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BIF-107-50030-68
15 July 1968
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To: W. L. Dalton

Date: 15 July 1968

Subject: DORIAN Monthly Progress Report
1 June - 30 June 1968

From: J. F. Chalmers

1.0 GENERAL

1.1 Activities during the month of June centered on three major areas:

- a) Preparation for and participation in the Fifth Interface Technical Sign-Off Meeting.
- b) Resolution of Aerospace position on major technical problems in preparation for a Program Managers Meeting scheduled for mid-July.
- c) Preparation and review of SOW, CDRL and Form 9 change packages necessary to accomplish system level tasks briefed at the last SP/DR - SAFSL review meeting at DAC.

2.0 INTEGRATION

2.1 Crew Systems Integration

2.1.2 The results of the analog simulation studies to determine appropriate transfer functions for the right hand control stick were briefed to Aerospace and SL-7 personnel, including the MOL Flight Crew, during this reporting period. Preliminary K functions have been identified and will be subjected to further study and validation on the R-38 simulator during the coming report period.

2.2 Design Integration

- 2.2.1 Attended a special CCB meeting at DAC on 24 and 25 June to effect the buy-off of the first Mission Module Forward Structure. This buy-off included eight DAC ECP's which proposed a total weight increase of 28 pounds. We obtained a DAC agreement on a total increase of 12 pounds and approved the ECP's at that value.
- 2.2.2 Submitted Orbiting Vehicle Weights briefing charts to the MOLSO. This briefing included status, pending changes to the current design and spec values, histories and GFE listings. These data were presented for all segments and the OV.

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2.2 Design Integration - continued

2.2.3 Interfaces: Attended the 5th IF TSOM at GE during the week of June 10. The following significant problem areas were resolved and signed-off:

- a) Relocation of the computer in Bay 8 upper, and provisioning for removal of the two MDAU units in Bay 8.
- b) LM Installation and Access
- c) Location of EK equipment on GE cold plates
- d) Clearance between the camera and a longeron and the secondary DRC's
- e) Space allocation for the secondary DRC's in the aft bulkhead equipment well.
- f) Space allocation for the installation of secondary film in Bay 5.

Among others, the following significant problem areas were defined and the appropriate action items and TEM's were defined and scheduled:

- a) Interference between the visual optics assembly and the DAC bird-cage structure in Bay 1.
- b) Inability of the Ross Barrel to support the overturning moment induced by the current version of the IVS.
- c) Interference between the camera and the IVS space allocations.
- d) Camera kickproofing.
- e) Mounting of secondary cassettes.

2.3 Effectiveness Integration

2.3.1 Started an analysis of the reliability (and effectiveness) of a single photographic pass. Some of the objectives of this study are listed below:

- a) Determine which equipments are required to operate and for what time periods. (Thus items with a high λ t can be more closely controlled.)
- b) Determine the time required to bring redundant units "on-line" after a failure. (In almost every case examined all further data from at least that pass will be lost.)

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2.3 Effectiveness Integration - continued

- c) Use the above when evaluating the data from the integrating contractor's (DAC) models.
- d) Through studies and liaison with contractors (and some subcontractors) attempt to improve the above through design changes, specific product control, development tests control and operational procedure changes (i. e., software) etc. The latter item is especially important when a "critical" pass is known to be next, i. e., both units of a redundant pair may be operational instead of one in standby.

2.4 Systems Analysis Section

- 2.4.1 An investigation of the dynamic null and bias due to image motion across the IVS field-of-view has been initiated. The computer simulation includes the actual on-orbit conditions as well as the Beta Tester conditions. Results will be obtained for a perfect IVS and the actual hardware. Preliminary results indicate that (1) simulator results are pessimistic with respect to the actual conditions, (2) in-track x-format effects are the principal problem, (3) dynamic null and bias are scene dependent and (4) methods of reducing dynamic null and bias below specification values look promising. Cloud effects are not included as part of this investigation. In conjunction with this investigation, methods of reducing the main optics on-axis smear, without LOS IMC, are also being investigated.

2.5 Electrical Integration

- 2.5.1 Task Statements - Tasks were written for the DAC, MMC, EK, MAC, GE and HS work statements with the accompanying CDRL lists and Form 9s for EMC, power, ordnance and electrical wiring. This was done for both segment and integration tasks.
- 2.5.2 Held a meeting with GE, EK and DAC at GE to discuss power switching transients on the Control Power System (CPS). Aerospace presented their evaluation of the GE switching analysis and recommended favorable action on the GE deviation request. Subsequently, a TWX was sent to DAC and GE granting them the deviation. Aerospace also presented their results to date of their analysis that will quantitatively relate transients and ripple. Aerospace requested that DAC re-submit their ripple analysis including a positive statement about their recommendations.
- 2.5.3 Conducted a meeting with GE, EK and DAC at GE on the application of the wire harness specification to the vehicle harnesses. The GE mockup at Valley Forge was used for demonstration purposes and several contractor questions were answered as well as action items generated.

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2.6 General

2.6.1 Coordinated preparation and review of SOW, CDRL, and Form 9 change materials for the System Level Tasks materials briefed at the last SP/DR SAFSL review meeting at DAC.

3.0 DAC

See Secret SAR Monthly Progress Report.

4.0 GE

4.1 Ground Systems

4.1.1 A DDS-1/EDCTU working group meeting was held at Radnor to review GE test planning progress. A detailed review of test objectives, hardware description, test requirements and software testing was conducted for both DDS-1 testing at King of Prussia and for DDS-1/EDCTU testing at Huntington Beach. A better understanding of these programs resulted and several significant problem areas were assigned action items; they were:

- a. GE inability to interface with DAC ACTS prior to flight
- b. Development of requirements for EG-48 Dynamic Simulation
- c. EDCTU schedule incompatibility at DAC
- d. Resolution of EG-28 electrical loads problem.

4.1.2 Considerable time has been spent at TSOM #5, the TD meeting, subsequent Exchange Hardware meetings and others in attempting to resolve several difficult areas relating to the Ground Test Program. These areas are still unresolved although the position of this office is now clear. These problems include:

- a. Definition of requirements for MMTE at Rochester and the subsequent definition of the necessary AGE to meet those requirements.
- b. Resolution of the requirements for refurbishment of the 113T vehicle to provide EK an engineering model.
- c. Definition of the LM Thermal Substitute supplied by DAC to GE (which GE subsequently supplies to EK). Presently inconsistent test requirements and hardware are in the baseline.

4.1.3 Definition of a new ground test plan has been discussed with GE and has been tentatively agreed upon. It is intended that this document will contain the contractual baseline flow, together with sufficient descriptive detail to define the entire test program. In addition to this effort, work has begun to define the integrated test program for the Statement of Work.

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4.1 Ground Systems - continued

4.1.4 The GE PDR package on their proposed (ground) alignment scheme was received in-house. This document is under review. Our comments and proposed Aerospace position are to be provided at an Aerospace in-house discussion on 12 July.

4.2 Crew Systems

4.2.1 Continued work on rewriting a portion of GE AVE CEI Specification relative to the ATS and Controls & Displays Subsystems.

4.2.2 A meeting was held on Controls & Displays design status at Radnor, 18-19 June. A major result of the meeting was the establishment of a procedural method for handling detailed changes to the C&D configuration as the design evolves. The meeting indicated the need for continued optimization of the design of the left hand stick. Also, considerable additional design effort is required to provide protection of critical components on the GE panels (eye-pieces, projectors, sticks) during non-use periods.

4.2.3 ATS problems identified at TD meeting of 20-21 June include off-axis optical resolution performance and a possible eye hazards condition. These problems are being actively worked.

4.2.4 An ATS alternatives meeting was held at Radnor 23 June through 27 June with participation of GE, DAC, ITEK, Aerospace and the Air Force. The major results of this meeting were:

- a) Decision to continue with the two fairing approach
- b) Withdrawal by GE of the humidity requirement under the fairing when vehicle is not in controlled environment.
- c) New definition of GE/DAC interface at penetration fitting which gives GE responsibility for thermally controlling temperature of window.
- d) Identification by GE of potential requirement of local stiffening of LV structure at scanner mounting points in order to eliminate the structure vibration modes from being coupled into the scanner servo response. (DAC will look at means for accomplishing this stiffening.)
- e) GE modified a method proposed by DAC to reduce the sensitivity of the ATS pointing errors to structural deflections. GE is examining this in greater detail.
- f) Products from molecular sieve do not contribute to the contamination problem as far as the ATS is concerned.
- g) A plan was formulated to resolve shock problem (incurred by fairing ejection).

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4.3 Systems Analysis

- 4.3.1 Considerable effort was devoted to a review of the Tracking Mirror drive (Drive A) control stability problem. Further refinements have been made on analyses of the Drive A stability/performance problem due to flexure stiffness. There is no change in the GE conclusions nor in their position that they have a requirement for minimum stiffness of the flexures as spelled out in ICN 2A to IF 101.2.
- 4.3.2 Efforts were made to have contingency analysis work reported on by GE during technical review meeting the week of 17 June. Lack of organization of this type of work resulted in poor coverage of this subject and has pointed up the need for planning and coordination. Work has been conducted on the needed organization.
- 4.3.3 The ground work was laid for achieving agreement between GE and DAC on the ACTS gyro data. It became apparent to Aerospace and GE that vehicle vibration sensed by the gyros had not been previously considered and no interface spec provisions were in existence. GE is now beginning to address the general problem of performance degradation due to vibration sensed by the gyros.
- 4.3.4 Equations and Cost Proposal Changes (CPC's) from version zero of the Part II Software Specification were reviewed and commented on in response to Aerospace action items resulting from the Software PDR. Non-uniformity of coordinate systems used by GE was heavily criticized in the comments. Also criticized was the GE incorrect approach to normalization of the Euler parameters in the D matrix of the attitude determination CPC - a correct approach was outlined.

4.4 Navigation and Control

- 4.4.1 Image Velocity Sensor (IVS) - Westover AFB was visited to explain 50 data requirements. The Aerospace Corporation will process the data to better define the optical input to the IVS, i. e., energy and modulation under conditions of snow, clear water, clouds, varying sun angles, etc.
- 4.4.2 An attempt was made during the June TSOM to solve the interface problems of IVS weight, e. g. location and thermal input to the Ross barrel between GE and EK.
- 4.4.3 GE presented their analysis of the IVS "dynamic null" problem and several possible "fixes". The Aerospace Corporation suggested that an acceleration threshold actuating an inhibit and memory be investigated by GE.
- 4.4.4 The GE IVS tester for DSS-1 was reviewed by Aerospace and felt to have a number of serious limitations. GE was asked not to pursue their design until some better ones can be suggested to them.

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- 4.4 Navigation and Control continued
- 4.4.5 Bearing Program - The Aerospace Corporation has completed tests and published a report on the torque noise of large diameter ball bearings for use in Drive A performance analysis and design. Aerospace loaned GE a set of small bearings from the Aerospace test to check correlation on the brassboard. Aerospace is building a bearing locking fixture for further tests using large bearings.
- 4.4.6 Alignment Monitor Set (AMS) - At the technical review meeting, GE presented their analysis showing that the light source at Location "A" is not satisfactory. They also said that Location "X" will meet spec. Aerospace is studying the requirements as related to the mission operations.
- 5.0 EK
- 5.1 Reliability
- 5.1.1 As a result of the Reliability and Redundancy Review on 10-12 June, it was determined that the EK ground rules for assessing reliability are not in accordance with the Work Specification. When the EK analysis is based upon the Work Specification, there is only a 0.88 probability instead of the required 0.914 probability of achieving mission objectives. A policy TWX was prepared directing the contractor to establish a baseline redundancy and reliability assessment consistent with the requirements. In addition, EK was directed to redesign the alignment system and the mirror launch locks to eliminate the unacceptable features.
- 5.2 Document Reivew
- 5.2.1 This office is reviewing the Component Qualification Test and Maintainability (PLOT) documents. Both documents required additional work by the contractor.
- 5.3 Program Managers Meeting Preparation
- 5.3.1 A review of the significant open interface problem areas was conducted in preparation for the Program Managers Meeting. This office has prepared Aerospace positions and recommendations on selected items.
- 5.4 Displays and Controls
- 5.4.1 An end-to-end review of displays and controls to be included in the Dorian payload was conducted by the contractor, Air Force (Engineering and Flight Ops Crew), and Aerospace. Formal minutes were established with crew signoff for adequacy of concepts except where specifically noted.

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5.4 Displays and Controls - continued

5.4.2 A technical baseline for the monitor and alarm system was developed and coordinated with the flight crew. Contractor direction is in coordination.

5.5. Performance Analysis

5.5.1 The Aerospace and EK static optical performance analyses are in agreement when assuming the same manufacturing errors.

5.5.2 The photographic performance is uncertain because of the uncertainty in film AIM characteristics. Presently, a variation of approximately 60% from low to high estimates exists.

5.5.3 Analyses of the on-axis performance as a function of sun angle and smear rate is in progress in cooperation with other Aerospace departments.

5.6 Safety

5.6.1 The film flammability problem tests completed to date and proposed tests were reviewed with DAC personnel. Appropriate subsystem level tests and EK participation required definition.

5.7 System Development

5.7.1 The "A" Chamber Review has resumed with the receipt of backup material requested by Aerospace. A preliminary report is being prepared. The Acoustic Chamber Facility is almost complete. The instrumentation is being installed, and transducer checkout will begin in about two weeks.

5.8 Interface Definition

5.8.1 DAC definition of LM environment design parameters to be included in several SAFSLs and SA 27 continues to be incomplete and unsatisfactory. Coordination meetings held during 9-11 July could not establish firm and unambiguous values.

5.8.2 GE and EK reported dissatisfaction with the DAC Lab Module thermal design. Aerospace analysis of DAC data indicates that LMTS may be usable as designed. GE and EK have been requested to submit analyses and comments.

5.8.3 Numerous interface ICN's have been signed off, including the MMTE Requirements Definition document.

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6.0 DATA SYSTEMS

6.1 EDCTU Substitutes

Technical review of EK substitutes for use in the EDCTU were conducted and briefed to SO management. It was concluded that the nature of the EDCTU configuration does not allow conclusive EMI testing and that fully representative EK substitutes are not justified. A minimum approach which provides for starting transients and major ripple contributors to conducted EMI is recommended.

6.2 Command

A meeting was held at GE on 4 June to resolve the command interface between the backup decoder and the support module. GE and DAC reached agreement on pulse widths and numbers of commands. One point still in question is whether a level or a pulse should be supplied to GE for establishing a clear mode inhibit. GE took an action item to present their requirements to DAC.

During the TSOM #5 at GE on 11-14 June, a timing problem involving the writing of edge data by the experiment controller was presented as an interface problem. The conflict which arose was the requirement to write edge data simultaneously with the movement of the camera shutter. During the 27 June meeting, EK provided updated timing information for the camera operations and presented the timing requirements. The requirement to write each data simultaneously with shutter movement was presented as a firm requirement and GE proposed a software solution to the problem which was acceptable to both EK and GE. An ICN will be prepared by GE for signoff at the next TSOM documenting the final resolution to this problem.

The ground software PDR, held at Sunnyvale on 24 through 28 June, revealed no major problems. The command and control programs for message generation and event generation were reviewed along with the total package.

6.3 Critical Telemetry

A TEM was held at GE with representation from DAC, GE, EK, and SO/Aerospace. The meeting was conducted to discuss the telemetry configuration and to verify that essential data would be obtained through redundant hardware in case of single circuit failure within the telemetry system.

DAC provides redundancy for essential measurements by blocks, switchable by command. GE has no redundancy, but identified

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6.3 Critical Telemetry (continued)

no measurements as mission-essential. EK has redundant transducers for critical measurements, but the GE multicoder is a single component whose failure would prohibit transmission of any data from the mission payload.

7.0 ORBITAL OPERATIONS

7.1 Mission Analysis

7.1.1 Mission Planning and Evaluation (MP&E)

7.1.1.1 The part I Specifications for the Mission Planning Software (MPS) and the Mission Correlation Data (MCD) Software submitted by TRW are currently under review.

7.1.1.2 The TWONDER computer program, a study version of the MPS, has been delivered and is undergoing final checkout. Solutions to problems encountered in revs of very high target density have been identified and are currently being incorporated into TWONDER.

7.1.1.3 Delivery of the basic 1700 constituents of the study target deck are expected from Foreign Technology Division by the end of July. Some work has already been done in terms of preparation for the expanded deck of approximately 13,000 targets. The TWONDER program is undergoing checkout with a 13,000 target deck, each of which has the same location as in the study deck but has "fake" data in the rest of the format.

7.1.1.4 A CCN to the basic TRW MP&E contract to cover the period from 1 July through 1 January 1969 has been negotiated. An additional task is included in the CCN: the development of a binary interface tape (BIT) capability out of TWONDER; the development of a Monte Carlo simulation program for targeting studies; Part II-type documentation for TWONDER; and TWONDER maintenance.

7.1.2 [REDACTED]

7.1.2.1 In response to direction given in an April briefing for Gen Stewart which highlighted the results of an intensive study of the [REDACTED] capabilities of the MOL/DORIAN System, a similar briefing for Dr. Flax was prepared. This briefing was given at the 24 June Program Review Council (PRC) meeting and the following recommendations were made:

a. [REDACTED]

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7.1.2

[REDACTED]

7.1.2.1 b. Authority to Proceed be granted for: (1) CCN to existing GE contract in early FY 1969 for ADC software and simulation equipment; (2) RFT for ground software in accord with a January 1969 "go ahead".

c.

[REDACTED]

7.1.2.2 The following direction was given at the PRC:

- a. Process the necessary changes to the GE contract that will ensure minimum impace on the ADC software if [REDACTED] is incorporated. Maximum expenditure to be approximately \$100,000.
- b. Prepare a ten-page paper on the [REDACTED] capabilities of the MOL/DORIAN System for dissemination to the intelligence community.
- c. Prepare a cost proposal with respect to incorporation of [REDACTED] into the MOL/DORIAN System for total program life cycle.
- d. Hold up any RFP effort on ground software until after Items a. and b. have been satisfied and further direction is given.

e.

[REDACTED]

7.1.2.3 As a result of the above direction, the following actions have been taken:

- a. Effort was initiated with GE to define the technical Contract Action Request (CAR) necessary to accomplish the ADC software definition of [REDACTED] through preliminary design.
- b. A paper was prepared for and transmitted to Dr. Flax (BIF-107-50006-68).
- c. A cost proposal is being prepared and the proposed Contractor Statement of Work and Preliminary Part I Specifications are being appended thereto.

7.1.3 Cueing

An operational philosophy associated with on-board briefing of the flight crew prior to targetting operations is being developed. This philosophy will cover use of both the on-board cue presentation subsystem and alphanumeric display devices. Discussions are currently being held with those agencies.

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7.2 COMMAND AND CONTROL

- 7.2.1 Conducted 804 Command Control Software PDR at GE, Sunnyvale, during week of 24 June. Action items generated are in work and should be completed in mid-August. Aerospace is responsible for providing comments on the Item Test Plan by 1 August.
- 7.2.2 The review of the GE Integrated Command Definition Specification and Hardware/Software Limitation Specification has been completed. Detailed comments have been prepared for discussion at the 8 July FOPG/OSG splinter group meeting on the subject.
- 7.2.3 The GE role of integrator for MOL-peculiar STC (3800) software referred to in the white progress report (CSR-0200(4107-10)MPR-1) requires interfacing of the TRW MP&E programs with DAC and GE programs performing the following functions:
- a. Flight plan generation and update.
 - b. Uplink message generation.
 - c. Telemetry prediction and analysis.

This system also makes use of the TRW reentry program, and both general and MOL-peculiar features of the advanced orbital/ephemeris subsystem, all operating in the STC environment (executive, data base system, control and display system).

7.3 OPERATIONS INTEGRATION

Developed a briefing in conjunction with the Air Force to show relationship of ground operations planning and activities to crew and OV operations. The briefing was developed specifically to brief J. Bleymaier and to present to the Flight Operations Planning Group (FOPG) in July.

7.4 AVE SOFTWARE

Comments were prepared on the Version Zero, Part II Specification and the Equations Notebook for GE AVE Software. Of particular concern was the lack of standardized coordinate systems used by GE throughout these documents. A report was prepared to be followed up by discussions with GE (see paragraph 4.3.4).

An analysis was conducted on an interference problem associated with taking photos at 1.5 sec intervals. A software solution was determined which would alleviate this priority interrupt processing and edge-data write-out conflict problem.

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7.4 AVE SOFTWARE (continued)

An initial interface specification between GE AVE and C&C software and EK hardware was reviewed, and a meeting was held during the TSOM #5 to critique the document.

8.0 AUTOMATIC CONFIGURATION

8.1 Wind Tunnel Tests

8.1.1 Participated in a pre-test meeting for the Martin Company's Wind Tunnel Test Planning of the Flight 6 and 7 configuration.

8.1.2 Reviewed test data of the NASA Ames Wind Tunnel Test of the 60 degree Support Module Fairing. Results indicate satisfactory accomplishment of objectives.

8.2 Documentation

An in-process System Engineering Documentation Review was conducted for Flights 6 and 7 to assure an orderly and adequate development of hardware requirements. Technical comments were provided to DAC and GE for the purpose of making necessary corrections prior to the completion of the effort on 15 July 1968.

8.3 Reviews and Studies

8.3.1 Conducted a study to eliminate test redundancies which resulted in an updated draft of Flights 6 and 7 test flow.

8.3.2 Conducted a review of GE proposed acoustic test facility to assure compatibility with hardware requirements.

8.3.3 A Technical Exchange Meeting was conducted on the Flight 6 and 7 thermal requirements. The contractor progress was reviewed and related action items assigned to contractors for further study.

8.4 Data Systems

A technical interface meeting was supported at GE on 9, 10 and 11 July 1968. At the Electrical Working Group meetings, the following problem areas were identified.

8.4.1 Instrumentation and Telemetry

The instrumentation and telemetry configurations for these vehicles has not been established to date. Primary reason for this is that

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EK has not supplied the PCM and FM requirements to GE. This was identified as a pacing item by GE, DAC and Aerospace at the wrap-up meeting. A TEM is planned for early August to try to identify and scrub the measurements.

8.4.2 Command

EK identified the hardware/software interface they desire for the recovery section. A TEM was scheduled for 8 August 1968 to discuss this after the preliminary requirements submitted by EK are reviewed by GE.

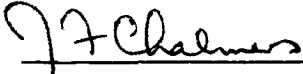
Definition of the inhibit signal characteristics from backup decoder are being reviewed by both DAC and GE.

8.4.3 Monitor and Alarm

No Monitor and Alarm interface requirements by EK have been identified to date. All malfunction detection and isolation for the EK equipment is intended to be accomplished via telemetry and ground analysis.

9.0 MANAGEMENT SYSTEMS

9.1 A Schedule Control System coordination trip to EK was made during the reporting period. A complete review of the Schedule/PERT planning network was accomplished. Direction was supplied that will allow the contractor to expand his schedule to include dates for flight four and subsequent. The additional detail is to be supplied at the rate of one flight each month until the total program is detailed. A tour of the Test Facility and a status report of the progress to date was provided. From the inspection and a review of the data presented, this facility should be operational early in 1969.



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