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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D.C.
April 27, 1962

IN REPLY REFER TO:

Mr. Arthur V. Zimmerman
Lewis Research Center
21000 Brookpark Road
Cleveland 35, Ohio

Dear Art:

We are now attempting to complete the mission profile on lunar orbit rendezvous. As you know, there are several problem areas being studied by Lewis Research Center, which are indicated in the minutes, dated April 13, 1962, of the LOR meeting.

I would appreciate your compiling and forwarding the results of the Lewis studies on the problem areas indicated in the minutes. If possible, I would like this information by May 16th.

Thank you.

Sincerely,

R. J. Hayes
Office of Systems
Manned Space Flight

cc: Dr. Abe Silverstein, Director, Lewis

3725

MAY 18 1962

Capt. Richard J. Hayes
NASA Headquarters
Office of Manned Space Flight
801 19th Street, N. W.
Washington 25, D. C.

Dear Dick:

In your letter of April 27, 1962 you requested a summary of the studies on the problem areas associated with the lunar orbit rendezvous mission conducted by the Lewis Research Center. As you know during the Lunar Orbital Rendezvous Meeting, held April 2 and 3, 1962, at NASA Headquarters, it was decided to form a committee of representatives from several NASA Centers for the purpose of investigating propulsion problems associated with the LOR mission. Such a committee has been activated under the chairmanship of A. O. Tischler from NASA Headquarters. The Lewis Research Center's representative on this Committee is William A. Tomazic of the Apollo Propulsion Office.

As a member of the LOR Propulsion Committee Mr. Tomazic was assigned the responsibility for: 1) Establishing performance, storability and reliability considerations for candidate propellants; and, 2) Assessing the state of the art of the propulsion industry in the areas of primary propulsion systems, reaction control systems, propellants and propellant tankage. Consequently, Lewis studies on these problem areas will be included in the report of the LOR Propulsion Committee.

In addition to the foregoing activities, analytical studies are being conducted by the Systems Engineering and Requirements Division, Lewis Research Center, to define the propulsion requirements for the LOR mission. Emphasis in these studies has been on the establishment of characteristic velocity, thrust level, throttleability and burning time requirements for the Lunar Excursion Vehicle. This work parallels and supplements the assignments of other members of the LOR Propulsion Committee, principally that of M. J. Queijo, Langley Research Center.

Apollo Spacecraft Project
Lewis Research Center Tasks
Lunar Landing Module

1. LeRC will be responsible for the detailed analysis, design, and development of the Lunar Landing Module, including engines and controls, propellant feed systems, temperature control systems, propellant tankage, module structure, landing gear, and meteoroid protection. The over-all configuration, performance, and operational requirements of the Module to be in accordance with objectives and requirements specified by MSC.

2. LeRC will be responsible for mounting any navigation and guidance equipment which requires installation on the Lunar Landing Module.

3. LeRC will be responsible for any torquing equipment located within the Landing Module such as nozzle gimbal actuators or attitude control jets. If a separate stabilization control system is required for the Landing Module LeRC will provide it.

4. The Lunar surface model characteristics associated with the lunar touchdown maneuver will be established by agreement between LeRC and MSC.

5. The attachment requirements of the physical interfaces of connecting modules will be the joint responsibility of those responsible for adjacent modules. Responsibilities for the stage separation mechanism will be established at a later date.

6. LeRC will be responsible for frequency and mode shape analysis of the Lunar Landing Module structure and shall provide these data and other module characteristics to MSC for use in over-all space vehicle analysis.

7. LeRC will apportion the reliability goals for systems within the Lunar Landing Module and accomplish the necessary analysis and tests to demonstrate the over-all module reliability goal apportioned by MSC and submit such data to MSC for inclusion in the continuing over-all spacecraft reliability review.

8. LeRC will be responsible for the ground support equipment required for the Lunar Landing Module. The design of this equipment shall be coordinated with the GSE provided by the contractor for the booster and spacecraft stages.

9. LeRC will be responsible for the qualification testing of the Lunar Landing Module (including ground static tests, simulated landing tests, and flight tests) and will support the over-all spacecraft flight test program by providing continued support as related to the Lunar Landing Module.

As you requested in your letter, the enclosed report summarizes the Lewis studies of LEV propulsion requirements carried out to date.

Very truly yours,

sl

Arthur V. Zimmerman
Chief, Mission Analysis Branch
Systems Engineering & Requirements Division

Enclosure:
As stated

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hms/ETH

Approved:

A. V. Zimmerman
Deputy Director

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