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QUARTERLY PROGRESS REPORT

SATELLITE SYSTEMS

1 January 1970 through 31 March 1970

I. CORONA PROGRAM

A. System Status

1. Mission 1109 (CR-10) was launched from VAFB on 4 March 1970. The entire mission was accomplished without incident with "A" recovery occurring on 11 March and "B" recovery on 23 March. Preliminary evaluation of the mission indicates that the technical performance of this system yielded photography of a predicted quality. NPIC assigned MIPS of 110 and 100 to the "A" and "B" portions respectively. The Performance Evaluation Team will convene 14 and 15 April to evaluate the flight.

2. The next scheduled CORONA flight system (CR-11) entered storage at LMSC on 17 March. No discrepancies in system status were noted. CR-11 flight preparations will begin in early May.

3. The CR-9 DISIC failure has been traced to a malfunction of the 400 cycle inverter. The test procedure has been changed to include "stage by stage" waveform evaluation.

4. Activity continues in the refurbishment of CR-8 with system checkout scheduled for early April and final acceptance testing scheduled for 22 May. Delivery is expected in late July.

5. A Payload Information Meeting was held at the A/P on 18 February 1970. In attendance were representatives of the principal offices of the intelligence community. All agenda items were covered in a satisfactory manner and the meeting was considered a successful method for sharing information with user organizations. Minutes of the meeting have been distributed throughout the community.

B. UTB Film Usage

Tracking problems encountered during pre-flight checkout of CR-11 demonstrated a basic incompatibility between J-3 systems and UTB film, resulting in the cancellation of the scheduled CR-11 flight. As a result of a meeting held at the A/P on 18 February 1970, a decision was made to delete planned UTB film use in future J-3 flights in favor of STB film.

C. Proposals and Future Changes

1. A prototype version of the improved Constant Tension Assembly (CTA) employing dual negator springs was successfully tested on CR-10 in early February. Accordingly, production versions have been installed on CR's 13, 14, 15, and 16. Installation of these devices on remaining J-3 systems will be accomplished upon receipt.

2. Proposals for the development and fabrication of replacement units for the Haydon Timers have been received from three sources. The most attractive proposal was submitted by Autronics, Los Angeles. Contract Award is currently in progress.

D. A/P Relocation

Preparations are proceeding for A/P relocation to Buildings 152 and 156 of the Sunnyvale facility. Material and equipment inventories are in progress and the move plan is being finalized.

E. Low RH Film Test

The investigation of the effects of low relative humidity on SO-380 film has been completed. Test results will be published in the forthcoming CR-11/CR-12 "Dr. A" report due May 1970.

F. Missions Completed This Quarter

Mission No. 1109
Booster No. 69-041
Agena No. 1657
Payload No. CR-10
Instrument No. 320/321
SI No. W/N 9
Film Type - Main Inst. 3404

F. Missions Completed This Quarter (cont'd)

Flight Date: 4 March 1970
Feet P/L Flown: 32,600
Feet P/L Recovered: 32,600
Recovery Dates: 11 March 1970
23 March 1970

G. Missions Planned For Next Quarter

Date: 20 May 1970
Mission: 1110
P/L: CR-11

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II. HEXAGON PROGRAM

A. Programmatic

1. The HEXAGON Project Office issued a Request for Proposal (RFP) to Perkin-Elmer in January 1970 for a follow-on quantity of six Sensor Subsystems. The bidder evaluation and selection criteria used by the prime contractor (Perkin-Elmer) in recommending the competition winner was reviewed and accepted by the Project Office. All subcontract bids were on a fixed price basis. Perkin-Elmer is now proceeding with negotiations on these subcontracts preparatory to negotiating a prime follow-on contract early in FY 1971. Subcontract negotiations are required at this time because of the procurement lead times.

2. Proposals for system improvement for follow-on production were reviewed by the Project Office, and Perkin-Elmer was authorized to complete several studies this fiscal year. These studies are directed toward defining design changes which will increase the system reliability and performance and/or reduce system costs. A list of preliminary studies to be performed in FY 1970 for definition of these changes was submitted to the NRO for approval.

3. A briefing was presented to PSAC on 10 February by the Agency and Air Force Project Offices. It appeared to be the general consensus that the program was proceeding satisfactorily. Dr. Land expressed an interest to discuss, at some later date, the rationale for the design of the active thermal control of the film path.

4. A Payload Information Meeting was held on 18 March 1970 at Perkin-Elmer to inform the using community of the payload development status and the design characteristics and performance capabilities of interest to the various users of the HEXAGON output.

5. A briefing was presented to Assistant Secretary of Defense for Administration and Intelligence, Robert Froelhke, and Air Force Undersecretary, John McLucas, on the status of the Sensor Subsystem development program during a 16 January visit to Perkin-Elmer at Danbury, Connecticut.

6. The Ad Hoc Committee under DD/NRO, Robert Naka, again reviewed the progress in the overall HEXAGON Program, and while some slippages have occurred in schedules, the Committee concluded that the schedule assessments which were made at the initial review of the program in June 1969 were still valid, and again recommended that further CORONA production was unnecessary.

7. Consolidation of the CIA portions of the CORONA and HEXAGON integration activities on the West Coast is proceeding on schedule. The installation and checkout of the IBM 360/65 computer, which will serve both projects, has been completed and the various system software programs are being checked out preparatory to the release of the IBM 360/50 at the A/P facility on 1 May 1970.

8. Eastman Kodak announced plans for discontinuing production of 3404 STB and SO-380 UTB film as of 1 July 1970. They are being replaced with two new products, SO-349 (STB) and SO-236 (UTB). The replacement films have equal or superior properties to the presently used films and provide increased speed (approximately 50%) while maintaining equal resolution and graininess. SO-349 will be tested on the next CORONA mission, and plans are under way to convert HEXAGON to SO-236 by Flight No. 2.

B. Technical

1. Development Model

The Development Model completed the final stages of qualification testing in Thermal Vacuum Chamber "A" and is being prepared for shipment to LMSC for integration with the forward and aft sections of the Satellite Basic Assembly.

Several important Sensor Subsystem milestones were accomplished with the Development Model during this period as follows:

a. Thermal/vacuum photographic qualification tests at 40°, 70°, and 100° were completed. Initial evaluation of the photographic and electro/mechanical data indicate satisfactory system design.

b. The first full "flight" complement of film was loaded into the supply assembly and checked out with the Development Model.

c. Electromagnetic compatibility qualification tests were conducted. The results were encouraging, and the sensor subsystem appears to be compatible with other vehicle hardware from an electromagnetic signal interference standpoint.

2. Flight Article No. 1

The First Flight Vehicle has essentially maintained its schedule by the addition of manpower and working overtime. The present date of shipment to LMSC is 31 May 1970. This is consistent with the December 1970 launch date.

The following significant milestones were achieved:

a. The Two-Camera Assembly was completed and subjected to acceptance level vibration and acoustic environments. Post-environmental tests showed no degradation in operation.

b. Successfully completed Two-Camera Assembly in-air electro/mechanical baseline tests.

3. Film Test Program

Design deficiencies were disclosed in the qualification testing of the take-ups which has delayed the qualification and delivery of these items. At the end of the reporting period, three of four take-ups had been delivered to the integrating contractor facility for forward section build-up scheduled to commence 8 April 1970. Take-up qualification is expected to be completed in April.

4. Free Radical Film Development (Horizons)

R&D work has been undertaken by Horizons toward the goal of obtaining a camera speed free radical material that could, at a later date, be worked into the HEXAGON camera

system. Direction was concentrated on developing the material itself with, for the current time period, no emphasis on coating techniques/equipment nor the practical aspects of using this film on HEXAGON. AEI speeds of 0.7 to 1.0 have been achieved repeatably in laboratory tests, which puts this film within a factor of 3X of this goal; the goal now appears to be within reach since free radical systems have, in the past, been several orders of magnitude slower than that required for use in reconnaissance systems. With this encouraging result, the program with Horizons was expanded to demonstrate a camera speed material compatible with the HEXAGON System. In addition, Horizons is conducting production engineering studies aimed at defining pilot and manufacturing production requirements to handle the material after the research phase has produced a satisfactory product.

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III. ELECTRO-OPTICAL IMAGING TECHNOLOGY

A. Program Planning

The Electro-Optical Imaging Program has accomplished virtually all technical program objectives scheduled for the Third Quarter of FY 1970. The program schedule has been revised to allow for the initiation of the System Definition Phase in August 1970 if approval is granted.

A contractor documentation package has been prepared to be used by the candidate Imaging Satellite contractors and Processing Facility contractors during System Definition Phase. This documentation package includes statements of work and baseline system specifications. A revision of the Relay Satellite Requirements Specification was made in the Third Quarter.

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IV. GENERAL RESEARCH AND DEVELOPMENT IN SUPPORT OF RECONNAISSANCE SATELLITE PROGRAMS

A. Sensing Techniques and Devices

1. Dry Silver Film Development (3M)

Preliminary results of the Dry Silver film development program which was initiated during the preceding Quarter indicate that substantial increases in film speed can be achieved. Recent laboratory samples have demonstrated speed enhancement of two orders of magnitude, though process control must be refined to achieve desired reproducibility. An increase of three orders is desired to make the dry processed material competitive with aerial reconnaissance acquisition films currently in use. This significant progress early in the program increases the probability of attaining acceptable acquisition speed for Dry Silver film in the first 12 month phase of the program.

2. Thermoplastic Transducer STX (Xerox)

During the past Quarter the basic relationship between frequency response and thermoplastic thickness was re-examined on the basis of recent data derived from an experiment in which the variables were thermoplastic thickness, image input frequency, and charge density. While validity of these results was somewhat questionable because of instrumentation uncertainties, the data clearly indicated a shift of the quasi-resonance peak toward frequencies considerably lower than those predicted by theory. The instrumentation ambiguities were rectified during the past Quarter and eight freshly prepared "standard" samples (250 cyc/mm screens, 1.8 microns of thermoplastic) were examined. These tests clearly confirmed the resonance peak shift to lower frequencies. Corollary experiments strongly suggested that modulation of a "frost" image was occurring rather than operation in a true quasi-resonance mode.

Physical examination of the critical component layers of these samples has been initiated in order to determine causes of this anomalous behavior. In parallel with this effort, new samples are being prepared so that the process and image evaluation studies necessary to conclude this program can be performed with representative samples.

B. Optical Fabrication and Evaluation Techniques

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

Development work on the 36-inch chamber is in the final stages. Installation of process control instrumentation in the chamber has been completed as has been the software to be used in data logging and closed-loop process parameter control. The interface between hardware and software requires some further testing and mirror modifications. Three demonstration optical elements will be corrected by the selective deposition process and tested during the Fourth Quarter. These optical elements will consist of the HEXAGON primary, HEXAGON folding flat and a 13-inch diameter convex F/2.4 hyperbolic secondary.

2. Hologram Interferometer (Perkin-Elmer)

The hologram interferometer program ended in the Second Quarter and the deficiencies in the Perkin-Elmer final report previously described have been resolved.

3. Fiber Optics Technology (American Optical)

Preliminary results of the Westinghouse program to evaluate fiber optic-coupled photodiode arrays have indicated that there may be some definite advantages to using the fiber optic approach. Fibers supplied by American Optical for this program have exhibitied high transmission and good alignment. Further work on fiber optics technology will await results of the test program on fiber optic-coupled arrays.

4. Low Scatter Coatings (University of Arizona)

In the next phase of the work at the University of Arizona, measurements will be made to ascertain the magnitude and angular distribution of the ratio of diffuse to specular flux in various optical coatings as a function of deposition parameters. A simple reflectometer is under construction for this purpose.

C. Optical Material Development and Evaluation

Beryllium-Based Material Development (SRI/P-E)

A program was initiated in the Third Quarter to investigate the characteristics of the SRI beryllium fabrication process when applied to larger sizes. Three 23-inch diameter beryllium substrates having different profiles will be fabricated by SRI and then figured, coated, and evaluated by Perkin-Elmer. In addition, various lightweight structures suitable for beryllium mirror substrates will be experimentally studied to determine optimum geometrical configuration as well as figuring techniques.

D. Mechanical/Optical Structures

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

E. Advanced Electromechanical Development

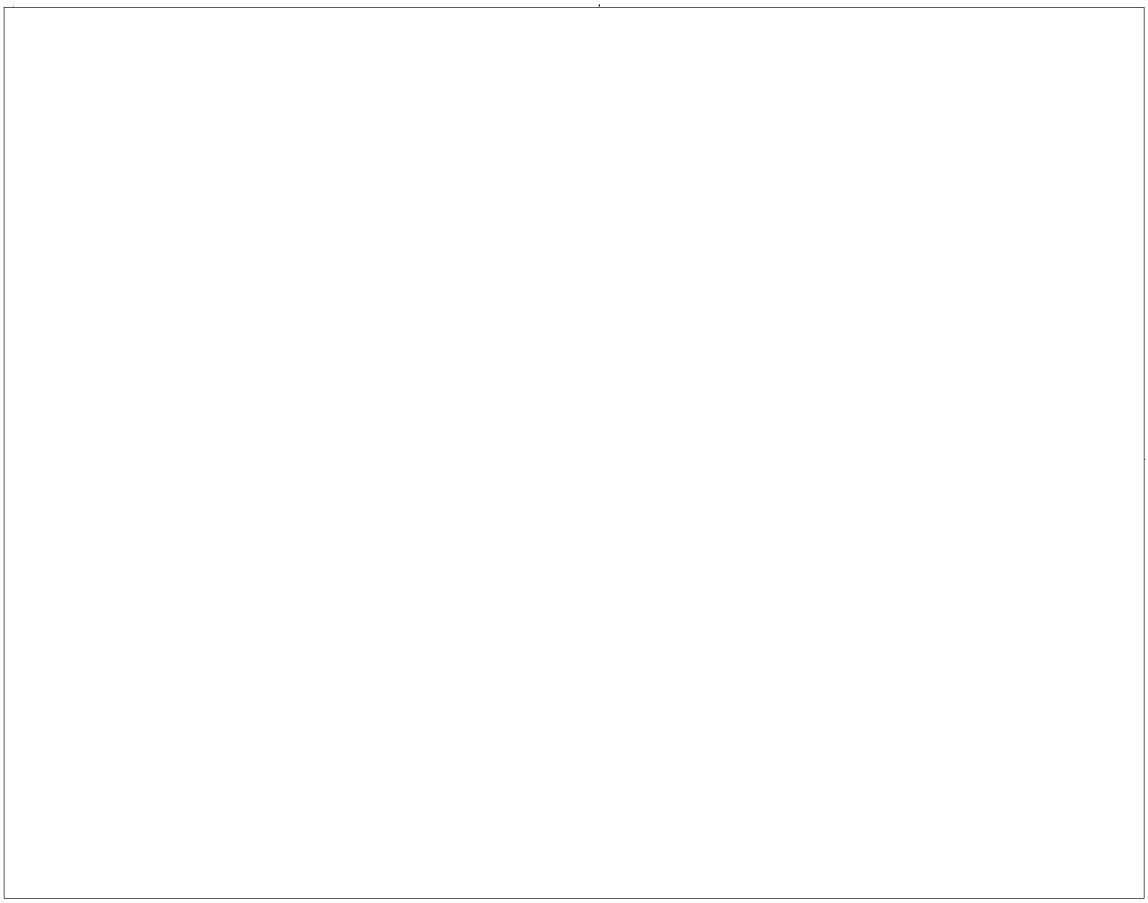
Sheet Film Transport

The request for funding for continued work on sheet film transport was disapproved during the past Quarter. Therefore no further work on this program was performed.

F. Data Transmission, Processing and Display Techniques

1. Photographic Coverage Assessment (Autometric-Raytheon)

A contract for the design, fabrication, and qualification testing of a Photographic Coverage Assessment Device for the HEXAGON Program was awarded to the Autometric-Raytheon Corporation. The development schedule calls for the delivery of an operationally-qualified unit by October 1971. A preliminary design review will be held in mid-April; this will be followed by a critical design review at the end of May.



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V. VULNERABILITY

Draft copies of all new sections of the Threat Model Notebook have been received for review. After minor editing changes and printing, the completely revised notebooks will be distributed.

A delegation for SP-6 visited CIA in March for discussions of the ASAT threat. In response to the needs expressed by SP-6, an attempt will be made in future reporting to project Soviet capabilities further into the future.