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19 December 1968

MOL MONTHLY PROGRESS REPORT

for

1 November 1968 through 30 November 1968

*for* Morton A. Byeman  
James F. Chalmers  
Systems Engineering Director  
Management Systems Office

SIGNED

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Walter C. Williams  
Vice President, General Manager  
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1.0 GENERAL

Major effort during the month of November was directed toward fact-finding in preparation for negotiations on the Supplemental Agreement. In fact, practically the entire Aerospace GE Office staff spent the month in Philadelphia in this type of activity combined with the Technical Sign-Off Meeting (TSOM) #8.

2.0 LOADS

MMC has made delivery to the associate contractors of all of the required static elastic load conditions and transient conditions except launch and thrust termination. There is a discrepancy between Aerospace and MMC modeling and analytical techniques. The technical concerns with the launch analysis have been basically resolved. MMC is to transmit the results of their launch analysis to SO/Aerospace for review on 17 December. If the review results in approval, MMC will release loads to associates by 20 December.

Thrust termination still has items to be resolved; principally thrust vector control influences and pitch and yaw mode compatibility. The loads resulting from current analysis indicates, for some items, an increase over Stage I shut-down, which to date is the most critical design condition.

2.1 COA Loads

Revised Subsystem "B" model has been prepared by Aerospace following receipt of model changes from the responsible associate contractor. Modes have been subsequently calculated and loads are in the final stages of preparation. The loads were obtained by driving the new model at its attach points with Load Cycle 4 forcing functions. Preliminary data indicates that the original 10% factor added to the Load Cycle 4 to account for Subsystem "B" deficiencies can be deleted.

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3.0 CONTAMINATION

The subject of contamination is divided conveniently into ground, launch-ascent and on-orbit contamination.

3.1 Ground Contamination

During the month of November preparations were made for a meeting to be held at Huntington Beach on 10 December 1968. The purpose of the meeting will be to achieve technical agreement among associate contractors on a ground contamination specification. A set of words on this subject (to be included in SAFSL Exhibit 10003, Environmental Design & Test Criteria for MOL System LM, MM, and Associate AGE) were written specifying air cleanliness and hardware cleanliness requirements as well as tumble testing and cleanliness control of transporters, tools and MOL Environmental Shelter (MES).

3.2 Ascent Contamination

A Technical Interchange Meeting was held at Martin Marietta, Denver, on 7 November 1968 to discuss the status of the THIM retro and fire-in-the-hole plume definition. Additional retro data required by MDAC-WD will be forwarded by 15 December. Fire-in-the-hole staging data will require a subsequent meeting to categorize harmful constituents and thus simplify the required Martin Marietta analysis.

3.3 On-Orbit Plume Contamination

Pulse mode testing of the one pound thruster in the radial position at AEDC resulted in contamination that would deleterious to the mission. The expected fix of a thruster shroud was shown to be effective in this orientation as well as the tangential orientation.

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### 3.3 On-Orbit Plume Contamination - Continued

MDAC-WD presented a plume contamination plan of action briefing to the Systems Office Wednesday, 27 November 1968. As a result, they initiated effort at Marquardt involving full scale pulsing tests and also in-house laboratory tests in support of the Marquardt effort.

### 4.0 ALIGNMENT

The GE study to re-evaluate the need for an elaborate ground alignment scheme and to upgrade the AVE alignment system is proceeding satisfactorily. It has been concluded by GE, Aerospace and the Air Force that the ground based alignment system is not justified if a third optical link to the back of the tracking mirror can be implemented. GE is evaluating two possible schemes for this link: (1) three sensors mounted in the lower tripod leg sensing motion of the COA line of sight, the star trackers and the tracking mirror and (2) two sensors on the tripod lower leg and one on the star tracker base sensing motions of the COA line of sight, star tracker and tracking mirror respectively. The selection between these two alternatives depends on the results of pointing error analysis, weight impact and cost impact.

GE is also proceeding towards development of the ATS alignment system using bench equipment, MDAC tooling mounted instruments and vehicle mounted AGE for the component, LM installations and LV checks respectively. An interface meeting is scheduled for mid-December to resolve remaining problems with MDAC.

### 5.0 IVS

The Goodyear IVS engineering model is experiencing the same development problem in test as did the breadboard unit and has been

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5.0 IVS - Continued

returned twice to the vendor for fixes. The Hycon IVS engineering unit has been returned to the vendor for minor equipment fixes. The test of the engineering model does show improvement over the breadboard; tests are continuing. A detail review of engineering model tests and problems is scheduled for mid-December.

6.0 FLIGHTS 6 & 7

A final incremental System Design Review Meeting was held to provide an in-process review of the Ground Test Plan - Part II, Hardware Description (AAE), Wind Tunnel Test Report and additional contractor comments to the SP/DR (SS-MOL-1B).

The data obtained at a test flow meeting at EK were utilized to prepare alternate test flows for management consideration.

A System Design Review was performed at MDAC-WD facilities, during which the contractors presented their technical data. The data presented acceptably defined the design, interface and test requirements for both AVE and AGE components. As a result of this meeting, it is felt that the Automatic Configuration is ready for integration into the MOL System. The review was concluded with an in-house Executive Session at which action items were assigned to the associate contractors to aid in resolution of the ATP schedule for the automatic configuration. Response to the assigned action items are to be presented at a meeting presently scheduled for 19 December 1968.

7.0 ADVANCED DATA SYSTEM (ADS)

The Aerospace Operations Directorate continued to support Air Force MOL Systems Office efforts in supplying SAMSO with

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7.0 ADVANCED DATA SYSTEM (ADS) - Continued

adequate information on MOL requirements. Analyses were made of several suggested methods of accomplishing MOL ground control using a number of different computer configurations. Effort was also expended in preparing for the Galentine Committee meetings and in accomplishing several discussions with this group.

*SOFTWARE  
PROFIT.*

8.0 TRACKING MIRROR DRIVE STABILITY

The stability of the tracking mirror drive system has been reported as marginal for some time, due principally to low stiffness values reported by Eastman Kodak for the tracking mirror flexures. GE has been conducting tradeoff studies for means of improving the stability and has accomplished those fixes possible within their hardware. The remaining areas open to us are: (1) increase flexure stiffness, and (2) increase permissible smear rate budgeted to the drive. GE is conducting a refined analysis to include MDAC shell stiffness, revised TM tripod stiffnesses and various levels of flexure stiffness. Assuming timely inputs from the associates, this analysis will be complete by mid-December and will be reviewed by Aerospace at a working meeting on 16 December 1968.

9.0 MCL SYSTEM SAFETY

The Aerospace MOL Safety Office continued to support the segment office effort associated with Project Upgrade. During this period, the Safety Office assumed the additional responsibility of controlling the ordnance exhibit. Other areas of support included development of safety criteria for specific problem areas.

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9.0 MOL SYSTEM SAFETY - Continued

An examination of the hazards associated with LMQTV testing with a 100% oxygen atmosphere was performed resulting in more stringent subsystem testing prior to LMQTV tests. In addition, criteria were developed for emergency egress to the Gemini B on-orbit due to a fire threat in the Laboratory Module.

Fire hazards associated with the coolant fluid of the Gemini B environmental control system were evaluated and presented to the Aerospace Safety Council for review. This resulted in recommended design changes to reduce the fire hazard associated with the coolant and oxygen lines of the Environment Control System (ECS) package. The helium valve failures of the LM two-gas controller were reviewed resulting in recommended design changes to reduce the potential for hypoxia.

Special efforts have been directed toward the MDAC-ED dual gas system test to be performed in February 1969. A review of the hazards and safety precautions for manned testing is being conducted. Recommendations to date for equipment and procedural changes are being incorporated. A final review will be performed after the unmanned test is completed.

During this report period, a MOL Safety Review was conducted for Generals Stewart and Bleymaier. Nearly all the MOL associate contractors participated in this review, covering all aspects of flight crew safety. Emphasis was placed on hardware design concepts reflecting safety criteria established in the SP/DR. This was the first review of this type presenting an evaluation of the total MOL Safety Program.

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10.0 METEOROID SHIELD

For some time there has been concern for the structural integrity of the meteoroid shield. Departures from standard structural design raised questions of the vulnerability of the large shroud surface area to flutter phenomena. The structure is relatively complex and does not lend itself to straight forward loads and aerodynamic analysis (see Figure 1).

The final, supersonic phase of the Meteoroid Shroud Flutter Model Test (1A35) (see Figure 2) has been completed in the period. Prior to the supersonic tunnel runs, tests and analyses were performed to resolve the apparent discrepancy in model dynamic similarity. The discrepancy was found in the predicted characteristics of the prototype rather than in the fabrication of the model. Flutter was not observed in either the transonic or the supersonic runs. Quick-look data also indicates lower than predicted buffet loads. Remaining areas of concern in the meteoroid shroud design are being listed for review by MDAC-WD management.

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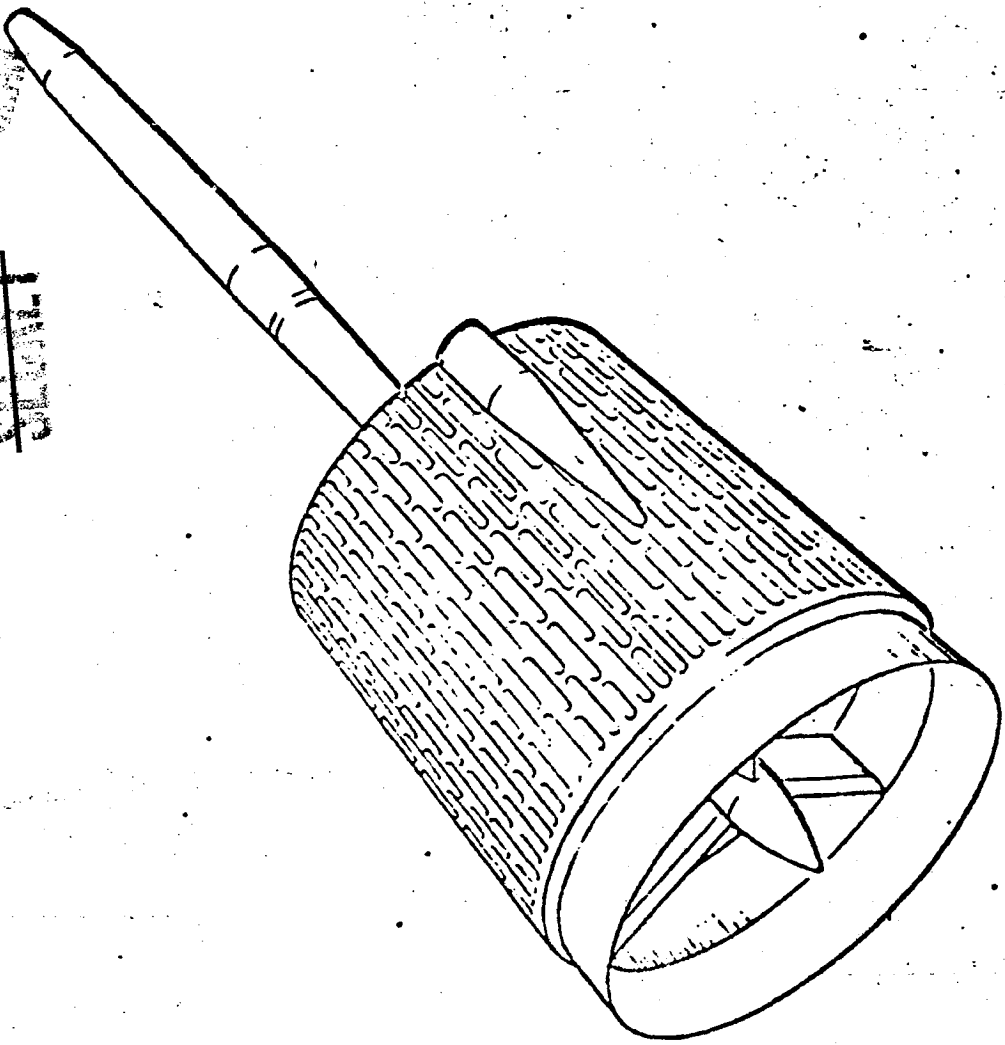
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1A35 FLUTTER TEST SPECIMEN

Figure 2

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