Prelaunch
Mission Operation Report
No. M-933-71-14

TO: A/Acting Administrator

22 January 1971

FROM: MA/Apollo Program Director

SUBJECT: Apollo 14 Mission (AS-509)

We plan to launch Apollo 14 from Pad A of Launch Complex 39 at the Kennedy Space Center no earlier than 31 January 1971. This will be the third manned lunar landing and, as planned for Apollo 13, Apollo 14 will be targeted to a preselected point in the Fra Mauro formation.

Primary objectives of this mission include selenological inspection, survey, and sampling of the ejecta blanket thought to have been deposited during the formation of the Imbrium basin; deployment and activation of an Apollo Lunar Surface Experiments Package; continuing the development of man's capability to work in the lunar environment; and obtaining photographs of candidate lunar exploration sites. Photographic records will be obtained of selected mission activities and real time coverage by television will include Command/Service Module transposition and docking with the Lunar Module and portions of the lunar surface extravehicular activities.

The 9-day mission will be terminated with the Command Module landing in the Pacific Ocean. Recovery and transportation of the crew, spacecraft, and lunar samples to the Lunar Receiving Laboratory at the Manned Spacecraft Center will be conducted under quarantine procedures.

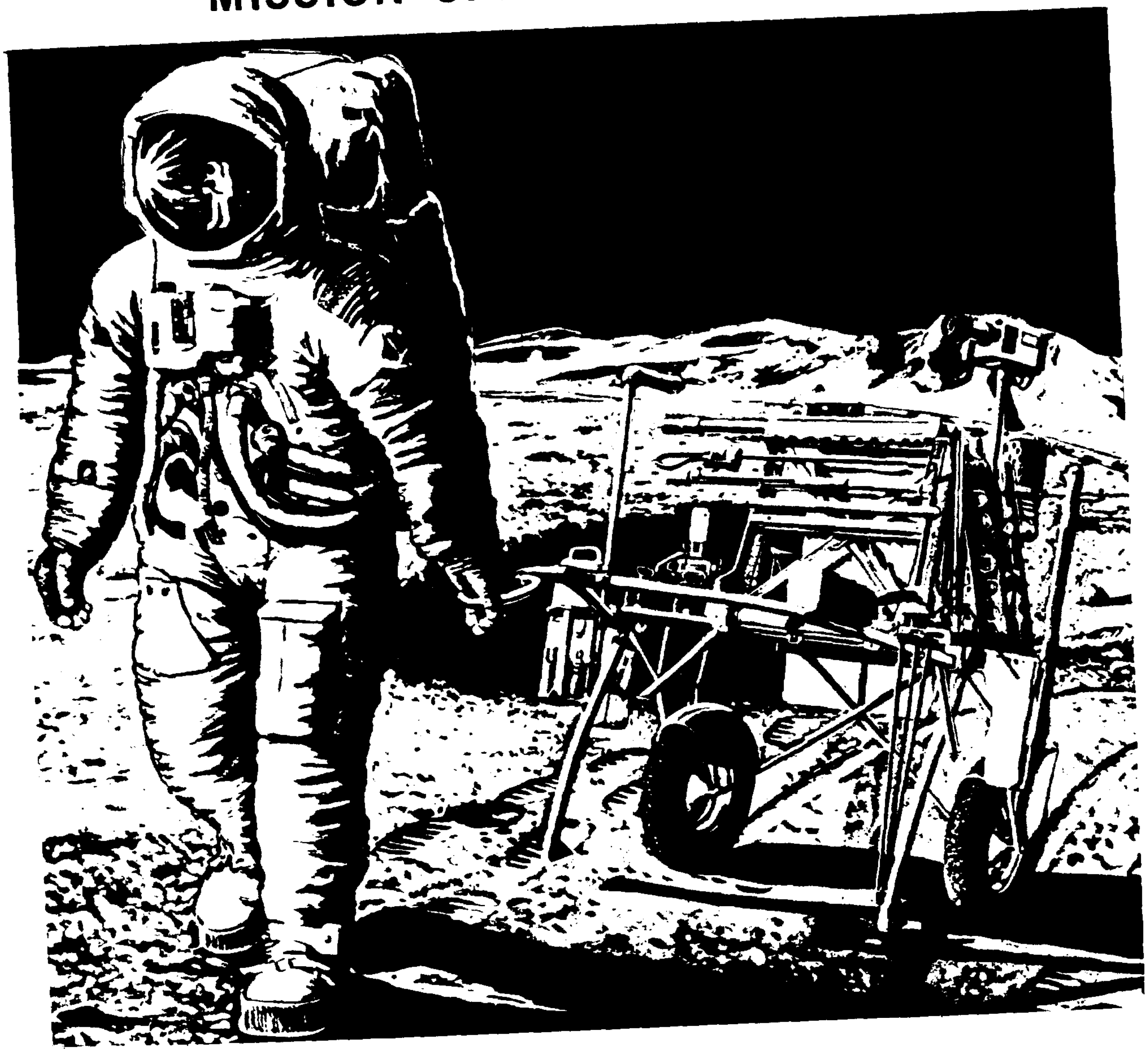
Rocco A. Petrone
Rocco A. Petrone

APPROVAL:

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

Report No. M-933-71-14

MISSION OPERATION REPORT



Apollo 14 Mission

OFFICE OF MANNED SPACE FLIGHT

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FOREWORD

MISSION OPERATION REPORTS are published expressly for the use of NASA Senior Management, as required by the Administrator in NASA Instruction 6-2-10, dated 15 August 1963. 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.

Initial reports are prepared and issued for each flight project just prior to launch. Following launch, updating reports for each mission are issued to keep General Management currently informed of definitive mission results as provided in NASA Instruction 6-2-10.

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 pre-launch and post-launch 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 28,500 fps.
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.

APOLLO/SATURN FLIGHTS

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	First manned lunar landing mission. Lunar surface stay time 21.6 hours. Mission duration 8 days 3 hours.
APOLLO 12	11/14/69	SA-507	CM-108 SM-108 LM-6 SLA-15	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 EVA's (15.5 manhours). 89 hours in lunar orbit (45 orbits). Mission duration 10 days 4.6 hours.
APOLLO 13	4/11/70	SA-508	CM-109 SM-109 LM-7 SLA-16	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.

NASA OMSF MISSION OBJECTIVES FOR APOLLO 14

PRIMARY OBJECTIVES

- Perform selenological inspection, survey, and sampling of materials in a preselected region of the Fra Mauro Formation.
- Deploy and activate an Apollo Lunar Surface Experiments Package (ALSEP).
- Develop man's capability to work in the lunar environment.
- Obtain photographs of candidate exploration sites.

Rocco A. Petrone
Rocco A. Petrone
Apollo Program Director

Date: 20 January 1971

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

Date: Jan. 2?, 1971

MISSION OPERATIONS

GENERAL

The following paragraphs contain a brief description of the nominal launch, flight, recovery, and post-recovery operations. For the second and third month launch opportunities, which may involve a T-24 hour launch, there will be a second flight plan. The alternate flight plan will provide for candidate landing site photography from a 60-NM lunar orbit prior to descent orbit insertion. Overall mission profile is shown in Figure 1.

LAUNCH WINDOWS

The mission planning considerations of 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 operational constraints during a given month or lunar cycle.

Launch windows are based on flight azimuth limits of 72° to 96° (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 14 launch windows and associated lunar landing sun elevation angles are presented in Table 1. The use of night launches and a T+24 hours (3 March) launch opportunity have been approved for Apollo 14. It should be noted that feasibility of the third month opportunities is still being determined.

TABLE 1

LAUNCH WINDOWS

LAUNCH DATE	WINDOWS (EST) OPEN	CLOSE	SUN ELEVATION ANGLE
31 January 1971	15:23	19:12	10.3°
1 March 1971 (T-24)	15:03	19:07	10.5°
2 March 1971 (T-0)	15:43	19:38	10.5°
3 March 1971 (T+24)	16:08	19:47	23.0°
30 March 1971 (T-24)	14:22	17:57	8.0°
31 March 1971 (T-0)	14:35	18:00	8.0°
1 April 1971 (T+24)	14:45	18:01	22.0°

FLIGHT PROFILE

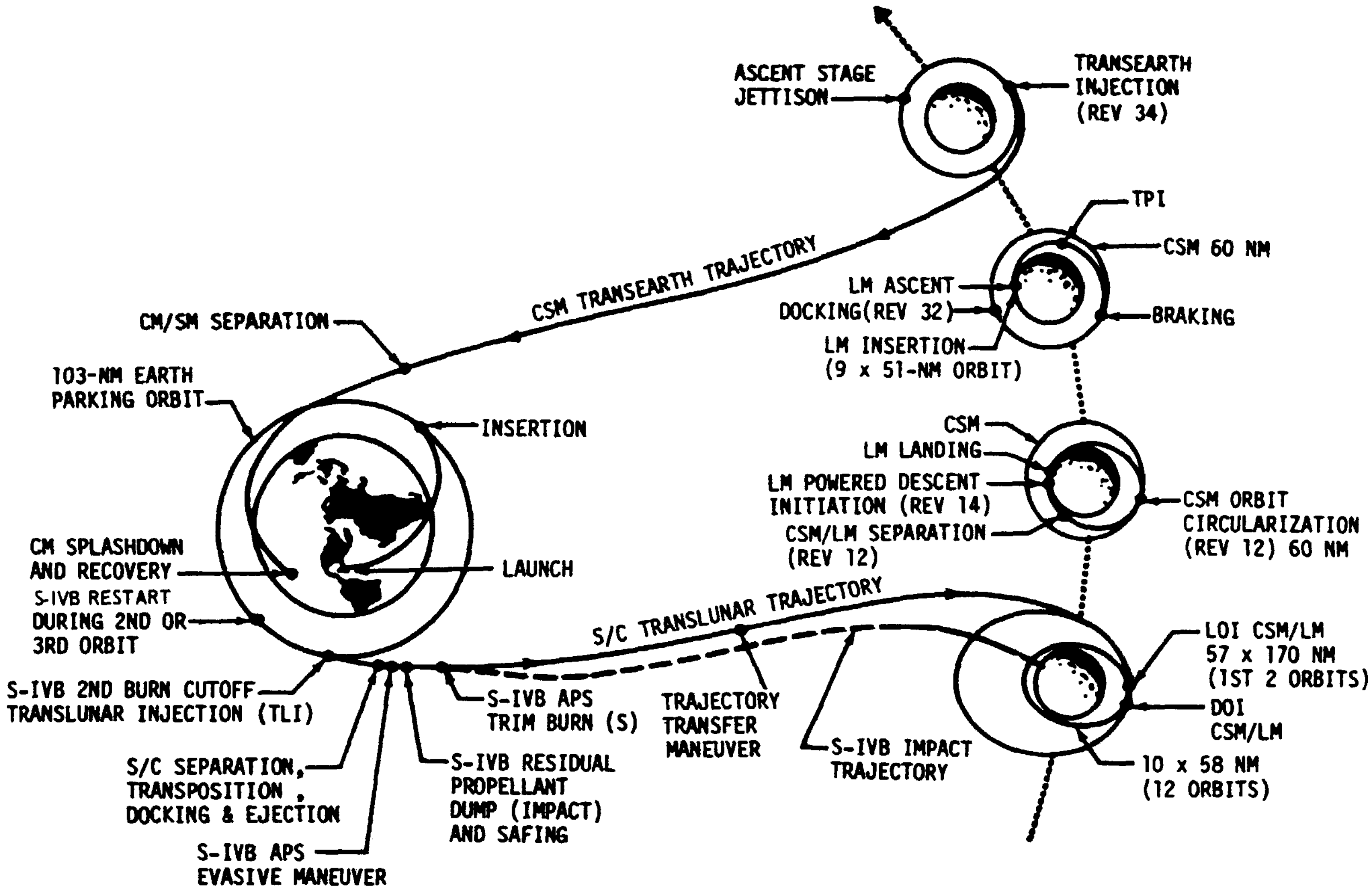

Fig. 1

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LAUNCH THROUGH TRANSLUNAR INJECTION

The space vehicle flight profile is essentially the same as that used during previous lunar landing missions. The vehicle is launched from Launch Complex 39A of the Kennedy Space Center on a flight azimuth between 72° and 96°. The boost into a 100-NM earth parking orbit (EPO) is accomplished by sequential burns and staging of the S-IC and S-II launch vehicle stages and a partial burn of the S-IVB stage. The S-IVB/instrument unit (IU) and spacecraft coast in a circular EPO for approximately 1.5 revolutions while preparing for the first-opportunity S-IVB translunar injection (TLI) burn, or 2.5 revolutions if the second-opportunity TLI burn is required. Both injection opportunities are to occur over the Pacific area. The S-IVB TLI burn places the S-IVB/IU and the spacecraft on a free-return translunar coast trajectory.

TRANSLUNAR COAST THROUGH LUNAR ORBIT INSERTION

Within 2 hours after injection, the Command/Service Module (CSM) separates from the S-IVB/IU and spacecraft-LM adapter (SLA), transposes, docks with the Lunar Module (LM), and ejects the LM/CSM from the S-IVB/IU. Subsequently, the S-IVB/IU performs an evasive maneuver which alters its circumlunar coast trajectory to clear the spacecrafts' trajectory.

As on the Apollo 13 Mission, an attempt will be made to impact the spent S-IVB/IU stages on the lunar surface to provide a stimulus for the Apollo 12 emplaced seismology experiment. The necessary delta velocity (ΔV) required to alter the S-IVB/IU circumlunar trajectory to the desired impact trajectory will be derived from dump of residual liquid oxygen (LOX) and burn of the S-IVB ascent propulsion system (APS) ullage motors. The final maneuver will occur within about 9 hours after launch. The impact point will be targeted for 1°36'S latitude and 33°15'W longitude. The IU will have an S-band transponder for trajectory tracking. An appropriate frequency bias will be incorporated to insure 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.

During translunar coast the service propulsion system (SPS) will be used to perform a trajectory transfer to a trajectory with a target pericynthion of 60 NM. The SPS will be used for lunar orbit insertion (LOI) of the spacecraft. The spacecraft will remain in a 60 x 170 NM orbit for approximately two revolutions.

LUNAR DESCENT THROUGH LANDING

The Apollo 14 Mission descent orbit insertion (DOI) maneuver combines the earlier missions' second LOI maneuver with the DOI maneuver. This SPS retrograde maneuver will place the CSM/LM combination into a 60 x 8-NM orbit. These events are shown in Figure 2. During the fourth revolution, strip photography will be taken which will include the area of prime interest as a potential landing site at Descartes.

A "soft" undocking will be made during the twelfth revolution, using the docking probe capture latches to reduce the imparted ΔV. Spacecraft separation will be executed by the service module (SM) reaction control system (RCS), providing an approximate ΔV of 1 foot per second radially downward toward the center of the moon. During the fourteenth revolution the LM descent propulsion system (DPS) will be used for powered descent initiation (PDI) which will occur approximately at pericynthion. A LM yaw maneuver may be performed to insure good LM steerable antenna communications coverage between the LM and the Manned Space Flight Network (MSFN). The vertical descent portion of the landing phase will start at an altitude of about 100 feet and will be terminated at touchdown on the lunar surface. A lunar terrain profile model will be available in the LM guidance computer (LGC) program to minimize unnecessary LM pitching or thrusting maneuvers.

LANDING SITE AND SCIENCE RATIONALE

Fra Mauro has been designated as the landing site for the Apollo 14 Mission (Figure 3).

The Fra Mauro Formation, an extensive geologic unit covering large portions of the lunar surface around Mare Imbrium, has been interpreted as the ejecta blanket deposited during the formation of the Imbrium basin. Sampling of the Fra Mauro Formation may provide information on ejecta blanket formation and modification, and yield samples of deep-seated crustal material giving information on the composition of the lunar interior and the processes active in its formation. Age dating the returned samples should establish the age of pre-mare deep-seated material and the age of the formation of the Imbrium basin and provide important points on the geologic time scale leading to an understanding of the early history of the moon.

The Apollo 14 planned lunar landing point and target point coordinates are 3°40'19"S, 17°27'46"W with a radius of 937.733 NM, referenced to the Apollo 12 Mapping Laboratory triangulation.

LM DESCENT ORBITAL EVENTS

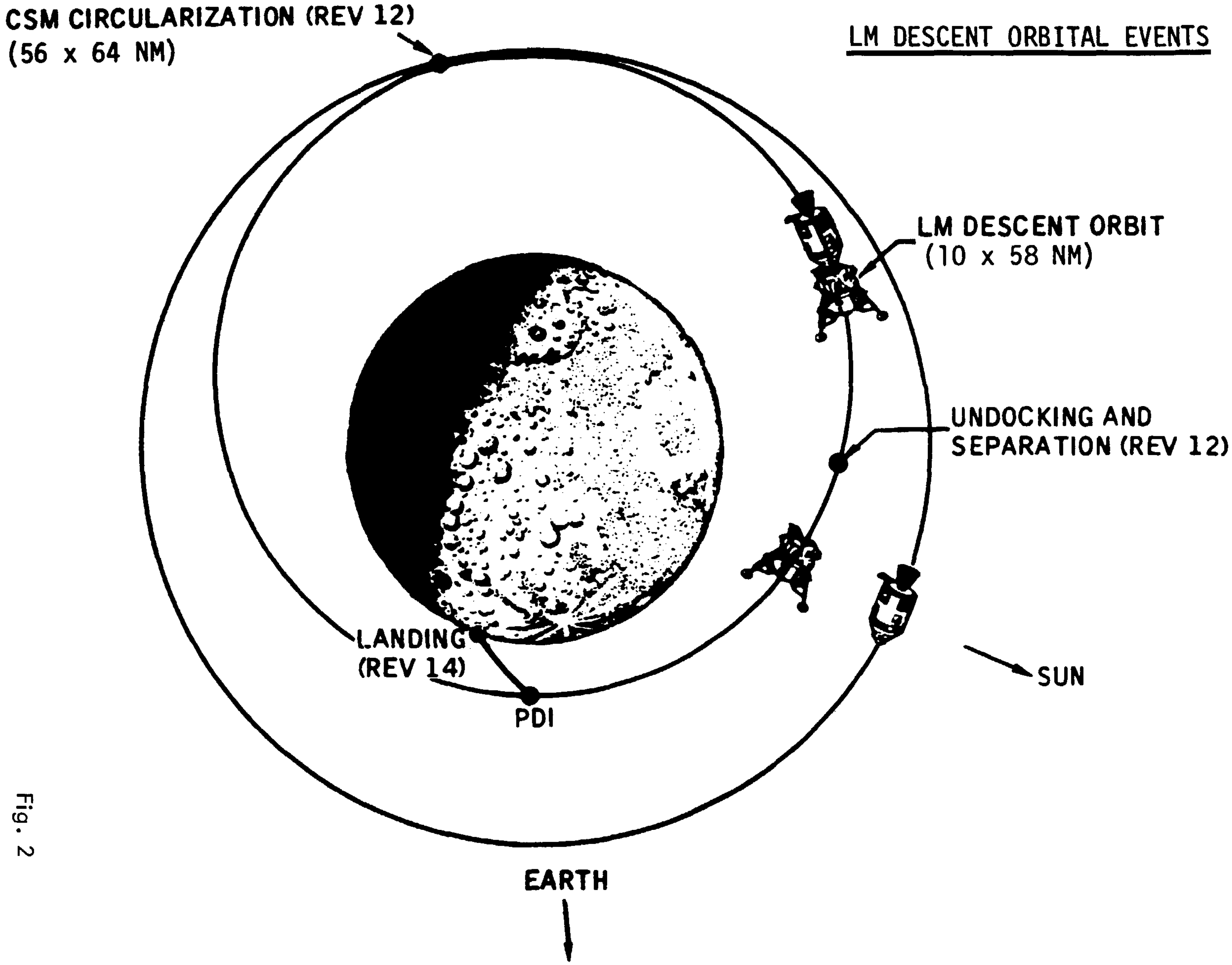

Fig. 2

APOLLO 14 LANDING AREA

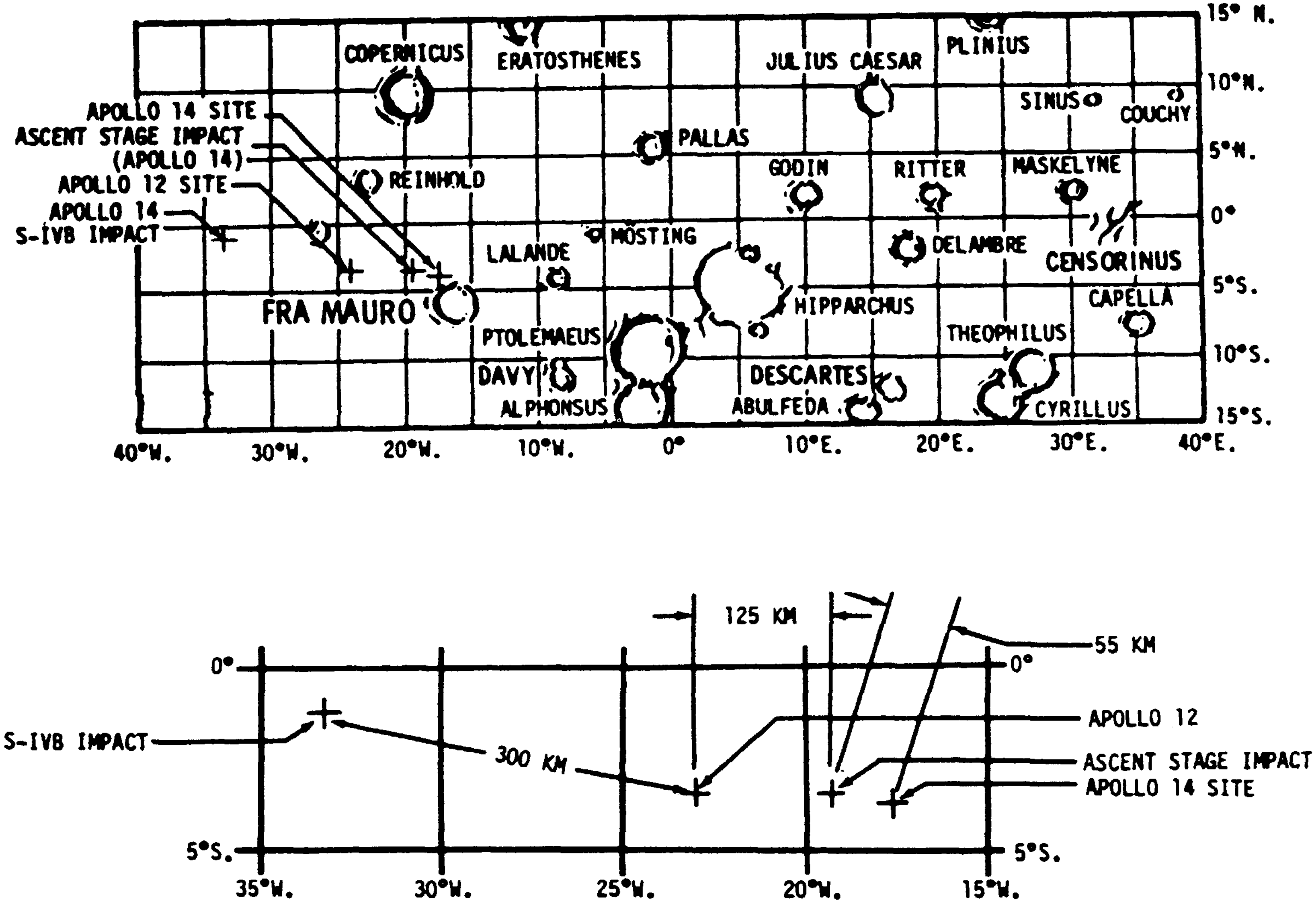

Fig. 3

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LUNAR SURFACE OPERATION

The stay time on the lunar surface is open-ended, with a planned maximum of 35 hours. The nominal extravehicular activity (EVA) is planned for two periods of approximately 4-1/4 hours each and for simultaneous crew operations. Each of the EVA periods may be extended to approximately 5 hours based upon real time assessment of the remaining consumables. This will provide greater utilization of potential crew and equipment capabilities. The radius of crew operations will be constrained to about 1 kilometer on the first EVA and about 3 kilometers on the second EVA when the buddy-secondary life support system (BSLSS) is carried for emergency use in the event of a portable life support system (PLSS) failure. Photographs of the lunar surface will be taken through the LM cabin window after landing.

First EVA Period

During the first EVA Period (EVA-1) the Mobile Equipment Transporter (MET) will be offloaded. The S-band erectable antenna, the Solar Wind Composition (SWC) experiment, and the flag will then be deployed. A contingency sample will be collected by the Lunar Module Pilot (LMP). Television will be used as a facility item and will be deployed as the Commander (CDR) descends the LM ladder. It will be used during the EVAs where possible for observation of lunar surface activities. The data acquisition camera and Hasselblad cameras, using color film, will be used to record the lunar surface operations. Nominally, the Apollo lunar surface experiments package (ALSEP) will be deployed at least 300 feet to the west of the LM. The geophone anchor should be employed for soil mechanics measurements immediately prior to its use as the cable anchor if lunar surface operations are ahead, or on the nominal timeline. After completion of the ALSEP and laser ranging retro-reflector (LRRR) deployment tasks, one crew member will collect samples of rock and fragmental materials. One large rock, approximately 6 x 7" will be collected. If this EVA is extended, arming of the active seismic experiment (S-033) mortars may be delayed in order to avoid danger to crew during the traverse. Figure 4 depicts the allocation of time for EVA-1 tasks. Figure 5 shows the EVA-1 traverse plan. Figures 6 and 7 show the near LM activities and the ALSEP deployment arrangement.

Second EVA Period

During the second EVA (EVA-2) the LMP will assist the CDR in loading the MET, which will be used to carry equipment such as cameras, film, and hand tools. The Lunar Portable Magnetometer (LPM) will be offloaded and a site measurement made at an appropriate distance from the LM. The lunar geology investigation experiment (S-059) will then be conducted. Still photography during this period will be with black and white film. The order of priority for visiting craters in the vicinity of the planned landing site is Cone Crater, Sunrise Crater, and Star Crater. At a point in the traverse to Cone Crater where it is determined that pulling the MET becomes too difficult, the

APOLLO 14 EVA-1

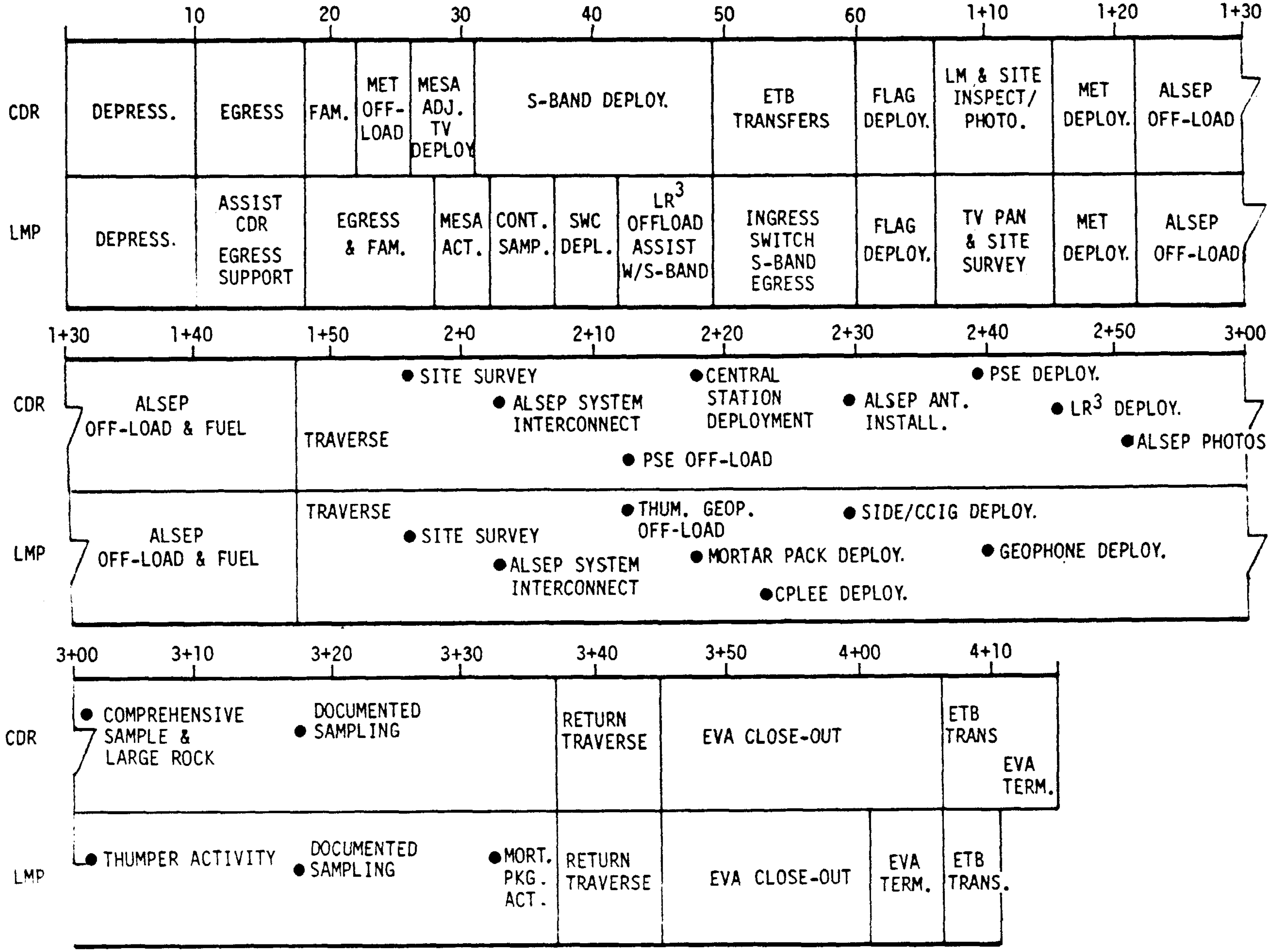

Fig. 4

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EVA TRAVERSES

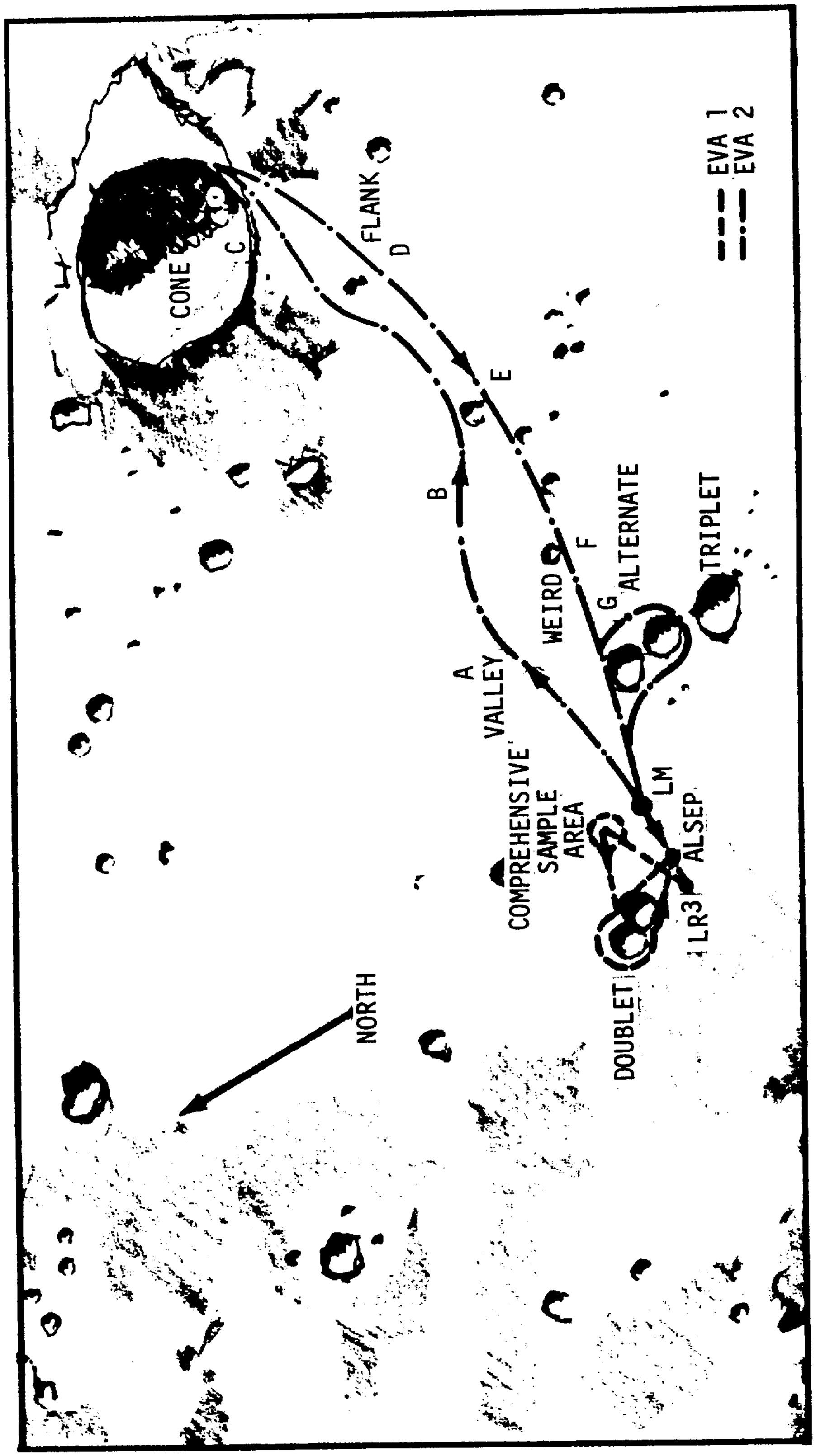
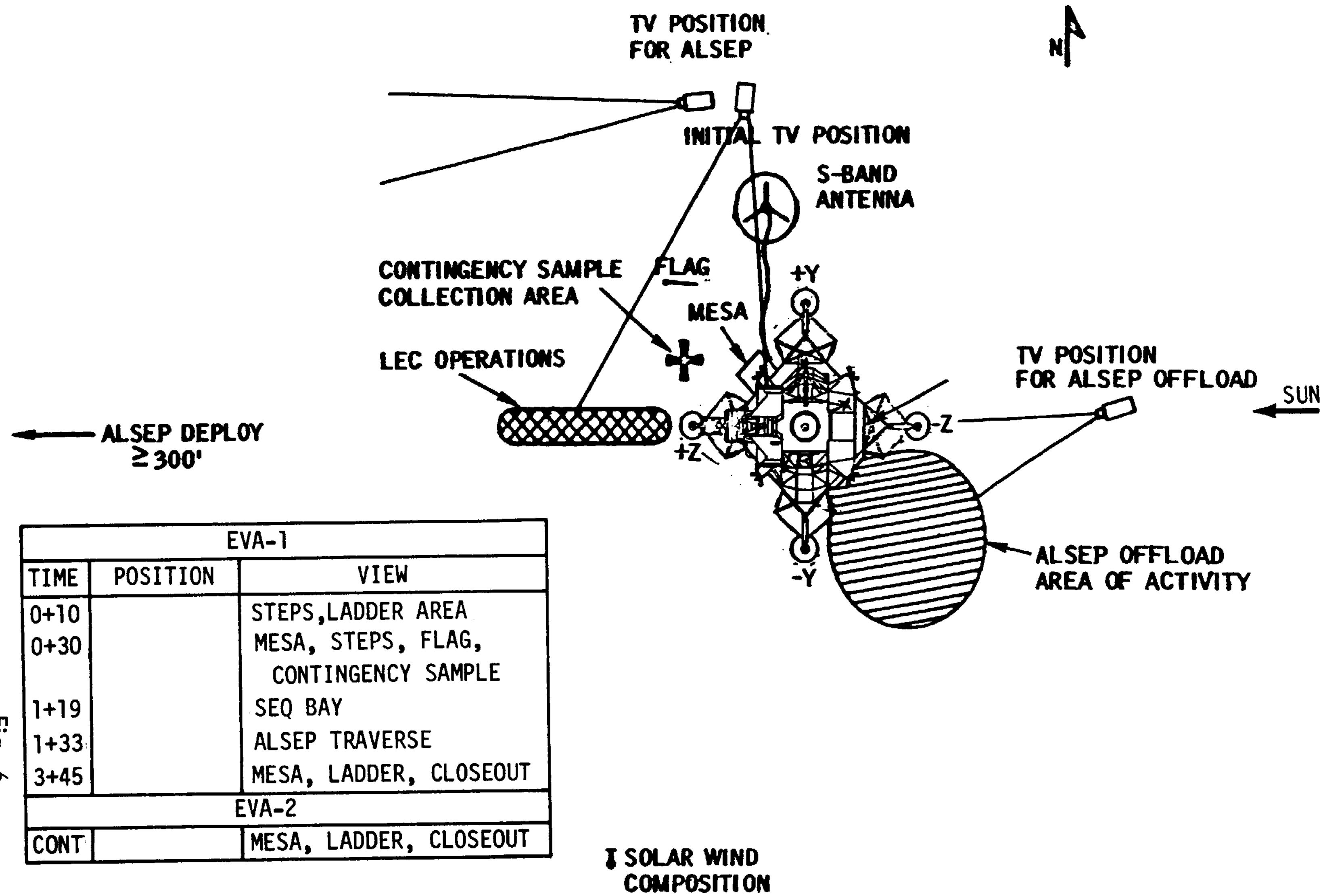


Fig. 5

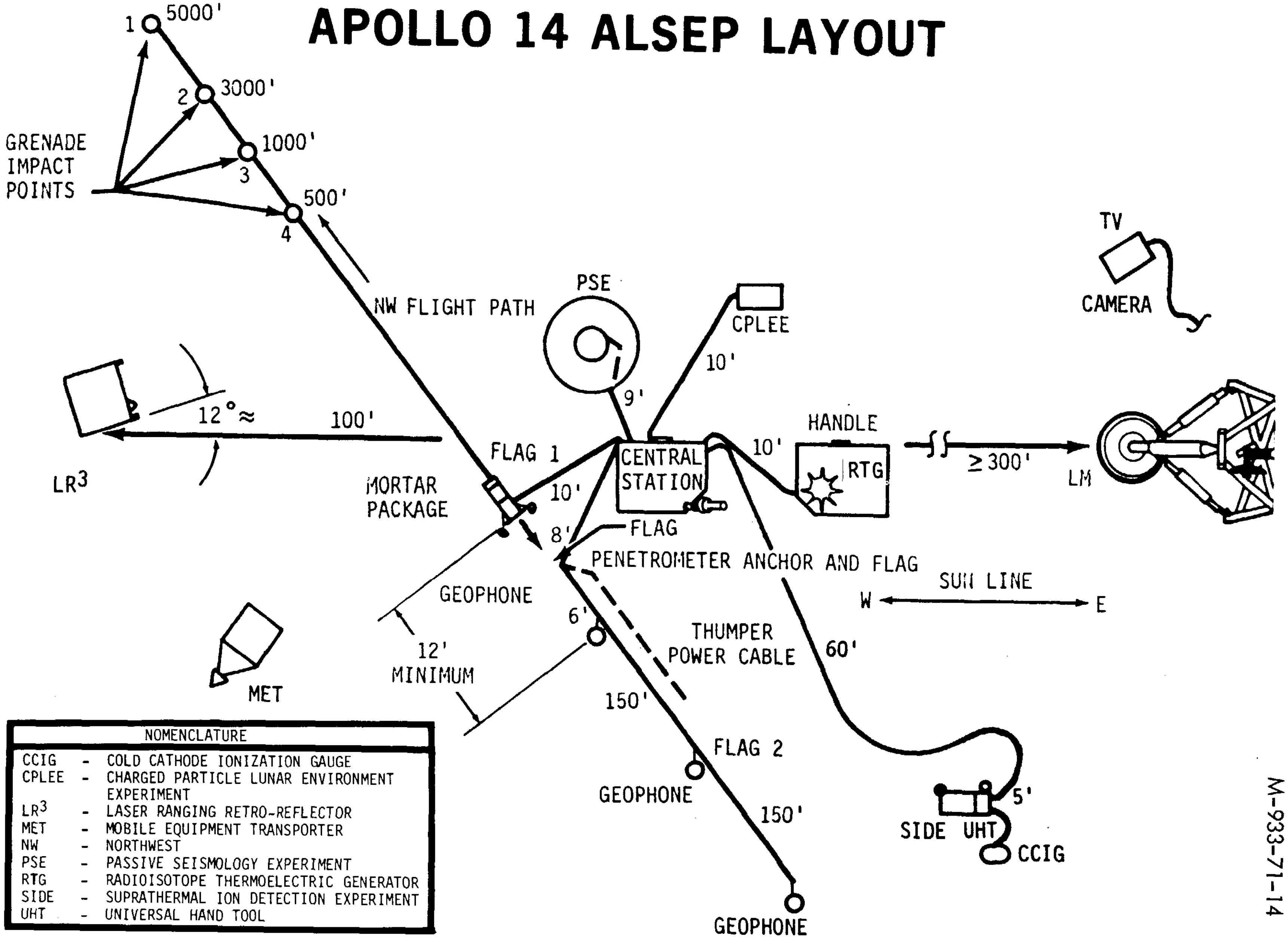
PROBABLE AREAS FOR NEAR LM LUNAR SURFACE ACTIVITIES



EVA-1		
TIME	POSITION	VIEW
0+10		STEPS, LADDER AREA
0+30		MESA, STEPS, FLAG, CONTINGENCY SAMPLE
1+19		SEQ BAY
1+33		ALSEP TRAVERSE
3+45		MESA, LADDER, CLOSEOUT
EVA-2		
CONT		MESA, LADDER, CLOSEOUT

Fig. 6

APOLLO 14 ALSEP LAYOUT



NOMENCLATURE		
CCIG	-	COLD CATHODE IONIZATION GAUGE
CPLEE	-	CHARGED PARTICLE LUNAR ENVIRONMENT EXPERIMENT
LR^3	-	LASER RANGING RETRO-REFLECTOR
MET	-	MOBILE EQUIPMENT TRANSPORTER
NW	-	NORTHWEST
PSE	-	PASSIVE SEISMOLOGY EXPERIMENT
RTG	-	RADIOISOTOPE THERMOELECTRIC GENERATOR
SIDE	-	SUPRATHERMAL ION DETECTION EXPERIMENT
UHT	-	UNIVERSAL HAND TOOL

Fig. 7

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MET may be parked at a suitable location, or, depending on real time evaluation by the crew, it may be picked up and carried to the crater rim. After the planned activities at Cone Crater the crew will return to the MET and continue their traverse. At an appropriate point in the traverse a trench will be dug. A triple core tube sample will be taken at an appropriate place in the traverse. The LMP will perform an LPM traverse measurement provided sufficient time is available. At the end of the EVA-2 the contamination sample will be taken. The SWC foil will be collected and stowed, and the sample return containers transferred to the LM. Figure 8 depicts the allocation of time for the EVA-2 tasks. Figure 5 shows the traverse plan for EVA-2.

CSM LUNAR ORBIT

During the twelfth revolution the CSM will perform a maneuver which will result in a 60 x 60-NM orbit at the time of the LM rendezvous. Certain lunar orbital experiments and photographic tasks will be performed by the CSM while the LM is on the lunar surface.

No CSM orbital plane change is required to provide photographic coverage of photography site Descartes. The photography will be accomplished with the lunar topographic camera; in the event of camera malfunction the Hasselblad camera with the 500mm lens will be used.

Other CSM orbital photography tasks, such as dim light photography, solar corona, etc., will be accomplished in lunar orbit.

LM LIFTOFF THROUGH ASCENT STAGE JETTISON

After completion of lunar surface activities and ascent preparations, the LM APS and LM RCS will be used to launch and rendezvous with the CSM. Prior to LM liftoff, the CSM will complete the required plane change to permit a nominally coplanar rendezvous. An early rendezvous technique will be used on Apollo 14 instead of the coelliptic rendezvous technique used on previous missions.

LM liftoff will occur about 2-1/2 minutes prior to the nominal time for a coelliptic rendezvous technique. The liftoff window duration is about 30 seconds and is restrained to keep the perilune above 8 NM. The goal of the early rendezvous technique is to insert the LM into a 48 x 9-NM orbit so that a fixed time (approximately 38 minutes) after insertion the terminal phase initiation (TPI) can be performed using APS. Terminal phase finalization (TPF) will occur about 130° later. The total time from insertion to rendezvous will be 85 to 90 minutes. Docking will be accomplished by the CSM with RCS maneuvers. Once docked, the two LM crewmen will transfer to the CSM with appropriate equipment. If required, a coelliptic rendezvous may be flown by delaying the liftoff time or performing appropriate maneuvers subsequent to LM insertion.

APOLLO 14 EVA-2

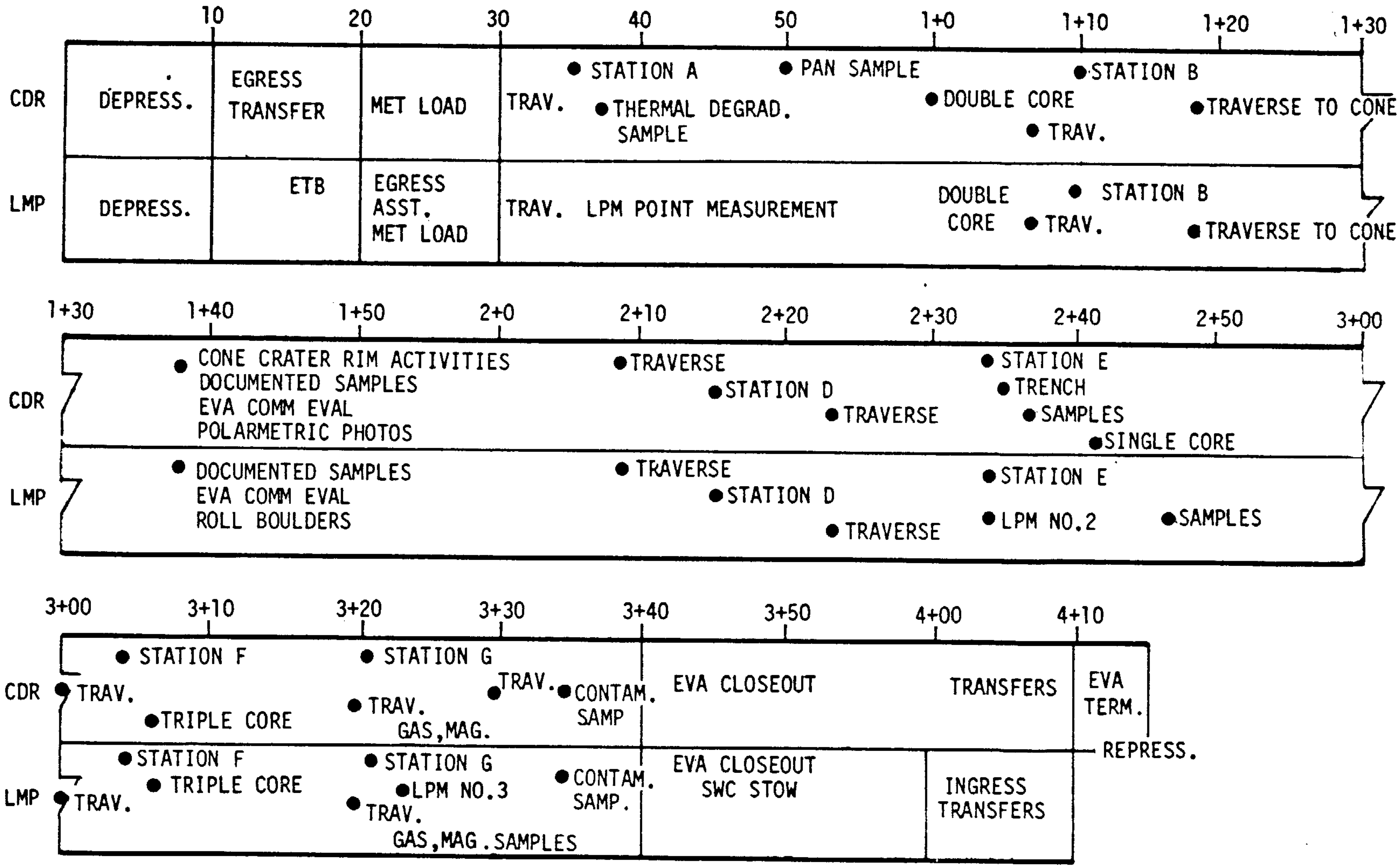

Fig. 8

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The jettisoned LM ascent stage will be deorbited for impact on the lunar surface. Food waste may remain in the ascent stage, but must be inventoried. All urine, feces, and unused food will be removed from the ascent stage prior to undocking. Ascent stage impact will be targeted for 3°30'S latitude and 19°16'W longitude

TRANSEARTH INJECTION THROUGH LANDING

After completion of the post-rendezvous CSM orbital activities, the SPS will be used to inject the CSM onto the transearth trajectory. The nominal return time will not exceed 110 hours and is presently planned to be approximately 68 hours. The return inclination will not exceed 40° (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. MCC's will be made, if required. The CM will separate from the SM 15 minutes before entry interface.

Earth landing will be in the mid-Pacific and will nominally occur 9 days after launch at 27°02'S and 171°30'W. The prime recovery ship will be the USS New Orleans.

POST-LANDING OPERATIONS

Following splashdown, the recovery helicopter will drop swimmers and life rafts near the CM. The swimmers install the flotation collar on the CM, attach the life raft, and pass fresh flight suits in through the hatch. The crew will don the flight suits and oral-nasal masks while inside the CM.

Biological isolation garments (BIG's) will be available for use in case of unexplained crew illness. The crew will be transferred from the spacecraft to the recovery ship via life raft and helicopter and will enter the Mobile Quarantine Facility (MQF). The crew will remain in the MQF until the recovery ship nears Samoa when they will be transferred by helicopter to a second MQF on board a C-141 for the flight to Houston.

CM and Data Retrieval Operations

After flight crew pickup by the helicopter, the CM will be retrieved and placed on a dolly aboard the recovery ship. The CM will be mated to the MQF, and the lunar samples, film, flight logs, etc., will be retrieved and passed out through a decontamination lock for shipment to the Lunar Receiving Laboratory (LRL). The spacecraft will be off-loaded from the ship at Pearl Harbor and transported to an area where deactivation of the CM propellant system will be accomplished.

ALTERNATE MISSIONS

General

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.

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.

Alternate Missions

The two general categories of alternate missions that can be performed during the Apollo 14 Mission are (1) earth orbital and (2) lunar. 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

The CSM will dock with the LM, and the photographic equipment will be retrieved from the LM. Following this, the LM will be deorbited into the Pacific Ocean area to eliminate debris problems. The CSM will perform SPS plane change maneuvers to achieve an orbital inclination of 40° with daylight coverage of all US passes. Earth orbital photography will then be conducted in accordance with the Apollo 13 Earth Orbital Contingency Plan, approved 6 April 1970.

Lunar Orbit

The CSM and LM with DPS capability will be employed during a lunar orbit alternate mission. Orbital photography will be performed as well as the planned inflight experiments. An SPS plane change of approximately 2.3° will be accomplished during revolution 14.

EXPERIMENTS, DETAILED OBJECTIVES, AND INFLIGHT DEMONSTRATIONS

The technical investigations to be performed on the Apollo 14 Mission are categorized as Experiments, Detailed Objectives, and Inflight Demonstrations. These three categories, as they apply to the Apollo Program, are defined below. Following the definitions are brief descriptions of each investigation.

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 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. CSM Orbital Photographic Tasks, though reviewed by the Manned Space Flight Experiments Board, are not assigned as formal Experiments and will be processed as a single Detailed Objective.

Inflight Demonstration — A technical demonstration of the capability of an apparatus and/or process to illustrate or utilize the unique conditions of space flight environment. Inflight Demonstrations will be performed only on a noninterference basis with all other mission and mission related activities. Utilization, performance, or completion of these demonstrations will in no way relate to mission success.

EXPERIMENTS

The following experiments are planned to be performed on Apollo 14:

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 Dust Detector (M-515) (ALSEP)

The lunar surface dust detector will provide data for the measurement of thermal control degradation caused by dust accretion. Accumulation of dust on any or all of three photoelectric cells is indicated by a reduction in their power outputs. The output variations caused by lunar dust on the photoelectric cells will be correlated with thermistor temperature measurements. A dust, thermal, and radiation engineering measurements package was deployed on Apollo 11. The lunar dust detector experiment was performed on Apollo 12.

Lunar Passive Seismology (S-031) (ALSEP)

The passive seismic experiment will be deployed to determine the internal structure, physical state, tectonic activity and composition of the moon. The equipment consists of a tri-axial long period seismometer and a single axis short period seismometer with supporting electronic and thermal control systems. The unit will be controlled from the Manned Spacecraft Center (MSC) through the MSFN stations. The seismometer, used in conjunction with the Apollo 12 unit now emplaced, will greatly enhance the effectiveness of lunar seismic exploration. The seismometer experiment performed on Apollo 11 is no longer operating.

Lunar Active Seismology (S-033) (ALSEP)

The active seismic experiment is designed to generate and monitor artifically stimulated seismic waves in the 3 to 250 Hz range in the lunar surface and near subsurface. It can also be used to monitor natural seismic waves in the same frequency range. Seismic waves will be produced by explosive devices and detected by geophones. Two energy sources will be employed. A thumper device containing 21 explosive initiators will be fired along the geophone lines by the astronaut. The astronaut will also emplace a mortar package containing four high explosive grenades. The grenades will be rocket-launched by earth command at a time still to be determined but subsequent to LM liftoff. The grenades are designed to impact at four different ranges: approximately 500, 1000, 3000, and 5000 feet, with individual high explosive charges proportional to their ranges. This will be the first lunar deployment of an active seismic experiment.

Suprathermal Ion Detector (S-036) (ALSEP)

The objectives of the suprathermal ion detector experiment are to provide information on the energy and mass spectra of positive ions close to the lunar surface and in the earth's magnetotail and magnetosheath, to provide data on plasma interaction between the solar wind, and to determine a preliminary value for electric potential of the lunar surface. The suprathermal ion detector has two positive ion detectors: a mass analyzer and a total ion detector.

Cold Cathode Ionization Gauge (S-058) (ALSEP)

The objective of the cold cathode ionization gauge experiment, which is integrated with the suprathermal ion detector, is to measure the neutral particle density of the lunar atmosphere.

Low Energy Solar Wind (S-038) (ALSEP)

The low energy solar wind experiment measurements will be used to ascertain proton and electron flux data for evaluation of solar wind and cosmic rays. The crew will deploy the self-contained unit which consists of electronics and two physical analyzers. Electrically charged particles entering the detector packages are deflected depending on energy and polarity of the particles. The count is recorded electronically and the information is transmitted to earth. This will be the first deployment of a low energy solar wind experiment.

Lunar Geology Investigation (S-059)

The lunar geology investigation experiment consists of collecting geological data at a number of stops or stations during the planned EVA lunar traverse by the flight crew. The crew will photograph, examine, collect, and describe lunar geologic samples. The activities will include documentation of size, shape, range, and patterns of distribution for accessible types of lunar physiographic features. Geology investigations were performed on Apollos 11 and 12.

Laser Ranging Retro-Reflector (S-078)

The purpose of the laser retro-reflector is to enable precise ranging from the earth to a point on the surface of the moon. The retro-reflector consists of an array of fused silica optical corner reflectors and a mounting and orientation device. When placed on the lunar surface it will serve as a reflecting target for active laser systems on the earth. A laser ranging retro-reflector was deployed on Apollo 11.

Soil Mechanics (S-200)

The purpose of the soil mechanics experiment is to obtain data on the lunar surface and subsurface characteristics and on the soil mechanical behavior. The data will be obtained during the planned EVA traverses and by flight crew observations on the LM-lunar surface interactions. Detailed information will be derived by examining returned photographs, from flight crew debriefings, and the soil mechanics team's examination of returned lunar material. Soil mechanics investigations were performed on Apollos 11 and 12. This will be the first time a lunar soil mechanics investigation has been performed as a separate experiment.

Portable Magnetometer (S-198)

A portable magnetometer will be used to measure the magnetic field of the moon at the Apollo 14 landing site. The instrument will have two ranges: ±50 gamma and ±100 gamma, with a resolution of 1 gamma. The instrument is placed on a tripod and the astronaut moves 50 feet away to make a reading from a cable connected meter. Values along three orthogonal axes will be read by the astronaut from a hand-held meter and sent to earth over the voice communication link. These measurements will be correlated with measurements being made simultaneously.

Solar Wind Composition (S-080)

The purpose of the solar wind composition experiment is to determine the isotopic composition of noble gases in the solar wind, at the lunar surface, by entrapment of particles in aluminum foil. A staff and yard arrangement is used to deploy the foil and maintain its plane perpendicular to the sun's rays. After return to earth, a spectrometric analysis of the particles entrapped in the foil allows quantitative determination of the helium, neon, argon, krypton, and xenon composition of the solar wind. Solar wind composition experiments were performed on Apollos 11 and 12.

Lunar Orbit Experiments

The lunar orbit experiments are conducted in flight, primarily during the lunar orbit phase of the mission.

Bistatic Radar (S-170) (CSM)

The objectives of the bistatic radar experiment are to obtain data on the lunar bulk electrical properties, surface roughness, and regolith depth to 10-20 meters. This experiment will determine the lunar surface Brewster angle, which is a function of the bulk dielectric constant of the lunar material.

The experiment data is obtained by analysis of bistatic radar echos reflected from the lunar surface and subsurface, in correlation with direct downlink signals. The S-band and VHF communications systems, including the VHF omni and S-band high-gain or omni antennas, are utilized for this experiment.

Gegenschein From Lunar Orbit (S-178)

The Apollo data acquisition camera will be used for photographing the Gegenschein (an extended light source in the region along the earth's anti-solar direction) and Moulton point (a mathematically located libration point on the earth-sun line behind the earth) regions to determine their spatial distribution. Photographs will be taken in lunar orbit, after sunset and earthset, to determine if a relationship exists between the Gegenschein and Moulton points. The observed Gegenschein light source may be attributable to a collection of dust particles at the Moulton point. Photographs taken from orbit should show the relationship between the Gegenschein and Moulton points and indicate the presence of dust particles at the Moulton point if a relationship does exist. This will be the first time this experiment has been performed on an Apollo mission.

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

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

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

Other Experiments

The following experiments will be accomplished by post-mission analysis and require no inflight crew activity.

Apollo Window Meteoroid (S-176) (CM)

The objective of the Apollo window meteoroid experiment is to obtain data on the cislunar meteoroid flux of mass range 10^{-12} grams. The returned CM windows 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.

Bone Mineral Measurement (M-078)

This experiment will investigate the possibility that a difference in bone mineral changes may result from the 1/6-g exposure of two crewmen about mid-mission versus the zero-g environment of the Command Module Pilot (CMP) for the entire flight. At selected times, pre- and post-flight, the degree of bone mineral changes in the three Apollo crewmen will be determined using an X-ray absorption technique. The radius, ulna (bones of the forearm) and the os calcis (heel) have been selected as the most appropriate sites for this study.

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 on the lunar surface under nominal flight profile conditions.
- Post-flight determination of actual S-IVB/IU point of impact within 5 km, and time of impact within 1 second.

Spacecraft Detailed Objectives

- Collect a contingency sample for assessing the nature of the surface material at the lunar landing site in event EVA is terminated.
- Obtain CSM photographs of future exploration site Descartes.
- Evaluate the CSM supercritical O_2 tank performance under low density and high flow rate conditions.
- Provide crew verbal data and photography on the visibility of selected targets at high sun angles.
- Evaluate the MET operational characteristics in the lunar environment.
- Obtain selenodetic reference point data for updating lunar aeronautical charts and maps.
- Obtain CSM orbital photographs of the lunar surface of prime scientific interest, including specific segments of the lunar surface in earth shine and low level light near the terminator.
- Obtain data for improving the confidence level in the real-time method of computing crew water consumption during EVA and for estimating EVA operating limits.
- Obtain data for determining changes in optical properties of thermal control coating samples after sample exposure to lunar soil.
- Evaluate the EVA communication system when the line of sight from EVA to LM is obstructed by lunar surface features.

INFLIGHT DEMONSTRATIONS

Following is a description of each of the planned inflight demonstrations.

Electrophoretic Separation

Most organic molecules pick up small electric charges when they are placed in slightly acid or alkaline water solutions and will move through such a solution if an electric field is applied to it; this effect is known as electrophoresis. Since different molecules move at different speeds, the faster molecules in a mixture that start moving from one end of the tube of solution will outrun the slower ones as they move toward the other end. The electrophoretic separation demonstration is designed to test an engineering approach to prepare pure samples of organic materials in space, where the weightlessness of the solutions and sample mixtures should suppress both convection and sedimentation which occur in the earth gravity environment.

A small, specially designed electrophoretic separation apparatus will be tested and the quality of the separations obtained will be demonstrated by trials with three sample mixtures having widely different molecular weights: (1) a mixture of red and blue organic dyes; (2) human hemoglobin; and (3) DNA (the molecules that carry the genetic code) from salmon sperm. If successful, the demonstration will show that more refined apparatus could be developed to prepare samples of materials on future space missions for use in medical and biological research on the ground. Ultimately, the method may prove practical for large-scale processing of new vaccines and similar biological preparations on board manned space stations.

Heat Flow and Convection

The Heat Flow and Convection demonstration is designed to perform four tests on heat transfer in weightless liquids and gases. In three of the tests temperatures around electric heaters immersed in samples of pure water, a sugar solution, and carbon dioxide gas will be mapped out by color changes produced in "liquid crystal" temperature indicators. The fourth test will observe the fluid flow induced by heating a sample of oil containing a suspension of fine aluminum flakes. The results observed by the astronauts will be of value in designing future space experiments and assessing the feasibility of many processes that have been proposed for manufacturing products in space.

Liquid Transfer

The Liquid Transfer demonstration is designed to demonstrate the benefits of utilizing tank baffling in the storage and transfer of liquids in zero-gravity. The tests will be conducted with two sets of simulated tanks, one set containing tank baffling and the other without any baffling. By observing and photographing the transfer of liquids in the two sets of tanks, a comparison can be made to determine the benefits obtained from the use of baffles in zero-gravity which can be important to the design of future space refueling systems.

Composite Casting

This technical demonstration is designed to demonstrate the effect of zero-gravity on the preparation of cast metals, fibre strengthened materials, and single crystals. These test specimens will be processed in a small heating chamber in flight for examination and testing upon return to earth. The results from these tests will be used to evaluate the prospects for making improved metallurgical products in space.

MISSION CONFIGURATION AND DIFFERENCES

MISSION HARDWARE AND SOFTWARE CONFIGURATION

The Saturn V Launch Vehicle and the Apollo Spacecraft for the Apollo 14 Mission will be operational configurations.

ITEM	DESIGNATION NUMBER
Space Vehicle	AS-509
Launch Vehicle	SA-509
First Stage	S-IC-9
Second Stage	S-II-9
Third Stage	S-IVB-509
Instrument Unit	S-IU-509
Spacecraft-LM Adapter	SLA-17
Lunar Module	LM-8
Service Module	SM-110
Command Module	CM-110
Onboard Programs	
Command Module	Colossus 2E
Lunar Module	Luminary 1D
Experiment Package	Apollo 14 ALSEP
Launch Complex	LC-39A

CONFIGURATION DIFFERENCES

The following summarizes the significant configuration differences associated with the AS-509 space vehicle and the Apollo 14 Mission.

Spacecraft

Command/Service Module (CSM-110)

. Cryogenic oxygen tank redesigned	Removed fans, eliminated, as far as possible, flammable materials, improved design for fabrication and assembly, and replaced teflon insulated conductors with stainless steel sheathed conductors.
. Added third cryogenic oxygen tank	Provided additional oxygen supply with associated piping to provide backup to existing tanks.

• Added solenoid valve in oxygen tank ECS line	Provided capability to isolate third oxygen tank from other two.
• Added auxiliary battery in the SM	Provided backup electrical power if fuel cell power becomes unavailable.
• Added water bags (40# capacity)	Provided return enhancement for CSM water system.

Lunar Module

• Added anti slosh baffles to descent stage propellant tanks	Improved PQGS flight performance and decreased propellant level uncertainty
• Added CSM/LM ascent stage wiring	Enhanced power transfer capability from ascent stage to CM.
• Modified LM batteries	Modifications made to prevent any free KOH from causing short circuits
• Modified descent stage Quads I and II structure	Provided for stowage of laser ranging retro reflector and lunar portable magnetometer.

Launch Vehicle

S-IC

- No significant changes

S-II

• Added center engine LOX feedline accumulator	Alleviated potential 16 Hz structural/propulsion oscillations (POGO).
• Provided center engine backup cutoff system	Eliminated possibility of high g loads developing to destructive levels.
• Incorporated two position mixture ratio control valves	Simplified propellant mixture control system by eliminating interface with IU computer and operating by direct command.

S-IVB

- Incorporated two position mixture ratio control valves — Simplified propellant mixture control system by eliminating interface with IU computer and operating by direct command.

Government Furnished Equipment

Crew Systems

- Incorporated BSLSS — Provided capability to supply cooling water to an astronaut with failed PLSS from a working PLSS — Doubles OPS lifetime.

Experiments and Inflight Demonstrations

- Added Lunar Portable Magnetometer — See Experiments section.
- Added Active Seismic Experiment — See Experiments section.
- Added Mobile Equipment Transporter — Increased lunar surface acitivty efficiency by improving capability for transporting equipment and experiments.
- Added four inflight demonstrations — See pages 24 to 26.

Network

- Guaymas station has been deleted.
- Dual USB capabilities have been added at the Canary Island station.
- The 85-foot wing sites have been modified for ALSEP support.

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 television and camera equipments and shows their stowage locations.

TABLE 2

TV AND PHOTOGRAPHIC EQUIPMENT

NOMENCLATURE	STOWAGE LOCATION CM AT LAUNCH	LM AT LAUNCH	CM TO LM TRANSFER	CM AT ENTRY
TV, COLOR, ZOOM LENS, AND MONITOR	1	1		1
TV, BLACK & WHITE, LUNAR DAY LENS		1		
CAMERA, 16MM, DATA ACQUISITION	1	1		1
LENS - 10MM	1	1		1
- 18MM	1			1
- 75MM	1			1
FILM MAGAZINES	12			12
CAMERA, 16MM, BATTERY OPERATED		1		
LENS - 10MM		1		
FILM MAGAZINES	8		8	8
CAMERA, HASSELBLAD, ELECTRIC DATA	1			1
LENS - 80MM	1			1
FILM MAGAZINES	3			3
CAMERA, 70MM, ELECTRIC HASSELBLAD	1			1
LENS - 80MM	1			1
- 250MM	1			1
- 500MM	1			1
FILM MAGAZINES	6			6
CAMERA, LUNAR SURFACE, ELECTRIC HASSELBLAD		2		1
LENS - 60MM		2		1
FILM MAGAZINES	5		5	5
FILTER - POLARIZING		1		
CAMERA, LUNAR TOPOGRAPHIC	1			1
FILM MAGAZINES	3			3
CAMERA, LUNAR SURFACE CLOSE-UP (STEREO)		1		
FILM CASSETTE		1		1

FLIGHT CREW DATA

PRIME CREW (Figure 9)

Commander: Alan B. Shepard (Captain, USN)

Space Flight Experience: Captain Shepard was one of the Mercury astronauts named by NASA in April 1959, and he holds the distinction of being the first American to journey into space.

On 5 May 1961, in the Freedom 7 spacecraft, he was launched by a Redstone vehicle on a ballistic trajectory suborbital flight — a flight which carried him to an altitude of 116 statute miles and to a landing point 302 statute miles down the Atlantic Missile Range.

He was designated Chief of the Astronaut Office in 1963 with responsibility for monitoring the coordination, scheduling, and control of all activities involving NASA astronauts. This included monitoring the development and implementation of effective training programs to assure the flight readiness of available pilot/non-pilot personnel for assignment to crew positions on manned space flights; furnishing pilot evaluations applicable to the design, construction and operations of spacecraft systems and related equipment; and providing qualitative scientific and engineering observations to facilitate overall mission planning, formulation of feasible operational procedures, and selection and conduct of specific experiments for each flight. Commander Shepard returned to full flight status in May 1969 following correction of an inner ear disorder.

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

Space Flight Experience: Major Roosa is one of 19 astronauts selected by NASA in April 1966. He was a member of the astronaut support crew for the Apollo 9 flight.

Roosa has been on active duty since 1953. His last assignment was as an experimental test pilot at Edwards Air Force Base, California, from September 1965 to May 1966, subsequent to graduating from the Aerospace Research Pilots School in September 1965.

Lunar Module Pilot: Edgar D. Mitchell (Commander, USN)

Space Flight Experience: Commander Mitchell was in the group selected for astronaut training in April 1966. He served as a member of the astronaut support crew for Apollo 9 and as backup lunar module pilot for Apollo 10. Mitchell came to the Manned Spacecraft Center after graduating first in his class from the Aerospace Research Pilot School where he was both student and part time instructor.

APOLLO 14 PRIME CREW

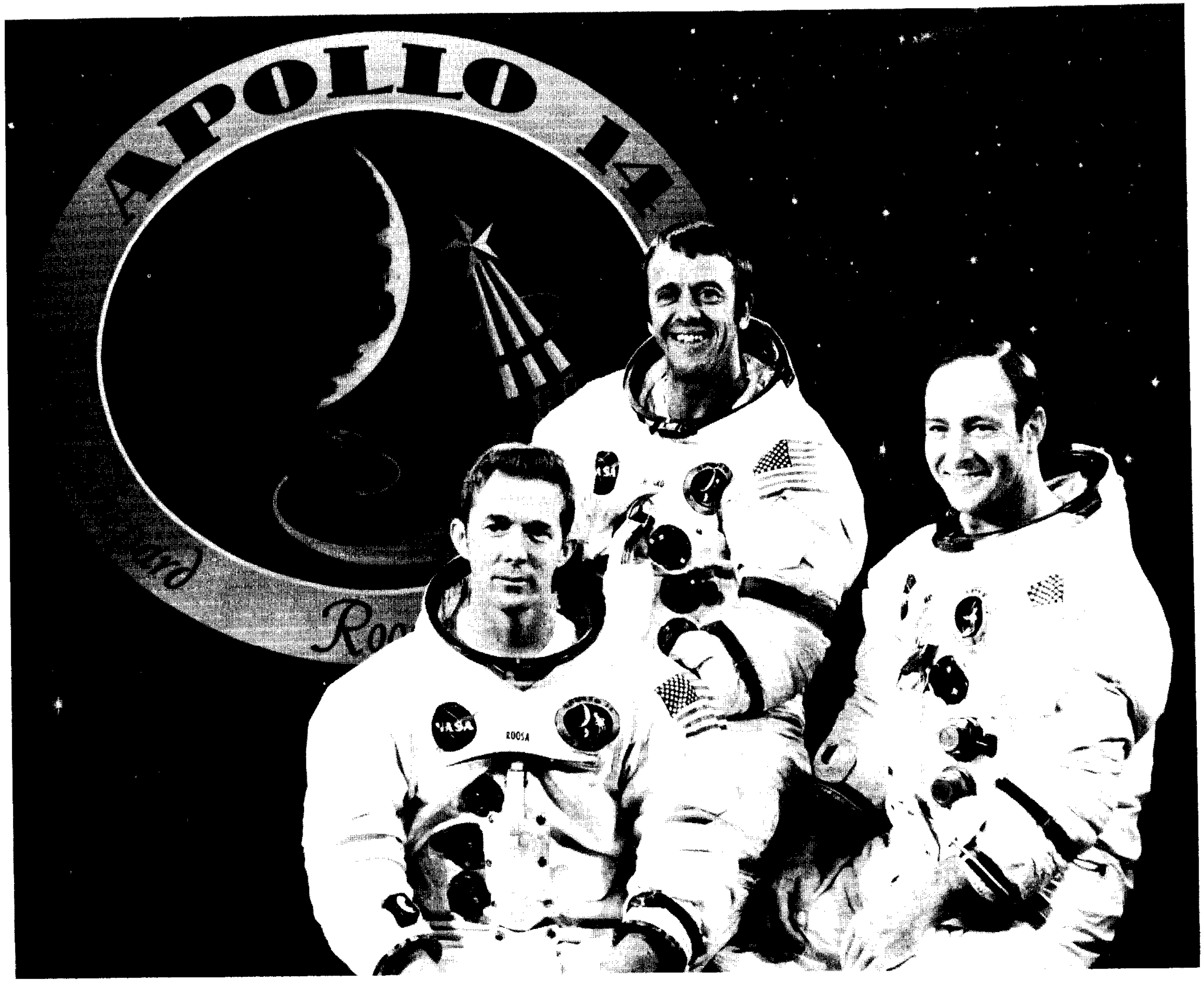


Fig. 9

BACKUP CREW

Commander: Eugene A. Cernan (Captain, USN)

Space Flight Experience: Commander Cernan was one of the third group of astronauts selected by NASA in October 1963.

He occupied the pilot seat along side of Command Pilot Tom Stafford on the Gemini 9 Mission. Cernan was the Lunar Module Pilot on Apollo 10, 18-26 May 1969, the first comprehensive lunar-orbital qualification and verification flight test of an Apollo lunar module.

Commander Cernan's space flight totals more than 264 hours 24 minutes.

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

Space Flight Experience: Lt. Commander Evans is one of the 19 astronauts selected by NASA in April 1966. He served as a member of the astronaut support crew for the Apollos 7 and 11 flights.

Lunar Module Pilot: Joe H. Engle (Lt. Colonel, USAF)

Space Flight Experience: Lt. Colonel Engle is one of the 19 astronauts selected by NASA in April 1966. He is currently involved in training for future manned space flights, and he was assigned as the Lunar Module Pilot on spacecraft 2TV-1.

MISSION MANAGEMENT RESPONSIBILITY

TITLE	NAME	ORGANIZATION
Director, Apollo Program	Dr. Rocco A. Petrone	OMSF
Mission Director	Capt. Chester M. Lee (Ret)	OMSF
Saturn Program Manager	Mr. Richard G. Smith	MSFC
Apollo Spacecraft Program Manager	Col. James A. McDivitt	MSC
Apollo Program Manager, KSC	Brig. Gen. Thomas W. Morgan	KSC
Director of Launch Operations	Mr. Walter J. Kapryan	KSC
Director of Flight Operations	Mr. Sigurd A. Sjoberg	MSC
Launch Operations Manager	Mr. Paul C. Donnelly	KSC
Flight Directors	Mr. Milton L. Windler Mr. Gerald F. Griffith Mr. Eugene F. Kranz	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
CCATS	Communications, Command, and Telemetry System
CCGE	Cold Cathode Gauge Experiment
CDH	Constant Delta Height
CDR	Commander
CPLEE	Charged Particle Lunar Environment Experiment
CM	Command Module
CMP	Command Module Pilot
CSC	Close-up Stereo Camera
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	Fixed Throttle Position
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
LDMK	Landmark
LEC	Lunar Equipment Conveyor
LES	Launch Escape System
LET	Launch Escape Tower
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
MHz	Megahertz
MOCR	Mission Operations Control Room
MOR	Mission Operations Report
MPL	Mid-Pacific Line
MQF	Mobile Quarantine Facility
MSC	Manned Spacecraft Center
MSFC	Marshall Space Flight Center
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
S-IC	Saturn V First Stage
S-II	Saturn V Second Stage
S-IVB	Saturn V Third Stage
SIDE	Suprathermal Ion Detector Experiment
SLA	Spacecraft-LM Adapter
SM	Service Module
SPAN	Solar Particle Alert Network
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

GPO 905.258

Post Launch
Mission Operation Report
No. M-933-71-14

FEB 2 2 1971

TO: A/Acting Administrator

FROM: MA/Apollo Program Director

SUBJECT: Apollo 14 (AS-509) Post Launch Mission Operation Report #1

The Apollo 14 Mission was successfully launched from the Kennedy Space Center on Sunday, January 31, 1971, and was completed as planned on Tuesday, February 9, 1971, with recovery of the crew and spacecraft in the Pacific Ocean recovery area. Initial review indicates that all mission objectives were accomplished. Further analysis of 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 Apollo 14 Summary Report which is submitted as Post Launch Mission Operation Report #1. Also attached are the OMSF Primary Mission Objectives for Apollo 14. The Apollo 14 Mission has achieved all the assigned primary objectives and I judge it to be a success.

Rocco A. Petrone
Rocco A. Petrone

APPROVAL:

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

NASA OMSF MISSION OBJECTIVES FOR APOLLO 14

PRIMARY OBJECTIVES

- Perform selenological inspection, survey, and sampling of materials in a preselected region of the Fra Mauro Formation.
- Deploy and activate an Apollo Lunar Surface Experiments Package (ALSEP).
- Develop man's capability to work in the lunar environment.
- Obtain photographs of candidate exploration sites.

Rocco A. Petrone
Rocco A. Petrone
Apollo Program Director

Date: 20 January 1971

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

Date: Jan 21, 1971

RESULTS OF APOLLO 14 MISSION

Based upon a review of the assessed performance of Apollo 14, launched 31 January 1971 and completed 9 February 1971, this mission is adjudged a success in accordance with the objectives stated above.

Rocco A. Petrone
Rocco A. Petrone
Apollo Program Director

Date: 22 February 1971

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

Date: Feb 22, 1971

1/15/71

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

9 February 1971

REPLY TO ATTN OF: MAO

TO: Distribution

FROM: MA/Apollo Mission Director

SUBJECT: Mission Director's Summary Report, Apollo 14

INTRODUCTION

The Apollo 14 Mission was planned as a lunar landing mission to: perform selenological inspection, survey, and sampling of materials in a preselected region of the Fra Mauro formation; deploy and activate an Apollo Lunar Surface Experiments Package (ALSEP); develop man's capability to work in the lunar environment; and obtain photographs of candidate exploration sites. Flight crew members were Commander (CDR) Capt. Alan B. Shepard, Command Module Pilot (CMP) Maj. Stuart A. Roosa, and Lunar Module Pilot (LMP) Cdr. Edgar D. Mitchell. Significant detailed mission information is contained in tables 1 through 12. Initial review indicates that all primary mission objectives were accomplished (reference table 1). Table 2 lists Apollo 14 achievements.

PRELAUNCH

An unscheduled 40 minute 3 second hold in the launch countdown occurred at T-8 minutes 2 seconds due to high overcast clouds and rain. The delayed launch resulted in a revised flight azimuth of 75.55 degrees vice the planned 72 degrees. The space vehicle prelaunch operations were nominal.

LAUNCH AND EARTH PARKING ORBIT

The Apollo 14 space vehicle was successfully launched from Kennedy Space Center, Florida, 40 minutes 3 seconds late at 4:03 p.m. EST, on 31 January 1971. The S-IVB/IU/LM/CSM was inserted into an earth parking orbit of 98.9 x 102 nautical miles (NM), 11 minutes 49 seconds after liftoff.

Following orbital insertion, all major space vehicle (CSM and S-IVB) systems were verified, preparations for translunar injection (TLI) were completed, and the S-IVB second burn for TLI was initiated. As planned, the launch vehicle modified the trajectory according to the late liftoff to cause spacecraft arrival at the moon at the same GMT as for an ontime launch.

Launch vehicle systems performed satisfactorily except for a data loss due to an apparent anomaly in a multiplexer in the instrument unit (IU). The data loss had a minimum effect on mission operations since most of the measurements were available from the S-IVB stage data link. The crew noted some S-II stage low level amplitude oscillations at approximately 8 minutes 40 seconds after liftoff, and a slight "abruptness" at S-II cutoff.

TRANSLUNAR COAST

The command service module (CSM) separated from the LM/S-IVB/IU at 3:02 (hr:min) ground elapsed time (GET). Onboard color television (TV) was initiated as scheduled to cover the docking of the CSM with the lunar module (LM) and the subsequent extraction of the LM from the S-IVB/IU. However, difficulties were encountered in the docking sequence. After five unsuccessful docking attempts, docking was achieved on the sixth try. The first two attempts were made with a low closing rate. The third and fourth attempts were made at a higher closing rate. The fifth attempt was a repeat of an earlier procedure. The sequence for the final successful docking consisted of (1) extend/release switch to extend position, (2) extend/release switch to retract, (3) initiate CSM/LM closure rate, (4) probe to drogue contact, and (5) nitrogen bottle select switch to primary position. The probe retracted to achieve CM/LM hard dock at 4:57 GET, 1 hour 54 minutes later than planned. From indications, a normal capture was achieved before the nitrogen bottle fired resulting in a normal hard dock.

At 10:00 GET, an unscheduled TV transmission was employed to trouble-shoot the probe and drogue of the docking mechanism. The crew removed the probe and drogue from the tunnel and found no foreign material or abnormal damage. The capture latch assembly was actuated 6 to 7 cycles and the system performed in a completely nominal manner. Trouble-shooting procedures and ground evaluation of available information did not reveal causes for the CSM/LM's earlier inability to complete a hard dock nor any reasons to believe the systems would not work normally again. The color TV transmission was terminated at 12:12 GET. The mission was continued as planned.

Tl.e midcourse correction-2 (MCC-2) trajectory transfer maneuver was performed at 30:36:07 GET. The Service Propulsion System (SPS) burn of 10.14 seconds resulted in a velocity change of 71.1 feet per second (fps). The burn was nominal in all respects and no trim was required.

Approximately 9 frames of earth dark side dim light photography were taken at about 31:00 GET.

A GET update was performed at 55:40 GET to add the 40 minutes 3 seconds that were lost during the launch day hold due to inclement weather. MCC-3, scheduled for 60:38:14 GET, was not required since the spacecraft was nearly on the planned trajectory.

TV transmission began at 60:40 GET, but was interrupted for about 6 minutes due to a ground transmission microwave dropout near San Francisco. The CDR and LMP began their intravehicular transfer into the LM about 60:59 GET. Upon entering the LM, the crew reported that both spacecraft were very clean. LM checkout was completed as planned. TV pictures of the LM interior and the moon were not of good quality because of the lighting conditions. TV transmission lasted for 42 minutes and was completed at 61:22 GET.

MCC-4 was performed by the SPS. The SPS burn of 0.6 second occured at 77:38:14 GET and produced a velocity change of 3.5 fps. No trim was required. Table 5 summarizes the translunar maneuvers.

LUNAR ORBIT INSERTION

Lunar Orbit Insertion (LOI) was performed using the SPS. The LOI burn, initiated at 82:36:43 GET, placed the CSM/LM in a 169.6 x 58.4 NM elliptical orbit. The burn time of 372.2 seconds produced a velocity change of 3022.4 fps. The LOI burn was nominal. Table 6 summarizes the lunar orbit maneuvers.

DESCENT ORBIT INITIATE

The Descent Orbit Insertion (DOI) burn was initiated at 86:50:55 GET and placed the spacecraft in a 58.8 x 9.6 NM orbit around the moon. The SPS burned 20.7 seconds producing a change in velocity of 205.7 fps. Table 6 summarizes the DOI maneuvers.

S-IVB IMPACT

The S-IVB/IU impacted the lunar surface at 83:17:55 GET (1:41 a.m. EST) at 7°49'S and 26°00'W, 155 NM southeast from the planned impact point and 94NM south/southwest of the Apollo 12 ALSEP. The Apollo 12 seismometer detected the impact and showed vibrations for approximately 2 hours.

LUNAR ORBIT PRELANDING ACTIVITIES

At 89:39 GET during strip photography which included the candidate landing site, Descartes, the Hycon topographic camera became noisy. After changing to a second magazine the noise continued. Ground tests on a Hycon camera with a low voltage supply reproduced a similar noise caused by continuous cycling of the shutter, which indicated photo results under these conditions would be unsatisfactory.

During the 12th lunar revolution, at 104:28 GET, the CSM/LM performed a nominal "soft" undocking. The CSM then maneuvered to a position that would result in a 60 x 60 NM orbit at the time of LM rendezvous. The CSM circularization burn at 105:51 GET of 3.8 seconds produced a velocity change of 77.2 fps (2 fps overburn). The burn was trimmed to within 1 fps.

Commencing at 106:31 GET, a spurious bit appeared in the LM guidance computer on four occasions. The spurious bit appeared to be generated by the abort switch which was suspected to be contaminated or defective. This condition during powered descent would trigger the abort program in the guidance computer and cause an unplanned abort. Procedures were developed by the flight controllers and passed to the crew to preclude an inadvertent abort.

POWERED DESCENT

Powered Descent Initiate (PDI) was initiated at 108:42 GET. The descent to landing at 108:54 GET was nominal. Landing radar lock occurred at 22,713 feet in lieu of the planned 30,000 feet, but minimum height to landing radar lock-on is 10,000 feet. The crew reported the LM landed at Fra Mauro on an 8 degree slope about 30 to 60 feet short of the planned landing point.

LUNAR SURFACE

The first extravehicular activity (EVA) was initiated at 114:19 GET (9:42 a.m. EST), but was 49 minutes late due to intermittent PLSS communications during the EVA preparations. Proper communications were established during a rerun of the checklist. The cause is believed to have been a LM configuration problem. A recycling of the audio circuit breaker cleared the problem.

The CDR egressed from the LM at 114:27 GET (10:50 a.m. EST), and touched the lunar surface at 114:30 GET (9:53 a.m. EST). The LMP egressed and started down the ladder at 114:36 GET (9:59 a.m. EST). The LMP collected a contingency sample. The TV and S-band antenna were deployed, with the LMP subsequently ingressing the LM and activating the S-band erectable antenna. After LMP egress, the crew deployed the flag, solar wind composition experiment, and took panoramic TV pictures of the LM and lunar surface.

The ALSEP was deployed approximately 500 feet west of the LM with the laser-ranging retro-reflector being deployed an additional 100 feet west of the ALSEP. Lock-on to the ALSEP transmitter was obtained at about 117:27 GET (12:50 p.m. EST). Problems encountered during deployment were: (1) difficulty in release of Boyd bolt on the suprathermal ion detector; (2) stiffness in the cable between the suprathermal ion detector cold cathode ion gauge that coused the cold cathode ion gauge to fall over; (3) low transmitter strength on the central station; (4) noisy data from the suprathermal ion detector experiment; and (5) failure of five of the active seismic experiment thumper Apollo standard initiators to fire.

The contingency sample and about 43 pounds of lunar surface material were satisfactorily obtained and returned to the ascent stage.

EVA-1 was terminated at 119:08 GET (2:31 p.m. EST). The crew spent 4 hours 49 minutes, including the 30 minute extension, deploying equipment and experiments, exploring and collecting lunar samples.

Communications were nominal through the EVA. Gradual degradation of the TV picture resolution was noted during the later part of the EVA.

At the crew's request EVA-2 started at 131:48 GET (3:11 a.m. EST), 2 hours 27 minutes earlier than planned. All PLSS start parameters were nominal and operation remained good throughout the EVA. Prior to egress, the LMP reported a broken wrist cable which caused some loss in wrist mobility. The cable is not required for structural integrity, but is included in the design for wrist control. Cable failures in the wrist area have occurred in the past with no required termination of suited activity. The LMP glove was brought back for analysis.

Subsequent to the crew egress, the Mobile Equipment Transporter (MET) was loaded with the necessary photographic equipment and the lunar portable magnetometer (LPM). They then proceeded to traverse toward Cone crater. Enroute, various samples, photographs, and terrain descriptions were obtained. The LPM site measurement was made at the first stop (Station A) and a LPM traverse measurement was later made near Cone crater (see Figure 1).

Many interesting geological features were described and materials collected. The crew never quite got to the rim of Cone crater because of the slopes involved and running behind the timeline by about 30 minutes. Materials were collected in a blocky field near the rim.

On the return leg of the traverse, an estimated 1.5-foot trench was dug and samples taken. An unsuccessful triple core tube attempt was made, and other containerized samples were collected. An alignment adjustment was made to the ALSEP Central Station's antenna just prior to crew ingress preparations in order to improve the signal strength being received at the Manned Space Flight Network (MSFN) ground stations. This improved signal strength approximately 1/2 db; however, data can still be received by the 30-foot antenna.

The following tasks, none of which were mandatory, were not performed during EVA-2 because of timeline considerations or minor problems: (1) second LPM traverse measurement; (2) magnetic sample; (3) diametric sample; (4) gas analysis sample; (5) polarimetric photography; (6) traverse stops at stations D and E; (7) EVA communication evaluation; (8) boulder rolling; and (9) contaminated sample.

Ingress occurred at 136:23 GET for a total EVA duration of 4 hours 35 minutes. Total EVA time (EVA-1 and EVA-2) was 9 hours 24 minutes. Total weight of rocks collected was approximately 100 pounds.

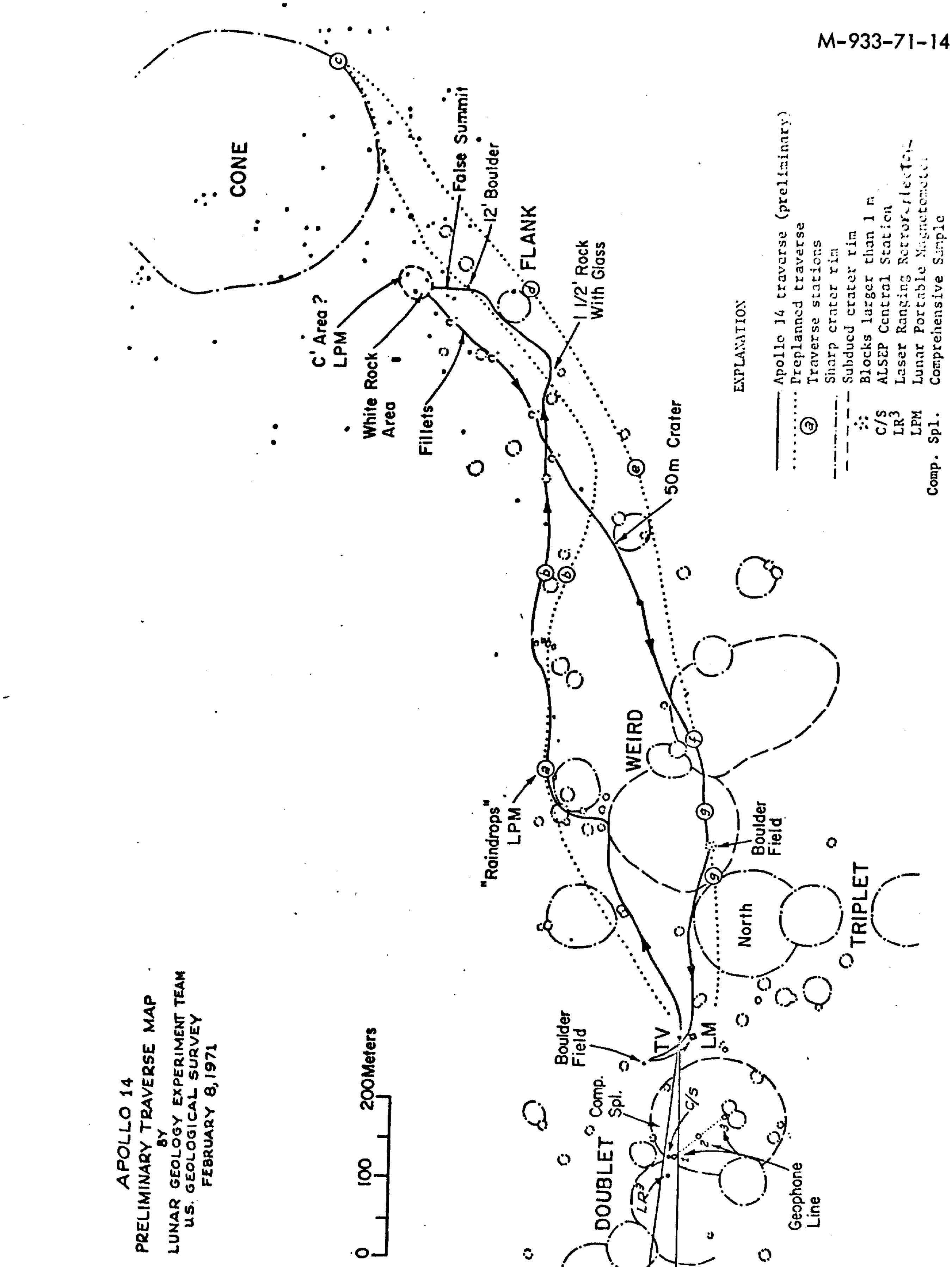

APOLLO 14
PRELIMINARY TRAVERSE MAP
BY
LUNAR GEOLOGY EXPERIMENT TEAM
U.S. GEOLOGICAL SURVEY
FEBRUARY 8, 1971
0
100
200Meters
N
CONE
False Summit
12' Boulder
FLANK
1 1/2' Rock With Glass
C' Area ? LPM
White Rock Area
Fillets
50m Crater
WEIRD
"Raindrops" LPM
Boulder Field
North
TRIPLET
TV
LM
Boulder Field
Comp. Spl.
C/S
DOUBLET
LR3
Geophone Line
EXPLANATION
Apollo 14 traverse (preliminary)
Preplanned traverse
Traverse stations
Sharp crater rim
Subdued crater rim
Blocks larger than 1 m
C/S ALSEP Central Station
LR3 Laser Ranging
LPM Lunar Portable
Comp. Spl. Comprehensive Sample

Fig. 1

The LM was depressurized, the excess equipment was offloaded, and the LM repressurized at about 137:08 GET (08:31 a.m. EST).

COMMAND MODULE SOLO ORBITAL ACTIVITIES

The CSM lunar orbital plane change (LOPC) maneuver was initiated at 118:09 GET. The SPS burn of 18:43 seconds produced a change in velocity of 370.5 fps.

The bootstrap strip photography planned for revolutions 27 and 28 with the lunar topographic camera was deleted beacuse of the malfunction of the lunar topographic camera. The bootstrap photography was accomplished using the 500mm lens on the Hasselblad camera. Slight retargeting on revolution 28 provided a greater photographed area of high resolution from which a Descartes landing point may be selected.

The CM activities were accomplished essentially in accordance with the nominal timeline except that the 70mm Hasselblad camera, 500mm lens system was used for Descartes photography because of the problems encountered with the lunar topographic camera. On revolution 30, the CMP took a third set of bootstrap photos of Descartes using the Hasselblad/500mm camera and lens. The CMP reported the high sun angle resulted in washout of surface details that he was able to see on the earlier bootstrap passes.

Numerous astronomic photography tasks were completed, including the Gegenschein Experiment, which are included in the Science Section of this report.

ASCENT, RENDEZVOUS, AND DOCKING

Liftoff from the lunar surface occurred at 142:25:42 GET. System performance throughout ascent was nominal. Engine cutoff occurred at 142:32:54 GET with velocity residuals less than 1 fps. A tweak burn was performed with the reaction control system (RCS) at 142:36:51 GET to null ascent residuals. Terminal phase initiation (TPI) was on time at 143:10:54 GET. During the braking phase for docking, telemetry indicated that the abort guidance system had failed, but no caution and warning signals were on. A cycling of all circuit breakers and switches did not remedy this condition. Docking was accomplished at approximately 144:13 GET. No probe/drogue problems were experienced. The probe was returned for post-flight analysis. TV during rendezvous and docking was excellent and clearly showed the docking maneuver.

POSTRENDEZVOUS

The LM RCS was utilized at 147:54 GET to cause the LM to impact the moon at about 148:22:19 GET. Impact coordinates were 3°25'S and 19°40'W. The planned coordinates were 3°31'S and 19°16'W (see Figure 2).

The ascent stage impact was recorded by Apollo 12 ALSEP and Apollo 14 ALSEP. On revolution 34, the CMP obtained Hasselblad 500mm photographs of the Apollo 13 S-IVB impact point.

MAP COORDINATES

EASEP SITE	0.65N	23.50E
ALSEP 1 SITE	2.95S	23.47W
ALSEP 4 SITE	3.67S	17.48W
ALSEP A2 SITE	26.08N	3.50E
APOLLO 12 LM IMPACT	3.94S	21.20W
APOLLO 13 SIVB IMPACT	2.40S	27.90W
APOLLO 14 SIVB IMPACT	7.81S	26.00W
APOLLO 14 LM IMPACT	3.42S	19.67W

DISTANCE, KM

	ALSEP 1	ALSEP 4
ALSEP 4	183.2	—
APOLLO 12 LM IMPACT	75.2	—
APOLLO 13 SIVB IMPACT	134.4	—
APOLLO 14 SIVB IMPACT	172.7	—
APOLLO 14 LM IMPACT	116.0	66.7

SCALE: 1 degree = 30.3 km

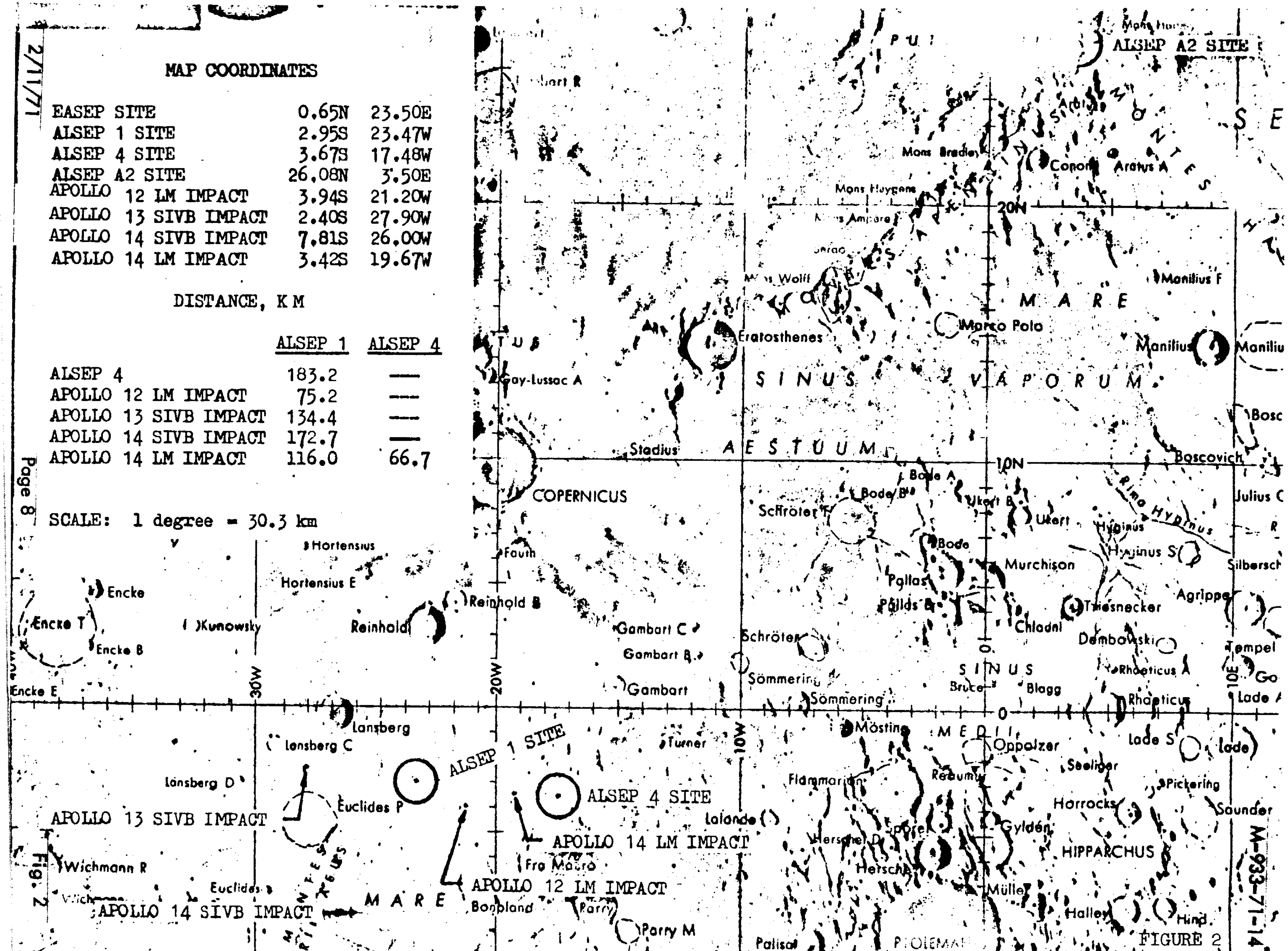


Fig. 2

FIGURE 2

M-933-71-14

TRANSEARTH INJECTION, COAST, AND ENTRY

The transearth injection maneuver (TEI) was successfully performed on time at 149:16 GET using the SPS. Initial tracking and telemetry shortly after the spacecraft emerged from behind the moon indicated the trajectory parameters were nominal.

MCC-5 was executed at 166:14 GET. The planned velocity change for the maneuver was 0.7 fps; however, only 0.5 fps was confirmed.

The O_2 flow rate test at 168:30 GET was progressing satisfactorily until approximately 169:20 GET at which time the O_2 manifold and water tank pressures dropped to 12 psig and 15 psia, respectively. At 169:26 GET these pressures read 8 psig and 13 psia. The cabin did not drop below 4.5 psia. Since these readings were not expected and a ready explanation was not available, the test was terminated at 169:40 GET.

Further review of the data indicated that a urine dump was made which also increased the O_2 flow through the main O_2 regulator. Since the test nozzle had been sized for maximum flow of the restrictors while maintaining a manifold pressure of about 100 psia, the additional demand of approximately 0.8 lb/hr (increase of 12 percent) by the urine dump operations exceeded the normal values established by the test criteria.

The inflight demonstrations commenced at 172:30 GET and were completed at 172:49 GET. The demonstrations performed were: composite casting, liquid transfer, and heat flow convection. All the demonstrations were televised and appeared to have performed satisfactorily.

MCC-6 was not performed since the spacecraft trajectory was near nominal.

A lunar seismic event was recorded by the Apollo 12 and Apollo 14 ALSEP's Passive Seismic Experiments (PSE's). The recording of the event started at the Apollo 14 ALSEP site at about 192:22 with the long period x axis showing the most activity. After 1.5 minute, the event reached the Apollo 12 ALSEP site with the long period y axis showing the most activity. The event duration was approximately 1 hour 10 minutes.

During the maneuver to the TV attitude preparatory to the press briefing, communications were momentarily lost. Communications were subsequently restored on the high gain antenna. The TV transmission in conjunction with the press briefing commenced at 195:09 GET. Good quality TV was transmitted through the briefing which ended at 195:32 GET.

Earth darkside dim light photography was performed at 198:24 GET.

At 201:24 GET, the Apollo 14 PSE leveling mode for the y axis was changed from auto to manual after no response was obtained in the automatic mode. Leveling was accomplished in the manual mode.

The LMP's respiration rate sensor was reported to be inoperable at 211:16 GET. The surgeon and flight controllers decided not to attempt to trouble shoot the inoperable sensor.

Since the spacecraft trajectory was near nominal, MCC-7 was cancelled. The flight path angle was -6.39 degrees.

CM/SM separation occurred at 216:12 GET and entry interface (EI) at 400,000 feet altitude was reached at 216:27 GET. Drogue and main parachutes deployed normally. Landing occurred about 14 minutes after EI at 216:42 GET (or 4:05 p.m. EST). The landing point was in the mid-Pacific Ocean, approximately 172°40'W longitude and 27°02'S latitude. The CM landed in the stable 1 position, about 4 NM from the prime recovery ship, USS New Orleans, and about 1 mile from the planned landing point.

Weather in the prime recovery area was good; visibility 10 miles, wind 15 knots, cloud cover 2000 feet, high, scattered, and wave height 4 feet.

ASTRONAUT RECOVERY OPERATIONS

Following landing, the recovery helicopter dropped swimmers who installed the flotation collar to the CM. A raft was deployed and attached to the flotation collar. Flight suits and oral/nasal masks were lowered into the raft and passed in to the crew through the spacecraft hatch. The postlanding ventilation fan was turned off, the CM was powered down, and the astronauts egressed. The swimmer closed the CM hatch and then decontaminated all garments, the hatch area, the collar, and the area around the post-landing vent valve.

The helicopter recovered the astronauts. After landing on the recovery carrier, the astronauts and a recovery physician entered the Mobile Quarantine Facility (MQF).

COMMAND MODULE RETRIEVAL OPERATIONS

After flight crew pickup by the helicopter, the CM was retrieved and placed in a dolly aboard the recovery ship. It was then moved to the MQF and mated to the transfer tunnel. From inside the MQF/CM containment envelope, the MQF engineer began post-retrieval procedures (removal of lunar samples, data, equipment, etc.), passing the removed items through the decontamination lock for delivery to the LRL. The crew will remain in the MQF until the recovery ship is near Samoa. Then the MQF occupants will egress the MQF and enter a double airlock in which clean flight suits and oral/nasal masks will be donned for the helicopter transfer to Samoa. The masks will be worn until the crew has entered a second MQF aboard a C-141 aircraft ready to transfer them to Ellington Air Force Base, Texas. The crew will remain in the MQF until its arrival at the LRL. The CM will be offloaded from the ship at Pearl Harbor where deactivation of the CM propellant system will be accomplished.

The Sample Return Containers (SRC's), film, data, etc., will be flown to Pago Pago by fixed-wing aircraft from USS NEW ORLEANS, and then by separate aircraft to Houston for transport to the LRL. Both of the SRC's should arrive at the LRL on 11 and 12 February.

SYSTEMS PERFORMANCE

The Saturn V stages performances were nominal except for the IU data dropouts at 0.4 second GET and 3:02:36.9 GET.

The spacecraft systems were also near nominal throughout the mission with the exception of the docking problems experienced at about 3:11 GET, the spurious signals in the Abort Guidance Computer at 106:30 GET which appeared to be generated by the abort switch and an occasional loss of communications. All anomalies are listed in Tables 9 through 12.

FLIGHT CREW PERFORMANCE

Apollo 14 flight crew performance throughout the flight was excellent. They exhibited exceptional poise during the CSM/LM docking attempts and, also, while troubleshooting the Abort Guidance Computer subsystem prior to the DOI maneuver.

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

C. M. Lee

PRELIMINARY SCIENCE REPORT

SCIENCE

Passive Seismic Experiment

The Passive Seismic Experiment (PSE) was leveled on command to 0.1" arc and the sensor assembly has reached equilibrium at 124.1°F. All axes are functioning nominally; however, the strength of the signal on the long period vertical (LPZ) appears low in comparison with the other two axes. The LPZ was recalibrated and found to be functioning nominally. It is believed the low amplitude signal may be a function of the lunar subsurface conditions.

Valuable scientific data was obtained from the S-IVB impact extending our seismic data from the lunar interior to depths of 35 - 40 km. The impact of the LM ascent stage between the Apollo 14 and Apollo 12 PSE produced a signal that was recorded on both instruments. Seismic wave velocity in lunar material at depth is approximately 5.5 km/sec and the frequency is 1 - 2 hertz; this agrees with the data obtained from Apollo 12.

Active Seismic Experiment

The Active Seismic Experiment was fully deployed. All three geophones are now in normal operation mode. The thumper mode was successfully completed during the first EVA with the thumper successfully firing 13 times. Nine of the 13 "thumps" were recorded on all three geophones. It is not yet certain that science data was recorded on the second geophone for the first four thumps. At that point, the second geophone was found to be loose and was again implanted in the lunar surface. The high bit rate (HBR) mode was successfully commanded "ON" at the beginning of the experiment and commanded "OFF" at the end. The mortar box assembly safety device has been removed and it is now ready to "arm" and "fire" on appropriate command.

Lunar Ionosphere Detector

The Lunar Ionosphere Detector (Supra Thermal Ion Detector Experiment - SIDE) dust cover has been removed. The high voltage is off and the instrument is in the "standby mode" until the temperature drops to approximately 24°C, i.e., approaching lunar sunset. This will allow sufficient time for the instrument to outgas.

Lunar Atmosphere Detector

The Lunar Atmosphere Detector (Cold Cathode Ionization Gauge) seal is open. The instrument made two measurements of cabin depressurization; one during the second EVA cabin depressurization and the second when equipment was jettisoned before LM liftoff. The instrument is now in standby with the high voltage off. High voltage will be turned on when the temperature drops to 24°C, i.e., near lunar sunset. This will allow sufficient time for the instrument to outgas.

Charged Particle Lunar Environment Experiment

The Charged Particle Lunar Environment Experiment (CPLEE) dust cover was removed following liftoff of the Apollo 14 ascent stage. As the ascent stage passed over the CPLEE at an elevation of 8 NM, the instrument recorded bursts of ions and electrons up to 200 electron volts. In addition the CPLEE recorded a variety of phenomena in the "Transition Region" of the earth's magnetic field which was entered by the moon on 6 February 1971 (see Figure 3).

Laser Ranging Retroreflector

The Laser Ranging Retroreflector (LR^3) was ranged on by the McDonald Observatory team prior to LM liftoff and a high quality signal was received. Weather conditions have prevented additional ranging required after liftoff to verify that the ascent stage engine burn did not degrade the LR^3.

Lunar Portable Magnetometer

The Lunar Portable Magnetometer (LPM) made two measurements; 100 gamma $\pm$10 to 15 in the direction of the Apollo 12 site (at Station A), and a 40 gamma $\pm$10 to 15 pointing 40° to the west at Station B.

CSM PHOTOGRAPHY

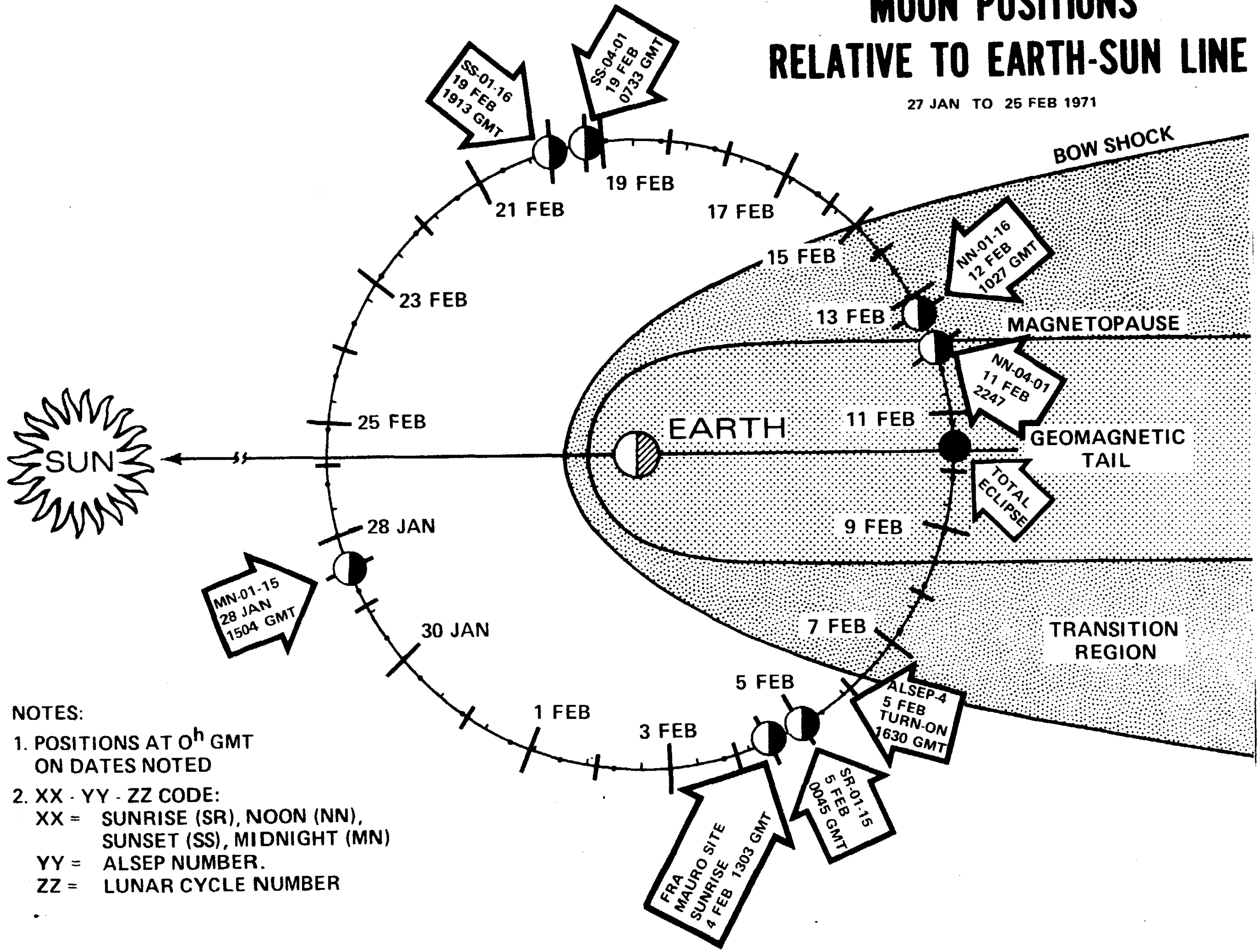
Lunar Topographic Camera Photography

The Lunar Topographic Camera (LTC) was planned to be used on revolutions 4, 14, 27, 28, 34, and during the transearth coast. The crew checked out the LTC by operating the camera for 9 frames during translunar coast. During the low orbit, revolution 4, Descartes photography, the CMP reported the LTC had malfunctioned. The camera had functioned properly up to frame 140; from frames 140 to 180 the camera became very noisy; from frames 180 to 240 the camera then appeared to function properly; and from frames 240 through the remaining operation to frame 420 the camera again became noisy.

After attempting to remedy the problem, it was decided to use the LTC on revolution 14 for a short operational period of about 1 - 2 minutes in order to obtain photographs of the LM during landing. The CMP reported normal operation during that time. Subsequent analysis and attempted operation of the camera failed to provide a valid explanation for the malfunction or to provide a satisfactory operating mode. As a result, the camera was not operated thereafter. Therefore, photographs of Descartes on revolutions 27, 28, and 30 were obtained using the 500mm lens on the Hasselblad camera.

MOON POSITIONS RELATIVE TO EARTH-SUN LINE

27 JAN TO 25 FEB 1971



NOTES:

1. POSITIONS AT 0^h GMT ON DATES NOTED
2. XX - YY - ZZ CODE:
   XX = SUNRISE (SR), NOON (NN), SUNSET (SS), MIDNIGHT (MN)
   YY = ALSEP NUMBER.
   ZZ = LUNAR CYCLE NUMBER

Fig. 3

M-933-71-14

Experiments

Four orbital experiments were conducted on Apollo 14. These were the Apollo Window Micrometeoroid, the S-band Transponder, the Bistatic Radar (VHF and S-band), and the Gegenschein. Since the first two were passive experiments, they will not be discussed here.

Downlink Bistatic Radar Experiment

The Bistatic Radar Experiment consists of VHF and S-band transmissions from the CSM during a lunar frontside pass, with ground based detection of both the direct transmission carrier signals and the reflected signal from the lunar surface. The VHF portion of the experiment was conducted during the CMP scheduled rest period while the LM was on the lunar surface. The S-band portion of the experiment was conducted after the CMP awoke since the experiments required specific CSM attitudes; this experiment was conducted for 45 minutes on revolution 25.

VHF — During the VHF portion of the Bistatic Radar Experiment, the investigators used an on-line spectrum analyzer at the Stanford 150-foot antenna receiver for real time monitoring of the signal. The analyzer indicated a surface echo was received throughout the VHF operation.

S-band — Data for this portion of the experiment was recorded at the Goldstone 210-foot antenna. The Goldstone tracking station had some intermittent problems with the open loop receiver, but proper operation was achieved during the experiment period. The closed loop receiver operated normally. Station personnel reported oscilloscope indications of echo modulation of the carrier.

Summary — All indications are that both portions of the Bistatic experiment were a success. Computer work on the data has started. Approximately 200 hours of computer time will be required, and data analysis will continue on a daily basis.

Gegenschein Experiment

The Gegenschein experiment was carried out using the DAC camera while the CSM was in the moon's umbra. Results are dependent upon post-flight analysis.

Photographic Tasks

(Dim light and lunar surface) — Based on the CMP's occasional comments on percent of remaining film, etc., it is assumed the majority of these tasks were conducted, except those that were planned to be carried out with the LTC.

Hasselblad photography (80mm Reseau using 250 and 500mm lenses) of the lunar surface was obtained. The number of frames used is unknown. The CMP commented several times he had taken both 250 and 500mm photographs of the target of opportunities. The important Hasselblad/80mm photo strip to obtain approach photography to the Descartes landing site was accomplished on revolution 26.

ZERO GRAVITY INFLIGHT DEMONSTRATIONS

Four demonstrations were tested during the Transearth Coast phase of the mission. A TV presentation describing and illustrating the operation of the demonstration was made at 172:30 GET.

Electrophoretic Separation

The operation of the unit and its objectives were explained during the TV presentation.

The astronauts reported that the required test was completed following the TV presentation.

Liquid Transfer

The unit was successfully operated and testing was completed in accordance with the requirements prior to TV. The tests produced the desired results. The TV presentation effectively showed the advantages of using the baffled tanks in a weightless environment.

Heat Flow and Convection

One test with the radial and zone cells was completed in accordance with the requirements prior to the TV performance. In this timeframe, the astronauts made a number of attempts to inject the oil into the Flow Pattern cell. The oil adhered to the corner at the junction between the side wall and bottom of the cell and would not flow uniformly over the botton of the surface as expected.

During TV, the radial and zone cell operation was repeated for presentation and illustrated the principles effectively. On being questioned by CAPCOM as to why the astronauts were not using the Flow Pattern cell, they replied noting the aforementioned anomaly. The demonstrators suggested that the astronauts spread the oil to the center of the cell. This suggestion was followed. The oil film was established and after a period of time, Binard cells formed, as expected.

The astronauts reported that they completed the required procedures following the TV presentation.

Composite Casting

Four samples (nos. 4, 5, 6, and 7) were successfully processed through the heating, shaking, and cooling cycle prior to the TV presentation.

The astronauts illustrated the processing of a sample during the TV presentation and noted that more samples would be processed.

TABLE 1 SHEET 1

APOLLO 14

OBJECTIVES AND EXPERIMENTS

I. PRIMARY OBJECTIVES

The following were the OMSF Apollo 14 Primary Objectives:

- o Perform selenological inspection, survey, and sampling of materials in a preselected region of the Fra Mauro formation.
- o Deploy and activate Apollo Lunar Surface Experiments Package (ALSEP).
- o Develop man's capability to work in the lunar environment.
- o Obtain photographs of candidate exploration sites.

II. DETAILED OBJECTIVES AND EXPERIMENTS

The following were the approved Detailed Objectives and Experiments:

SPACECRAFT

Priority	Title
1	Contingency Sample Collection
2	Apollo Lunar Surface Experiments Package (ALSEP) Array C
3	Lunar Geology Investigation (S-059)
4	Photographs of Candidate Exploration Sites
5	Laser Ranging Retro-Reflector (S-078)
6	Soil Mechanics (S-200)
7	Portable Magnetometer (S-198)
8	Visibility at High Sun Angles
9	Mobile Equipment Transporter Evaluation
10	Selenodetic Reference Point Update
11	Bistatic Radar (S-170)
12	CSM Orbital Photographic Tasks
13	Assessment of EVA Operation Limits
14	CSM Oxygen Flow Rate
15	Solar Wind Composition
16	Thermal Coasting Degradation
17	EVA Communication System Performance
18	Gegenschein From Lunar Orbit (S-178)
19	S-Band Transponder (S-164)
--	Apollo Window Meteoroid (S-176)*
--	Bone Mineral Measurement (M-078)*

*Passive experiments; priorities not assigned

POST-TLI

LAUNCH VEHICLE DETAILED OBJECTIVES

Impact the expended S-IVB/IU on the lunar surface under nominal flight profile conditions.

Postflight determination of actual S-IVB/IU point of impact within 5 km, and time of impact within 1 second.

III. APPROVED EXPERIMENTS

The following are the experiments performed during the mission:

ALSEP

S-031	Passive Seismic Experiment
S-033	Active Seismic Experiment
S-036	Suprathermal Ion Detector
S-038	Charged Particle Lunar Environment
S-058	Cold Cathode Ion Gauge Experiment
M-515	Lunar Dust Detector

LUNAR SURFACE

S-059	Lunar Geology Investigation
S-078	Laser Ranging Retro Reflector
S-080	Solar Wind Composition
S-198	Portable Magnetometer
S-200	Soil Mechanics

LUNAR ORBIT

S-154	CSM/LM S-Band Transponder Experiment
S-174	Down Link Bistatic Radar Experiment
S-176	Apollo Window Meteoroid Experiment
S-178	Gegenschein From Lunar Orbit

OTHER

M-078	Bone Mineral Measurement

IV. SUMMARY

1. It is considered that accomplishment of the Primary Objectives, paragraph (I), qualify Apollo 14 as a success. The accomplishment of the Detailed Objectives and Experiments identified in paragraph (II) and (III) further enhanced the scientific and technological return of this mission.

TABLE 1 SHEET 3

2. Other major activities not listed as Detailed Objectives or Experiments:

   a. SPS DOI
   b. Shortened rendezvous
   c. Deorbit of LM ascent stage

9 FEB 1971

TABLE 2

APOLLO 14 ACHIEVEMENTS

- THIRD MANNED LUNAR LANDING MISSION AND RETURN
- FIRST USE OF MOBILE EQUIPMENT TRANSPORTER (MET)
- LARGEST PAYLOAD PLACED IN LUNAR ORBIT
- LONGEST DISTANCE TRAVERSED ON THE LUNAR SURFACE
- LARGEST PAYLOAD EVER RETURNED FROM THE LUNAR SURFACE
- LONGEST LUNAR SURFACE STAY TIME (33 HOURS)
- LONGEST TOTAL EVA (9 HOURS AND 24 MINUTES)
- FIRST USE OF SHORTENED RENDEZVOUS TECHNIQUE
- FIRST SPS DOI
- FIRST CONDUCT OF ACTIVE SEISMIC EXPERIMENT - CPLEE, LPM
- FIRST CONDUCT OF INFLIGHT DEMONSTRATIONS
- USE OF COLORED TV WITH NEW VIDICON TUBE ON LUNAR SURFACE
- FIRST EXTENSIVE ORBITAL SCIENCE PERIOD CONDUCTED DURING CSM SOLO OPERATIONS

APOLLO 14

TABLE 3

POWERED FLIGHT SEQUENCE OF EVENTS

EVENT	PRE-LAUNCH PLANNED (GET) HR:MIN:SEC	ACTUAL (GET) HR:MIN:SEC
Guidance Reference Release	-17.3	-17.5
Liftoff Signal (TB-1)	0	0
Pitch and Roll Start	13.0	12.8
Roll Complete	29.0	28.8
S-IC Center Engine Cutoff (TB-2)	2:15.0	2:14.7
Begin Tilt Arrest	2:43.0	2:42.8
S-IC Outboard Engine Cutoff (TB-3)	2:44.8	2:43.5
S-IC/S-II Separation	2:45.5	2:44.2
S-II Ignition (Command)	2:46.2	2:44.9
S-II Second Plane Separation	3:15.5	3:14.2
LET Jettison	3:21.2	3:20.7
S-II Center Engine Cutoff	7:43.8	7:42.5
S-II Outboard Engine Cutoff (TB-4)	9:16.7	9:18.5
S-II/S-IVB Separation	9:17.7	9:19.5
S-IVB Ignition	9:17.8	9:19.6
S-IVB Cutoff (TB-5)	11:42.4	11:39.5
Insertion	11:52.2	11:49.3
Begin Restart Preps (TB-6)	2:19:09.7	2:18:53.4
Second S-IVB Ignition	2:28:47.7	2:28:31.4
Second S-IVB Cutoff (TB-7)	2:34:43.6	2:34:22.4
Translunar Injection	2:34:53.4	2:34:32.2

*Not available

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

TABLE 4

APOLLO 14
MISSION SEQUENCE OF EVENTS

EVENT	*PLANNED (GET) HR:MIN:SEC	ACTUAL (GET) HR:MIN:SEC
Range Zero (04:03:00 EST, Jan 31)	00:00:00	00:00:00
Earth Parking Orbit Insertion	00:11:52	00:11:49
Second S-IVB Ignition	02:28:47	02:34:22
Translunar Injection	02:30:38	02:28:30
CSM/S-IVB Separation, SLA Panel Jettison	03:01:34	03:02:30
CSM/LM Docking	03:11:34	04:57:00
Spacecraft Ejection From S-IVB	03:56:34	05:47:25
S-IVB APS Evasive Maneuver	04:19:35	06:04:20
Midcourse Correction-1	11:36:34	Not Performed
Midcourse Correction-2 Transfer Maneuver	30:36:07	30:36:07
Midcourse Correction-3	60:38:14	Not Performed
Midcourse Correction-4	77:38:14	78:38:14
Lunar Orbit Insertion (Ignition)	82:36:58	82:36:43
Descent Orbit Insertion (Ignition)	86:50:41	86:50:55
CSM/LM Undocking	104:27:31	
CSM Separation	104:27:31	104:28:00
CSM Circularization	105:46:49	105:51:48
Powered Descent Initiate	108:42:01	108:42:29
LM Lunar Landing	108:53:53	108:54:02
Begin EVA-1	113:30:00	114:19:00
CSM Plane Change (LOPC)	118:09:40	118:09:35
Begin EVA-2	134:15:00	131:48:00
Terminate EVA-2	138:30:00	136:16:00
LM Liftoff	142:24:29	142:25:42
LM Tweak Burn	142:34:40	142:36:51
Terminal Phase Initiate Maneuver	143:09:40	143:10:54
LM/CSM Docking	144:10:00	144:13:00
LM Jettison	146:23:31	146:25:00
CSM Separation	146:28:31	146:30:00
Ascent Stage Deorbit	147:52:59	147:54:19
Ascent Stage Lunar Impact	148:20:58	148:22:19
Transearth Injection	149:14:50	149:16:04
Midcourse Correction-5	166:17:17	166:14:59
Midcourse Correction-6	194:24:05	Not Performed
Midcourse Correction-7	213:24:05	Not Performed
CM/SM Separation	216:09:05	216:12:50
Entry Interface (400,000 ft)	216:24:05	216:27:47
Landing	216:38:00	216:42:01

APOLLO 14 TRANSLUNAR MANEUVER SUMMARY

DATE: 9 February 1971

TABLE 5

MANEUVER	GROUND ELAPSED TIME (GET) AT IGNITION (HR:MIN:SEC:)			BURN TIME (SECONDS)			VELOCITY CHANGE (FEET PER SECOND - FPS)			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)	02:30:38	02:28:30	02:28:30	355.7	352.0	350.8	10 353.1	10 355.8	10 346.5	82:39:29 2030	82:10:50 2022	82:10:50 2022
CSM SEP	03:01:34	02:59:23	03:02:30	3.0	---	*	0.5	---	*	82:39:29 2030	82:10:50 2022	82:10:50 2022
CSM DOCK	03:11:34	03:13:56	04:57:00	N.A.			N.A.			82:39:29 2030	82:10:50 2022	82:10:50 2022
CSM/LM SEP	03:56:34	03:56:00	05:47:25	3.0	3.0	6.9	0.4	0.3	0.8	82:39:29 2030	----	82:15:19 1980
S-IVB EVASIVE	04:19:35	06:04:20	06:04:20	80.2	80.0	80.0	9.7	9.5	9.5	83:03:04 0	----	82:36:03 0
MCC-1 (SPS)	11:36:34	---	N.P.	0.0	---	N.P.	0.0	---	N.P.	83:39:29 2030	NP	NP
MCC-2 (SPS)	30:36:07	30:36:07	30:36:07	11.1	10.3	10.14	73.4	71.4	71.1	82:40:58 59.9	82:00:37 60.3	82:00:45 67.1
MCC-3	60:38:14	---	N.P.	0.0	---	N.P.	0.0	---	N.P.	82:40:58 59.9	N.P.	82:40:48 65.8
MCC-4	77:38:14	77:38:14	77:38:14	0.0	0.7	0.6	0.0	3.8	3.5	82:40:58 59.9	82:40:35 60.7	82:40:36 60.7

*Data not available
N.P. Not performed
N.A. Not Applicable

M-933-71-14

APOLLO 14 LUNAR ORBIT SUMMARY

TABLE 6

DATE: 9 February 1971

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	82:36:58	82:36:43	82:36:43	369.5	372.3	372.2	2986.5	3022.7	3022.4	169.3 / 58.4	169.3 / 58.1	169 / 58.4
DOI	86:50:41	86:50:55	86:50:55	21.6	20.8	20.7	206.7	206.4	205.7	58.5 / 9.8	58.8 / 9.1	58.8 / 9.6
UNDOCKING	104:27:31			N.A.			N.A.			59.5 / 8.2		
CSM SEP	104:27:31	104:27:31	104:28:00	3.2	3.2	2.7	1.0	1.0	0.8	59.5 / 8.2	60.2 / 7.8	60.2 / 7.8
CSM CIRC	105:46:49	105:51:48	105:51:48	3.9	3.8	3.8	72.5	76.2	77.2	63.5 / 56.0	63.3 / 55.6	63.9 / 56.0
PDI	108:42:01	108:42:29	108:42:29	691.5	693.5	693.5	6638	6639.1	6639.1	0 / 0		
LANDING	108:53:53	108:54:02	108:54:02	N.A.			N.A.			N.A. / N.A.		
CSM LOPC	118:09:40	118:09:35	118:09:35	18.6	18.45	18.43	360.7	371.0	370.5	61.7 / 57.4	62.1 / 57.2	62.1 / 57.6
ASCENT	142:24:29	142:25:42	142:25:42	430.7	432.0	432.0	6053.4	6066.1	6066.1	51.0 / 9.1	52.1 / 9.2	52.1 / 9.2
TWEAK	142:34:40	142:36:51	142:36:51	0			0	10.0	10.0	50.3 / 9.1		
TPI	143:09:40	143:10:54	143:10:54	4.0			92.2	100.7		61.0 / 44.6		
DOCKING	144:10:00		144:13:00	N.A.			N.A.			60.2 / 58.7		
LM JETT	146:23:31	146:25:00	146:25:00	N.A.			N.A.			60.6 / 58.7		63.4 / 56.8
CSM SEP	146:28:31	146:30:00	146:30:00	6.0	6.0	7.0	1.0	1.0	1.2	60.2 / 58.3	61.8 / 56.9	62.3 / 56.8
ASC DEORB	147:52:59	147:54:19	147:54:19	77.0	75.4	75.4	183.7	186.1	186.1	58.4 / 63.9	56.7 / -62.1	56.8 / -62.2
ASC IMPACT	148:20:58	148:22:19	148:22:19	N.A.			N.A.			N.A. / N.A.		

N.A.--Not Applicable

2/11/71

APOLLO 14 TRANSEARTH MANEUVER SUMMARY

TABLE 7

DATE 9 February 1971

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
										--- ---	--- ---	--- ---
TEI (SPS)	149:14:50	149:16:04	149:16:04	149.2	148.1	148.1	3449.5	3460.6	3460.6	216:24:05 36 170.7 -6.5	216:23:05 36170.8 -6.5	216:31:25 36126.9 -7.3
MCC-5	166:17:17	166:14:59	166:14:59	0.0	2.9	2.2	0.0	0.7	0.5	216:24:05 36 170.7 -6.5	216:27:18 36170.5 -6.97	216:27:31 36170.4 -6.63
MCC-6	194:24:05	---	N.P.	0.0			0.0	---	N.P.	216:24:05 36 170.7 -6.5	--- ---	--- ---
MCC-7	213:24:05		N.P.	0.0			0.0		N.P.	216:24:05 36 170.7 -6.5	--- ---	--- ---
CM/SM SEP	216:09:05	216:12:47	216:12:50	N.A.			N.A.			N.A. N.A. N.A.	--- ---	--- ---
ENTRY	216:24:05	216:27:47	216:27:47	N.A.			N.A.			216:24:05 36 170.7 -6.5	216:27:47 36 170 -6.4	216:27:47 36 170 -6.4
SPLASH	216:38:00	216:41:38	216:42:01	N.A.			N.A.			N.A. N.A. N.A.	--- ---	--- ---
										--- ---	--- ---	--- ---
										--- ---	--- ---	--- ---
										--- ---	--- ---	--- ---

N.A.--Not Applicable
N.P.--Not Performed

APOLLO 14 CONSUMABLES SUMMARY

END OF MISSION

TABLE 8

DATE: Feb. 9 1971

CONSUMABLE		LAUNCH LOAD	FLIGHT PLANNED REMAINING	ACTUAL REMAINING
CM RCS PROP (Pounds)	U	208.6	Not Available	Not Available
SM RCS PROP (Pounds)	U	1233	34.4	518
SPS PROP (Pounds)	TK	40796	2202.0	1977.1
SM HYDROGEN (Pounds)	U	53.4	14.90	15.25
SM OXYGEN (Pounds)	U	835	324.2	438.6
LM RCS PROP (Pounds)	U	548.9	**181.2	**200.0
LM DPS PROP (Pounds)	U	18103.5	*327.1	*262.4
LM APS PROP (Pounds)	U	5161.2	**190.2	**164.6
LM A/S OXYGEN (Pounds)	T	4.86	**4.66	Transducer known to be erroneous
LM D/S OXYGEN	T	42.2	*18.7	*19.4
LM A/S WATER (Pounds)	T	85	**73.0	**73.0
LM D/S WATER (Pounds)	T	266	*77	*70
LM A/S BATTERIES (AMP-HOURS)	T	592	** N/A	**310.3
LM D/S BATTERIES (AMP-HOURS)	T	1600	*371	*409.0

D - Deliverable Quantity
U - Usable Quantity
TK - Tank Quantity
T - Total Quantity

* - At LM ascent stage liftoff
** - AT LM ascent stage impact
NA - Not Applicable

TABLE 9

SA-509 LAUNCH VEHICLE

DISCREPANCY SUMMARY

1. AT 0.4 SECONDS FROM RANGE ZERO THE IU 270 MULTIPLEXER DATA WAS LOST. (59 of 122 ANALOG MEASUREMENTS)

2. AT 3:02:35.9 GET IU 410K MULTIPLEXER DATA WAS LOST CAUSING THE LOSS OF THE H60-603 GUIDANCE COMPUTER.

TABLE 10

COMMAND/SERVICE MODULE 110

DISCREPANCY SUMMARY

1. COMMANDER'S EKG WAS NOT WORKING PRIOR TO LIFTOFF.
2. FIRST SEVERAL ATTEMPTS AT DOCKING WERE UNSUCCESSFUL.
3. REACTION CONTROL SYSTEM QUAD B OXIDIZER MANIFOLD PRESSURE LOSS AT SPACECRAFT/LAUNCH VEHICLE SEPARATION.
4. INTERMITTENT LOSS OF HIGH GAIN ANTENNA PITCH MEASUREMENT ON TELEMETRY FROM 03:22:00 TO 06:31:00 HOURS APOLLO ELAPSED TIME.
5. UNEXPLAINED VENTING ON LEFT SIDE OF S/C WITH HIGHER THAN NORMAL OXYGEN FLOW.
6. OXYGEN TANK 2 PRESSURE TRACKING TANK 3 DURING HEATER CYCLE.
7. BETWEEN 76:45 AND 76:55 PROPER HIGH GAIN ANTENNA AUTO-TRACK COULD NOT BE ACHIEVED.
8. HIGH GAIN ANTENNA FAILED TO ACQUIRE IN NARROW BEAM AUTO REACQUISITION MODE DURING REVOLUTION 6.

TABLE 11

LUNAR MODULE-8

DISCREPANCY SUMMARY

1. ASCENT BATTERY 5 VOLTAGE WAS .3 VOLT LOWER THAN BATTERY 6.

2. LGC ABORT SWITCH DESCENT ENGINE BIT SET OCCURRED FOUR TIMES PRIOR TO POWERED DESCENT INITIATION. RECURRED AGAIN AFTER ASCENT PHASE FROM LUNAR SURFACE.

3. C/B OF S-BAND STEERABLE POPPED - RECURRED AGAIN AFTER ASCENT PHASE FROM LUNAR SURFACE.

4. WATER SEPARATOR SPEED (GF9999) ERRATIC.

5. LANDING RADAR TURNED ON WITHIN LOW SCALE INSTEAD OF HIGH. EXCESSIVE SLANT RANGE CHANGES WERE NOTED DURING THE FIRST 8 SEC AFTER INITIAL ACQUISITION.

6. PLSS COMM. INTERMITTENT DURING INITIAL ACTIVATION GET 113:45.

7. PROBLEM WITH ACQUISITION ON LM STEERABLE ANTENNA ON TENTH AND FOURTEENTH REVOLUTIONS.

8. LOSS OF ABORT GUIDANCE SYSTEM AFTER BRAKING DURING RENDEZVOUS.

9. LOOSE ITEM HANGING OFF THE ASCENT STAGE.

TABLE 12

APOLLO 14 CREW/EXPERIMENT EQUIPMENT

DISCREPANCY SUMMARY

1. HYCON CAMERA MAGAZINE MAKING CLACKING TYPE NOISE GET 89:45.
2. OF THE 18 IGNITERS USED IN THE THUMPER, 5 FAILED TO FIRE.
3. COLOR TELEVISION PICTURE BECAME FUZZY.
4. BOYD BOLTS DIFFICULT TO RELEASE ON ALSEP/SIDE EXPERIMENT.
5. STIFFNESS OF CABLE BETWEEN SIDE AND CCGE.
6. APPARENT LOW TRANSMITTER POWER OUTPUT ON CENTRAL STATION.
7. NOISY DATA ON SIDE.
8. LUNAR MODULE PILOT RIGHT HAND EVA GLOVE WRIST CONTROL CABLE REPORTED BROKEN.