	64	57	63	59	61
12	71	78	73	74	73	77	73	76	71	73	70	72	66	70	64	70	64	69	66	69
13	59	76	75	72	74	75	74	74	72	71	70	67	64	64	62	64	60	63	61	61
AVG	64	77	74	76	73	75	74	74	73	71	70	69	65	67	62	67	61	66	62	65
Master Slave																				
3	61	73	70	71	69	69	69	69	66	65	63	62	58	59	55	58	53	57	65	55
4	54	69	64	68	62	66	64	66	60	62	59	60	53	56	50	57	50	55	50	53
5	59	76	72	75	71	73	68	73	69	73	68	69	63	67	62	66	62	65	62	64
6	59	75	71	75	71	73	73	73	70	70	70	69	64	66	62	66	62	66	63	65
7	55	74	72	74	71	72	73	71	69	69	69	67	63	64	60	64	60	64	62	62
8	57	72	67	71	66	70	67	70	64	67	63	63	59	62	57	63	57	61	58	61
9	58	73	69	73	68	72	69	72	68	70	67	68	63	66	61	66	61	66	62	66
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	62	67	63	66	63	65	63	66	61	62	59	59	55	58	53	57	52	56	53	55
12	57	69	66	69	64	67	64	67	61	63	60	61	54	58	52	57	52	56	52	54
13	53	66	64	65	64	65	63	64	62	62	60	58	55	56	54	55	50	55	53	54
AVG	63	71	68	71	67	69	67	69	65	66	64	64	59	61	56	61	55	60	57	59
Supply Spool																				
1	59	62	59	62	58	62	62	62	60	61	60	59	55	57	53	56	53	56	54	55
2	59	63	60	63	60	62	61	62	59	61	58	59	52	55	57	54	49	53	51	52

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

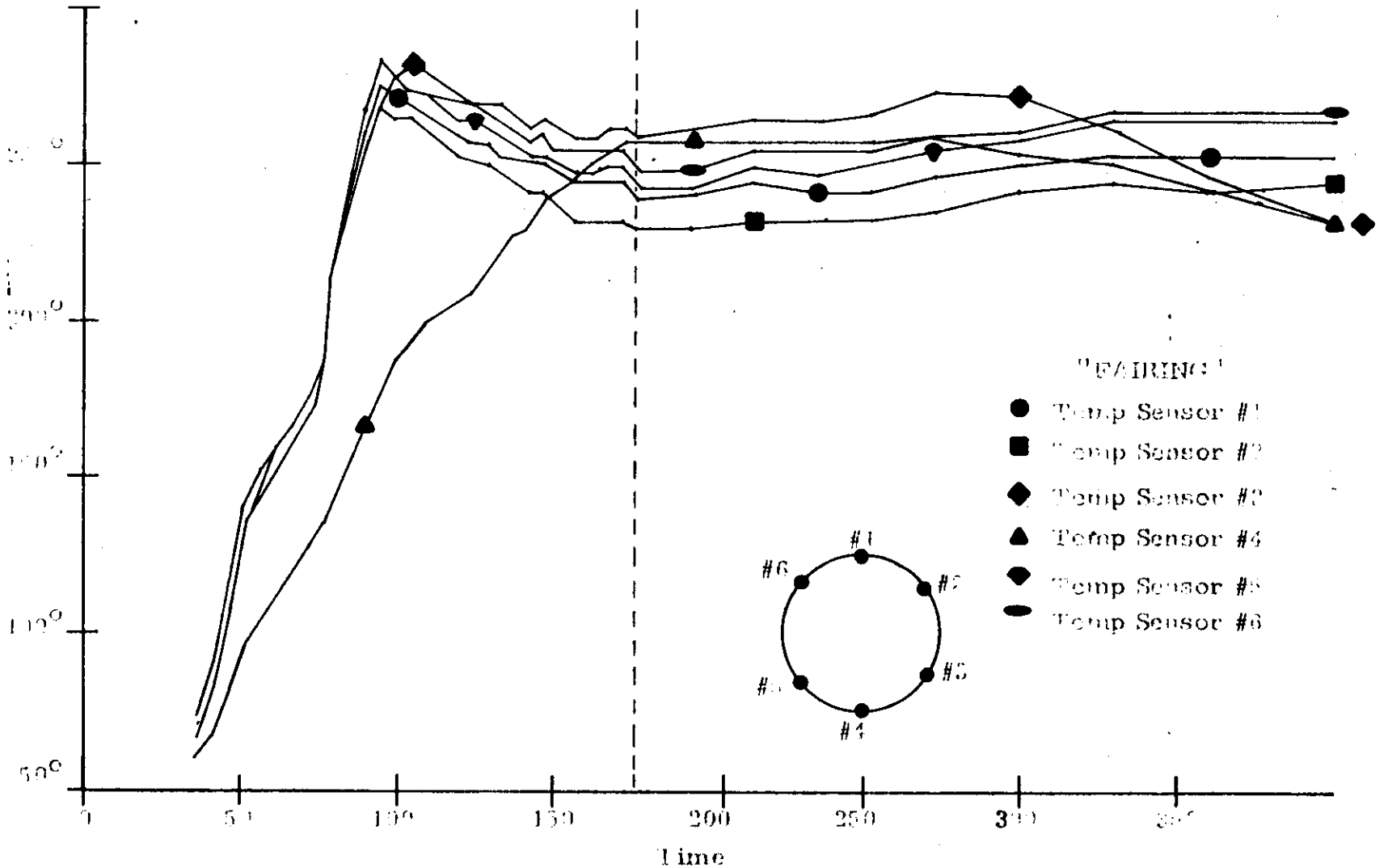
TABLE 3-4

J-31 TEMPERATURE SUMMARY

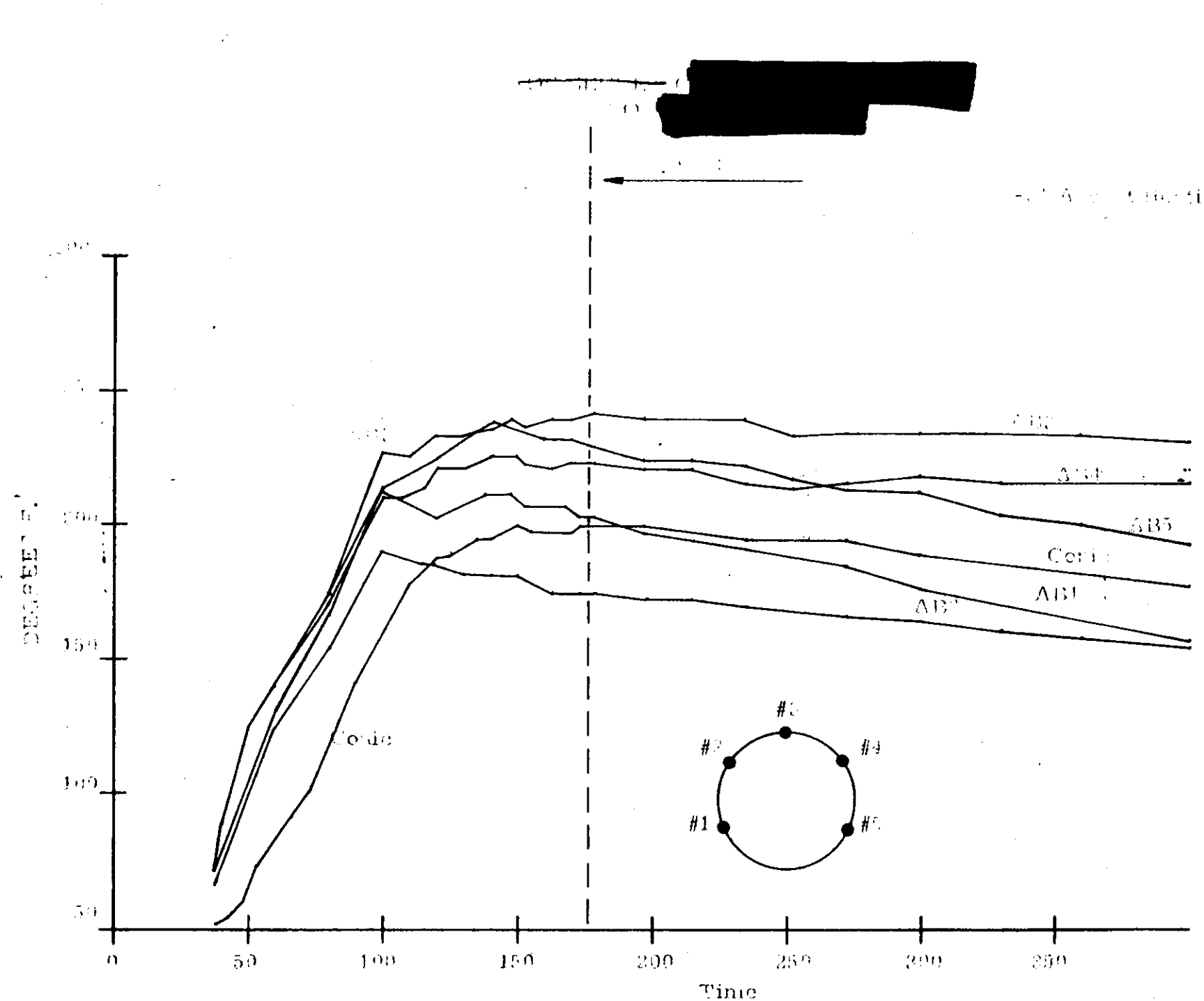
SENSOR	ORBITS ACQUIRED																		
											A | B								
Pair ("A") Barrel #1 ("B")	L/O Pad	09	16	24	32	40	47	56	63	72	79	88	95	104	111	120	127	135	143	152
1	--	22	81	22	78	19	81	22	78	15	71	21	44	21	44	18	41	21	44	21
2	--	0	13	0	10	0	16	0	16	-4	29	56	78	53	78	53	84	59	90	53
3	227	-13	15	-9	8	-9	18	-9	15	-13	15	58	143	58	146	55	148	58	146	49
4	223	35	52	35	42	32	52	33	48	26	45	19	68	19	59	16	52	13	49	10
5	--	44	54	41	47	37	54	37	44	34	44	22	28	22	35	16	25	16	25	9
6	--	35	83	35	77	32	74	82	71	25	61	--	--	--	--	--	--	--	--	--
Barrel #2																				
1	144	39	54	33	48	30	51	30	45	27	42	24	36	21	30	18	24	18	27	12
2	144	31	90	31	84	24	81	28	76	21	70	21	61	21	53	15	49	15	46	12
3	--	50	140	54	140	50	143	50	140	44	137	54	134	50	131	50	137	50	137	44
4	216	48	64	55	64	51	74	51	74	48	77	55	74	55	77	55	83	55	89	51
5	191	48	68	64	61	45	64	42	64	42	64	38	55	38	51	38	51	42	58	38
Conic Aperture																				
1	164	36	39	29	36	23	36	23	29	16	26	13	16	10	10	6	6	6	6	3
Clock																				
1	90	61	61	63	61	61	63	61	61	59	61	55	51	51	49	51	47	51	51	49
2	94	60	60	62	60	60	62	60	60	58	58	54	52	50	48	50	46	50	50	48
Thrust Cone "A" to "B" SRV																				
1	116	37	34	34	33	33	40	33	33	32	32	56	52	53	49	53	49	53	51	50
2	72	53	35	47	43	44	42	43	41	37	37	62	57	58	49	58	53	57	55	55
Stellar/Index "A" to "B"																				
1	84	51	51	48	51	48	48	45	51	42	48	54	51	51	48	48	45	48	48	42
2	71	48	48	48	45	45	45	45	45	42	42	52	46	49	43	46	40	49	46	43
Recovery/Battery "B" SRV																				
1	69	67	63	63	63	63	63	62	63	61	62	83	79	78	79	81	81	84	84	84
Master Cassette "A" SRV																				
2	91	67	64	64	65	66	66	66	66	65	66	--	--	--	--	--	--	--	--	--

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

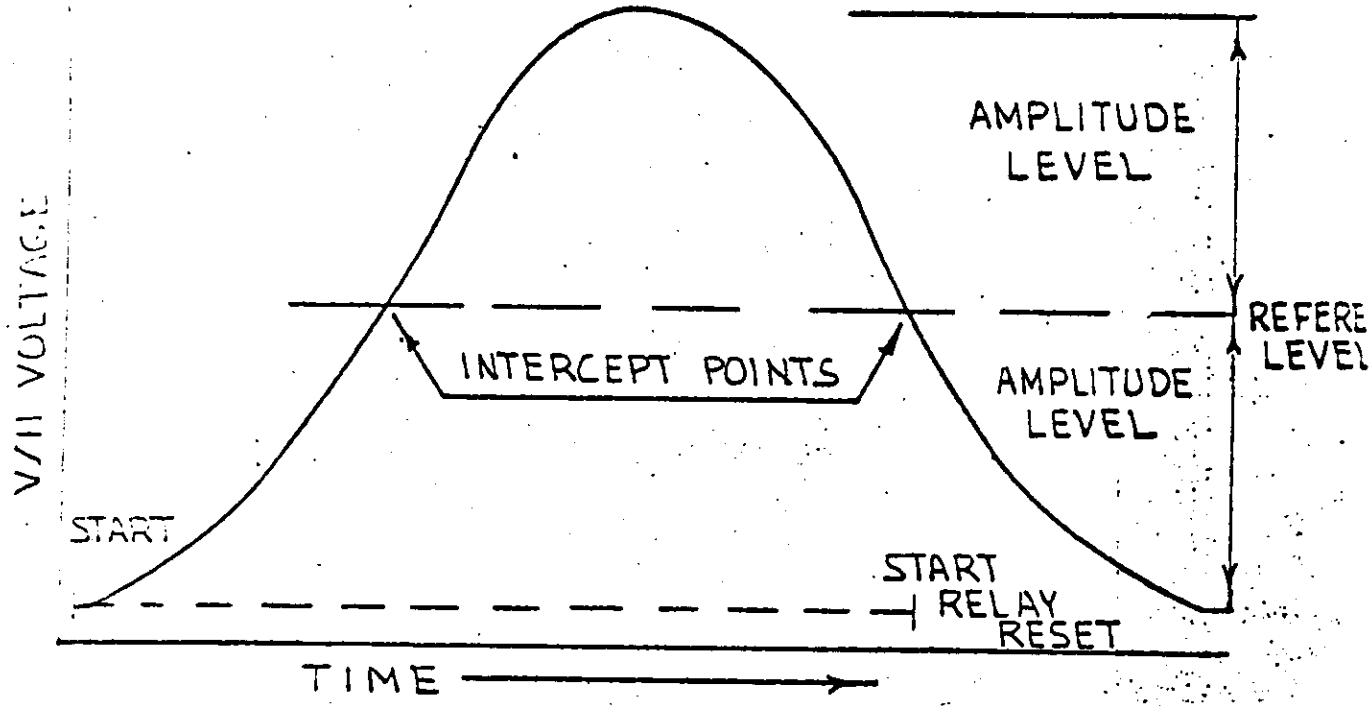
[redacted]



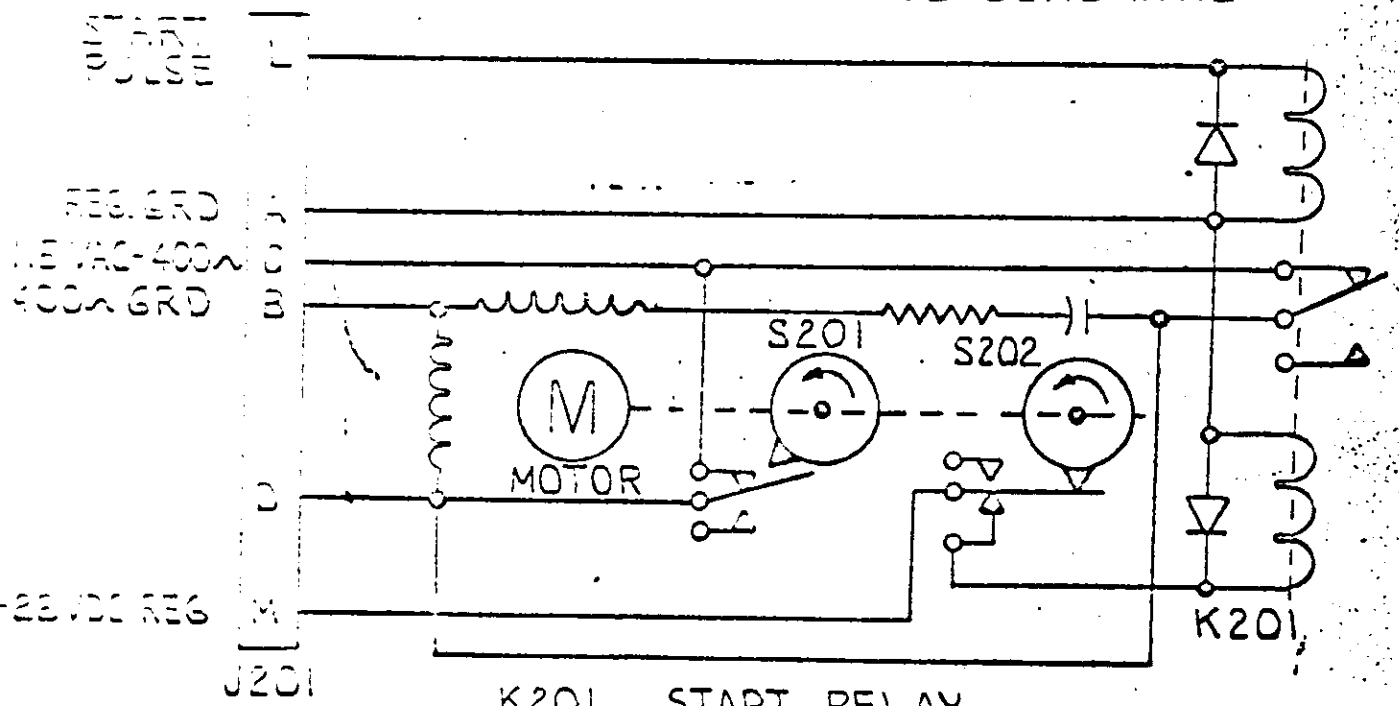
[redacted]


[redacted]
Time
0
50
100
150
200
250
#1
#2
#3
#4
#5

V/H PROGRAMMER VOLTAGE PROFILE



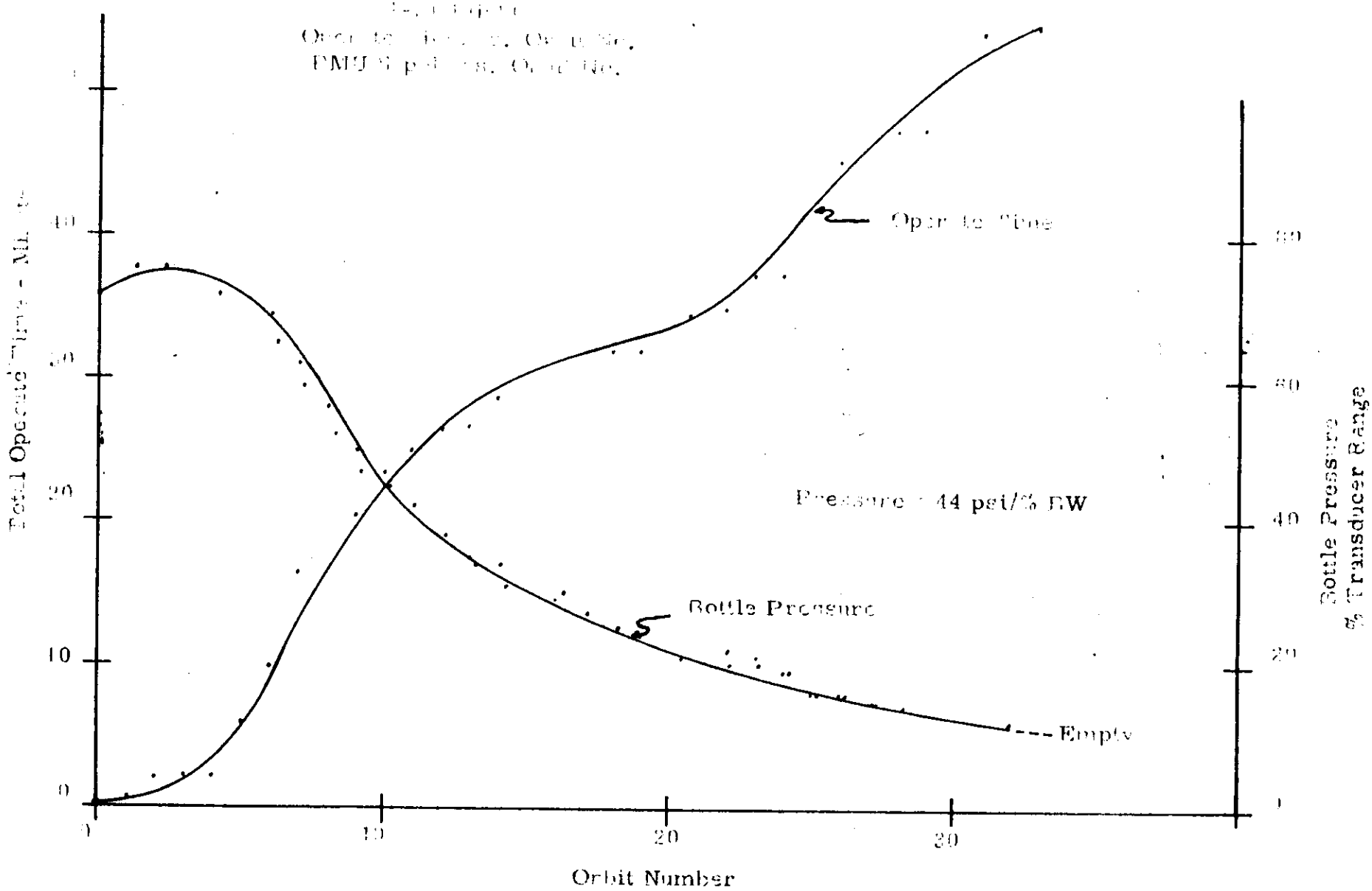
V/H PROGRAMMER DRIVE SCHEMATIC



K201 START RELAY
S201 SELF ENERGIZE SWITCH
S202 START RELAY RESET SWITCH

Figure 3-3

[redacted]


Operate Time
Bottle Pressure
Empty
Pressure = 44 psi/% FW
Total Operate Time - Min
Bottle Pressure
% Transducer Range
Orbit Number
0
10
20
30
40
50
60
70
80
90
100

SECTION 4

MISSION 1034-1 RECOVERY SYSTEM

SRV #713 was received at A/P on 23 August 1965. The receiving weight was 148.9 pounds. After modifications and incorporation of outstanding E.O.'s, the SRV was delivered to Systems Test for incorporation into the J-31 system.

The capsule was shipped to VAFB on 18 May 1966.

The -1 recovery system was successfully recovered by air catch from orbit 81 on 26 June 1966. The impact point was as follows:

Predicted Impact	25°-02'N/156°-59'W
Actual Impact	25°-00'N/157°-02'W

The conditions of the recovered capsule was satisfactory with no damage other than normal paint blistering due to the re-entry environment.

Event times are shown in Table 4-1.

MISSION 1034-1

RECOVERY SEQUENCE OF EVENTS

Event	Delta Time (Seconds) Actual	Nominal
*Arm	76.97	77.0 ± 1.0
*Transfer	2.01	2.0 ± 0.25
Electrical Disconnect	0.64	0.900 $^{+0.450}_{-0.400}$
Separation	---	---
**Spin	3.41	3.4 ± 0.30
Retro	7.49	7.55 ± 0.45
Despin	10.60	10.75 ± 0.59
T/C Separation	1.52	1.5 ± 0.15
***"G" Switch Open	527.45	528.0
Parachute Cover Off	33.80	34.0 ± 1.5
Drogue Chute Deployed	0.67	0.68 ± 0.08
Main Chute Bag Separate	10.19	10.25 ± 1.5
Main Chute Deployed	0.55	0.52 ± 0.13
Main Chute Disreef	4.51	4.5 ± 0.80

* From Separation
** From Electrical Disconnect
*** From Retro

TABLE 4-1

SECTION 5

MISSION 1034-2 RECOVERY SYSTEM

SRV #714 was received at A/P on 23 August 1965. The receiving weight was 151.7 pounds. After modifications and incorporation of outstanding E.O.'s the unit was delivered to Systems Test for mating to the J-31 system.

The capsule was shipped to VAFB on 18 May 1966.

The -2 recovery system was successfully recovered by air catch from orbit 161 on 1 July 1966. The impact point was as follows:

Predicted Impact	24^{o}-36'N/170^{o}-16'W
Actual Impact	24^{o}-38.4'N/169^{o}-59.4'W

Event times are shown in Table 5-1.

The condition of the recovered capsule indicated no abnormal re-entry effects.

It was reported by the recovery aircraft that the flashing light was working during descent. However, after the recovery system was caught and being reeled into the aircraft the flashing light was inoperative. Post recovery tests indicated satisfactory operation of all equipment. The unit was returned to G.E. for a detailed analysis. G.E. located the component that caused the intermittent failure.

MISSION 1034-2

RECOVERY SEQUENCE OF EVENTS

Event	Delta Time (Seconds) Actual	Nominal
*Arm	76.96	77.0 ± 1.0
*Transfer	1.96	2.0 ± 0.25
Electrical Disconnect	0.90	$0.900^{+0.430}_{-0.400}$
Separation	--	---
**Spin	3.41	3.4 ± 0.30
Retro	7.63	7.55 ± 0.45
Despin	10.73	10.75 ± 0.59
T/C Separation	1.51	1.5 ± 0.15
***"G" Switch Open	534.94	534.0
Parachute Cover Off	34.08	34.0 ± 1.5
Drogue Chute Deployed	0.63	0.63 ± 0.08
Main Chute Bag Separate	9.78	10.25 ± 1.5
Main Chute Deployed	0.44	0.52 ± 0.13
Main Chute Disreef	4.32	4.45 ± 0.80

* From Separation
** From Electrical Disconnect
*** From Retro

TABLE 5-1

SECTION 6

MISSION 1034 PANORAMIC CAMERAS

A. COMPONENT ASSIGNMENT

Component	Master Serial Number	Slave Serial Number
Main Camera	186	187
Main Camera Lens	1942435	1932435
Supply Horizon Camera	290-G6	302-G6
Supply Horizon Camera Lens	E12846	E12843
Take-up Horizon Camera	290-G5	302-G5
Take-up Horizon Camera Lens	E12875	E12833
Supply Cassette	SC-41	SC-41

B. CAMERA DATA AND FLIGHT SETTINGS

Main Camera:		
Lens	24"f/3.5	24"f/3.5
Slit Width	0.200"	0.150"
Filter Type	Wratten 23A	Wratten 21
Film Type (Eastman)	3404	3404

Supply Horizon Camera:	Port	Starboard
Lens	55 mm f/6.3	55 mm f/6.3
Aperture Setting	f/6.3 Port	f/8.0
Exposure Time	1/100 second	1/100 second
Filter Type	Wratten 25	Wratten 25

Take-up Horizon Camera	Master	Slave
Lens	55 mm f/6.3	55 mm f/6.3
Aperture Setting	f/8.0	f/6.3
Exposure Time	1/100 second	1/100 second
Filter	Wratten 25	Wratten 25

C. POST FLIGHT PERFORMANCE EVALUATION

The overall image quality was not as good as on recent missions. The selection of the best frames for the MIP rating (80) indicates that the quality was below that expected for the J system. The average altitude was 6% higher than normally flown which decreases the obtainable ground resolution. This mission was flown in the latter part of June and it has been observed that the atmospheric conditions degrade the photography more so than in early winter or spring. Another factor that can degrade is the higher solar elevations giving rise to more specular reflections. The best ground resolution observed on several fixed targets was 14 feet.

The V/h programmer failed during Rev. 04. See discussion in Section 3-B. Visual inspection of the photography at 40X magnification showed smear and/or double images in the flight direction. Flight data indicates V/h mismatch generally below 10% with some as high as 20% .

The master camera film experienced corona marking starting on pass 38D. This fog was caused by the input metering rollers at instrument starts. Three inches of film was affected at each start up. The pressure make-up system was exhausted at this time due to gas leakage.

There was minor light leak fog on a few frames which occurred during non-operate periods. The source of this light leak is at the drums of the pan cameras. An improved light seal is to be incorporated in Systems J-36 and up.

Static discharge on the film edges were less than normal. Rail scratches were minor and there were no ragged format edges. There were the normal minor scratches in the formats of both cameras.

The starboard looking (sun side) horizon camera on the master instrument produced veiled imagery from pass 8 D through 35D. The condition started and stopped gradually and it was not as severe as on Mission 1033. The surfaces in front of the starboard looking horizon camera of the slave instrument were painted a dull black and there was no veiled imagery. Subsequent missions will have the H. O. boot and lens mount face painted a dull black.

SECTION 7

MISSION 1034 STELLAR-INDEX CAMERAS

A. COMPONENT ASSIGNMENT

Component	-1 Mission Serial Number	-2 Mission Serial Number
Camera	D-85	D-87
Index Reseau	109	107
Stellar Reseau	76	105

B. CAMERA DATA AND FLIGHT SETTINGS

Stellar Camera:		
Lens	85 mm f/1.8	85 mm f/1.8
Exposure Time	2 seconds	2 seconds
Filter Type	None	None
Film Type (Eastman)	3401	3401
Index Camera:		
Lens	38 mm f/4.5	38 mm f/4.5
Exposure Time	1/500 second	1/500 second
Filter Type	Wratten 21	Wratten 21
Film Type (Eastman)	3400	3400

C. POST FLIGHT PERFORMANCE EVALUATION

The -1 instruments each produced 415 frames of good photography. Light flare was present over 35% of each stellar format. The index camera correlation lamp functioned normally through frame 5 and then produced images of very low density. This anomaly was due to a loosened electrical connection. Static discharges were considered to be of the normal level. There was no exposure on frame 1 of the index photography.

The -2 S/I unit satisfactorily produced 409 frames of stellar and 423 frames of index photography. The stellar frames contained 20 or more images and 30% flare. The film was exhausted before the end of the main camera exposure and the ends were fogged. A similar anomaly was investigated on Mission 1033 and it was discovered that the hot wire film cutter can operate before the programmed time in the recovery sequence. Corrective action has been initiated.

The percentage of index frames with less than 10% cloud cover over terrain was 12% on -1 and 22% on -2. The same analysis over snow and ice showed 4% on -1 and 2% on -2 mission.

SECTION 8

PANORAMIC CAMERA EXPOSURE

The Master camera contained a 0.200 inch slit and a Wratten 23A filter. The Slave camera had a 0.150 inch slit and a Wratten 21 filter. These conditions placed the nominal exposure on the full processing curve.

The frequency distributions of the solar elevations and solar azimuths encountered during the photographic operations are shown in Figures 8-1 to 8-4.

The nominal exposure times of the Master and Slave cameras are shown as a function of latitude for passes D-8, D-56, D-104 and D-152 in Figures 8-5 to 8-12. The predicted level of processing for the original negative is based on the in-flight performance estimate and is tabulated below with the processing levels reported by [redacted]

Mission	Camera		% Primary	% Intermediate	% Full
1034-1	FWD	Predicted	0	96	4
		Reported	2.6	20.9	76.5
1034-1	AFT	Predicted	0	55	45
		Reported	1.9	31.5	66.6
1034-2	FWD	Predicted	0	88	12
		Reported	8.9	25.7	65.4
1034-2	AFT	Predicted	0	41	59
		Reported	6.1	37.3	56.6