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26 October 1966

To: V. Webb ✓
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Thru: [REDACTED]

From: [REDACTED]

Subject: MISSION 1028-1 AND 1028-2 FINAL REPORT

Enclosed is the Final Performance Evaluation Report
for Mission 1028-1 and 1028-2.

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Advanced Projects

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CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1028-1 and 1028-2

FTV 1610, J-26

9 September 1966

Approved: 

Mgr.

Advanced Projects

Approved: 

Mgr.

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FOREWARD

This report details the performance of the payload system during the operational phase of the Program [REDACTED] Flight Test Vehicle 1610.

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 1028-1 and 1028-2 which was launched on 24 December 1965.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1028-1 and 1028-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-26 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, values 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 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 I
SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1028, placed into orbit by Flight Test Vehicle #1610 and LV-2A booster #451, 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-26 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.

B. MISSION DESCRIPTION

The payload was launched from Vandenberg Air Force Base (VAFB) at 2106:15 Z (1306:15 PST) on 24 December 1965. 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 1028-1 consisted of a five day photographic operation and was air recovered on 29 December 1965. Mission 1028-2 was air recovered, after a four day operation, on 2 January 1966. The -2 mission was limited by battery life.

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

ORBITAL PARAMETERS

| <u>Parameter</u> | <u>Predicted</u> | <u>Orbit 1 Actuals</u> |
|----------------------------|------------------|----------------------------|
| Period (Min.) | 90.856 | 90.84 |
| Perigee (N. M.) | 99.99 | 97.44 |
| Apogee (N. M.) | 244.71 | 244.35 |
| Inclination (Deg.) | 79.99 | 80.01 |
| Perigee Latitude (Deg. N.) | 19.11 | 19.06 |
| Eccentricity | 0.02008 | 0.02033 |

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 30% for the entire flight.

D. STELLAR-INDEX CAMERAS

The S/I Camera #D77 operated satisfactorily on the -1 mission. The stellar photography on S/I #D74 was partially degraded by light fog due to the index camera shutter failing to open throughout the -2 mission.

E. OTHER SUBSYSTEMS

The telemetry instrumentation, command, thermal control, clock, pressure make-up and recovery subsystems performed satisfactorily throughout both missions.

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SCHMATIC INBOARD PROFILES - CORONA J SYSTEM

MISSION 1028

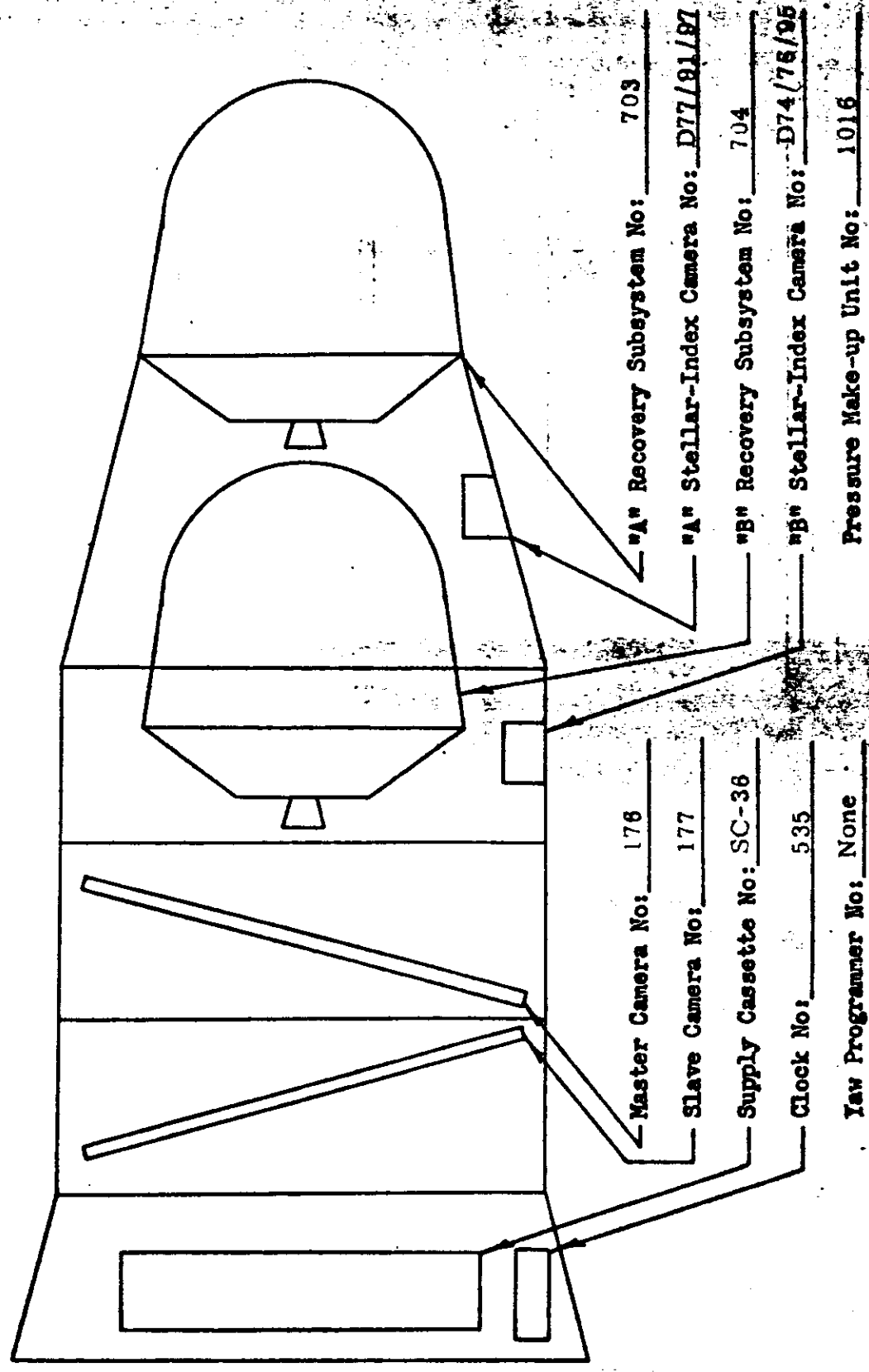


FIGURE 4-1

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-26 payload system consisting of panoramic instruments 176 and 177 was in the TASC chamber at Sunnyvale for environmental testing during 30 July to 6 August 1965. Testing consisted of 14 orbits of operations in both the "A" and "B" modes with a vehicle deactivate/reactivate sequence conducted in between.

The lowest internal camera pressure experienced was 1.2 microns in the "B" mode. Corona was experienced from the input metering roller, however it did not exceed the specification tolerances.

Dynamic operation of both instruments was satisfactory during both "A" and "B" modes. Cycle rates were within ± 1.5 percent for the operations in the upper portion of the ramp.

Both stellar/index units performed satisfactorily.

The clock/IRIG "C" correlation indicated a drift of approximately 2 milliseconds/hour during the "A" and "B" modes and a discrepancy of approximately 1 second after the clock recycled.

The TLM instrumentation was satisfactory except for the instrument #2 cycle counter which randomly lost counts during the "B" mode operations.

The pressure-make-up system operated normally with an average gas consumption rate of 6.6 psi/min.

Both "A" and "B" recovery sequences were satisfactory. Both instruments stowed properly for the "A" mode C & W operation.

The deactivate/reactivate capability was successfully demonstrated between the "A" and "B" operations. Both instruments stowed normally for the deactivate operation sequence.

3. Panoramic Camera Performance

The dynamic performance of both panoramic instruments was satisfactory as observed on the TLM monitors for Center of Format switch, lens rotation, 99/101 clutch, and film transport.

The average 99/101 percent clutch ratios for both instruments were 6/6. The ratios did not vary by more than one on either side of the average value during the entire test.

The cycle rate data for all of the stereo operations are listed in Table 2-1. Instrument cycle rate predictability was +1.5 percent for the operations near the top of the ramp and +3 percent overall. The instruments operated within +1 percent of each other. During the "A" operations instrument #2 generally ran faster while for the "B" operations the opposite was true.

The supply metering monitor indicated that the lens of both instruments had an abnormally long coast period during a fast operation in the "A" mode.

The instruments operated for 5 cycles during the deactivate sequence. The cycle periods were 6.850 seconds for instrument #1 and 6.740 seconds for the #2 instrument.

4. Stellar/Index Performance

Normal stellar/index operations were observed on TLM monitors

for both units. The shutter and platen events occurred in proper relation to each metering cycle. Index and stellar metering ratios were consistently 7/3 and 8/3 throughout all operations observed with an occasional 6/3.

5. Clock Performance

Several clock readouts during the test were correlated with the IRIG "C" time. The results are listed on Table 2-2.

The results indicated a large discrepancy (approximately 1 sec.) following the clock (S/N 536) recycle. Also a drift of approximately 2 milliseconds per hour was observed. This clock was replaced by clock S/N 535 for flight.

6. Instrumentation Performance

The TLM instrumentation was satisfactory except for (1) the instrument #2 cycle counter which randomly lost counts during the "B" mode operations, and (2) a dirty commutator on the I/R monitor also observed during "B" operations.

The instrument #2 counter lost counts going from the "9" to the "0" position. The counter dropped 102 counts in approximately 2600 cycles.

7. Pressure Make-up System Performance

Satisfactory operation was observed for the PMU unit. The average consumption for the "A" operations was 6.6 psi/min.

8. Temperature Summary

Average instrument temperature for several orbits in the "A" and "B" mode are listed below:

| <u>ORBIT</u> | <u>"A" Mode</u> | | | <u>"B" Mode</u> | | |
|--------------|-----------------|----------|-----------|-----------------|----------|-----------|
| | <u>1</u> | <u>9</u> | <u>14</u> | <u>1</u> | <u>9</u> | <u>14</u> |
| Inst. #1 | 87 | 81 | 73 | 66 | 45 | 58 |
| Inst. #2 | 85 | 74 | 69 | 62 | 42 | 62 |

J-26 176/177 TASC TEST OPERATIONS 7-31 TO 8-9-65

| REV/MODE | RAMP | T.U.R. | INST 176 | | | INST 177 | | | 176/177 DIFF. |
|----------|------|--------|----------|-------|-------|----------|-------|-------|------------------|
| | | | ACT. | NUM. | DEV. | ACT. | NUM. | DEV. | |
| 1 A | 7 7 | 390 | 3.490 | 3.515 | 0.72 | 3.508 | 3.496 | -0.11 | 0.29 |
| 1 A | 7 7 | 2275 | 2.945 | 2.588 | 1.66 | 2.555 | 2.580 | 0.96 | 0.39 |
| 2 A | 4 1 | 2130 | 2.160 | 2.196 | 1.64 | 2.150 | 2.197 | 2.12 | -0.46 |
| 2 A | 5 8 | 725 | 2.850 | 2.884 | 1.17 | 2.850 | 2.872 | 0.75 | -0.00 |
| 3 A | 5 8 | 1550 | 2.400 | 2.445 | 1.85 | 2.400 | 2.439 | 1.62 | -0.00 |
| 4 A | 7 7 | 2280 | 2.550 | 2.591 | 1.57 | 2.550 | 2.583 | 1.26 | -0.00 |
| 4 A | 8 2 | 335 | 5.000 | 5.061 | 1.20 | 4.980 | 5.037 | 1.13 | -0.40 |
| 5 A | 8 2 | 1725 | 2.200 | 2.231 | 1.38 | 2.190 | 2.234 | 1.98 | -0.45 |
| 5 A | 8 2 | 2245 | 2.250 | 2.291 | 1.80 | 2.250 | 2.288 | 1.56 | -0.30 |
| 5 A | 11 1 | 1582 | 2.400 | 2.446 | 1.87 | 2.400 | 2.440 | 1.64 | -0.00 |
| 6 A | 11 1 | 2032 | 2.260 | 2.296 | 1.59 | 2.260 | 2.293 | 1.44 | -0.00 |
| 6 A | 5 8 | 1091 | 2.660 | 2.690 | 1.13 | 2.650 | 2.681 | 1.15 | -0.38 |
| 6 A | 5 8 | 1446 | 2.450 | 2.437 | 1.48 | 2.450 | 2.480 | 1.22 | -0.00 |
| 7 A | 7 7 | 1181 | 2.845 | 2.863 | 0.63 | 2.840 | 2.851 | 0.39 | -0.18 |
| 7 A | 7 7 | 1591 | 2.510 | 2.562 | 2.04 | 2.515 | 2.555 | 1.55 | 0.20 |
| 8 A | 7 7 | 2531 | 2.735 | 2.768 | 1.21 | 2.735 | 2.758 | 0.83 | -0.00 |
| 8 A | 4 1 | 1016 | 2.690 | 2.701 | 0.42 | 2.685 | 2.692 | 0.25 | -0.19 |
| 9 A | 4 1 | 3211 | 3.475 | 3.521 | 1.31 | 3.470 | 3.502 | 0.92 | -0.14 |
| 9 A | 11 1 | 891 | 4.360 | 4.358 | -0.04 | 4.360 | 4.334 | -0.59 | -0.00 |

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TABLE 3-1

| REV/MODE | RAMP | T.U.R. | INST 176 | | | INST 177 | | | 176/177 DIFF. | |
|----------|------|--------|----------|-------|-------|----------|-------|-------|------------------|-------|
| | | | ACT. | NOM. | DEV. | ACT. | NOM. | DEV. | | |
| 10 | A | 11 1 | 1881 | 2.240 | 2.273 | 1.43 | 2.240 | 2.269 | 1.30 | -0.00 |
| 10 | A | 11 1 | 2971 | 4.520 | 4.571 | 1.12 | 4.510 | 4.547 | 0.81 | -0.22 |
| 10 | A | 7 7 | 141 | 3.590 | 3.625 | 0.98 | 3.570 | 3.606 | 0.99 | -0.56 |
| 11 | A | 7 7 | 1911 | 2.450 | 2.490 | 1.59 | 2.450 | 2.483 | 1.33 | -0.00 |
| 11 | A | 7 7 | 2281 | 2.560 | 2.591 | 1.20 | 2.550 | 2.583 | 1.28 | -0.39 |
| 12 | A | 8 2 | 1156 | 2.940 | 2.936 | -0.12 | 2.940 | 2.924 | -0.56 | -0.00 |
| 12 | A | 8 2 | 846 | 3.665 | 3.654 | -0.31 | 3.640 | 3.633 | -0.18 | -0.68 |
| 13 | A | 11 1 | 1978 | 2.263 | 2.279 | 0.72 | 2.250 | 2.276 | 1.16 | -0.57 |
| 14 | A | 11 1 | 3082 | 5.120 | 5.123 | 0.06 | 5.080 | 5.099 | 0.38 | -0.78 |
| 1 | B | 7 7 | 385 | 3.520 | 3.518 | -0.05 | 3.515 | 3.499 | -0.45 | -0.14 |
| 1 | B | 7 7 | 2210 | 2.570 | 2.556 | -0.53 | 2.560 | 2.549 | -0.44 | -0.39 |
| 2 | B | 4 1 | 2130 | 2.170 | 2.196 | 1.19 | 2.177 | 2.197 | 0.89 | 0.32 |
| 2 | B | 5 8 | 732 | 2.860 | 2.880 | 0.70 | 2.870 | 2.868 | -0.07 | 0.35 |
| 3 | B | 5 8 | 1550 | 2.430 | 2.445 | 0.63 | 2.430 | 2.439 | 0.39 | -0.00 |
| 4 | B | 7 7 | 2280 | 2.610 | 2.591 | -0.75 | 2.616 | 2.583 | -1.30 | 0.23 |
| 4 | B | 8 2 | 341 | 5.105 | 5.046 | -1.17 | 5.115 | 5.022 | -1.85 | 0.20 |
| 5 | B | 11 1 | 1460 | 2.636 | 2.613 | -0.89 | 2.646 | 2.604 | -1.60 | 0.38 |
| 5 | B | 11 1 | 2040 | 2.300 | 2.300 | -0.01 | 2.317 | 2.296 | -0.90 | 0.74 |
| 6 | B | 5 8 | 1090 | 2.713 | 2.691 | -0.81 | 2.720 | 2.682 | -1.43 | 0.26 |
| 6 | B | 5 8 | 1445 | 2.497 | 2.487 | -0.39 | 2.507 | 2.481 | -1.06 | 0.40 |
| 7 | B | 7 7 | 1205 | 2.860 | 2.840 | -0.72 | 2.875 | 2.828 | -1.66 | 0.52 |
| 7 | B | 7 7 | 1591 | 2.575 | 2.562 | -0.50 | 2.570 | 2.555 | -0.61 | -0.19 |

TO TABLE 3-1

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| REV/MODE | RAMP | T.U.R. | INST 176 | | | INST 177 | | | 176/177 DIFF. | |
|----------|------|--------|----------|-------|-------|----------|-------|-------|------------------|-------|
| | | | ACT. | NOM. | DEV. | ACT. | NOM. | DEV. | | |
| 8 | B | 7 7 | 2531 | 2.777 | 2.768 | -0.31 | 2.780 | 2.758 | -0.81 | 0.11 |
| 8 | B | 4 1 | 1014 | 2.740 | 2.705 | -1.30 | 2.740 | 2.695 | -1.67 | -0.00 |
| 9 | B | 4 1 | 3211 | 3.545 | 3.521 | -0.67 | 3.550 | 3.502 | -1.36 | 0.14 |
| 9 | B | 11 1 | 891 | 4.430 | 4.358 | -1.65 | 4.440 | 4.334 | -2.44 | 0.23 |
| 10 | B | 11 1 | 1881 | 2.290 | 2.273 | -0.77 | 2.297 | 2.269 | -1.21 | 0.31 |
| 10 | B | 11 1 | 2970 | 4.680 | 4.567 | -2.48 | 4.680 | 4.542 | -3.03 | -0.00 |
| 10 | B | 7 7 | 140 | 3.660 | 3.626 | -0.95 | 3.660 | 3.606 | -1.50 | -0.00 |
| 11 | B | 7 7 | 1910 | 2.503 | 2.490 | -0.54 | 2.507 | 2.483 | -0.96 | 0.16 |
| 11 | B | 7 7 | 2280 | 2.610 | 2.591 | -0.75 | 2.613 | 2.583 | -1.18 | 0.11 |
| 12 | B | 8 2 | 1155 | 2.987 | 2.939 | -1.64 | 2.997 | 2.926 | -2.43 | 0.35 |
| 12 | B | 8 2 | 845 | 3.710 | 3.656 | -1.47 | 3.705 | 3.636 | -1.90 | -0.13 |
| 13 | B | 4 1 | 2630 | 2.425 | 2.404 | -0.88 | 2.430 | 2.399 | -1.31 | 0.21 |
| 13 | B | 11 1 | 1973 | 2.293 | 2.278 | -0.64 | 2.290 | 2.275 | -0.65 | -0.13 |
| 4 | B | 11 1 | 3078 | 5.170 | 5.102 | -1.34 | 5.170 | 5.078 | -1.82 | -0.00 |
| 14 | B | 1 11 | 3680 | 2.290 | 2.283 | -0.31 | 2.287 | 2.280 | -0.32 | -0.13 |

DEV. AND DIFF. ARE IN PERCENT
 THE (-) SIGN INDICATES THAT THE INST IS SLOWER THAN
 PREDICTED OR THAT INST 1 IS SLOWER THAN INST 2

TABLE 2-1

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CLOCK/IRIG "C" CORRELATION

"A" MODE

| Rev. | IRIG "C" TIME | | | CLOCK TIME (Seconds) | ERROR (Seconds) |
|------|---------------|------|-----|-------------------------|--------------------|
| | Day | Hour | Min | | |
| 1 | 212 | 8 | 8 | 409,553.463 | -- |
| 6 | 213 | 9 | 1 | 499,115.468 | + .008 |
| 11 | 213 | 16 | 15 | 526,965.712 | .000 |
| 12 | 214 | 13 | 58 | 66,498.754* | + .986 |
| 14 | 215 | 8 | 39 | 133,762.253 | + .959 |

"B" MODE

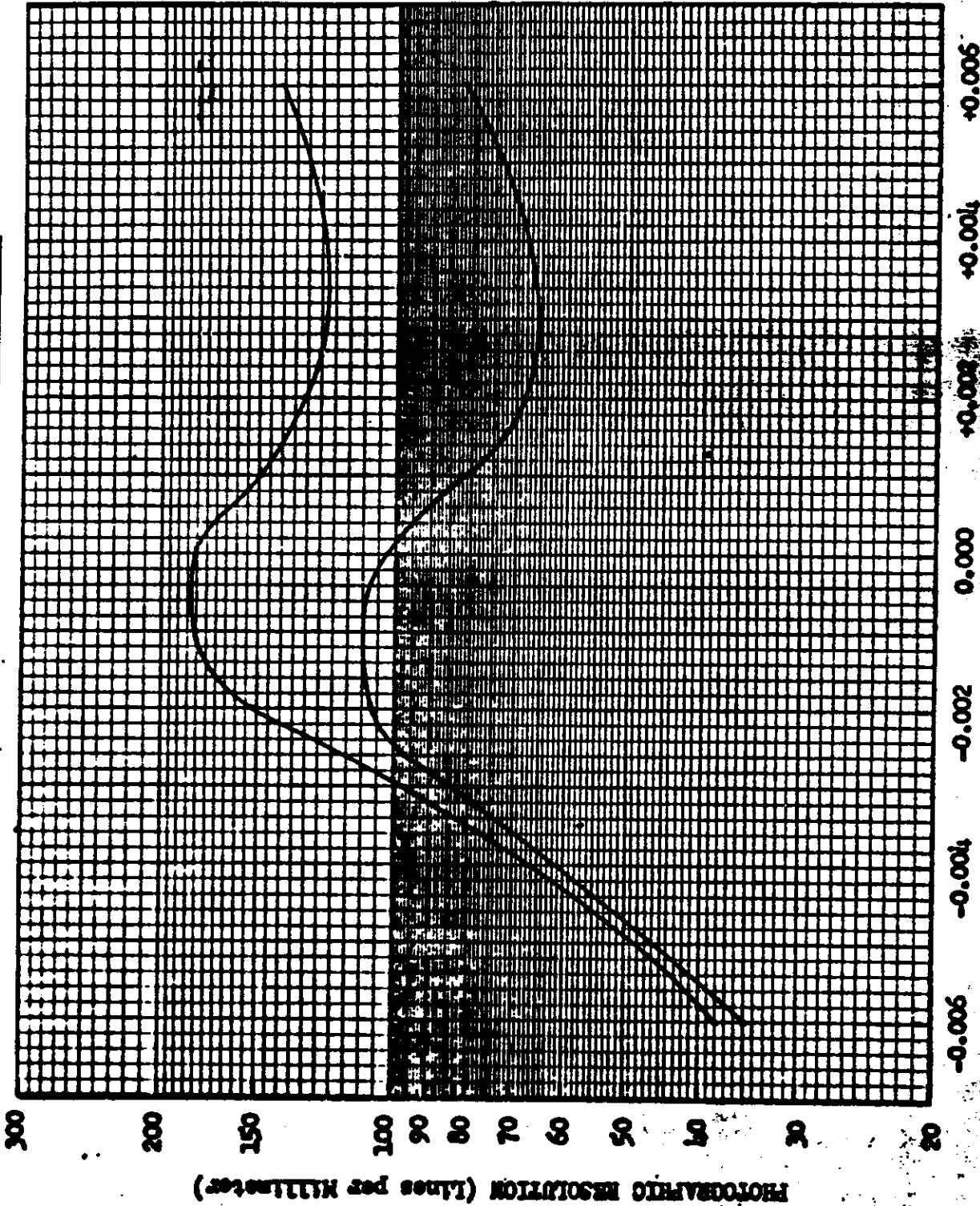
| | | | | | |
|----|-----|----|----|-------------|------|
| 1 | 215 | 12 | 35 | 341,307.323 | |
| 4 | 216 | 8 | 44 | 413,889.975 | .033 |
| 5 | 216 | 11 | 29 | 423,792.795 | .038 |
| 6 | 216 | 12 | 59 | 429,189.866 | .042 |
| 7 | 216 | 14 | 25 | 434,339.943 | .040 |
| 10 | 217 | 8 | 31 | 499,463.001 | .077 |

*Clock recycled between Rev. 11 and 12.

TABLE 2-2

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PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 176

Payload No: J-26

Resolution (1/mm)

High Contrast: 180

Low Contrast: 109

Film Type: 3404

Test Date: 8/11/66

FIGURE 2-1

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