~~TOP SECRET~~ [redacted]

CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1012-1 and 1012-2

FTV 1179; J-13

22 October 1965

Approved: [redacted] Mgr
Advanced Projects

Approved [redacted]

~~TOP SECRET~~ [redacted]

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1179.

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

This document is the final payload test and performance evaluation report for Missions 1012-1 and 1012-2 which was launched on 17 October 1964.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1012-1 and 1012-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-13 payload system, to identify the source of in-flight anomalies and recommend the appropriate corrective action.

The performance evaluation was jointly conducted by representatives of Lockheed Missiles and Space Company (LMSC) and ITEK at the facilities of NPIC and AFSPPL. 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, visual RES values and MTF/AIM resolution are produced by AFSPPL. The vehicle attitude error values, frame correlation times are made at NPIC who also supply the Processing Summary and MTF/AIM resolution reports published by [redacted]

Computer programs developed by A/P are utilized to calculate and plot the frequency distribution of the various contributors to image smear to permit analysis and correlation of the conditions of photography to the information content and quality of the acquired pictures. Computer analysis of the exposure, processing and illumination data provides the necessary data to analyze the exposure criteria selected for the mission.

SECTION 1

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1012, placed into orbit by Flight Test Vehicle #1179 and LV-2A booster #418, 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-13 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, 4 day photographic periods separated by a seven day inactive period.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 2202:23 Z (1502:23 PDT) on 17 October 1964. 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 1012-1 consisted of three days operation and was completed by air recovery on 20 October 1964. The mission was one day shorter than originally planned due to a beacon problem that prevented controlled photographic programming. Mission 1012-1 was completed with a water recovery on 22 October 1964 following two days of photographic operations. Mission 1012-2 was prematurely recovered according to plan because of unstable vehicle attitude that developed on Pass 72.

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

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM

MISSION 1012

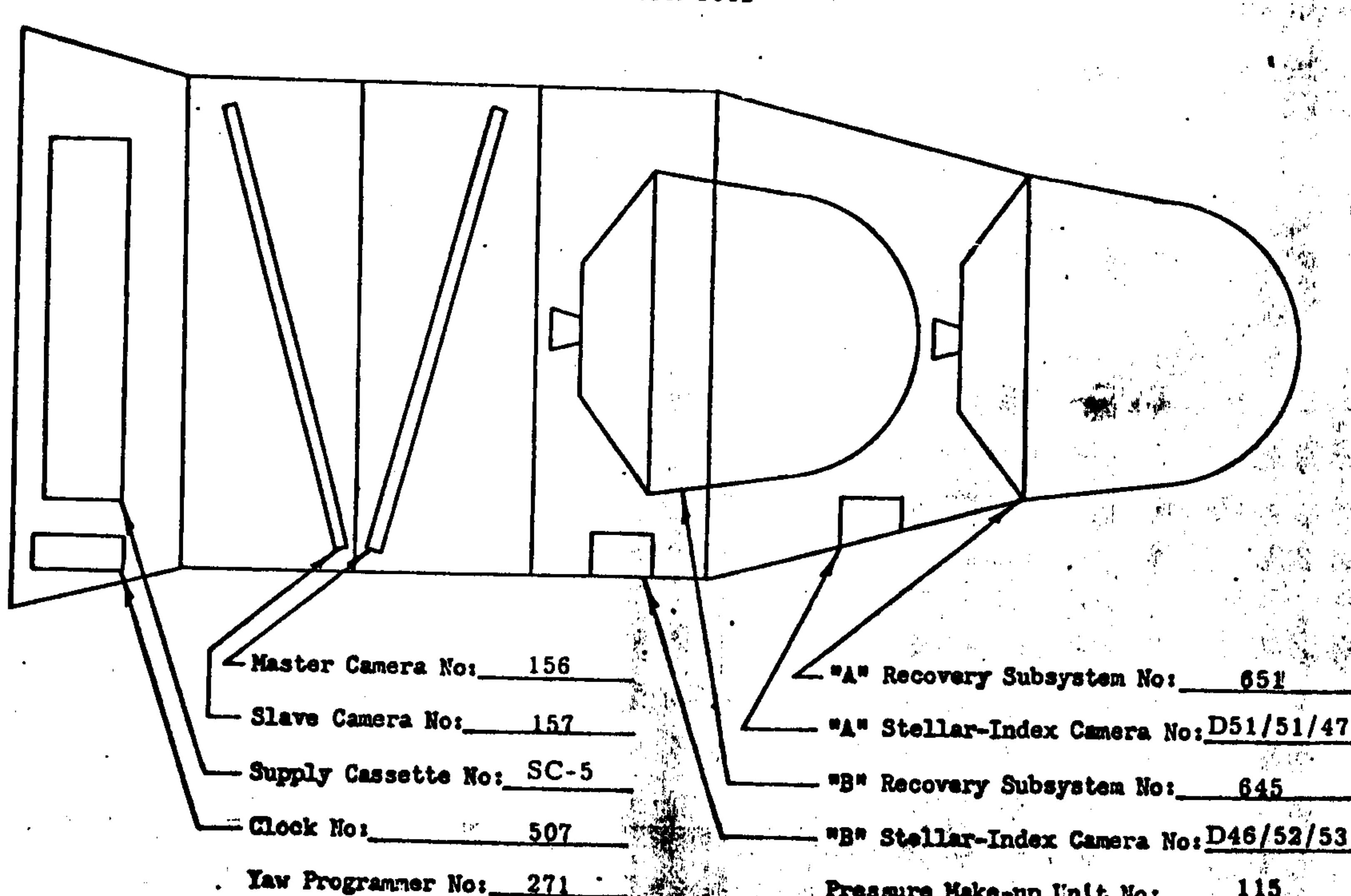

FIGURE 1

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 1 Actuals
Period (Min.)	90.67	90.60
Perigee (N.M.)	100.00	96.28
Apogee (N.M.)	237.1	237.68
Inclination (Deg.)	75.00	75.05
Perigee Latitude (Deg. N.)	29.99	32.43
Eccentricity	0.01905	0.0196

SRV #1 contained 86% of the normal amount of payload. SRV #2 was filled with payload to approximately 50% of full capacity. Lifeboat recovery of Mission 1012-2 was successfully initiated on orbit 81.

C. PANORAMIC CAMERAS

The Master and Slave panoramic cameras operated throughout both missions with no significant problems and produced excellent photographic coverage. The cloud cover observed in the photography averaged 50% for the entire flight.

D. STELLAR-INDEX CAMERAS

Stellar-Index camera #D-51 used during Mission 1012-1 did not work in orbit. No stellar or terrain photography was acquired during Mission 1012-1. Film transport in orbit did not appear to occur except for possibly one or two frames that were left in the camera from pre-launch operations. Stellar-Index camera #D-46 worked well throughout Mission 1012-2.

E. OTHER SUBSYSTEMS

During Mission 1012-1 the Agena vehicle command verification transmitter was inconsistent. Commands received could not be verified. As a result, Mission 1012-1 was terminated after three days.

During Mission 1012-2, beginning with orbit D-72, the type 9 voltage regulator in the Agena vehicle malfunctioned, adversely affecting the

Agena guidance system and the stability of the satellite SRV. #2 was recovered prematurely according to plan because of loss of vehicle stability. Lifeboat recovery was executed successfully on pass D-81.

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

F. CONCLUSIONS

The panoramic photography acquired in orbit during Mission 1012-1 and 1012-2 was of high quality and adequate to meet the search and surveillance objective of the "J" Program. Failure of Stellar-Index #D-51 to operate during Mission 1012-1 is attributed to loss of unregulated power at the film metering drive motor. The poorly made final splice joining the S/I D 51 index camera flight film to the leader at the core of the take-up spool does not appear to be associated with the failure of S/I D-51.

G. RECOMMENDATIONS

The evaluation and analysis of the data produced by both missions has resulted in the following recommendations:

1. Increase the use of the yaw steering capability in order to produce sufficient photography to prove the value of yaw steering control.

2. Increase the light level at VAFB to permit reliable inspection of splicing technique and the final flight splices.

3. Use a splice alignment fixture to assist in the preparation of all future flight splices.

SECTION 2

PRE-FLIGHT SYSTEMS TESTS

A. ENVIRONMENTAL TESTING

1. Test Objective

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

2. Test Summary

The J-13 payload system completed a 4-1/2 day orbit simulation test at the Sunnyvale HIVOS chamber on 1 July 1964. The HIVOS test consisted of 2-1/2 days of SRV-"A" testing followed by one day of J-13 deactivate, and one day of SRV-"B" operation. Approximately 10,000 feet of 4404 type flight film was programmed thru panoramic cameras #156 and #157 during altitude testing. Stellar-Index cameras were not altitude tested with J-13 system due to a shortage of double frame units. Minor corona discharge marks were present on the start up frame of both panoramic cameras. Corona is attributed to the input metering roller at camera start up.

The electrical and mechanical operation of the system was generally acceptable, except for the following:

(1) The pressure make-up system did not work.

(2) Instrument #157 started up and ran on two occasions apparently without an "on" command with the 400 cycle power off.

(3) The yaw programmer did not operate from orbit 4 to 8 during the "A" SRV operation.

(4) Panoramic instrument cycle rates varied from 10% fast to 6% slow.

(5) During the SRV "A" operation the V/h sine potentiometer programmer showed a 2-5 second opening at the top of the ramp.

3. Panoramic Camera Performance

Instrument #157 started and ran twice without a planned "on" command during the one day deactivate period of the altitude test. In addition, cycle rates varied from 10% fast to 6% slow. Both the apparent unexplained start-up of the slave camera and the fast cycle rates of both panoramic cameras coorelate with excessively high temperatures experienced in the HIVOS chamber. Subsequent bench tests conducted using the J-13 system demonstrated that temperatures above 100°F were responsible for activating certain power transistors that caused instrument #157 to operate without the "on" command. In as much as the in-flight temperatures are not expected to reach levels high enough to activate the panoramic cameras without the "on" command, no corrective action was taken.

Cycle rate errors up to 10% faster than normal and 6% slower than normal are attributed to the wide temperature excursions to which the system was subjected.

The electrical and mechanical operation of the panoramic cameras was acceptable with the exception of the anomolies noted above.

4. Stellar-Index Camera Performance

Stellar-Index cameras were not available for altitude testing with J-13 system.

5. Instrumentation Performance

Instrumentation performance was normal throughout the altitude test. There were minor indications of dirty electrical contacts associated with the TM sensor on the 99/101 idlers.

6. Temperature Environment

J-13 system experienced a wide range of temperatures from approximately 70°F to over 100°F. Cycle rate errors were found to be excessive during periods of high instrument temperature.

7. Clock Performance

Data reflecting clock performance is tabulated to show the accumulated error in seconds for the SRV "A" and SRV "B" operation as follows:

Operation	Clock Time Span	Clock Error (Seconds)
SRV "A"	Orbit 8 Day 1 to Orbit 14 Day 2	0.016
SRV "B"	Orbit 1 Day 1 to Orbit 14 Day 1	0.015

Clock performance was rated excellent and was accepted for flight.

8. Yaw Programmer

Operation was satisfactory except during orbits 4 thru 8 when the yaw programmer failed to operate. Yaw programmer failure was investigated. The cause of failure was attributed to broken wires in cabling used for test purposes only.

9. Pressure Environment

Although the gas pressure make-up system was in good operating condition, the gas release nozzle was left capped throughout the altitude test. Make-up gas could not escape from the gas container due to the capped nozzle.

Typical internal payload pressures in microns of mercury as recorded during the altitude test are as follows:

Orbit	Alphatron Master Camera		Alphatron Slave Camera		Pressure Make-up System
	ON	OFF	ON	OFF	
1	26	60	26	60	OFF
6	24	59	26	60	OFF
12	22	39	22	40	OFF
18	15	29	16	30	OFF
24	11	32	12	34	OFF
30	10	30	12	32	OFF
36	6	24	10	27	OFF
56	1.4	4.2	--	--	OFF
62	.6	7	--	--	OFF
68	.8	5.4	--	--	OFF
72 test End	.6	2.8	--	--	OFF

No corona discharge marks were observed on altitude test film from orbit 1 thru orbit 36. Orbit 1 thru 36 represents SRV "A" operation with internal camera pressures ranging between 6 to more than 60 microns of mercury.

Minor start up corona marks were observed for most master and slave camera starts during the SRV "B" operation. Marking was confined to the film frame in contact with the input metering roller at camera start. Pressure ranged from 4.2 to 0.6 microns of mercury from the beginning to the end of SRV "B" operation. J-13 system corona marking met J Program requirements for flight.

B. RESOLUTION TEST

The dynamic resolution test of the J-13 payload system was performed at the A/P facility on 23 July 1964. Each panoramic camera photographed high and low contrast resolution targets. The resulting through focus resolution data is shown in Figure 2-1 for the Master camera and in Figure 2-2 for the Slave camera.

C. LIGHT LEAK TEST

The examination of the film threaded in the J-13 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.

PRE-FLIGHT DYNAMIC RESOLUTION

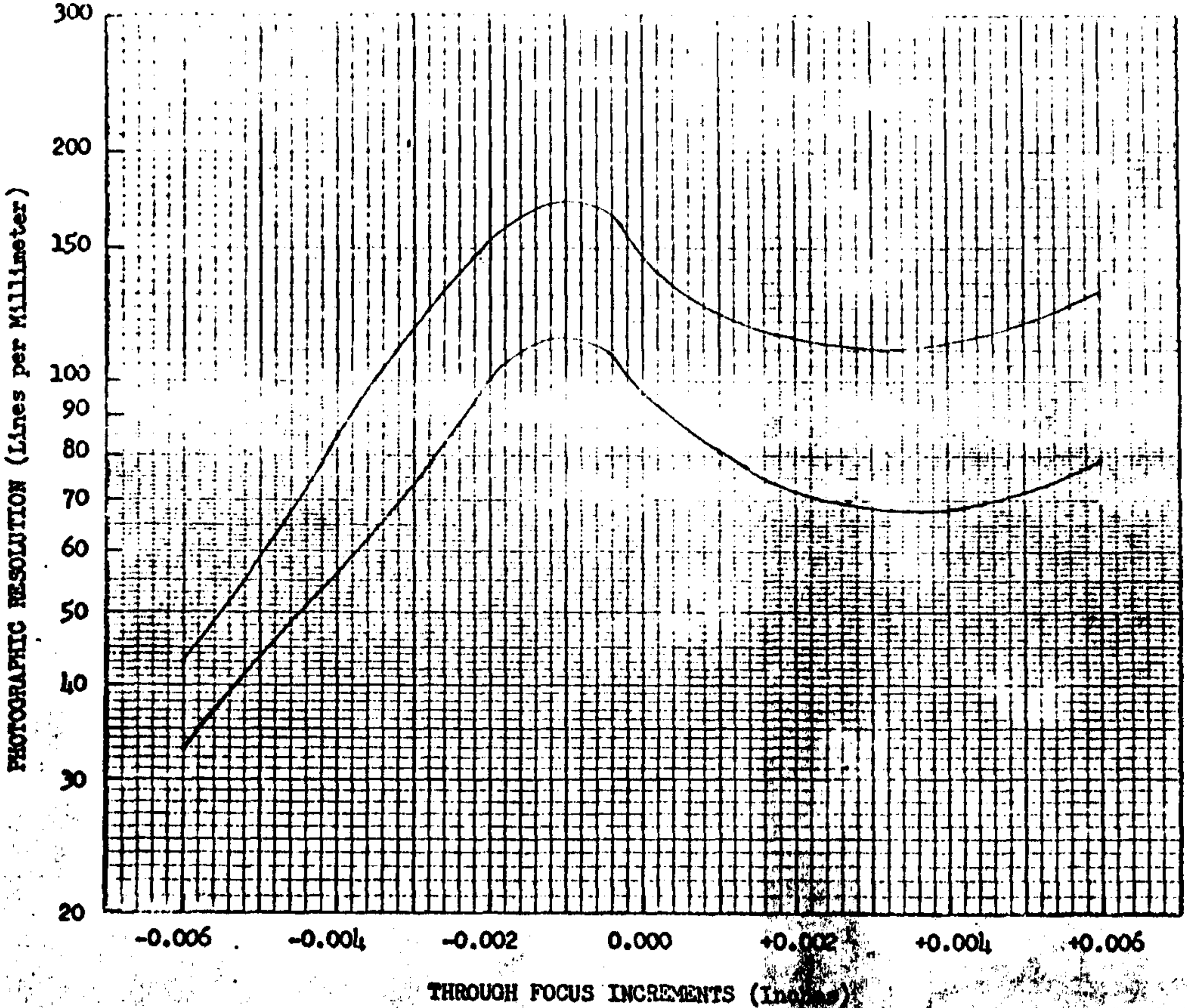

FIGURE 2-1

Camera No: 156

Payload No J-13

Resolution (1/mm)

High Contrast: 173

Low Contrast: 114

Film Type: 3404

Test Date: 7/29/64

PRE-FLIGHT DYNAMIC RESOLUTION

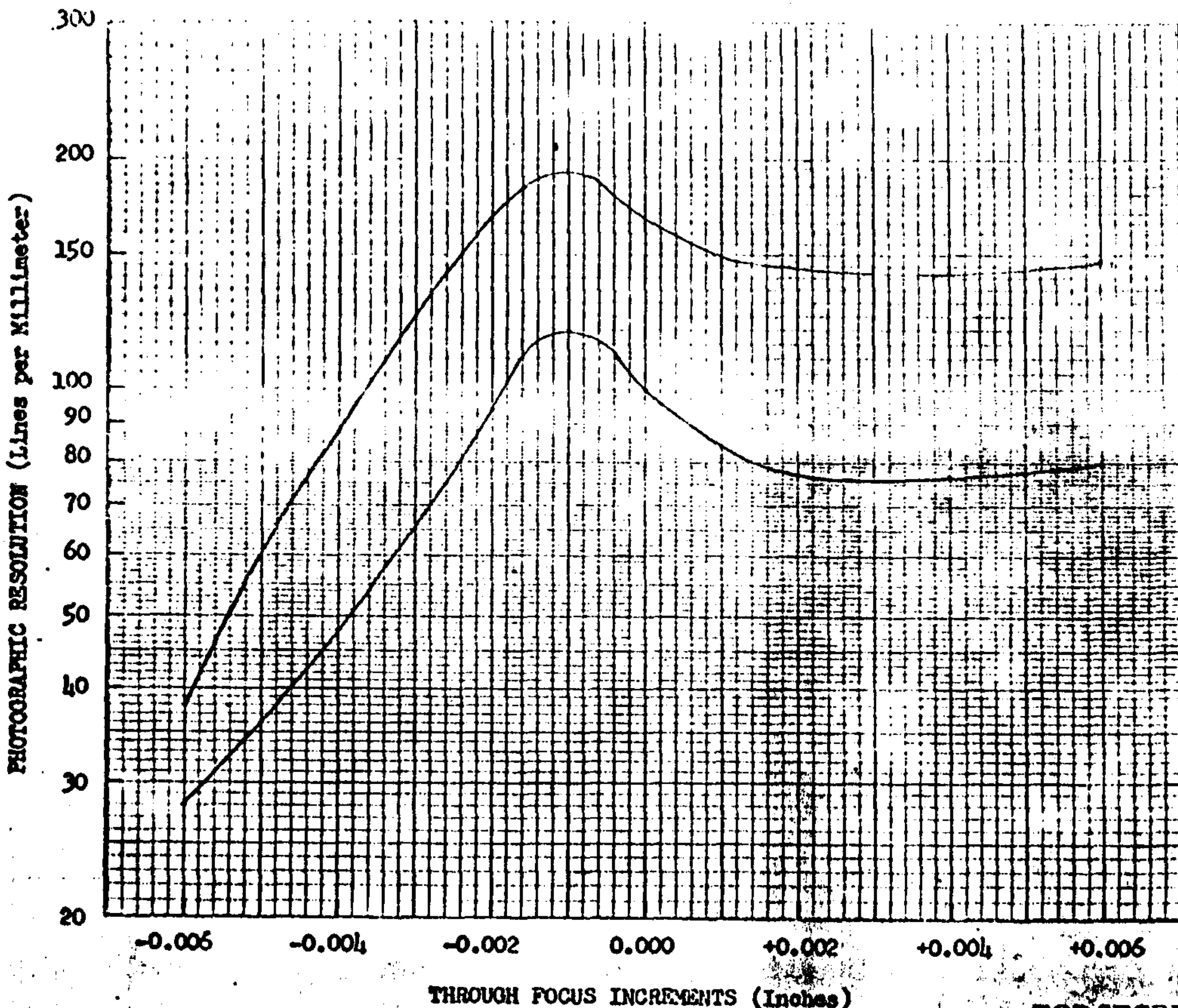

FIGURE 2-2

Camera No: 157

Payload No: J-13

Resolution (1/mm)

High Contrast: 193

Low Contrast: 119

Film Type: 3404

Test Date: 7/29/64

SECTION 3

FLIGHT OPERATIONS

A. INSTRUMENTATION AND COMMAND PERFORMANCE

T/M data indicated no instrumentation problems on either the continuous or the commutated channels. During Mission 1012-1 the Agena vehicle command verification transmitter was inconsistent and commands received could not be verified. As a consequence, Mission 1012-1 was terminated after three days.

During Orbit 72 of Mission 1012-2 the Type 9 voltage regulator in the Agena vehicle malfunctioned, and the Agena vehicle guidance system was adversely affected. With the loss of vehicle stability Mission 1012-2 was terminated, and a lifeboat next orbit recovery mode was initiated for a recovery on Orbit 81.

B. PANORAMIC CAMERA PERFORMANCE

Both panoramic instruments operated properly throughout the mission. T/M data from the engineering passes over the [redacted] Tracking Station [redacted] were monitored to provide information about the panoramic cameras performance. No data were acquired from the first engineering pass on Orbit 9. This omission was due to the vehicle T/M transmitter having been commanded off. The second engineering pass acquired was on Orbit 25. The T/M data from Orbit 25 indicated there was erratic rotation of the instrument #1 input idler.

T/M data from subsequent engineering passes indicated an improvement in the input idler, and on Orbit 57 T/M data indicated normal operation of the input idler.

Analysis of the panoramic camera's film showed normal metering. It would appear that the anomaly was probably caused by the T/M wiper exerting excessive pressure on the input idler contacts. This would relegate the anomaly to a T/M malfunction rather than a panoramic malfunction.