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Manifold Scientific Benefits Are Possible From MA-9 Experiments

Experiments that may make significant contributions to scientific knowledge and to near-future space exploration were described by L. Gordon Cooper during his review of the MA-9/20 Flight Plan at the general mission briefing held at MSC, Houston, on April 17. Other representatives of MSC, DOD, and GSFC reviewed matters pertaining to recovery operations, network status and operations, simulations, and data handling.

The flight experiments are to be conducted in a manner that will not conflict with the operational requirements of the mission. They are briefly summarized below in order of priority.

Aeromedical Studies

Man's response to the conditions associated with extended orbital flight will be evaluated. The resulting physiological parameters can be used to assess the adequacy of the spacecraft environment and the function of life support systems.

Two periods are scheduled for the astronaut to perform a calibrated exercise study as a measured load on the cardiovascular system. The first of these exercise periods, which is scheduled to occur during the second pass over Australia, will provide baseline data for medical evaluation early in the flight.

Sufficient rest, eating, and drinking periods have been scheduled during the flight so that the pilot can maintain the proper hydration, nutrition, and physiological reserves of energy required throughout the mission. A study of the pilot's water balance and kidney function will be made by comparing body weight before and after flight, by recording water intake during flight, and by analyzing urine samples collected at intervals throughout the flight. A postflight urinalysis will be made to see if any body chemical reactions result from prolonged weightlessness.

Flashing Beacon Experiment

The astronaut's capability to see a flashing beacon light of known intensity at distances up to 15 miles from the spacecraft will be determined. The results will provide a basis for comparison with measured values for similar tests performed in the atmosphere and will provide data for use in the design of acquisition aids for rendezvous.

The experiment uses two xenon lights (mounted on opposite sides of a sphere) that flash on for about 100 microseconds of each second. The lights radiate approximately omnidirectionally and are designed to equal a star magnitude of +2 (about the same magnitude as Polaris) at a distance of 6 to 8 nautical miles. The sphere is contained in a cylindrical canister attached to the retro pack and is ejected downward by a compressed spring and piston assembly.

As the spacecraft approaches Africa on the 3rd orbit, the astronaut will deploy the sphere. The pilot will mark on tape the instant he sees the light and will repeat sightings at 10-minute intervals during the next three night phases and first daylight phase. In addition, he will estimate the relative intensity of the beacon in terms of star magnitudes or by using the extinction photometer technique. He will also comment on its appearance against the star or earth background, describe ease of acquisition, and estimate its relative position from the spacecraft.

Dim Light Phenomenon Photos

Photographic data of two dim light phenomena—zodiacal light and the night airglow layer—that are best observed from outside the earth's atmosphere will be gathered during the 16th orbit. Photographs of zodiacal light will help to determine its origin, geometric distribution, and its usefulness in studying solar radiation and flare activity. Data on the airglow will provide further information on the solar energy conversion processes occurring in the upper atmosphere.

The astronaut will take time exposures on color film after sunset during the 16th orbit using a modified 35-mm Robot Royal 24S camera provided by the University of Minnesota, which proposed this study.

Horizon Definition Photos

This experiment will study the earth's sunlit limb (horizon and atmosphere) to determine if it can be used as a reliable sextant reference during the midcourse phase of trans-lunar missions. Numerous photographs will be taken at various times during the 21st orbit with a 70-mm Hasselblad camera. The results will be of direct use to Massachusetts Institute of Technology, which proposed this study, in the development of the Apollo guidance and navigation system.

This experiment is a continuing effort to accurately define a suitably invariant horizon line in the atmosphere near the earth's surface that will be independent of lighting angle or atmospheric conditions.

Radiation Measurements

Radiation measurements at spacecraft altitudes will be made. The results will provide a survey of fission electrons trapped in the lower regions of the earth's magnetic field approaching closest to the earth's surface over eastern South America and the South Atlantic. They should also give additional data on decay of the artificial radiation belt created by high altitude nuclear detonation.

Radiation detectors will be located at various places inside and outside the spacecraft. Correlation of interior and exterior data may reveal radiation attenuation.



L. Gordon Cooper, Jr., selected as astronaut for one-day mission, reviews flight plan at briefing. (Backup astronaut is Alan B. Shepard, Jr., first American to ride rocket into space.)

Infrared Weather Photos

A series of infrared photographs using the Hasselblad camera will be taken to provide basic information on infrared reflectance from the earth's atmosphere and to provide data for design of instrumentation going into future meteorological satellites. This experiment follows previous investigations made on MA-8. Processing and sensitometric calibration of the infrared-sensitive film will be done by the U. S. Weather Bureau, which proposed the study, with the aid of Eastman Kodak Company. This experiment is planned for the 17th and 18th orbits. Other shots may be taken at the discretion of the pilot.

Tethered Balloon Experiment

The measurement of drag on a known aerodynamic shape should provide an accurate profile of atmospheric density at spacecraft altitudes. Information on aerodynamic stability and damping will also be obtained. Visually the fluorescent-orange balloon will provide a conveniently located space object for tracking and ranging after release from the towed position.

The balloon, tethering line, and small nitrogen inflating bottle are packaged in a cylindrical container located in the antenna canister under the destabilizing flap. After being ejected (during the 6th orbit) by a compressed spring and piston, a spring-loaded valve on the nitrogen bottle opens as the package clears the container, inflating the balloon to a 30-inch-diameter sphere in less than one second.

Aerodynamic drag on the balloon transmitted through the tethering will cause a bending moment that will be measured by a strain gauge and recorded on the spacecraft tape recorder. The maximum drag force will occur at perigee and is expected to be on the order of 0.015 lb.

TV System Operation

A special TV camera will be carried on this flight to evaluate its operational value for monitoring the pilot's well being, for obtaining backup readings of the instrument panel indications, and for observing tests, experiments or external phenomena through the spacecraft window. (See TIB No. 1 for a more detailed explanation of this experiment.)

Cabin Environmental Temperature Study

This test will yield information on the temperature balance within the spacecraft cabin and on heat losses into free space without the cabin coolant system in operation. It is predicted that the maximum stable temperature reached will be within the tolerable limits of the cabin equipment and the man when using only the suit circuit coolant. This test should provide engineering design data for future heat exchanger systems.

This test will begin during the 5th orbit, after the cabin has achieved generally stabilized temperatures. The cabin coolant valve will be turned off and cabin temperature monitored by both the astronaut and the ground stations. Suit temperature readings will also be monitored, and the settings appropriately adjusted to bear the added heat load. The cabin coolant will be turned back on during the 21st orbit.

HF Antenna Test

This experiment will provide measurements of antenna polarization and atmospheric effects associated with HF communications between the spacecraft and ground stations. Results will be directly applicable to the vertically polarized HF antenna to be used on the Gemini spacecraft. (See TIB No. 3 for additional information on this experiment.)

Ground Light Experiment

The ground light experiment should provide data on the approximate minimum intensity for a point-source ground light that is visible at spacecraft altitudes. This information will indicate feasibility of using ground or high-altitude lights as navigation fixes for midcourse and near-earth corrections in Project Apollo. Using this data in conjunction with data from the window attenuation experiment will also yield information on light attenuation through the atmosphere.

The pilot needs only the extinction photometer and standard light source in the spacecraft. A high-intensity xenon light will be located at Bloemfontein in the Union of South Africa. The 3-million-candlepower light will be illuminated continuously for 3 minutes when the spacecraft is within range on the 6th and 21st orbits. The spacecraft will be oriented to observe the light on only one occasion, depending on best weather conditions over Bloemfontein. Previous attempts to sight ground flares or test lights have failed because of cloud cover.

Window Attenuation Evaluation

This experiment will obtain data to evaluate the transmission of light through the spacecraft window. A photometer and a calibrated standard light source mounted on the instrument panel are used. The readings are to be obtained at opportune moments (possibly the 7th orbit) for the pilot when identifiable stars are in view during either the daylight or night phase. Reading the light level of the standard source before and after the star readings provides a measure of light unrestricted by the window and also establishes the degree of the pilot's dark adaptation. The ratio of relative star magnitudes to actual magnitudes gives the window transmissivity.

Tricks of the Trade

Evaluations of site failure reports indicate that some test equipments are exhibiting high failure rates. The Triplett 630PL multimeter, which is probably the most widely used piece of test equipment in the network, has shown numerous failures, particularly from burned out resistors. It is believed, however, that many failures could be prevented by making sure the equipment under test is turned off before making resistance measurements and by not overloading the meter. If there is doubt about the approximate expected reading, a change of overloading the meter should not be taken. It is always safer to start with the highest possible range. These precautions are of course elementary, but a reminder may help prevent a lapse of memory.

The HP606A signal generator also shows a high failure of resistor R18. Examination of the related output circuitry discloses that burn out from malfunction of the signal generator is unlikely. Connecting the signal generator to a highly energized circuit with the generator set for minimum attenuation could be causing much of the trouble.

Site personnel should constantly keep in mind that most test equipments are precision items and must be handled carefully. Rough handling and misuse of the instruments can upset calibration or cause equipment failures.

TLM Data to be Remoted to MCC

BDA and CAL for MA-9 will be able to remote TLM aeromedical data to MCC over telephone lines as a result of a network change request now being processed by the Network Engineering Branch. A composite telemetry signal made up of IRIG channels 5 (respiration), 6 (EKG No. 1), and 7 (EKG No. 2) will be transmitted from CAL to MCC for real-time demodulation. BDA will transmit only IRIG channel 7, which will be multiplexed on a voice circuit. EI 587 is being issued to cover this modification.

About Documentation

The following manuals were revised and shipped to applicable sites during April:

- ME-127 Range Simulator, Verloort Radar
- ME-153 Model MAC 7 1/2-9C Air Conditioning Unit
- ME-155 Audio Amplifier Model BXR-LA200
- ME-157 HF/UHF Signal Generator Model BXR-SG300

A booklet entitled Gemini Agena Target Vehicle, C&C Subsystem, published by Lockheed Missiles and Space Co. on March 1, 1963, (publication number LMSC 314668) was recently received from Lockheed and copies will be distributed to the sites in the very near future. This publication will provide the sites with excellent technical data in regard to the communication and control system for the target vehicle.

The new MSFN Training Manual MT-200 for 1963 has been published and is now being distributed. MT-200 supersedes MTP-162, Wallops Island Demonstration Site, Mercury Training Program, and covers all aspects of training at the MSFN Engineering and Training Center located at Wallops Station, Wallops Island, Va. All activities which received a copy of MTP-162 will receive the new training manual.

A binding machine recently has been supplied to each station to assist in revising manuals bound with plastic-ring binders. These machines should prove a godsend to all who have tried to manually insert revision pages in such documents.

The following new manual was forwarded to MCC during April:

- ME-1029 TA-3C Video Distribution Amplifier

The Gemini Implementation Plan, dated March 15, 1963, NASA report No. I-551-63-64, has been printed and is now being distributed.

The *Technical Information Bulletin* is published biweekly for network personnel by the Manned Space Flight Support Division. Address communications to TIB Editor, NASA, Goddard Space Flight Center, Code 551, Greenbelt, Maryland, or use the MSFN teletype facilities.
