Prelaunch
Mission Operation Report
No. M-933-72-17
28 November 1972

MEMORANDUM

TO: A/Administrator

FROM: M/Apollo Program Director

SUBJECT: Apollo 17 Mission (AS-512)

We plan to launch Apollo 17 from Pad A of Launch Complex 39 at the Kennedy Space Center no earlier than 6 December 1972. This will be the Apollo Program's sixth and last manned lunar landing and the third consecutive mission to carry the Lunar Roving Vehicle for surface mobility, added Lunar Module consumables for a longer surface stay time, and the Scientific Instrument Module for extensive lunar orbital science investigations.

Primary objectives of this mission are selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Taurus-Littrow region of the moon; emplacement and activation of surface experiments; and the conduct of in-flight experiments and photographic tasks. In addition to the standard photographic documentation of operational and scientific activities, television coverage is planned for selected periods in the spacecraft and on the lunar surface. The lunar surface TV coverage will include remote controlled viewing of astronaut activities at each major science station on the three EVA traverses.

The 12.7-day mission will be terminated with the Command Module landing in the mid-Pacific Ocean about 650 km (350 NM) southeast of Samoa Islands.

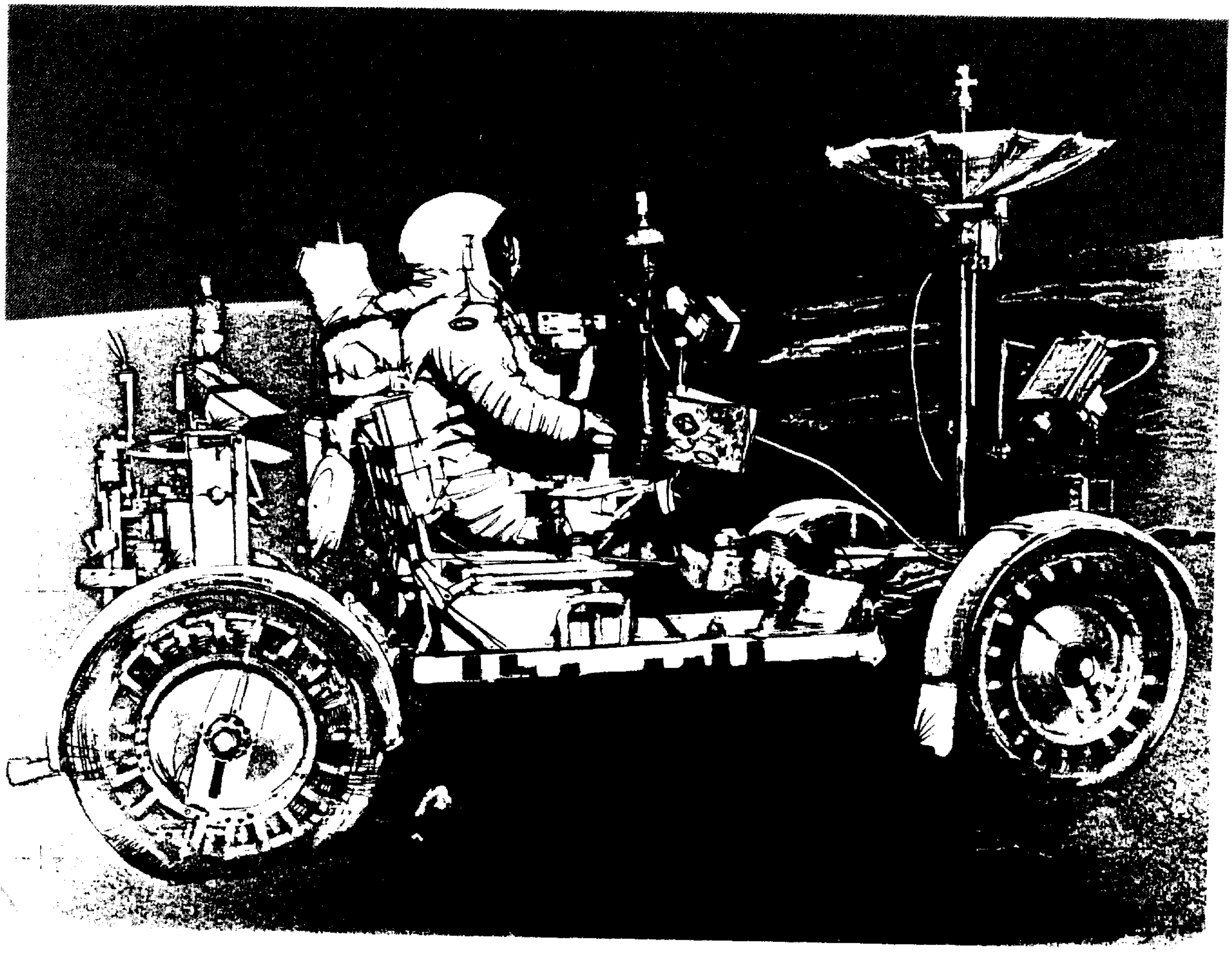
Rocco A. Petrone
Rocco A. Petrone

APPROVAL:

Dale D. Myers
Dale D. Myers
Associate Administrator for
Manned Space Flight

Report No. M-933-72-17

MISSION OPERATION REPORT



APOLLO 17 MISSION

OFFICE OF MANNED SPACE FLIGHT

FOREWORD

MISSION OPERATION REPORTS are published expressly for the use of NASA Senior Management, as required by the Administrator in NASA Management Instruction HQMI 8610.1, effective 30 April 1971. The purpose of these reports is to provide NASA Senior Management with timely, complete, and definitive information on flight mission plans, and to establish official Mission Objectives which provide the basis for assessment of mission accomplishment.

Prelaunch reports are prepared and issued for each flight project just prior to launch. Following launch, updating (Post Launch) reports for each mission are issued to keep General Management currently informed of definitive mission results as provided in NASA Management Instruction HQMI 8610.1.

Primary distribution of these reports is intended for personnel having program/project management responsibilities which sometimes results in a highly technical orientation. The Office of Public Affairs publishes a comprehensive series of reports on NASA flight missions which are available for dissemination to the Press.

APOLLO MISSION OPERATION REPORTS are published in two volumes: the MISSION OPERATION REPORT (MOR); and the MISSION OPERATION REPORT, APOLLO SUPPLEMENT. This format was designed to provide a mission-oriented document in the MOR, with supporting equipment and facility description in the MOR, APOLLO SUPPLEMENT. The MOR, APOLLO SUPPLEMENT is a program-oriented reference document with a broad technical description of the space vehicle and associated equipment, the launch complex, and mission control and support facilities.

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Mission	Launch Date	Launch Vehicle	Payload	Description
AS-201	2/26/66	SA-201	CSM-009	Launch vehicle and CSM development. Test of CSM subsystems and of the space vehicle. Demonstration of reentry adequacy of the CM at earth orbital conditions.
AS-203	7/5/66	SA-203	LH_2 in S-IVB	Launch vehicle development. Demonstration of control of LH_2 by continuous venting in orbit.
AS-202	8/25/66	SA-202	CSM-011	Launch vehicle and CSM development. Test of CSM subsystems and of the structural integrity and compatibility of the space vehicle. Demonstration of propulsion and entry control by G&N system. Demonstration of entry at 8689 meters per second.
Apollo 4	11/9/67	SA-501	CSM-017 LTA-10R	Launch vehicle and spacecraft development. Demonstration of Saturn V Launch Vehicle performance and of CM entry at lunar return velocity.
Apollo 5	1/22/68	SA-204	LM-1 SLA-7	LM development. Verified operation of LM subsystems: ascent and descent propulsion systems (including restart) and structures. Evaluation of LM staging. Evaluation of S-IVB/IU orbital performance.
Apollo 6	4/4/68	SA-502	CM-020 SM-014 LTA-2R SLA-9	Launch vehicle and spacecraft development. Demonstration of Saturn V Launch Vehicle performance.

Mission	Launch Date	Launch Vehicle	Payload	Description
Apollo 7	10/11/68	SA-205	CM-101 SM-101 SLA-5	Manned CSM operations. Duration 10 days 20 hours.
Apollo 8	12/21/68	SA-503	CM-103 SM-103 LTA-B SLA-11	Lunar orbital mission. Ten lunar orbits. Mission duration 6 days 3 hours. Manned CSM operations.
Apollo 9	3/3/69	SA-504	CM-104 SM-104 LM-3 SLA-12	Earth orbital mission. Manned CSM/LM operations. Duration 10 days 1 hour.
Apollo 10	5/18/69	SA-505	CM-106 SM-106 LM-4 SLA-13	Lunar orbital mission. Manned CSM/LM operations. Evaluation of LM performance in cislunar and lunar environment, following lunar landing profile. Mission duration 8 days.
Apollo 11	7/16/69	SA-506	CM-107 SM-107 LM-5 SLA-14 EASEP	First manned lunar landing mission. Lunar surface stay time 21.6 hours. One dual EVA (5 man hours). Mission duration 8 days 3.3 hours.
Apollo 12	11/14/69	SA-507	CM-108 SM-108 LM-6 SLA-15 ALSEP	Second manned lunar landing mission. Demonstration of point landing capability. Deployment of ALSEP I. Surveyor III investigation. Lunar surface stay time 31.5 hours. Two dual EVAs (15.5 man hours). Mission duration 10 days 4.6 hours.

Mission	Launch Date	Launch Vehicle	Payload	Description
Apollo 13	4/11/70	SA-508	CM-109 SM-109 LM-7 SLA-16 ALSEP	Planned third lunar landing. Mission aborted at approximately 56 hours due to loss of SM cryogenic oxygen and consequent loss of capability to generate electrical power and water. Mission duration 5 days 22.9 hours.
Apollo 14	1/31/71	SA-509	CM-110 SM-110 LM-8 SLA-17 ALSEP	Third manned lunar landing mission. Selenological inspection, survey and sampling of materials of Fra Mauro Formation. Deployment of ALSEP. Lunar surface stay time 33.5 hours. Two dual EVAs (18.8 man hours). Mission duration 9 days.
Apollo 15	7/26/71	SA-510	CM-112 SM-112 LM-10 SLA-19 LRV-1 ALSEP Subsatellite	Fourth manned lunar landing mission. Selenological inspection, survey and sampling of materials of the Hadley-Apennine Formation. Deployment of ALSEP. Increased lunar stay time to 66.9 hours. First use of Lunar Roving Vehicle and direct TV and voice communications to earth during EVAs. Total distance traversed on lunar surface 27.9 km. Three dual EVAs (37.1 man hours). Mission duration 12 days 7.2 hours.
Apollo 16	4/16/72	SA-511	CM-113 SM-113 LM-11 SLA-20 ALSEP	Fifth manned lunar landing mission. Selenological inspection, survey and sampling of materials of the Descartes Formation. Deployment of ALSEP. Lunar surface stay time 71.2 hours. Use of second Lunar Roving Vehicle and direct TV and voice communications to earth during EVAs. Total distance traversed on lunar surface 26.7 km. Three dual EVAs (40.5 man hours). Use of Far UV camera/spectroscope on lunar surface. Mission duration 11 days 1.8 hours.

NASA OMSF MISSION OBJECTIVES FOR APOLLO 17

PRIMARY OBJECTIVES

- Perform selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Taurus-Littrow region.
- Emplace and activate surface experiments.
- Conduct in-flight experiments and photographic tasks.

Rocco A Petrone
Rocco A. Petrone
Apollo Program Director

Date: 22 November 1972

Dale D Myers
Dale D. Myers
Associate Administrator for
Manned Space Flight

Date: Nov 22 1972

MISSION OPERATIONS

The following paragraphs contain a brief description of the nominal launch, flight, recovery, and post-recovery operations. For launch opportunities which may involve a T-24 or T+24 hour launch, there will be a revised flight plan. Overall mission profile is shown in Figure 1.

LAUNCH WINDOWS

The mission planning considerations for the launch phase of a lunar mission are, to a major extent, related to launch windows. Launch windows are defined for two different time periods: a "daily window" has a duration of a few hours during a given 24-hour period; a "monthly window" consists of a day or days which meet the mission operational constraints during a given month or lunar cycle.

Launch windows are based on flight azimuth limits of 72° to 100° (earth-fixed heading of the launch vehicle at end of the roll program), on booster and spacecraft performance, on insertion tracking, and on lighting constraints for the lunar landing sites.

The Apollo 17 launch windows and associated lunar landing sun elevation angles are presented in Table 1.

TABLE 1
LAUNCH WINDOWS

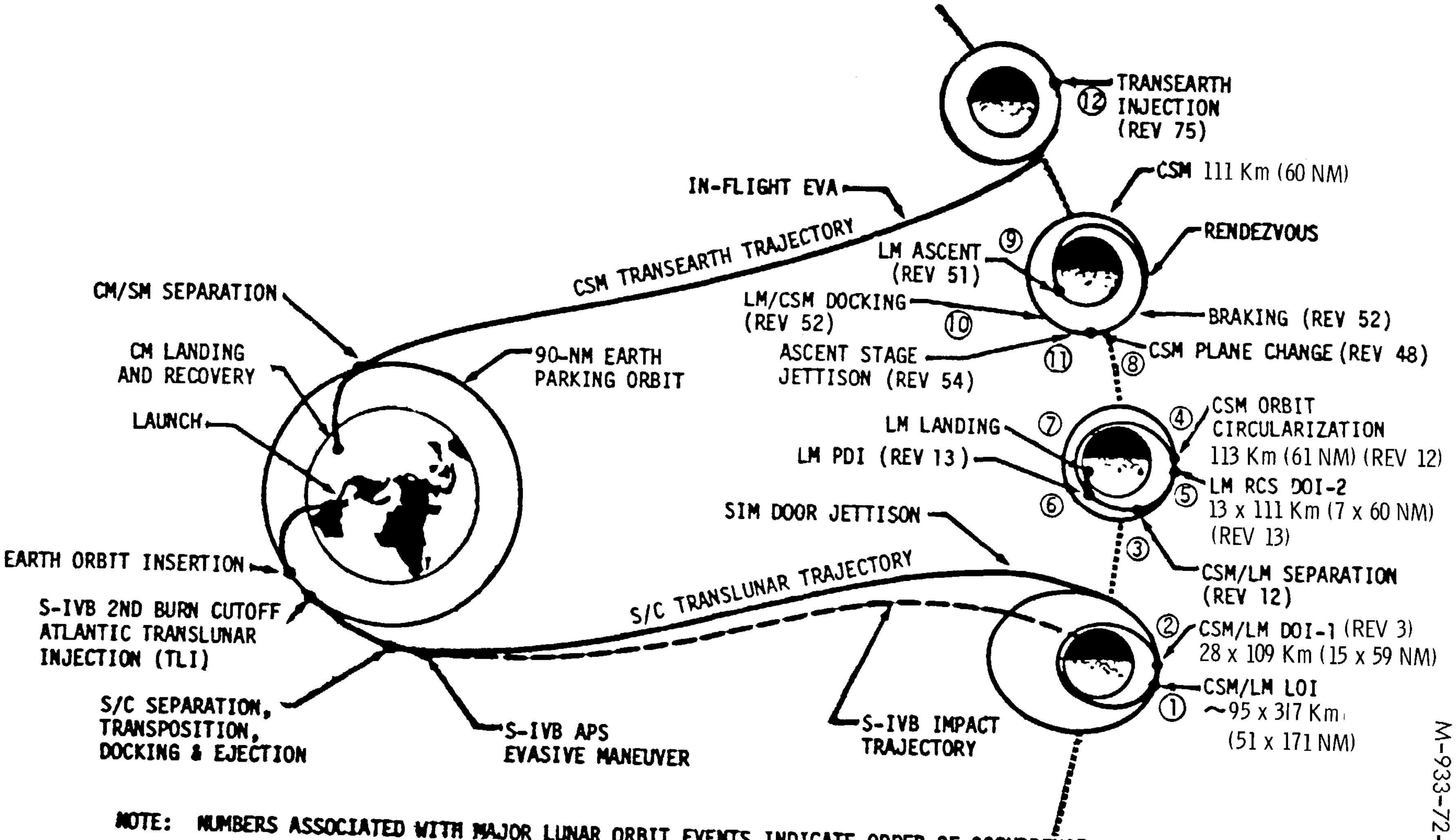
LAUNCH DATE	WINDOWS (EST) OPEN	CLOSE	SUN ELEVATION ANGLE (degrees)
6 December	2153	0131	13.3
7 December	2153	0131	16.9 - 19.1
4 January *	2150	2352	6.8
5 January	2021	2351	10.2 - 11.1
6 January	2028	2356	20.3 - 22.4
3 February	1847	2213	13.3 - 15.5
4 February	1858	2220	13.3 - 15.5

* Launch aximuth limits for 4 January are 84 to 100 degrees

LAUNCH THROUGH TRANSLUNAR INJECTION

The space vehicle will be launched from Pad A of launch complex 39 at the Kennedy Space Center. The boost into a 167 km (90 NM) earth parking orbit (EPO) will be accomplished by sequential burns and staging of the S-IC and S-II launch vehicle stages

APOLLO 17
FLIGHT PROFILE



NOTE: NUMBERS ASSOCIATED WITH MAJOR LUNAR ORBIT EVENTS INDICATE ORDER OF OCCURRENCE.

Fig. 1

and a partial burn of the S-IVB stage. The S-IVB/instrument unit (IU) and spacecraft will coast in a circular EPO for approximately 2 revolutions while preparing for the first opportunity S-IVB translunar injection (TLI) burn, or 3 revolutions if the second opportunity TLI burn is required. Both injection opportunities are to occur over the Atlantic Ocean. TLI targeting will permit an acceptable earth return to be achieved using the service propulsion system (SPS) or LM descent propulsion system (DPS) until at least pericynthion plus 2 hours if lunar orbit insertion (LOI) is not performed. A reaction control system (RCS) capability to return the command service module/lunar module (CSM/LM) combination to an acceptable earth return exists to as great as 57 hours; for a CSM only case the RCS capability exists to about 69 hours. In the unlikely event of no separation from the S-IVB a combination RCS burn, LOX dump, and auxiliary propulsion system (APS) burn permits an acceptable earth return as late as 46 hours GET.

TRANSLUNAR COAST THROUGH LUNAR ORBIT INSERTION

Within 2 hours after injection the CSM will separate from the S-IVB/IU and spacecraft-LM adapter (SLA) and will transpose, dock with the LM, and eject the LM/CSM from the S-IVB/IU. Subsequently, the S-IVB/IU will perform an evasive maneuver to alter its circumlunar coast trajectory clear of the spacecraft trajectory.

The spent S-IVB/IU will be impacted on the lunar surface at 7°00'S and 8°00'W providing a stimulus for the Apollo 12, 14, 15, and 16 emplaced seismology experiments. The necessary delta velocity ($\triangle V$) required to alter the S-IVB/IU circumlunar trajectory to the desired impact trajectory will be derived from dumping of residual liquid oxygen (LOX) and burn(s) of the S-IVB/auxiliary propulsion system (APS) and ullage motors. The final maneuver will occur within about 10 hours of liftoff. The IU will have an S-band transponder for trajectory tracking. A frequency bias will be incorporated to insure against interference between the S-IVB/IU and LM communications during translunar coast.

Spacecraft passive thermal control will be initiated after the first midcourse correction (MCC) opportunity and will be maintained throughout the translunar-coast phase unless interrupted by subsequent MCCs and/or navigational activities. The scientific instrument module (SIM) bay door will be jettisoned shortly after the MCC-4 point, about 4.5 hours before LOI.

Multiple-operation covers over the SIM bay experiments and cameras will provide thermal and contamination protection whenever they are not in use.

A LOI retrograde SPS burn will be used to place the docked spacecraft into a 95 x 317 km (51 x 171 NM) orbit, where they will remain for approximately two revolutions.

DESCENT ORBIT INSERTION THROUGH LANDING

The descent orbit insertion (DOI-1) maneuver, a SPS second retrograde burn, will place the CSM/LM combination into a 28 x 109 km (15 x 59 NM) orbit (Figure 2).

A "soft" undocking will be made during the twelfth revolution, using the docking probe capture latches to reduce the imparted △V. Spacecraft separation will be executed by the SM RCS. Following separation, the CSM will maneuver into a 100 x 130 km (54 x 70 NM) orbut during the twelfth revolution to achieve an approximate 113 km (61 NM) circular orbit at the time of CSM/LM rendezvous. After the CSM circularization maneuver, DOI-2 will be performed with the LM RCS to lower the pericynthian to about 13,170 meters (43,200 feet) which will be about 10° west of the landing site with PDI nominally commencing at about 17,200 meters (56,400 feet). During the thirteenth revolution the LM DPS will be used for powered descent which will begin approximately 26° east of pericynthian. A terrain profile model will be available in the LM guidance computer (LGC) program to minimize unnecessary LM pitching or thrusting maneuvers. A LM yaw maneuver may be performed to ensure good LM steerable antenna communications coverage with the Spaceflight Tracking and Data Network (STDN). A descent path of 25° will be used from high gate to about 61 meters (200 feet) altitude, or to crew manual takeover, to enhance landing site visibility.

LANDING SITE (LITTROW REGION)

Taurus-Littrow is designated as the landing site for the Apollo 17 Mission. This site is located on the southeastern rim of Mare Serenitatis in a dark deposit between massif units of the southwestern Taurus Mountains, south of the crater Littrow. It is about 750 km (405 NM) east of the Apollo 15 site and about the same distance north of the Apollo 11 site.

The massif units of the Taurus Mountains are believed to be ancient highland crustal blocks (pre-Imbrian in geologic age) which were emplaced by faulting and uplifting both during and after formation of the Serenitatis basin. However, a thin (because of the base distances) ejecta blanket from the younger impacts of Crisium and Imbrium may have mantled some of the massif units. Fresh and blocky slopes in excess of 25° are common, which indicates that later debris movements have exposed the origin massif surfaces. One large landslide or debris flow southwest of the landing site offers an excellent opportunity to sample both the massif materials and any later ejecta materials.

The dark deposit, which occupies the low-lands between, and in a few cases the tops of the massif units, is believed to be among the youngest lunar surface units. It is characterized by a smooth appearance and lack of large blocks as indicated by photogeologic analysis and earth-based radar studies. This deposit is associated with

APOLLO 17
CSM/LM LANDING EVENTS
(DOI-2 AND PDI)

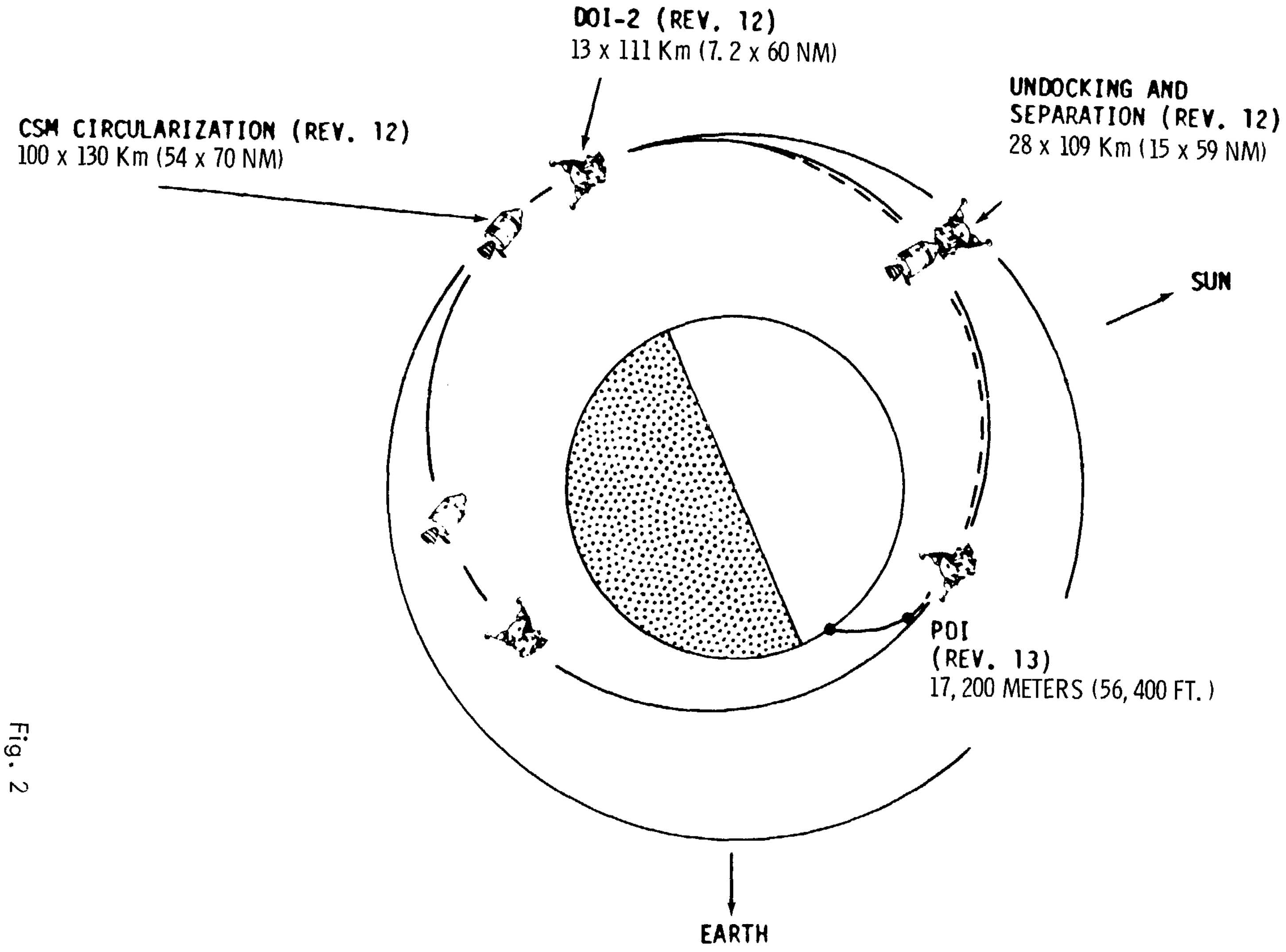


Fig. 2

numerous dark halo craters and is believed to be a volcanic (pyroclastic) mantle which originated deep within the moon. It offers, therefore, an opportunity to sample a relatively young volcanic material which may shed light on the composition as well as thermal history of the lunar interior.

The Taurus-Littrow site is geologically complex: it offers a number of rock types which apparently vary in age, albedo, composition and probable origin; it also portrays numerous stratigraphic-structural problems which will be investigated by the traverse geophysics to be carried for the first time on Apollo 17. The location of the site makes the inclination of the orbital tracks suitable for the SIM bay experiments, especially those to be carried for the first time on Apollo 17.

The planned landing coordinates for the Taurus-Littrow area are 20°09'50"N latitude and 30°44'58"E longitude (Figure 3).

APOLLO 17 LANDING SITE

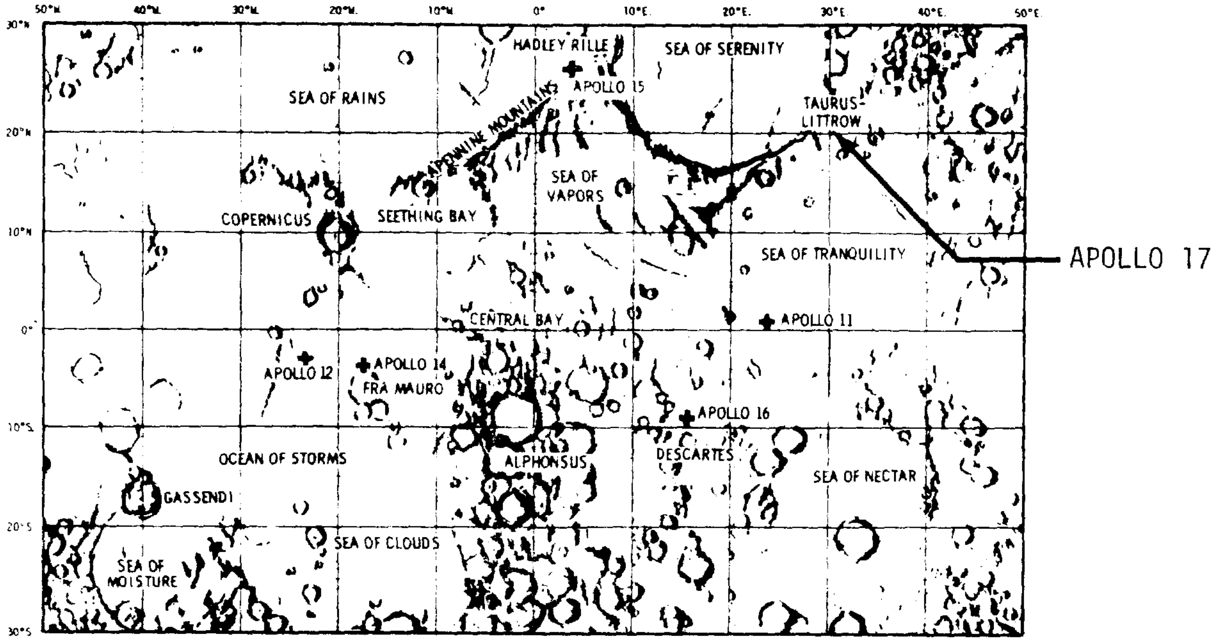


Fig. 3

LUNAR SURFACE OPERATIONS

The nominal stay time on the lunar surface is planned for about 75 hours, with the overall objective of optimizing effective surface science time relative to hardware margins, crew duty cycles, and other operational constraints. Photographs of the lunar surface will be taken through the LM cabin window after landing. The nominal extravehicular activity (EVA) is planned for three periods of up to 7 hours each. The duration of each EVA period will be based upon real time assessment of the remaining consumables. As in Apollo 15 and 16, this mission will employ the lunar roving vehicle (LRV) which will carry both astronauts, experiment equipment, and independent communications systems for direct contact with the earth when out of the line-of-sight of the LM relay system. Voice communication will be continuous and color TV coverage will be provided at each major science stop (Figure 4) where the crew will align the high gain antenna. The ground controllers will then assume control of the TV through the ground controlled television assembly (GCTA) mounted on the LRV. A TV panorama is planned at each major science stop, as well as coverage of the astronauts' scientific activities.

The radius of crew operations will be constrained by the portable life support system (PLSS) walkback capability, or the buddy secondary life support system (BSLSS) ride-back capability, whichever is less. If a walking traverse must be performed, the radius of operations will be constrained by the BSLSS capability to return the crew to the LM in the event of a PLSS failure.

EVA PERIODS

The activities to be performed during each EVA period are described below. Rest periods are scheduled prior to the second and third EVAs and prior to LM liftoff. The three traverses planned for Apollo 17 are designed for flexibility in selection of science stops as indicated by the enclosed areas shown along traverses II and III (Figure 4).

First EVA Period

The first EVA will include: LM inspection, LRV deployment and checkout, and deployment and activation of the Apollo lunar surface experiments package (ALSEP). Television will be deployed on the LRV as soon as possible in this period for observation of crew activities near the LM (Figure 5). ALSEP deployment will be approximately 90 meters (300 feet) west of the LM (Figure 6). After ALSEP activation the crew will perform a geology traverse (see Figure 4).

Lunar samples collected will be verbally and photographically documented. Sample return must be assured; therefore, a contingency sample of lunar soil will be collected in the event of a contingency during the EVA, but only if no other soil sample has been collected and is available for return to earth. Experiment activities other than ALSEP include the deployment and activation of the surface electrical properties transmitter at least 70 meters (230 feet) east of the LM, deployment of some of the seismic profiling charges, obtaining some traverse gravimeter readings, obtaining a measurement of surface electric properties, and emplacement of the lunar neutron probe. The planned timeline for EVA-1 activities is presented in Figure 7.

LRV TRAVERSES

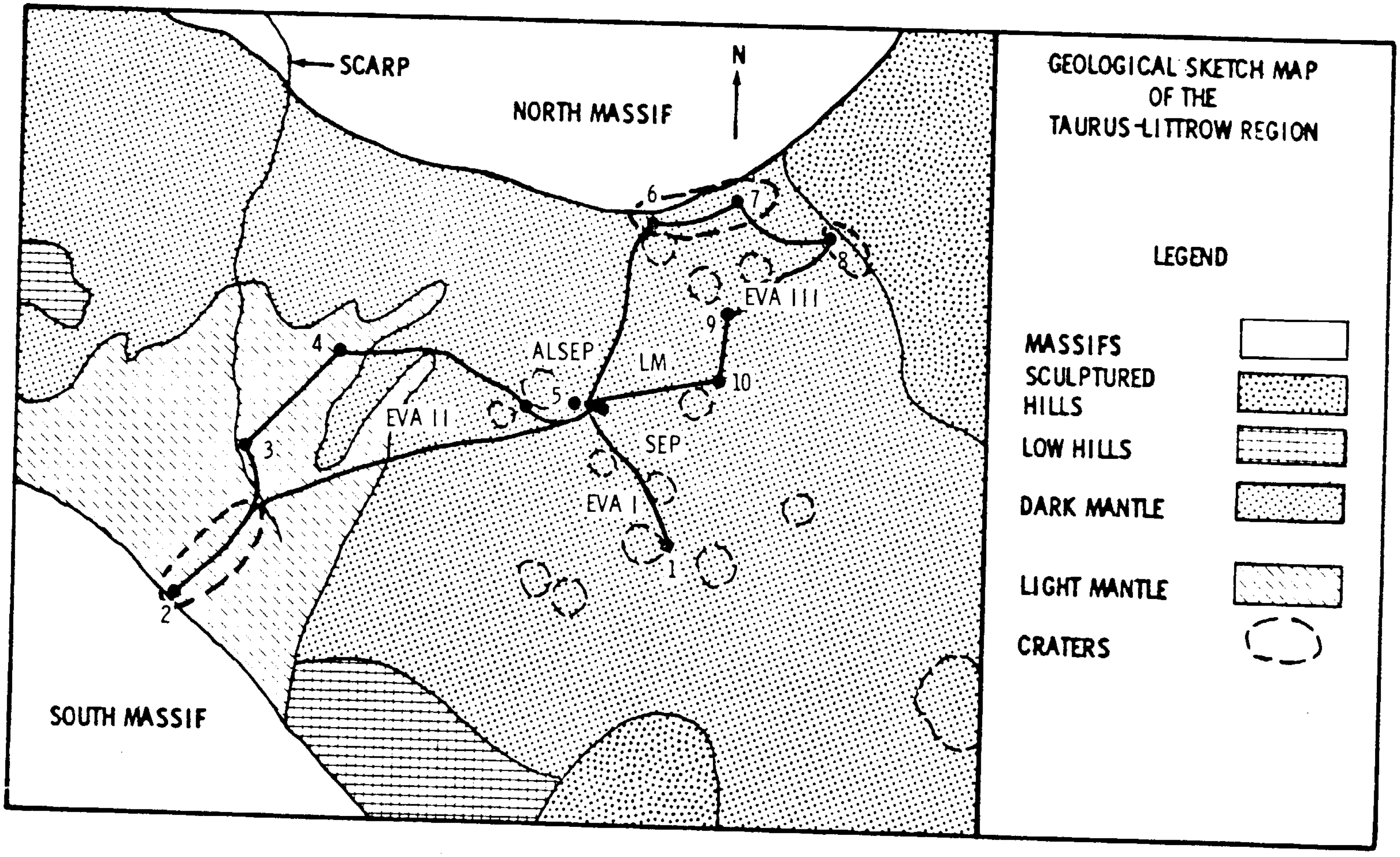


Fig. 4

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APOLLO 17
NEAR LM LUNAR SURFACE ACTIVITY

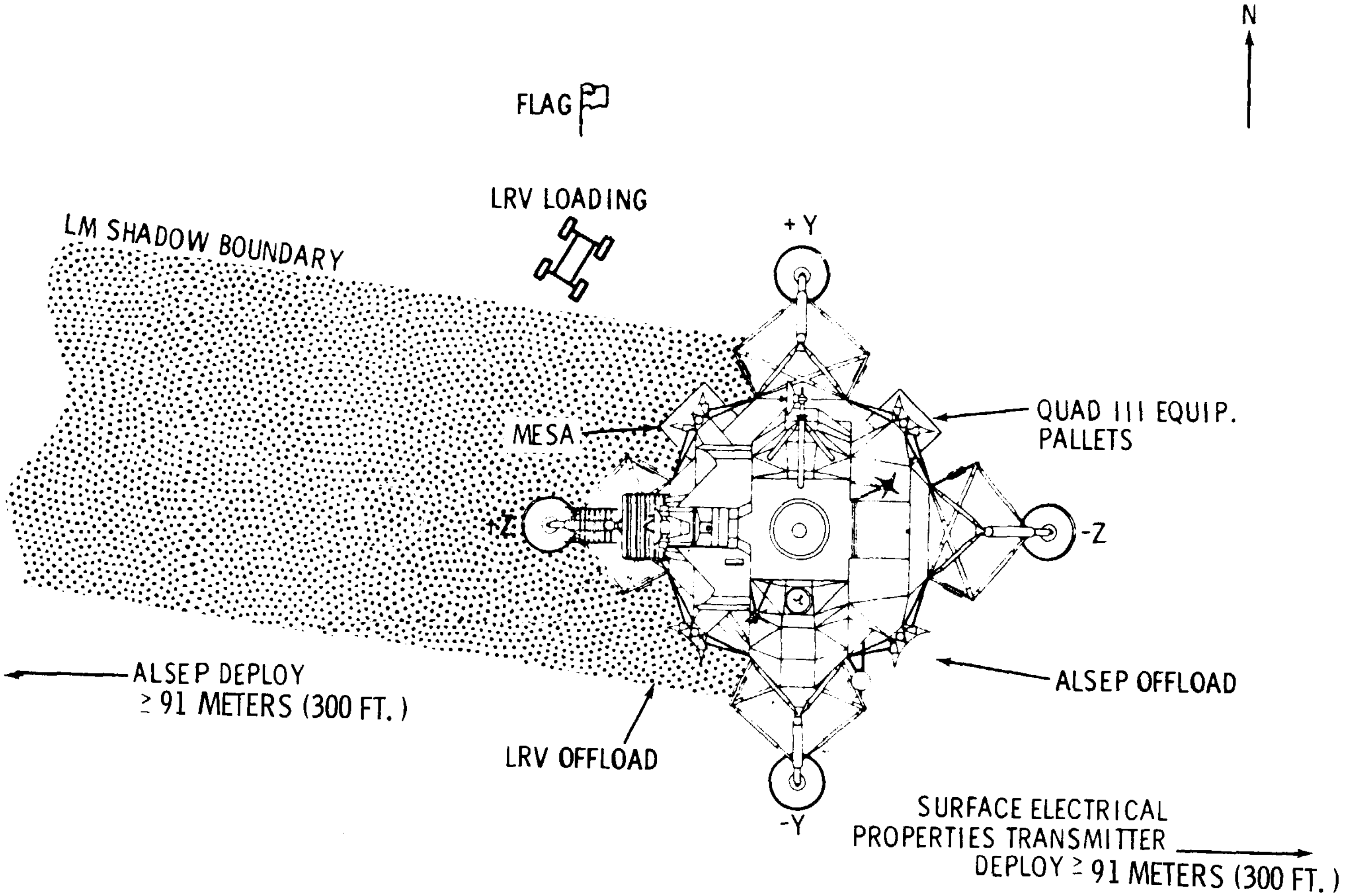
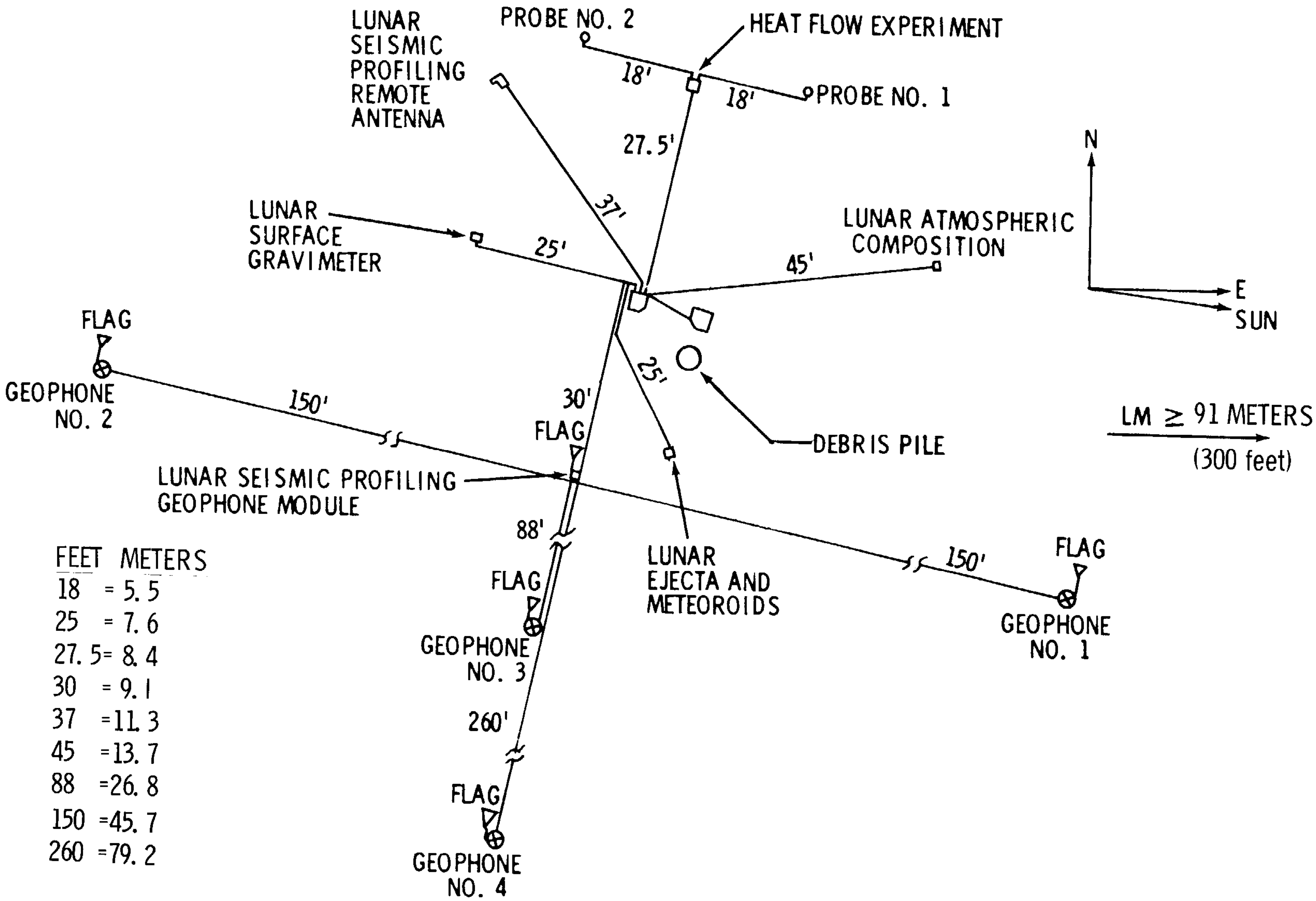


Fig. 5

APOLLO 17
ALSEP DEPLOYMENT



FEET	METERS
18	= 5.5
25	= 7.6
27.5	= 8.4
30	= 9.1
37	= 11.3
45	= 13.7
88	= 26.8
150	= 45.7
260	= 79.2

Fig. 6

APOLLO 17
EVA 1 TIMELINE

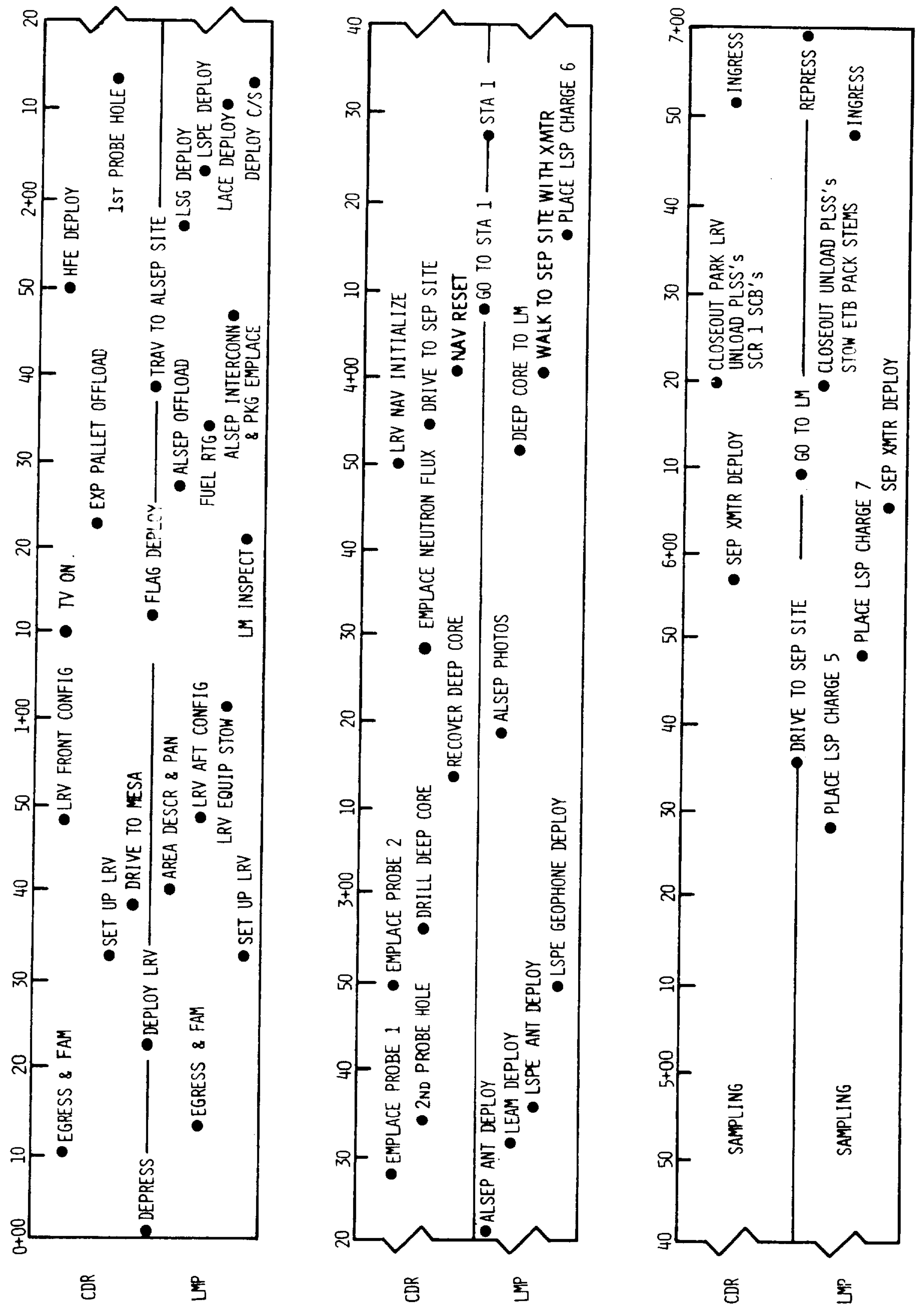


Fig. 7

Second and Third EVA Periods

Traverses in the second and third EVA periods (Figures 8 and 9) are planned to maximize the scientific return in support of the primary objectives. LRV sorties will be planned for flexibility in selecting stops and conducting experiments. Consumables usage will be monitored at Mission Control Center (MCC) to assist in real time traverse planning.

The major portion of the lunar geology investigation (S-059) will be conducted during the second and third EVAs and will include voice and photographic documentation of sample material as it is collected and descriptions of lurain features. If time does not permit filling the sample containers with documented samples, the crew may fill the containers with samples selected for scientific interest. Deployment of the lunar seismic profiling (S-203) explosive charges will be completed on EVA-2 and 3. Readings from the traverse gravimeter experiment (S-199) will be taken at specified traverse stations. The surface electrical properties experiment (S-204) will be continued during the second and third EVAs.

The LRV will be positioned at the end of the EVA-3 traverse to enable GCTA-monitored ascent and other TV observations of scientific interest.

LUNAR ORBIT OPERATIONS

The Apollo 17 Mission is the third with the modified Block II CSM configuration. An increase in cryogenic storage provides increased mission duration for the performance of both an extended lunar surface stay time and a lunar orbit science period. The SIM in the SM provides for the mounting of scientific experiments and for their operation in flight.

After the SIM door is jettisoned by pyrotechnic charges and until completion of lunar orbital science tasks, selected RCS thrusters will be inhibited or experiment protective covers will be closed to minimize contamination of experiment sensors during necessary RCS burns. Attitude changes for thermal control and experiment alignment with the lunar surface and deep space (and away from direct sunlight) will be made with the active RCS thrusters. Orbital science activities have been planned at appropriate times throughout the lunar phase of the mission and consist of the operation of five cameras (35mm Nikon, 16mm data acquisition, 70mm Hasselblad, 24-inch panoramic and a 3-inch mapping), a color TV camera, a laser altimeter, a gamma ray spectrometer, a lunar sounder, a far ultraviolet spectrometer, and infrared scanning radiometer.

Pre-Rendezvous Lunar Orbit Science

Orbital science operations will be conducted during the 109 x 28 km (59 x 14 NM) orbits after DOI-1, while in the docked configuration. Orbital science operations will be stopped for the separation and circularization maneuvers performed during the

APOLLO 17
EVA 2 TIMELINE

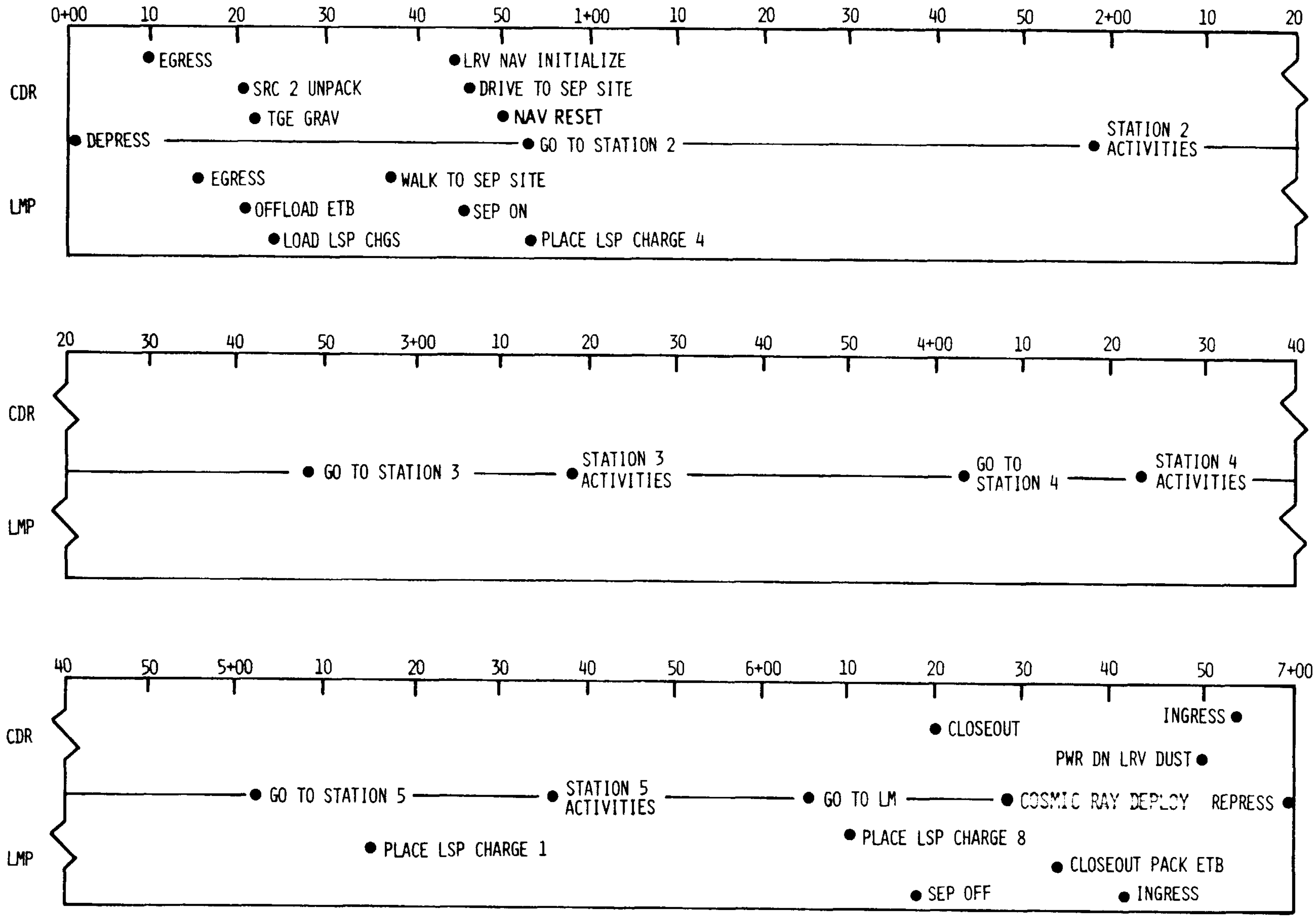


Fig. 8

APOLLO 17
EVA 3 TIMELINE

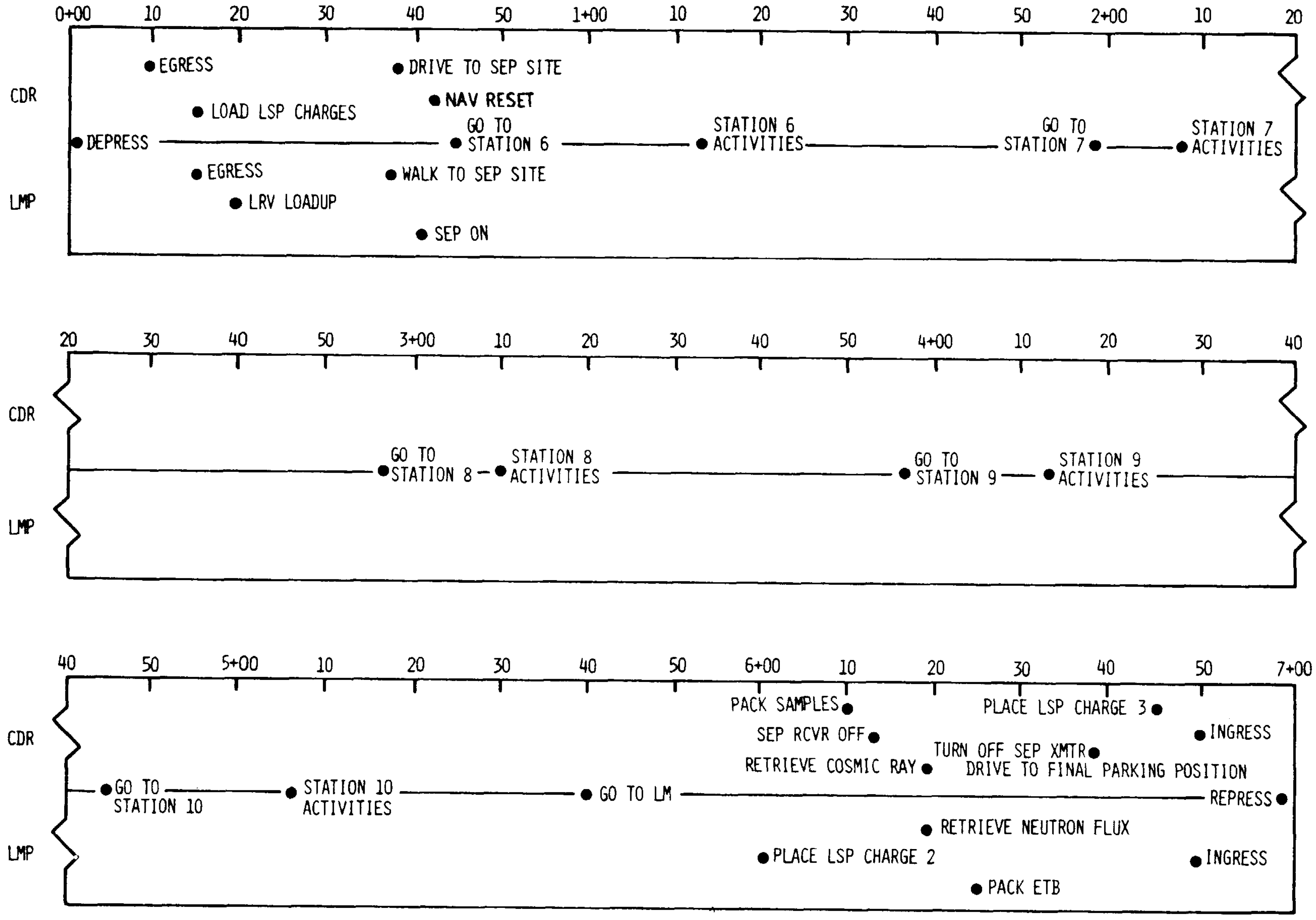


Fig. 9

12th revolution, then restarted after CSM circularization. In the event of a T-24 launch, the additional day in the 111 x 26 km (60 x 14 NM) orbit prior to lunar landing will also be used for orbital science.

The experiments timeline has been developed in conjunction with the surface timeline to provide, as nearly as possible, 16-hour work days and concurrent 8-hour CSM and LM crew sleep periods. Experiment activation cycles are designed to have minimum impact on crew work-rest cycles.

Conduct of orbital experiments and photographic tasks have been planned in consideration of: outgassing, standby, and warmup periods; experiments fields-of-view limitations; and STDN data collection requirements. Water and urine dumps and fuel cell purges have been planned to avoid conflict with operation cycles. Prior to LM liftoff, the CSM will perform a plane change maneuver to provide the desired coplanar orbit at the time of the LM rendezvous.

LM Ascent, Rendezvous and Jettison

After completion of lunar surface activities and ascent preparations, the LM ascent stage propulsion system (APS) and RCS will be used to launch and rendezvous with the CSM.

The direct ascent rendezvous technique initiated on Apollo 14 and subsequently used on Apollo 15 and 16 will be performed. The LM ascent stage liftoff window duration is about 30 seconds and is constrained to keep the perilune above 15 km (8 NM). The ascent stage will be inserted into a 89 x 17 km (48 x 9 NM) orbit so that an APS terminal phase initiation (TPI) burn can be performed approximately 38 minutes after insertion. The final braking maneuver will occur about 45 minutes later. The total time from ascent stage liftoff to the final braking maneuver will be about 90 minutes.

Docking will be accomplished by the CSM with SM RCS maneuvers. Once docked, the two LM crewmen will transfer to the CSM with lunar sample material, exposed films, and designated equipment.

The LM ascent stage will be jettisoned and subsequently deorbited to impact on the lunar surface to provide a known stimulus for the emplaced seismic experiment. The impact will be targeted for 30°32.4'E and 19°55.8'N about 9 km (5 NM) from the Apollo 17 ALSEP.

Post-LM Jettison Lunar Orbit Science

After LM ascent stage jettison, additional scientific data will be obtained by the CSM over a 2-day period. Conduct of the SIM experiments and both SM and CM photographic tasks will take advantage of the extended ground track coverage during this period.

TRANSEARTH INJECTION THROUGH LANDING

After completion of the post-rendezvous CSM orbital activities, the SPS will perform a posigrade burn to inject the CSM onto the transearth trajectory. The nominal return time will not exceed 110 hours and the return inclination will not exceed 70° with relation to the earth's equator.

During the transearth phase there will be continuous communications coverage from the time the spacecraft appears from behind the moon until shortly prior to entry. MCCs will be made, if required. A 6-hour period, including pre- and post-EVA activities, will be planned to perform an in-flight EVA to retrieve film cassettes and the lunar sounder tape from the SIM bay in the SM. TV and photographic tasks will be conducted during transearth coast. The CM will separate from the SM 15 minutes before the entry interface. Earth touchdown will be in the mid-Pacific and will nominally occur approximately 12.7 days after launch. Targeted landing coordinates are 17°54'S, 166°00'W.

POST-LANDING OPERATIONS

Flight Crew Recovery

Following splashdown, the recovery helicopter will drop swimmers and life rafts near the CM. The swimmers will install the flotation collar on the CM, attach the life raft, and pass fresh flight suits in through the hatch for the flight crew to don before leaving the CM. The crew will be transferred from the spacecraft to the recovery ship via life raft and helicopter and will return to Houston, Texas, for debriefing.

Quarantine procedures were eliminated prior to Apollo 15; therefore, the mobile quarantine facility will not be used. However, biological isolation garments will be available for use in the event of unexplained crew illness. The Skylab medical laboratory will be aboard the prime recovery ship and will be used in lieu of the ship's post-flight medical facilities. However, the ship's facilities will be used for X-rays.

CM and Data Retrieval Operations

An attempt will be made to recover the earth landing system main parachutes on this mission. In addition, the CM RCS propellants will not be vented during the landing in order to preclude possible damage to the parachutes. After flight crew pickup by helicopter, the CM will be retrieved and placed on a dolly aboard the recovery ship, USS TICONDEROGA. The CM RCS helium pressure will be vented and the CM will be stowed near the ship's elevator to insure adequate ventilation. Lunar samples, film, flight logs, etc., will be retrieved for shipment to the Lunar Receiving Laboratory (LRL). The spacecraft will be offloaded from the ship in San Diego and transported to an area where deactivation of the propellant system will be accomplished. The CM will then be returned to contractor facilities.

ALTERNATE MISSIONS

If an anomaly occurs after liftoff that would prevent the space vehicle from following its nominal flight plan, an abort or an alternate mission will be initiated. An abort will provide for acceptable flight crew and CM recovery in the Atlantic or Pacific Ocean.

An alternate mission is a modified flight plan that results from a launch vehicle, spacecraft, or support equipment anomaly that precludes accomplishment of the primary mission objectives. The purpose of the alternate mission is to provide the flight crew and flight controllers with a plan by which the greatest benefit can be gained from the flight using the remaining systems capabilities.

The two general categories of alternate missions that can be performed during the Apollo 17 Mission are (1) earth orbital and (2) lunar orbital. Both of these categories have several variations which depend upon the nature of the anomaly leading to the alternate mission and the resulting systems status of the LM and CSM. A brief description of these alternate missions is contained in the following paragraphs.

Earth Orbit

In case of no TLI burn, an earth orbital mission of up to about 6-1/2 days will be conducted to obtain maximum benefit from the scientific equipment onboard. Subsequent to transfer of necessary equipment to the CM, the LM will be deorbited into the Pacific Ocean. The SPS will be used to attain the optimum orbit for conducting orbital science and to increase the orbital inclination up to 45°. A backup RCS deorbit capability will be maintained at all times. The lunar sounder, far UV spectrometer, and IR scanning radiometer will be used to obtain data on the earth's surface and atmosphere and for galactic observations. The mapping camera and pan camera will be used to photograph selected earth targets. The lunar sounder optical recorder film, mapping camera film, and pan camera film will be retrieved by EVA on the last day of the mission.

Lunar Orbit

Lunar orbit missions of the following types will be planned if spacecraft systems will enable accomplishment of orbital science objectives in the event a lunar landing is not possible. If the SIM bay cameras and/or the lunar sounder are used, film cassettes will be retrieved by EVA during transearth coast. An attempt should be made to follow the nominal timeline in order to minimize real time flight planning activities. An SPS capability to perform TEI on any revolution will be maintained.

Generally, when the LM is available for a lunar orbit alternate mission it will be retained. The decision on when to jettison the LM will be made in real time.

CSM/LM (Operable DPS)

The translunar trajectory will be maintained to be within the DPS capability of an acceptable earth return until LOI plus 2 hours in the event LOI is not performed. If it is determined during translunar coast that a lunar landing mission cannot be performed, either the SPS or the LM DPS may be used to perform the LOI-1 maneuver to put the CSM/LM into an appropriate orbit. In the event the SIM bay door is not jettisoned prior to LOI, the LOI-1 maneuver will be performed with the SPS. The LOI-2 maneuver will be performed with the SPS. The LOI-2 maneuver will place the CSM/LM into a 111 km (60 NM) orbit. Orbital science and photographic tasks will be performed for up to approximately 6 days in lunar orbit.

CSM/LM Inoperable DPS

If, following a nominal LOI maneuver it is determined that the DPS is inoperable, an SPS circularization maneuver will be performed to obtain near nominal orbital inclination. The CSM will generally remain in a 111 km (60 NM) orbit. Orbital science and photographic tasks will be performed for up to approximately 6 days in the lunar orbit per the nominal flight plan.

CSM Alone

In the event the LM is not available following a nominal TLI burn, an SPS MCC-1 maneuver will place the CSM on a trajectory such that an acceptable return to earth can be achieved within the SM RCS capability. LOI will not be performed if the SIM bay door cannot be jettisoned. If the SIM bay door has been jettisoned, orbital science and photographic tasks will be performed in an orbit of near nominal (approximately 20°) inclination but with an easterly node shift of from 40° to 60°. The CSM will remain in a 111 km (60 NM) orbit. The duration in lunar orbit will be up to approximately 6 days.

CSM Alone (From Landing Abort)

In the event the lunar landing is aborted, an orbital science mission will be accomplished by the CSM alone after rendezvous, docking, and LM jettison. The total lunar orbit time will be approximately 6 days.

EXPERIMENTS, DETAILED OBJECTIVES, IN-FLIGHT DEMONSTRATIONS, AND OPERATIONAL TESTS

The technical investigations to be performed on the Apollo 17 Mission are classified as experiments, detailed objectives, in-flight demonstrations, or operational tests:

> Experiment — A technical investigation that supports science in general or provides engineering, technological, medical or other data and experience for application to Apollo lunar exploration or other programs and is recommended by the Manned Space Flight Experiments Board (MSFEB) and assigned by the Associate Administrator for Manned Space Flight to the Apollo Program for flight.
>
> Detailed Objective — A scientific, engineering, medical or operational investigation that provides important data and experience for use in development of hardware and/or procedures for application to Apollo missions. Orbital photographic tasks, though reviewed by the MSFEB, are not assigned as formal experiments and will be processed as CM and SM detailed objectives.
>
> In-flight Demonstration — A technical demonstration of the capability of an apparatus and/or process to illustrate or utilize the unique conditions of space flight environment. In-flight demonstration will be performed only on a non-interference basis with all other mission and mission-related activities. Utilization performance, or completion of these demonstrations will in no way relate to mission success.
>
> Operational Test — A technical investigation that provides for the acquisition of technical data or evaluates operational techniques, equipment, or facilities but is not required by the objectives of the Apollo flight mission. An operational test does not affect the nominal mission timeline, adds no payload weight, and does not jeopardize the accomplishment of primary objectives, experiments, or detailed objectives.

EXPERIMENTS

The Apollo 17 Mission includes the following experiments:

Lunar Surface Experiments

Lunar surface experiments are deployed and activated or conducted by the Commander and the Lunar Module Pilot during EVA periods. Those experiments which are part of the ALSEP are so noted.

Lunar Heat Flow (S-037) (ALSEP)

The heat flow experiment is designed to measure the subsurface vertical temperature gradients and brightness temperature in the lunar surface layer, and the absolute temperature and thermal conductivity of the lunar subsurface material to a depth of approximately 2 meters (7 feet). The experiment includes two sensor probes which are placed in bore holes drilled with the Apollo lunar surface drill (ALSD).

Lunar Ejecta and Meteorites (S-202) (ALSEP)

The lunar ejecta and meteorites experiment is designed to measure physical parameters of primary cosmic dust particle impacts on sensors in cislunar space, and of lunar ejecta emanating from the sites of meteorite impacts on the lunar surface. It will measure the direction, mass distribution, and speed of both the primary and secondary particles.

Lunar Seismic Profiling (S-203) (ALSEP)

The lunar seismic profiling experiment is designed to obtain data on physical properties of the lunar surface and subsurface by generating and monitoring artificial seismic waves in the surface and near subsurface in the active mode, and by detecting moonquakes and meteorite impacts in the passive listening mode.

The experiment electronics package and the four-geophone array will be deployed in the ALSEP area during EVA-1. Transport modules with explosive charges will be mounted on the LRV for deployment during the EVA traverses within 2.5 km (1.3 NM) of ALSEP. The eight charges will be detonated remotely from earth subsequent to lunar liftoff.

Lunar Atmospheric Composition (S-205) (ALSEP)

The lunar atmospheric composition experiment is designed to obtain data on composition of the lunar atmosphere in mass range 1-110 AMU at the lunar surface. A secondary goal is the detection of transient changes in composition due to emission of gasses from the surface or from man-made sources. The instrument is a magnetic sector field mass spectrometer with a Nier-type thermionic electronic bombardment ion source.

Lunar Surface Gravimeter (S-207) (ALSEP)

The lunar surface gravimeter is designed to gather the following information: absolute lunar gravity, tidal changes in local gravity due to the change in relative position of celestial bodies, low level lunar gravity changes with periods between 10 seconds and 20 minutes due to natural oscillations of the moon excited by gravity waves, and vertical axis seismic activity. From this information conclusions may be drawn about the internal constitution of the moon, about associated seismic activity, and about the existence of gravity waves. The vertical component of gravity is measured in three different frequency ranges.

Lunar Geology Investigation (S-059)

The lunar geology experiment is designed to provide data for use in the interpretation of the geologic history of the moon in the vicinity of the landing site. The investigation will be carried out during the planned lunar surface traverses and will utilize astronaut descriptions, camera systems, hand tools, drive tubes, the ALSD, and sample containers. The battery powered ALSD will be used to obtain core samples to a maximum depth of approximately 3 meters (11 feet). There are two major aspects of the experiment:

Documented Samples — Rock and soil samples representing different morphological and petrological features will be described, photographed, and collected in individual pre-numbered bags for return to earth.

Geological Description and Special Samples — Descriptions and photographs of the field relationships of all accessible types of lunar features will be obtained. Special samples, such as drive tube samples, will be collected and documented for return to earth.

Cosmic Ray Detector (S-152)

The Apollo 17 cosmic ray detector is designed to measure the elemental composition, abundance and energy spectrum of the solar and galactic cosmic rays, with emphasis on quiet sun conditions, and to detect radon emissions from the lunar surface. All elements heavier than hydrogen in the energy range from 1 kev/AMU to 25 Mev/AMU will be detected.

The experiment will be in two sections, each about 5 x 10 cm (2 x 4 inches). One section holding mica, glass, aluminum foil and platinum foil detector elements will be placed in the sun in order to detect solar emissions. A second section, containing in addition Lexan sheets, will be placed in the shade in order to detect galactic cosmic rays and radon emission.

Traverse Gravimeter (S-199)

The traverse gravimeter experiment is designed to measure and map the gravity in the area traversed by the LRV. The data can provide resolution of surface and subsurface gravity anomalies, and their relationships to observed geological features. The experiment will also provide surface verification of Lunar Orbiter gravity measurements and information on higher harmonic contents of the lunar gravitational field. It will also provide a comparison of terrestrial and lunar gravity.

The instrument mounted on the LRV uses a vibrating string accelerometer to measure gravity fields at the traverse stations. Data will be read to the ground by the crew. Stations will be accurately located by orbital stereo photo coverage and surface photos.

Surface Electrical Properties (S-204)

The surface electrical properties experiment is designed to determine layering in the lunar surface, to search for the presence of water below the surface, and to measure the electrical properties of the lunar material in situ.

Instrumentation includes a solar panel powered transmitter and multiple frequency antenna deployed at least 70 meters (230 feet) from the LM and 70 meters (230 feet) from the ALSEP, and a receiver with tri-loop receiving antenna and data recorder mounted on the LRV. It is utilized on the EVAs while the LRV is in motion. Six frequencies ranging from 1 to 32 MHz allow probing of the subsurface from a few meters to several kilometers. The data recorder is to be returned to earth for analysis.

Lunar Neutron Probe (S-229)

The neutron probe experiment is designed to measure neutron capture rates as a function of depth in the lunar regolith. The neutron probe data will permit an unambiguous interpretation of neutron dosage measurements on the lunar samples. The lunar dosage enables one to calculate regolith errosion and accretion rates, regolith mixing depths, and rock irradiation depths.

The experiment probe is a two-section, 2 meter (7 feet) rod which is activated assembled, and inserted into a core stem hole in the lunar surface during the early stages of extravehicular activity and retrieved, deactivated, and disassembled at the end of the final extravehicular activity. The two sections of the rod consist of concentric tubes. One half of the inner diameter of the outer tube is lined with a plastic track detector. Half of the outer diameter of the center tube is lined with a boron film which emits alpha particles when struck by neutrons. These alpha particles leave traces in the plastic film when the two films are in registration.

In-Flight Experiments

In-flight experiments may be conducted during any phase of the mission. They are performed within the command module (CM), and from the scientific instrument module (SIM) located in sector I of the service module (SM).

S-band Transponder (CSM/LM) (S-164)

The S-band transponder experiment is designed to detect variations in the lunar gravity field caused by mass concentrations and deficiencies and to establish gravitational profiles of the ground tracks to the spacecraft.

The experiment data are obtained by analysis of the S-band Doppler tracking data for the CSM and LM in lunar orbit. Minute pertubations of the spacecraft motion are correlated to mass anomalies in the lunar structure.

Far UV Spectrometer (S-169)

The far UV spectrometer experiment is designed to determine the atomic composition, density, and scale height for each constituent in the lunar atmosphere, and to repeatedly scan the spectral region of 1175 to 1675Å with primary emphasis on hydrogen Lyman Alpha (1216Å) and xenon (1470Å).

The instrument will detect spatial and temporal variations in the lunar atmosphere, measure the temporary atmosphere created by the LM descent and ascent engines, measure the UV albedo and its graphic variations, study the fluorescence on the lunar darkside, measure the UV galactic emission, and study the atomic hydrogen distribution between the earth and the moon.

IR Scanning Radiometer (S-171)

The IR scanning radiometer experiment is designed to obtain data to construct a high resolution temperature map of the lunar surface. It will measure lunar surface thermal emissions along the spacecraft orbital track, and will be used to determine thermal conductivity, bulk density, and specific heat on the lunar surface. Data from this experiment will also be correlated with data obtained from other lunar orbiting spacecraft.

Lunar Sounder (S-209)

The lunar sounder experiment is designed to obtain lunar subsurface and near subsurface stratigraphic, structural, and tectonic data for development of a geological model of the lunar interior to a depth of approximately 1.3 km (.7 NM).

The instrument utilizes three tranceivers (frequencies are 150 MHz, 15 MHz, and 5 MHz), a VHF antenna, an HF antenna, and an optical recorder. Return echos will be linearly detected, displayed in the recorder's cathode ray tube, and photographed. The film cassette will be retrieved during in-flight EVA and returned to earth.

Passive Experiments

Additional experiments assigned to the Apollo 17 Mission which are completely passive are discussed in this section only. Completely passive means no crew activities are required during the mission to perform these experiments.

Gamma Ray Spectrometer (S-160)

This extension of the basic S-160 experiment is designed to obtain measurements of background caused by activation products produced with the Sodium Iodide crystal by cosmic ray interaction, and is in support of the analysis of astronomical gamma ray data collected on the Apollo 15 and 16 Missions. The experiment package is completely passive, consisting of a NaI crystal and plastic scintillator, and is stowed in the CM for the duration of the mission. Immediately upon return to earth, the detector crystal count rate will be measured to determine the background counts produced by the cosmic ray flux interaction with the crystal.

Apollo Window Meteoroid (S-176) (CM)

The Apollo window meteoroid experiment is designed to obtain data on the cislunar meteoroid flux of mass range 10^{-12} grams. The returned CM window will be analyzed for meteoroid impacts by comparison with a preflight photomicroscopic window map. The photomicroscopic analysis will be compared with laboratory calibration velocity data to define the mass of impacting meteoroids.

Soil Mechanics Experiment (S-200)

The soil mechanics experiment is designed to obtain data on the mechanical properties of the lunar soil from the surface to depths of several meters.

Data are derived from LM landing, flight crew observations and debriefings, examination of photographs, analysis of lunar samples, and astronaut activities using the Apollo hand tools.

Biostack IIA Experiment (M-211)

The Biostack experiment is designed to investigate the biologic effects of cosmic radiation during space flight. The Biostack consists of layers of several selected kinds of biological objects (Bacillus subtilis spores, Colpoda cucullus cysts, Arabidopsis thaliana seeds, Vicia faba radiculae, Artemia salina eggs, Tribolium castaneum eggs) stacked alternatively with different physical track detectors (nuclear emulsions, plastics, AgCl-crystals). The biologic affects of galactic cosmic particles under consideration are: molecular and cellular inactivation; damage to nuclei and other sub-cellular systems; induction of mutations leading to genetic changes; and modification in growth and development of tissues. The experiment is stowed in the CM for the duration of the mission. The research is of special interest because of its possible relationship to the biologic effects of space flight on man.

Biocore Experiment (M-212)

The Biocore experiment is designed to ascertain whether heavy particles of cosmic radiation of known trajectory and terminating in the brain and eyes, will produce morphologically demonstratable damage. Five pocket mice will be used to establish occurrence or nonoccurrence of brain lesions caused by the particles. The experiment is stowed in the CM for the duration of the mission. For a T-24 launch opportunity this experiment will not be flown.

DETAILED OBJECTIVES

Following is a brief description of each of the launch vehicle and spacecraft detailed objectives planned for this mission.

Launch Vehicle Detailed Objectives

Impact the expended S-IVB/IU in a preselected zone on the lunar surface under nominal flight profile conditions to stimulate the ALSEP passive seismometers.

Post-flight determination of actual S-IVB/IU point of impact within 5 km (2.7 NM), and time of impact within 1 second.

Spacecraft Detailed Objectives

Obtain SM high resolution panoramic and high quality metric lunar surface photographs and altitude data from lunar orbit to aid in the overall exploration of the moon.

Obtain CM photographs of lunar surface features of scientific interest and of low brightness astronomical and terrestrial sources.

Record visual observations of farside and nearside lunar surface features and processes to complement photographs and other remote-sensed data.

Obtain data on whole body metabolic gains or losses, together with associated endocrinological controls for food compatibility assessment.

Obtain data on the effectiveness of the protective pressure garment in counteracting orthostatic intolerance.

Obtain more definitive information on the characteristics and causes of visual light flashes.

Obtain data on Apollo spacecraft induced contamination.

IN-FLIGHT DEMONSTRATION

Heat Flow and Convection

This demonstration will be performed to show the convective instability existing in fluids containing temperature gradients at low acceleration levels. The demonstration is designed to obtain further information on the effects detected in the Apollo 14 demonstration.

OPERATIONAL TESTS

The operational tests listed below have been approved for conduct in conjunction with the Apollo 17 Mission, with the qualification stated in connection with the ETR 0.13 Radar Skin Track Test. The ETR 0.13 Radar Skin Track Test and Chapel Bell actively radiate, whereas the remaining tests are passive. The operational tests using the Air Force Eastern Test Range (AFETR) instrumentation or facilities are to be scheduled by the AFETR.

Chapel Bell (TEPEE)

The DOD operational test Chapel Bell has been coordinated between centers and has received OMSF approval. This test has been conducted on previous Apollo launches and has received OMSF approval for the Apollo 17 Mission.

ETR 0.13 Radar Skin Track Test

Subject to certification by KSC, in coordination with other OMSF Centers, the AFETR will operate a research and development FPQ-13, C-band radar during the launch and orbital phases of the mission. Certification will be based upon a satisfactory radio frequency interference test. The AFETR Superintendent of Range Operations will respond to the MSC Network Controller and turn the radar off if radio frequency interference should occur.

Ionospheric Distrubances from Missiles

This test studies the long-range propagation of acoustic waves of continuous sources, such as rocket vehicles, in the upper atmosphere and in the lower ionosphere at Grand Bahama Island. Observations will be made of electromagnetic radiation at audio-frequencies expected to result from vehicle flight.

Acoustic Measurement of Missile Exhaust Noise

The acoustic noise of the rocket's exhaust is recorded at Cape Kennedy Air Force Station by a cross-shaped array of nine microphones, which are sheltered from wind noise by heavy vegetation. The Air Force performs analyses of the recorded data to determine wind speed and direction from sea level to 80 km (43 NM)

Army Acoustic Test

This DOD operational test has been conducted on previous Apollo launches and has received OMSF approval for Apollo 17.

Long Focal Length Optical System

Photographic information on selected launch and orbital operations is collected by the AFETR, using a long focal length optical system.

Sonic Boom Measurement

The sonic boom overpressure levels of the Apollo 17 space vehicle during launch will be measured in Atlantic launch abort area. The data will be used to assist in developing high-altitude, high-Mach number, accelerated flight sonic boom prediction techniques.

Skylab Medical Mobile Laboratory

The Skylab Medical Mobile Laboratory will be on board the prime recovery ship when the crew is recovered. The Skylab medical laboratory will be used to replace the ship's post-flight medical facilities, except for shipboard X-ray. No new medical protocol changes will be implemented above the normal Apollo Program requirements.

MISSION CONFIGURATION AND DIFFERENCES

MISSION HARDWARE AND SOFTWARE CONFIGURATION

The Saturn V Launch Vehicle and the Apollo Spacecraft for the Apollo 17 Mission will be operational configurations.

CONFIGURATION	DESIGNATION NUMBERS
Space Vehicle	AS-512
Launch Vehicle	SA-512
First Stage	S-IC-12
Second Stage	S-II-12
Third Stage	S-IVB-512
Instrument Unit	S-IU-512
Spacecraft-LM Adapter	SLA-21
Lunar Module	LM-12
Lunar Roving Vehicle	LRV-3
Service Module	SM-114
Command Module	CM-114
Onboard Programs	
Command Module	Colossus 3
Lunar Module	Luminary 1G
Experiments Package	Apollo 17 ALSEP
Launch Complex	LC-39A

CONFIGURATION DIFFERENCES

The following summarizes the significant configuration differences associated with the AS-512 Space Vehicle and the Apollo 17 Mission:

Spacecraft

Command/Service Module

Added 5 micron filter in ECS Suit P gauge	To prevent particulate contamination from causing erroneous pressure readings.
Added battery manifold relief valve	To permit overboard dumping of battery gasses in event manual vent valve is closed during a pressure buildup.
Added lunar sounder booms	To provide equipment for lunar sounder experiment.

Added fuel and oxidizer pressure transducers	To provide redundant fuel and oxidizer system pressure measurements.
Crew Systems	
Added third EMU maintenance kit	To provide additional lubricant due to amount of dust encountered on previous flights.
Enlarged PGA bag	To preclude dust from contaminating wrist connects.
Modified OPS purge valve	To preclude inadvertant pulling of locking pin.
Added spare OPS antenna	To provide spare in event of breakage.
Eliminated EVA Visor Stop in helmet	To prevent difficulty in retracting center eye shade.
LRV	
Added fender extension fasteners	To preclude loss of fender extensions.
Lunar Module	
Modified S-band steerable antenna latch mechanism	To improve unstow capability.
Removed thermal paint from RCS panels	To preclude peeling during space flight
Improved structural attachment between base heatshield and support tube for aft equipment rack panels	To preclude shearing during LM lunar liftoff
Launch Vehicle	
S-IVB	
Redesigned S-IVB APS Helium pressure transducer mounting block	To reduce possibility of internal system leakage

Replaced APS Helium bulkhead fittings and seals	To reduce possibility of external system leakage
Interconnected stage Helium repressurization system with APS Helium system	To provide capability to charge APS Helium spheres from stage Helium spheres in event of APS leak

IU

Modified EDS distributor to provide three independent liftoff signals and change Time Base one and start logic	To provide two out of three voting logic for start of Time Base one to eliminate single failure point
Added redundant path across IU/ESE interface to assure power to IU measuring bus prior to liftoff	To reduce possibility of S-IC engine shutdown after ignition
Removed modulating flow control valve and associated circuitry	Not required. In line production change.
Added lightning detection devices to Saturn launch vehicle	To determine magnitude of lightning strike to provide ample data for retest requirements

J-2 Engine

Replaced engine control assembly (ECA) with ECA incorporating redundant timers	To eliminate single failure points by providing redundant circuits
Modified LOX dome and gas generator purge control valve	To prevent excessive Helium loss due to slow engine purge control valve closure

TV AND PHOTOGRAPHIC EQUIPMENT

Standard and special-purpose cameras, lenses, and film will be carried to support the objectives, experiments, and operational requirements. Table 2 lists the TV and camera equipments and shows their stowage locations.

Table 2

Nomenclature	CSM at Launch	LM at Launch	CM to LM	LM to CM	CM at Entry
TV, Color, Zoom Lens (Monitor with CM System)	1	1			1
Camera, Data Acquisition, 16mm	1	1			1
Lens - 10mm	1	1			1
- 18mm	1				1
- 75mm	1				1
Film Magazines	13		3	3	13
Camera, 35mm Nikon	1				1
Lens - 55mm	1				1
Cassette, 35mm	8				8
Camera, Hasselblad, 70mm Electric	1				1
Lens - 80mm	1				1
- 250mm	1				1
Film Magazines	8				8
Camera, Hasselblad Electric Data (Lunar Surface)		2			
Lens - 60mm		2			
Film Magazines	14		14	14	14
Polarizing Filter		1			
Camera, 24-in Panoramic (In SIM)	1				
Film Magazine (EVA Transfer)	1				1
Camera, 3-in Mapping Stellar (SIM)	1				
Film Magazine Containing 5-in Mapping and 35mm Stellar Film (EVA Transfer)	1				1
Lunar Sounder Film Magazine (SIM) (EVA Transfer)	1				1

FLIGHT CREW DATA

PRIME CREW (Figure 10)

Commander: Eugene A. Cernan (Captain, USN)

Space Flight Experience: Captain Cernan was selected as an astronaut by NASA in October 1963.

Captain Cernan was the LM Pilot for the Apollo 10 Mission, which included all phases of a lunar mission except the final minutes of an actual landing.

He also served as pilot for the Gemini 9 Mission.

Captain Cernan has logged more than 264 hours in space.

Command Module Pilot: Ronald E. Evans (Commander, USN)

Space Flight Experience: Commander Evans was selected as a NASA astronaut in April 1966.

He served as a member of the astronaut support crews for the Apollo 7 and 11 flights and the backup command pilot for Apollo 14.

Commander Evans has flown 3400 hours in jet aircraft.

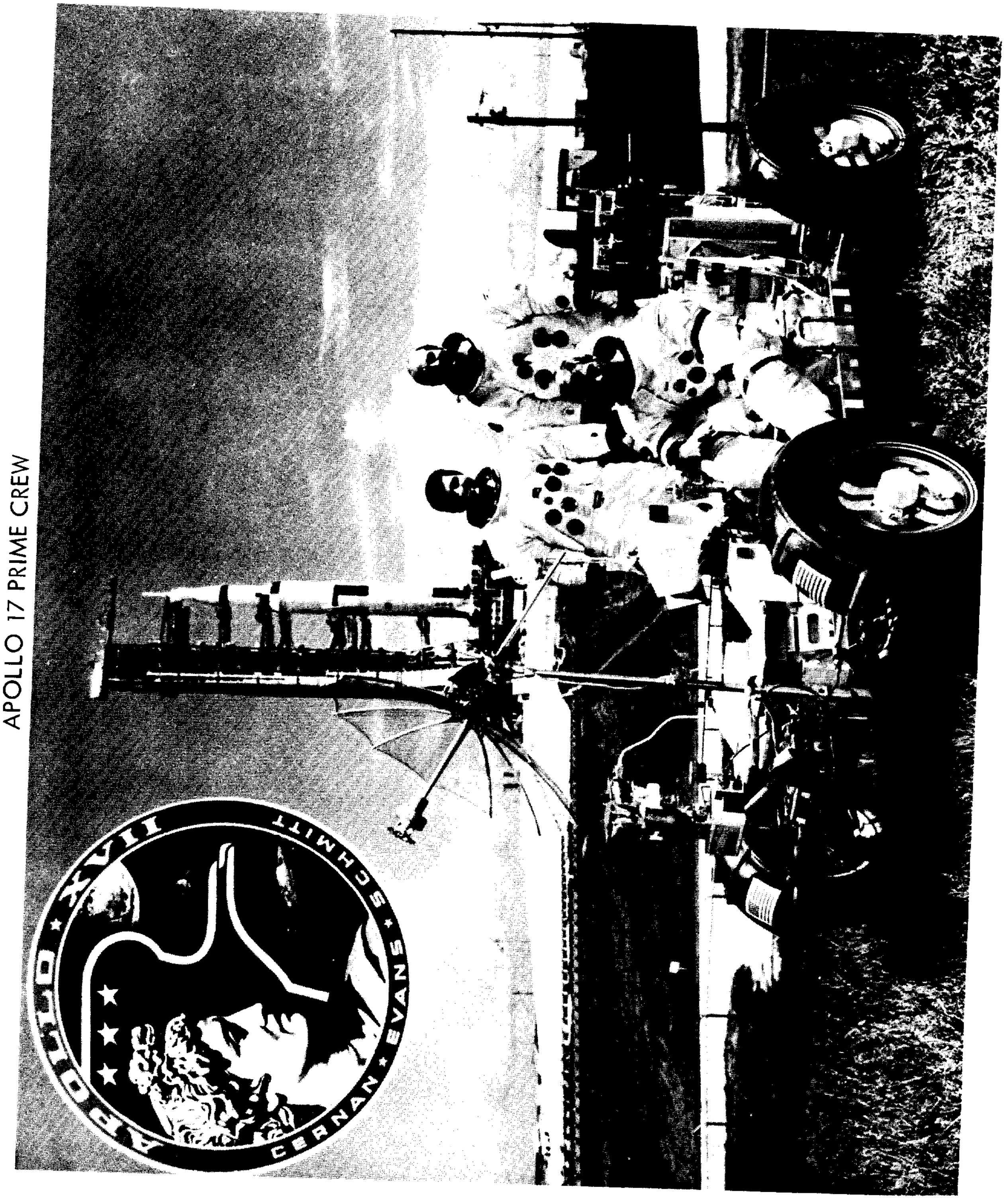
Lunar Module Pilot: Harrison H. Schmitt (Dr. Phd)

Space Flight Experience: Dr. Schmitt was selected as a scientist astronaut by NASA in June 1965.

He served as backup lunar module pilot for Apollo 15.

He has logged 1100 hours in jet aircraft.

APOLLO 17 PRIME CREW



BACKUP CREW

Commander: John W. Young (Captain, USN)

Space Flight Experience: Captain Young was selected as an astronaut by NASA in September 1962.

Captain Young was the commander for the lunar landing Apollo 16 Mission and command module pilot for the Apollo 10 Mission.

He also served as pilot for the Gemini 3 Mission and commander of the Gemini 10 Mission.

Captain Yound has logged more than 533 hours in space.

Command Module Pilot: Stuart A. Roosa (Lieutenant Colonel, USAF)

Space Flight Experience: Lt. Colonel Roosa was selected as an astronaut by NASA in April 1966.

He was the command module pilot for the Apollo 14 lunar landing mission, backup command module pilot for the Apollo 16 Mission, and a member of the Apollo 9 Mission.

He has logged more than 216 hours of space flight.

Lunar Module Pilot: Charles M. Duke, Jr. (Colonel, USAF)

Space Flight Experience: Colonel Duke was selected as an astronaut by NASA in April 1966. He served as backup lunar module pilot for the Apollo 15 Mission and was the lunar module pilot for the Apollo 16 lunar landing.

Colonel Duke has been on active duty since graduating from the U.S. Naval Academy in 1957. He has logged more than 267 hours in space.

MISSION MANAGEMENT RESPONSIBILITY

Title	Name	Organization
Director, Apollo Program	Dr. Rocco A. Petrone	OMSF
Mission Director	Capt. Chester M. Lee, USN (Ret)	OMSF
Saturn Program Manager	Mr. Richard G. Smith	MSFC
Apollo Spacecraft Program Manager	Mr. Owen G. Morris	MSC
Apollo Program Manager, KSC	Mr. Robert C. Hock	KSC
Director of Launch Operations	Mr. Walter J. Kapryan	KSC
Director of Flight Operations	Mr. Howard W. Tindall, Jr.	MSC
Launch Operations Manager	Mr. Paul C. Donnelly	KSC
Flight Directors	Mr. M. P. Frank Mr. Eugene F. Kranz Mr. Gerald Griffin	MSC MSC MSC

ABBREVIATIONS AND ACRONYMS

AGS	Abort Guidance System
ALSEP	Apollo Lunar Surface Experiments Package
AOS	Acquisition of Signal
APS	Ascent Propulsion System (LM)
APS	Auxiliary Propulsion System (S-IVB)
ARIA	Apollo Range Instrumentation Aircraft
AS	Apollo/Saturn
BIG	Biological Isolation Garment
BSLSS	Buddy Secondary Life Support System
CCATS	Communications, Command, and Telemetry System
CCGE	Cold Cathode Gauge Experiment
CDR	Commander
CPLEE	Charged Particle Lunar Environment Experiment
CM	Command Module
CMP	Command Module Pilot
CSI	Concentric Sequence Initiation
CSM	Command/Service Module
DAC	Data Acquisition Camera
DDAS	Digital Data Acquisition System
DOD	Department of Defense
DOI	Descent Orbit Insertion
DPS	Descent Propulsion System
DSKY	Display and Keyboard Assembly
ECS	Environmental Control System
EI	Entry Interface
EMU	Extravehicular Mobility Unit
EPO	Earth Parking Orbit
EST	Eastern Standard Time
ETB	Equipment Transfer Bag
EVA	Extravehicular Activity
FM	Frequency Modulation
fps	Feet Per Second
FDAI	Flight Director Attitude Indicator
FTP	Full Throttle Position
GCTA	Ground Commanded Television
GET	Ground Elapsed Time
GNCS	Guidance, Navigation, and Control System (CSM)
GSFC	Goddard Space Flight Center
HBR	High Bit Rate
HFE	Heat Flow Experiment
HTC	Hand Tool Carrier
IMU	Inertial Measurement Unit
IU	Instrument Unit
IVT	Intravehicular Transfer
KSC	Kennedy Space Center
LBR	Low Bit Rate
LCC	Launch Control Center
LCRU	Lunar Communications Relay Unit
LDMK	Landmark
LEC	Lunar Equipment Conveyor
LES	Launch Escape System
LET	Launch Escape Tower
LGC	LM Guidance Computer
LH_2	Liquid Hydrogen
LiOH	Lithium Hydroxide
LM	Lunar Module
LMP	Lunar Module Pilot
LOI	Lunar Orbit Insertion
LOS	Loss of Signal
LOX	Liquid Oxygen
LPO	Lunar Parking Orbit
LR	Landing Radar
LRL	Lunar Receiving Laboratory
LRRR	Laser Ranging Retro-Reflector
LSM	Lunar Surface Magnetometer
LV	Launch Vehicle
MCC	Midcourse Correction
MCC	Mission Control Center
MESA	Modularized Equipment Stowage Assembly
MH_z	Megahertz
MOCR	Mission Operations Control Room
MOR	Mission Operations Report
MPL	Mid-Pacific Line
MSC	Manned Spacecraft Center
MSFC	Marshall Space Flight Center
MSFEB	Manned Space Flight Experiment Board
MSFN	Manned Space Flight Network
NASCOM	NASA Communications Network
NM	Nautical Mile
OMSF	Office of Manned Space Flight
OPS	Oxygen Purge System
ORDEAL	Orbital Rate Display Earth and Lunar
PCM	Pulse Code Modulation
PDI	Powered Descent Initiation
PGA	Pressure Garment Assembly
PGNCS	Primary Guidance, Navigation, and Control System (LM)
PLSS	Portable Life Support System
PSE	Passive Seismic Experiment
PTC	Passive Thermal Control
QUAD	Quadrant
RCS	Reaction Control System
RR	Rendezvous Radar
RLS	Radius Landing Site
RTCC	Real-Time Computer Complex
RTG	Radioisotope Thermoelectric Generator
S/C	Spacecraft
SEA	Sun Elevation Angle
STDN	Spaceflight Tracking and Data Network
S-IC	Saturn V First Stage
S-II	Saturn V Second Stage
S-IVB	Saturn V Third Stage
SIDE	Suprathermal Ion Detector Experiment
SIM	Scientific Instrument Module
SLA	Spacecraft-LM Adapter
SM	Service Module
SPS	Service Propulsion System
SRC	Sample Return Container
SSB	Single Side Band
SSR	Staff Support Room
SV	Space Vehicle
SWC	Solar Wind Composition Experiment
TD&E	Transposition, Docking and LM Ejection
TEC	Transearth Coast
TEI	Transearth Injection
TFI	Time From Ignition
TLC	Translunar Coast
TLI	Translunar Injection
TLM	Telemetry
TPF	Terminal Phase Finalization
TPI	Terminal Phase Initiation
T-time	Countdown Time (referenced to liftoff time)
TV	Television
USB	Unified S-Band
USN	United States Navy
USAF	United States Air Force
VAN	Vanguard
VHF	Very High Frequency
ΔV	Differential Velocity

Post Launch
Mission Operations Report
No. M-933-72-17

December 19, 1972

TO: A/Administrator

FROM: MA/Apollo Program Director

SUBJECT: Apollo 17 Mission (AS-512) Post Mission Operation Report No. 1

The Apollo 17 mission was successfully launched from the Kennedy Space Center on Thursday, December 7, 1972. The mission was completed successfully, with recovery on December 19, 1972. Initial review of the mission events indicates that all mission objectives were accomplished. Detailed analysis of all data is continuing and appropriate refined results of the mission will be reported in the Manned Space Flight Centers' technical reports.

Attached is the Mission Director's Summary Report for Apollo 17, which is submitted as Post Launch Operations Report No. 1. Also attached are the NASA OMSF Primary Objectives for Apollo 17. The Apollo 17 mission has achieved all the assigned primary objectives and I judge it to be a great! success.

Rocco A Petrone
Rocco A. Petrone

Approval:

Dale D Myers
Dale D. Myers
Associate Administrator for
Manned Space Flight

Attachments

NASA OMSF MISSION OBJECTIVES FOR APOLLO 17

PRIMARY OBJECTIVES

- Perform selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Taurus-Littrow region.
- Emplace and activate surface experiments.
- Conduct in-flight experiments and photographic tasks.

Rocco A Petrone
Rocco A. Petrone
Apollo Program Director

Date: 22 November 1972

Dale D Myers
Dale D. Myers
Associate Administrator for
Manned Space Flight

Date: Nov 22 1972

ASSESSMENT OF THE APOLLO 17 MISSION

Based upon a review of the assessed performance of Apollo 17, launched 7 December 1972 and completed 19 December 1972, this mission is adjudged a success in accordance with the objectives stated above.

Rocco A. Petrone
Rocco A. Petrone
Apollo Program Director

Date: 20 December 1972

Dale D Myers
Dale D. Myers
Associate Administrator for
Manned Space Flight

Date: JAN 10, 1973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

IN REPLY REFER TO: MAO

December 19, 1972

TO: Distribution

FROM: MA/Apollo Mission Director

SUBJECT: Mission Director's Summary Report, Apollo 17

INTRODUCTION

The Apollo 17 Mission was planned as a lunar landing mission to accomplish selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Taurus-Littrow region of the moon; emplace and activate surface experiments; and conduct in-flight experiments and photographic tasks. Flight crew members were Commander (CDR) Captain Eugene A. Cernan (USN), Command Module Pilot (CMP) Commander Ronald E. Evans (USN), Lunar Module Pilot (LMP) Dr. Harrison H. Schmitt (PhD). Significant detailed information is contained in Tables 1 through 15. Initial review indicates that all primary mission objectives were accomplished (reference Table 1). Table 2 lists the Apollo 17 achievements.

PRELAUNCH

The launch countdown proceeded smoothly until T-30 seconds, at which time an automatic cutoff occurred. Subsequent to a recycle and hold at T-22 minutes, an additional hold was called at T-8 minutes. The duration of the holds delayed the launch by 2 hours 40 minutes.

The hold was caused when the Terminal Countdown Sequencer (TCS) failed to command pressurization of the S-IVB LOX tank. This command: (1) Closes the LOX tank vent; (2) Opens the LOX tank pressurization valve; and (3) Arms the S-IVB LOX tank pressurized interlock. The tank was pressurized manually. Satisfying (1) and (2) above, but the absence of (3) prevented actuation of the interlock in the S-IVB ready to launch logic train. The result was automatic cutoff at T-30 seconds. The launch was accomplished with the interlock bypassed by a jumper. Investigation indicates cause of failure to be a defective diode on a printed circuit card in the TCS.

The workaround to jump the single failed function was thoroughly analyzed and satisfactorily checked out on the breadboard at MSFC and, subsequently, a decision was made to proceed with the countdown. The countdown then proceeded smoothly. Launch day weather conditions were clear, visibility 13 kilometers (km)(7 nautical miles (nm)), winds 4 meters per second (mps) (8 knots), and scattered cloud cover at 1200 meters (m) (4000 feet).

LAUNCH, EARTH PARKING ORBIT, AND TRANSLUNAR INJECTION

The Apollo 17 space vehicle was successfully launched from Kennedy Space Center, Florida, 2 hours 40 minutes late, at 00:33 EST, December 7, 1972. The S-IVB/IU/LM/CSM was inserted into an earth orbit of 170 x 168 km (92.5 x 91.2 nm) at 00:11:52 GET (hrs:min:sec).

Following nominal checkout of the space vehicle, the S-IVB performed the Translunar Injection Maneuver over the Atlantic Ocean as planned. The maneuver occurred at 3:12:36 GET and was nominal in all respects.

TRANSLUNAR COAST

The CSM separated from the S-IVB/IU/LM at 3:42:29 GET, transposed, and then docked with the LM at 3:57:10 GET. However, during docking, a talkback barberpole indicated a possible ring latch malfunction. Subsequent LM pressurization, hatch removal, and troubleshooting revealed that latches 7, 9, and 10 handles were not locked. Latch 10 handle was locked by pushing on the latch handle. Latches 7 and 9 were locked and manually fired to lock the handles and the system talkback indicated normal. Following hatch replacement, the CSM/LM combination was successfully ejected 4:45:20 GET.

The S-IVB lunar impact maneuver targeted the stage for impact at lunar coordinates 7.0°S and 8.0°W at about 87:05 GET.

The spacecraft trajectory was such that midcourse correction (MCC) 1 was not performed. MCC-2 maneuver was performed on time at 35:29:59 GET. The Service Propulsion System (SPS) was fired for 1.7 seconds, resulting in a velocity change of 3 mps (9.9 feet per second (fps)). This was 0.2 mps (0.7 fps) less than planned because tank pressures at the time of the maneuver were slightly lower than those used to predict the firing duration. This residual was trimmed out manually to near zero using the service module Reaction Control System (RCS).

The Commander (CDR) and Lunar Module Pilot (LMP) began IVT to the LM at approximately 40:10 GET. At ingress, it was discovered that #4 docking latch was not properly latched. The CMP moved the latch handle about 30°-45°, disengaging the hook from the docking ring. After discussion between the ground controllers and the flight crew, it was decided to curtail further action on the latch until the second IVT/LM Activation at 59:59 GET. The remainder of the LM housekeeping was nominal and the LM was closed out at 42:11 GET.

The Heat Flow and Convection demonstrations were conducted as planned. The first demonstration was performed with the spacecraft in attitude hold while the second run was accomplished with the spacecraft in the passive thermal control (PTC) mode. The radial. lineal and flow pattern demonstrations produced satisfactory results.

Since the spacecraft trajectory was near nominal, MCC-3 was not required.

IVT/LM housekeeping commenced about 59:59 GET and completed about 62:16 GET. All LM systems checks were nominal. During the LM housekeeping period, the Command Module Pilot (CMP) performed troubleshooting on the docking latch #4 problem experienced during the first IVT/LM. Following instructions from the ground controllers, the CMP stroked latch #4 handle and succeeded in cocking the latch. The latch was left in the cocked position for CSM/LM rendezvous.

As the delay in liftoff was being experienced, the planned trajectory was continually being modified to speed up the translunar coast so that the spacecraft would arrive at lunar orbit insertion (LOI) at the same GMT time. Subsequently, in order to adjust the GET to allow for the delay in liftoff, a 2-hour and 40-minute GET clock update was performed at 65:00 GET, placing all events back on schedule with the flight plan.

At 68:19 GET, a 1-hour Visual Light Flash Phenomenon observation was conducted by the crew. The crew reported seeing light flashes ranging from bright to dull.

The spacecraft entered the moon's sphere of influence at about 73:18 GET.

(MCC) 4 was not performed since the spacecraft trajectory was near normal.

The SIM door was successfully jettisoned at 84:12 GET. The crew stated that the SIM bay looked good.

LUNAR ORBIT INSERTION AND S-IVB IMPACT

LOI was performed with the service propulsion system (SPS) at 88:54:22 GET. The 398-second maneuver produced a velocity change (ΔV) of -910 mps (-2988 fps) and inserted the CSM/LM into a 315 x 97 km (170.0 x 52.6 nm) lunar orbit. The resultant orbit was very close to the prelaunch planned orbit of 317 x 95 km (171 x 51 nm).

S-IVB impact on the lunar surface occurred at 89:39 GET about 18 minutes later than the prelaunch prediction. Impact coordinates were 4°12'S and 12°18'W, about 160 km (86 nm) northwest of the planned target point. The event was recorded by the Apollo 12, 14, 15, and 16 Apollo Lunar Surface Experiment Packages (ALSEPs).

DESCENT ORBIT, UNDOCKING, POWERED DESCENT, AND LANDING

The DOI-1 SPS 22-second burn at 93:11 GET was nominal and produced a ΔV of -60 mps (-197 fps) and a resultant orbit of 109 x 27 km (59 x 14.6 nm).

IVT/LM activation occurred at about 107:42 GET (hr:min). The LM was powered up and all systems were nominal.

The CSM and LM performed the undocking and separation maneuver on schedule at 110:27:55 GET. The CSM then performed the circularization maneuver at 111:57:28 GET which placed the CSM into a 129 x 100 km (70 x 54 nm) orbit.

The Descent Orbit Insertion-2 maneuver occurred at 112:02:41 GET and inserted the LM into a 111 x 11 km (59.6 x 6.2 nm) orbit. Powered Descent initiation was performed at 112:49:52 GET and landing at Taurus-Littrow occurred at 113:01:58 GET. The landing coordinates were 20°12.6'N and 30°45.0'E.

LUNAR SURFACE

Extra-Vehicular Activity (EVA)-1 commenced at 117:01:36 GET and terminated at 124:13:47 for a total duration of 7 hrs. 12 min. 11 secs. After deploying the Lunar Roving Vehicle (LRV) and prior to traversing to the ALSEP site, the CDR inadvertently knocked the right rear fender extension off of the LRV fender. The fender extension was subsequently secured to the fender with tape. The ALSEP and the Cosmic Ray experiment were deployed. Steno Crater was used as Station 1A in lieu of the preplanned station (Emory Crater). The new station was selected because of the accumulated delay time in the EVA by completion of ALSEP deployment. During the traverse to Station 1A, the fender extension came off and assa result, the crew and LRV experienced a great deal of dust. The Surface Electrical Properties (SEP) Transmitter was deployed near the end of the EVA. Since the crew did not get far enough out to deploy the 1.4 Kilogram (Kg) (3 pound (lb)) Explosive Package (EP), only the 0.23 Kg (½ lb) and 0.45 Kg (1 lb) EPs were deployed on EVA-1.

EVA-2 started at 140:34:48 GET, approximately 1 hour, 20 minutes late, and ended at 148:12:10 GET. Total EVA time was 7 hours, 37 minutes, 22 seconds.

Prior to starting the EVA traverse, the crew received instructions from the ground controllers for improvising a replacement for the lost fender extension. A rig of 4 chronopaque maps, taped together and held in position by two clamps from portable utility lights, made an excellent substitute for the extension and the crew did not experience the dust problem as on EVA-1.

Stations 2 (Nansen), 3 (Lara), 4 (Shorty), and 5 (Camelot) were visited according to premission plan although station times were modified. An additional brief stop at Station 2A, 0.7 km at 71° fron Station 2, was made in order to obtain an additional Traverse Gravimeter reading and additional samples. During the traverse, the crew deployed the 0.06 Kg (1/8 lb), 2.7 Kg (6 lb) and 0.11 Kg (¼ lb) EPs, obtained photographs, and documented samples.

An orange colored material, believed to be of volcanic origin, was found at Station 4. The LMP revisited the ALSEP site at the end of the EVA in order to verify that the Lunar Surface Gravimeter (LSG) was properly deployed and leveled. Total distance covered was approximately 19 km (12 nm).

EVA 3 was initiated at 163:32:35 GET about 50 minutes late, and was terminated 7 hours and 15 minutes 31 seconds later at 170:48:06 GET. Exploration of the stations was modified during the traverse. In lieu of traversing Stations 6 (North Massif) through 10B (Sherlock) as planned, the crew was instructed to spend less time at Station 7 (North Massif) due to a longer stay time at Station 6. Station 9 (Van Serg) was explored as planned. Station 10B was deleted and Station 8A (Sculptured Hills) was added. Photographs and documented samples were obtained at all stations. About 66 Kg (145 pounds) of samples were retrieved, and the LRV traversed a total of 11.6 km (6 nm).

The 1.4 Kg (3 lb) EP, left over from EVA-1, was deployed in addition to 0.11 Kg ($\frac{1}{4}$ lb) and 0.06 Kg (1/8 lb) EPs. (See Table).

The total time for the three EVAs was 22 hours, 5 minutes, 4 seconds. The total distance traveled in the lunar rover was about 35 km. The combined weight of samples was about 115 kg (250 lbs), plus 2 double cores and 1 deep drill core. Surface photographs taken during the three EVAs total at least 2120.

Good quality television transmission was received throughout the three EVAs.

Equipment jettison #1 was completed at 171:59 GET.

Since the CSM orbit did not decay to the planned orbit for CSM/LM rendezvous, a trim maneuver was initiated at 181:34:01 GET. The 2.8 mps (9.2 fps) burn for 30 seconds produced a 124 x 115 Km (67.3 x 62.5 nm)orbit.

The Lunar Orbit Plane Change to orient the CSM orbit for rendezvous occurred at 182:33:53 GET. The maneuver produced a change of 3.2° in inclination with a 6.1° shift in the line of nodes.

Equipment jettison #2 was completed at 186:04 GET.

ASCENT, RENDEZVOUS, DOCKING, AND LM IMPACT

LM Ascent Stage lift-off occurred at 188:01:36 GET. A 3 mps (10 fps) tweak burn for 10 seconds at 188:12:12 GET set up the LM orbit for a nominal rendezvous. The Terminal Phase Initiate burn of 3.2 seconds was executed at 188:55:57 GET and resulted in a velocity change of 16.4 mps (53.8 fps) and an orbit of 119 x 90 Km (64.7 x 48.5 nm). CSM/LM docking was completed at 190:17:03 GET. Following equipment and crew transfer to the CSM, the LM Ascent Stage Jettison and CSM Separation were completed as planned. Ascent Stage Deorbit was initiated at 195:38:13 GET and lunar surface impact occurred at 195:57:18 GET. The event was observed by the four Apollo 17 Geophones and the Apollo 12, 14, 15, and 16 ALSEPs. Initial data indicated the impact point location to be at 19°54'N and 30°30'E.

The crew did not obtain photographs of Solar Corona at 208:17 GET due to extension of the rest period. The task was not rescheduled. Other photographic tasks were performed as planned.

Explosive Package (EP) #6 0.45 Kg (1 lb) was detonated at 212:55:35 GET and EP #7 0.23 Kg ($\frac{1}{2}$ lb) at 215:25:01 GET. Both events were picked up by the Lunar Seismic Profiling (LSP) geophones. The resulting flash and dust from the EP #7 explosion was seen on Television. (See Table 10).

The Ground Controlled Television Assembly (GCTA) and Lunar Communications Relay Unit (LCRU) failed to operate when attempts were made to command the camera on at 221:20 GET. Additional attempts between 237:44 and 237:53 GET to command the systems on were unsuccessful. It was later determined, the LCRU experienced an over-temperature failure.

Explosive Package (EP) #4 0.06Kg (1/8 lb) detonated at 232:15:45 GET.

TRANSEARTH INJECTION AND COAST

The Transearth Injection (TEI) maneuver was performed at 236:42:08 GET. The Service Propulsion System (SPS) 144.9-second burn produced a change in velocity of 928 mps (3046.3 fps).

EP#1 2.7Kg (6 lb) detonated at 237:49:52 GET and EP#8 0.11 Kg (1/4 lb) at 240:52:50 GET (see Table 10). The Lunar Seismic Profiling geophones received strong signals from EP's 4, 1, and 8.

Midcourse Correction (MCC)-5 was not performed since the spacecraft trajectory was near nominal.

The spacecraft left the moon's sphere of influence at 250:39:50 GET, traveling at a velocity of 1173 mps (3851 fps).

CMP in-flight EVA commenced at 257:34:24 GET. The CMP retrieved the Lunar Sounder film, Panoramic Camera, and Mapping Camera Cassettes in three trips to the SIM Bay. The CDR reported the SIM Bay was in good condition. EVA termination occurred at 258:41:42 GET for a total of 1 hour, 7 minutes, 18 seconds.

Explosive Packages #5 1.4 Kg (3 lbs), #2 0.11 Kg ($\frac{1}{4}$ lb), and #3 0.06Kg (1/8 lb) were detonated at 260:23:56, 261:52:02, and 264:14:29 GET, respectively. The detonations were received by Launar Surface Profiling geophones.

The spacecraft trajectory was such that MCC-6 was not performed.

MCC-7 at 301:18:00 was performed with the RCS firing of 9 seconds. The burn produced a change in velocity of .63 mps (2.1 fps).

ENTRY AND LANDING

The CM separated from the SM at about 304:03:50 GET, 15 minutes before entry interface (EI) at 121,920 m (400,000 feet). Drogue and main parachutes deployed normally; landing occurred in the mid-Pacific Ocean at 304:31:58 GET at approximately 166°07'W longitude and 17°53'S latitude. The CM landed in a stable one position, about 6.4 km (3.5 n.m.) from the prime recovery ship, USS Ticonderoga, and about 2.4 km (1.3 n.m.) from the planned landing point.

Weather in the prime recovery area was as follows: Visibility 18 km (10 miles), wind 130° at 5 mps (10 knots), scattered cloud cover 914 m (3,000 feet) and wave height of .6 - .9 m (2 - 3 feet).

ASTRONAUT RECOVERY OPERATIONS

Following CM landing, the recovery helicopter dropped swimmers who installed the flotation collar and attached the life raft. Fresh flight suits were passed through the hatch for the flight crew. The post ventilation fan was turned off, the CM was powered down, the crew egressed, and the CM hatch was secured.

The helicopter recovered the astronauts and transferred them to the recovery ship. After landing on the recovery ship, the astronauts proceeded to the Biomed area for a series of examinations. Following the examinations the astronauts departed the USS Ticonderoga the next day for Samoa, were flown to Norton Air Force Base, California, and then to Ellington Air Force Base, Texas.

COMMAND MODULE RETRIEVAL OPERATIONS

After astronaut pickup by the helicopter, the CM was retrieved and placed on a dolly aboard the recovery ship. Since the CM had propellants onboard, it was stowed near the elevator shaft to insure adequate ventilation. All lunar samples, data, and equipment will be removed from the CM and subsequently returned to the Manned Spacecraft Center via Ellington Air Force Base, Texas. The CM will be offloaded at San Diego, California, where deactivation of the CM propellant system will take place.

SYSTEMS PERFORMANCE

Systems performance on Apollo 17 was very near nominal throughout the entire mission. Only minor discrepancies occurred which had no affect on safety or mission objectives.

FLIGHT CREW PERFORMANCE

The crew's condition was good throughout the mission with the exception of some occasional minor discomfort due to gas.

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All information and data in this report are preliminary and subject to revision by the normal Manned Spaceflight Center's technical reports.

C M Lee
C. M. Lee

SURFACE SCIENCE

As in previous missions, the first surface science event was the S-IVB impact. S-IVB impact occurred at 89:39:40 GET, about 18 minutes later than the prelaunch prediction. The event was recorded by the Apollo 12, 14, 15, and 16 passive seismometers. The best estimate of the impact point location is 4° 12'S and 12° 18'W. The Apollo 14 Charged Particle Lunar Environment Experiment (CPLEE) and Suprathermal Ion Detector Experiment (SIDE), located approximately 85 nm from the impact point, recorded small events. The Apollo 15 SIDE approximately 549 nm away did not record the impact. As a result of initial analysis by the principal investigator for the passive seismometer some changes may be in order for the interpretation of the moon's internal structure. There is a suggestion that the thickness of the lunar crust should be reduced by about one half of the previously held thickness, to approximately 25 KM. Seismic velocities in the moon's mantle may also be less than previously estimated with the new velocity approximately 7.5 KM/Sec.

The LM touched down in the valley at Taurus-Littrow at 113:01:58 GET. Landing site landmarks were clearly visible during descent and the crew reported that they believed they were abeam of the western-most Trident crater and about 100M north of Poppy. Final estimates of the landing point placed the LM at 20°10'N, 30°46'E. Very little dust was noted during descent. The surface at the landing site was described as undulating and with a much higher abundance of blocks than anticipated. Many large blocks could be seen from the LM windows and it was estimated that LRV traversing would not be difficult.

EVA-1 commenced at 117:01:36. The Cosmic Ray Detector was deployed by the LMP prior to removing the ALSEP from the SEQ Bay. During LRV deployment, the Surface Electrical Properties (SEP) Receiver and the Traverse Gravimeter Experiment (TGE) were mounted on the rear of the LRV. ALSEP removal was nominal but some difficulty was experienced removing the dome from the RTG fuel cask. This was finally accomplished by prying up the dome and then removing the fuel element. After carrying the ALSEP to the general deployment area, LMP found it difficult to locate a large enough area, free of boulders, to carry out the deployment. The final area chosen included some boulders but it is not believed that they will effect any of the experiments. ALSEP deployment was nominal. A deep core (2.8m) was successfully drilled. Retraction from the hole was difficult but eventually completed. The Neutron Probe was inserted into the hole and covered with its thermal blanket.

With various small delays encountered up to the end of ALSEP, deployment and Neutron Probe insertion, a new Station IA was selected at the crater Steno. LMP returned to the LM and carried the Surface Electrical Properties (SEP) transmitter to its deployment site east of the LM. The crew then rode to Station IA. Dark mantle material and subfloor samples, described by the crew as a vesicular, gabbroic, basalt, were collected. A traverse gravimeter reading was taken at IA as well as several other points during EVA-I for a total of six readings. Closure back at the LM was within 1 milligal. The Explosive Package (EP) #6 was deployed at Station 1A and EP #7 approximately half-way back to the LM.

On returning to the LM the SEP transmitter was deployed but not turned on. Back at the LM the samples collected were stowed. Approximately 15 Kg of samples, including the deep core, were collected. Four hundred and fifteen frames of black and white and color film were taken. Total duration of the EVA was 7h 12m 11s with the EVA terminating at 124:13:47 GET.

EVA-2 commenced at 140:34:48 GET, approximately 1 hour and 30 minutes late. The TGE was loaded aboard and the crew returned to the SEP transmitter where the traverse started. Traverse from the SEP to Station 2 (Nansen) went as planned. Along the way EP #4 was deployed just west of the ALSEP and three LRV samples collected. The SEP receiver was on throughout this leg of the traverse. At Station 2, temperatures being high, the receiver was turned off. At Station 2, bluegray breccias and porphyritic gabbros dominated the samples. The TGE reading at this station showed a large negative anomally, relative to the landing site, of approximately 38 milligals. Shortly after leaving Station 2 an unscheduled stop was made (Station 2A) to check the gravity gradient between the south massif and the valley. This reading also showed a negative anomaly (-28.8 mgal) and indicated a steep gravity gradient.

Station 3, at the edge of Lee Scarp, was the next sampling stop. Here, blue-gray breccia, soil and a light colored gabbroic rock were collected. A TGE reading indicated that the local gravity was very close to the value at the LM. While traversing between Station 3 and Station 4, two LRV samples were collected.

At Station 4, Shorty, spectacular orange colored soil samples were collected. The first hypotheses are that these samples represent geothermal alteration associated with vulcanism. Final conclusions will await sample return and analysis. Glasses and basalts were also collected. The TGE reading showed a slight positive gravity anomaly at this station. Further analysis is required before it can be determined if this is significant. The SEP receiver was turned on at Station 4 and was left in the receive mode until the crew returned to the LM.

A short stop was made between Station 4 and Station 5 to deploy EP #1 and take an LRV sample. A second LRV sample was taken further along the traverse.

At Station 5 (Camelot) fresh, angular boulders were sampled along the rim. Vesicular, gabbroic basalt was the dominant rock type. Soil samples were also collected. Returning to the LM, EP #8 was deployed slightly southwest of the ALSEP.

After what appeared to be a nominal deployment and turn-on, the Lunar Surface Gravimeter (LSG) could not be nulled. Since this problem could be caused by the experiment being off-level, the LMP was asked to verify alignment at the end of the EVA. The LMP returned to the experiment and verified that the experiment was level.

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EVA-2 traverse was the longest carried out on any mission, 19.5 KM. Approximately 36.4 Kg of samples were collected during the traverse and 833 photos were taken. The EVA ended at 148:12:10 GET for a total EVA time of 7 hours 37 minutes 2 seconds, the longest EVA ever carried out.

The crew commenced EVA-3 at 163:32:35 GET. The Cosmic Ray Detector was retrieved prior to start of the traverse in order to avoid exposure to low energy solar protons from a small solar flare. Once again, the traverse started at the SEP transmitter. The SEP receiver was turned on at the beginning of the traverse. While driving north to Station 6 on the north massif, two LRV sample stops were made. A large boulder was the primary sampling station at this stop. A depressed track, tracing the boulder's path as it rolled down the mountain was evident. Samples included blue-gray breccias, fine grained vesicular basalt, crushed anorthositic rocks and soils. The TGE recorded a large negative anomaly, 26.9 milligal, indicating that like the south massif, the north massif is made up of lower density rocks than the valley. On arrival at this station, the SEP receiver was turned off and not used again.

A short stop was made near Station 7. Blue-gray breccias with white inclusions and what appeared to vesicular anorthositic gabbro were found.

Between Station 7 and Station 8 one stop was made for an LRV sample. At Station 8, Sculptured Hills, glasses, basalts, and soil samples were taken. No breccias were reported although they may be present. TGE reading at Station 8 shows the sculptured hills to have the same approximate density as the north massif.

From Station 8 the traverse turned southwest to Station 5, Van Serg. Samples here were very variable. EP #5 was deployed on the southeast side of the crater. TGE reading at this station still showed a -11 milligal value. (It should be noted that all TGE readings have had a terrain correction made). Before leaving the station, the crew removed the SEP-DSEA tape recorder to prevent it from over-heating.

Between Station 9 and LM, one LRV sample was taken. Back at the LM closeout was accomplished. The LMP returned to the ALSEP site to recover the LNPE, complete photographic documentation and adjust the LSG. LSG operation was still unsatisfactory with the level beam indicating off-scale high. LMP attempted to shock the instrument so that the beam would be free. After tapping and rocking the experiment, no noticeable change was observed. The final two EP's, EP #3 and EP #2, were deployed near the SEP transmitter. During this traverse approximately 63.5 kg. of samples were collected. Included in this weight are four core tubes and 1 SESC. A total of 952 black and white and color photos were taken. The EVA terminated at 170:48:06 GET after a total time of 7 hours 15 minutes 31 seconds on the lunar surface.

EXPERIMENT SUMMARY

HFE - Probe temperatures continue to equilibrate. A gradient of approximately 1.2° c/meter is being measured in the lower 1 meter of the holes. All experiment functions appear normal.

LSPE - All eight EP's were detonated and the LM ascent and LM impact recorded. All functions of the experiment are nominal.

LACE - Experiments dust covers have been removed and bake-out is underway. All experiment parameters are nominal and high voltages will be turned on near lunar sunset.

LEAM - Instrument dust covers remain on. Covers over the thermal radiators will be removed within next two days. A "noise" listening mode will commence two days before sunset and continue for four days. Sensors will then be uncovered and scientific data recorded.

LSG - Experiment data still remains invalid. Studies are still underway to discover corrective actions, if possible. If status cannot be changed, the Principle Investigator (P.I.) estimates that 30% of the scientific data could be recovered. This would consist primarily of using the instrument as a seismometer.

TGE - Twenty normal and 2 bias readings were taken. Closure was excellent. A minor unknown is why there is a difference between reading the instrument on the LRV vs. on ground.

SEP - Because of temperature problems, only three traverse legs were recorded. The PI believes valid data will be on the tape from these legs.

CRDE - The CRDE was exposed for a total of 46 hours and 25 minutes, about four hours short of nominal. PI expects data to be good.

LNPE - The LNPE was deployed in the core hole for 45 hours. This was as planned. Because of the extra deployment distance from the RTG vs. what was planned, the PI expects to have excellent data. Deployment in a slight depression was also beneficial in shielding from the RTG.

INFLIGHT SCIENCE

The inflight science phase of the mission was initiated with the turn-on of the Far Ultraviolet Spectrometer (FUVS) at 86:06 GET and was terminated with the end of the FUVS operations at 302:00 GET.

Except for the Panoramic Camera stereo gimbal drive which failed 8 minutes before the end of the last photographic pass no significant instrument problems occurred and all major orbital science objectives were achieved.

Panoramic Camera

Panoramic Camera (PC) operations in lunar orbit were initiated on Rev 1 and were terminated with the last PC pass on Rev 74. During the photographic pass on Rev 15, the PC V/H sensor became erratic and the V/H manual override was used for the duration of the mission. Operations of the PC was then nominal until the last 8 minutes of operation on Rev 74 when the stereo gimbal drive failed. The last 8 minutes of panoramic photography were then acquired in the monoscopic mode.

A total of 1603 PC frames were exposed during the mission, of which 20 were acquired post-TEI. The PC film cassette was successfully retrieved by the CMP at 258:03 GET during the inflight EVA.

Mapping Camera

Mapping Camera photographic operations were initiated on Rev 1 and the lunar orbit portion ended with the last MC pass on Rev 74. An additional 30 minutes of lunar photography was acquired post-TEI. All essential MC photography was acquired. The first MC extension sequence on Rev 1 was nominal, but the second extension on Rev 13 required 3 min 19 sec versus the nominal 72 sec. The camera was left in the extended position until after operation on Rev 38 when retraction took 3 min 51 sec. Consequently, the camera was operated in the retracted position on Rev 49 with the resultant loss of stellar photography.

Fifteen minutes of the north oblique photography scheduled for Rev 65 was not acquired when the camera was not turned-on by the CMP after failure to get a barber-pole at camera turn-on. This is a normal occurrence when the CSM is rolled 40°. The camera was turned-on after the CMP consulted with the MCC and the rest of the Rev 65 oblique photography was acquired.

Throughout the mission, the shutter open pulses were missing at the lower light levels. In addition, the temperature excursions of the front lens elements were up to 7° outside nominal limits. Neither of these anomalies is expected to cause any degradation of the photography.

A total of 3554 frames of MC photography were acquired during the mission. This photography covers 8.5% of the total lunar surface area, bringing to over 17% of the lunar surface photographed by the Mapping Cameras on Apollo.

The MC film cassette was successfully retrieved at 258:16 by the CMP during the inflight EVA.

Laser Altimeter

The performance of the Laser Altimeter (LA) was nominal throughout the mission. Operation was according to the flight plan except for:

1) the loss of 4 min of data on Rev 24 when the instrument was inadvertently turned off

2) 38 minutes of darkside altimetry on Rev 62 not acquired when the LA was turned off in order to allow a darkside attitude maneuver for the FUVS

3) an additional 10.3 hrs (Revs 67-72) of LA data added to that already scheduled since the LA was performing above expectations.

A total of 3769 shots were fired during the mission.

A preliminary analysis of the data acquired on Revs 27-29 agree well with the Laser Altimeter data acquired on Apollo 15 and indicate that:

1) profile of nearside basins are relatively flat and are depressed with respect to the surrounding terrae

2) the farside appears to be very mountainous in comparison with the nearside (consistent with LA observations from previous missions)

3) the farside depression observed on Apollo 15 at 26°S latitude extends at least to 20°S latitude

4) the bottom of the crater Reiner is 6 km below the top of the adjacent highlands and the bottom of the crater Neper is 7 km below the adjacent highlands.

S-Band Transponder

Preliminary analysis of the doppler tracking data are consistent with the Apollo 15 S-Band Gravity Experiment observations and indicate that:

1) the Taurus-Lattrow landing site is a gravity low (i.e., mass deficiency). The value obtained from S-band observations agrees well with the value obtained by the Traverse Gravity Experiment.

2) Copernicus is a gravity low (all small craters over which doppler tracking data have been obtained are gravity lows)

3) Sinus Aestum, Mare Serenitatis, and Mare Crisium are gravity highs

4) Oceanus Procellarum is a relatively flat gravity region.

Infrared Scanning Radiometer

The Infrared Scanning Radiometer (ISR) operated nominally throughout the mission and attained all flight test objectives. In over 100 hrs of operation in lunar orbit over one-third of the lunar surface was scanned and one hundred million temperature measurements were made to an accuracy of one degree.

Temperatures as low as 80^{o}K were observed just prior to lunar sunrise and temperatures as high as 400^{o}K were observed at lunar noon.

Preliminary analysis of the abbreviated real-time data show that several thousand nighttime thermal anomalies (both hot and cold spots) have been detected. Nighttime "hot spots" are generally associated with boulder fields or exposed bedrock near fresh impact features and "cold spots" indicate the existence of areas covered by material with exceptionally low values of density and thermal conductivity. Tentatively identified "thermal anomalies" are:

1) Kepler A, 10 days into the lunar night, is seen as a sharp spike on a broader enhancement corresponsing to its ejecta blanket

2) Kepler C, 11.6 days into the lunar night, is observed as a 132^{o}K anomaly on a 94^{o}K background

3) the crater Reiner is seen as a 140^{o}K anomaly against a background of 98^{o}K

4) a "cold spot", 10^{o}K colder than the surrounding terrain, is coincident with a cinder cone in Mare Orientale near the crater Hohman.

The ISR was operated for 4.3 hrs for instrument calibration during TEC prior to the inflight EVA. Scientific data acquisition terminated at 253:20 GET.

After the inflight EVA the ISR was used to obtain data on spacecraft contamination produced by RCS thruster firings, waste water dumps, and urine dumps. These data were collected for the Skylab Program.

Lunar Sounder

Operation of the Lunar Sounder Coherent Synthetic Aperture Radar and Optical Recorder were nominal throughout the mission. However, problems were experienced with extending and retracting the high frequency (HF) antennas. These extension/retraction problems were attributed to both a faulty talkback indicator and to a low temperature of the extension/retraction mechanism. No data were lost as a result of the dalays in the HF antenna extensions/retractions.

The Lunar Sounder (LS) data were acquired according to the flight plan except for the postponement of the HF pass scheduled for Rev 55 to Rev 56 due to a low temperature of the Optical Recorder film cassette.

Ten hours 31 sec of LS data were recorded on film including:

1) two consecutive revs in the HF active mode
2) two consecutive revs in the VHF active mode
3) specific targets in both the HF and VHF modes.

Since the prime LS data is recorded on film, successful attainment of the experimental objectives cannot be determined until the film is processed. (The LS film was successfuly retrieved at 257:54 GET by the CMP during the inflight EVA). Telemetry monitoring of average reflected power has yielded some information, however. In particular, there is a high correlation between the signature of the power trace and lunar features. Namely,

1) the highlands and mare show distinctively different spectral signatures
2) the highlands show a low frequency structure, the details of which are well correlated with surface topography
3) the mare show a high frequency characteristic consistent with the presence of subsurface structure. The amplitude of this structure is highest in HF1 and least in VHF, also consistent with the presence of subsurface structure.

The LS was also operated in the receive only mode simultaneously with transmissions from the Surface Electrical Properties Experiment (SEP). Monitoring of average reflected power by telemetry indicate that the SEP transmitter was observed over a narrower range of angles than had been expected.

During operation of the LS in the receive only mode with the SEP transmitter off, a noise level much higher than anticipated was observed on the lunar frontside. Absence of this signal on the backside, as well as correlation of antenna orientation with noise level, indicates that the noise is of terrestrial origin. An experiment was carried out to determine the polarization state of the noise.

The LS was also operated for a 24 hr. period during TEC to further determine the levels of terrestrial noise.

Far Ultraviolet Spectrometer

The operation of the Far UV Spectrometer (FUVS) was nominal throughout the lunar oribital phase and a total of 114.5 hrs. of data were acquired. All the planned observations were accomplished. In addition, a fourth solar atmospheric observational mode was added during Rev 62.

An unexpectedly high background count was observed throughout the extent of the UV spectrum measured by the FUVS. This background has been tentatively interpreted as due to cosmic rays. The background noise does not degrade the accuracy with which hydrogen measurement can be made but does obscure very weak signals. For example, the background noise limits the minimum level of detection for atomic oxygen to 100 atoms/cc vs. a pre-flight estimate of 25 atoms/cc.

During FUVS operation on Rev 38, an Aerobee was launched from the White Sands Missile Range to provide a solar UV calibration concurrent with lunar orbital data acquisition. An earlier attempt to obtain a similar solar calibration was unsuccessful when the Aerobee payload viewing port failed to open after a successful rocket launch.

Preliminary analysis of farside terminator data indicate that a lunar atmosphere of atomic hydrogen does exist but that its density is considerably less than had been predicted earlier. In fact, the FUVS data indicate that if the total lunar atmospheric pressure at the surface determined by the Apollo 12 ALSEP/CCIG is correct ($P = 10^{-12}$ torr), then the hydrogen component is less than one percent of this total. Additionally, no atmospheric component detectable by the FUVS (H, O, Kr, Xe, N, C) is present in concentrations as great as one percent of this amount.

The FUVS also observed the lunar surface UV albedo to be approximately 2% with the same angular dependence of reflectivity as the visible. A surface variation in the UV albedo was also observed which may be a measure of the mineralogical variation over the surface.

During the TEC phase of the mission the FUVS was operated for 60 hrs. performing galactic scans and observing a number of galactic UV sources for extended periods. Observations were made to determine the extent of the earth's hydrogen geotail and to determine the extent of the solar atmosphere.

CM Photography

All objectives of CM photography of the lunar surface were successfully accomplished.

To supplement SIM Bay photography, ten photographic strips were planned with the Hasselblad camera and color film. Five of the strips are on the nearside and 5 on the farside. No anomalies were noted and the hardware performance was nominal. Some of the film magazines had to be rescheduled because of additional crew option photography.

Under near-terminator lighting conditions, eight targets were planned using the Hasselblad camera and black-and-white film. Two of the targets were on the farside and the remaining six targets on the nearside. All targets were acquired successfully and no anomalies were noted.

In addition to the scheduled photography, the crew took photographs of lunar surface features to document visual observations. Photographs were taken over the Apollo 17 landing site using a polaroid filter, a red filter, and a blue filter.

Dimlight Photography

The dimlight photography scheduled for Apollo 17 included photography of the solar corona and of the zodiacal light. The sunrise solar corona photography, scheduled for Rev 25, consisted of seven data frames from ten seconds to one-sixtieth second duration. The corona extending eastward beyond the lunar limb was photographed as the sun moved from three-and-one-half degrees below to one-half degree below the limb. The CMP reported that this sequence was accomplished according to plan.

The sunset solar corona was not photographed because of lengthened sleep period and non-availability of the -X attitude required for its performance.

The other dim light phenomenon photographed on this mission was the zodiacal light from fifty degrees eastward of the sun down to the solar corona region. This photography was carried out successfully three separate times; first, in red light on Rev 23, again in blue light on Rev 38, and finally in plane-polarized white light on Rev 49. The CMP noted that the second photography in red light, a planned sixty-second exposure, was underexposed because of inadvertent, early shutter closure.

Visual Observation From Orbit

All the objectives of visual observations from lunar orbit were successfully accomplished. Ten targets were planned for visual study and excellent comments were made by the crew. These comments will help solve geologic problems that are hard to solve by other means. Among the salient findings are the following:

1. Finding that only relatively young craters on the farside are filled with mare material. Domes in the floor of the crater Aitken are probably extrusive calcite domes.

2. Spotting of orange-colored ejecta blankets of craters in Mare Crisium, in the landing site area and on Western Mare Serenitatis.

3. Characterization of the actual colors of lunar surface units especially in the lunar maria. This will help in the extrapolation of ground truth and remotely-sensed data.

4. Verification of the extensive nature of the rings of the basin Arabia. The swirls in and west of the basin have no topographic expression associated with them.

5. Discovery of several volcanic craters under the groundtracks that were not characterized previously.

All onboard items carried in support of this task were found to be adequate, including the 10X binoculars. Only the color wheel was not used because its colors did not correspond to the actual lunar colors.

TABLE 1

APOLLO 17 OBJECTIVES AND EXPERIMENTS

PRIMARY OBJECTIVES

The following were the NASA OMSF Apollo 17 Primary Objectives:

- Perform selenological inspection, survey, and sampling of materials and surface features in a preselected area of the Taurus-Littrow region.
- Emplace and activate surface experiments.
- Conduct in-flight experiments and photographic tasks.

APPROVED EXPERIMENTS

The following experiments were performed:

Apollo Lunar Surface Experiments Package (ALSEP)

S-037	Lunar Heat Flow
S-202	Lunar Ejecta and Meteorites
S-203	Lunar Seismic Profiling
S-205	Lunar Atmospheric Composition
S-207	Lunar Surface Gravimeter

Lunar Surface

S-059	Lunar Geology Investigation
S-153	Cosmic Ray Detector
S-199	Traverse Gravimeter
S-204	Surface Electrical Properties
S-229	Lunar Neutron Probe
--	Long Term Lunar Surface Exposure Tasks (not classified as experiment)

In-Flight

S-164	S-Band Transponder
S-169	Far UV Spectrometer
S-171	IR Scanning Radiometer
S-209	Lunar Sounder
--	CM Photographic Tasks
--	SM Orbital Photographic Tasks
--	Skylab Contamination Study
--	Visual Light Flash Phenomenon

In-Flight (Continued)

Other (Passive)

S-160	Gamma-Ray Spectrometer
S-176	Apollo Window Meteoroid
S-200	Soil Mechanics
M-211	Biostack IIA
M-212	Biocore

Demonstration

--	Heat Flow and Convection

DETAILED OBJECTIVES

The following detailed objectives were assigned to and accomplished on the Apollo 17 Mission:

- o CM Photographic Tasks
- o SM Photographic Tasks
- o Visual Observations from Lunar Orbit
- o Spacecraft Contamination Study
- o Visual Light Flash Phenomenon
- o Impact S-IVB on Lunar Surface
- o Post Determination of S-IVB Impact Point
- o Protective Pressure Garment Evaluation
- o Body Metabolic Gains and Losses and Food Compatibility Assessment.

SUMMARY

Fulfillment of the primary objectives qualifies Apollo 17 as a successful mission. The experiments and detailed objectives which supported and expanded the scientific and technological return of this mission were successfully accomplished.

TABLE 2

APOLLO 17 ACHIEVEMENTS

- Sixth Manned Lunar Landing
- First Geologist Astronaut on Lunar Surface
- Longest Lunar Surface Stay Time (74 hours 59 min. 38 seconds)
- Longest single Lunar Surface EVA Time (7 hours 37 minutes 22 seconds)
- Longest Total Lunar Surface EVA Time (22:05:04)
- Longest Lunar Distance Traversed with LRV on One EVA (19 km (12 nm))
- Longest Total Distance Traversed with LRV (35 km (22 nm))
- Longest Apollo Mission (301 hours 51 minutes)
- Most samples returned to Earth (115 Kg (250 lbs))
- Longest time in lunar orbit (147 hours, 48 minutes)

APOLLO 17

POWERED FLIGHT SEQUENCE OF EVENTS
END OF MISSION

TABLE 3

EVENT	PRE-LAUNCH PLANNED (GET) HR;MIN;SEC	ACTUAL (GET) HR;MIN;SEC
Guidance Reference Release	-17.7	-17.6
Liftoff Signal (TB-1)	0	0
Pitch and Roll Start	11.9	11.9
Roll Complete	13.4	13.4
S-IC Center Engine Cutoff (TB-2)	2:18.8	2:18.8
Begin Tilt Arrest	2:39.6	2:39.6
S-IC Outboard Engine Cutoff (TB-3)	2:41.0	2:40.6
S-IC/S-II Separation	2:42.7	2:42.3
S-II Ignition (Command)	2:43.4	2:43.0
S-II Second Plane Separation	3:12.7	3:12.3
S-II Center Engine Cutoff	7:41.0	7:40.6
S-II Outboard Engine Cutoff (TB-4)	9:19.5	9:19.0
S-II/S-IVB Separation COMMAND	9:20.5	9:20.0
S-IVB Ignition	9:20.6	9:21.1
S-IVB Cutoff (TB-5)	11:46.4	11:42.2
Insertion	11:56.2	11:52.0
Begin Restart Preps (TB-6)	3:11:41.3	3:02:58.1
Second S-IVB Ignition	3:21:19.3	3:12:36.0
Second S-IVB Cutoff (TB-7)	3:27:04.1	3:18:27.2
Translunar Injection	3:27:14.1	3:18:37.0

Prelaunch planned times are based on MSFC Launch Vehicle Operational Trajectory.

TABLE 4 M-933-72-17

APOLLO 17 MISSION SEQUENCE OF EVENTS

END OF MISSION

EVENT	PLANNED (GET) HR: MIN: SEC.	ACTUAL (GET) HR: MIN: SEC.
Liftoff 0033 EST December 7, 1972	00:00:00.4	00:00:00.2
Earth Parking Orbit Insertion	00:11:56	00:11:52
Second S-IVB Igntion	03:21:19	03:12:36
Translunar Injection	03:27:14	03:18:37
CSM/S-IVB Separation, SLA Panel Jettison	04:12:05	03:42:29
CSM/LM Docking	04:22:05	03:57:10
Spacecraft Ejection From S-IVB	05:07:05	04:45:20
S-IVB APS Evasive Maneuver	05:30:05	05:03:33
Midcourse Correction-1	08:45:00	Not Performed
Midcourse Correction-2	35:30:00	35:29:59
Midcourse Correction-3	66:55:38	Not Performed
Midcourse Correction-4	83:55:38	Not Performed
SIM Door Jettison	84:25:38	84:12:50
Lunar Orbit Insertion (Ignition)	88:55:38	88:54:22
S-IVB Impact	89:21:26	89:39:40
Descent Orbit Insertion 1 (Ignition)	93:13:09	93:11:37
CSM/LM Undocking	110:27:55	110:27:55
CSM Separation	110:27:55	110:27:55
CSM Circularization	111:55:23	111:57:28
LM Descent Orbit Insertion 2 (Ignition)	112:00:34	112:02:41
Powered Descent Initiate	112:49:38	112:49:52
LM Lunar Landing	113:01:38	113:01:58
Begin EVA-1 Cabin Depress	116:40:00	117:01:36
Terminate EVA-1 Cabin Repress	123:40:00	124:13:47
Begin EVA-2 Cabin Depress	139:10:00	140:34:48
Terminate EVA-2 Repress	146:10:00	148:12:10
Begin EVA-3 Cabin Depress	162:40:00	163:32:35
Terminate EVA-3 Cabin Repress	169:40:00	170:48:06
Trim Burn (CSM)	Not Planned	181:34:01
CSM LOPC	182:35:45	182:33:53
LM Liftoff	188:03:15	188:01:36
LM Tweak Burn	Not Planned	188:12:12
Terminal Phase Initiate Maneuver	188:57:32	188:55:57
LM/CSM Docking	190:00:00	190:17:03
LM Jettison	193:58:30	193:58:30
CSM Separation	194:03:30	194:03:30
Ascent Stage Deorbit	195:39:12	195:38:13
Ascent Stage Lunar Impact	195:58:25	195:57:18
Transearth Injection	236:39:51	236:42:08
Midcourse Correction-5	253:42:13	Not Performed
CMP EVA Depress	257:22:00	257:34:24
CMP EVA Repress	258:30:00	258:41:42
Midcourse Correction-6	282:18:01	Not Performed
Midcourse Correction-7	301:18:01	301:18:00
CM/SM Separation	304:03:01	304:03:50
Entry Interface (400,000 ft)	304:18:01	304:18:37
Landing	304:31:11	304:31:58

12/19/72

APOLLO 17 TRANSLUNAR AND MANEUVER SUMMARY

TABLE 5

MANEUVER	GROUND ELAPSED TIME (GET) AT IGNITION (HR:MIN:SEC:)			BURN TIME (SECONDS)			VELOCITY CHANGE (FEET PER SECOND - FPS)			END OF MISSION GET OF CLOSEST APPROACH / HT (NM) CLOSEST APPROACH		
	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL
TLI * (S-IVB)	03:21:16	03:12:35	03:18:37	346	351			10376		88:55:38 51	86:12:14 161	86:20:52
CSM SEP	04:12:05	03:43:00	03:42:29							----	----	----
CSM DOCK	04:22:05		03:57:10							----	----	----
LM EJT	05:07:05	04:39:00	04:45:20		3	5.5		0.3	0.6	88:55:38 51	86:12:18 150	86:19:54 0
S-IVB EVASIVE	05:30:05	05:03:32	05:03:33		13.9	15.1	9.8	9.5	9.4	89:21:26 0.	86:12:00 0	86:12:01 0
MCC-1 (SPS)	N.A.			NA			NA			NA NA	----	----
MCC-2 (SPS)	35:30:00	35:29:59	35:29:59	0	1.6	1.7	0	10.6	9.9	NA NA	86:18:09 53.1	86:18:14 52.1
MCC-3	66:55:38		NP	0			0			NA NA	----	----
MCC-4	83:55:38		NP	0			0			NA NA	----	----
SIM DOOR JETT	84:25:38		84:12:50	NA			NA			NA NA	----	----
										----	----	----
										----	----	----
										----	----	----
										----	----	----
										----	----	----

NA - Not Applicable
NP - Not Performed

*S-IVB Restart

APOLLO 17 LUNAR ORBIT SUMMARY

TABLE 6

END OF MISSION

MANEUVER	GROUND ELAPSED TIME (GET) AT IGNITION (HR:MIN:SEC:)			BURN TIME (SECONDS)			VELOCITY CHANGE (FEET PER SECOND - FPS)			RESULTING APOLUNE/PERILUNE (N. MI.)		
	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL
LOI	88:55:38	88:54:22	88:54:22	395.4	398	398	2980	2988	2988	171/51	170/52.5	170/52.6
S-IVB IMPACT	89:21:26		89:39:40	NA			NA			NA		
DOI-1	93:13:09	93:11:37	93:11:37	22.9	22.1	22.1	199	197	197	59/15	59/14.5	59/14.5
UNDOCKING	110:27:55	110:27:55	110:27:55	NA			NA					
CSM SEP	110:27:55	110:27:55	110:27:55	3.3	3.3	3.4	1.0	1.0	1.0	60/14	61.6/12	61.5/11.5
CSM CIRC	111:55:23	111:57:28	111:57:28	4	3.7	3.7	70	70.5	70.5	70/54	70/54	70/54
DOI-2	112:00:34	112:02:41	112:02:41	26.9	21.5	21.5	9	7.5	7.5	60/7.2	61.5/6.7	59.6/6.2
PDI	112:49:38	112.49.52	112.49.52	720	717	717	6702	6697	6698	0/0	0/0	0/0
LANDING	113:01:38	113.01.48	113.01.58	NA			NA			NA		
TRIM	NONE	181:34:01	181:34:01	NONE	30.	30	NONE	9.2	9.2	NONE	67.3/62.5	67.3/62.5

NA - Not Applicable

APOLLO 17 LUNAR ORBIT SUMMARY

TABLE 7

MANEUVER	GROUND ELAPSED TIME (GET) AT IGNITION (HR:MIN:SEC:)			BURN TIME (SECONDS)			VELOCITY CHANGE (FEET PER SECOND - FPS)			END OF MISSION RESULTING APOLUNE/PERILUNE (N. Mi.)		
	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL
CSM LOPC	182:35:45	182:33:53	182:33:53	18.7	20.1	20.1	336.7	366.	366.	63/61.3	62.8/62.5	62.8/62.5
ASCENT	188:03:15	188:01:36	188:01:36	437.7	440.9	440.9	6062.2	6075.7	6075.7	47.9/9.1	48.5/9.1	48.5/9.1
TWEAK	NONE	188:12:12	188:12:12	---	10	10	---	10	10		/9.3	48.5/9.4
TPI *	188:57:32	188:55:57	188:55:57	2.7	3.2	3.2	54.8	53.8	53.8	64.4/46.7	64.7/48.5	64.7/48.5
DOCKING	190:00:00	190:00:00	190:17:03	N/A			N/A			N/A		
LM JETT	193:58:30	193:58:30	193:58:30	N/A			N/A	2.5	1.7	N/A	62.7/60.7	63.4/61.7
CSM SEP	194:03:30	194:03:30	194:03:30	12.6	12.	12.	2	2	2	64/62	62.4/61.1	63.9/61.2
ASC DEORB	195:39:12	195:38:13	195:38:13	116.4	118	118	281.8	286	286	0		
ASC IMPACT	195:58:25	195:57:25	195:57:18	N/A			N/A			N/A		

*APS only, does not include the nominal 10-sec RCS ullage (21.8 fps).

APOLLO 17 TRANSEARTH MANEUVER SUMMARY

END OF MISSION

TABLE 8

MANEUVERS	GROUND ELAPSED TIME (GET) AT IGNITION (HR:MIN:SEC:)			BURN TIME (SECONDS)			VELOCITY CHANGE (FEET PER SECOND - FPS)			GET ENTRY INTERFACE (EI) VELOCITY (FPS) AT EI FLIGHT PATH ANGLE AT EI		
	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE LAUNCH PLAN	REAL-TIME PLAN	ACTUAL	PRE-LAUNCH PLAN	REAL-TIME PLAN	ACTUAL
										304:18:01 36090 -6.5	304:18:04 36090 -6.5	304:17:48 36090 -7.26
TEI (SPS)	236:39:51	236:42:08	236:42:08	142.2	144.8	144.9	3045.7	3046.1	3046.3	304:18:01 36090 -6.5		
MCC-5	253:42:13		NP	0			0			304:18:01 36090 -6.5		
MCC-6	282:18:01		NP	0			0			304:18:01 36090 -6.5		
MCC-7	301:18:01	301:18:00	301:18800	0	9	9	0	2.1	2.1	304:18:01 36090 -6.5	304:18:37 36090 -6.5	304:18:37 36090 -6.5
CM/SM SEP	304:03:01		304:03:50	NA			NA			304:18:01 36090 -6.5		
ENTRY	304:18:01	304:18:37	304:18:37	NA			NA			304:18:01 36090 -6.5	304:18:37 36090 -6.49	304:18:37 36090 -6.49
SPLASH	304:31:11	304:31:47	304:31:58	NA			NA					

NP - Not Performed

APOLLO 17 CONSUMABLES SUMMARY

TABLE 9

CONSUMABLE		LAUNCH LOAD	END OF MISSION	
			FLIGHT PLANNED REMAINING	ACTUAL REMAINING
CM RCS PROP (POUNDS)	T	233.2	178.5	No Data
SM RCS PROP (POUNDS)	T	1341.7	680.5	717.0
SPS PROP (POUNDS)	TK	40539.8	1731.8	1630.0
SM HYDROGEN (POUNDS)	U	78.9	18.3	18.0
SM OXYGEN (POUNDS)	U	955.8	377.7	349.0
LM RCS PROP (POUNDS)	T	631.2	158.0	127.0
LM DPS PROP (POUNDS)	TK	19487.9	708.1	1237.5
LM APS PROP (POUNDS)	TK	5247.5	246.6	228.2
LM A/S OXYGEN (POUNDS)	T	4.6	3.6	4.6
LM D/S OXYGEN	T	93.4	45.2	48.5
LM A/S WATER (POUNDS)	T	83.3	53.0	43.2
LM D/S WATER (POUNDS)	T	407.5	67.0	32.4
LM A.S BATTERIES (AMP-HOURS)	T	592.0	255.0*	260.0*
LM D/S BATTERIES (AMP-HOURS)	T	2075.0	380.0**	490.0**
LRV BATTERIES (AMP-HOURS)	T	121/121	71/71***	80/78***

TK - TANK QUANTITY
T - TOTAL QUANTITY
U - USABLE QUANTITY

* After LM Jettison
** After LM Liftoff
*** After EVA-3

12/19/72

TABLE 10

LSP EXPLOSIVE PKG EVENTS

E/P No.	Chg Wt	TB Time *	Deploy Time	Distance to ALSEP Geophones	DETONATION TIME (CST)					
					Day	Minimum	Maximum	Probable	Nominal	Actual
6	1 lb	90:45	Mon (12/11) 22:69 (122:05:48)	1.10 km	Fri (12/15)	17:17 (212:23:48)	18:11 (213:17:48)	17:49 (212:55:48)	17:44 (212:50:48)	17:49 (212:55:35)
7	½ lb	92:45	Mon (12/11) 23:36 (122:42:40)	0.65 km	Fri (12/15)	19:54 (215:00:40)	20:48 (215:54:40)	20:27 (215:33:40)	20:21 (215:27:40)	20:19 (215:25:01)
4	⅛ lb	90:45	Tue (12/12) 18:29 (141:36:04)	0.20 km	Sat (12/16)	12:47 (231:54:04)	13:41 (232:48:04)	13:01 (232:10:04)	13:14 (232:21:04)	13:06 (232:15:45)
1	6 lb	91:45	Tue (12/12) 23:00 (146:07:00)	2.95 km	Sat (12/16)	18:18 (237:25:00)	19:12 (238:19:00)	18:49 (237:56:00)	18:45 (237:52:01)	18:42 (237:49:52)
8	¼ lb	93:45	Tue (12/12) 23:57 (147:03:39)	0.15 km	Sat (12/16)	21:15 (240:21:39)	22:09 (241:15:39)	21:45 (240:51:39)	21:42 (240:48:39)	21:46 (240:52:50)
5	3 lb	91:45	Wed (12/13) 21:32 (168:39:28)	2.20km	Sun (12/17)	16:50 (259:57:28)	17:44 (260:51:28)	17:20 (260:27:28)	17:17 (260:24:28)	17:17 (260:23:56)
2	¼ lb	92:45	Wed (12/13) 22:05 (169:12:12)	0.40 km	Sun (12/17)	18:23 (261:30:12)	19:17 (262:24:12)	18:45 (261:52:12)	18:50 (261:57:12)	18:45 (261:52:02)
3	⅓ lb	93:45	Wed (12/13) 23:18 (170:24:46)	0.35 km	Sun (12/17)	20:36 (263:42:46)	21:30 (264:36:46)	21:14 (264:20:46)	21:03 (264:09:46)	21:08 264:14:29)

LM ASCENT	Thursday	12/14/72	188:03 GET	(4:56 PM CST)
ASCENT STAGE IMPACT	Friday	12/15/72	195:58 GET	(12:51 AM CST)

* TB Time - Nominal Time to EP Detonation after Timer Activation.

CSM LOCATION AT DETONATION

#6	- Backside of moon
#7	- Overhead +1 minute
#4	- Backside of moon
#1	- 1 hour after TEI
#8,5,2,3	- After TEI

TABLE 11

SA-512 LAUNCH VEHICLE DISCREPANCY SUMMARY

- Failure of Vehicle Automatic Test Sequencer (VATS) to initiate S-IVB prelaunch LOX pressurization. Open
- S-IVB forward #2 battery voltage drop. Open
- S-IC remote digital sub-multiplexer replacement. Open
- S-II helium injection bottle pressure decay. Open
- S-IVB helium bottle pressure deviation. Open

TABLE 12

COMMAND/SERVICE MODULE 114 DISCREPANCY SUMMARY

- Spurious master alarms. Open
- Mission timer behind other timers. Open
- Spacecraft fragments observed before and after CSM/SLA separation. Open
- H_2 tank upper pressure limit shift. Open
- Fuel cell current oscillations. Open
- Inoperative tone booster. Open
- Fuel interface pressure measurement fluctuations. Open
- Glycol temperature control valve failure to maintain glycol temperature. Open
- High suit pressure; 5.26 psi. Open
- Excessive mapping camera extend time; 3 min, 21 sec. Open
- HF lunar sounder boom 1 limit switch failure. Open
- Velocity/altitude sensor improper data to pan camera. Open
- HF antenna 2 boom deployment slow at 194:18 GET. Open
- Instrumentation dropout of several parameters for two minutes at 1944:22. Open
- No CMP EVA warning tone at 256:22 to 257:22. Open
- Primary Radiation flow control switched to secondary at 277:08 GET. Open

TABLE 13

LUNAR MODULE 12 DISCREPANCY SUMMARY

- Gimbal drive actuator drive timer in error at 109:04. Open
- Three guidance and navigation restarts prior to powered descent initiations. Closed
- Battery 4 read 0.5 volt lower than battery 3. Open
- Cabin pressure increase above regulator A lockup pressure at 163:31 GET. Open

TABLE 14

LUNAR ROVING VEHICLE 3 DISCREPANCY SUMMARY

- Left rear fender extension lost on EVA 1. Open

TABLE 15

APOLLO 17 CREW/EQUIPMENT DISCREPANCY SUMMARY

- UV spectrometer photomultiplier tube dark current excessive. Open
- Mapping camera film motion exposure discrete drop outs. Open
- Excessive surface electrical properties receiver temperature at start of EVA-2. Open
- Lunar surface gravimeter null failures. Open
- Out-of-spec OPS regulated pressures at 171:70 GET. Open
- ALSEP 5 signal fluctuations in downlink. Open
- No CMP EVA warning tone at 256:22 to 257:22. Open
- Panoramic camera motion ompensation ceased operation at 233:52 GET. Open