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9 April 1965

MEMORANDUM FOR: Chief of Projects

SUBJECT: Weekly Status Report No. 29 on Project FULCRUM

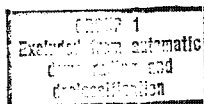
1. Camera System

A. ITEK - Dr. Hills of Itek visited P. E. on 5 April to discuss problems associated with beryllium production. The Final Summary Report, the last Itek deliverable, is still undergoing "revision".

B. P. E. - Messrs. Besserer and Quick presented a briefing to P. E. on 6 April on STL's approach to systems engineering. Messrs. Maxey, [redacted], and Dirks represented the Project Office at the briefing. The briefing consisted primarily of outlining the responsibilities of the SEAC contractor and the other associate contractors, describing in general the initial tasks for the Definition Phase, and relating proposed program control methods and techniques.

Following the SEAC briefing, discussions involving representatives of the Project Office, SEAC, and P. E. were held to define the various camera units to be delivered. The agreed-upon list with tentative shipping destinations is as follows:

- (1) Flight Units 1-40 (at least the first 3 will be engineering/diagnostic) (ship to SEAC)
- (2) One Prototype Unit (Training Unit/"Fit Test Unit") (ship to SEAC)
- (3) One Engineering Model (to be retained at P. E.)

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- (4) One Space Vehicle Qual unit (ship to G.E.) (ship back to P.E. for retrofit)
- (5) One Camera System Qual unit (retain at P.E. , retrofit for flight, if can)
- (6) One Electrical unit (ship to G.E.)
- (7) One Structural unit (ship to G.E.)
- (8) One Thermal unit (ship to G.E.)

Mr. Stoll visited G. E. on 6 and 7 April to discuss payload thermal problems.

C. RCA - The "nothing at all" device is nearing completion and is scheduled for basic experimentation with respect to film movement soon thereafter.

## 2. Spacecraft

Messrs.  and Dirks attended a briefing at G.E. on 5 April on the status of the attitude control subsystem design. The results of the single-gyro feasibility study, which is ultimately to include:

- (1) The payload mode
- (2) The recovery mode
- (3) The initial acquisition mode
- (4) The drag make-up mode

were confined in March to the payload operational mode. Two types of control logic -- torque integral feedback and pulse width-frequency modulation -- were considered in order to allow the use of high torque levels in the payload mode that are consistent with the DMU mode, thus eliminating the need for two levels of control torque. It was found that additional logic circuitry had to be added to the basic torque integral feedback scheme in order to obtain the required noise rejection. April efforts will be directed toward evaluating the additional hardware implications of this additional circuitry. With both control logic schemes it was found that:

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- (1) Torque levels compatible with DMU operation could be used in the payload mode,
- (2) A disturbance-torque bias signal must be used to allow the settling time requirement to be satisfied,
- (3) Some margin over the predicted scanner noise power has been established.

However, no evaluation of acceptable values of cycle payload disturbance torques have been made to date using analog computer simulation.

A work study was let by G. E. with ATL essentially to obtain technical data on their scanner equipment accuracy and noise characteristics. The current G. E. selection for an ATL type horizon sensor utilizes the best features of the other ATL sensors (OGO, Gemini, "Mod III") plus some innovations. Design characteristics for these scanners are as follows:

- (1) Spectral response -- 14.1 to 15.6 microns
- (2) Noise feature (230° K earth) -- 0.0125° (RMS). 30 CPS  
dither noise -- 0.15° (peak)
- (3) Horizon accuracy (3 sigma) -- 0.08°

The current configuration for the Actuation Subsystem has a total of 8 thrusters, all of which are hypergolic bipropellant pulse-rocket engines, utilizing the tankage and pressurant components provided in the DMU subsystem. Two clusters (one pitch and two roll engines per cluster) and two single yaw engine mounts are required. Torque levels currently provided are 50 foot-pounds in pitch and yaw and 10 foot-pounds in roll. The approximate thrust levels to provide these torques are 5.3 pounds in pitch and yaw and 1.4 pounds in yaw. Marquardt's 5 pound pulse-rocket engine, which has undergone extensive testing, appears to be the leading contender for the higher thrust engine, but Bell Aerosystems Company and Rocketdyne are also being evaluated. The approximate one-pound thruster requirement also appears feasible, and some test results from engines operating at this thrust level are available. Total

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propellant and subsystem dry weight for a 7-day mission is 84.5 pounds for this configuration and 99.0 pounds for a 10-day mission. In addition, a six-thruster configuration is being investigated.

[redacted] and Mr. Reese visited STL on 7 April and discussed with [redacted] the cognizant Air Force project officer, the current and future status of the SGLS system. Unfortunately, the future deployment of the SGLS concept to all ground tracking stations beyond the two test facilities currently planned is uncertain, and even if approved, would coincide roughly with the initiation of the FULCRUM launch schedule. Therefore, the command subsystem for FULCRUM must be designed to be compatible with the current ground facilities, with a built-in ability, if possible, to shift over to an operational SGLS system later in the program.

(b)(1)

(b)(3)

Copies of the March Status Report were delivered to Headquarters on 8 April, along with copies of the "Attitude Control Subsystem Design Study."

### 3. Recovery System

Messrs. Besserer and Quick presented the SEAC briefing on 7 April to Dr. Adams and to management level personnel associated with the FULCRUM project at Avco. [redacted] represented the Project Office at this briefing, at the end of which a slightly revised organizational set-up was presented by Dr. Berninger. Under the new business manager, Mr. R. V. Smith, (Mr. Carlson had been awarded a scholarship for special graduate school studies and will be on leave of absence for awhile) are contract administration (J. S. Gillies), Project control (L. A. Hammond), and Project security (C. L. Oliver). Under the space systems engineering manager (T. W. Cahow) are functional systems (T. A. Olsson), vehicle development (T. N. Banks), field operations (L. F. Gallo), engineering analysis (J. W. Graham), flight test plans & evaluation (R. E. Demming), and product assurance (A. M. Dallon). Plant operations under Mr. Belpedio remains unchanged.

Mr. Baer and Mr. Wilkinson of the SEAC group reviewed the design status of the recovery system on 6 and 7 April.

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**4. Systems Engineering**

A copy of the SEAC briefing charts presented to P. E. and Avco was given to the Project Office and copies of the Program Plan are being edited in order that they may be released to the associate contractors.

**5. Interface Aspects**

Messrs. Stamm and Matson of G. E. met with Messrs. Gustafson and James of Avco at Avco on 7 April to discuss RV pitch-down angle and other operational deorbit aspects. Agreement was reached on reasonable 3 sigma values for the spacecraft-induced attitude errors ( $\pm 3^\circ$ ) and 3 sigma angular rate errors ( $\pm 1^\circ$  per second) that are transmitted to the RV. The Project Office approved the concept that perigee location would not exceed  $20^\circ$  north to  $75^\circ$  north latitude. A fixed pitch-down angle was agreed to, the exact value of which would be obtained in current Avco studies.

A thermal interface meeting between the recovery vehicle and the spacecraft was held at G. E. on 8 April with the following persons present: Messrs. Petty, Sommerville, Stamm, and McLay of G. E.; Grunitz and Gustafson of Avco; and Vehrencamp and Green of SEAC. An atmospheric model for both contractors to use in studying the effects of free molecular heating was agreed to. In the area of heat exchange between the RV and the spacecraft, it was agreed that separate radiation barriers separating the surfaces of the RV which would be visible from inside the spacecraft were undesirable and probably unnecessary. SEAC agreed to perform a preliminary examination of the thermal environment of the RV during its pre-launch conditioning. A further meeting on the orbital thermal environment was deemed the subject of a later interface discussion.

A twix defining the operational requirements to be used for preliminary thermal design work was transmitted on 9 April, stating in effect the camera operating times at perigees of 80, 100, and 120 NM with a maximum operating time per day of 40 minutes. Beta angles of  $\pm 60^\circ$ , time from launch to first operation of 340 minutes, and on-pad temperature of  $70^\circ \pm 5^\circ$  were specified.

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