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MONTHLY STATUS REPORT

HEXAGON PROGRAM

PERIOD ENDING - 15 MAY 1968

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Control System

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MONTHLY STATUS REPORT

HEXAGON PROGRAM

1. Program Overview

a. A joint SPO/SSPO scheduling meeting was held on 23 April and resulted in an integrated schedule (See Atch 1) based on a first launch on 1 October 1970.

b. A special meeting of SPO/SSPO management was held on 16 April and agreement was reached on testing at LMSC. It was agreed that:

(1) A vacuum/collimator facility is required at LMSC.

(2) SPO will provide the facility, vacuum chamber, maintenance and test support.

(3) SSPO will provide test requirements, procedures, collimators and associated AGE, and personnel to conduct and evaluate camera performance tests.

(4) These tests are included in the Satellite Development Vehicle-Qualification (SDV-Q) and Satellite Vehicle One (SVI) assembly sequence, with the provision that they will revert to an off-line capability (use as required) if experience indicates optical testing is not routinely required at LMSC.

c. The third bi-monthly status review and monthly managers' meeting were conducted on 14-15 May and the following significant items resulted:

(1) Proposed attitude rate and momentum fluctuation specification values were presented for acceptance by SPO/SSPO. It was agreed to accept these values and LMSC will conduct analyses to provide an SV error budget.

(2) A Weight Control Board has been established to insure adherence to system weight allocations. The Board will report at each monthly managers' meeting.

(3) An SBA/SS interface conference has been scheduled for 27-29 May, and it was agreed to negotiate and incrementally sign all ICD's which were distributed as of 15 May.

d. Joint SAFSP and SSPO studies have been initiated to arrive at a common mission profile. The results are expected to provide the payload activity profile, the command load (rev span) profile and the tape recorder (dump schedule) profile. It has been agreed that both SAFSP and SSPO computer simulations are adequate and provide comparable results. Definition of the quarterly coverage requirements and the quantizing of targets into the WAC grid system has been accomplished, and the required simulation runs have been defined. Preliminary results are expected by 15 June and a report published on 1 July.

e. As a result of this month's activities, a number of differences between the Hexagon System Performance/Design Requirements General Specification (SPDR) and the Performance Specification for the Sensor Subsystem (PSSS) have been resolved. These include agreement on the attitude control disturbances and the use of the Interface Control Documents (ICDs), for interface definition in the PSSS. It is expected that the remaining differences will be resolved as a result of the interface meetings of 27-29 May.

f. Efforts are continuing on the SS and SI film recovery study. Additional analysis indicates that the 25% SS film take-up and 54.5 inch diameter RV results in an unstable configuration. With some take-up modification, it appears that a 56 inch diameter RV will be satisfactory. Using the present take-up design, however, a 58.5 inch RV is required. TRW has provided design information for the 30% size take-up which will be used to establish a RV size for the system configuration where all SI film is recovered in the fourth RV.

g. The overall system reliability analyses are continuing. Revised weights and updated SBA and SS models and LMSC electronic parts failure rates, including λ on & λ off, have been used for both systems in an attempt to put them on a more equal basis for comparison by the computer. The results of the new computer runs provide an unexplained difference between the failure rates for similar components used in the SBA and SS. In an attempt to resolve these differences, LMSC and P-E will exchange their respective piece part and circuit data permitting each to calculate the others failure rate. Resolution of this difference is expected to result from a meeting of SPO, SSPO, Aerospace, SETS and LMSC at P-E on 22 May 1968.

h. LMSC has completed a study to preserve an attitude determination option in the Hexagon satellite vehicle which are necessary to satisfy the geodetic requirements. Study showed that incorporation of the option is major and requires a separate data tape recorder and a separate PCM telemetry unit. The cost and feasibility of preserving the option increases rapidly between 1 June 1968 and 1 March 1969. After this date, structural testing is completed and component design is completed; preservation of the option would become extremely difficult.

2. Interface Status

a. Structural/Mechanical Interface (S/M). Although none of the ICD's have been formally approved, many differences have been resolved and efforts are progressing toward agreement at the 27-29 May meetings. A summary of each S/M ICD is as follows:

(1) Mechanical ICD - SS alignment tolerances have been furnished to LMSC and there appears to be general agreement on the alignment approach. LMSC has reported difficulty in meeting the P-E forward film path alignment requirements, and has requested P-E to determine if they can be relaxed. Access requirements and test take-up film path routing have been agreed to on a technical level. The viewport baffle/optical bar mechanical interface, two camera assembly forward hanger location, RV/steerer interface, and the interference of the SS film supply dynamic envelope with the SBA mid-bulkhead cross beam remain open items.

(2) Master Tooling ICD - There is general agreement on master tooling required by P-E

and the controlled interfaces where LMSC will drill holes; however, most details are highly dependent on the alignment plan and requirements which still have open items.

(3) Mass Properties ICD - Agreement is being reached on this ICD.

(4) Structural Environments ICD - Pyro shock and acoustic environments have been defined; separation transients, based on computer, runs have been established; and agreement has been reached on the values of load factors on P-E equipment. The SBA loads transmitted into the SS pneumatics and electronics are under review; the random vibration levels, although agreeable by all, are thought to be too high; and the number of allowable load limit reversals for transportation are still under negotiation.

(5) Environmental ICD - Agreement has been reached on the scope and content of the ICD. P-E has defined new SS environmental requirements, some of which result in substantial increases over previous values. Items still requiring resolution are: Orbital venting and pressure levels, temperature and humidity constraints on ground conditioned air, and equipment cleanliness criteria.

(6) Attitude Disturbance ICD - This ICD has been reworked incorporating the agreements reached at the managers' meeting of 15 May.

(7) Thermal Interface - Agreement has been reached on the viewport baffle thermal interface, and LMSC has completed the preliminary thermal design of the SS/SBA midsection which will be furnished to P-E, along with the proposed ICD format, on 27 May. The design includes a relocation of the SS compartment electronics to provide a more desirable thermal environment and a titanium transition cone between the aft and the mid sections to minimize conduction heat transfer. The net effect is an integrated thermal design which is relatively insensitive to power dissipation and interface heat transfer. The interface working group is also addressing the integrated SBA/SS thermal model tests, and it has been agreed that the thermal model midsection should include forward and aft section thermal simulators.

b. Assembly and Test. Efforts are mainly directed toward cataloging areas of agreement to permit incremental signoffs.during the meetings of 27-29 May. Joint P-E/LMSC efforts have been initiated to define the design criteria for the LMSC vacuum chamber A-2 to be used for camera performance tests.

(1) Aerospace Ground Equipment (AGE) ICD - The role of P-E electrical AGE at LMSC and VAFB during satellite vehicle systems test still is unresolved. Related to this problem is the lack of overall understanding of the software responsibilities. A joint SPO/SSPO meeting to determine the real time data processing requirements for subsystems during system test on 23 May. Resolution of the AGE problem is predicated on this understanding.

(2) Facilities ICD - The P-E requirements for space at LMSC is still under discussion, however, early resolution is anticipated.

(3) Development and Qualification ICD - The questions of operational duration of the SS during SDV-Q testing, end to end film path testing, and the role of P-E electrical AGE in SV testing are impeding agreement on this ICD.

(4) Acceptance Testing and Checkout ICD - The most significant problems affecting agreement on this ICD are the configuration of the SBA midsection when itis sent to P-E for SS installation and the three items in 2. b(3) above.

c. Tracking, Telemetry, Command, and Electrical Power - Primary emphasis has been placed on resolving the problems to permit sign off on all ICD during the 27-29 May meetings.

(1) Command ICD - An interface revision notice to this signed ICD to provide additional SS commands is in review.

(2) Data Signal ICD - Technical agreement has been reached on this ICD.

(3) Telemetry ICD - An SS/SBA equipment input impedance incompatibility has been identified and an analysis of the problem is now in process.

(4) Electric Power ICD - The impasse on the electric power resulting from a ripple voltage induced by the SS causing an unacceptable electromagnetic interface (EMI) safety margin appears to be resolved. Agreement has been reached on P-E's proposed reduction of inrush and ripple currents.

d. Booster Interfaces - Technical agreement has been reached on the Booster/Satellite/Vehicle Master Tooling ICD and it is presently in signature coordination.

3. Satellite Basic Assembly (SBA) Status

The SBA subsystem Preliminary Design Reviews (PDR) have been completed as scheduled. The SV engineering mock-up is about 75% complete and has been found invaluable as a tool for determining access requirements and component locations.

a. Tracking, Telemetry and Command (TT&C) Subsystem. Kinelogic has been selected as the vendor for the SV tape recorder. The PRD on the GE command subsystem is scheduled for 12-13 June and the Contract End Item Specification is scheduled for completion on 17 June.

b. Electric Power and Distribution (EDAP) Subsystems. The design of the EDAP subsystem is nearly complete; the only outstanding item is solar array sizing, and this is dependent upon inputs from the mission profile studies which should be available by 1 July.

c. Structure Subsystem - Refinement of the structure design has been initiated in an effort to reduce systen. weight. Access holes in the midsection structure have been defined.

d. Attitude Control Subsystem (ACS) - The task force established to reduce flight control electronics procurement and manufacturing time spans are continuing their efforts, and it is anticipated that substantial schedule gains will be realized after release of manufacturing drawings. The ACS design concept of single thrust level and thrust vector trim for orbit adjust has been approved and parametric studies to specify detail design requirements have been initiated.

e. Orbit Adjust Subsystem (OAS). - The Thrust Chamber Assembly (TCA) and SBA mechanical interface has been finalized. TCA vendor, Walter Kidde Company, has been authorized to proceed with a thrust mount which will accommodate thrust vector trim actuators. TCA design evaluation tests using a 200 lb thrustor have been completed and analysis of the results is scheduled for the next reporting period.

f. Backup Recovery Attitude Control (BRAC) - A BRAC system concept has been developed which meet all SPDR requirements except EMI. An EMI waiver is in preparation and will be submitted to the EMI Control Board.

g. Aerospace Ground Equipment (AGE) - The AGE preliminary design review (PDR) package has been received and is in review. PDR is scheduled to commence on 4 June.

4. Sensor Subsystem (SS) Status

a. SSPO has suggested to P-E that performance incentive provisions be included in their contract and agreement has not yet been reached on these incentives. signed contract is anticipated by mid June.

b. The design and development of the SS is proceeding close to schedule. P-E is well into development testing at the component and subassembly level (e.g., film handling tests are being performed in air on the Film Path Simulator and in a vacuum in the Abbreviated Film Path Simulator (AFP). Film is being moved in this AFP Simulator at 156 inches per second; film flatness, outgassing, lateral disturbance and corona effects tests all being performed. Component tests on the metering capstan, the optical bar encoder and motor, and bearings are being conducted to verify design. Performance of the final design optical bar encoder test unit exceeded specification by a wide margin. The drive capstan encoder also met specifications; however, the metering capstan encoder manufactured by a vendor did not meet specifications. Results so far indicate that techniques exist for manufacturing satisfactory SS encoders.

All major optical elements for the Engineering Model have been completed through polishing and testing. These elements all meet design requirements and will soon be coated and assembled into the optical bar configuration for fixture testing.

The optical bar schedule for the Engineering Model which was on the SS critical path has been exercised with the result that 55 days have been gained and this unit is on schedule. Other assembly schedules are also being exercised to bring this model back on schedule.

Shutter performance and life tests are being made, and initial results indicate satisfactory performance is being achieved.

c. P-E has reviewed the plans and schedule for Radiation, Inc. and steps have been taken to recoup schedule slippage previously reported. It is anticipated that the electronics will be on schedule in approximately two months. This will be accomplished by arranging an increase in contractor effort and by using such time-saving steps as nonflight packaging of Engineering Model units which will not be flown.

d. To assure early identification of any problem areas, P-E has undertaken a detailed design audit. The audit will cover the entire sensor development, fabrication and test and will insure consistency in specifications, drawings, procedures, etc. The goal of this effort is to assure that the first flight unit will meet its resolution performance on schedule.

e. Detailed drawing releases on SS design are 40 percent complete and all drawings on the optical bar have been released. Assembly drawings are being released in the order of sequence of manufacture. Ninety-five percent of long-lead items for the Engineering and Development Models have been released and are under procurement. Optical bar tubes and end bells are scheduled for delivery in six weeks at which time the optical bar final assembly will commence.

f. With the exception of Chamber D, the plant and test facilities are essentially on schedule. Chamber D, which is used for optical bar acceptance testing, is two months behind schedule; a recovery plan is being developed.

Chamber B, the two-bar assembly test chamber, is nearing structural completion and will be pumped down during May. Chamber A, the SS system level acceptance test chamber is proceeding on

schedule. The SS mock-up was updated for joint P-E/LMSC access port size and location studies, and was instrumental in arriving at technical agreement in this area. A combined SBA/SS mock-up to be constructed at LMSC is planned for resolving detailed structural interface problems.

PROGRAM SCHEDULE

~~HX SECRET~~
SPECIAL HANDLING

HEXAGON INTEGRATED SCHEDULE

23 APRIL 1968

FY | FY | FY

CY 68 | CY 69 | CY 70 | CY

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10 DEVELOPMENT MODEL
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13 SSC FLIGHT MODEL DELIVERY
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16 SBAC ASSY & TEST
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18 DYNAMIC TEST VEHICLE
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21 STATIC TEST VEHICLE
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