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I. SUMMARY

This report constitutes a preliminary flight performance evaluation of FTV 1166 Cm 22 and is based on an analysis of available telemetry data. Flight Test Vehicle 1166 consisted of an SLV-2A/GLA combination. The primary payload was reconnaissance camera system Cm 22 consisting of panoramic cameras 110 and 111, stellar index camera D11/11/11, and a long focal length experimental camera serial number P2.

A yaw steering program was utilized for minimizing the yaw component of image motion, primarily for the "P" experiment. A 5-day camera operational mission was programmed.

Launch occurred at VAFB at 5:40 PM PDT on 26 June 1963. Telemetry data indicated abnormally high temperatures in the payload system and a reduced scan rate of one horizon sensor on the vehicle. Analysis of the data resulted in a decision to terminate the mission at the end of the fourth day. The full film supply was expended prior to successful recovery, which was achieved by air catch on orbit 65.

The payload system operation, as determined from telemetry data available at this date, is discussed in the following sections of this report.

II. LAUNCH PERFORMANCE

Ascent into orbit appeared normal in all aspects. The orbit achieved was very near nominal. (Refer to Table I.)

Table I

Orbital Parameters

Parameter	Predicted	Actual
Period (Minutes)	90.61	90.59
Apogee (N.M.)	221	222.5
Perigee (N.M.)	110	110.5
Eccentricity	0.0156	0.0154
Inclination (Degrees)	81.8	81.6
Perigee Latitude (Degrees)	30	30

III. PAYLOAD SYSTEM TELEMETRY AND COMMANDING PERFORMANCE

The telemetry data generally indicated satisfactory operation of the payload system throughout the flight. On orbit 11 a short of approximately 2 kilohms developed in either the commutator or the signal conditioner between the 5-volt calibration circuitry and the hundreds digit of the cycle counter for the slave instrument. For the remainder of the mission, as a result of this short, the calibration points on the payload commutator stepped with the hundreds digit cycle counter of the slave instrument. This caused difficulty in real-time command verification by the tracking stations. However, all real-time commands issued were verified with few complications and little delay. The additional resistance introduced into the cycle counter circuitry resulted in erroneous cycle counts , making film-consumption estimates difficult.

IV. PANORAMIC INSTRUMENT PERFORMANCE

Both panoramic instruments operated throughout the mission. The cycle period variation between instruments was nominal, however on engineering passes monitored by telemetry Both instruments ran from five to seven percent faster than the pre-flight cycle periods. This increase in cycle period was probably due to the high on-orbit temperatures. This high cycle period was first observed on the engineering operation on orbit 25 and amounted to approximately seven percent. An attempt was made to compensate for this increased cycle period by using a lower V/H ramp and an earlier programmer starting time. One engineering operation on orbit 40 was monitored by telemetry after changing to the lower V/H ramp. Data on this operation indicated the desired cycle periods were being achieved within three percent. However, the overall film consumption indicated an increase of approximately 10 percent near the end of the mission. As a result of these data it would appear that on the shorter operations, such as those monitored on telemetry, a V/H error within five percent was achieved, and on longer operational passes, the V/H error increased to approximately 10 percent.

The lens-rotation monitor indicated the lenses stowed on most of the engineering operations monitored on telemetry. However, the coast-down time of the instruments was almost twice as long as has been noted on any previous flight. From an operational standpoint, this causes doubt as to the validity of the data. One operation, a lens stow experiment, was programmed without the V/H programmer being started. The resulting data indicates the lens on the master instrument stopped in a stowed position and the slave instrument lens coasted past the stow position by approximately 25 degrees.

Both panoramic instruments were loaded with SO-132 film and had Wratten 21 (orange) filters with slit widths of 0.200 inch. The horizon optics were set at F6.8 with a 1/100-second exposure time and used Wratten 25 (red) filters.

The payload system was commanded to the off mode between orbits 65 and 72 after capsule separation. An engineering operation had been pre-programmed for orbit 72 and was monitored by telemetry and the master instrument failed to operate. The cause of this failure has not been determined.

V. STELLAR INDEX PERFORMANCE

Stellar index operation appeared normal on all four engineering operations monitored on telemetry.

The index camera was loaded with SO-130 film and had a lens setting of F4.5 with a 1/500-second exposure time. A wratten 21 (orange) filter was used. The stellar camera was loaded with a split roll of SO 102 and SO 130 film. The lens was set at F1.9 with a 2 to 5 second exposure time. No filter was used.

VI. CLOCK PERFORMANCE

The serial output and voltage monitors on the clock indicated satisfactory operation on all engineering operations monitored on telemetry with the accuracy within reading tolerances.

VII. TEMPERATURE ENVIRONMENT

Generally, the temperatures, as derived from telemetry data, indicated the payload system was in the 120° to 130° F range. Enclosure I is a tabulation of the on-orbit temperature data. These data indicate temperatures were approximately 40°F higher than the control objectives.

The thermal control mosaic consisted of white Kemacryl lacquer on vacuum-deposited gold painted for the actual launch date and window. Several possible causes of the high temperature indications are being considered, some of which are:

(1) High absorbanses for the gold or Kemacryl.

(2) Low emissions for the gold or Kemacryl

(3) Loss of adhesive in the Kemacryl

(4) Charring of the Kemacryl

(5) Telemetry data calibration shifts

(6) Self heating in the temperature sensors.

(7) Variations in the excitation voltage.

(8) Space thermal environment variations possibly due to a high albedo coefficient resulting from unusually dense cloud formations.

(9) Internal heat transfer due to decreased emission of the drum and the low specific heat capacity of the drum and scan arm assembly.

On the last mission (1161 - Cm-21), the same basic materials were used for thermal control. The orbital parameters were the same and the difference in initial earth sun angle was less than 4 degrees. Comparing temperatures of the two systems shows 1166 Cm-22 was approximately 35°F warmer. than 1161 - Cm-21, yet the internal gradients were comparable. On this basis it appears that charring or loss of adhesion of the Kemacryl can be discounted, since the internal gradients would be much greater if the paint were lost or charred.

Since a short developed in the instrumentation calibration circuitry it would seem possible that the telemetry system may have shifted calibration.

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However, these high temperatures were noted as early as orbits 2, 8 and 9 before the short in the calibration circuitry occurred. For the remainder of the flight the telemetry data was calibrated by using the plus and minus 28-volt telemetry calibration monitors which directly monitor the excitation voltage to the temperature transducers. Therefore, calibration shifts seem unlikely. Self heating does not seem likely since the temperature sensors are the same on this flight as on previous flights and there has not been evidence of self heating on any other flight. Temperature sensors (both solid state and resistance thermometer types), as installed by Philadelphia, New York, Boston and AP, indicated approximately the same temperatures. Thus, the possibility of gross calibration errors can be discounted.

Data taken at both AP and Boston under uncontrolled environments indicate the scan-arm temperature calibrations used during flight were in error by 5° to 15°F. This error is not compensated for in Enclosure I.

This was the first system to use invar scan arms. Therefore, this could account for some temperature variations, due to different thermal properties. Calibration data from another system with an invar scan arm is being obtained.

Temperature data was recorded during the northern hemisphere portion of each orbit. Automatic processing of most of this data will be impossible due to the loss of the calibration circuitry of the telemetry system. None of these data are available at this time.

VIII. P EXPERIMENT PERFORMANCE

Telemetry data generally indicated satisfactory operation of the "P" system.

During ascent, the door ejection monitor was on a telemetry channel used for vehicle status and precluded observation of a change of state in the monitor at the time of door ejection. The door monitor indicated the door had ejected as programmed per the calibration available. A calibration re-check was made when an input indicated that there was no imagery on the film. At this time it was found that the calibration used for door status was reversed and that telemetry indicated the door did not eject. Two possible causes for the door ejection failure are mechanical binding, due to thermal expansion during ascent, and incorrect ejection squibs. Investigation is continuing to determine the exact cause(s).

Five operations of the "P" system were observed on telemetry, one each on orbits 14, 30, 31, 46 and 47. Telemetry data indicated satisfactory operation of the thermal curtain and modulation of the film velocity (See Enclosure II) during all operations. Enclosure III is a tabulation of the film velocity and exposure times derived from telemetry.

The "P" system temperature sensors indicated 100°F, approximately 20°F lower than the panoramic system. Enclosure IV is a diagram showing the location of the temperature sensors. The differential temperature sensor stepper switch was calibrated at one degree per volt. Enclosure V is a tabulation of the temperatures monitored.

IX YAW STEERING PROGRAMMER PERFORMANCE

A yaw steering programmer to correct for the yaw component of image motion was incorporated in Cm-22. Yaw compensation of ±3.5 degrees was programmed. Telemetry data indicated proper operation of the programmer. Vehicle attitude data is not available at this time for an evaluation of the effect on the vehicle if any. However, a definite control gas consumption was evident.

X RECOVERY SYSTEM PERFORMANCE

An air catch recovery was made on orbit 65 on 6 June 1963. Telemetry data of the recovery events is not available at this time. The recovered capsule was in satisfactory condition and the preliminary data indicates proper performance of the recovery system.

1166 - Cm 22 TEMPERATURE SUMMARY

Temp. Sensor		Orbit												
Master Inst.	Launch	2	8	9	16	24	25	31	32	40	47	48	57	63
2	64	103	112	114	120	122	123	123	121	126	122	123	122	119
4	86	113	111	113	119	118	120	121	119	120	120	120	119	116
5	69	100	110	113	118	120	122	123	120	126	131	122	122	118
6	69	113	120	123	128	130	115	130	130	131	122	130	129	126
7	67	110	115	118	123	125	125	126	124	128	124	126	123	121
11*	131	135	130	131	138	131	139	145	131	140	143	131	139	131
12	74	105	105	105	112	113	114	121	113	118	115	113	114	111
13	60	116	120	123	126	130	129	130	129	131	129	128	128	126
Slave Inst.														
2	62	103	113	115	121	124	125	126	124	128	126	124	124	123
4	69	123	118	118	132	127	127	130	132	128	133	131	126	128
5	69	103	111	113	121	123	124	126	126	128	124	124	124	122
6	64	98	107	110	114	118	118	119	119	120	116	118	118	115
7	64	105	113	115	121	123	123	126	126	126	124	123	122	122
11	110	135	120	128	131	130	131	133	134	131	145	131	132	134
12	74	123	115	118	133	126	124	133	134	128	133	133	124	127
13	64	116	118	120	128	128	128	130	131	131	133	131	128	130
Clock														
1	90	119	115	118	119	120	122	121	120	124	120	120	120	118
2	98	105	104	105	108	109	110	113	109	112	108	108	109	106
Thrust Cone														
1	116	113	109	111	116	116	116	115	132	116	116	117	114	114
2	91	105	97	98	106	103	103	108	108	106	106	106	103	105
Fairing														
1	-	142	119	123	147	130	128	155	144	137	145	144	130	137
2	-	177	119	118	132	128	130	145	136	132	132	132	130	130
3	-	128	113	114	132	123	121	145	132	123	130	132	123	130
4	-	146	125	128	147	130	130	155	146	131	142	142	126	137
Cassette														
2	98	90	69	69	67	69	71	73	73	76	77	75	76	74

* These values may require adjustment based on test history.

ENCLOSURE I

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VANDENBERG

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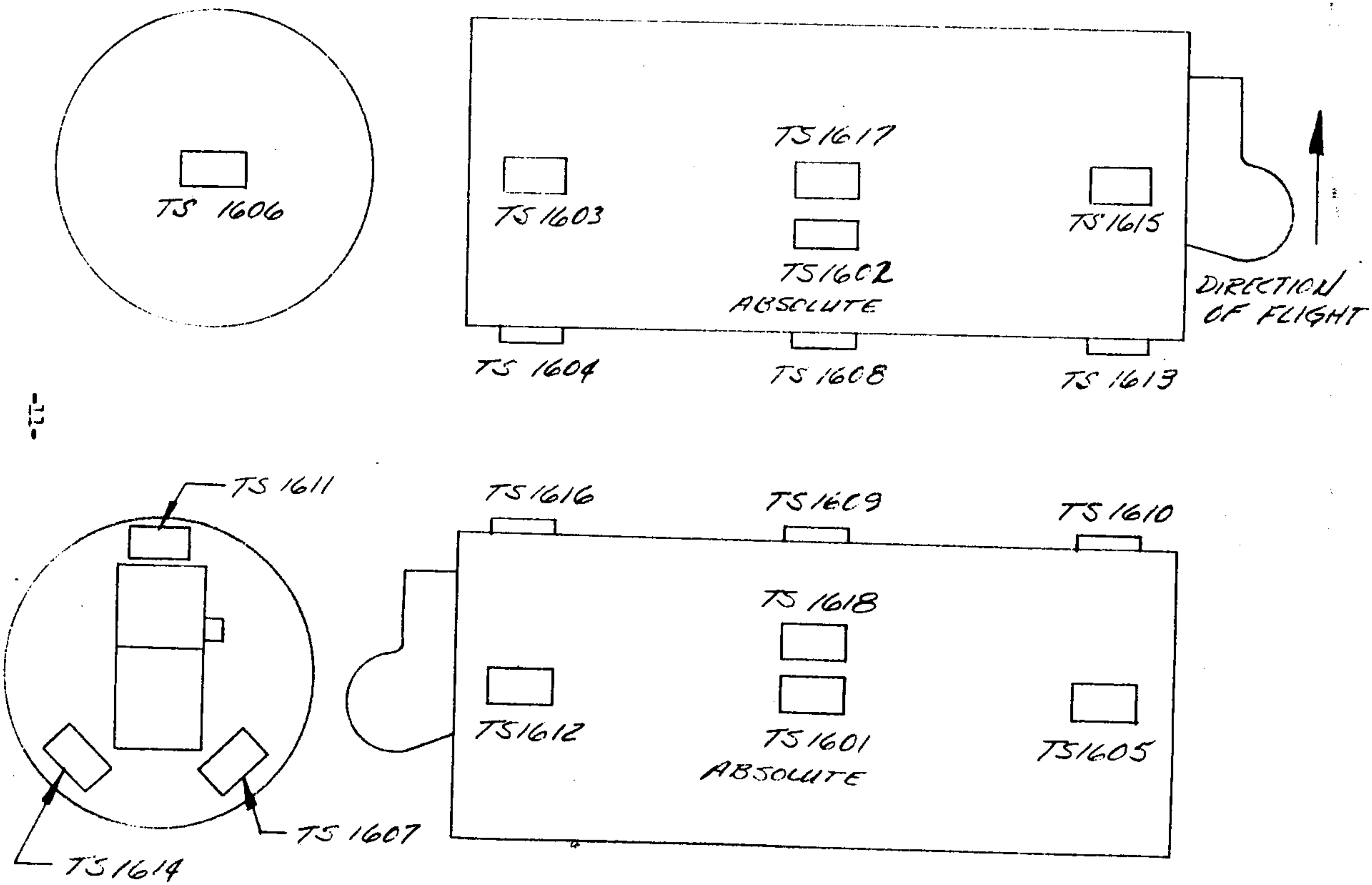
"P" SYSTEM FILM VELOCITIES AND EXPOSURE TIMES

ORBIT	HIGH SPEED		LOW SPEED	
	Film Velocity (IPS)	Exposure Time (MS)	Film Velocity (IPS)	Exposure Time (MS)
14	9.22	8.7	8.35	9.6
15 *	9.3	8.6	7.84	10.2
30	8.49	9.4	7.73	10.3
31	9.3	8.6	7.84	10.2
46 *	8.35	9.6	8.0	10.0
47 **	8.35	9.6	8.0	10.0

* = Estimated values

** = Runout of film monitored on telemetry



P EXPERIMENT TEMP SENSOR LOCATIONS

ENCLOSURE IV

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"F" SYSTEM TEMPERATURE SUMMARY

Temp Sensor		Orbit 14		30		31		46		47	
* 1601		90		100		102.5		100		104	
* 1602			90		100		100		105		106
1603		0	0	1	.6	.8	.5	1.0	--	.2	.45
1604		.1	0	1.2	.8	1.0	.6	1.25	--	.4	.5
1605		.25	.1	1.3	.9	1.0	.7	1.30	--	.4	.6
1606		.9	.8	1.3	1.0	1.1	.9	1.20	--	.35	.5
1607		4.3	4.1	1.75	1.35	1.4	1.2	.85	--	.2	.3
1608		- .5	- .5	- .4	-.7	-.5	- .7	- .45	--	- .32	-.2
1609		1.0	1.0	1.4	1.05	1.2	1.0	1.25	--	.4	.55
1610		0	0	.5	.2	.4	0	.55	--	.1	.25
1611		3.9	3.6	.9	.55	.5	.3	0	--	.1	0
1612		- 2.75	-2.7	-2.5	-2.80	-2.5	-2.7	-2.30	--	-1.1	-1.0
1613		.8	.7	.75	.4	.6	.5	.6	.3	.15	.3
1614		4.1	3.9	1.30	1.00	1.1	.7	.5	.15	.1	.2
1615		.9	.8	.80	.5	.7	.5	.65	.3	.2	.3
1616		1.2	1.0	1.15	.9	1.1	.6	1.0	.7	.4	.45
1617	Reference										
1618	Reference										
1301	(Motor)	95		105		105		106		105	
1201	(Control Box)	95		98		98		100		99	

* = Temperature sensors adjacent to reference temp sensors

All temperatures for sensors 1603 thru 1616 are differential compared against temp sensors 1617 and 1618.

ENCLOSURE V

SECRET