Post Launch
Mission Operation Report
No. M-932-69-12

TO: A/Administrator

25 November 1969

FROM: MA/Apollo Program Director

SUBJECT: Apollo 12 Mission (AS-507) Post Launch Mission Operation Report #1

The Apollo 12 Mission was successfully launched from the Kennedy Space Center on Friday, 14 November 1969 and was completed as planned, with recovery of the spacecraft and crew in the Pacific Ocean recovery area on Monday, 24 November 1969. Initial review of the flight indicates that all mission objectives were attained. Further detailed analysis of all data is continuing and appropriate refined results of the mission will be reported in the Manned Space Flight Centers' technical reports.

Attached is the Mission Director's Summary Report for Apollo 12 which is hereby submitted as Post Launch Mission Operation Report #1. Also attached are the NASA OMSF Primary Mission Objectives for Apollo 12. I recommend that the Apollo 12 Mission be adjudged as having achieved all the established Primary Objectives and be considered a success.

Rocco Petrone

APPROVAL:

for George E. Mueller
Associate Administrator for
Manned Space Flight

M-932-69-12

NASA OMSF PRIMARY MISSION OBJECTIVES FOR APOLLO 12

PRIMARY OBJECTIVES

- Perform selenological inspection, survey, and sampling in a mare area.
- Deploy and activate an Apollo Lunar Surface Experiments Package (ALSEP).
- Develop techniques for a point landing capability.
- 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: 31 October 1969

Charles W. Mathews
for George E. Mueller
Associate Administrator for
Manned Space Flight

Date: 11-3-69

RESULTS OF APOLLO 12 MISSION

Based upon a review of the assessed performance of Apollo 12, launched 14 November 1969 and completed 24 November 1969, this mission is adjudged a success in accordance with the objectives stated above.

Rocco A Petrone
Rocco A. Petrone
Apollo Program Director

Date: 25 November 1969

Charles W. Mathews
for George E. Mueller
Associate Administrator for
Manned Space Flight

Date: 25 November 1969

10/29/69

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

IN REPLY REFER TO: MAO

25 November 1969

TO: Distribution

FROM: MA/Apollo Mission Director

SUBJECT: Mission Director's Summary Report, Apollo 12

INTRODUCTION

The Apollo 12 Mission was planned as a lunar landing mission to: perform selenological inspection, survey, and sampling in a mare area; deploy and activate an Apollo Lunar Surface Experiments Package (ALSEP); develop techniques for a point landing capability; develop man's capability to work in the lunar environment; and obtain photographs of candidate exploration sites. Flight crew members were: Commander (CDR), Cdr. Charles Conrad, Jr.; Command Module Pilot (CMP), Cdr. Richard F. Gordon, Jr.; Lunar Module Pilot (LMP), Cdr. Alan L. Bean. Significant detailed mission information is contained in Tables 1 through 11. Initial review of the flight indicates that all mission objectives were attained (Reference Table 1). Table 2 lists Apollo 12 mission achievements.

PRELAUNCH

An unscheduled 6-hour hold occurred at T-17 hours (spacecraft cryogenic loading) in order to replace Service Module (SM) liquid hydrogen tank No. 2 which had been leaking. The weather conditions at launch were: peak ground winds of 14 knots, light rain showers, broken clouds at 800 feet, and overcast at 10,000 feet with tops at about 21,000 feet.

LAUNCH AND EARTH PARKING ORBIT

The Apollo 12 space vehicle was successfully launched on schedule from Kennedy Space Center, Florida, at 11:22 a.m. EST on 14 November 1969. All launch vehicle stages performed satisfactorily, inserting the S-IVB/IU/LM/CSM combination into an earth parking orbit with an apogee of 102.5 nautical miles (NM) and a perigee of 99.9 NM (103 NM circular planned). All launch vehicle systems operated satisfactorily except for two minor off-nominal conditions which were noted in the launch vehicle digital computer. During the ascent (36.5 to 52 seconds ground elapsed time (GET)) a number of spacecraft electrical transients also occurred. The tentative conclusion is that the cause of these events was an electrical potential discharge from the clouds through the space vehicle to the ground.

After orbital insertion, launch vehicle and spacecraft systems were verified, preparations were made for translunar injection (TLI) as planned, and the second S-IVB burn was initiated on schedule (Reference Tables 3, 4, and 5). All major systems operated satisfactorily and all end conditions were nominal for a free-return circumlunar trajectory. The prelaunch planned height of closest approach of the spacecraft after the TLI maneuver was 1851 NM prior to the second midcourse correction, MCC-2, as shown in Table 5. The actual height of closest approach, after TLI and prior to MCC-2, was estimated to be 457 NM, the spacecraft still being injected on a free-return trajectory. This difference appears to be due to a state vector error in the Saturn Instrument Unit (IU). The error was known before TLI, but because of time limitations, the decision was made to ignore it and not change the TLI targeting.

TRANSLUNAR COAST

The Command/Service Module (CSM) separated from the LM/IU/S-IVB at about 3:18 (hr:min) GET. Onboard television was initiated shortly thereafter and clearly showed docking with the Lunar Module (LM) at 3:27 GET. Ejection of the CSM/LM was successfully accomplished at about 4:14 GET and an S-IVB Auxiliary Propulsion System (APS) evasive maneuver was performed (and observed on television) at 4:27 GET. All launch vehicle safing activities were performed as scheduled.

The S-IVB slingshot maneuver was initiated on schedule. The total APS burn time was 570 seconds of which 270 seconds were due to a commanded burn. Due to the same IU state vector errors that affected the TLI result, the slingshot maneuver did not achieve the desired heliocentric orbit but rather a geocentric orbit with the following parameters: period - 39 to 45 days; apogee - 448,000 to 487,000 NM; perigee - 81,000 to 95,000 NM. The S-IVB/IU closest approach to the moon was 3091 NM at 85:48 GET.

To insure that the electrical transients noted in the CSM during launch had not affected the LM systems, the CDR and LMP entered the LM earlier than planned, at about 7:20 GET, to perform some of the housekeeping and systems checks. All checks indicated that the LM systems were satisfactory.

The TLI maneuver parameters were accomplished such that the CSM/LM were on an acceptable free-return trajectory and MCC-1, scheduled for 11:53 GET, was not required.

MCC-2 was performed as planned at 30:53 GET and resulted in placing the spacecraft on the desired hybrid, non-free-return circumlunar trajectory with a closest approach of 60 NM. All SM Service Propulsion System (SPS) burn parameters were normal.

Good quality television coverage of the preparations and performance of MCC-2 was received for 47 minutes. The accuracy of MCC-2 was such that neither MCC-3 (scheduled for 61:31 GET) nor MCC-4 (78:31 GET) was required.

The CDR and LMP began their intravehicular transfer to the LM during translunar coast about 1/2 hour earlier than planned in order to obtain full television coverage through the Goldstone tracking station. The 56-minute transmission, beginning at 62:52 GET, showed excellent color pictures of the Command Module (CM), intravehicular transfer, the LM interior, and brief shots of the earth and moon. The television clearly showed numerous linear streaks in CM window number 1 as previously reported. The crewmen completed their activities in the LM in under 40 minutes.

LUNAR ORBIT

Lunar orbit insertion (LOI) was performed in two separate maneuvers, LOI-1 and LOI-2, using the SPS. LOI-1, initiated at 83:25 GET, placed the spacecraft in a 168.8 by 62.6-NM elliptical orbit. LOI-2, initiated two revolutions later at 87:49 GET, placed the spacecraft in a near-circular orbit of 66.1 by 54.3 NM. Table 6 summarizes the maneuvers performed by the CSM and LM in lunar orbit.

During the first lunar orbit, good quality television coverage of the lunar surface was received for about 33 minutes. The crew provided excellent descriptions of the lunar features while transmitting sharp pictures back to earth. A television broadcast scheduled for 81:30 GET prior to LOI-1 was cancelled due to the sun angle and the glare on the spacecraft windows.

One revolution after LOI-2 the LM crew transferred to the LM and performed various housekeeping chores and communications checks in preparation for lunar descent the following day. The intravehicular transfer and LM activities lasted about 1-1/2 hours, during which time the LM was powered up about 22 minutes.

CSM/LM docking took place at 107:54 GET. Television pictures clearly showed the LM landing gear to be in the deployed position. The CSM separation maneuver was successfully executed as planned at 108:25 GET, using the SM Reaction Control System (RCS). The descent orbit insertion (DOI) maneuver was also successfully executed as planned at 109:24 GET, using the LM Descent Propulsion System (DPS).

DESCENT

The LOI maneuver resulted in a CSM/LM position some 4 to 5 NM north of the expected ground track prior to DOI. This crossrange error was known prior to DOI and was corrected during the powered descent maneuver, which was on time at 110:21 GET. The initial LM roll angle resulted from an initial crossrange distance of 4.9 NM. The LM guidance computer was updated during powered descent to compensate for indications that the trajectory was coming in 4200 feet short of the target point. The initial crossrange distance was continuously reduced throughout the braking phase. At entry into the approach phase the spacecraft's trajectory was very close to nominal. Redesignations were incorporated during the approach phase. The crew took over manual control at about 370 feet, passed over the right side of the target crater, then flew to the left for landing at 110:32:35 GET (01:54:35 a.m. EST, 19 November. The Commander reported extensive dust obscuring his view during final descent. The actual landing point is estimated to be about 600 feet from the Surveyor III spacecraft. Landing coordinates are 3.036°S, 23.418°W. LM tilt on the surface was 3.5° from the vertical and the LM was pointing on an azimuth of 295° (10° right of the approach path).

During the next CSM revolution, the Commander reported a visual sighting of the CSM orbiting overhead. On the following CSM revolution, the CMP reported sighting the Surveyor III spacecraft as well as the LM northwest of Surveyor III.

LUNAR SURFACE

The first extravehicular activity period (EVA-1) started at 115:11 GET, about 1/2 hour later than planned due to time spent in establishing the location of the landed LM and general preparations for EVA. The Commander egressed from the LM, went partway down the ladder, and deployed the Modularized Equipment Stowage Assembly (MESA) and color television camera. He reported seeing the Surveyor III spacecraft about 600 feet away and also stated that the LM had landed about 25 feet downrange from the lip of a crater. The Commander first touched the lunar surface at 115:22 GET (06:44 a.m. EST, 19 November). His descriptions indicated that the lunar surface was quite soft and loosely packed, causing his boots to dig in as he walked.

The LMP descended to the lunar surface at 115:52 GET (07:14 a.m. EST). Shortly after the television camera was removed from the bracket in the MESA, transmission was lost, and, despite repeated efforts, was not regained for the remainder of the EVA. The lithium hydroxide canisters and contingency sample were transferred to the LM cabin as planned. Deployment of the S-band erectable antenna, the Solar Wind Composition experiment, and the American flag was accomplished as planned.

Except for minor difficulty removing the radioisotope thermoelectric generator fuel element from the cask, the removal of the Apollo Lunar Surface Experiments Package (ALSEP) from the MESA, transport to the site, and deployment was accomplished nominally. The ALSEP deployment site was estimated to be 600 to 700 feet from the LM. Shortly after deployment, the Passive Seismometer transmitted to earth the crewmen's footsteps as they returned to the LM.

A considerable amount of dust was kicked up by the astronauts during ALSEP deployment and some adhered to the instruments. The overall effect will be determined through the long-term measurements of the engineering parameters of the system. The crewmen dusted each other off prior to ingressing the LM. The LM was repressurized, concluding a total EVA time of 3 hours 56 minutes.

The first CSM plane change maneuver, LOPC-1, was successfully accomplished as planned at 119:47 GET.

Prior to the second LM egress a plan for the second extravehicular activity period (EVA-2) had been formulated by the astronauts, earth-based geologists, and Mission Control. The EVA-2 traverse (Figure 1) took the crew to the ALSEP deployment site, Head Crater, Bench Crater, Sharp Crater, Halo Crater, Surveyor III, Block Crater, and back to the LM. The astronauts walked between 1500 and 2000 feet from the LM, and the total distance traversed was about 6000 feet. As the astronauts gained experience in walking on the lunar surface their confidence and speed increased significantly, as evidenced throughout EVA-2.

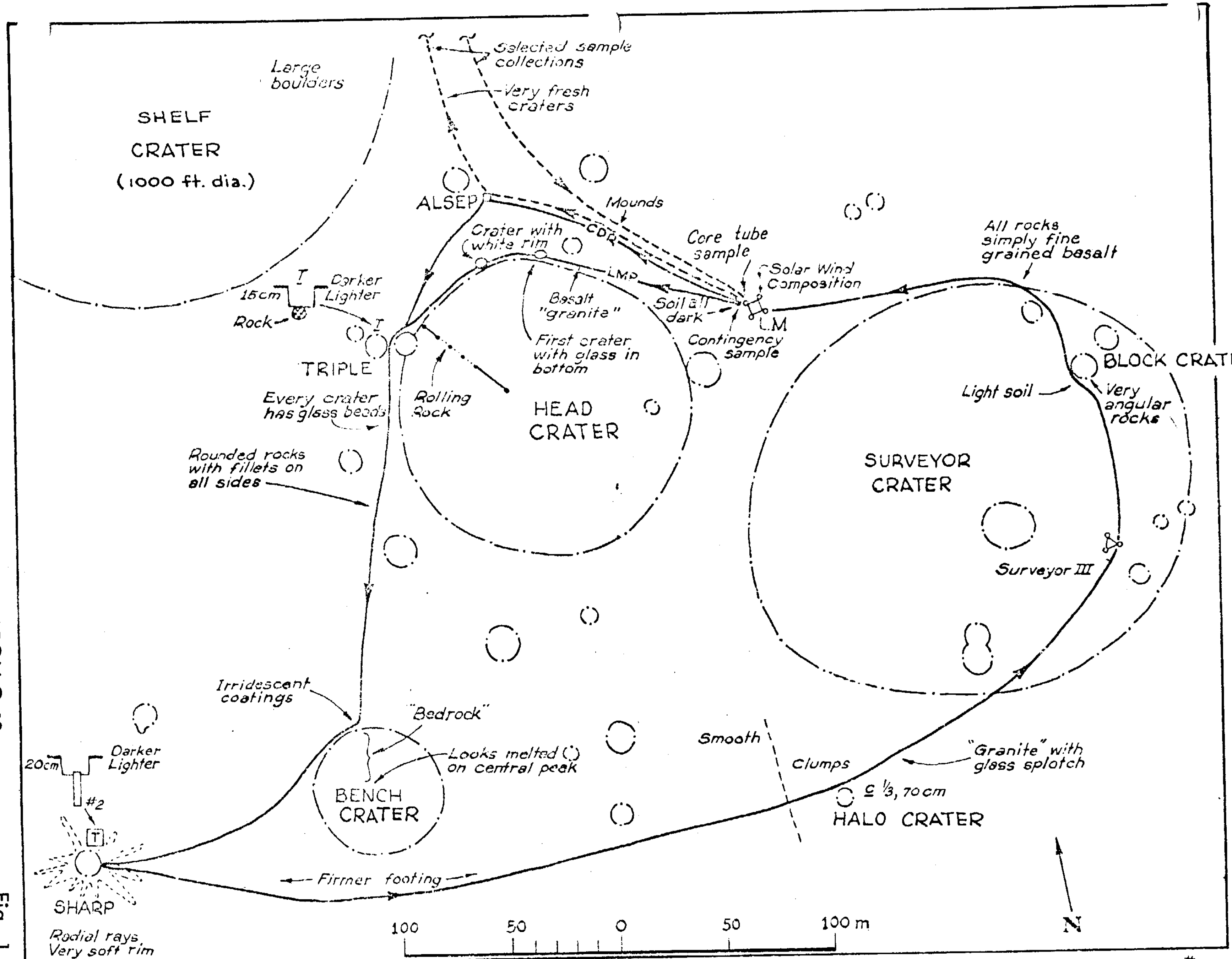
EVA-2 began at 131:33 GET (10:55 p.m. EST, 19 November), 1 hour 40 minutes ahead of schedule, and lasted for 3 hours 49 minutes. The astronauts first cut the cable and stored the inoperative LM TV camera in the Equipment Transfer Bag for return to earth and subsequent failure analysis. The Commander then went to the ALSEP site to check the leveling of the Lunar Atmopshere Detector (Cold Cathode Ion Gauge). As he approached the instrument, it recorded a higher atmosphere, rising to 10^{-6} torr (one millionth of a millimeter of mercury). This rise is attributed to the outgassing of the astronaut's suit.

Astronaut movement on the lunar surface was recorded on the Passive Seismometer and on the Lunar Surface Magnetometer. In addition, the Commander rolled a grapefruit-sized rock down the wall of Head Crater, about 300 to 400 feet from the Passive Seismometer. No significant response was detected on any of the four axes.

During the geological traverse, the crewmen obtained the desired photographic panoramas, stereo photographs, core samples (2 single, 1 double), trench (8-inch deep) sample, lunar environment samples and assorted rock, dirt, bedrock, and "molten" samples. They reported seeing fine dust buildup on all sides of larger rocks and that soil color seemed to become lighter as they dug deeper. The Apollo Lunar Surface Close-up Camera was used to take stereo pictures in the vicinity of the LM during the last few minutes of EVA-2.

All Surveyor III activities were accomplished as planned (Figure 2). In addition, the soil scoop was removed and retrieved by the crew. They reported that the Surveyor footpad marks were still visible and that the entire spacecraft had a brown appearance. The glass parts were not broken, only warped slightly on their mountings, and therefore were not retrieved.

Following the geological traverse, the Solar Wind Composition experiment was retrieved and stowed in the Equipment Transfer Bag. Some difficulty was experienced in the retrieval operation. All of the collected samples, parts, and equipment were then transferred into the LM, using the Lunar Equipment C[illegible]veyor. The crewmen dusted each other off prior to ingressing the LM. Exp[illegible]e equipment was jettisoned and the cabin was repressurized.



HEAD Informal crater name

Crest of crater rim

Lunar Module

Surveyor III spacecraft

ALSEP, approx. location

EVA 1 traverse

EVA 2 traverse

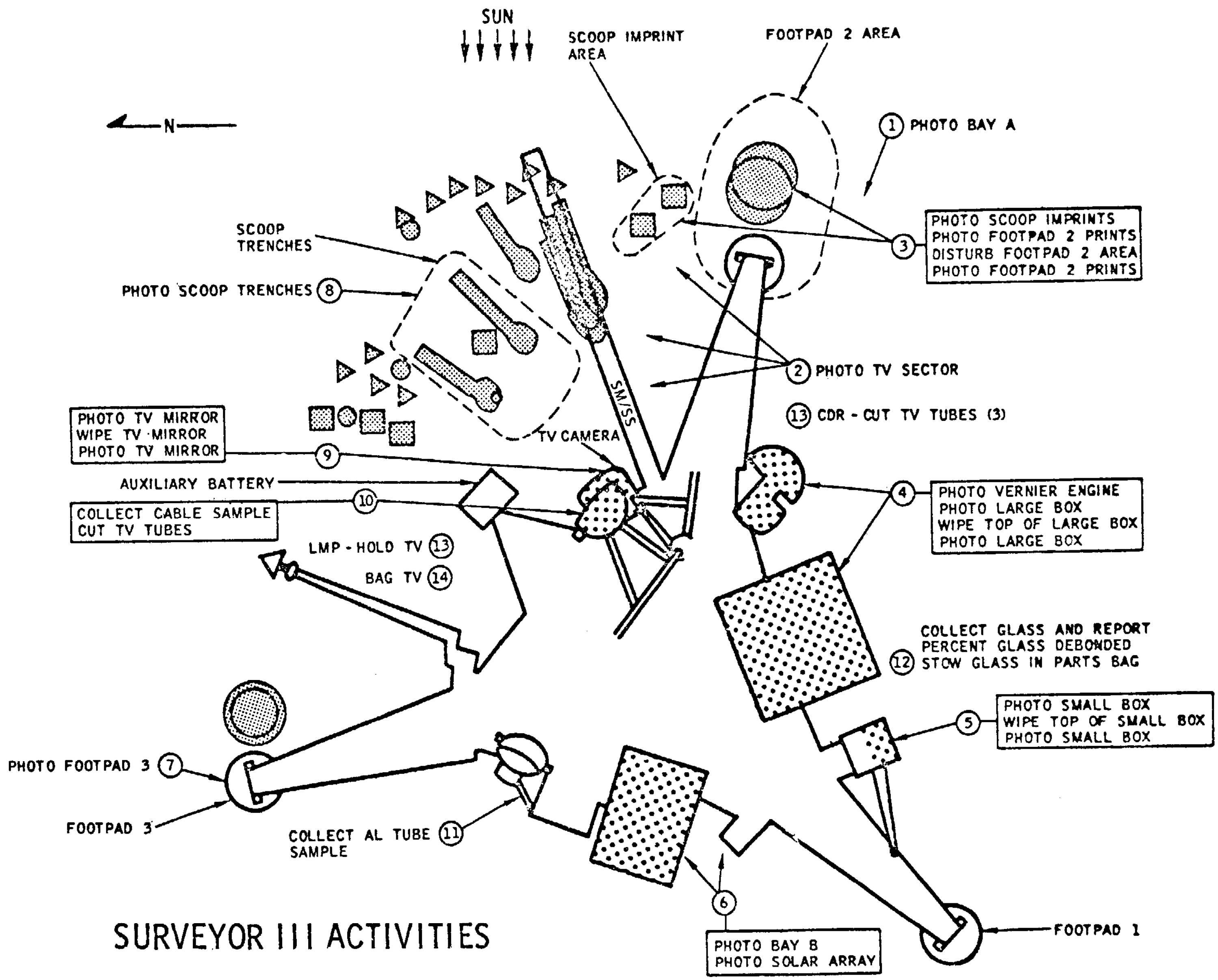
T Trench site sample: trench with core #2, gas analysis sample, enviromental sample

T Trench

c 1/3 Double core tube, #1 over #3

PRELIMINARY TRAVERSE MAP, APOLLO 12

Fig. 1



SURVEYOR III ACTIVITIES

Fig. 2

During the LM lunar surface stay period the S-158 Lunar Multispectral Photography Experiment was completed by the CMP in the CSM according to plan. In addition, photography of three desirable targets of opportunity was obtained: the Wall of Theophilus and two future Apollo landing sites, Fra Mauro and Descartes. The returned film will be analyzed to aid scientists in planning for future sample collection and in extrapolating known compositions from returned samples to other parts of the moon that will not be visited by man. The CMP reported that, in his judgement, the condition of the CM windows did not degrade the quality of the photographs.

ASCENT AND RENDEZVOUS

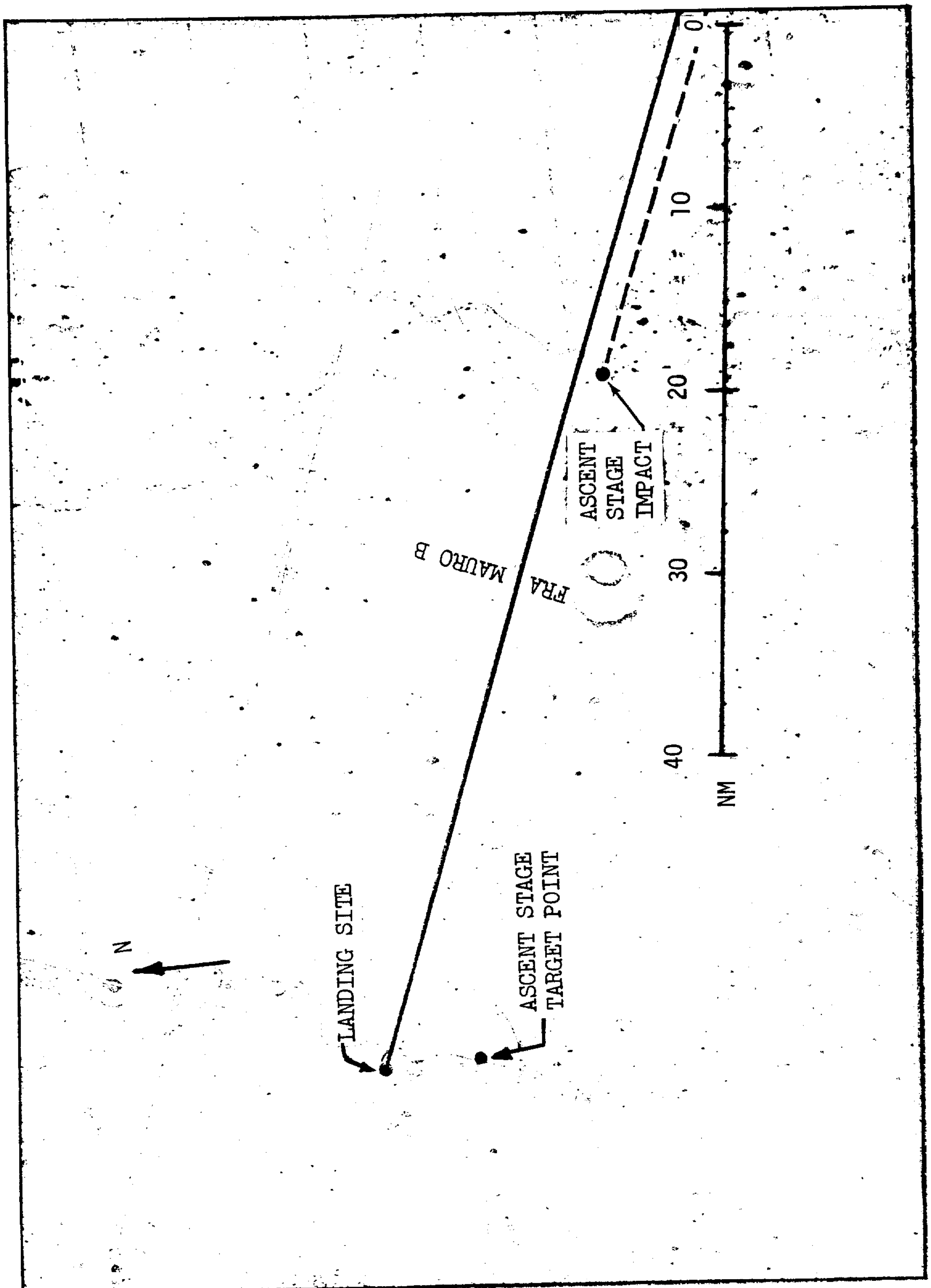
Lunar liftoff occurred at 142:04 GET (09:26 a.m. EST, 20 November) concluding a total lunar stay time of 31 hours 31 minutes. A 1.2-second overburn of the LM Ascent Propulsion System resulted in an insertion velocity 32 feet per second greater than planned, placing the LM in a 62 by 9.2-NM orbit. The overburn was caused by an incorrect manual switching sequence, which prevented the automatic shutdown command from shutting off the engine. The crew quickly recognized the discrepancy and manually shut down the engine. Subsequently, they used an RCS trim maneuver to return to an orbit with the planned parameters of 46.3 by 8.8 NM.

The rendezvous sequence of maneuvers occurred as planned. The Commander in the LM reported first visually sighting the CSM at a range of 122 NM. Good quality television was transmitted from the CSM for 24 minutes during the final portions of the rendezvous sequence. Docking was accomplished at 145:36 GET and was clearly seen on television. Intravehicular transfer of the crew and equipment from the LM to the CSM was accomplished without difficulty. LM jettison and CSM separation took place normally at 148:00 GET and 148:05 GET, respectively.

POST-RENDEZVOUS

The ascent stage deorbit retrograde burn was initiated at 149:28 GET and burned slightly longer than planned. This resulted in lunar impact about 36 NM short of the target point (Figure 3). Impact occurred at 149:55:17 GET (05:17:17 p.m. EST, 20 November), about 39 NM southeast of Surveyor III. Coordinates of impact were 3.95°S, 21.17°W as compared to the target point of 3.34°S, 23.42°W. LM weight and velocity at impact were 5254 pounds and 5502 feet per second, respectively. The flight path angle at impact was -3.792 degrees.

Following the completion of LM activities, the crew performed housekeeping functions in the CSM. The second CSM plane change maneuver (LOPC-2) was successfully executed at 159:05 GET. The resultant orbit was as planned for the subsequent lunar reconnaissance photography.



LANDING AND IMPACT LOCATIONS

Fig. 3

High resolution photography, landmark tracking, and stereo strip photography were conducted during this period to conclude the required Flight Plan activities over the sites Fra Mauro, Descartes, and Lalande.

TRANSEARTH AND ENTRY

The transearth injection (TEI) maneuver was successfully performed on time using the SPS. All systems performed normally and initial tracking shortly after the spacecraft emerged from behind the moon indicated that trajectory parameters were nominal.

Good quality television of the receding moon and spacecraft interior was received for about 38 minutes, beginning about 20 minutes after TEI.

MCC-5 was postponed until 188:28 GET, 1 hour later than planned, to allow additional crew rest, and the 2.0-foot per second maneuver was performed nominally. MCC-6, showing a requirement for less than 1 foot per second, was not performed.

Good quality television of the spacecraft interior and a question and answer period with scientists and members of the press began at 224:07 GET and lasted approximately 37 minutes.

The final transearth midcourse correction, MCC-7, was initiated at 241:24 GET resulting in a predicted entry velocity of 36,116 feet per second and a flight path angle of -6.47 degrees.

CM/SM separation occurred at 244:07 GET and entry interface (EI) at 400,000 feet altitude was reached at 244:22 GET. Visual contact with the spacecraft was reported at 244:33 GET. Drogue and main parachutes deployed normally. Landing occurred about 14 minutes after EI at 244:35:25 GET (03:58:25 p.m. EST). The landing point was in the mid-Pacific Ocean, approximately 165°10'W longitude and 15°44'S latitude. The CM landed in the Stable 2 position about 3.5 NM from the prime recovery ship, USS HORNET. Flotation bags were deployed to right the spacecraft to the Stable 1 position at 244:41 GET. The crew reported that they were in good condition.

Weather in the prime recovery area was good; visibility 10 miles, wind 15 knots, and wave height 3 feet with swells about 15 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 postlanding 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).

The flight crew, recovery physician, and recovery technician will remain inside the MQF until it is delivered to the Lunar Receiving Laboratory (LRL) in Houston, Texas. This delivery is currently planned to occur on 29 November.

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. The CM will remain sealed during RCS deactivation and delivery to the LRL.

The Sample Return Containers (SRC), film, data, etc., will be flown to Pago Pago by fixed-wing aircraft from USS HORNET, and then by separate aircraft to Houston for transport to the LRL. Both of the SRC's should arrive at the LRL on 25 November.

MISSION SCIENTIFIC ACTIVITY

Apollo Lunar Surface Experiments Package

The Apollo Lunar Surface Experiments Package (ALSEP) was deployed on the lunar surface by the Apollo 12 crew on 19 November 1969. The ALSEP deployment site was estimated to be 600 to 700 feet from the LM. Activation took place at 9:21 a.m. EST by "transmitter on" command from the ground. All initial conditions were normal.

The ALSEP is powered by SNAP-27, a radioisotope thermoelectric generator which uses plutonium 238 as a fuel. The initial power output of the generator was 56.74 watts. As the generator warmed up, the power output increased and stabilized at 73.59 watts.

The dust detector cells are operating well. The top and east cells show a slight disagreement that could be caused by tilt of the central station.

The Passive Seismic Experiment (PSE) recorded astronaut operation of the core tube, foot steps, and other crew activities. The seismometer measured the effects of the LM ascent at 9:26 a.m. EST on 20 November 1969, and the subsequent impact of the LM ascent stage at 5:17 p.m. EST. The PSE showed significant response to the impact of the jettisoned ascent stage. The impact was 39 NM (43 statute miles) from the ALSEP. The signal received at the PSE recorded on all three long period axes, but not on the short period vertical, indicating that the wave traveled through the lunar surface layer but was not strong enough to travel through the body of the moon. The signal was low frequency (1 hertz), extremely low velocity, and lasted nearly 1 hour. This long duration was not anticipated and is outside of our experience here on earth.

Although the significance of the event is not now understood, it appears similar to the signals obtained for the Apollo 11 seismic experiment. Since scientists know the amount of energy of the impact, location, time, etc., detailed analyses are expected to provide an explanation of the event.

The Lunar Surface Magnetometer (LSM) was aligned and leveled to 0.2°. The magnetic field measurements indicated that the moon was passing through the earth's bow shock during the first day of operation and subsequently passed through the transition region into the geomagnetic tail during 20, 21, and 22 November 1969. Five calibrations have been performed to date and the results indicate that the instrument is performing as expected. The site survey operation was performed between 5:50 and 6:40 p.m. EST on 22 November 1969. This important operation verified that the LSM measurements are not influenced by any local magnetic field anomalies.

The Solar Wind Spectrometer (SWS) was turned on at 1:40 p.m. EST on 19 November 1969. The dust covers for the seven Faraday cups were blown at 10:25 a.m. EST, 20 November 1969. Plasma ion data characteristic of the earth's "transition region" was observed. These data were consistent with the indications from the magnetometer that ALSEP passed behind the plasma bow shock of the earth near the time of deployment.

The SWS is equipped with a solar cell, located under a very narrow slit that allows sunlight to pass through at a sun angle of 60 degrees. The solar cell operated as planned, and, based on this data, the principal investigator estimates that the Apollo 12 crew leveled this instrument to within 1.2 degrees of actual level. Deployment tolerance was ±5 degrees.

The Lunar Ionosphere Detector (Suprathermal Ion Detector Experiment - SIDE), which measures the lunar ionosphere, was activated at 2:18 p.m. EST on 19 November 1969. The dust cover was inadvertently opened during deployment and was left open. The total ion detector and the mass analyzer both have returned interesting and useful scientific data. The background counting rates indicated outgassing from the interior of the electronics package. This outgassing causes arcing, which does not damage the instrument, but which prevents it from detecting scientific data. The high voltage (3.5 kilovolts) power supply was turned off until after lunar noon, at which time outgassing is expected to be complete. The instrument will then be commanded back on high voltage.

The Lunar Atmosphere Detector (Cold Cathode Ion Gauge - CCIG), which measures the ambient lunar atmosphere, was turned on between the first and second EVA's. During the astronaut sleep period prior to liftoff, the CCIG's high voltage power supply turned itself off. This shut-off is probably due to arcing similar to the condition described for the SIDE. The CCIG high voltage power supply has also been turned off until outgassing is complete.

The primary objective of the CCIG to measure the lunar atmosphere has not yet been achieved. It would not have been achieved by this time even if the experiment were operating perfectly, since there is still considerable contamination in the area of the landing.

During the 14 hours of CCIG data, the indicated pressure dropped at a decreasing rate. When the LM was vented for the second EVA, a slight pressure increase was noticed, and when the Commander walked near the gauge a large pressure increase was noted.

The Solar Wind Composition Experiment is designed to measure abundances and isotopic compositions of noble gases in the solar wind. It consists of a specially prepared aluminum foil that is unrolled on a staff implanted in the lunar surface. The experiment was deployed at 7:35 a.m. EST on 19 November 1969 and a foil exposure time of 18 hours 42 minutes was achieved. The foil is being returned in the documented sample Sample Return Container (SRC).

Lunar Geology

The Apollo 12 landing site is a gently rolling surface that includes several large, subdued craters and many smaller craters with raised rims. It is underlain everywhere by a regolith consisting of very fine-grained, gray, particulate material with admixed glassy beads, clasts, and coatings in other rocks. Blocks from several centimeters to 7 meters across are sparsely strewn in the regolith.

The Apollo 12 landing site is on a mare (Ocean of Storms). At this locality, the mare appears to consist of basalt flows overlain by a regolith that varies in thickness from 1 to 5 meters. The site also lies on a broad ray associated with the large crater Copernicus, 400 km to the north.

Contingency Sample

A contingency sample was acquired early in the first EVA in the immediate vicinity of the LM. This sample includes several rock fragments, fine-grained material, and at least one piece of glassy material.

Selected Sample

After deployment of the ALSEP, individual samples were taken on a traverse that extended to a point approximately 350 meters from the LM to a crater approximately 450 meters in diameter. Photographs were taken of several sample locations. One core tube sample was taken near the LM and SRC No. 1 was then filled with fine-grained material.

Documented Sample

At least 20 well documented samples were collected along the 6000-foot traverse performed during the second EVA. An environmental sample was taken from a shallow trench and sealed in the Special Environmental Sample Container. The environmental sample, core tube sample, and gas analysis sample were taken near Sharp crater, the farthest point from the LM. The two remaining core tubes were joined together and successfully driven in the surface near Halo crater to get a core sample approximately 70 cm long.

Hasselblad Surface Camera

Two calibrated 70mm cameras were used to take a total of approximately 500 black and white and color pictures of the lunar surface prior to, during, and after the EVA's. Color film was used in the first EVA and black and white in the second. Monoscopic and stereoscopic panoramas were taken to record small geologic features. The Apollo Lunar Surface Close-up Camera, especially designed to take close-up stereoscopic color pictures of very small areas on the lunar surface, was used to record selected sites close to the LM.

Optical Properties

Some unusual optical characteristics reported by the astronauts during their EVA's included: (1) green crystals or spots on several rocks, (2) purplish iridescence on at least one rock, (3) the occurrence of several light-gray rocks, and, in one case, a reddish rock, as contrasted with normal occurance of gray to dark gray rocks, and (4) occurrence of light gray fine-grained material at several inches depth (instead of the normal darker gray material) on the rims of at least two craters (Head and Sharp). The astronauts could not detect visually the optical variations in the surface along their traverse (inferred from lunar orbital photographs).

Lunar Surface Materials

As in the Apollo 11 landing, lunar surface material erosion resulted from the Apollo 12 LM descent engine exhaust, and dust was blown from the surface along the flight path. The distance to which the dust was transported will be examined critically from the point of view of possible contamination of the Surveyor III spacecraft. The landing was apparently normal with no excessive stroking of the shock absorbers and without substantial penetration of the footpads into the lunar surface.

After an initial period of adjustment to lunar conditions, the astronauts encountered no unexpected problems in moving about on the surface. Bootprint penetrations were reported to be similar in magnitude to those of the Apollo 11 crew. In the crater containing the Surveyor III spacecraft, the astronauts, burdened with rock samples and a tool carrier, were able to traverse slopes of about 15 degrees. Lunar dust adhered extensively to the astronauts' suits, tools, and other equipment. This was also observed during the Apollo 11 lunar surface activities. The astronauts commented that the Surveyor III was also coated with a thin layer of dust.

Penetration of the lunar surface by various handtools substantially exceeded that accomplished by the Apollo 11 crew. These included excavation of trenches to a depth of about 20 cm and penetration by a double core tube to a depth of approximately 70 cm. The implication of these results in terms of lunar surface material properties will be closely examined.

In general, the lunar surface material properties are similar to those of the material at the Surveyor spacecraft and Apollo 11 landing sites. The lunar surface material exhibits the properties of a fine-grained, granular material possessing both friction and a slight amount of cohesion. Comparison of photographs taken by the astronauts of the Surveyor III surface sampler tests and footpad imprints with those made by the Surveyor television camera 2-1/2 years ago will give information of considerable interest to lunar material property interpretation.

SYSTEMS PERFORMANCE

Launch vehicle performance was satisfactory throughout its expected lifetime except for the S-IVB slingshot maneuver. The spacecraft systems functioned satisfactorily during the entire mission except for the perturbations caused by an electrical anomaly which occurred shortly after liftoff. Communications were very good except for occasional problems with the High Gain Antenna (HGA). Table 7 summarizes the consumables status at the end of the mission. Tables 8 through 11 summarize the discrepancies encountered during the Apollo 12 Mission.

At 36.5 seconds after liftoff a major electrical anomaly occurred in the space vehicle, attributed to a potential discharge from the clouds through the space vehicle to the ground. The three fuel cells in the SM were disconnected from the main busses, placing main bus A loads on entry battery A and main bus B loads on entry battery B. In addition, numerous alarms and caution and warning lights in the CM cabin were turned on. The signal conditioning equipment dropped out and temperature, RCS propellant secondary quantity, and nuclear particle measurements were permanently lost. A similar incident occurred at 52 seconds GET resulting in tumbling the inertial measurement unit. At T+97.5 seconds the signal conditioning equipment started functioning and by 142.5 seconds GET the crew placed fuel cells 1 and 2 on the line. Fuel cell 3 was placed on the line at 170.5 seconds GET. The electrical power system remained normal throughout the remainder of the mission.

The SM RCS propellant usage exceeded the premission planned rates through most of the mission. This is primarily attributable to two factors: first, a recent procedural change in spacecraft attitude maneuver rate from 0.2 to 0.5 degrees per second; second, higher than planned usage during lunar orbital photography. At all times, the RCS propellant remaining exceeded redline limits by a wide margin.

On several occasions during the mission, communications with the CSM experienced some degradation due to inability of the HGA to hold lock. Two special HGA tests were conducted during the transearth coast to attempt to identify the cause of the anomaly. Results indicate that the problem appears to be associated with the dynamic thermal operation of the antenna, probably in the microwave circuitry in the narrow beam mode.

FLIGHT CREW PERFORMANCE

The Apollo 12 crew performance was outstanding throughout the mission. They exhibited quick thinking and alert reaction during the launch phase emergency. The crew provided a detailed and comprehensive commentary of the lunar surface activities. They were initially cautious in their movements but eventually adapted to the extent that they were able to move (lope) around with great ease. The crew conducted the lunar surface traverse without tiring. Cdr Conrad fell once but was able to get back up easily from the prone position. He suggested addition of a strap to facilitate a buddy lift. Both crewmen became somewhat thirsty while conducting lunar surface activities in hard suits for an extended period. It was noted that the lunar surface tools were more fragile to handle than anticipated. The crew was able to accomplish all lunar surface requirements.

The crew members took a minimal amount of medication, mostly decongestants to relieve stuffiness which they attributed primarily to lunar dust transferred to the CM by the LM crew's suits and gear. The LMP used sleeping pills prior to two of his rest periods following LM ascent stage separation. Skin cream was used by the Commander to treat a skin rash caused by his biomedical sensors. The crew was exceptionally enthusiastic during all phases of the mission, particularly during the lunar surface extravehicular activities and television transmissions.

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

C. M. Lee

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OBJECTIVES AND EXPERIMENTS

I. PRIMARY OBJECTIVES

The following are the OMSF Apollo 12 Primary Objectives:

- o Perform selenological inspection, survey, and sampling in a mare area
- o Deploy and activate ALSEP
- o Develop techniques for a point landing capability
- o Develop man's capability to work in the lunar environment
- o Obtain photographs of candidate exploration sites

II. PRINCIPAL AND SECONDARY DETAILED OBJECTIVES

The following are the approved Detailed Objectives:

PRIORITY	DETAILED OBJECTIVES AND EXPERIMENTS
1	Contingency sample collection
2	Lunar surface EVA operations
3	Apollo Lunar Surface Experiments Package (ALSEP I)
4	Selected sample collection
5	Portable Life Support System Recharge
6	Lunar Field Geology (S-059)
7	Photographs of candidate exploration sites
8	Lunar surface characteristics
9	Lunar environment visibility
10	Landed LM location
11	Selenodetic Reference Point Update
12	Solar Wind Composition (S-080)
13	Lunar multispectral photography (S-158)
14	Surveyor III investigation (SECONDARY OBJECTIVE)
–	Photographic Coverage (SECONDARY OBJECTIVE)
–	Television Coverage (SECONDARY OBJECTIVE)

III. APPROVED EXPERIMENTS

The following are the experiments performed during the mission:

A.	S-031	Passive Seismic Experiment (ALSEP I)
B.	S-034	Lunar Surface Magnetometer Experiment (ALSEP I)
C.	S-035	Solar Wind Spectrometer Experiment (ALSEP I)
D.	S-036	Suprathermal Ion Detector Experiment (ALSEP I)
E.	S-058	Cold Cathode Ion Gauge Experiment (ALSEP I)
F.	M-515	Lunar Dust Detector (ALSEP I)
G.	S-059	Lunar Field Geology
H.	S-080	Solar Wind Composition
I.	S-158	Lunar Multispectral Photography
J.	T-029	Pilot Describing Function

IV. SUMMARY

1. It is considered that accomplishment of (I) qualify Apollo 12 as a success. The accomplishment of the Detailed Objectives and Experiments identified in (II) and (III) further enhanced the scientific and technological return of this mission.
2. Other major activities not listed as Detailed Objectives or Experiments:

- Color TV in CSM
- Transfer to a non-free return (hybrid) trajectory
- S-IVB APS evasive maneuver
- Deorbit of LM ascent stage

3. All detailed objectives were 100% accomplished except:

- ALSEP I experiments S-036 (SIDE) and S-058 (CCIG): The high voltage is scheduled to be turned on after lunar noon.
- Television coverage of the lunar surface activities utilizing the color TV on the lunar surface was not accomplished because of a malfunction of the TV camera. This camera is being returned for analysis.

25 NOVEMBER 1969 TABLE 2

APOLLO 12 ACHIEVEMENTS

- SECOND MANNED LUNAR LANDING MISSION AND RETURN
- SEVENTH SUCCESSFUL SATURN V ON-TIME LAUNCH
- FIRST USE OF THE S-IVB STAGE TO PERFORM AN EVASIVE MANEUVER
- FIRST USE OF A HYBRID TRAJECTORY
- LARGEST PAYLOAD PLACED IN LUNAR ORBIT
- FIRST DEMONSTRATION OF A POINT LANDING CAPABILITY
- FIRST USE OF TWO LUNAR SURFACE EVA PERIODS (ABOUT 4 HOURS EACH)
- FIRST ALSEP DEPLOYED ON THE MOON
- FIRST DEPLOYMENT OF THE ERECTABLE S-BAND ANTENNA
- FIRST RECHARGE OF THE PORTABLE LIFE SUPPORT SYSTEM
- FIRST USE OF GEOLOGISTS TO PLAN A LUNAR SURFACE TRAVERSE IN REAL-TIME
- FIRST DOCUMENTED SAMPLES RETURNED TO EARTH
- FIRST DOUBLE CORE-TUBE SAMPLE TAKEN
- FIRST RETURN OF SAMPLES FROM A PRIOR LUNAR LANDED VEHICLE (SURVEYOR III)
- LONGEST DISTANCE TRAVERSED ON THE LUNAR SURFACE
- LARGEST PAYLOAD EVER RETURNED FROM THE LUNAR SURFACE
- FIRST MULTISPECTRAL PHOTOGRAPHY FROM LUNAR ORBIT
- LONGEST LUNAR MISSION TO DATE

POWERED FLIGHT SEQUENCE OF EVENTS

EVENT	*PLANNED (GET) HR:MIN:SEC	ACTUAL (GET) HR:MIN:SEC
Range Zero (11:22:00.0 EST November 14)	00:00:00.0	00:00:00.0
Liftoff Signal (TB-1)	00:00:00.6	00:00:00.6
Pitch and Roll Start	00:00:12.5	00:00:12.5
Roll Complete	00:00:30.5	00:00:30.5
S-IC Center Engine Cutoff (TB-2)	00:02:15.3	00:02:15.2
Begin Tilt Arrest	00:02:38.5	00:02:41.5
S-IC Outboard Engine Cutoff (TB-3)	00:02:42.5	00:02:41.7
S-IC/S-II Separation	00:02:43.2	00:02:42.4
S-II Ignition (Engine Start Command)	00:02:43.9	00:02:43.1
S-II Second Plane Separation	00:03:13.2	00:03:12.4
Launch Escape Tower Jettison	00:03:18.6	00:03:17.9
S-II Center Engine Cutoff	00:07:41.5	00:07:40.7
S-II Outboard Engine Cutoff (TB-4)	00:09:11.0	00:09:12.3
S-II/S-IVB Separation	00:09:11.9	00:09:13.2
S-IVB Ignition	00:09:13.0	00:09:14.3
S-IVB Cutoff (TB-5)	00:11:29.9	00:11:33.9
Earth Parking Orbit Insertion	00:11:39.9	00:11:43.9
Begin Restart Preparations (TB-6)	02:37:42.0	02:37:43.9
Second S-IVB Ignition	02:47:20.2	02:47:22.6
Second S-IVB Cutoff (TB-7)	02:53:05.0	02:52:03.8
Translunar Injection	02:53:15.0	02:53:13.8

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

APOLLO 12
MISSION SEQUENCE OF EVENTS

EVENT	*PLANNED (GET) HR:MIN:SEC	ACTUAL (GET) HR:MIN:SEC
Range Zero (11:22:00 EST, November 14)	00:00:00	00:00:00
Earth Parking Orbit Insertion	00:11:40	00:11:44
Second S-IVB Ignition	02:47:20	02:47:23
Translunar Injection	02:53:15	02:53:14
CSM/S-IVB Separation, SLA Panel Jettison	03:12:00	03:18:19
CSM/LM Docking Complete	03:22:00	03:26:58
Spacecraft Ejection from S-IVB	04:07:20	04:13:42
S-IVB APS Evasive Maneuver	04:25:00	**04:27:--
S-IVB Slingshot Maneuver	04:34:25	04:36:19
Midcourse Correction -1	11:53:05	Not Performed
Midcourse Correction -2 (Hybrid Transfer)	30:52:44	30:52:44
Midcourse Correction -3	61:31:14	Not Performed
Midcourse Correction -4	78:31:14	Not Performed
LOI-1 (Lunar Orbit Insertion) Ignition	83:25:18	83:25:23
LOI-2 Ignition	87:44:10	87:48:47
LM Undocking from CSM	107:54:22	107:54:03
CSM Separation Maneuver	108:24:22	108:24:42
LM Descent Orbit Insertion	109:23:00	109:23:39
Powered Descent Initiation	110:19:58	110:20:38
Lunar Landing	110:31:18	110:32:35
Begin First Extravehicular Activity (EVA-1)	114:40:00	115:10:35
Terminate EVA-1	117:47:00	119:06:38
CSM Plane Change (LOPC-1)	119:47:02	119:47:13
Begin EVA-2	133:15:00	131:32:45
Terminate EVA-2	137:52:00	135:22:00
LM Liftoff	142:08:28	142:03:47
Coelliptic Sequence Initiation Maneuver	142:58:05	143:01:51
Constant Differential Height Maneuver	143:56:28	144:00:02
Terminal Phase Initiation Maneuver	144:36:25	144:36:29
LM/CSM Docking	145:40:00	145:36:22
LM Jettison	147:57:00	147:59:30
CSM Separation Maneuver	148:02:09	148:04:30
Ascent Stage Deorbit Maneuver	149:24:41	149:28:14
Ascent Stage Lunar Impact	149:52:51	149:55:17
CSM Plane Change (LOPC-2)	159:01:46	159:04:45
Transearth Injection Ignition	172:21:15	172:27:16
Midcourse Correction -5	187:23:24	188:27:14
Midcourse Correction -6	222:21:48	Not Performed
Midcourse Correction -7	241:21:48	241:21:57
CM/SM Separation	244:06:48	244:07:21
Entry Interface (400,000 feet)	244:21:48	244:22:19
Landing	244:35:23	244:36:24

*Prelaunch planned times are based on MSFC Launch Vehicle Operational Trajectory and MSC Spacecraft Operational Trajectory

**This time is approximate. MSFC does not have actual times.

APOLLO 12 TRANSLUNAR AND TRANSEARTH MANEUVER SUMMARY

DATE: 24 NOVEMBER, 1969 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	REAL-TIME	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)	02:47:19.8	02:47:20.6	02:47:20.6	345	344	344	10,510	10,515	10,515	83:25:51 1851	83:43:15 457	83:43:15 457
MCC-1	11:53:04.8	---	N.P.	0	---	N.P.	0	---	N.P.	83:25:51 1851	--- ---	N.P. N.P.
MCC-2 (SPS)	30:52:43.7	30:52:43.7	30:52:43.7	10	8.8	8.8	68.8	61.7	61.8	82:28:59 59	83:28:30 60	83:28:26 60
MCC-3	61:31:13.6	---	N.P.	0	---	N.P.	0	---	N.P.	83:28:59 59	--- ---	N.P. N.P.
MCC-4	78:31:13.6	78:25:18.2	N.P.	0	16.7	N.P.	0	1.0	N.P.	83:28:59 59	83:28:27 60	N.P. N.P.
LUNAR ORBIT	Lunar orbit maneuvers are summarized on a separate table.									GET ENTRY INTERFACE (EI) VELOCITY (fps) AT EI FLIGHT PATH ANGLE AT EI		
TEI (SPS)	172:21:14.7	172:27:16.1	172:27:16.1	129	130	130	3,036	3042.3	3042.4	244:21:48 36,116 -6.5	244:21:27 36,116 -6.5	244:21:14 36,116 -6.69
MCC-5	187:23:23.6	188:27:13.7	188:27:13.7	0	4.53	4.54	0	2.0	2.0	244:21:48 36,116 -6.5	244:22:06 36,116 -6.50	244:22:07 36,116 -6.49
MCC-6	222:21:47.5	---	N.P.	0	----	N.P.	0	---	N.P.	244:21:48 36,116 -6.5	--- --- ---	244:22:32 36,116 -6.01
MCC-7	241:21:47.5	241:21:57.4	241:21:57.4	0	5.23	4.69	0	2.4	2.1	244:21:48 36,116 -6.5	244:22:18 36,116 -6.49	244:22:19 36,116 -6.47

N.P. - Not Performed

DATE: 24 NOVEMBER, 1969

APOLLO 12 LUNAR ORBIT MANEUVER SUMMARY

TABLE 6

MANEUVER	GROUND ELAPSED TIME (GET) AT IGNITION (hr:min:sec)			BURN TIME (seconds)			VELOCITY CHANGE (feet per second - fps)			APOLUNE/PERILUNE RESULTANT (NAUTICAL MILES)		
	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
Lunar Orb Insertion (LOI-1)	83:25:18.2	83:25:22.7	83:25:22.7	355.4	358	352	2889.9	2889.3	2889.5	170.2 / 59.9	169.3 / 62.3	168.8 / 62.6
Lunar Orb Insertion (LOI-2)	87:44:10.0	87:48:47.4	87:48:47.4	17.6	17.1	17.0	169.6	165.5	165.2	66.0 / 54.2	66.2 / 54.1	66.1 / 54.3
CSM/LM Sep - CSM Result	108:24:22.0	108:24:42	108:24:42	15.8	15.96	15.43	2.5	2.5	2.4	64.2 / 55.7	63.7 / 56.4	63.5 / 56.3
Descent Orbit Insertion	109:23:00.0	109:23:39.4	109:23:39.4	28.2	28.96	28.97	72.0	72.4	72.4	59.3 / 8.3	60.5 / 8.3	60.6 / 8.1
Powered Descent Initiation	110:19:58.0	110:20:37.4	110:20:37	680	680.53	715	6611	6618.7	---	0 / 0	0 / 0	0 / 0
CSM Plane Change (LOPC-1)	119.47:02.0	119:47:12.5	119:47:12.5	19.4	18.14	18.2	372.4	349.7	350.0	62.7 / 56.9	62.5 / 57.3	62.5 / 57.5
Ascent To Insertion	142:08:27.9	142:03:47	142:03:47	430.0	452.6		6046.2	6059.5	6057.4	45.3 / 9.0	46.3 / 8.8	46.3 / 8.8
Coelliptic Sequence Initiate	142:58:05.2	143:01:51	143:01:50.6	45.3		41.1	50.3	49.0	45.2	45.6 / 44.6		51.0 / 41.5
Constant Delta Height	143:56:27.5	144:00:01.5	144:00:01.5	0	12.66	12.5	0	14.0	13.8	— / —	44.2 / 40.4	44.4 / 40.4
Terminal Phase Initiate	144:36:25.7	144:34:--	144:36:29.4	22.1		25.75	24.6	25.0	28.5	61.9 / 44.2		60.2 / 43.8
Final Braking (Docking)	145:21:57.1	145:20:59	145:19:29.3	4.2			4.7	32.	36.3	59.8 / 59.5		
CSM/LM Sep - CSM Result	148:02:08.6		148:04:30	3.1			1.0			60.0 / 59.8		
LM Ascent Stage Deorbit	149:24:41.2	149:28:14	149:28:14	83.8	81.2	83.45	189.7	190.9	196.3	59.9 / -64.4	58 / -62.5	57.7 / -66.3
CSM Plane Change (LOPC-2)	159:01:46.0	159:04:44.8	159:04:44.8	18	19.1	19.2	360	381.3	382	61.2 / 57.8	64 / 56.5	64.1 / 56.7

24 November 1969 TABLE 7

APOLLO 12 CONSUMABLES SUMMARY AT END OF MISSION

CONSUMABLE		LAUNCH LOAD	PRELAUNCH PLANNED REMAINING	ACTUAL REMAINING
CM RCS PROP (POUNDS/PERCENT)	D	208/100	194/93.3	Not Available
SM RCS PROP (POUNDS/PERCENT)	U	1,233/100	540/43.8	272/20.6
SPS PROP (POUNDS/PERCENT)	TK	40,614/100	3339/8.22	3473/8.55
SM HYDROGEN (POUNDS/PERCENT)	U	54.3/100	8.0/14.8	9.7/17.3
SM OXYGEN (POUNDS/PERCENT)	U	634/100	164/25.9	150/23.2
LM RCS PROP (POUNDS/PERCENT)	U	549/100	*173/30.2	*110/20.1
LM DPS PROP (POUNDS/PERCENT)	U	18,226/100	**1491/8.18	**705/3.87
LM APS PROP (POUNDS/PERCENT)	U	5,182/100	*320/6.18	*285/5.50
LM A/S OXYGEN (POUNDS/PERCENT)	T	4.72/100	*3.28/69.5	*4.01/85.0
LM D/S OXYGEN (POUNDS/PERCENT)	T	48.9/100	**17.0/34.8	**23.7/48.5
LM A/S WATER (POUNDS/PERCENT	T	85.0/100	*45.0/53.0	*45.0/53.0
LM D/S WATER (POUNDS/PERCENT)	T	252/100	**88.0/34.9	**80.8/32.1
LM A/S BATTERIES (AMP-HRS/PERCENT)	T	592/100	*165/27.9	* 185/31.2
LM D/S BATTERIES (AMP-HRS/PERCENT)	T	1,600/100	**452/28.2	**576/36.0

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

* At LM Ascent Stage Lunar Impact
** At LM Ascent Stage Liftoff

24 November 1969 Table 8

SA-507 LAUNCH VEHICLE

DISCREPANCY SUMMARY

1. THE S-IVB O_2H_2 BURNER OXIDIZER SHUTOFF VALVE FAILED TO CLOSE WHEN THE IU ISSUED A CLOSED SIGNAL AT 9958.8 SECONDS, BUT WAS CLOSED BY GROUND COMMAND.

2. LOW FREQUENCY OSCILLATIONS (16 HZ) WERE EXPERIENCED DURING S-II POWERED FLIGHT BEGINNING AT 340 SECONDS AND OCCURRING AT 3 OTHER DISTINCT PERIODS DURING THE BURN.

3. A CCS DOWNLINK DROPOUT WAS EXPERIENCED ON OMNI ANTENNA AT 19,255 SECONDS. PERFORMANCE WAS NOMINAL ON LOW GAIN AND HIGH GAIN ANTENNA. UPLINK LOCK WAS LOST AND NEVER REGAINED AFTER 26,786 SECONDS.

4. AN ELECTRICAL PHENOMENON OCCURRED AT APPROXIMATELY 36 SECONDS THAT WAS INDICATED BY A TRANSIENT RESPONSE IN APPROXIMATELY 60 LAUNCH VEHICLE MEASUREMENTS. A RELATIONSHIP HAS NOT BEEN ESTABLISHED BUT OTHER OCCURRENCES INCLUDED:

   a. AT APPROXIMATELY 35.53 SECONDS THE IU LVDA PITCH GIMBAL CROSSOVER COUNTERS OUTPUT INDICATED A CHANGE IN EXCESS OF THE ACCEPTABLE LIMIT OF 0.4 DEG. THE COMPUTER RESPONDED PROPERLY BY REUSING THE LAST COUNTER READING.

   b. AT APPROXIMATELY 36.17 SECONDS BIT 1 IN MODE CODE 24 WAS SET BECAUSE OF THE REDUNDANT ACCELEROMETER COUNTERS DIFFERED BY APPROXIMATELY 9 COUNTS. THE COMPUTER USED THE MORE REASONABLE VALUE.

5. TRACKING VECTORS INDICATE THE S-IVB/IU WAS PLACED IN A VERY ELLIPTICAL EARTH ORBIT RATHER THAN THE PLANNED HELIOCENTRIC ORBIT.

COMMAND/SERVICE MODULE-108

DISCREPANCY SUMMARY

1. ALL ELEMENTS ON THE DSKY (DISPLAY KEYBOARD) LIT UP INTERMITTENTLY (PRELAUNCH).

2. TUNING FORK INDICATION INTERMITTENT ON MISSION TIMERS. CENTRAL TIMING EQUIPMENT VERIFIED OPERATIONAL (PRELAUNCH).

3. LEAK IN CRYOGENIC HYDROGEN TANK LINE INTERFACE TO INNER TANK (PRELAUNCH).

*4. AT 36.5 SECONDS GET--FUEL CELLS DROPPED OFF BUSES, LOSS OF AC BUSES AND EVENT TIMER, TRANSIENT ON LAUNCH VEHICLE BUS DUE TO POTENTIAL DISCHARGE TO GROUND. FOUR SKIN TEMPERATURES ON SERVICE MODULE FAILED.

5. THE FOUR SERVICE MODULE REACTION CONTROL SYSTEM BACKUP QUANTITY MEASUREMENT PRESSURE/TEMPERATURE DEVICES FAILED.

*6. AT 52 SECONDS GET--INERTIAL MEASUREMENT UNIT LOSS, OTHER PULSE CODE MODULATION INDICATION AND LAUNCH VEHICLE TRANSIENTS INDICATED ANOTHER DISCHARGE POTENTIAL.

7. HELIUM QUAD B AND QUAD A SECONDARY PROPELLANT TALK BACKS INDICATED BARBERPOLE AT S-IVB SEPARATION.

8. AFTER INSERTION STABILIZATION AND CONTROL SYSTEM LOGIC 3-4 MAIN A WAS FOUND TO BE OPEN.

9. AT 31:40 GET--MASTER ALARM WITH NO ANNUNCIATOR.

10. CARBON DIOXIDE PARTIAL PRESSURE INDICATOR READ LOW LEVEL.

*11. UP AND DOWNLINK COMMUNICATIONS SIGNAL STRENGTHS BELOW EXPECTED LEVELS FOR HIGH GAIN ANTENNA OPERATION IN NARROW BEAM AUTO TRACK DURING SEVERAL PERIODS IN LUNAR ORBIT.

12. CALCULATED ENVIRONMENTAL CONTROL SYSTEM AND FUEL CELL OXYGEN USAGE DIFFERED FROM TELEMETERED QUANTITY.

13. HIGH OXYGEN FLOW WITHOUT MASTER ALARM SEVERAL TIMES DURING FLIGHT.

14. LOOSE PIECE OF MATERIAL OBSERVED BY LM CREW AT FINAL DOCKING.

*15. OPTICS COUPLING DISPLAY UNIT INDICATED OPTICS MOVEMENT WHEN OPTICS IN "ZERO OPTICS" MODE--OCCURRED SEVERAL TIMES.

16. QUAD D HELIUM MANIFOLD PRESSURE TRANSDUCER READ IMPROPERLY.

*17. CLOGGED URINE DUMP FILTERS.

18. RADIATOR HEATERS CAME ON AT -7° INSTEAD OF -15°F.

* MOST SIGNIFICANT FLIGHT PROBLEMS

LUNAR MODULE-6

DISCREPANCY SUMMARY

1. FLOODLIGHT DID NOT TURN OFF WHEN LM TUNNEL HATCH WAS CLOSED BUT SWITCH TURNED FLOODLIGHTS OFF WHEN SWITCH OPERATED BY HAND.

2. LM DOOR CLOSED WHILE COMMANDER WAS ON LUNAR SURFACE AND LUNAR MODULE PILOT WAS IN LM.

*3. WATER ACCUMULATED IN COMMANDER'S SUIT LOOP AND BOOTS.

4. MASTER ALARM DURING ASCENT AND IMMEDIATELY AFTER CUTOFF.

*5. LM TRACKING LIGHT NOT WORKING AT 144:26 GET.

6. CARBON DIOXIDE PARTIAL PRESSURE CAUTION AND WARNING WHILE BEHIND MOON ON REVOLUTION 31.

7. REACTION CONTROL SYSTEM MAIN SHUTOFF VALVE, SYSTEM A INDICATOR SHOWED CLOSED DURING INITIAL ACTIVATION (FINAL PHASES OF APS BURN). PROPER AFTER RECYCLE.

*8. POOR VHF (VERY HIGH FREQUENCY) RELAY TO CSM DURING LM ASCENT.

9. COMMUNICATION TONES (KEYING) DURING EXTRAVEHICULAR ACTIVITY.

* MOST SIGNIFICANT FLIGHT PROBLEMS

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Table II

APOLLO 12 CREW/EXPERIMENT EQUIPMENT

DISCREPANCY SUMMARY

*1. TELEVISION CAMERA INOPERATIVE AFTER REMOVAL FROM LM

*2. 16mm SEQUENCE CAMERA STOPPED OPERATING DURING LM ASCENT

3. EQUIPMENT TRANSFER BAG DIFFICULTY WITH LUNAR EQUIPMENT CONVEYOR INTERFACE DURING INITIAL PHASE OF SECOND EXTRAVEHICULAR ACTIVITY PERIOD

4. RADIOISOTOPE THERMOELECTRIC GENERATOR FUEL ELEMENT DIFFICULT TO REMOVE FROM CASK

5. PASSIVE SEISMIC EXPERIMENT DEPLOYMENT DIFFICULT

6. SUPRATHERMAL ION DETECTOR WOULD NOT REMAIN UPRIGHT

7. SHORTING PLUG AMMETER DID NOT INDICATE CURRENT PRIOR TO ACTIVATION OF SHORTING PLUG SWITCH

*8. TEFLON BAGS CRACKED AT FOLD WHEN FOLDED WHILE ON LUNAR SURFACE

9. RETAINING CLIPS FOR SAMPLE BAG WOULD NOT HOLD BAG

*10. DURING LANDMARK TRACKING 500mm CAMERA COUNTER DID NOT AGREE WITH CREW COUNT. ALSO, BACK OF MAGAZINE CAME OFF

* MOST SIGNIFICANT FLIGHT PROBLEMS