SECRET [redacted] COPY NO [redacted]

CORONA J

PERFORMANCE EVALUATION REPORT

MISSIONS 1007-1 and 1007-2

FTV 1609; J-07

19 February 1965

Approved: [redacted] 3-10-65
Mgr. Date
Advanced Projects

Approved: [redacted] 3-12-65
Mgr. Date
Program

SECRET [redacted] COPY NO. [redacted]

FOREWORD

This report details the performance of the payload section during the operational phase of the Program [redacted] Flight Test Vehicle 1609.

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

This document is the final payload test and performance evaluation report for Missions 1007-1 and 1007-2 which was launched on 19 June 1964.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION 1

INTRODUCTION

This report presents the final performance evaluation of Missions 1007-1 and 1007-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-07 payload system, to identify the source of in-flight anomalies and recommend the necessary corrective action.

The performance evaluation was jointly conducted by representatives of Lockheed Missiles and Space Company and Itek at the facilities of NPIC and AFSPPL. The off-line evaluation normally performed at the individual contractors plant using Corona engineering material was of no value for this mission as essentially no photography was programmed during the orbital passes over the United States.

The quantitative data used for this report is obtained from government organizations. The diffuse density data, visual RES values and MTF/AIM resolution measurements are produced by AFSPPL. The vehicle attitude values and frame correlation times are made at NPIC who also supply the Processing History and MTF/AIM reports published by [redacted]

[redacted]

SECTION 2

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1007, placed into orbit by Flight Test Vehicle #1609 and Thor booster #410, 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 2-1 presents an inboard profile of the J-07 payload system. This Corona "J" system is designed to acquire search and reconnaissance photography of selected areas of the earth from orbital altitudes. The planned mission was two, four day photographic periods with no deactive period.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 4:18:07 PM PDT on 19 June 1964. Ascent and injection were normal with the achieved orbit within nominal tolerances. Tracking and command support was effected by the Air Force Satellite Control Facility consisting of tracking and command stations at [redacted] under central control of the Satellite Test Center at Sunnyvale, California. Mission 1007-1 consisted of four days operation, recovery being effected by air catch on Orbit 65, 23 June 1964. Mission 1007-2 was accomplished over the following four days without a deactive phase. Mission 1007-2 was terminated with a successful air catch recovery on Orbit 128 on 27 June 1964.

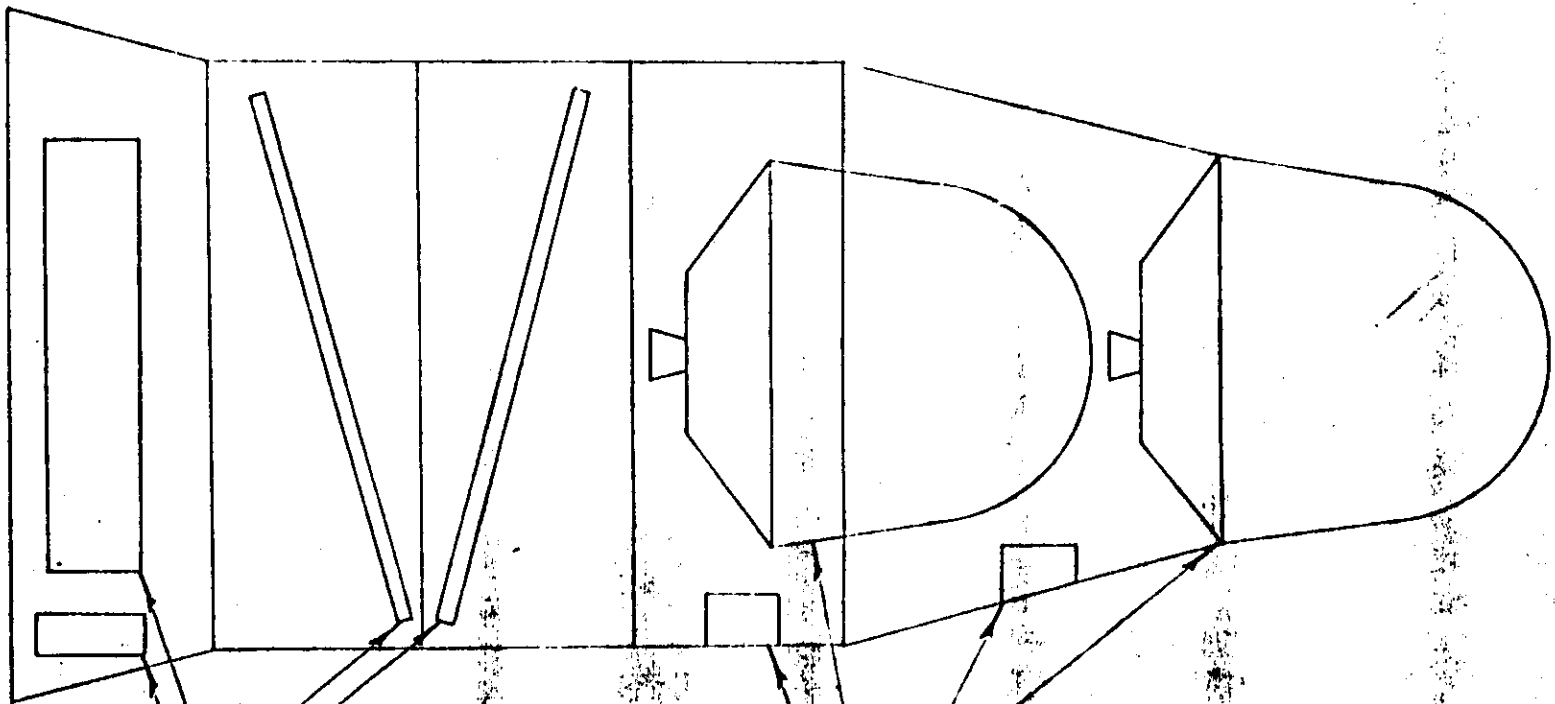
The comparison of the planned and actual orbit parameters is tabulated below:

Parameter	Planned	Actual (Orbit 1)
Period (Minutes)	91.06	90.95
Apogee (N.M.)	259.6	259.6
Perigee (N.M.)	100.27	99.2
Eccentricity	.02206	.02200
Inclination (Deg.)	85	85
Perigee Latitude (Deg.)	39.16	41.5

[redacted]

[redacted]

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM



[redacted]

Figure 2-1

Both phases of the mission were executed in a normal manner. The two air recoveries had impact points within the prediction tolerances.

C. PANORAMIC CAMERAS

The Master and Slave panoramic cameras operated normally throughout both missions and produced excellent photographic coverage of the programmed areas. A small area on the Master camera formats was slightly out of focus during the later portion of Mission 1007-1. This soft spot was not present during Mission 1007-2.

D. STELLAR-INDEX CAMERAS

The Stellar-Index camera operation during Mission 1007-1 was completely normal. The star images and terrain photography were satisfactory for the desired attitude determination and relative orientation. The camera used during Mission 1007-2 encountered some shutter problems particularly in the stellar portion. Approximately 40% of the stellar photography was unusable and 3% of the index photography unusable due to shutter malfunctions.

E. OTHER SUB-SYSTEMS PERFORMANCE

The clock, instrumentation sub-system, and command and thermal control sub-system performed satisfactorily throughout the mission.

F. CONCLUSIONS

Mission 1007-1 and 1007-2 achieved the prime objective of obtaining high quality reconnaissance photography. The experiment using the red, Wratten 25 filter on the Master camera was successful.

G. RECOMMENDATIONS

Evaluation of the results of both missions has produced the following recommended actions:

1. Analyze the failure modes of the Stellar-Index camera shutters and take the necessary action to preclude future failures.

2. Incorporate a Wratten 25 filter on near noon launch missions to improve the normally lower performance of the Master camera.

3. Investigate the possibility of using a lower processing gamma to permit the recording of all imagery on the straight line portion of the characteristic curve.

[redacted]

SECTION 3

PRE-FLIGHT SYSTEMS TESTS

A. ENVIRONMENTAL TESTING

1. Test Objective

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

2. Test Description

The J-07 System was subjected to environmental testing six times before a valid test resulted in flight acceptable performance with respect to corona resistance. The final system environmental test was conducted in the LMSC Thermal Altitude Simulation Chamber (TASC) from 17 April 1964 to 21 April 1964. The payload system was operated for 16 orbits with extended soak periods between operations. This procedure assures a pressure within the corona marking pressure range at the start of each operation.

3. Test Environment

The thermal instrumentation system used in the system is subject to self-heating errors in the transducers, due to electrical power dissipation. The magnitude and characteristics of the self-heating errors have been demonstrated to be a function of time from excitation voltage on, the nature of the bond for each individual temp sensor, and the thermal mass of the component to which the sensor is bonded. A calibration of the self-heating characteristics of the installed temp sensors was conducted during the J-07 TASC Test No. 4. Figure 3-1 presents the results of this test. During the test, the time from excitation voltage on cannot be determined with certainty; therefore, accurate self-heating corrections cannot be applied to the TASC temperature data. Changes are in process to eliminate this problem. Following are representative thermal data (no self heating corrections applied):

[redacted]

[redacted]

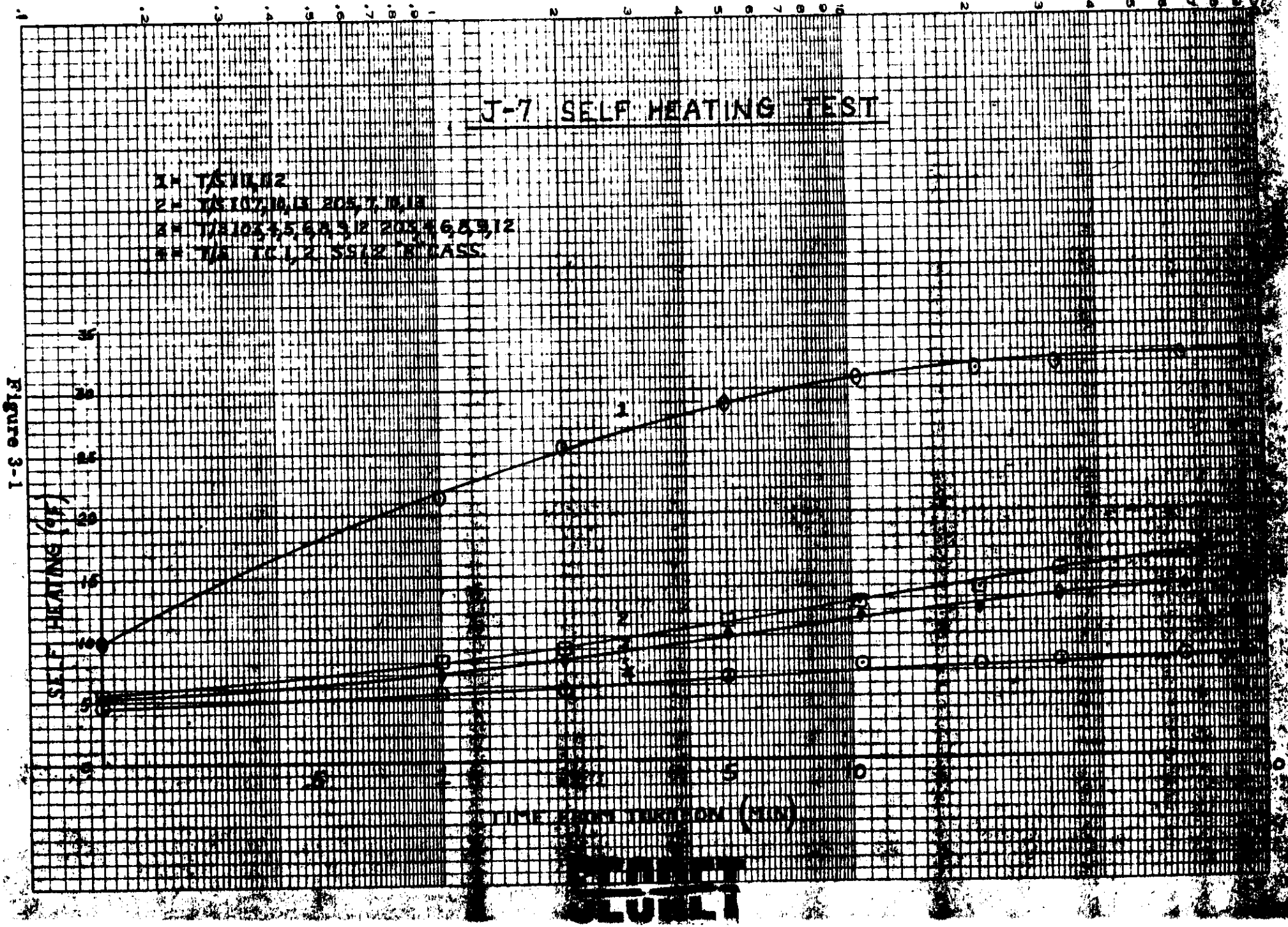

J-7 SELF HEATING TEST
1= TA 11,12
2= TA 10,7,13, 205, 7, 10, 13
3= T/B 10 3,4,5, 6, 8, 9, 12 205, 4, 6, 8, 9, 12
4= T/B TC 1, 2 SS 12 "E" GLASS.
SELF HEATING (°F)
TIME FROM TURN ON (MIN)

Figure 3-1

Temp Sensor	Orbit 0	Orbit 9	Orbit 16
Instrument #1	74.3	83.0	85.9
Instrument #2	76.6	89.0	88.1
Barrel #1	68.6	99.8	85.4
Barrel #2	69.3	97.4	83.8
Clock	74.2	90.0	92.5
Supply Spool	69.5	75.1	75.9
Thrustcone	67.8	81.0	87.5
Thermal Shield	57.3	110.4	72.3
Stellar/Index	77.3	85.8	95.2
Cassette	76.3	87.0	92.0

Figure 3-2 presents representative pressure data obtained during the test. As indicated, the pressures attained were within the corona marking range.

4. Panoramic Camera Performance

In general, the Panoramic Camera System Electro/Mechanical operation was satisfactory. The following anomalies were noted.

(1) There were several indications of possible payload movement during the scan portion of the camera cycle. Whether the payload actually moved, or whether the telemetry monitor was sitting on the edge of the cam producing this indication cannot be ascertained. This indicated movement was apparent on both panoramic instruments and is frequently observed in ground tests.

(2) A Mono No. 1 operation was conducted on Orbit 7. During this operation, the Horizon Idler on the Slave camera indicated possible payload take-up for approximately 4 seconds after the Master camera began operation. At this time, the Slave Horizon Idler returned to its normal inactive state. On the third cycle of the Master camera, one perturbation again occurred on the Slave Horizon Idler. There were no other indications of abnormal performance on the Slave camera during this operation.

[redacted]

K+E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO.

SECRET

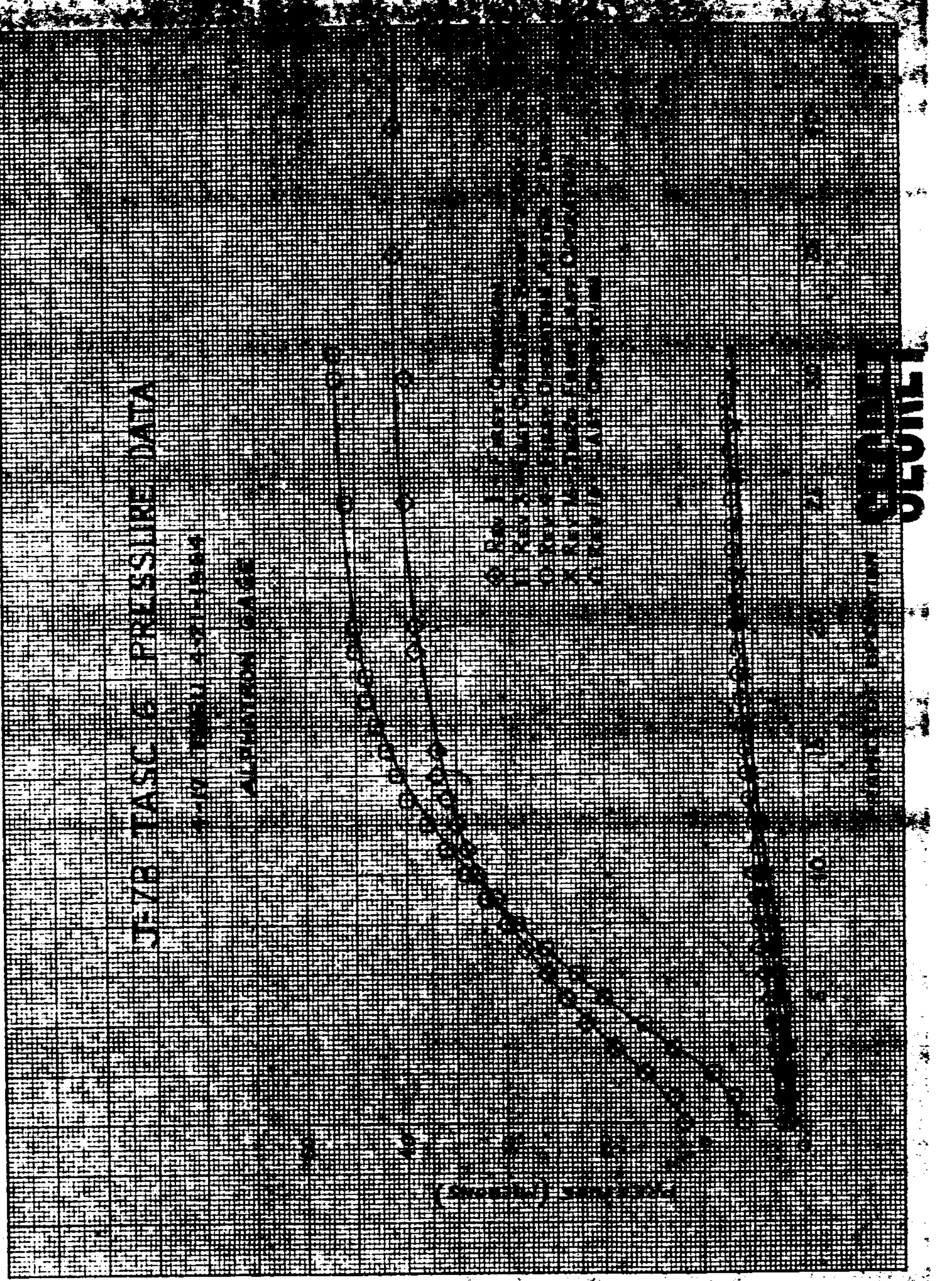


Figure 3-2

The Slave camera operate voltage was off during the aforementioned period. The take-up cassette rotation monitor gave no indication of payload take-up. Therefore, this anomaly was probably caused by the bouncing of the commutator. A Mono No. 2 confidence run was conducted immediately after the previously-mentioned anomaly, and all payload system monitors indicated proper operation of the Slave camera.

(3) The T/M data indicated a possible payload slack loop on the Slave camera at the start of the last operation during Orbit 11.

(4) After the 7-second shutdown of the Master camera, the T/M data exhibited a possible take-up indication or slack during Orbit 16 of the test.

(5) No valid cycle rate calibration existed, due to replacement of the V/H programmer and several transistors in the magnetic amplifier; therefore, cycle rate performance could not be evaluated.

Examination of the film metered during the environmental test showed that the Master camera displayed a fog pattern from corona discharge during the start-up frames. No indication was present of a tendency to produce corona discharge continuously. The Slave camera did not fog the film during start-up. Both cameras were considered acceptable for flight.

5. Stellar Index Camera Performance

The test instrumentation indicated proper electro-mechanical operation of the S/I cameras throughout the test. Examination of the film metered during the test showed that both cameras met the acceptance criteria for corona discharge fogging hence both cameras were accepted for flight.

6. Clock Performance

The clock system operation appeared satisfactory. IRIG "C" was utilized as a standard. There were two time segments for

the entire TASC test due to a power shutdown on Orbit 4. A 38-millisecond offset occurred between Orbit 8 and Orbit 3, and a 79 millisecond offset between Orbit 4 and Orbit 16.

7. Instrumentation Performance

All instrumentation monitors indicated proper operation, with the exception of the Channel 13, Points 45, 51, and 56. These points are the minus 28 TLM buss voltage monitor, minus 28 volt TLM calibrate for the Master camera, and minus 28 volt TLM calibrate for the Slave camera. During Orbit 16, these monitors increased approximately 1/2 volts, indicating that the minus 28 voltage had decreased approximately 1 volt. A Theodolite and Resolution Run was conducted at A/P after the TASC test and this anomaly was not present indicating a test power supply problem. Good correlation was available between the film footage pots of both instruments and the corresponding cycle counters. The recovery sequence for the "B" bucket was satisfactory.

B. RESOLUTION TEST

The dynamic resolution test of the J-07 payload system was performed at the A/P facility on 24 April 1964. Each panoramic camera photographed high and low contrast resolution targets. The resulting through focus resolution data is shown in Figure 3-3 for the Master camera and in Figure 3-4 for the Slave camera.

C. LIGHT LEAK TEST

The examination of the film threaded in the J-07 system during the light leak test determined that no film fogging was present. The light tight integrity of the system was considered acceptable for flight.

NO. 340R L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.