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CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1033-1 and 1033-2

FTV 1630, J-33

12 May 1967

Approved: [redacted]
Manager
Advanced Projects

Approved: [redacted]
Mgr.
Program [redacted]

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No. [redacted]

7 July 1967

TO: [redacted]

THRU: [redacted]

FROM: [redacted]

SUBJECT: MISSION 1033-1 AND 1033-2 FINAL REPORT

Enclosed is the Final Performance Evaluation Report for Mission 1033-1 and 1033-2.

[redacted]
Advanced Projects

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FOREWORD

This report details the performance of the payload system during the operational phase of the [redacted] Flight Test Vehicle 1630.

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 1033-1 and 1033-2 which was launched on 24 May 1966.

[redacted]

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INTRODUCTION

This report presents the final performance evaluation of Missions 1033-1 and 1033-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-33 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 [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 1033, placed into orbit by Flight Test Vehicle #1630 and LV-2A booster #469, 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-33 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, 5 day photographic periods with no inactive period.

The orbit was designed by A/P, at customer request, to give daily coverage of three specified area targets. Coincidentally, it afforded good coverage of many other primary targets. The general orbit parameters featured low (66°) inclination, a relatively short/higher drag period yielding second-day synchronism, and 100 N.M. Perigee on the northbound side.

Because of the longitudinal spacing between the three main targets, it was necessary to operate the system in the northbound direction as well as the normal southbound. In turn, this necessitated a relatively late launch to provide proper illumination for all target areas; extensive A/P studies indicated optimum liftoff for exposure purposes was 0245Z (6:45 PM, PST) ± 15 min. A launch at this time would have provided continuous proper illumination above 45°N, which included all primary target areas, plus the greater amount of usable bonus coverage. However, it was also necessary to assure adequate illumination for the recovery area (24°N, southbound). For this reason, the desired liftoff was set back to 0200Z to provide at least a half hour of sunlight on every mission day for possible recovery operations. This compromised northbound coverage late in the mission.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 0200:33 Z (1900:33 PDT) on 24 May 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 1C33-1 consisted of a 5 day operation and was completed by air recovery on 28 May 1966. Mission 1033-2 completed a six day operation and was air recovered on 4 June 1966.

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 42 Actuals	Orbit 130 Actuals
Period (Min.)	88.96	88.93	88.826
Perigee (N.M.)	100.1	101.83	100.45
Apogee (N.M.)	157.1	154.55	151.46
Inclination (Deg.)	66.01	66.032	66.032
Perigee Latitude (Deg. N.)	61.93	60.75	63.744
Eccentricity	0.0080	0.00739	0.00717

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM

MISSION 1033

Master Camera No: 10[illegible]

Slave Camera No: 19[illegible]

Supply Cassette No: [illegible]

Clock No: [illegible]

Yaw Programmer No: [illegible]

"A" Recovery Subsystem No: [illegible]

"A" Stellar-Index Camera No: [illegible]

"B" Recovery Subsystem No: [illegible]

"B" Stellar-Index Camera No: [illegible]

Pressure Make-up Unit No: [illegible]

FIGURE 1-2

C. PANORAMIC CAMERAS

The panoramic cameras operated throughout both missions and provided better than average quality photography. The cloud cover was 45% and 50% on -1 and -2 missions respectively.

D. STELLAR-INDEX CAMERAS

The -1 mission S/I unit operated satisfactorily. The -2 Stellar camera shutter failed to open intermittently. The -2 hot wire cutter fired prematurely. The photo record on both missions was usable.

E. OTHER SUBSYSTEMS

The clock, instrumentation, command, recovery and pressure make-up systems performed satisfactorily. The thermal environment averaged 20°F higher than normal.

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 susceptibility to corona discharge. Such discharge fogs the film thus degrading the operational photography.

2. Test Summary

The J-33 payload system was tested in the Sunnyvale TASC chamber to determine thermal and orbital effects on the system. The test, from January 22 to January 28, 1966, was composed of three days in Mission 1, three days in Mission 2, and part of one day in a thermal soak.

Random current spikes at the instrument on command were seen from Rev 9 in the "B" mode until the end of the test. These spikes were observed on all the current monitors and the V/h monitor. The current spikes could not be measured for amplitude because no calibrations were supplied on the Sanborn recorders. There was also an arcing from the chamber heating elements to the payload system. This arcing caused random pulses on the + regulated current and V/h channels.

Cycle rates were acceptable for the master and slave instruments. The master camera cycle rate errors ranged from 1% slow to 2.25% fast but averaged 1.5% fast. The slave camera cycle rate errors ranged from 0% to 2.25% fast for orbits 1A through 14A; from 2.0% slow to 0% for orbits 15A through 4B; and from 1% slow to 1% fast for orbits 5B through 14B. The slow down of slave camera after orbit 14A is unexplained.

There were IRIG "C" time syncs on the morning of the twenty-third and twenty-fourth. These syncs caused errors in the clock correlation, but the clock itself is acceptable.

Instrument #194 exhibited excessive corona. Metering rollers were changed and a second altitude test showed no corona present. The lowest internal camera pressure was 0.8-microns during the second test.

3. Panoramic Camera Performance

Both instruments operated satisfactorily throughout the test.

The 99/101 per cent clutch ratios averaged 7/5 for both instruments.

The cycle periods, take-up voltage and V/h program voltage were acceptable.

A deactivate sequence was performed with both instruments operating 4 cycles and the lens stopping in the stowed position.

The cut and wrap operation was normal with both instruments operating 3 cycles and the lens stopping in the stowed position.

FILM CONSUMPTION (Cycles)

	Master	Slave
-1 Mission		
Cycle Counter	2800	2854
Footage Pot (Hump Rack)	2802	2818
Actual	2800	2854
-2 Mission		
Cycle Counter	2899	2948
Footage Pot	2962	3064
Actual	2899	2948

4. Stellar/Index Performance

The Stellar/Index camera operated satisfactorily throughout the A phase with normal camera slewing during the cut and wrap operation.

The B phase Stellar/Index camera operated satisfactorily with normal camera slewing during the B recovery sequence.

5. Temperature Summary -

Average Panoramic Instrument Temperatures (^{o}F)

Date	-1 Mission Day	Master High	Master Low	Slave High	Slave Low	Orbits
22nd	1	94	72	86	70	1 - 4
23rd	2	91	85	83	78	5 - 10
24th	3	88	85	80	76	11 - 14
25th	4	63	58	60	58	15 - C&W

	-2 Mission Day	Master High	Master Low	Slave High	Slave Low	
25th	1	60	59	58	58	1 - 2
26th	2	82	59	81	60	3 - 7
27th	3	80	72	79	72	8 - 12
28th	4	72	70	72	71	13 - Recovery

6. Pressure Make-up System Performance

The pressure make-up system operated satisfactorily throughout the test. The average gas consumption was approximately 7.9 lbs/minute of instrument operate time. The maximum pressure attained with the PMU was approximately 48 microns during instrument operation.

The minimum pressure attained during the test was approximately 2 microns during a static condition.

[redacted]

7. Instrumentation

The instrumentation system performed satisfactorily thoughout the altitude test.

B. RESOLUTION TEST

Resolution and theodolite tests were performed on 2 February 1966. Results of the thru-focus resolution tests of pan instruments 194 and 195 show the following characteristics:

Master Pan Instrument No. 194

Maximum high contrast resolution 182 lines/mm at 0.000 focal position.

Maximum low contrast resolution 116 lines/mm at - .001 focal position.

Slave Instrument No. 195

Maximum high contrast resolution 169 lines/mm at 0.000 focal position.

Maximum low contrast resolution 116 lines/mm at 0.000 focal position.

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

C. LIGHT LEAK TEST

J-33 was subjected to the System Light Leak test on 28 March, 1 April, and 4 April 1966.

The first test revealed unacceptable film fog that was traced to a defective bath tub fitting at the Master/Slave barrel interface and excessive Master drum leaks. Light leaks were repaired and the test of 1 April was completed. The 1 April test was found to be invalid due to inadvertent use of 3404 type film in the Master camera in place of standard light leak test film type 3401. The test of 4 April demonstrated that the subject light leaks were

significantly suppressed as evidenced by the presence of minor acceptable fog attributed to the normal drum/felt seals of the Master and Slave cameras.

The J-33 system was accepted without further film light leak testing.

D. FLIGHT LOADING AND CERTIFICATION

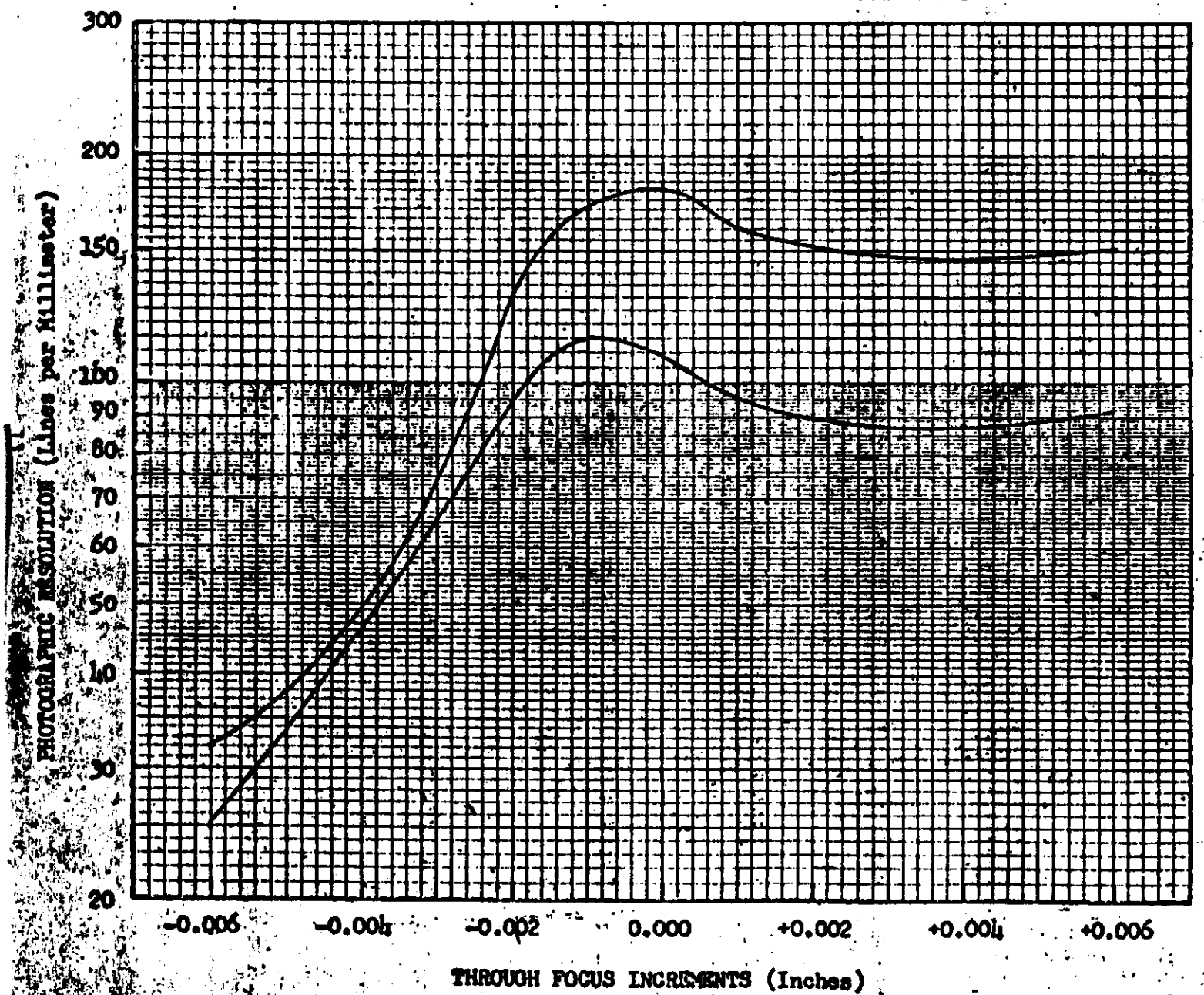
The J-33 System Flight Readiness Test was completed on 18 May 1966. The test was repeated the second time to verify operation of the No. 6 binary bit lamp in Master Instrument #194. The No. 6 binary bit was out in the first test and present in the second test. No lamp change was made to correct the problem. However, the No. 6 bit electrical disconnect pins were cleaned prior to running the second test.

Instrument 195 blanking pulse sometimes removed two (2) timing pips instead of one. A waiver was recommended.

The J-33 Flight Readiness Test film was exceptionally clean and free of physical damage.

The supply cassette was loaded with flight film on 19 May 1966. On 20 May 1966, J-33 system was threaded with flight film and operated to verify final film tracking and system operation. The system performed well.

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 194

Payload No: J-33

Resolution (1/mm)

High Contrast: 182

Low Contrast: 116

Film Type: 3404

Test Date: 2/8/66

FIGURE 2-1