19 October 1962

MEMORANDUM FOR RECORD

SUBJECT: LANYARD System Engineering Meeting

The Lanyard Systems Engineering and Technical Direction Meeting was held 2 October at Newton, Mass. The following agenda items were discussed.

1. Qualification and Acceptance Tests. The qualification and acceptance test specifications for both components and complete camera subsystems are complete and accepted by the government.

a. Component Test. The shock, vibration, and functional tests of the camera components are completed. The high and low temperature and environmental tests are scheduled for completion 12 October.

b. Subsystem Tests. The shock and vibration test including simulated launch and re-entry have been completed. This includes spools, spool drive (with spool) cassette (spool and spool drive) metering drive, film transport (spool, spool drive, takeup and dancers) and optical bar (lens drive, platen, and mirror drive). There was only one failure during the subsystem test which required the addition of a lens lock for launch and store position. Delivery schedule of 22 Nov is still firm.

c. Electrical/Mechanical Structures. The decoder schematic is complete and the mechanical is 50% complete. The roll joint is in parallel with the bread board. All the structures are on schedule. The S/I film path required redesign and 90° rotation. The roll joint is on schedule for first flight, however, some tests are running behind schedule. SE recommended that the acceleration tests for the complete system be deleted. Experience from the [redacted] indicates this test is not productive or conclusive. The static test will be better and give more realistic test results. The instrument acceleration tests are scheduled for the first week in December at the MIT centrifuge at Hanscom AFB.

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Page 1 of 6 Pages
Control No [redacted]

2. Systems Test (Atch 1). At the June SETD, a systems test philosophy established that the camera subsystem would be bought by SE in Boston after a successful demonstration in accordance with the acceptance spec in the DRT at Boston. The 300" colimater located at LMSC was to be returned to Boston for re-work and calibration with the 300" colimater in Boston and then returned for installation at LMSC. The only measurement to be made at LMSC upon delivery of a camera was the position of the platen to assure best focus setting had not shifted. Dynamic resolution test during complete system runs were not planned. LMSC now considers this an unacceptable procedure. It is their position that they need to have the capability on the West Coast to run a complete systems test since technical problems continue to exist all the way up to launch. Duplicate capabilities for dynamic resolution tests are absolutely necessary. The DRT at Boston is not large enough to incorporate the complete system. Therefore, the only complete system test can be done at AP (not in vacuum). This requires moving the DRT optics from the white side of LMSC to the AP facility. The cost is approximately [redacted]

The Itek tests for every camera will be as follows:

a. Strobe Test. This test will give a comparison to the Mann Bench test of the mirror-lens resolution, with the chamber evacuated to measure vacuum focus.

b. Static Test. A D C flash light of 1/300th of a second over the entire platen with a compur shutter.

c. Semi-static Test. The D C flash, scanning drive, shutter, and moving target.

d. Semi-dynamic Test. D C flash, scanning drive, shutter, and moving target.

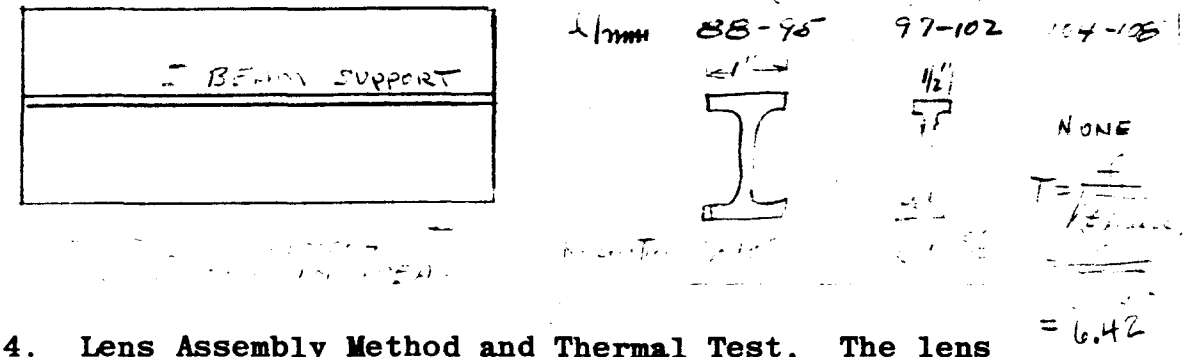
e. Full dynamic including the film transport.

All test results will be set up on a base line of 2:1 contrast ratio. Itek is in favor of all the tests that can be reasonably evaluated. They disagree with the duplicate testing because there will be no way of quantizing the test results. With the above test procedure, Itek believes that by using on the West Coast a 300" colimater (11" aperture whereas LANYARD has 13" aperture) a static on axis test to measure the focal length, not a resolution test, to assure the

focus condition is all that is required. All optical adjustments (platen) will be done in Boston.

SE recommendations are that Itek philosophy is good and should provide a good base line and will provide the government with a good camera when accepted. However, a control test is required and therefore the DRT optics at AP should be approved. A detailed analysis of this recommendation is in the LANYARD technical data file.

3. Door Support Effect on Optics. Because of the large door required for the scan of the LANYARD camera, LMSC requested a test to determine degradation of the system by putting a door support across the opening. A one inch I beam and a one-half inch I beam and no beam was used during the test. The one-half inch I beam showed approximately 10% degradation. It is to be noted that the T stop is reduced by the ratio of areas.



4. Lens Assembly Method and Thermal Test. The lens assembly is a rigid mount press fit system. Plastic shims are used. The barrel is heated to insert the elements then cool and fixed followed by machine to high tolerances. Lead times from glass order are 4 to 6 months for delivery of blanks and 3½ months for lens fabrication. Three complete sets of lenses are ready for delivery. One complete set is in test and the final assembly on the last one is due for completion 30 Nov. Thermal tests of the complete lens assembly are then run in accordance with the following diagram to determine focus and nodel point shift.

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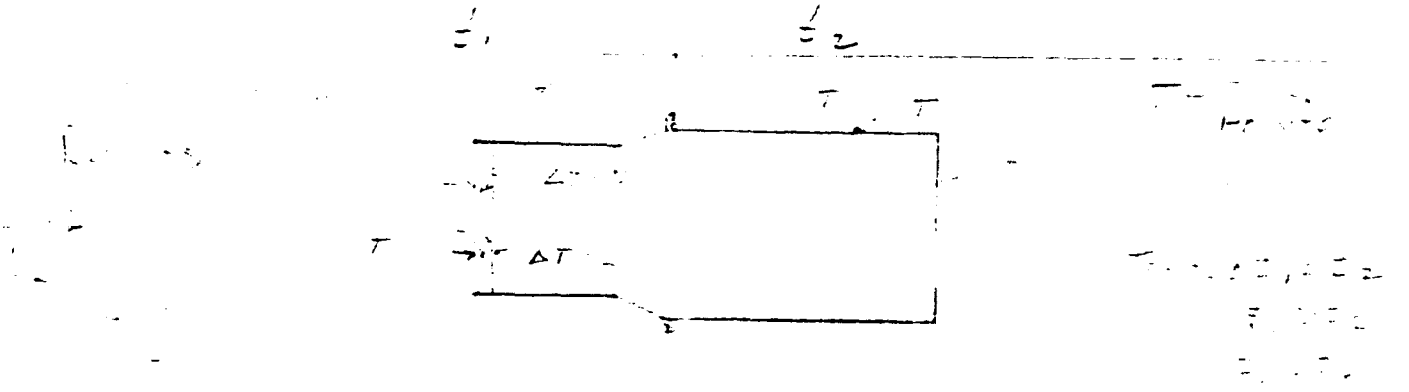


5. Data Lamp Failure Study. The completed study resulted in the verification that the data block reader is very sensitive to small changes in density and that the current system is compatible with the data block reader at SPPL.

6. Weight Summary. The current weight summary is attached. The Itek weight is based on 90% actuals with a weight of cassettes, 14 lbs., pan system, 601 lbs., S/I 19 lbs, total 634 lbs. This includes 10 lbs. contingency and 6 lbs ballast. At a 110 n.m. circular orbit, current weight indicates that a subsatellite can be carried and still have a 1.2 lbs. margin.

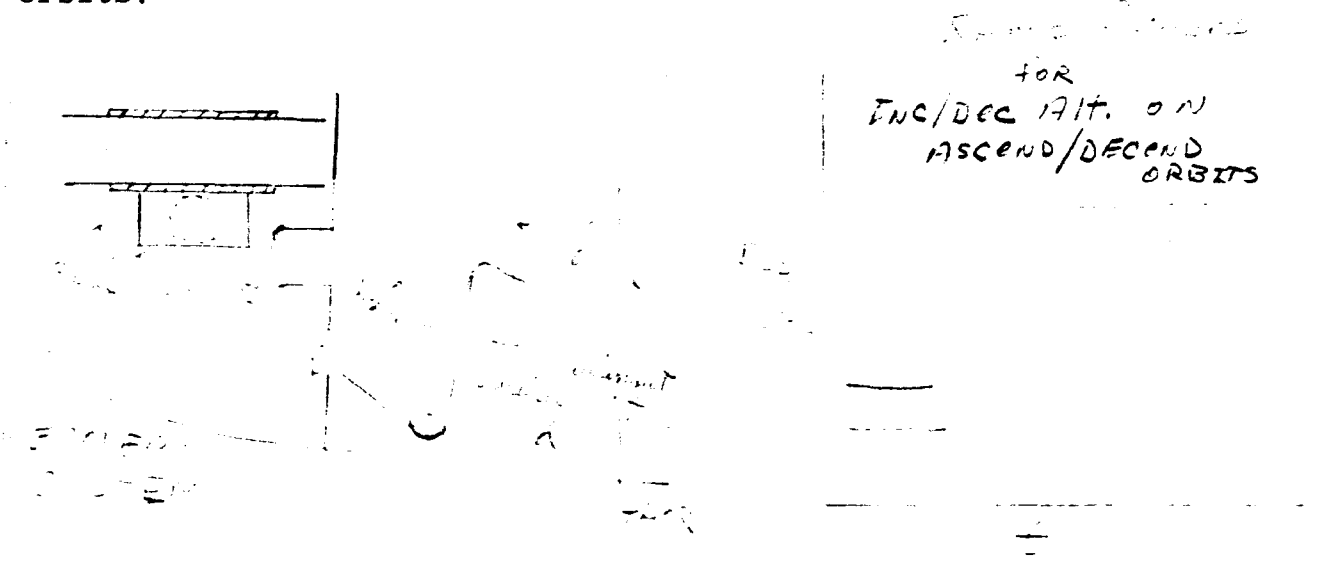
7. Radio Frequency Interference (RFI). The program office is being pressured to assure compliance with Mil-Spec with regard to RFI. The AGENA D suppression level is adequate since it is bought through the standard procedure. However, the payload has not been required to meet the Mil-Spec Requirements. The RFI at the check out complex is creating an ever increasing problem. PMR has notified SSD that [redacted] must comply because of interference. The current payload is a million times out of spec. In addition, the payload is causing interference with the [redacted] payloads. Itek was enjoined to provide to the greatest extent possible bonding, suppression features, and interference filters on motors, diodes to remove noise from inductance loads, and better shieldings from ground to basic airframe.

8. Self-Induced Vibration. Itek was requested to make a study of the self-induced vibration and the degradation to the final resolutions caused by these vibrations. Itek reported

[redacted]

that essentially all of the vibration generating components from the old E5 program have been removed. Movement of the optical bar during operation should be small since the body is essentially rigid and well within vehicle guidance and stability capability.

9. TD's. The most serious problem has to do with the S/I film path and the requirement or desire for increased S/I film capacity. A technical solution to the film path has been determined in that one additional roller is required to get from the camera into the cassette through the water seal. No technical solution has been determined with regard to the increased capacity since an interference exists between the battery fill stem (5/16 of an inch) with S/I take-up cassette. The other pressing TD is the requirement to modify the V/H ramps to provide increased/decreased capability. This is required in order to provide the capability to shift perigee to specific targets and to take pictures on both decrease and increase in altitude on descending and ascending orbits.



10. Schedule. The flight sequence by instrument serial number is 3, 4, 5, 2, 1. The recovery systems are on schedule. Pan unit number 3 (S/M 12) on schedule for delivery 22 November and the remaining four on a one per month subsequent to 22 November. With regard to the three additional payloads, the longest lead time item is the glass. With a

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Page 5 of 6 Pages.
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15 October go ahead, lens could be available by 1 July provided no new plates (manufacturing calibration) are required. If new plates are required, an additional three months will be needed. LMSC indicated a three-month gap in flight schedule with a delivery of 1 July. However, if we use lens S/N 07 (lens assembled by P&E on old E5 program) and the available glass blanks (no allowance for mistakes) and reorder glass by 15 October, one per month flight schedule carry on from current schedule may be maintained. Itek will attempt to shorten lead time on glass with Shott in order to maintain the schedule without use of S/N 07 (currently being used in thermal test). 07 is tentatively allocated to [redacted] for [redacted] next June.

Itek gave the film characteristics from the test that they had run on SO 206. Test results show that SO 206 is approximately 10 l/mm better than SO 130 and that 206 is 4 times faster. CCB requested that Itek make similar measurements on the Mann Bench of SO 206 versus SO 132 and report at the next meeting, which is scheduled for 6 November.

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Lt Col, USAF
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1. Tech Justification
2. Weight Summary
3. L Status

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Page 6 of 6 Pages.

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LANYARD STATUS AND CAPABILITY

1. FLIGHT RESULTS

The only LANYARD flight results are from Mission 8003 which was launched 31 July 1963 and recovered 2 August 1963.

The camera stopped on Orbit 22 due to a short or open in the tachnometer wires which allowed the metering servo to overspeed and jam. Examination of other tachometers revealed a sharp edge which was considered to be the cause of the wire breakage.

The system resolution was approximately a factor of two lower than predicted from preflight ground tests. Four to five foot ground resolution was predicted. There was also a sudden drop in performance observed on Rev 9 which could have been a structural element suddenly relieving itself. The low performance was attributed to out of tolerance temperatures which caused structural deformations and focus shifts.

2. STATUS AND TEST RESULTS

There are five complete LANYARD payloads available for flight, two at LMSC and three at the CIA Storage Facility on the West Coast. The two at LMSC are being used for state-of-the-art evaluation tests by ITEK and the three at the Storage Facility are in sealed containers.

SYSTEM NR	LOCATION OF TEST	LINES/MM	CONTRAST	REMARKS
L-4	Boston	106	3.3:1	1/200 sec exposure time all others at 1/400sec.
	Palo Alto	111	3.5:1	
L-5	Palo Alto	99	3.5:1	
L-6	Palo Alto	105	3.5:1	
L-7	Palo Alto	115	3.5:1	
		100	1.9:1	
L-8	Boston	89	3.3:1	

(This would indicate an average ground resolution of 3.5ft from 100 miles.)

Five of the recent CORONA systems performed as follows during their acceptance tests:

MSN NR	TEST LOCATION	LINES/MM (Fwd/Aft)	CONTRAST	REMARKS
1005	Boston	127/131	2.34:1	60"collimators
	Palo Alto	105/113	2.09:1	
1006	Boston	129/129	2.34:1	
	Palo Alto	109/106	2.09:1	
1007	Boston	126/123	2.34:1	
	Palo Alto	105/110	2.09:1	
1008	Boston	131/127	2.34:1	
	Palo Alto	112/113	2.09:1	
1009	Boston	131/133	2.34:1	
	Palo Alto	102/110	2.09:1	

(This would indicate an average ground resolution of 8.5 feet from 100 miles.)

The LANYARD tests were conducted with different test equipment, different collimators and different targets; however, it is felt that the tests on both systems accomplished at Palo Alto are nearly comparable and that the variations, if any, due to the different procedures are small.

[redacted]

3. PREVIOUSLY SUBMITTED PROPOSALS.

ITEK has previously proposed two modifications to insure that thermal distortions do not degrade the photography. The first proposal was to install heated magnesium rods with thermostatic controls to compensate for platten-lens distance shifts due to temperature variations. The second proposal was to stow the mirror horizontally to minimize temperature gradients across it.

4. First flight with an unmodified payload can be sixteen weeks from go-ahead. Additional flights at one per month are possible. Costs would be approximately [redacted]

If the magnesium rods and mirror stowage modification is accomplished [redacted] estimates that the first flight would be in six months and the cost would be [redacted]