For Network Personnel Only

TECHNICAL INFORMATION BULLETIN

THE MANNED SPACE FLIGHT NETWORK

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Moon Landing Mission To Carry Two Experiments In EASEP Package

The first astronaut on the moon will leave two scientific experiments which will be identified as EASEP (Early Apollo Scientific Experiments Payload). EASEP is the first ALSEP package that will be displayed on the Lunar surface. It will consist of a passive seismometer and a laser ranging retro reflector.

The purpose of EASEP is to return as much significant data as possible about the moon on the first mission.

EASEP will be deployed 30 feet from the spacecraft in about 10 minutes; requirements which are well within the capabilities of the astronaut and the mission time line.

Uncertainties during the first lunar landing may affect the length of stay time

Passive Seismic Experiment

Most of the information EASEP will return to earth will come from the Passive Seismic Experiment (PSE). This is a 3-axis seismometer which will measure both long and short period seismic disturbances and meteoroid impacts. It is mounted on a pallet and is housed in a cylinder covered with a highly reflective surface for temperature control. On top of the cylinder is a leveling and alignment device with which the astronaut may level and align the experiment before he leaves the moon. After his departure, earth commands will control small motors in the unit to complete the fine leveling of this sensitive instrument.

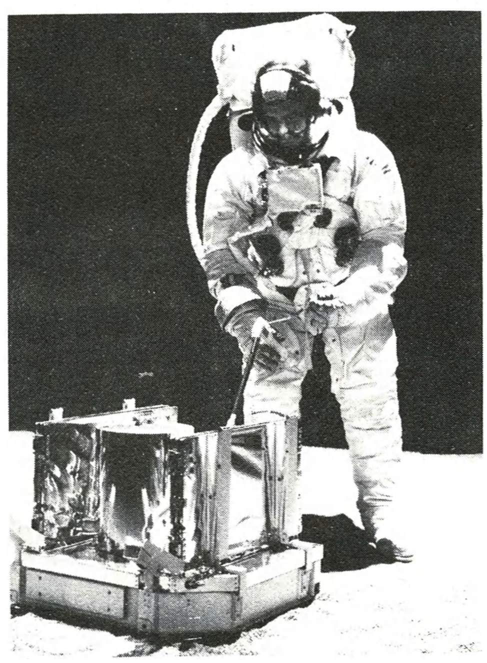
The data gathered from the PSE will give new information about the structure of the moon, possible volcanic activity, and the rate at which its surface is bombarded by meteoroids.

This data is sent through a data processing/transmitter/receiver station contained in the pallet on which the PSE is mounted. Communication with the earth is through a helical antenna which will be aligned by the astronaut on the moon.

A dust detector is mounted on the pallet to detect any settling of lunar dust on the surfaces of the EASEP, and its report is combined with the data from the PSE for transmission to earth.

Protection of the Passive Seismic Experiment Package (PSEP) from the extreme heat of the lunar day is provided by the highly reflective surfaces with which the package is covered and by the second surface mirrors on the primary structure. Survival heating during the cold lunar night is provided by two small, shielded radioisotope heaters.

Continued on Next Page



The Passive Seismic Experiment is the shiny large cylinder in the center of the package. It contains a sophisticated seismometer which feeds information to a data processing unit contained in the base of the PSEP. Communication with the earth is through a transmitter/receiver also housed in the base.

The engineer is about to pull the lanyard to deploy the solar cell panels and antenna on the Passive Seismic Experiment, part of the Early Apollo Scientific Experiments Payload to be placed on the lunar surface.

CYI, NST, NTTF Join In Success

The Canary Islands MSFN station, the Network Test and Training Facility, and the Network Support Team at GSFC joined their talents to solve what could have been a serious problem during the AS-504 mission.

At approximately one hour before launch, the Telemetry Instrumentation Controller (TIC) at MCC advised NST/Data that the IU Launch Vehicle Digital Computer (LVDC) special function sets were not being processed correctly. MCC said that single word dump downlink parameters were being inserted into the general table slots instead of the assigned LVDC slots.

At T+27 minutes, TIC reported all H0060-603 LVDC parameters were outputting zeroes from all stations. In order to determine if this was caused by an onboard IU (IBM) computer hardware failure or a station program error, NST/Data suggested to TIC that one station be reconfigured to playback a previously recorded LVDC Confidence Tape at the earliest convenience. This would ensure that the onstation telemetry programs were processing LVDC without error. Canary Islands (CYI) was selected as the test station; the results were positive, and no problems were encountered.

The Network Controller advised NST/Data, at approximately T+1 1/2 hours, that Flight Controllers had confirmed an onboard computer malfunction. Tag bit 12 was always set to a "one" condition. NST/Data contacted cognizant telemetry programmers, researched the effects of tag bit 12 being set, and directed NTTF to bring up their computer systems to support as necessary.

LVDC tag bit 12 is 1 of 12 bits used to identify (tag) parameters telemetered from the IU Guidance computer. Each tag word (12 bits) was individually considered to determine the effects of tag bit 12. It was determined that the most convenient solution would be a software change to the telemetry program. The

Continued on Next Page

New M and O at Madrid

Jack Zaratzian, who has been assigned to the Madrid MSFN station was named Maintenance and Operations at that station recently. He replaces George Burawa.

Mr. Zaratzian had held the post of assistant M&O at Madrid prior to his appointment.

The new M&O has been employed by Bendix Field Engineering Corporation on several assignments in the United States, Germany, and Spain since 1953. He joined the MSFN at Madrid in February, 1965.

Bermuda-Critical Point In Network

This is the first in a series of articles on MSFN stations. The articles are designed to acquaint new personnel with the network as well as to provide newer information about station operation and capability to all MSFN personnel.

Bermuda plays a vital role in manned spaceflight tracking. Built to support Project Mercury and Gemini, its facilities were expanded to support Apollo missions.

Bermuda is a particularly important station in the network because of its geographic location. Project Mercury engineers knew that spacecraft launched from Cape Kennedy reached their orbital insertion points close to the launch complex at a low elevation angle; thus the tracking and data acquisition facilities there could not always produce reliable data, nor would the flight director have time to determine go, no-go conditions. To solve these problems a tracking station was needed that would be directly along the launch path, that could acquire a spacecraft within four minutes of liftoff, and that could track for about eight minutes, thus ensuring uninterrupted coverage during the critical launch and early orbital stages of a flight. Bermuda met these requirements.

Construction was begun in 1960, and by 1961 tracking equipment for Project Mercury was operational at two sites. New network systems required for Gemini were installed by late 1964 at Cooper's Island. More new equipment was added in preparation for Apollo missions, and was fully operational by the end of 1966.

Equipment at Bermuda includes a 30-foot USB antenna, two exciters, 2-way VHF voice communications systems, VHF telemetry receivers, UHF transmitting systems, and signal processing equipments. The UHF equipment is also interfaced with a special command encoder for range safety use. In addition, an FPS-16 and a modified FPQ-6 C-band radar have been installed. With these, Bermuda acquires data during the first minutes after launch but can also track at lunar distances when a highly directional spacecraft antenna is used.

Approximately 90 contractor employees and 63 indigenous personnel man the Bermuda station. Since its inception, more than 350 Mercury, Gemini, and other scientific and deep space missions have been successfully supported including the nine Apollo missions.

The station director at Bermuda is F. A. Healey; the M&O supervisor is G. B. Gallup.

EASEP Package

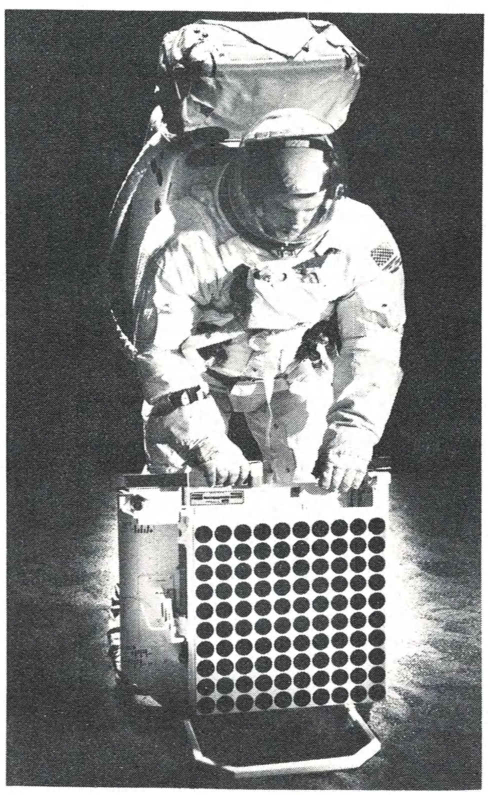
Continued From Page One

Power for the PSEP is provided by two arrays of solar panels which are attached to the pallet structure.

Laser Ranging Retro-Reflector

The second EASEP experiments is a Laser Ranging Retro Reflector. This is an assembly of 100 corner reflectors which will be a target for earth based lasers. Using the reflector, scientists will be able to measure the distance to the moon within six inches. Similarly, precise measurements may give new information about the lunar mass and orbit, the tidal deformation of the moon, and the action of gravity in general. By using two lasers, information about distances on the earth can be refined.

The scientific return from EASEP will be great. It will give information not only on the structure of the moon but a better understanding of the forces acting in the universe, and perhaps a clearer understanding of how it all came to be.



An engineer is shown demonstrating the emplacement of a Laser Ranging Retro-Reflector, one of two experiments in the Early Apollo Scientific Experiments Payload, for deployment on the first lunar landing.

To deploy the reflector assembly, the astronaut carries the unit 30 feet from the lunar module, sets it on the surface of the moon and aligns it according to the lunar landing site.

The reflector is designed to survive 10 years as the lunar temperature swings from -250° to $+300^\circ$ Farenheit.

Join In Success

Continued From Page One

corrective action recommended would be to modify the program to mask tag bit 12.

The programmers determined that a 48 memory cell change was necessary to mask all references to tag bit 12. The errata was voiced to CYI and NTTF. Both stations were to incorporate the errata to verify its integrity and to ensure that other sub-programs were not affected. As the errata was being relayed, another programmer determined that a one cell erratum would perform the same function. The later software change corrected the problem at CYI and NTTF. It was immediately transmitted, at T+2 hours, to all Network stations via an OPN message. This OPN was followed-up by ISI-146 which authorized implementation of the errata. Once the IU battery depleted, at T+8 hours, the erratum was removed from the telemetry program, per ISI 148 instructions.

210-Foot Antennas Planned At Two DSN Locations

NASA will receive proposals for the fabrication and erection of two 210-foot diameter tracking antennas.

The antennas will be part of the Deep Space Network (DSN) and arrangements are being planned for their installation in Spain and Australia.

Plans call for the antennas to be built in the U. S. and shipped to the sites at Tidbinbilla, near Canberra, and Madrid.

These two antennas, in conjunction with the existing 210-foot antenna at Goldstone, will send commands to and recover data from the planned 1973 unmanned photographic and landing Viking mission on Mars, the Pioneer missions toward Jupiter in 1972-73, and other planetary missions possible during the 70's and beyond.

The 210's provide performance increased six-and-a-half times over the existing 85-foot antennas. With them it will be possible to return useful scientific data from the edge of the solar system, three-and-a-half billion miles from Earth.

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