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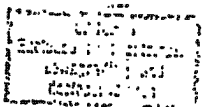
MEMORANDUM FOR: Director, CIA Reconnaissance Programs

SUBJECT : OSP's NRO Quarterly Report on NRP
Satellite Systems

Attached for your consolidation into an overall CIA Reconnaissance Report is OSP's NRO Quarterly Progress Report. Two additional copies are attached for Dr. McLucas and General Berg, and one copy each of CORONA and HEXAGON is attached for forwarding to SAFSP.

John J. Crowley
JOHN J. CROWLEY
Director of Special Projects

Attachments: a/s



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SUBJECT: OSP's NRO Quarterly Report on NRP Satellite Systems

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QUARTERLY PROGRESS REPORT

SATELLITE SYSTEMS

1 July 1969 through 30 September 1969

I. CORONA PROGRAM

A. J-1 System Status

1. Mission 1052 (J-46): The last J-1 payload was successfully launched 22 September 1969. Originally scheduled for 17 September, the launch date was slipped due to problems in the vehicle command box and booster hydraulic system. The slope programmer failed to start on Revs. 21 and 38, otherwise all systems functioned normally.

2. The first and second recovery vehicles were successfully recovered via aircraft on 29 September and 7 October 1969 respectively. No significant problems were evident on either half of the mission. Preliminary evaluation of the processed film from the first recovery indicated that it was a normal J-1 mission take. An MIP of 85 was assigned.

B. J-3 System Status

1. Mission 1107 (CR 7) was successfully launched on 23 July 1969. PET stated "The general image quality of the aft-looking camera record is comparable to what was expected from that instrument considering the operational aspects of the mission; i. e., altitude (100 NM vs. 85 nominal for J-3's) launch time and the measured quality of the lens." The mission received an MIP rating of 95. At Rev. 1 KODI, during the first operation, the forward-looking instrument (No. 315) failed. The aft-looking instrument continued to function normally. The DISIC Subsystem operated satisfactorily until Rev. 282, at which time the system jammed.

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Excluded from automatic
downgrading and
declassification

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2. A thorough examination of all available data resulted in the probable determination of the failure mode experienced by the forward-looking camera; however, the actual cause is still uncertain. Two possible causes have been hypothesized:

a. Film restriction or film velocity reduction at the shuttle input.

b. Film restriction at the supply cassette.

As the actual cause of failure is unknown, no corrective action is being taken at this time. However, if future events provide more definitive data corrective action will be considered.

3. Evaluation indicates that the most probable cause of the DISIC stall was a drag on both the stellar and terrain films. Several areas are being investigated by Fairchild Camera and Lockheed personnel. Their recommendations are due by mid-October 1969.

C. Ultra Thin Base Film Usage in the CR Camera System

1. CR-8 qualification tests have been completed. These included POCO vibration (3.5 G's), acoustic, and simulated shock. All UTB film modifications were successfully qualified. Minor hardware problems and questionable workmanship items were noted. Corrective actions have been implemented for CR-9 and all successive systems.

2. The thermal/vacuum tests (described in the last Quarterly) are completed. Estimated release date of final report is 15 October 1969.

3. The next UTB flight will be CR-11 (Mission 1109) scheduled for 18 February 1970. The Dr. Aschenbrenner Grid Test will be conducted on this system during environmental testing. Based on acceptable results in future testing the system will use a full load, 48,000 feet, of UTB film.

4. Although it has completed its original acceptance-level vibration, CR-9 is currently being prepared for another vibration test to ensure that corrective action has been successful. See I. C. 1. above. The vibration levels for this test are being reviewed.

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5. Test of a low R.H. UTB film roll will be conducted at the Boston ITEK facility. After drying of the roll, the film will be forwarded to E.K. for respooling at normal tensions and concurrent monitoring of static discharge. Upon return to ITEK, a series of Dr. Aschenbrenner Grid Tests and evaluation of resultant data will be accomplished using CR-8. These tests will determine the effectiveness of utilizing pre-dried film in operational endeavors.

D. Proposals and Future Changes

1. CR-14 and subsequent systems will utilize .040 inch glass filters in the primary position. CR-8 refurbishment will include change to glass filters and is therefore included in the subsequent category. Additionally, it is planned to use a .037 inch glass filter in the alternate filter position. This will allow a small focus adjustment during on-orbit operations. Film evaluation of the A portion will allow selection of the better focus during the B portion.

2. Splices: The ultrasonic splice testing at AP is completed. The test report will be released 20 October 1969.

E. ITEK, Boston, will refurbish CR-8 after its qualification starting in early December 1969. The system will be returned to AP in September 1970. General Electric will refurbish the SRV's during the same time span.

F. A new CORONA flight schedule has been approved. One flight during the remainder of C. Y. 1969, four flights for C. Y. 1970, and five flights for C. Y. 1971. The last CORONA flight is scheduled for November 1971.

G. To utilize more effectively Government personnel for both the CORONA and HEXAGON Program, these two offices have been combined. Direction of both programs is maintained in OSP by the Photographic Reconnaissance Systems Office. Field direction to both CORONA and HEXAGON contractors is maintained by the West Coast project office presently located at the A/P, with temporary office space in building No. 156 in the LMSC complex in Sunnyvale.

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H. Missions Completed This Quarter

Mission No.	1107	1052
Booster No.	69-038	58-300
Agena No.	1652	1653
Payload No.	CR-7	J-46
Instrument No.	314/315	216/217
S.I. No.	S/N-11	D-110/111
Film Type (Main Instruments)	3404	3404
Flight Date	24 July 69	22 Sept 69
Feet Payload Flown	32,600 feet	32,600 feet
Feet Payload Recovered	16,570 feet	32,600 feet
Recovery Dates	2 Aug 69 12 Aug 69	29 Sept 69 7 Oct 69

I. Missions Planned For Next Quarter

Date - 26 November 1969
 Mission 1108
 Payload CR-9

J. Meetings and Briefings

1. PET meeting for Mission 1107 was held at NPIC 3-5 September 1969.
2. Special engineering review for Mission 1052 was conducted by the SPD (Gen. King) at VAFB on 10 September. The normal R-1 meeting on this mission was conducted on 16 September at VAFB.
3. Mission 1052 PET meeting will be convened at NPIC 28-29 October 1969.

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QUARTERLY PROGRESS REPORTSATELLITE SYSTEMS

1 July 1969 through 30 September 1969

II. HEXAGON PROGRAMA. Programmatic

1. Representatives of the Agency and the Air Force participated as a joint Source Selection Board to review and evaluate three proposals for the integrated STC software package for HEXAGON. The Board completed the evaluation and submitted the results to the Source Selection Authority for selection of the successful bidder. The contract is expected to be signed in early October.

2. The CORONA and HEXAGON Project Staffs were merged into a single Project Organization entitled "Photographic Reconnaissance Systems." This will provide for better application of project manpower and will reduce personnel dislocations during phase-over between projects. A study has been undertaken to examine the problems and prepare a plan for the physical move of the CORONA Program from the AP to areas in the LMSC complex. This study is to be completed in October.

3. Agreement was reached between the SPO and SSPO for active Thermal Control in the forward film path to prevent film sticking. The design was approved by the interface working group.

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4. Negotiations with Perkin-Elmer for all of the identified unnegotiated changes were completed. A new target cost for incentive fee purposes was established at \$195,000,000. Several changes to the basic contract work statement were included to clarify certain areas of the work statement and to correct deliverables and delivery schedules. In addition, certain modifications were made to the incentive provision of the contract which were considered beneficial to both parties.

5. A list of program milestones leading to the completion of the program has been established and agreed upon between the Program Office and Perkin-Elmer. These milestones are monitored on a weekly basis through schedule reviews with the contractor to assure positive program overview. While slippages have occurred in portions of the schedule, the program is still on schedule to deliver the first flight system in April 1970 for a December 1970 launch.

6. Dr. Sorrels of the Bureau of the Budget visited ITEK on 24 September 1969 for a review of the HEXAGON Stellar Index Camera and the CORONA Camera Programs and visited Perkin-Elmer on 25 September 1969 for a review of the HEXAGON Sensor Subsystem Program.

7. On the basis of a decision by EXCOM that the HEXAGON Program should be pursued to meet a December 1970 launch date, the Sensor contractor was directed to proceed on this schedule although present fund authorization will not support the effort for the full fiscal year.

8. Perkin-Elmer has encountered some difficulty in obtaining adequate skilled manufacturing and test manpower; however, the existing manpower available is expected to be able to maintain the assembly and test schedules now established. Additional manufacturing and test people will be hired as available in an effort to insure the meeting of the Development and First Flight Model schedules.

9. Program expenditures are following closely to the SSPO budget figures which at the present time are in excess of the NRO authorized funding. It appears NRO authorization of the full budget request will be required to maintain the present schedule.

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B. Technical

1. Analysis of the Sensor Subsystem pressurized film path predicted a potential problem in film sticking to itself, support rollers, and air bars. A film sticking test program was initiated at Wright-Patterson Air Force Base in conjunction with tests at Eastman-Kodak and Perkin-Elmer to study the problem and recommend corrective action. In conjunction with the test program, the Project Office requested Eastman-Kodak to produce 40% R. H. film vice 45% R. H. \pm 5% as is their usual production. Eastman-Kodak complied by delivering two rolls (52K and 40K feet) of 40% R. H. film to be used with the Engineering Model. It is believed that the sticking problem will be eliminated by utilization of 40% R. H. film and active thermal control in the forward film path. Verification will be obtained from the Engineering Model tests in a thermal vacuum environment scheduled for completion December 1969.

2. Engineering Model

a. Single camera resolution tests were conducted in a thermal vacuum environment. The results were encouraging with the performance approaching specification levels.

b. The Engineering Model was successfully installed into the SBA mid-section.

c. The Integrated Thermal Testing, including film sticking tests associated with temperature/humidity conditions, was also incorporated into the overall Thermal Testing program.

3. Development Model

a. Orbital environment acceptance tests of Optical Bars A and B were completed with the results generally in excess of specification requirements. Some minor design deficiencies were discovered during these tests.

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b. Mass Property Tests were completed on Optical Bars A and B.

c. The two-camera assembly was completed during this period.

d. Electromechanical Functional and Format Tests for the Development Model were not completed during this period. They are scheduled for completion on 9 October.

e. The SBA mid-section was received on schedule from LMSC.

4. Flight Model #1

a. Fabrication of Optical Bars A and B was completed. Initial tests of the Optical Bars showed performance outside of the specification and Optical Bars for Flight Unit #2 were used to replace those in Flight #1.

b. The Optical Bars passed alignment and manufacturing assurance tests, and environmental acceptance tests are currently under way.

5. Test Stations

All of the Test Stations scheduled for completion during this Quarter were substantially 100% complete and are awaiting checkout with the Engineering Model during Engineering Model tests.

C. Facilities

All of the Thermal Vacuum Chambers at the contractor's facility have been inspected and accepted by the Government. All of the planned facility items are complete.

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D. Mission Planning Software

Initial studies of statistical performance prediction techniques were carried out by TRW, supported by \$50,000 of FY 69 funds. This effort forms the basis for the Mission Planning Software definition and development being initiated with \$500,000 of FY 70 funds.

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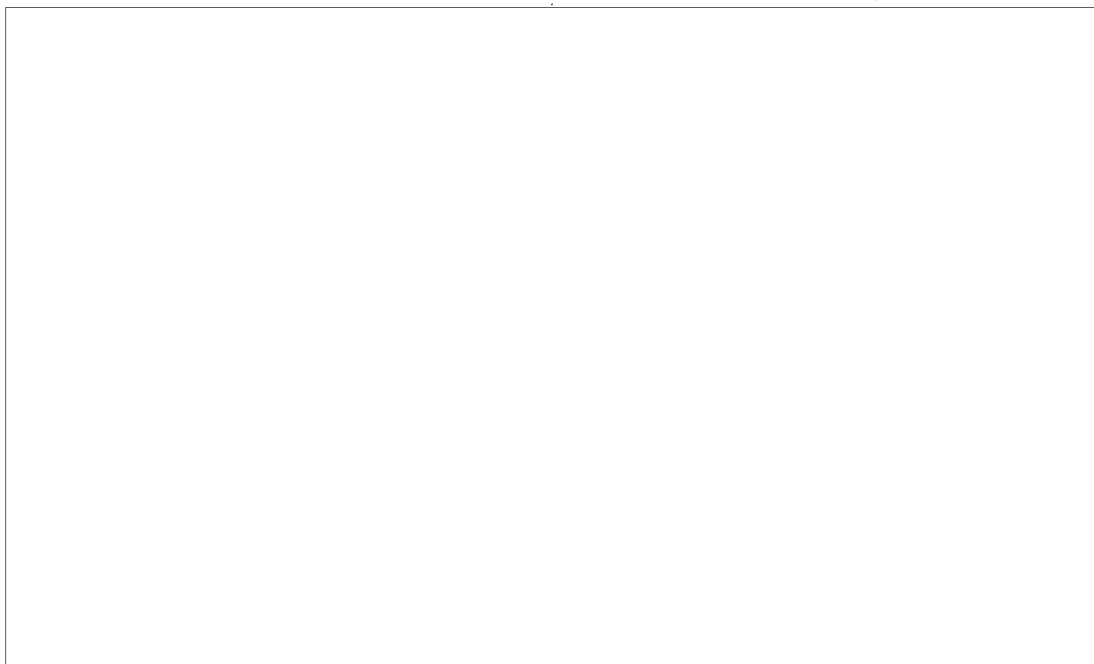
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III. ELECTRO-OPTICAL IMAGING TECHNOLOGYA. Program Planning

The EOI Program for FY 70 has been initiated in accordance with current Readout Technology Program approvals. This plan provides for the Systems Definition Phase of the overall program to be initiated in February 1970 if program approval is granted.

An EOI System Logic Network has been prepared outlining the program schedule from FY 70 to FY 74. The EOI Program Cost Estimates from FY 72 through FY 75 were being revised at the end of the Quarter.

B. Transducers

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IV. GENERAL RESEARCH AND DEVELOPMENT IN SUPPORT OF
RECONNAISSANCE SATELLITE PROGRAMSA. Sensing Techniques and Devices1. Thermoplastic Recording (STX)

First Quarter efforts were devoted primarily to determining the sources of noise present in samples analyzed during the previous Quarter. As reported earlier, samples demodulated in the Suzuki system had a large noise component which precluded the accurate measurement of frequencies greater than 40 cyc/mm. Micro-defects within the sample were originally thought to be the major noise source; however, this hypothesis was not fully supported by electron microscopy studies. It was also established that samples examined using self-interference techniques were significantly less noisy than when viewed with Suzuki optics. An analysis of the Suzuki optical system employed for data gathering indicated that the coherence length of the illumination being used was approximately 20 cm. Theory indicates an optimum coherence length of about 10 microns is required for demodulation with the system. Alternate illumination sources are being evaluated to provide light of appropriate coherence. Evaluation of the tri(m-phenoxy phenoxy phenyl) cyanurate materials ("Star" compound) as thermoplastic candidates continued to be encouraging. These compounds have extremely sharp deformation temperatures, possess good dielectric properties, and in the ambient state

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have hard, non-tacky surfaces. Finally, both zinc sulfide and zinc selenide were successfully tested as trapping layer materials. These materials should be extremely stable chemically, and the zinc sulfide is also suitable as an anti-reflective coating for the photoconductor surface. It appears that the sum of the technologies is, for the first time, adequate to support fabrication of prototype operational devices.

2. Readout Studies

This program terminated on 31 July 1969 with the submission of a technical report providing details (reported in the previous Quarterly Report under EOI Transducer Development) of the spot and television breadboard scanning systems suitable for dynamic retrieval of hard copy from phase images.

B. Optical Fabrication and Evaluation Technique Development

1. Selective Vacuum Deposition for Figuring Large Optics (Perkin-Elmer)

The demonstration correction of the 30-inch Cervit flat was completed. From an initial surface figure of $.12\lambda$ rms, the piece was brought to $.05\lambda$ rms. While this demonstration does not reflect the process' ultimate correction capability, the fact that this correction was made with temporary equipment, minimal instrumentation, and a mask-making process that was not fully optimized demonstrates that under proper conditions the selective deposition process should indeed provide a diffraction-limited surface.

Following the demonstration correction, the temporary fixtures were removed from the chamber and work on the permanent instrumentation was resumed. After installation of the electron beam evaporation guns, new evaporant distribution runs will have to be made.

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2. Hologram Interferometer (Perkin-Elmer)

The study to determine the limitation to holographic testing of optical elements from dimensional changes in film emulsion during processing was almost completed during this Quarter. Results have indicated that the emulsion limits testing accuracy to approximately $\lambda/25$ rms.

The metrology study has been completed and work is continuing on synthetic hologram generation using both the scribing technique and direct exposure with the optical head.

3. Fiber Optics Technology (American Optical)

Improvements were made on fiber alignment this Quarter and more accurate measurements were made on both the geometrical and optical characteristics of these arrays in order to get a quantitative estimate of required improvement. In addition, a joint program with Westinghouse Corporation was initiated in which the problems of solid state phototransistor/fiber optic array coupling will be investigated. American Optical will supply fiber arrays for the test program, as well as continuing its work on a controlled separation of monofibers in a fiber optic array.

4. Low Scatter Coatings (University of Arizona)

Preliminary runs on the newly installed equipment have been run to determine apparatus accuracy and measurement reliability. Initial tests were then made to determine the effects of deposition rate on the specular reflectance and scattering of vacuum deposited coatings. Work will continue on the determination of optimum conditions for minimization of scatter.

C. Optical Material Development and Evaluation

1. Beryllium-Based Material Development (SRI)

All required samples of Beryllium cubes and discs have been fabricated by SRI and delivered to Perkin-Elmer for test and evaluation. In addition to the set of small samples, SRI

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fabricated a sample 12 inches in diameter on borrowed equipment. Although process parameters were far from ideal due to the limitations of the available hydrostatic press and sintering furnace; nevertheless, the blank was found to be extremely isotropic from preliminary x-ray analysis and by its fabrication, SRI has demonstrated at least a limited scale-up capability. A more extensive analysis and evaluation of this sample is under way at Perkin-Elmer.

D. Mechanical/Optical Structures

No contractual effort in this category was performed during this Quarter.

E. Advanced Electromechanical Development

1. Sheet Film Transport (RCA)

During this Quarter, no major modifications were made to the Sheet Film Transport development model. Several minor modifications, however, were made in order to optimize film passage and maintain speed and alignment tolerances. In addition, the sheet feed magazines were modified to allow them to handle UTB in vacuum. This tuning and optimization work has been done in preparation for the large film volume demonstration run scheduled for late October.

F. Data Transmission, Processing, and Display Techniques

1. Photographic Coverage Assessment (Previously Area Coverage Program)

Following a satisfactory total assessment at NPIC, the PCA equipment was transferred to TOPCOM for preliminary operational evaluation. In conjunction with the latter application, spare circuit modules and shaft encoders are being fabricated; and software programs were modified to flag erroneous records from the digitizing table. Mission 1051 assessment was completed on the PCA during this period.

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V. VULNERABILITY

Work continued on compilation of the Threat Model Notebook. Two sections were approved. The first, on the Galosh missile, has been distributed. The other, on the new Sary Shagan radars, will be issued shortly.

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