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Control System

2 May 1966

TO: V. Webb
C. Murphy
A. Johnson
[redacted]

THRU: [redacted]

FROM: [redacted]

SUBJECT: MISSION 1022-1 AND 1022-2 FINAL REPORT

Enclosed is the Final Performance Evaluation Report for Mission 1022-1 and 1022-2.

[redacted] Manager
Advanced Projects

IF ENCLOSURES ARE WITHDRAWN OR NOT ATTACHED THE CLASSIFICATION OF THIS DOCUMENT WILL BE CHANGED TO UNCLASSIFIED.

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Control System

CORONA J

PERFORMANCE EVALUATION REPORT

MISSION 1022-1 and 1022-2

FTV 1617; J-22

30 March 1966

Approved: [redacted] Manager
Advanced Projects

Approved: [redacted] Mgr.

FOREWORD

This report details the performance of the payload system during the operational phase of the Program [redacted] Flight Test Vehicle 1617.

Lockheed Missiles and Space Company has the 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 1022-1 and 1022-2 which was launched on 19 July 1965.

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INTRODUCTION

This report presents the final performance evaluation of Missions 1022-1 and 1022-2 of the Corona Program. The purpose of this report is to define the performance characteristics of the J-22 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 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, visual RES 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 1

SYSTEM PERFORMANCE

A. MISSION OBJECTIVES

The payload section of Mission 1022, placed into orbit by Flight Test Vehicle #1617 and LV-2A booster #446, 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-22 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 five day photographic period followed by a four day photographic period possibly separated by a four day deactivate period.

B. MISSION DESCRIPTION

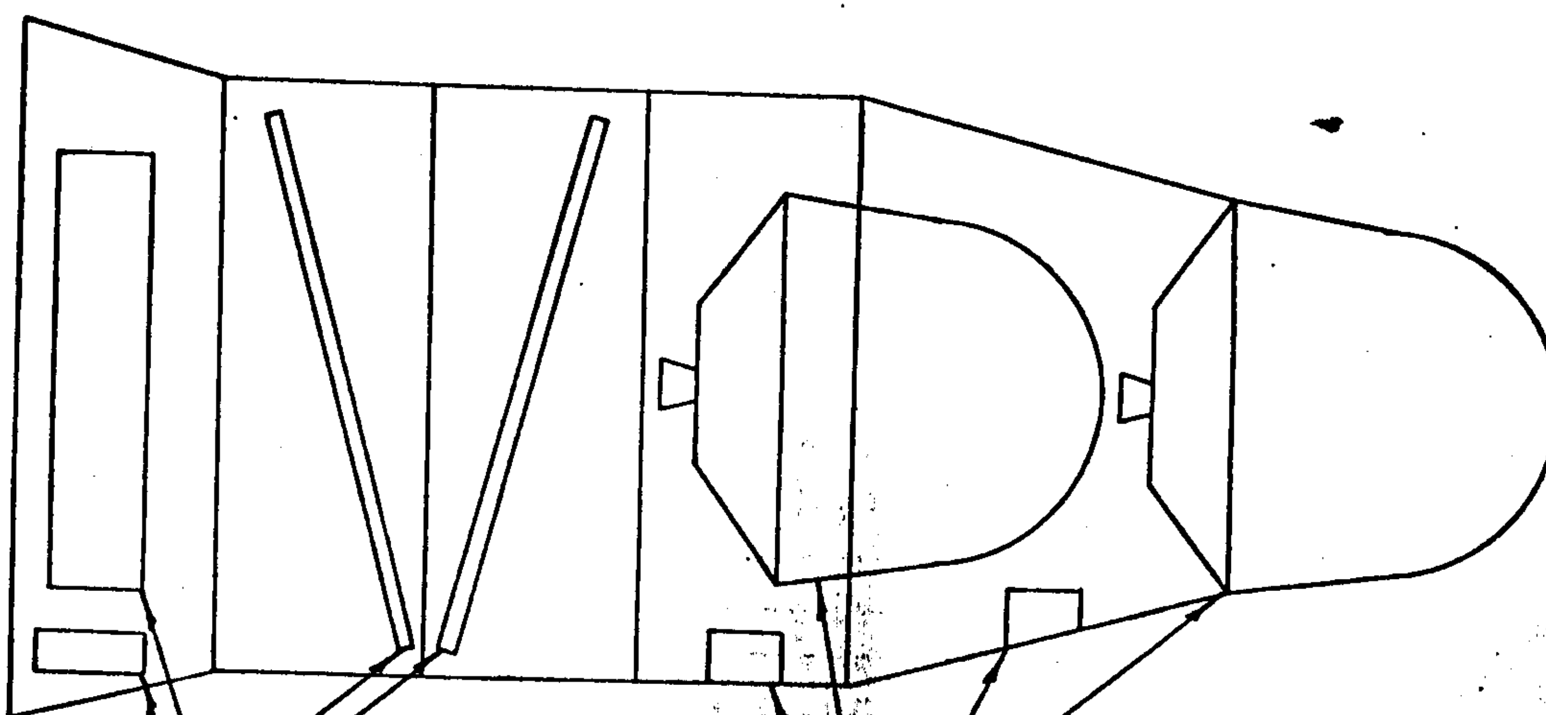
The payload was launched from Vandenberg Air Force Base (VAFB) at 2201:13 Z (3:01:13 PDT) on 19 July 1965. Ascent and injection were normal and the achieved orbit within nominal tolerances. Tracking and command support was effected by the Air Force Satellite Control Facility consisting of tracking and command stations at [redacted] under central control of the Satellite Test Center at Sunnyvale, California. Mission 1022-1 consisted of four days operation and was completed by air recovery on 23 July 1965. Mission 1022-2 followed immediately with no deactivate period and consisted of five days operation and was completed by air recovery on 28 July 1965.

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

ORBITAL PARAMETERS

Parameter	Predicted	Orbit 1 Actuals
Period (Min.)	91.060	91.045
Perigee (N.M.)	99.98	99.12
Apogee (N.M.)	255.24	254.24
Inclination (Deg.)	85.00	85.05
Perigee Latitude (Deg. N.)	21.72	22.52
Eccentricity	0.0214	0.02144

SCHEMATIC INBOARD PROFILE - CORONA J SYSTEM



FIGURE

The vehicle was launched with a V/h ramp, amplitude and start position set up of 8, 3, 6 (RTC 6, 8 and 10 respectively). This setup maintained FMC match at less than 3.5% error. The variation was approximately 0% to 3.5% slow. The ramp level was increased from level 8 to 7 on orbit 21 which resulted in estimated FMC errors of less than ± 2% through the remainder of the flight.

C. PANORAMIC CAMERAS

The Master and Slave panoramic cameras operated throughout both missions with no significant problems and Mission 1022-1 produced good photographic coverage. The cloud cover and atmospheric haze observed in the photography was nominal.

On three engineering passes, a "stereo-suppress" mode of operation was exercised for evaluation purposes. This mode of operation provides sequential starting and stopping of the panoramic cameras to eliminate the mono strips at each end of a stereo operation. Particular attention was directed to system performance on these operations. Specific observations and conclusions are reported in a subsequent section on vehicle attitude.

D. STELLAR-INDEX CAMERAS

The Mission 1022-1 Stellar-Index camera operated properly throughout the mission and produced very high quality photography. The Mission 1022-2 Stellar-Index camera operated properly during the mission except that the center format switch failed to function for 10 cycles during pass D-75.

E. OTHER SUB-SYSTEMS

The clock, pressure make-up, and thermal control sub-systems performed satisfactorily through both missions. The telemetry and command sub-systems performed satisfactorily with the exception that the slave instrument cycle counter randomly missed counts. At one point the counter indicated a gain of approximately 90 counts, but by the next acquisition this error had disappeared.

F. CONCLUSIONS

Missions 1022-1 and 1022-2 achieved the objective of acquiring high quality search and reconnaissance photography from orbital altitudes.

G. SYSTEM IMPROVEMENT STUDIES

The evaluation and analysis of the system performance has resulted in suggesting the following studies:

1. Forebody light leaks should be eliminated either by use of improved paint or a light deflecting chute.

2. Pan instrument light leaks should be determined to be acceptable or corrected. If the correction cannot be made at the pan instrument, partial correction might be made through use of baffles or chutes in exposed areas.

3. The reliability of the new type center of format switch should be reviewed to determine whether the intermittent failures encountered on the slave instrument indicate a need for corrective action.

4. The defects that occur near the ends of the stellar and index films (as well as insufficient supply) should be reviewed for possible corrective action. Possible corrective actions may be limited by cost or reliability considerations with respect to the secondary significance of the subsystem functions.

5. Continue mono overlap reduction experiments to obtain further evidence of vehicle dynamics, gas consumption and overlap.

SECTION 2

PRE-FLIGHT SYSTEMS TESTS

A. ENVIRONMENTAL TESTING

1. Test Objective

As a standard procedure, the J payload systems are subject 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-22 payload system was in the TASC chamber at LMSC, Sunnyvale for environmental test during March 20 through 23, 1965. The test consisted of 1 day operation in the "A" mode; 1 day of soak, and 1 day of operation in the "B" mode. The system during the test was complete with all flight subsystems included.

Results of the operation were generally satisfactory. Cycle rate predictability for the panoramic cameras was within + 1.5% during the "A" mode, but averaged 2% fast during the "B" mode. The higher rates were attributed to the increased environmental temperatures during that portion of the test.

Clock performance was satisfactory. The error observed after 1 day each of "A" and "B" mode operation was -0.001 second and -0.002 second respectively.

Both "A" and "B" recovery sequences indicated satisfactory performance. The instruments stowed properly during the "A" recovery cut and wrap operation. All subsystems responded as expected after a programmed 70°F deactivate soak.

3. Panoramic Camera Performance

Satisfactory instrument operation was observed throughout the test as indicated by the monitoring of such functions as payload transport and clamping, 99/101 clutch operation, lens rotation, and center of format. Instrument operation at start and shut-down was normal, with the exception of an unexplained random current drain at instrument "ON" command.

Evaluation of the test film showed that the tested payload was free of any noticeable corona marking. The J-22 system was recommended for flight.

4. Stellar-Index Camera Performance

Both "A" and "B" mission stellar/index operations were normal, with an average stellar/index ratio of 7 to 3. On several occasions during the "A" mission and on orbit #2 of the "B" mission, the index metering monitor indicated that the index idler contact was chattering. The chattering occurred between platen "down" and platen "up" commands.

5. Instrumentation Performance

During orbit #11 of the "B" mode brush 14 and 27 functions did not respond correctly while operating at a reduced voltage. Problems encountered were V/h delay switch not homing with a Br. 14, and RTC 12 not stepping with a Br. 14; and the V/h delay switch "over-stepping" with a Br. 27 command. Camera cycle rate deviations are shown in Table 2-2.

6. Temperature Environment

The TASC Chamber thermal environment was programmed to simulate the on-orbital temperature environment of the J-22 payload system in flight. Average instrument temperatures during various times throughout the test are tabulated below. There were no evidences of self-heating of the temp sensors from tests conducted during the "A" and "B" soak periods. It is interesting to note that the clock has some inherent heating characteristics while first "Warming Up".

After chamber pump-down it was noticed that thermocouple #20 had completely come off the surface at station zero. Thermocouple #22, it was concluded, had a loose connection to vehicle surface

J-22 168/169 ENVIRONMENTAL TEST CYCLE RATES 03-20-65

REV/MODE		RAMP		T.U.R.	INST 168 ACT.	INST 168 NOM.	INST 168 DEV.	INST 169 ACT.	INST 169 NUM.	INST 169 DEV.	168/169 DIFF.
1	A	7	7	385	3.505	3.516	0.31	3.510	3.520	0.28	0.14
2	A	4	1	2125	2.172	2.166	-0.27	2.162	2.167	0.25	-0.46
3	A	5	8	1550	2.437	2.446	0.37	2.437	2.456	0.77	-0.
4	A	7	7	2275	2.566	2.572	0.22	2.570	2.581	0.41	0.16
4	A	8	2	260	5.350	5.312	-0.72	5.350	5.319	-0.59	-0.
6	A	11	1	2040	2.283	2.291	0.36	2.290	2.302	0.54	0.31
7	A	7	7	1175	2.900	2.879	-0.71	2.890	2.886	-0.13	-0.34
8	A	7	7	2525	2.760	2.746	-0.49	2.740	2.754	0.51	-0.72
9	A	4	1	3206	3.460	3.458	-0.07	3.460	3.462	0.05	-0.
10	A	11	1	1870	2.270	2.272	0.09	2.272	2.283	0.50	0.09
11	A	7	7	1900	2.496	2.479	-0.70	2.500	2.488	-0.47	0.16
13	A	11	1	1975	2.283	2.273	-0.44	2.287	2.284	-0.12	0.18
14	A	11	1	2385	3.990	3.986	-0.10	4.005	3.990	-0.40	0.38
15	A	5	8	1925	2.393	2.377	-0.69	2.400	2.387	-0.54	0.29
16	A	8	2	2550	2.687	2.670	-0.65	2.683	2.678	-0.19	-0.15
1	B	7	7	390	3.540	3.513	-0.77	3.535	3.517	-0.51	-0.14
2	B	4	1	2131	2.175	2.166	-0.39	2.155	2.168	0.59	-0.92
2	B	5	8	830	2.820	2.837	0.60	2.820	2.844	0.85	-0.
3	B	5	8	1650	2.397	2.414	0.69	2.397	2.424	1.11	-0.
4	B	7	7	2281	2.550	2.575	0.96	2.560	2.584	0.92	0.39
4	B	8	2	341	5.070	5.125	1.07	5.080	5.131	0.99	0.20
6	B	11	1	2041	2.240	2.292	2.25	2.250	2.303	2.29	0.45

TABLE 2-2

REV/MODE		RAMP		T.U.R.	INST 168 ACT.	NUM.	DEV.	INST 169 ACT.	NOM.	DEV.	168/169 DIFF.
6	B	5	8	1091	2.640	2.698	2.14	2.660	2.706	1.69	0.76
6	B	5	8	1446	2.440	2.489	1.98	2.450	2.499	1.95	0.41
7	B	7	7	1281	2.730	2.777	1.68	2.750	2.784	1.22	0.73
7	B	7	7	1692	2.480	2.517	1.47	2.490	2.526	1.43	0.40
8	B	7	7	2631	2.770	2.845	2.64	2.790	2.852	2.18	0.72
8	B	4	1	1017	2.660	2.705	1.67	2.680	2.713	1.22	0.75
9	B	4	1	3211	3.390	3.468	2.26	3.400	3.473	2.09	0.29
10	B	11	1	2965	4.500	4.524	0.53	4.520	4.527	0.17	0.44
11	B	7	7	1900	2.500	2.479	-0.86	2.517	2.488	-1.15	0.68

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 2-2
(Cont'd)

which caused intermittent readings. A heat lamp was too close to thermocouple #24 (S/I #1) causing the 144^{o}F temperature. Internal S/I temperature monitors did not substantiate the external recorded temperatures.

TABLE 2-1

Self-Heating Test

	T=0	T=1200	T=5400	ø15A	Deactive	ø1B	ø9B
Inst. #1	75	76	76	65	67	74	93
Inst. #2	78	78	78	64	65	71	92
Supply Spools	82	83	82	57	58	66	83
Clock	72	76	82	63	68	70	85

The noticeable increase in temperature recorded during the "B" mode is due to a beta angle of 53^{o} versus a beta angle of 0^{o} during the "A" mode.

7. Pressure Environment

The J-22 environmental test was conducted with a flight pressure make-up system. Analysis of the pressure make-up system data and correlation with corona performance of the system will be covered in a separate report.

However, preliminary data indicates that the PMU system functioned satisfactorily throughout the test, and that tested payload was corona free. An orbit versus pressure (microns of H_g) is shown as Figure 2-1.

B. RESOLUTION TEST

The dynamic resolution test of the J-22 payload system was performed at the A/P facility on 2 April 1965. Each panoramic camera photographed high and low contrast resolution targets. The resulting through focus resolution data is shown in Figure 2-2 for the Master camera and in Figure 2-3 for the Slave camera.

J-22 TASC TEST PRESSURES

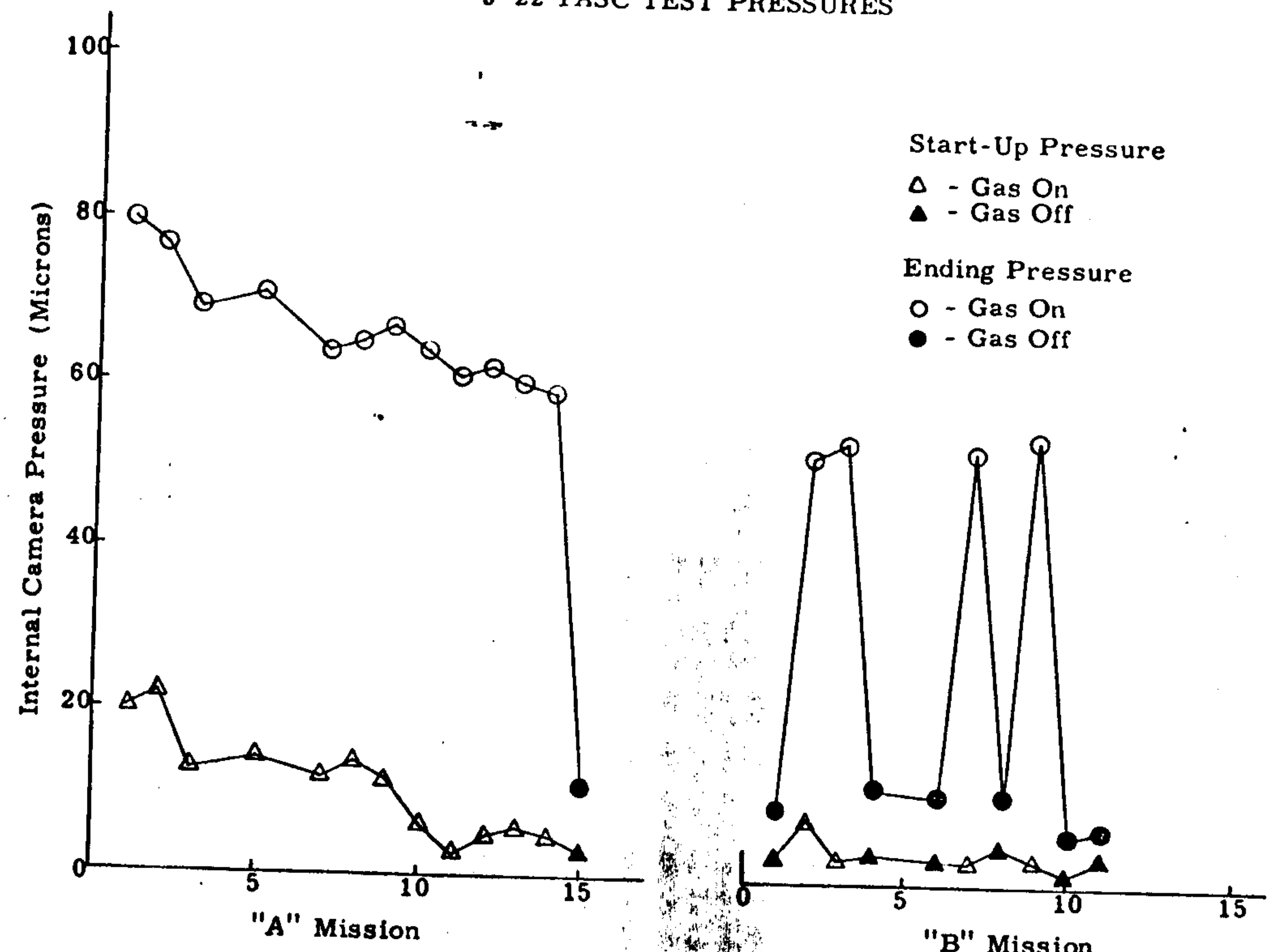
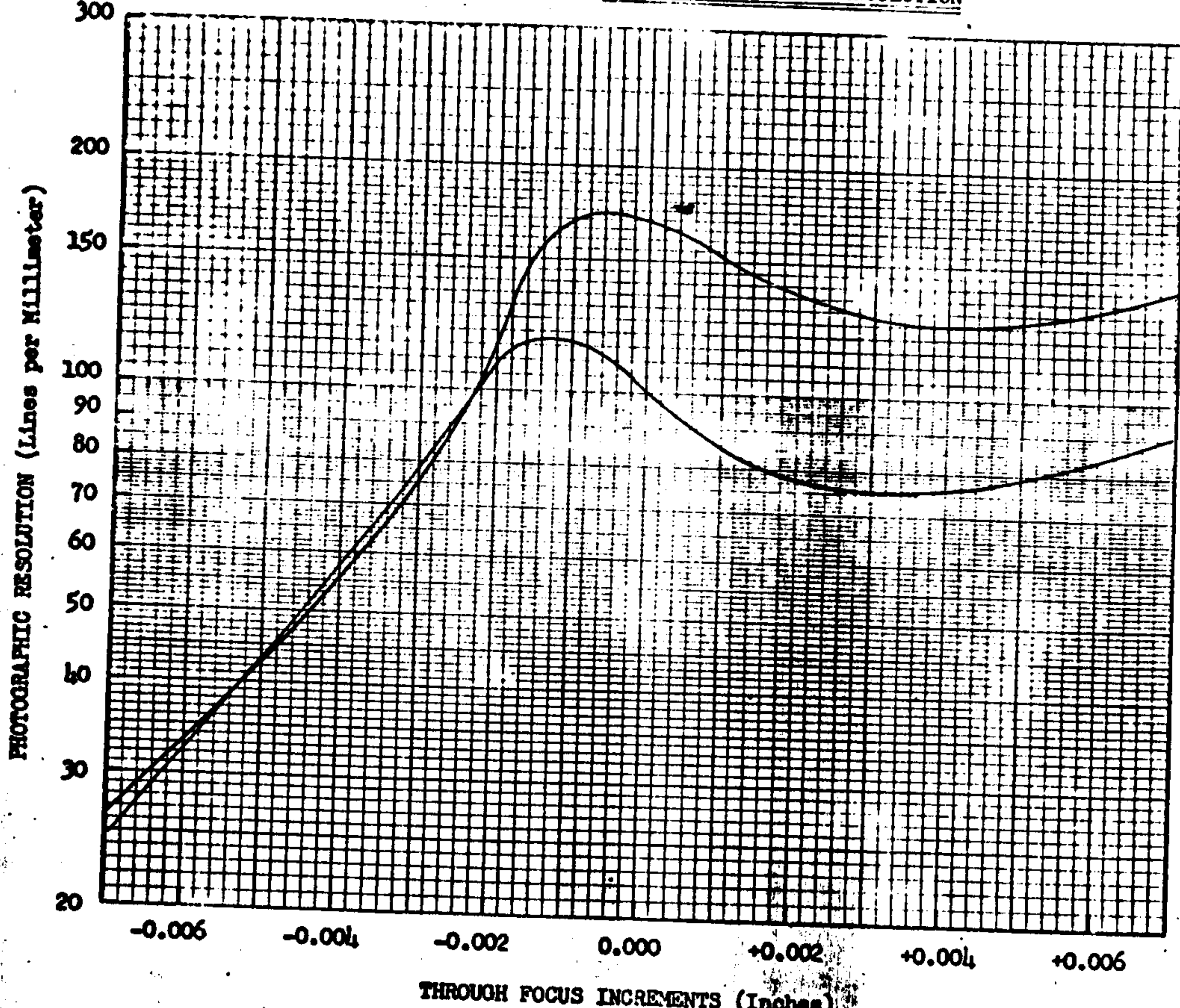


FIGURE 2-1

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 168

Payload No: J-22

Resolution (l/mm)

High Contrast: 171

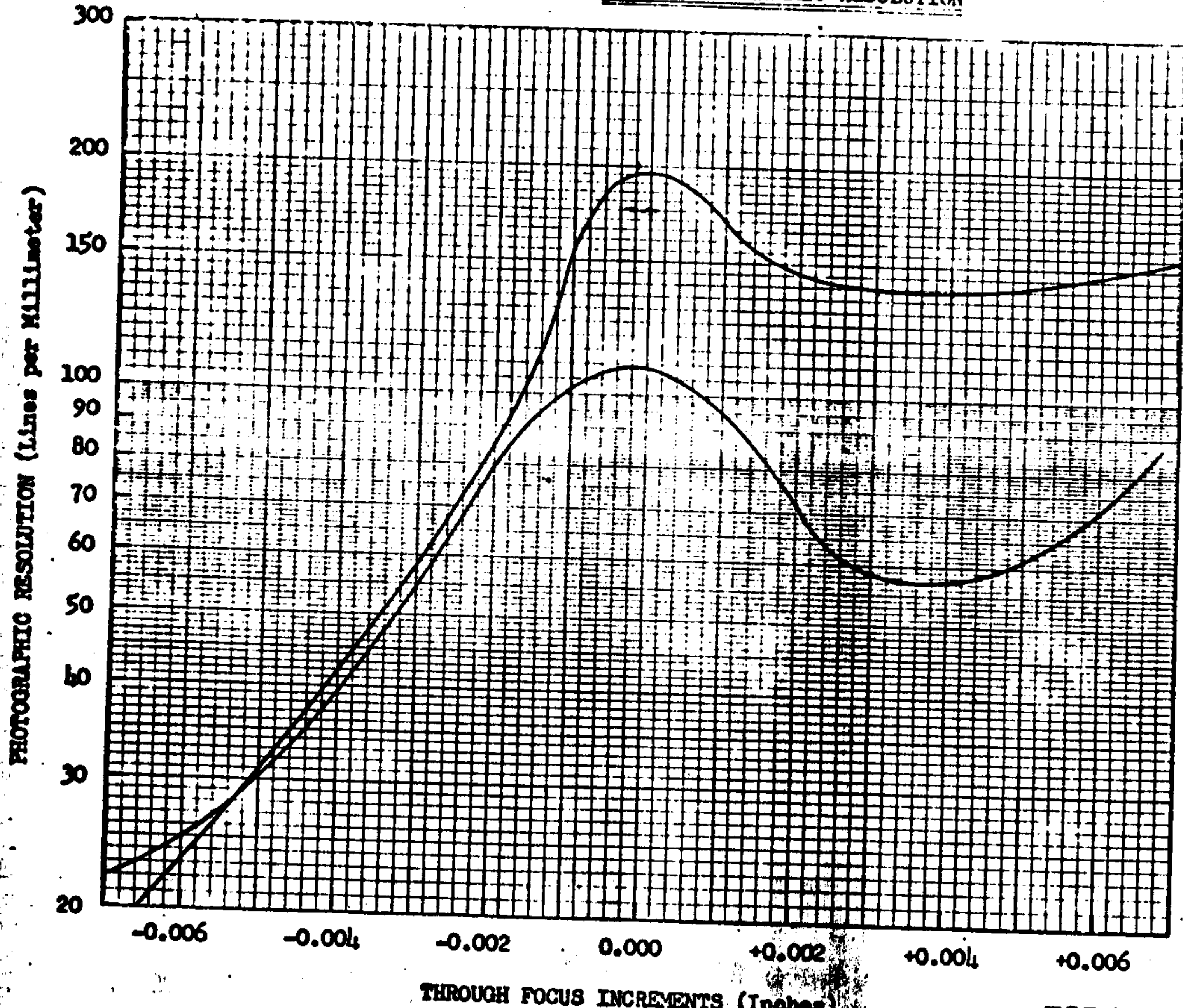
Low Contrast: 117

Film Type: 4404

Test Date: 8 April 196

FIGURE 2-2

PRE-FLIGHT DYNAMIC RESOLUTION



Camera No: 169

Payload No: J-22

Resolution (1/mm)

High Contrast: 196

Low Contrast: 109

Film Type: 4404

Test Date: 2 April 196

FIGURE 2-[illegible]

C. LIGHT LEAK TEST

The examination of the film threaded in the J-22 system during the light leak test determined that all of the fogging considered significant to flight performance resulted from a single light leak region at the drum of the Master Instrument. The felt seals at this location were readjusted, and subsequent examination showed that the leak was reduced to a level considered to be adequate for flight certification of the system.

SECTION 3

FLIGHT OPERATIONS

A. INSTRUMENTATION AND COMMAND PERFORMANCE

The telemetry instrumentation system operated satisfactorily except for the cycle counter for the slave camera. The counter malfunctioned between orbits 131[redacted], 132[redacted] and 133[redacted]. The counter gained approximately 90 counts between orbits 131 and 132 but lost approximately 90 counts between orbits 132 and 133. Similar problems as this (counter counting xx99 to xx00) have occurred in both test and flight but has never corrected itself. Improved cycle counters are scheduled to be installed in J-25 and up.

Normal response was obtained from all stored and real time commands Between orbit 30[redacted]fade and orbit 31[redacted] several unexplained ZEKE commands were experienced. The H-timer motor frequency setting changed causing the timer to be 17.3 seconds ahead of predicted at orbit 31[redacted] This caused one operation to occur early. The timer was then reset at orbit 31[redacted] RFI type noise coupled with slow relay response is considered to have caused the random command generation which caused the timer motor frequency change.

B. PANORAMIC CAMERA PERFORMANCE

Engineering operations were programmed for acquisition over [redacted] Tracking Station during orbits 9, 16, 31, 47, and 63 of Mission 1022-1, and 72, 79, 94, 110 and 126 of Mission 1022-2. Instrument dynamic operation was good on all engineering operations observed.

Instrument operation and payload metering was satisfactory throughout both Mission 1022-1 and 1022-2 as indicated on TLM by the center-of-format, lens rotation, and payload supply, take-up and horizon idler monitors. Start-up and shut-down was normal.

Cycle rate data obtained from the engineering operations indicated that instrument number 1 was running 1.6% to 2.65% slow in the limiter region. Instrument number 2 was running 1.65% to 3.10% slow in this same region. The cycle rate errors were approximately the same for both the -1 and -2 missions.

This indicates that the cycle rate error was not caused by temperature. However, the mag amp, V/h transducer and the V/h programmer temperature could be sensitive to temperature but are not monitored. The instruments operated within 1% of each other on all the engineering operations. Average 99/101 clutch ratios were 6/5 and 6/6 for the master and slave respectively. A summary of the engineering cycle rate data is presented in Table 3-1.

The center format switch S-105 malfunctioned for 10 frames on orbit 75. The H.O. cameras, data block and cycle counter failed to operate as a result.

Film consumption for the flight was as follows:

	Master	Slave
MISSION 1022-1		
Cycles	2967	2943
Feet	8213*	8170*
MISSION 1022-2		
Cycles	2935	2967
Feet	7758	7849

*Includes pre-flight test footage

C. STELLAR-INDEX PERFORMANCE

Both the -1 and -2 stellar/index cameras operated properly during the entire mission. Stellar/index events were observed on all of the engineering operations acquired at [redacted] Metering was normal for both units. The index shutter pulses were indicating properly during all of the daytime engineering operations at [redacted] The -1 index payload was depleted prior to the engineering operation on orbit 63 [redacted] which was the last operation of the -1 mission. The -2 index supply was depleted on orbit 158 engineering operation which was the first stellar/index meter command after the -2 recovery. All S/I events occurred in the proper sequence throughout the flight.

J-22 MISSION 1022 CYCLE RATE SUMMARY-ENGR. OPERATIONS

REV/MODE		RAMP		T.U.R.	INST 168 ACT.	INST 168 ~~NOM.~~ CALIB.	INST 168 DEV.	INST 169 ACT.	INST 169 ~~NOM.~~ CALIB.	INST 169 DEV.	168/169 DIFF.
9	A	8	3	150	5.080	5.091	0.22	5.120	5.097	-0.46	0.79
16	A	8	3	1705	2.310	2.255	-2.46	2.321	2.266	-2.42	0.48
31	A	7	3	1845	2.233	2.200	-1.50	2.254	2.200	-2.45	0.94
47	A	7	3	1815	2.250	2.201	-2.23	2.265	2.201	-2.91	0.67
63	A	7	3	1866	2.236	2.200	-1.65	2.236	2.200	-1.65	-0.
72	B	7	3	365	4.490	4.445	-1.02	4.537	4.448	-2.00	1.05
79	B	7	3	1905	2.240	2.199	-1.85	2.249	2.199	-2.26	0.40
94	B	7	3	2018	2.250	2.201	-2.24	2.250	2.201	-2.24	-0.
110	B	7	3	2142	2.255	2.207	-2.17	2.263	2.207	-2.55	0.35
126	B	7	3	1982	2.258	2.200	-2.65	2.268	2.200	-3.10	0.44

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 3-1

D. CLOCK PERFORMANCE

Satisfactory clock correlation was obtained for both missions. Clock/System time correlation data is contained in Table 3-2. The system time is fitted to a best fit curve of clock versus system times which is represented by a second order equation in this case. The table includes the amounts that the recorded values of system time deviate from the corrected values.

The corrected system time values are computed from the equation -

$y = a_2x^2 + a_1x + a_o$, where y = corrected system time and x = clock time.

E. PRESSURE MAKE-UP SYSTEM PERFORMANCE

The PMU supply consumption vs. camera operate time is plotted in Figure 3-1. The overall average consumption rate was 7.42 PSIA/Minute of camera operate time. The plot of Figure 3-1 indicates that the PMU system is being heated during ascent and requires up to 2 days to dissipate. It is typical for past missions to have the same supply pressure at orbit 9 as the launch pressure. The instruments had been operated 24 minutes prior to orbit 9 and should have depleted 180 PSIA of the gas supply, based on the average flight consumption rate.

F. TEMPERATURE ENVIRONMENT

The temperature data obtained from [redacted] TLM acquisitions are summarized in Tables 3-3, and 3-4. Predicted vs actual flight temperatures are compared in Figures 3-2, 3-3 and 3-4.

The master camera drum temperature and the SRV-1 cassette mount temperatures were higher than predicted but were within the tolerance of 70 ± 30^o.

The clock temperature was lower than predicted at 56 to 58°F. Other temperatures were within the predicted ranges.

G. MONO OVERLAP REDUCTION EXPERIMENT

An experiment was conducted on this mission to verify dynamic operation of the system under simulated mono overlap reduction. To simulate overlap reduction, program 10 (stereo-disable) was used to delay the start up and shut down on one of the cameras. On orbits 1 and 47, only startup overlap was reduced. On orbit 126 the startup and shut down overlap was reduced. Vehicle dynamics, gas consumption and overlap on these experiments are still being analyzed.

TOP SECRET [redacted]

MISSION 1022 PMU SUPPLY PRESSURE

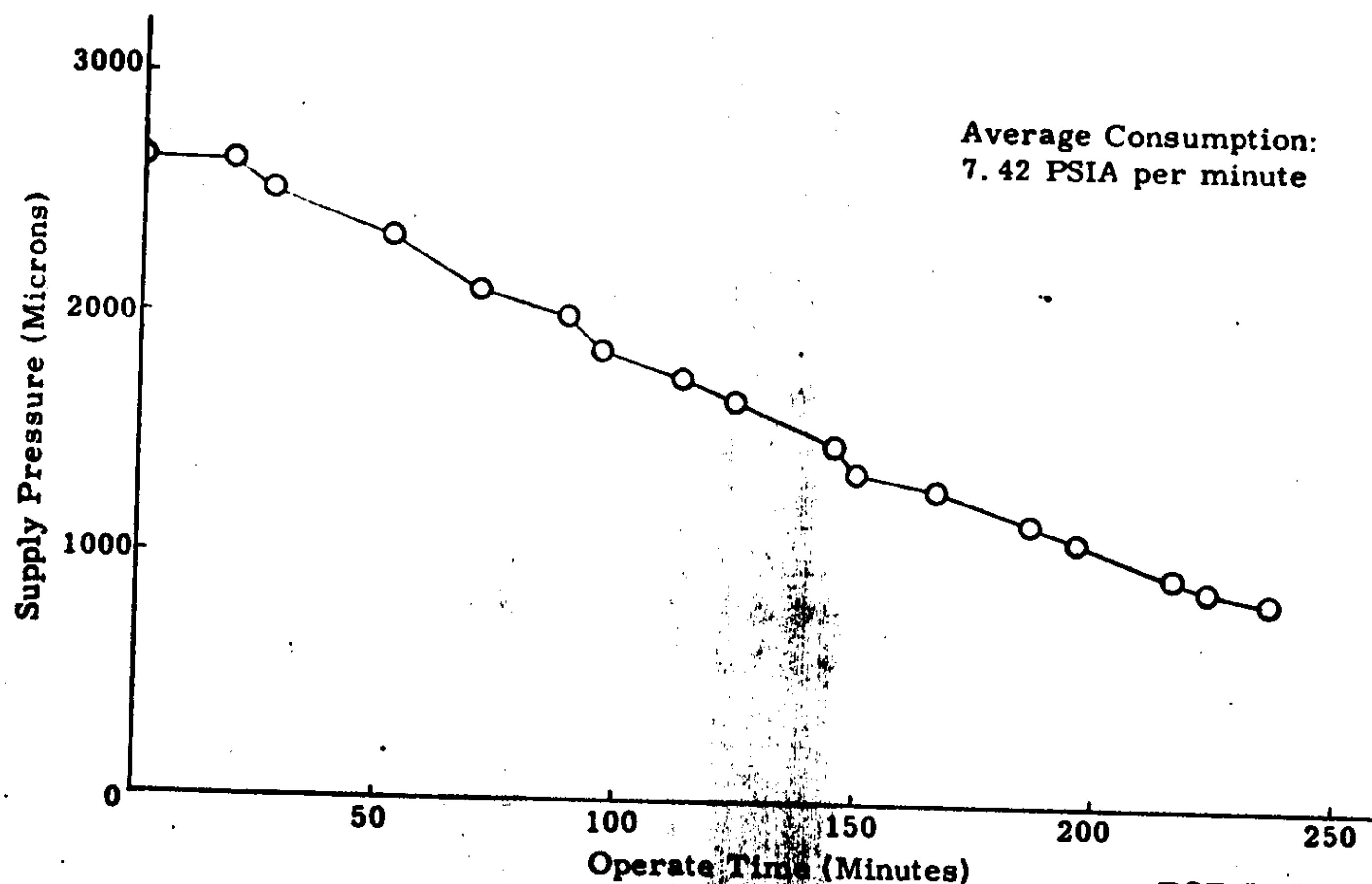


FIGURE 3-1

TOP SECRET [redacted]

CLOCK SUMMARY
PRELIMINARY CLOCK CORRELATION

ORDER FIT 1

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
40717.297	104793.64390	40717.30590	-0.00793	9	1
80485.598	144561.95590	80485.60710	-0.00813	16	1
36239.857	186716.21990	36239.85960	-0.00169	24	1
75995.477	226471.84490	75995.47380	0.00410	31	1
37206.245	274082.62690	37206.24290	0.00303	40	1
76949.312	313825.70790	76949.31310	-0.00018	47	1
32603.139	355879.54190	32603.13570	0.00423	55	1
77801.997	401078.40890	77801.99040	0.00751	63	1
39085.109	448761.53690	39085.10550	0.00445	72	1
78811.371	488487.81490	78811.37270	-0.00077	79	1
34546.657	530623.10890	34546.65530	0.00267	87	1
74347.909	33553.45890	74347.90650	0.00348	94	1
35449.792	81055.35490	35449.78960	0.00337	103	1
75234.395	120839.97690	75234.40080	-0.00483	110	1
36237.947	168243.53390	36237.94490	0.00304	118	1
76013.699	208019.30190	76013.70210	-0.00216	126	1
31735.473	250141.08790	31735.47670	-0.00272	134	1
76816.782	295222.41390	76816.79040	-0.00749	142	1

A0=-0.6407630962D 05 A1= 0.9999997285250 00
SIGMA=0.00449 NO. POINTS= 18
RATIO OF CLOCK TIME TO SYS TIME= 0.100000027147D 01

ORDER FIT 2

SYS TIME I/P	CL TIME I/P	COMP SYS TM	DELTA ST	REV	STA
40717.297	104793.64390	40717.29910	-0.00111	9	1
80485.598	144561.95590	80485.60250	-0.00360	16	1
36239.857	186716.21990	36239.85720	0.00072	24	1
75995.477	226471.84490	75995.47320	0.00478	31	1
37206.245	274082.62690	37206.24400	0.00198	40	1
76949.312	313825.70790	76949.31530	-0.00238	47	1
32603.139	355879.54190	32603.13880	0.00111	55	1
77801.997	401078.40890	77801.99420	0.00371	63	1
39085.109	448761.53690	39085.10960	0.00032	72	1
78811.371	488487.81490	78811.37680	-0.00488	79	1
34546.657	530623.10890	34546.65910	-0.00114	87	1
74347.909	33553.45890	74347.90970	0.00022	94	1
35449.792	81055.35490	35449.79180	0.00113	103	1
75234.395	120839.97690	75234.40190	-0.00593	110	1
36237.947	168243.53390	36237.94430	0.00365	118	1
76013.699	208019.30190	76013.69980	0.00017	126	1
31735.473	250141.08790	31735.47220	0.00171	134	1
76816.782	295222.41390	76816.78340	-0.00046	142	1

A0=-0.6407632371D 05 A1= 0.9999998066970 00
A2=-0.8374618655688D-13
SIGMA=0.00272 NO. POINTS= 18

TABLE 3-2