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19 May 1967

TO: C. Murphy

FROM: [redacted]

SUBJECT: CORONA J-3 PAYLOAD SYSTEM ENGINEERING EVALUATIONS

REF: [redacted]

1. A series of Payload System Engineering Evaluations have been approved for the first four J-3 Corona Missions. These payloads have been instrumented for R & D purposes, and test data are being recorded via special T/M link, on film and on a recoverable tape recorder. Engineering materials gathered from these evaluations will be analyzed by the government and contractor teams as appropriate. Briefings on the evaluations have been provided to the NRO, the SOC, and NPIC in recent months. Although the detailed operations and analysis plans have not been completed, the basic engineering plan has been established. This memo is provided to furnish you and your staff with a ready reference for the J-3 Payload Capability Evaluation Program. The memo has been updated to be current as of this date.

A. Systems CR-3, CR-4, and CR-5 will be equipped with nod to scan encoders for in-flight verification of the nod to scan calibration. Nod to scan calibration is a part of the pan geometry calibration of the J-3 system. The data from the nod shaft encoder is being recorded on the flight film through use of a xenon flash tube and fiber optics. The in-flight calibration will be compared with the pre-flight nod shaft calibration furnished in our calibration report. It is anticipated that the validity of the pre-flight nod to scan calibration can be established through these flights, and that in-flight calibration will not be necessary on payload systems CR-6 and subsequent.

B. Payload vibration data are being recorded on flights CR-1 through CR-4 for purposes of verifying qualification levels and error budget analyses. The vibration data will be transmitted over a special Agena T/M link which has been made available on these flights. Ascent vibration data is being recorded on payloads CR-1 and CR-2 in order that we may verify the CORONA Program environmental qualification criteria for the J-3 payloads. On-orbit vibration data will be recorded on payloads CR-3 and CR-4 to provide data for use in the analysis of the camera system error budget. Elimination of camera vibration was one of the major goals of the J-3 design at Itek.

C. System time, special payload temperature measurements, slit and filter position recordings, vehicle gas jet

monitors, and instrument status monitors are being recorded during instrument "operates" by means of an SRV tape recorder. The time words for both forward and aft cameras will be provided to NPIC in advance of film arrival. This provides for these first four systems an independent time correlation source, and will prevent any possible delays which could arise because of the technical interface problems in the introduction of the new silicon light pulser data block and data block reader. A requirement for advance delivery of time and attitude data has been expressed by NPIC for new programs and this CORONA Engineering Evaluation will allow us to test a technique which has potential in meeting the NPIC requirement. The temperature data and vehicle gas jet monitors will provide inputs both for the PG analysis and the camera performance evaluations. The slit and filter recordings and instrument status monitors are primarily intended as systems engineering diagnostic analysis tools. The SRV tapes will be formatted at AP following recovery and will be made available to the appropriate analysis groups.

D. A post flight engineering evaluation on redesigned SRV subsystems will be conducted on CR-1 and CR-2. Capsules from these flights will be returned directly to AP for defilming in order to facilitate the life sensitive testing. Special reset boxes and instructions for the VJ series SRV's will be provided to the recovery forces.

E. Instrument performance evaluations will be conducted on the CR-1 through CR-4 flights using both Brainstorm targets and Corn targets as analysis references. Evaluations will be made at the camera contractors and at Eastman Kodak. The latter will be tasked to do work in edge-gradient analysis as a part of our evaluation of this technique for its application to future systems. We hope, with the CORONA tests, to verify J-3 system error budgets, to compare J-1 and J-3 results, and to establish a baseline for work with future systems. The phase-in of the improved Petzval lens with CR-4 will allow flight verification of its perdicted performance inprovement.

F. The system exposure control device will be tested as a part of the CR-1 through CR-4 engineering evaluations, but will be programmed primarily in the latter stages of the mission. The material/filter tests are being varied on each flight in order that the full capabilities can be examined and analyzed by the end of the CR-4 mission.

PAYLOAD (launch date)	CAMERA	FILM TYPE	(Footage)	FILTER Primary	Alternate
(1) CR-1 (July/Aug 67)	FWD looking	3404	(16,000)	W/23A	W/25
	AFT looking	3404	(16,000)	W/21	W/23A

The CR-1 flight will be used primarily to demonstrate the basic capability and performance of the J-3 payload and the reliability and operational control of the J-3 exposure control device. As programmed in CR-1 the exposure control device will provide data not heretofore available on the operational effects of filtration on target contrast and imagery information content. The filter optimization study will be continued on CR-2 and CR-3 flights with the goal to optimize our filter selection on a scientific and emperical basis, and to provide to the Satellite Operations Center flexibility in using filtration as a function of solar angle weather predictions, and operational requirements.

PAYLOAD (Launch Date)	CAMERA	FILM TYPE	(Footage)	FILTER Primary	Alternate
(2) CR-2 (OCT/NOV 67)	FWD looking	3404	(15,000)	W/25	I.S.F.
		S0230	(1,000)	W/25	I.S.F.
	AFT looking	3404	(14,500)	W/21	W/57
		S0230	(1,500)	W/21	W/57

The evaluation programmed for CR-2 involves use of a new higher speed, high resolution black and white film which is being marketed by Eastman Kodak (S0230). If the resolution of this film approaches that of 3404, the operational photography of both the J-1 and J-3 systems can possibly be improved through its use. Laboratory testing of S0230 at both Eastman Kodak and Itek, and flight testing of S0230 in aircraft systems will precede the CR-2 flight. The AFT looking camera filter device on CR-2 will be programmed for an evaluation of additive bi-color photography, i.e., the reproduction of color imagery through the proper filtration and reconstitution of the color from the black and white negatives (see EKIT Test Plan 2). If additive bi-color reproduction with the CORONA panoramic camera proves successful, color photography for the photointerpreter can be selectively produced on J-3 without special film loading, and without loss in resolution. The forward looking camera filter device will be used during a different portion of the mission for a continuation of the filter optimization study. The forward looking camera alternate filter is planned to be the Itek Special Filter (I.S.F.). This special filter peaks between the frequency range of 5700 to 6900 angstroms.

PAYLOAD (Launch Date)	CAMERA	FILM TYPE	(Footage)	FILTER Primary	Alternate
(3) CR-3 (FEB 68)	FWD looking	3404	(15,000)	W/25	Polarizer (HN-38)
		S0380	(1,500)	W/25	
	AFT looking	3404	(15,000)	W/21	Polarizer (HN-38)
		S0380	(1,500)	W/21	

S0380 is 3404 emulsion on ultra thin base (UTB). One of the design goals of the J-3 Program was to develop a system capable of handling UTB. Incorporation of UTB will provide a 50% increase in available film footage, and as such should be accomplished as soon as possible consistent with program reliability. By the flight of CR-3, we believe will have sufficient ground test data to warrant a flight test with UTB. In addition to the UTB flight test, CR-3 will be used to examine the effects of the use of polarizers on satellite photography. Of particular importance are the possible improvements in photography at low solar elevations, such as are experienced in mid winter at the extreme northern latitudes. Test results on the EKIT Program (EKIT Test 10) have indicated no discernable loss in resolution through use of polarizers. The forward and aft camera polarizers will be tested both independently and together.

PAYLOAD (Launch Date)	CAMERA	FILM TYPE	(Footage)	FILTER
(4) CR-4 (May 68)	FWD looking	3404	(14,000)	W/23A
		S0180	(1,600)	W/15+W/96 (1.0)
	AFT looking	3404	(15,300)	W/21
		S0340	(400)	NONE

CR-4 is to be the first engineering demonstration of the automatic split material change capability of the J-3 system. A small amount (1600 ft.) of S0180 will be spliced on to the end of roll # 1 and about one-quarter of that amount of S0340 will be provided on the end of roll # 2. Changes in filters will be programmed automatically. S0180 is the near infrared color film, commonly called camouflage detection film. Work has been carried out with this film in the past several years in attempting to develop techniques which will enable estimates of crop yield to be made from satellite photography. Other potential use of S0180 appears to exist in industrial and military applications, particularly as related to Communist China. S0180's suitability in the CORONA satellite application requires flight verification, and the May time period appears suited for not only the technical but also the analytical evaluation. A detailed post flight report on the use of S0180 in CR-4 will be prepared by the government and contractor community.

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Night photography experiments with military reconnaissance systems have been carried out in the past. Several additional experiments are planned. Work related to CORONA night photography was conducted under the EKIT Program and is summarized in EKIT Report # 6. A flight verification of the ability of the CORONA camera to handle very high speed films will be made by flying approximately 400 feet of SO340 at the tag end of the AFT looking camera. In addition to the night photography analysis, the SO340 will be used to perform a detailed in-flight system light leak engineering evaluation. The night photography will be primarily mono since in imagery analysis it is used comparatively with day materials.

2. The final test and analysis plan for each of the four CR flight systems will be distributed at R-9 day when the system is released for flight preparations. This detailed test and analysis plan will delineate responsibilities for analysis and provide direction for distribution of test material.

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DISTRIBUTION:

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