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APOLLO 15

FINAL

LUNAR SURFACE PROCEDURES

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PREPARED BY

LUNAR SURFACE PROCEDURES SECTION

EVA/IVA PROCEDURES BRANCH

CREW PROCEDURES DIVISION

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

JULY 9, 1971

FINAL

APOLLO 15

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APOLLO 15

LUNAR SURFACE PROCEDURES

FINAL

PREFACE

This document has been prepared by the Crew Procedures Division, Flight Crew Operations Directorate, Manned Spacecraft Center, Houston, Texas and by General Electric, Apollo Systems, Houston Programs. The information contained within this document represents the Lunar Surface Procedures for Apollo 15, Mission J-1, the fifth manned lunar landing mission.

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to the Lunar Surface Procedures

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SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION

The Apollo 15 Lunar Surface Procedures is used to document the planning for lunar surface EVA operations on Mission J-1, to describe the crew equipment interface, and to document the manner in which the lunar surface mission requirements are to be implemented.

The nominal plan includes three two-man EVA periods during the 66.5 hour stay of the LM vehicle on the lunar surface. The first, second and third EVA's are planned for seven, seven and six hours, respectively, of activity from depressurization to repressurization of the LM. Several alternate operation plans are included in this document to cover such off-nominal cases as higher-than-anticipated workloads which result in shorter PLSS time-to-consumables-redline, difficulties in placement or deployment of experiments resulting in time loss, and malfunction of an EMU or PLSS before or during an EVA which occasions subsequent single-man EVA contingency operation.

EMU operations and procedures (including contingency) are covered in the EMU AOH, Reference 13.

Detailed photographic and TV camera operations are covered in Reference 6 , but are integrated herein in a summary manner.

This document contains summary and detailed timeline and procedures data, the voice data plan, and copies of the crew's cuff checklist. The summary timelines are essentially a task flow analysis along a time base showing coincident activities and points of interaction between crewmen. The detailed timeline procedures simply list in the sequence of performance, the steps required to carry out each of the tasks identified in the summary timeline. It is in the detailed timeline procedures that the crew/equipment interfaces are revealed. Both the summary and detailed timeline procedures present the CDR's and the LMP's tasks side-by-side to minimize the confusion as to which crewman is doing what and to show how they cooperate in the lunar surface operations. The voice data plan is provided coincident with the detailed timeline procedures as a device by which cap-com (capsule communicator) is able to keep abreast of the crew's activities and to provide cap-com with cues, data and data recording points with which to provide realtime assistance to the lunar surface crew during the EVA activities. The crew's cuff checklists are included for information only, showing the procedural cues the crew have at their fingertips.

The procedures herein are responsive to the Mission Requirements for SA-510/CSM-112/LM-10 J-1 Type Mission currently in effect as of the date of this document.

SECTION 2.0

MISSION PLAN

2.0 MISSION DESCRIPTION

The following information is taken from the "Mission Requirements, SA 510/CSM-112/LM-10 J-1 Type Mission, Lunar Landing," dated January 4, 1971 and its approved revisions.

2.1 MISSION OBJECTIVES

The primary mission objectives have been assigned to this mission by the office of Manned Space Flight (OMSF) in the Apollo Flight Mission Assignments Directive (Reference 1). These objectives are:

1) Perform selenological inspection, survey, and sampling of materials and surface features in a pre-selected area of the Hadley - Apennine region.

2) Emplace and activate surface experiments.

3) Evaluate the capability of the Apollo equipment to provide extended lunar surface stay time, increased EVA operations, and surface mobility.

4) Conduct in-flight experiments and photographic tasks from lunar orbit.

The following lunar surface experiments have been assigned to this mission by OMSF (Reference 1):

1) M-515 Lunar Dust Detector Experiment

2) S-031 Passive Seismic Experiment

3) S-034 Lunar Surface Magnetometer Experiment

4) S-035 Solar Wind Spectrometer Experiment

5) S-037 Heat Flow Experiment

6) S-036 Suprathermal Ion Detector Experiment

7) S-058 Cold Cathode Ion Gage Experiment

8) S-059 Lunar Geology Investigation

9) S-078 Lunar Ranging Retro-Reflector

10) S-200 Soil Mechanics

11) S-080 Solar Wind Composition

Experiments 1 through 7 are part of the ALSEP Array A-2 package. Detailed objectives have been derived from OMSF-assigned primary objectives, placed in order of priority, and detailed to the extent necessary for mission planning.

Experiments are detailed and assigned priority in this document only in the event that they require crew action or otherwise impact the mission timeline. All of the detailed experiments are in support of the primary mission objectives or were assigned by OMSF as a numbered experiment.

2.2 LUNAR SURFACE PRIORITIES

The detailed objectives and experiments are listed below in their order of priority. These priorities should be used for realtime mission planning.

Mission and Lunar Surface Priority	Detailed Objectives and Experiments
1	Contingency Sample Collections
2	Documented Sample Collection at Apennine Front (Part of Lunar Geology Investigation)
3	Apollo 15 ALSEP ARRAY A-2
4	Drill Core Sample Collection (Part of Lunar Geology Investigation)

5	Laser Ranging Retro-Reflector
6	Lunar Geology Investigation
7	Lunar Rover Vehicle Evaluation
8	EVA Communications with the LCRU/GCTA
9	EMU Assessment on Lunar Surface
10	LM Landing Effects Evaluation
11	Solar Wind Composition
12	Soil Mechanics
N/A	LM Descent Engine Performance

2.3 EVA REQUIREMENTS

The stay time on the lunar surface is open ended and the planned maximum will not exceed approximately 67 hours. After checkout of the launch capability of the LM it will be depressurized for a SEVA. The crew will then begin a rest period prior to LM depressurization to begin the first of three periods of surface activity. The first and second EVA periods will be approximately 7 hours duration each while the third period will be a 6 hour EVA.

The traverse planning provides for the capability of the crew to return to the LM under each of the following single-failure conditions:

1) Use of the buddy-secondary life support system (BSLSS) due to an inoperative PLSS anytime during a riding traverse (based upon the assumptions that the LRV will operate properly during the return to the LM).

2) Use of two PLSS's for a walking return to the LM from an inoperative LRV anytime during a riding traverse (based upon the assumption that both PLSS's will operate properly during the return to the LM).

The planned lunar surface activities will include the following major tasks:

1) Contingency Sample Collection

2) Lunar Rover Vehicle Deployment

3) Lunar field geology to the Appinine Front (S-059)

4) ALSEP Deployment

5) Lasar Ranging Retro-Reflector Experiment (S-078)

6) Deep Core Drilling Sample

7) Lunar field geology (S-059)

8) Lunar Rover Evaluation

9) Solar Wind Composition (S-080)

Television transmission will be provided as early as practicable during the EVA period to observe crew activities around the LM. Television coverage will also be provided at each science stop by the GCTA when using the LRV. Photography will be utilized throughout the EVA to document activities and observations.

2.4 SITE DESCRIPTION

2.4.1 Hadley-Apennine

The Apennine Mountains rise up to 2 km above the relatively young mare surface of Palus Putredinis and might contain material exposed during excavation of the Imbrium basin. Sampling of such Apenninian material might provide ancient rocks whose origin predates both the formation and the filling of the major mare basins. Rima Hadley is a V-shaped lunar sinuous rille which parallels the Apennine Mountain front along the eastern depression of Mare Imbrium. The rille originates in an elongate depression in an area of associated volcanic domes and generally maintains a width of about 1 km and a depth of 200-300 meters until it merges to a second rille to the north. The origin of sinuous rilles such as Rima Hadley is an enigma but probably involves some type of fluid flow and-or collapse. Thus, the study of the process of sinuous rille formation may yield data on the history of lunar volatiles.

2.5 DETAILED SCIENTIFIC OBJECTIVES OF THE HADLEY-APENNINE REGION

2.5.1 Apennine Mountains

The Apennine Mountains form part of the southeastern boundary of Mare Imbrium and are believed to have been formed at the time of origin of the Imbrium basin. The Apennines are analogous to the Cordillera Mountains in the fresher Orientale basin on the western limb of the lunar frontside. Study of these analogous regions in the Imbrium and Orientale basins suggest that the impact ultimately responsible for the formation of the multi-ringed structures also resulted in deposition of a thick blanket of ejecta around and on the rim of these basins. This ejecta would mantle large areas around the Imbrium basin, thinning away from the basin interior, and overlying preexisting topography probably similar in morphology to highland regions of the moon. The material exposed on the scarps or mountain fronts could represent a cross section of lunar crust several thousand meters thick.

2.5.2 Hadley Rille

Hadley Rille is a sinuous rille originating in the vicinity of several elongate depressions near the Apennine Mountain front. The origin of these widespread lunar features has long been debated and has variously been attributed to flowing water, nues ardentes, tectonism, lava channels, and collapsed lava tubes. Whatever their detailed origin, they appear to be related to volcanic processes associated with mare basin filling. Investigation of Hadley Rille could shed light on the origin of these ubiquitous mare features. Since Hadley has a rather V-shaped cross section, as opposed to flat floored rilles such as Schroeters Valley and Rimae Prinz, it appears that the floor has been filled in by collapse or talus slump. The approximate slope of the side of the rille is ~25° and it averages 250-325 m in depth. Numerous outcrops and apparently layered material are seen along and just below the rille rim. These layers may represent lava flows and interlayered regolith. Numerous large blocks have rolled to the bottom of the rille and several large boulder tracks can be seen. Sampling of the rille rim and photography of the walls would be highly desirable.

2.5.3 Mare Material

The major portion of the flat terrain between Hadley Rille and the Apennine ridges consists of mare material forming an embayment into this area from Palus Putredinis to the west. This unit has been mapped as Imbrian in age. Using the crater dating methods, the Hadley area mare material appears relatively younger than both Apollo 11 and 12 sites. Examination of high resolution photographs reveals blocky craters in the 50 - 250 m range, particularly in the northern part of the area, which should make sampling of this unit very easy.

2.5.4 Possible Volcanic Landforms Associated with the Mare

A wide spectrum of domes, domical hills, and associated structures exist in various places between the Apennine Front and Apennine Ridge to the west of Rima Hadley. Most of these features appear to be superimposed on the mare material and their morphology suggests that they may be constructional volcanic landforms. In particular, these structures abound around the origin of Rima Hadley near the elongate depression and are also found along the Apennine Front and on the northeast bank of Rima Hadley where it turns northwest toward Rimae Fresnel. Investigation of this spectrum of landforms may provide important geochemical and age data on late stages of mare basin fill.

2.5.5 Secondary Crater Clusters

Secondary crater clusters from the Copernican age craters Autolycus and Aristillus, located approximately 150 - 300 km to the north, are widespread in this region. Examination of a cluster large enough to yield rocks from these craters could provide information about the absolute age of these Copernican events, as well as samples from another part of the Imbrium Basin.

2.6 LUNAR SURFACE ACTIVITY FOR 67 HOUR STAY

The nominal plan is for the Commander and the Lunar Module Pilot to remain on the lunar surface for approximately 67 hours. A summary timeline for the lunar surface stay is presented in Fig. 2.6-1.

Immediately after landing on the lunar surface, the crew will perform post landing LM systems integrity verification checks to establish lunar stay capability. Upon establishing the stay capability, the crew will depress the LM and conduct a Standup EVA (SEVA). In the EVA, the Commander stands upon the ascent engine cover with his head, shoulders and upper torso extending above the docking ring to view, take a photographic panorama and verbally describe the lunar landscape from a vantage point at the top of the LM and with assistance from MSFN determine their exact landing site. This period of time can also be utilized to describe any unforseen anomalies in the lunar surface which might necessitate revisions of any or all of the preplanned traverses. Following the SEVA is an eat period, a 7.5 hour sleep period and a second eat period after which the crew begins to configure the LM systems and cabin equipment for the first EVA period. PLSS/OPS donning, systems activation and checkout and communications checkout utilize the final hour preceeding the first EVA which begins with cabin depressurization at approximately 16-hours after touchdown on the lunar surface. A detailed discussion and timeline for EVA-1 is included in Section 3.1.2.

Upon completion of EVA-1, the crew will reconfigure the LM systems for pressurized cabin operations. The crew will doff helmets, gloves, PLSS/OPS's and suits prior to the debrief and eating periods. Recharge of the PLSS consumables (battery, LiOH canister, O2 and feedwater) will take place during the EVA post activities. During the post EVA debrief, the crew discusses with MSC Houston the activities of the EVA and surface conditions experienced during the EVA and whether any changes are required in the planning for subsequent EVA's. Following the debrief the crew settles down to an eat period, an 8.5 hour sleep period and a second eat period prior to donning the suits and beginning the EVA-2 Prep. During the Prep the crew will again reconfigure the LM systems and cabin equipment for depressurized operation. The PLSS/OPS units are again donned and the systems and communications verified prior to depressurization for a 7 hour EVA-2 at approximately 36 hours 40 minutes after touchdown. A detailed discussion and timeline for a 7 hour EVA-2 is included in Section 3.1.3.

Upon completion of EVA-2, the crew will again reconfigure the LM systems for pressurized activities and will proceed on the Post EVA activities which consist of doffing helmet and gloves, stowing equipment and samples, recharging of the PLSS consumables (battery, LiOH canister, O2, feedwater). The crew then doff their suits and proceed to debrief with MCC Houston discussing the EVA activities, any new observations of surface terrain encountered during the EVA, and whether any changes are required in the EVA-3 preplanned activities. Following the debriefing, the crew enjoys another eat period, a 7.5 hour sleep period and another eat period where upon they again don their suits before proceeding with the EVA-3 Prep activities. During the EVA-3 Prep the crew will again configure the LM systems and cabin equipment for depressurized operations. The PLSS/OPS units are donned and the systems and communications reverified prior to cabin depress for the third EVA period which will begin at approximately 57.5 hours after touchdown and last for 6 hours. A detailed description and timeline for EVA-3 is included in Section 3.1.4.

At the completion of EVA-3 the crew will ingress the LM and connect to the LM ECS and begin the EVA-3 Post activities which include doffing the gloves and the PLSS's, and preparation of all excess equipment in the cabin for jettison. After the crew has donned the gloves, depressed the LM, jettisoned the excess gear and repressed the cabin they turn to the task of stowing all equipment and samples and reconfiguring the LM cabin for lift-off. When the EVA Post activities are completed, the crew again debriefs with MCC Houston, does a P57 update, enjoys their final lunar meal and performs the final prelaunch checklist for a liftoff at approximately 66.5-67 hours after touchdown. This final activity will conclude the fifth manned lunar landing mission and the fourth lunar landing.

TABLE 2.6-1 LOOSE EQUIPMENT LEFT ON LUNAR SURFACE

1. <u>Jettison During EVA-1: (In a Jettison Bag)</u>
   2 - OPS Pallets
   3 - Arm rests
   Used LiOH cartridge & Bracket
   BSLSS Bag

2. <u>Discarded On Lunar Surface During EVA-1</u>
   Misc Pip Pins and Fastenings
   Thermal Covers
   LRV Thermal Blanket
   TV Camera Bracket
   ALSEP RTG Dome Removal Tool and Fuel Transfer Tool
   PSE Girdle
   ALSEP Subpallet
   LRRR Dust Cover
   Lunar Surface Drill, Treadle and Rack
   LEC Bag
   TV Tripod
   LCRU/GTCA Pallet
   Pallet 1
   SRC Dust Skirt and Seal Protector

3. <u>Operational Equipment Deployed and Left On EVA-1</u>
   Flag
   TV Camera
   LRV
   ALSEP: PSE, LSM, HFE, SIDE/CCIG, SWE
   LRRR
   SWC

4. <u>Jettison During EVA-2 (In Jettison Bag)</u>
   1 - LM ECS LiOH Cartridge and Bracket
   Used Food Containers
   2 PLSS Batteries
   2 PLSS LiOH Cartridges and Canisters

5. <u>Discarded on Lunar Surface During EVA-2</u>
   EVA-2 Pallet
   1 - Core Tube Cap Dispenser
   SRC Dust Skirt and Seal Protector

6. <u>Jettisoned During EVA-3 (In Jettison Bag)</u>
   2 PLSS Batteries
   2 PLSS LiOH Cartridges and Canisters

1 LM LiOH Canister and Bracket
2 Hammock Assys and Sleep Restraints
Used Food Containers
Used Towels
2 LCG's
2 CWG's
LGC Adapter
Urine Receptacle
2 ICG Assys

7. <u>Discarded on Lunar Surface During EVA-3</u>
LRV w/GCTA, LCRU, QUAD III Pallet, 3-LCRU Batteries
Hand Tool Carrier w/tools
Penetrometer (less drum)
Lunar Hand Tools
Gnomon
Polarizing Filter
2-70mm Data Camera w/Bracket, Handle, Trigger
16mm Lunar Data Acquisition Camera Assy w/staff
Lunar Equipment Conveyor
500mm lens Camera
SWC Staff
100' Tether w/2 lens Brushes
BSLSS
Dust Brush
Unused Documented Sample Bags
Reseau Plate Cover

8. <u>Jettisoned to Lunar Surface After EVA-3 (In Jettison Bag)</u>
2 pr Lunar Boots
2 PLSS
2 Drink Bags
Used Food Containers
Urine Bags (if used)
Used Towels
Used Emesis Bags
Misc Small Items
1 Armrest

TABLE 2.6-2 EQUIPMENT TRANSFERRED BETWEEN ASCENT STAGE/SURFACE/ASCENT STAGE

1. <u>Transferred to Surface EVA-1</u>

ETB and contents
Map holder w/lunar surface maps and LRV checklist
3-70mm mags (2-HCEX mags KK,NN, 1-HBW mag OO)
3-16mm mags CC,DD,EE (CEX)
500mm lens camera w/lens camera w/mag MM (HBW)
1-70mm camera (HBW-mag LL)
BSLSS

Empty EVA-1 pallet
CSRC

2. <u>Transferred into Ascent Stage EVA 1</u>

EVA 1 pallet w/ECS LiOH canister
CSRC
SCB #3
SCB #4
SRC #1
ETB and contents
  Lunar surface maps
  2-70mm mags LL(HBW), NN(HCEX)
  3-16mm mags (CEX)
  Mag MM from 500mm lens camera (HBW)
  2-70mm cameras (HCEX mag KK,HBW-mag OO)

3. Transferred to surface EVA-2

ETB and contents
  Lunar surface maps
  3-70mm mags PP,QQ,RR (HBW)
  3-16mm mags FF,GG,HH (CEX)
  Mag MM for 500mm lens camera
  2-70mm cameras (HBW mag OO, HCEX mag KK)

Empty EVA-2 pallet

4. Transferred into Ascent Stage EVA-2

EVA 2 pallet w/ECS LiOH canister
SCB #2
SCB #6
SRC #2
ETB and contents
  Lunar surface maps
  3-70mm mags OO,RR(HBW) KK(HCEX)
  3-16mm mags FF,GG,HH (CEX)
  Mag MM from 500mm lens camera
  2-70mm cameras (HBW-mags QQ,PP)

5. Transferred to surface EVA-3

ETB and contents
  Lunar surface maps
  2-70mm mags UU,VV,WW(HBW)
  2-16mm mags II,JJ (CEX)
  Mag MM for 500mm lens camera
  2-70mm cameras (HBW mag SS, HCEX mag TT)

6. Transferred into Ascent Stage EVA-3

SCB #7
SCB #8
BSLSS Sample Bag
ETB and contents
  Lunar surface maps
  4-70mm mags SS,VV,UU,WW(HBW)
  2-16mm mags II,JJ (CEX)
  Mag MM from 500mm lens camera (HBW)
  SESC 2
  1-70mm mag TT(HCEX)

SECTION 3.0

NOMINAL LUNAR EVA

3.0 NOMINAL LUNAR SURFACE EVA

3.1 EVA GENERAL DESCRIPTION

In the nominal lunar surface activities plan, two crewmen will spend a total of 20 hours outside the Lunar Module and on the lunar surface for a total of 40 man hours of EVA time. This period is divided into three smaller periods of seven, seven, and six hours respectively for EVA-1, 2 and 3. These EVA periods are separated by adequate periods of LM cabin activity for housekeeping, eating and sleeping. In addition to the surface EVA activities, a SEVA (Stand-up EVA) will be conducted from the top of the LM for a period of 30 minutes beginning approximately 1-1/2 hours after LM touchdown. The nominal LM landing configuration provides for the +Z strut to face a due West direction (downsun).

Figure 3.1-1 is the summary timeline for the SEVA while Figures 3.1-2, 3.1-7 and 3.1-8 are the summary timelines for EVA-1, 2 and 3 respectively. SEVA is briefly described in paragraph 3.1.1, EVA-1 in paragraph 3.1.2, EVA-2 in paragraph 3.1.3 and EVA-3 in paragraph3.1.4.

3.1.1 Stand-up EVA (SEVA)

The SEVA is primarily a one-man activity conducted from a vantage point atop the LM approximately 20-25 feet above the lunar surface. Preparation for the SEVA will begin following the Post TD Powerdown sequence and will include assembly of both the 70mm data camera and the 500mm lens camera, and configuration by both crewmen for pressurized EMU operations while connected to the LM ECS system. The CDR will then open the tunnel hatch, remove the docking drogue and hand it to the LMP who will stow it in the CDR's station. The CDR will then stand on the ascent engine cover with his head and shoulders protruding above the LM. From his observation point above the lunar surface the CDR will be able to see a greater distance and will conduct a verbal description of the luraine 360° around the LM. Also from this position, the CDR will take a 360° vertical stereo panorama using the 70mm Data Camera and he will obtain the first long lens photographs of the Appenine Front and Hadley Rille using the 500mm lens camera. The LMP assists the CDR during the SEVA to hand him the necessary photographic equipment and to provide secondary observations of the luraine visible thru the LM window. It is anticipated that observations during the SEVA will enable MSC-Houston to more accurately pinpoint the

APOLLO 15 SUMMARY TIMELINE

LUNAR SURFACE SEVA

TIME SCALE	0	10	20	30
TV COVERAGE				
SEQ. CAM. COVER.				
COMMANDER ACTIVITY	●STAND ON ASCENT ENGINE COVER ●OBSERVE AND DESCRIBE LM SITE ●70 MM VERTICAL STEREO PAN ●GENERAL SURFACE DESCRIPTION	●DESCRIBE INITIAL IMPRESSIONS OF FRONT, RILLE, NORTH COMPLEX, MARE SURFACE, BOULDER FIELDS ●500 MM LENS CAMERA PHOTO OF FRONT, RILLE, NORTH COMPLEX, BOULDER FIELDS AND OTHER FEATURES	●DESCRIBE SURFACE CONDITION IN IMMEDIATE VICINITY OF LM (CRATER DISTRIBUTION, BOULDER POPULATION, FRAGMENTATION AND ANY NOTICEABLE DPS EXHAUST EFFECTS ON SURFACE) ●TERMINATE SEVA	
LM PILOT ACTIVITY	●ASSIST CDR WITH CAMERA ●DESCRIBE SURFACE FEATURES THROUGH LM WINDOW	●ASSIST CDR WITH 500 MM LENS CAMERA	●ASSIST CDR AS REQUIRED ●TERMINATE SEVA	
TIME SCALE	0	10	20	30

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			APOLLO 15 SUMMARY TIMELINE LUNAR SURFACE SEVA FIGURE 3.1-1
DR/C. HENDRICKS	CH	GE	PREPARED BY GENERAL ELECTRIC HOUSTON PROGRAMS — BASIC JUNE 1971

actual landing site as well as highlighting possible reference landmarks for use during the EVA traverse and perhaps taking sightings on these landmarks with a simple sun compass. Post SEVA activities include replacement of the drogue and reconfiguration of the tunnel hatch, LM and crewmen for pressurized cabin operations.

3.1.2 EVA-1

The first lunar surface activity period begins with depressurization of the LM cabin at approximately 15 hours 10 minutes after touchdown. The Commander (CDR) egresses first by backing out of the hatch, feet first on his hands and knees to the LM porch. As the CDR passes through the hatch, the LM pilot (LMP) deploys the CDR's PLSS antenna. The CDR then moves to a position at the top of the LM ladder which provides him with convenient access to the MESA unlock/deploy lanyards. The CDR then removes a cover from the MESA release mechanism, unlocks the MESA and activates the MESA deploy mechanism which allows the MESA to revolve out of its QUAD IV stowage and ratchet down to a position approximately 120° to the vertical side of the LM. In this position the TV camera mounted on the MESA will cover most of the activity in the vicinity of the LM ladder. The CDR then retrieves the jettison bag which has been placed in the hatch by the LMP and discards it to the lunar surface. The LMP then passes one end of the LEC to the CDR who, inturn, deploys it to the lunar surface. The CDR then descends the ladder to the footpad and after checking his capability to regain the bottom rung of the ladder, steps to the lunar surface where he will spend a few moments becoming accustomed to the lunar environment, restowing the jettison bag under the LM and discussing briefly surface conditions and LM landing effects on the surface and the LM struts. The LMP meanwhile has verified the LM cabin and circuit breaker configuration and prepared the ETB for transfer to the surface via the LEC. After completing this transfer, the LMP disconnects the LEC from the overhead handhold and stows it on the RHSC.

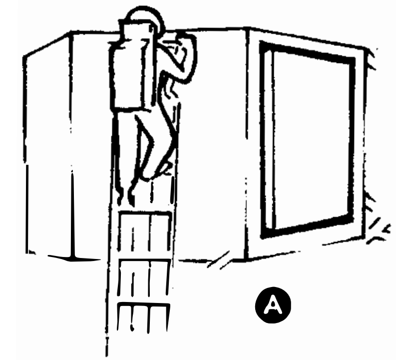
The LMP after making a final check of the LM cabin proceeds to egress to the LM porch. After partially closing the hatch he then descends the ladder to the lunar surface where he spends a few moments becoming acclimated to the lunar environment and making his initial observations of the luraine in the vicinity of the LM site.

Having transferred the ETB down, the CDR hangs it on the ladder hook and proceeds to open the MESA thermal blankets. He then unstows and deploys the TV camera tripod, and unstows and mounts the TV camera on the tripod. The TV cable is then unstowed from its location of the MESA and the TV is then carried to a 12 o'clock position approximately 50 feet from the LM and oriented to view the LM QUADS I and IV to cover the MESA and LRV offload activities.

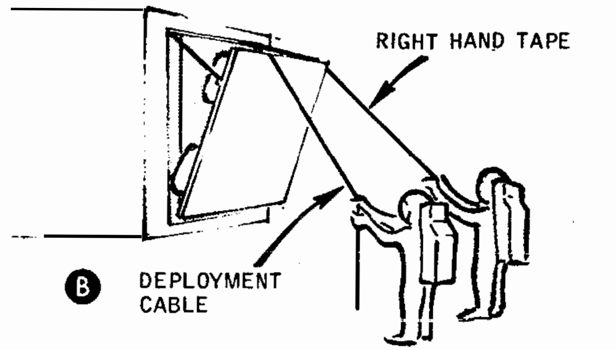
The LMP has proceeded to his first lunar surface task, that of getting the contingency sample. He removes the CSC from his suit pocket and deploys the handle and bag. He then selects a suitable undisturbed area, preferably within view of the cabin window and scoops approximately 1 kg of material from the lunar surface. He then removes the bag from the contingency sampler, seals it and climbs the LM ladder to interim stow the CSRC on the LM porch. While in position at the top of the ladder, the LMP will verify that the CDR has deployed the left-hand and aft LRV deploy tapes and is holding the right hand LRV deploy tape in a position at least 15 feet from the LM/LRV. The LMP then pulls the D-ring to unlock the LRV, allowing it to rotate outward from its stowage cavity in QUAD I approximately 4 degress from vertical. The LMP then descends the ladder to assist the CDR with the LRV off-load.

The CDR, having observed the LRV unlock and initial movement to the 4° position, now pulls the right-hand LRV offload tape until the rear wheels rest on the lunar surface. (Note: The LMP will assist by maintaining tension on the aft deploy cable.) With the rear wheels resting on the lunar surface, the right and left outrigger cables are detached and the CDR begins to pull the left-hand off-load tape until the front wheels rest on the lunar surface. The LMP then assists the CDR in deploying the LRV fender extensions, checking that the hinges are locked, erecting the seats, locking the console into place, positioning the footrests and disconnecting the LRV from the LM. After completing the post deployment checklist the the CDR mounts the LRV, powers it up, test drives it, and parks it near the MESA.

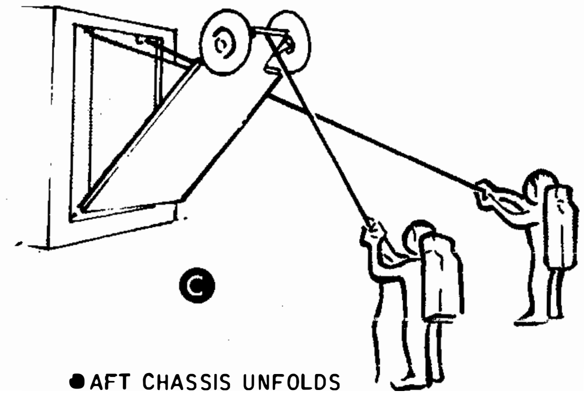
FIGURE 3.1-3 LRV DEPLOYMENT SEQUENCE



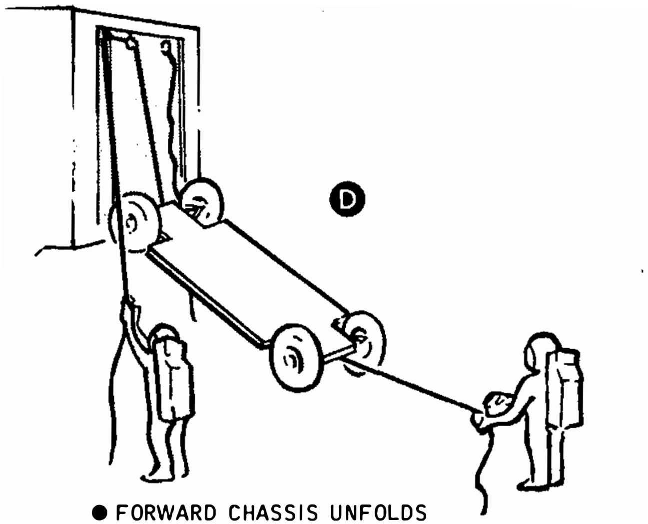
- LRV STOWED IN QUADRANT
- ASTRONAUT REMOVES INSULATION BLANKET, OPERATING TAPES
- ASTRONAUT REMOTELY INITIATES DEPLOYMENT



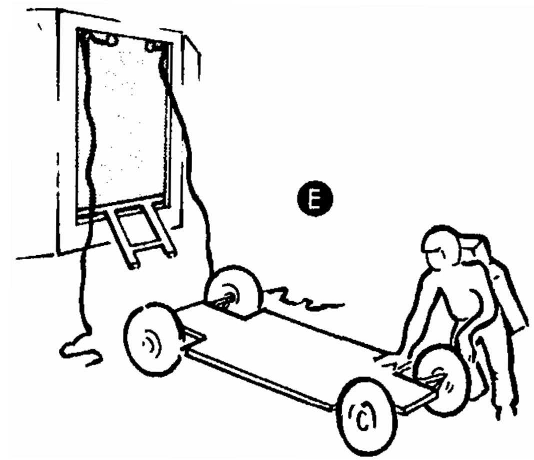
- ASTRONAUT LOWERS LRV FROM STORAGE BAY WITH RIGHT HAND TAPE



- AFT CHASSIS UNFOLDS
- REAR WHEELS UNFOLD
- AFT CHASSIS LOCKS IN POSITION



- FORWARD CHASSIS UNFOLDS
- AND LOCKS
- FRONT WHEELS UNFOLD
- ASTRONAUT LOWERS LRV TO SURFACE WITH LEFT HAND TAPE



- ASTRONAUT DISCONNECTS SSE

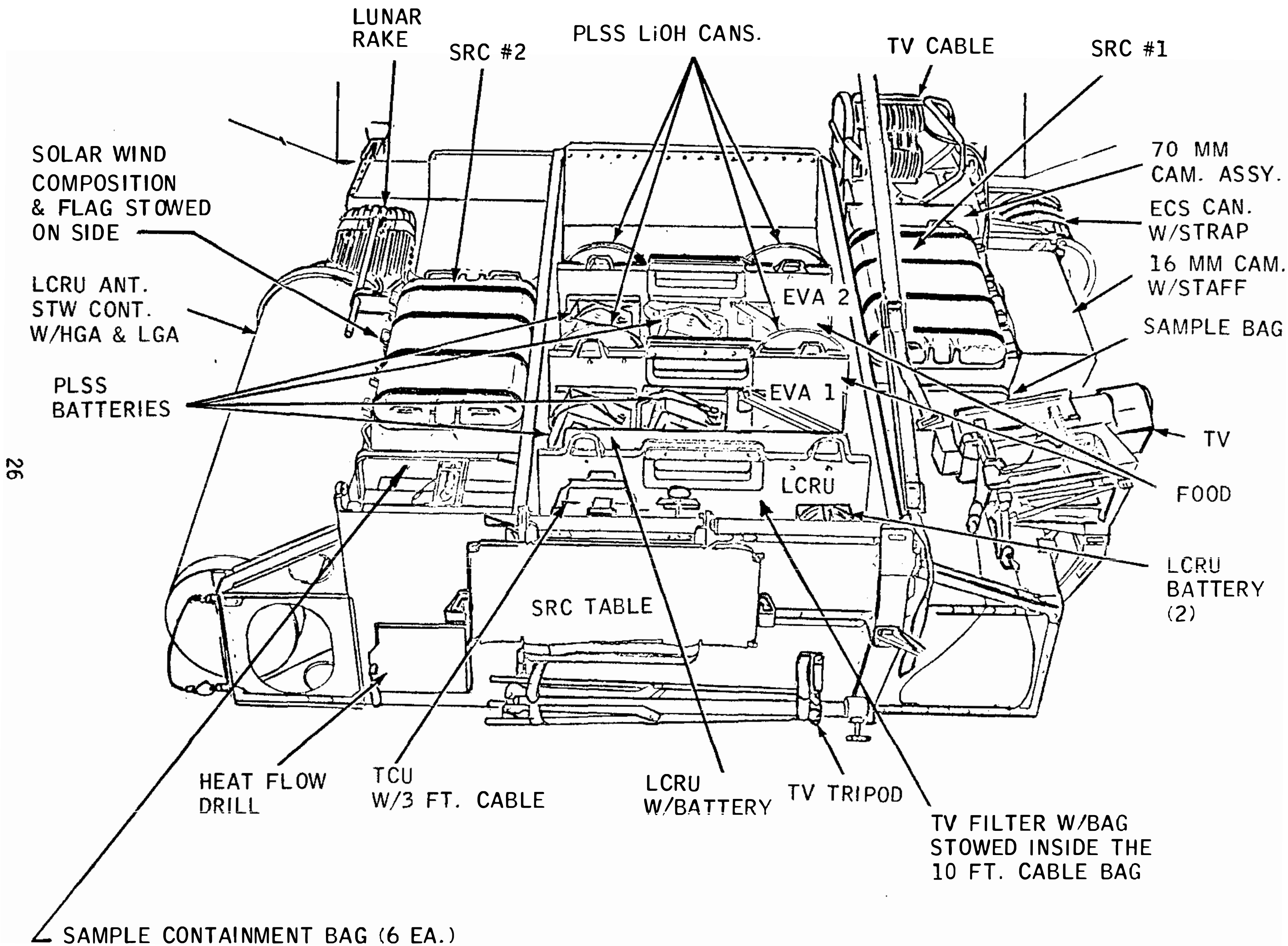


Figure 3.1-4 MESA STOWAGE

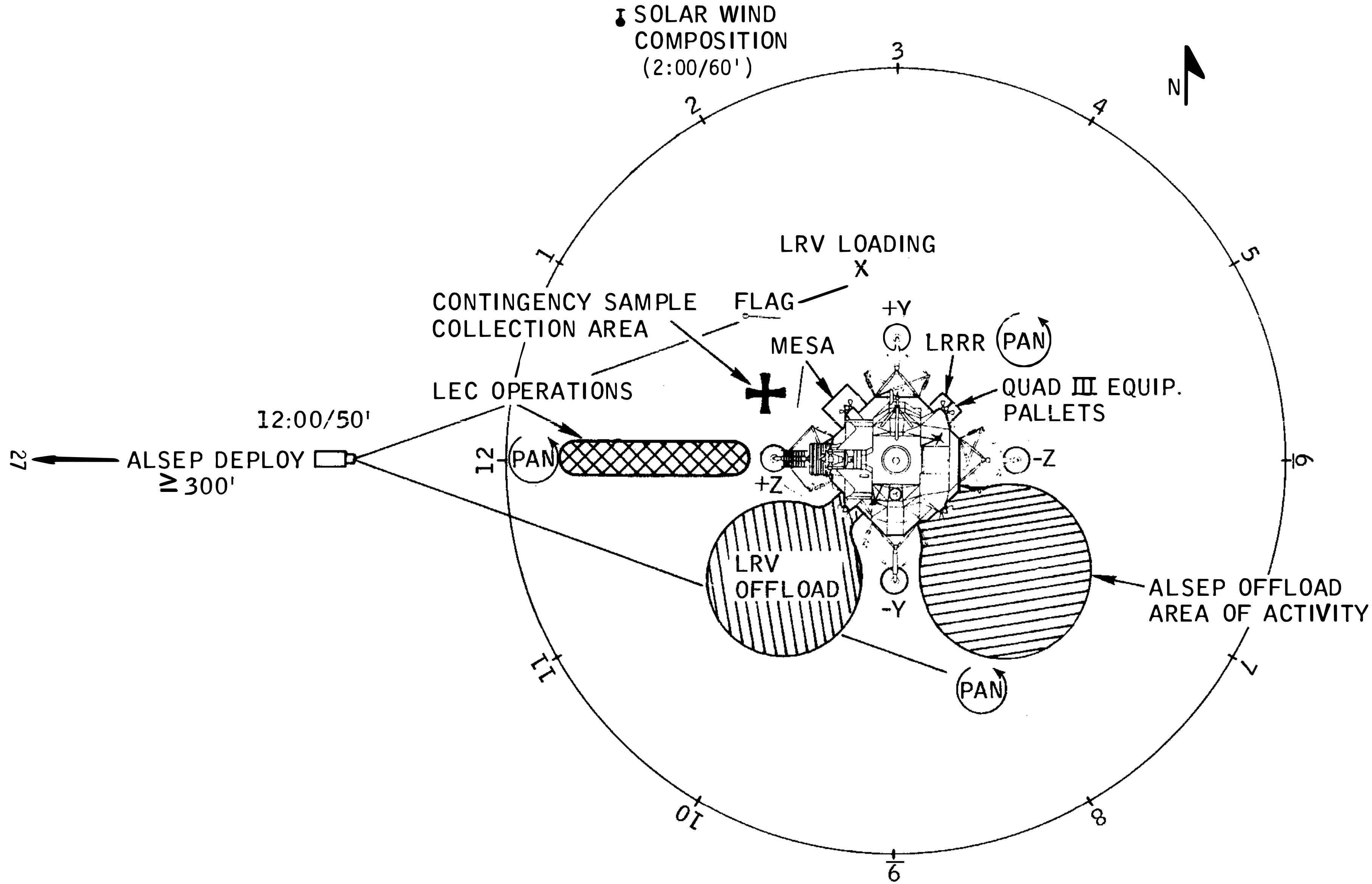


FIGURE 3.1-5 PROBABLE AREAS FOR NEAR LM LUNAR SURFACE ACTIVITIES

The LMP, having unstowed and assembled the 16mm LDAC, photographs the CDR as he test drives the LRV in the vicinity of the LM. He then mounts the 16mm camera on the LRV. Returning to the MESA area the LMP performs the following MESA housekeeping and LRV stowage activities: unstow the 70mm DC, attach a magazine from the ETB and stow on LRV; unstow the EVA-1 pallet and attach to the MESA table; discard the 16mm camera rack from MESA; unstow the ECS LiOH can and stow in EVA 1 pallet pocket; remove thermal blankets from QUAD III geology pallet, offload pallet and stow on LRV; unstow SRC 1, place on MESA table and open; remove SCB #1 from SRC 1 and attach to HTC (on QUAD III pallet). The LMP then pulls the HTC pip pin to allow HTC to swing out on the QUAD III pallet providing access to tools stowed on the pallet. He then assembles the extension handle and small scoop and stows them on the HTC; unstows and deploys the gnomon and restows on the CDR's seatback; restows penetrometer on the pallet; unstows and attaches SCB #2 to the HTC and SCB #3 to the front of the pallet. Then he transfers the following equipment from SCB #1: 6 core stems and core stem cap to SCB #2, a 20 DSBD to the CDR's floor pan and a 20 DSBD to the LMP's floor pan. The rake is then unstowed from the MESA and restowed on the QUAD III/LRV pallet. The LMP then proceeds to ingress the LM, retrieving the contingency sample in route.

The CDR, having parked and powered down the LRV, unstows the LCRU and the TCU from the MESA and mounts them on the front of the LRV and makes the required cable connections. He then unstows the LGA and HGA from MESA canisters and mounts them on the LRV connecting the proper cables. The TV camera is retrieved from the tripod, turned off, mounted on and connected to the TCU. The LCRU is then powered up, the antennas oriented and the LCRU system checked out for acceptable communications with MSFN and MCC-Houston. The CDR then brings the ETB to the LRV, offloads and stows the contents: 2-70mm mags, 2-16mm mags and the 500mm lens camera to the CDR's underseat bag; 1-16mm mag to the 16mm camera; map holder to the LMP inboard handhold; and the BSLSS to the LMP seatback.

The LMP having ingressed the LM and stowed the contingency sample, modifies the configuration of the LM communications by switching Power Amp - OFF, Bit Rate - LOW, TV cb - OPEN and modulation switch - PM. He then connects the LEC to the overhead handhold and transfers the EVA 1 pallet from the surface. After offloading the food packages, batteries and LiOH from the pallet and stowing them, the LMP egresses the cabin, discards the pallet to the surface, closes the LM hatch and descends again to the surface to tidy up the thermal control blankets around the MESA before departing on the geology traverse.

The CDR having attached the EVA-1 pallet to the LEC and having accomplished the pallet transfer into the LM cabin, returns to the LRV to stow the HGA and configure the LCRU for traverse operations. He then mounts the LRV, performs the power up sequence and positions the LRV for initializing the LRV navigation system.

The CDR and LMP then configure each other for the geology traverse. The CDR installs the hammer, core tubes cap dispenser and SCB #4 on the LMP's PLSS tool harness and then tethers his tongs and dons his 70mm DC with 20 DSBD attached. The LMP attaches SCB #1 to the CDR's PLSS tool harness and then tethers the extension handle/scoop and dons his 70mm DC with attached 20 DSBD. Both crewmen then mount the LRV and depart to geology station #1.

(NOTE: For purposes of the final edition of the Lunar Surface Procedures, the geology traverse information is contained in Section 3.6.)

After completing the EVA-1 geology traverse to the Front, the crew returns to the LM site to prepare for the ALSEP deployment. The CDR parks East of the LM, heading West, reports Nav readings, pulls the Nav cb and then powers down the LRV and configures the LCRU and HGA for TV coverage of the ALSEP offload. The tools, cameras and SCB's are removed from the EMU's and stowed on the LRV.

The LMP retrieves the SEQ Bay door lanyard and opens the SEQ Bay door. He then offloads the ALSEP power package (Pkg 2) and positions it for fueling the RTG. He then removes two UHT's, tethers one and gives the other to the CDR. He also removes and hands to the CDR the carry bar sections. Next, he retrieves the fuel cask deployment lanyard and rotates the fuel cask to a position convenient for removing the fuel element. He then retrieves the dome removal tool from the power package, engages it with the fuel cask dome, removes and discards the dome/tool.

After retrieving and engaging the fuel transfer tool with the fuel element, he withdraws the fuel element from the cask and installs it in the RTG. He then disengages the fuel transfer tool and discards it. He attaches the power package to the carry bar, completing assembly of the ALSEP barbell. Before leaving the QUAD II area the LMP closes the SEQ Bay doors.

The CDR offloads the ALSEP experiments package (Pkg 1) and positions it clear of the SEQ Bay. He receives a UHT from the LMP and tethers it. He also receives the carry bar sections which he assembles and attaches to the bottom of the experiments package. The CDR then retrieves the ALSD from the MESA and interim stows it on the LMP's LRV floor pan. He then offloads the LRRR from LM QUAD III and stows it on the LMP seat, lashing it down with the LMP seat belt. After configuring the HGA and LCRU for traverse operations, the CDR mounts the LRV and drives to the area of the ALSEP deployment site at least 100m West of the LM, and selects a specific ALSEP deploy site.

The LMP retrieves the ALSEP barbell from the SEQ Bay area and carries it to the ALSEP site. Upon arriving at the site he places the experiments package in the desired location, disconnects the power package from the barbell and deploys it 10 feet East of the experiments package. Next he unstows the RTG power cable and connects it to the C/S (experiments package). After removing two Boyd Bolts, the subpallet containing the SIDE and the ALSEP antenna gimbal is removed from the power package and placed on the surface 10 feet to the North. The SIDE/CCIG is then removed 10 feet from the subpallet by releasing four Boyd Bolts. Before placing the SIDE on the surface, the cable reel is unstowed and the SIDE legs and deployed. The SIDE connector is unstowed from the subpallet and connected to the C/S. Next, the PSE stool is removed from the subpallet and emplaced on the surface 9 feet West of C/S. The PSE is removed from C/S after releasing 4 Boyd Bolts, emplaced on the PSE stool, the thermal skirt deployed and the PSE leveled and aligned. After removing 4 more Boyd Bolts the SWE is removed from C/S and deployed 13 feet North of C/S with the legs extended and locked. The SWE is then leveled and aligned. Next, the LSM is released from C/S by removing 2 Boyd Bolts and positioned 50 feet WNW of C/S. After the legs are deployed and the LSM aligned, the LSM sensor arms are deployed, the dust covers and PRA cover are removed and the unit is leveled.

The CDR, after parking the LRV and configuring the LCRU and HGA to provide TV coverage of the ALSEP deployment, offloads the LRRR and the ALSD to the lunar surface. He then removes the HFE pallet from the subpallet by releasing two Boyd Bolts, connects the HFE cable to the C/S and then carries the HFE pallet to a position 30 feet North of the C/S. The HFE probe container is then removed from the pallet, opened and one probe and the emplacement tool are interim stowed on the pallet. The other probe is placed on the surface 16 feet West of the HFE. The remaining probe is then placed on the surface 16 feet NE of the HFE. The HFE electronics box is removed from the pallet and emplaced on the surface and the pallet discarded. The CDR retrieves the ALSD and places it on the LMP's LRV seat. The bore tube rack is removed from the drill package and the legs extended. The drill chuck is reset and the drill is removed from the treadle and the drill and rack are carried to the HFE site. The first two bore stem sections are removed from the rack, assembled and inserted into the drill chuck. The bore stems are then drilled into the surface until approximately 1/3 of a section protrudes above the surface at which point the chuck is released and the drill is removed. A second pair of bore stems are assembled and attached to those already emplaced in the surface. The drill chuck is reset and the drill placed atop the new bore stem sections and the total bore stem assembly is drilled further into the surface until again approximately 1/3 of a section remains above the surface. The drill is again removed, a third pair of bore stems assembled and added to the bore stem in the surface. The drill chuck is reset and the drill attached to the new bore stem section and the total bore stem is again drilled into the surface until the top of the stem is approximately 15 cm above the surface. The drill is removed from the bore stem and the HFE probe is inserted as far as possible into the bore stem using the emplacement tool. The depth of penetration is indicated by ruled markings on the emplacement tool. The drill and rack is carried to the second probe site and the above bore stem and probe emplacement procedure is repeated.

The LMP, after completing the LSM deployment, returns to the C/S to deploy the sunshield. Using the UHT he releases 16 Boyd Bolts on the C/S perimeter, 2 Boyd Bolts on the ALSEP antenna, releases the antenna rf cable, and 3 inner Boyd Bolts. As the sunshield is raised, the sunscreen curtains are automatically deployed and positioned except for velcro tabs at the corners which the LMP secures. The antenna mast and gimbal are retrieved from the sub-pallet. The mast is installed on C/S and the gimbal mounted on the mast. The ALSEP antenna is then inserted into the gimbal and the gimbal is leveled, aligned and adjusted to the predetermined azimuth and elevation offsets. He then gets the SIDE and carries it to a position 55 feet NE of C/S. The ground screen is removed and deployed on the surface. Next the CCIG is removed from its cavity and installed on the ground screen tube which also serves as a CCIG deployment arm. The ground screen tube pin is removed and the SIDE is oriented and placed on the ground screen in a position such that the CCIG when deployed will be clear of the ground screen. After leveling and aligning the SIDE, the CCIG is rotated to the surface.

Upon returning to the C/S, the LMP then activates C/S by depressing the shorting switch, turning Astro SW #1 CW and requesting a transmitter turn-on command from MSFN. Next, the LMP mounts his 70mm camera on his RCU, picks up the LRRR, carries it to a position at least 25 feet West of C/S, deploys, aligns and levels it. He then proceeds to photograph the ALSEP experiments using the 70mm camera and HCEX film. See Figure 3.3-1.

The CDR, having completed the HFE probe emplacement, then selects a suitable site to obtain the deep core sample. This site will be in the vicinity of the LRV since LRV mounted equipment is utilized in the coring operation. The drill treadle is placed on the surface and the first two core stems are removed from SCB #2 (on HTC), assembled and threaded onto drill. Then, with the core stem inserted through the treadle the core stem is drilled into the surface until approximately 15 cm protrudes above the surface. The drill is removed and the second pair of core stem sections are assembled and threaded onto the core stem in the surface. The drill then is attached to the new section and the total core stem is drilled further into the surface until again approximately 15 cm remains. The drill is removed and the final pair of core stem sections are assembled, threaded onto the existing core stem, the drill re-attached and the core stem drilled the final increment into the surface until approximately 15 cm of the core stem is exposed. The CDR retrieves his 70mm camera and takes a pan from a position 7 feet South of the implaced core stem. After restowing the camera on the LRV, the drill is decoupled from the core stem and the core stem is withdrawn from the surface, the joints broken and the individual core stem sections are disassembled and capped. Before the core stems are stowed, SCB #2 is removed from the HTC and placed under the LMP's seat. SCB #4, which is under the LMP'S seat is attached to the HTC and the core tubes in SCB #1 are transferred into SCB #4. The capped core stems are then stowed in SCB #1.

After the ALSEP deployment has been completed and the necessary documentation photographs taken, the CDR and LMP survey the undisturbed areas in the proximity of the ALSEP site to collect additional documented samples of any unusual features not previously encountered and to document the types of material in the vicinity of the ALSEP. However, sufficient volume must be retained in the SCB's to accommodate the samples that will be taken during the polarimetric study to be done in the vicinity of the LM.

The CDR then configures the HGA and the LCRU for traverse operations back to the LM. Both crewmen then mount the LRV, carefully depart the ALSEP site to minimize the dust contamination of the ALSEP and traverse back to the LM where the LRV is parked cross-run, heading North and powered down.

The CDR then opens the MESA thermal blankets and unstows the polarizing filter and installs it on his 70mm camera. Then, taking the gnomon and tongs, he surveys the area to find a suitable rock/soil distribution site suitable for the polarimetric sample series. After completing the distant and near polarimetric photography, a suitable quantity of representative samples are taken from the site.

The LMP meanwhile unstows the SWC from the MESA, extends the staff, unfurls the foil shade and emplaces the SWC experiment approximately 60 feet NW of the LM taking cross-sun and down-sun photographs with the 70mm camera. Following this, the LMP conducts a rather detailed LM site inspection and description noting particularly the condition of the landing struts and the surface/footpad interaction. During this site inspection, the LMP pauses to take three photographic panoramas, one each at the 12, 4 and 8 o'clock positions.

The flag kit is then unstowed from the MESA. While the LMP drives the staff into the surface the CDR unfurls the flag and then mounts the upper staff and flag onto the lower staff. The crewmen then take each other's pictures standing next to the flag.

Having completed the tasks for EVA-1, the crewmen begin the EVA closeout tasks. The LMP places SCB #1 into SRC 1 which he then closes and seals. He then retrieves SCB #3 and #4, closes them and places them atop the SRC. He tidys the MESA thermal blankets and prepares to dust off the CDR's EMU.

The CDR transfers all 70mm and 16mm magazines from beneath the LRV seats into the ETB along with the magazines from the 500mm lens camera and the 16mm camera and the maps from the LRV map folder.

Using the MESA brush, each crewmen brushes the loose soil from the other's EMU. The LMP then retrieves SCB #3 and ingresses the LM. The CDR then attaches the LEC to SRC #1 and transfers it into the LM after the LMP has completed his ingress. The ETB is then transferred into the LM via the LEC.

The CDR powers down the LCRU, retrieves SCB#4 and ingresses the LM. The LM cabin is then repressurized, terminating EVA-2.

3.1.3 EVA-2

The second period of surface EVA activity is planned to begin approximately 36.5 hours after touchdown and is planned for 7 hours duration. The CDR again backs out of the LM hatch onto the porch and receives a jettison bag from the LMP which he discards onto the surface. The CDR then passes the LEC to the LMP and descends to the lunar surface where he unstows the EVA 2 pallet from the MESA and prepares it for transfer into the cabin. The pallet is transferred into the cabin and the ETB transferred to the surface and carried to the LRV. After uncovering the BSLSS and the 500mm lens camera, the 16mm and 70mm magazines are offloaded and stowed under the LRV seats (one magazine is attached to the 500mm lens camera). The maps are placed in the map holder and the ETB returned to the MESA table.

The LMP completes his cabin housekeeping activities and then egresses the cabin bringing with him the empty EVA-2 pallet which he discards to the surface before closing the hatch. He descends to the surface, retrieves the two spare LCRU batteries, stows one in the +Y footpad and places the other on the LRV. The CDR then turns off the LCRU, installs a fresh battery and turns the LCRU on again. The LMP then unstows and opens SRC 2 and off loads SCB #5 to the HTC. SCB #6 and #7 are unstowed from the pallet. SCB #7 is hung on the HTC and SCB #6 is attached to the geology pallet. Excess equipment in the form of 3 core tubes, one core tube cap dispenser, 2-20 DSBD's and one SESC are removed from SCB #5 and stowed in SCB #7 which is then removed from the HTC and stowed under the LMP's LRV seat. SCB #2 is removed from the underseat location and attached to the HTC.

The CDR and LMP then assist each other in configuring the PLSS tool harnesses for the geology traverses. The LMP will carry a hammer, the core tube cap dispenser, and SCB #2. The CDR will carry SCB #5 which contains the 3 core tubes and one SESC. The 70mm cameras with 20 DSBD are installed on the RCU's and the HGA and LCRU are configured for traverse operation. Both crewmen mount the LRV, drive to the initialization site to initialize the navigation system, and begin the traverse to geology station #5.

(NOTE: For purposes of the final edition of the Lunar Surface Procedures, the geology traverse information is contained in Section 3.6.)

Upon returning to the LM after geology station #8 the navigation and LRV displays are read out and the LRV parked near the MESA and powered down. The CDR configures the HGA and the LCRU for TV coverage and then begins offloading equipment from the LMP's PLSS tool harness. SCB #2 is stowed on the HTC and the LMP removes SCB #5 from the CDR's PLSS and stows it also on the HTC. The CDR retrieves the ETB and stows all 70mm and 16mm magazines (including the magazines on the 500mm lens camera and the 16mm camera). The lunar surface maps are also stowed in the ETB which is then attached to the MESA table.

The LMP places SCB #5 into SRC #2, closes and seals it. SCB #2 and #6 are removed from the HTC and geology pallet and placed atop SRC #2.

Using the MESA brush, the crewmen dust off their EMU's. The LMP, carrying SCB #6, climbs the LM ladder and ingresses the cabin.

The CDR meanwhile places the BSLSS and the 500mm lens camera on the LMP's LRV seat and covers it with the thermal blanket previously used for this purpose. When the LMP is set, SRC #2 and the ETB are transferred into the cabin via the LEC. The CDR then picks up SCB #2 and climbs the ladder to the porch. After handing SCB #2 to the LMP he receives the LEC, stows it on the porch, and ingresses the cabin to terminate the second surface EVA period.

3.1.4 EVA-3

The third and final period of lunar surface EVA activity begins approximately 57 hours after TD and is planned for 6 hours duration.

The CDR egresses to the LM porch and pauses, receiving a jettison bag from the LMP which he discards to the surface. The CDR hands the LEC to the LMP and continues his descent to the lunar surface. The ETB is transferred to the surface and carried to the LRV where, after configuring the LCRU for TV coverage, the CDR offloads the ETB contents to the proper LRV stowage compartments. The BSLSS is restowed behind the LMP's seat and the 500mm lens camera is restowed under the CDR's seat. After returning the ETB to the MESA, the CDR replaces the LCRU battery.

The LMP, after transferring the ETB, egresses the cabin, closes the hatch, and descends to the surface for his last lunar expedition. He retrieves the last LCRU battery from the +Y footpad and places it on the LRV floor pan and stows the BSLSS sample bag on the geology pallet forward hooks. He retrieves SCB #7 from beneath the LMP's seat and attaches it to the HTC along with SCB #8 from the geology pallet. The 20 DSBD's are removed from SCB #7 and placed on the LRV seats.

The CDR and LMP then assist each other restowing tools and equipment on the PLSS tool carrier, then mount the LRV, power it up and depart the LM site for geology station #9.

(NOTE: For purposes of the final edition of the Lunar Surface Procedures, the geology traverse information is contained in Section 3.6.)

Upon arriving at the LM site, the LRV is again positioned at the initialization site and the nav parameters and LRV displays read out. The LRV is then parked near the MESA and powered down for the EVA closeout activities while the LMP takes cross-sun and down-sun photographs of the LRV. The CDR reconfigures the HGA and LCRU for TV coverage and then the crewmen proceed to offload the equipment from their PLSS harnesses.

The LMP then places SCB #7 and #8 and the BSLSS sample bag (from the geology pallet) on the MESA table. After checking the LRV to verify all samples have been removed, he removes the 16mm camera from the LRV and prepares to photograph the CDR driving the LRV to the site from which the TV camera will cover the LM A/S lift-off.

The CDR gets the ETB and offloads from the LRV: the 70mm magazines, 500mm lens camera magazine, the 16mm camera magazines, and the lunar surface maps; and returns the ETB to the MESA table. The LRV is then powered up and driven to the lift-off observation site approximately 100 meters East of the LM such that the LM is on a bearing of 276° from the LRV. The LRV is parked and powered down except as required to support the TV/LCRU operations. The HGA is aligned and the LCRU switched to the TV/REMOTE mode. LCRU power is switched to EXT to utilize the remaining energy in the LRV batteries. The LRV is parked in this location to permit observation of LM lift-off via remote controlled TV.

The LMP stows the 16mm camera on the MESA and then retrieves the SWC foil, stowing it in a bag provided for its protection and then stows it in the ETB along with the final 16mm magazine.

When the CDR has returned to the LM site, the MESA brush is used to dust off the EMU's as much as possible prior to ingressing the cabin. The LMP ascends the ladder carrying the BSLSS bag and enters the cabin. The LEC is used to transfer SCB #7 and the ETB into the cabin. The CDR ascends the ladder to the porch carrying SCB #8 which he then hands to the LMP. The CDR discards the LEC now lying on the porch and ingresses the cabin to conclude the final surface EVA period of the Apollo 15 mission.

3.2 DETAILED EVA TIMELINE PROCEDURES

3.2.1 SEVA

The detailed timeline procedures for SEVA are shown on the following vertical format pages. In the SEVA, the activity is primarily centered around the CDR who stands on the Ascent Engine cover with his head and shoulders protruding through the LM tunnel and above the LM. The LMP supports the CDR's activity by equipment management and secondary lunar surface descriptions as viewed from the cabin windows.

MISSION: APOLLO 15 DATE: 4/19/71
EVA: SEVA

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+00	Stand on Ascent Engine cover with head and shoulders protruding through docking tunnel hatch			
		Describe lurain and landmarks to assist in LM landing site location			
Hand CDR'S 70mm camera to CDR standing in docking tunnel		Receive 70mm camera from LMP			
		Using 70mm camera obtain 360° vertical stereo panorama (use approximately 36 frames)			
Describe lurain, surface conditions and landmark features as observed through LM windows					
Interim stow 70mm camera		Hand 70mm camera to LMP			
		Describe general surface condition as they appear in directions of preplanned traverses for possible trafficability, landmarks and ALSEP site location			
	0+10				
		Describe in general the initial impressions of the Front, Rille, North Complex, Mare Surface and Boulder fields			
Hand 500mm lens camera to CDR		Receive 500mm lens camera from LMP			
		Do long lens photography of Front, Rille, North Complex, Boulder fields and any other prominent features			
Interim stow 500mm lens camera	0+20	Hand 500mm lens camera to LMP			

MISSION: APOLLO 15 DATE: 4/19/71
EVA: SEVA

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Interim stow 500mm lens camera	0+20	Hand 500mm lens camera to LMP			
		Describe lunar surface conditions in immediate vicinity of LM such as crater distribution, fragmentation, boulder population, and any noticable affects of DPS exhaust on the surface			
SEVA Termination (For termination procedures, see Lunar Surface checklist)	0+30	SEVA Termination (For termination procedures, see Lunar Surface checklist)			

3.2.2 EVA-1

The detailed procedures for EVA-1 are shown on the following vertical format pages. The crew cuff checklist pages which correspond approximately to the timeline are shown on the far left-hand facing sheets along with the Voice Data Plan with which cap-com can assure that the required information is given by the crew to MCC-H and which assists cap-com in essential communications with the crew. The crew's cuff checklist does not necessarily correspond to the vertical timeline in content or verbage as this is a crew preference item and contains those cues the crew feels they need to accomplish the required tasks.

EVA 1

CODE

(1) MANDATORY REQUIREMENT FOR DATA AT TIME OR EVENT DESIGNATED

(2) DATA MAY BE DEFERRED UNTIL LATER IN EVA OR DEBRIEFING

NOTE: AT START OF EVA 1

- SUN ANGLE ∿ 19°
- LM SHADOW LENGTH ≈ 20.2m(66.8ft)
- ASTRONAUT SHADOW LENGTH ≈ 5.28m(17.4ft)

EMU STATUS TABLES @ 30 MIN INTERVALS

0+00 (1) CDR/LMP EVA WATCH START - MARK

CDR-2 | EVA-1 | 7/1/71 | EGRESS H2O XFER

PLSS TO LM H2O TRANSFER

Torso Tiedown - Loosen as reqd
PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - ON
Torso Tiedown - Tighten as reqd

LMP-2 | EVA-1 | 7/1/71 | EGRESS H2O XFER

PLSS TO LM H2O TRANSFER

Torso Tiedown - Loosen as reqd
PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - ON
Torso Tiedown - Tighten as reqd

0+10

Final

June 28, 1971

Apollo 15

Mission J-1

NOMINAL TIMELINE

LUNAR SURFACE EVA 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
START EVA WATCH	0+00	START EVA WATCH (CALL "MARK")		PRE-EGRESS OPERATIONS	PRE-EGRESS OPERATIONS
		NOTE: DETAILED PROCEDURES ARE PRESENTED IN "LUNAR SURFACE CHECKLIST", "EQUIPMENT PREP EVA 1"SECTION			
OPEN HATCH	0+10	EGRESS			

CREW EVA CHECKLIST

H2O XFER | EGRESS

CDR - EVA 1

0+10 Move Through Hatch - Comm Ck
PLSS Antenna - Deploy
MESA - Deploy
Jett Bag - Discard
LEC - Deploy to LRV Side

Descend to Surface
FAM - 3 Minutes
Jett Bag - Under LM

0+20 ETB - Transfer Down
ETB - To Ladder Hook

MESA Height - Adjust
Blankets - Open
[LMP: Egress]
LMP PLSS Ant. - Unstow

CDR-3 | EVA-1 | 7/1/71

H2O XFER | EGRESS

LMP - EVA 1

0+11 CDR PLSS Antenna - Deploy
Jett Bag - Place in Hatch
LEC - to CDR

Recorder - OFF
VOX SENS (2) - MAX
CB Configuration - Verify
Utility & Flood Lts - OFF

LEC - To Overhead Handhold
0+20 ETB - Transfer
LEC - Stow to Side

Egress
Hatch - Close
Descend to Surface
{CDR: LMP PLSS Ant.-Unstow}

LMP-3 | EVA-1 | 7/1/71

CDR-4 | EVA-1 | 7/1/71

[TV] Tripod - Unstow
TV Camera - To Tripod
TV - Position 12:00/50 Ft.
Lens - Set f-11, 12.5mm, Pk.
Check Hou TV Reception

0+29 [LRV] Thermal Blanket - Remove
Ck - Walking hinges - Locked
- Chassis - Parallel
- Outrigger Cables - Taut
LRV Left Tape - over Strut
LRV Right Tape - Deploy
[LMP: D-ring & Aft Lanyard]
Right Tape - Pull - MARK; Aft
Chassis Deploy - Fwd Unlock
Outrigger Cables - DISCNT
Left Tape - Pull
0+37 LRV - Set Up
•Chassis Hinge Pins - Check
•Ind. Lock Pins - Pull

LCRU MF. | LRV OFFLD

LMP-4 | EVA-1 | 7/1/71

0+25 Fam - 3 minutes
Contingency Sample - Collect
Sample - To Platform

Check CDR Ready
LRV - Unlock from LM
Descend to Surface

Aft Lanyard - Unstow
- Pull to assist
- Discard
Pallet Post - Erect

0+36 LRV - Setup
•Chassis Hinge Pins - Check
•Battery Covers-Check Closed

16MM LRV | LRV OPLY

VOICE DATA

0+10

(1) LMP - Deploy CDR PLSS antenna

(2) CDR - Jettison Bag

(1) CDR - Stability & Mobility discussion

CDR - LM check

CDR - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) LMP - Stability & Mobility discussion

(2) LMP - Verify cb configuration - OK

(1) CDR - Deploy LMP PLSS antenna

(1) CDR - TV position OK
Settings Peak, f 11, 12.5mm

(1) LMP - EMU check
(1) CS on LM porch

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

0+30

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LRV	TASK FUNCTION LMP	TASK FUNCTION CDR
Assist CDR	0+10	Move through hatch			EGRESS
Deploy CDR PLSS antenna		Deploy PLSS antenna			
Place Jettison bag in hatch		Descend ladder to deploy MESA			
Remove LEC, loop end, from stowage bag		Deploy MESA Retrieve & discard jettison bag into Quad I			
Pass LEC, loop end, to CDR		Deploy LEC			
Recorder-OFF Verify VOX SENS (2)-MAX Verify CB configuration		Descend ladder to surface Check footing, stability, and mobility			
Utility & floodlights - OFF					
Attach LEC to overhead handhold		Kick Jettison bag under LM			
Transfer ETB to surface	0+20	Transfer ETB to surface			
Remove from handhold & stow LEC Move through hatch		Hang ETB on LEC stowage hook Adjust MESA height Loosen MESA blanket around TV camera		EGRESS	TV DEPLOY
Close hatch		Open MESA blankets Deploy LMP PLSS antenna Unstow, deploy, and place TV tripod on surface			
Descend to surface		Unstow and mount TV camera on tripod			
Deploy PLSS antenna Check footing, stability, and mobility		Position TV at 12:00/50' to view Quads I & IV Adjust TV per MCC request			
Remove CSC from pocket Deploy CSC handle & bag Collect contingency sample				CONTINGENCY SAMPLE	
Remove handle & close bag Climb LM ladder & place cont sample on platform	0+30	Remove LRV thermal blanket Check walking hinges latched Deploy left LRV offload tape across secondary strut			

CREW EVA CHECKLIST | VOICE DATA

0+30

(2) ETB Contents:
- LMP 70mm cam w/mag LL(HBW)
- 2-70mm mags KK,NN (HCEX)
- 1-70mm mag OO (HBW)
- 3-16mm mags CC,DD,EE
- 500mm Lens camera/mag MM(HBW)
- Maps
- BSLSS

LRV OFFLD | LCRU MF | CDR-5 | EVA-1 | 7/1/71

0+42 Mount LRV
LRV Post Deployment Checks
Test Drive LRV
[LMP: Photo CDR on LRV]
Park LRV - Quad IV - Face MESA
Power Down & Dismount LRV

0+46 $\boxed{\text{LCRU}}$ Post Locks - Lift
Velcro Tab - Release
TCU Cable - To Batt Cover

LCRU - To LRV
Cable - Connect

$\boxed{\text{TCU}}$ - To LRV
Cable - Connect
[LMP: EVA 1 Pallet to MESA]
Rake - To MESA Side
$\boxed{\text{LGA}}$ - To Handhold
LGA Cable - Connect To LCRU

(2) LMP-Rpt 16mm mag ___ on 16.mm cam
(1) LMP-Photo LRV 16mm cam (f8,1/250,24fps)

(1) CDR - LRV Displays prior to test drive

Amp-Hr Bat 1		Temp Bat 1	
Amp-Hr Bat 2		Temp Bat 2	
Amps Bat 1		Temp LF mtr	
Amps Bat 2		Temp RF mtr	
Volts Bat 1		Temp LR mtr	
Volts Bat 2		Temp RR mtr	

LRV OPLY | 16MM LRV | LMP-5 | EVA-1 | 7/1/71

0+42 16mm Cam - Assemble
Mag"CC" - Install on 16mm Cam
16mm Photo - CDR/LRV
(f8,1/250,24FPS)
16mm Cam - To LRV

CDR 70mm Cam - Unstow
Cam Bracket - Remove & Discard
Filter & Reseau Cover-To MESA

CDR 70mm Cam - To LMP RCU
Mag "NN" - To CDR 70mm Cam
CDR 70mm Cam-To CDR Floor pan

0+50 EVA #1 Pallet - To MESA Table
PLSS LiOH Cans - Check Pins
16mm Cam Bracket - Discard
LiOH Can(Band Off) - To Pallet

(1) LMP-Rpt 70mm mag/frame on CDR cam
___/_____

0+50

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Climb LM ladder & place cont sample on platform	0+30	Deploy left LRV offload tape across secondary strut		LRV OFFLOAD & DEPLOY	LRV OFFLOAD & DEPLOY
		Deploy LRV aft cable & place on lunar surface			
Descend to ladder for LRV deploy		Deploy right LRV offload tape			
Pull D-handle to release LRV		Check LRV released from LM			
Descend to surface		Pull offload tape until rear wheels rest on surface			
Pull LRV aft cable as required to offload LRV from LM		Remove right outrigger cable			
		Remove left outrigger cable			
		Pull offload tape until front wheels rest on surface			
Disconnect & discard aft cable					
Erect LRV geo pallet mtg post					
Deploy right rear fender extension					
Ck rear steering decouple ring seal		Deploy left rear fender extension			
Ck right rear hinge pins engaged		Ck left rear hinge pins engaged			
Erect right seat		Erect left seat			
Lower the armrest		Release handhold tiedown			
Pull T-handle & lower console		Pull T-handle & lower console			
Lift handhold into position		Lift handhold into position			
Lock hndhold/console using T-hndl		Lock Hndhold/console using T-hndl			
Remove tripod apex - 3 pins		Remove tripod apex - 3 pins			
Remove & stow toehold	0+40	Remove & stow toehold			
Erect footrest		Erect footrest			
Ck right front hinge pin engaged		Ck left front hinge pin engaged			
Dply right front fender extension		Dply left front fender extension			
Verify battery covers closed		Disconnect telescoping rods			
Walk to MESA		Pull att indicator and C&W pins			
Connect 16mm power cable		Mount LRV			
Unstow & insert staff into 16mm Cam		Accomplish LRV post-deployment checklist			
Unstow 16mm Camera & place on MESA table				LRV CONFIGURATION	LRV CONFIG & TRAVER PREP
Remove 16mm mag from ETB & attach to camera					
Photo CDR/LRV 16mm Cam (f8,1/250,24fps)		Test drive LRV - Park LRV in Quad IV near MESA			
		Power down LRV			
		Dismount LRV			
Stow 16mm cam on LRV. LMP hndhold		Lift LCRU mounting post locks			
Unstow 70mm cam from MESA		Release Y-cable velcro tab			
Remove filter from 70mm cam & stow		Unstow TCU connector & discard adapter			
Remove Reseau Cover from 70mm cam & stow					
		Unstow LCRU from MESA			
Remove 70mm mag, NN from ETB & attach to 70mm cam		Mount LCRU on front of LRV			
Stow 70mm cam in CDR floor pan		Unstow & connect LCRU power cable-discard adapter			
		Unstow TCU from MESA			
Unstow & attach EVA 1 pallet to MESA table	0+50	Mount TCU front of LRV			

CREW EVA CHECKLIST

CDR-6 | EVA - 1 | 7/9/71 | ETB UNPK HGA & TV

0+53 [HGA] - Unstow at MESA
Yellow Bracket - Discard
Antenna - Rotate onto staff
HGA - to LRV
Velcro strap - Discard

Cable - Route behind TCU
- Connect to LCRU
LMP: Unstow tools
0+56 [TV] /Tripod to +Z Strut
TV PWR SW - OFF
TV Cable - Disconnect & Stow

TV Camera - To TCU
TV Cable - Connect

[LCRU] CB - CLOSE
LCRU PWR SW - INT
1+00 "CTV PWR SW - ON

LMP-6 | EVA-1 | 7/1/71 | INGRESS GEO PALLET

0+52 Geology Pallet - To LRV
Handrails & lanyards - Remove

SRC #1 - To MESA Table
C-Bag #1 - Unstow
Control Sample - Close
C-Bag #1 - To HTC, (L)

0+56 Unstow from Pallet
- Tongs - To HTC
- Ext. Handle/Scoop - To HTC
- Penetrometer - To Pallet
- Gnomon - To CDR Seat
- C-Bag #2 - To HTC (R)
- C-Bag #3 - To pallet back
- Vise - To pallet

1+04 Core Stems & Caps-To C-Bag #2
C-Bag #2 - To LMP Seat Bag
Sample Bags - To Floor Pans
C-Bag #4 - To HTC (R)

CDR-7 | EVA-1 | 7/1/71 | HGA & TV ETB UNPK

1+01 Whip Antenna - Deploy
LCRU Sel - PM1/NB
Check - AGC, TEMP, & PWR
LCRU Sel - TV RMT
LCRU Blankets - 100% open
Conn. Cover (LCRU) - Closed

HGA Dish - Deploy
HGA - Point To Earth

[ETB] Contents - To LRV
ETB (Empty) - To Ladder Hook
LMP PLSS Ant. - Stow
[LMP: Ingress]
1+09 LEC - To Pallet #1
Pallet #1 - Transfer
LEC Hooks - To Ladder Hook

HGA - Stow
1+12 LCRU Sel - PM1/WB

LMP-7 | EVA-1 | 7/1/71 | GEO PALLET INGRESS

1+05 Rake - To Pallet
Secure HTC for Driving
Check Lanyards Clear of Wheels
[CDR: LMP PLSS Ant. - Stow]
1+06 Ascend Ladder
Cont. Sample - Retrieve
Ingress LM
Cont Sample - Stow

CB(16) COMM: TV - OPEN
MODULATE - PM
PWR AMPL - OFF
TLM PCM - LO
LEC - To Overhead Handhold
1+10 Pallet - Transfer into LM
LEC Hooks to Surface
LEC - Stow to Side

Pallet - Strip
Pallet - To LM Floor

VOICE DATA

0+50

(1) LMP - CLOSE ORGANIC CONTROL SAMPLE

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR-Rpt LCRU

AGC	
VOLTS	
TEMPS	

(1) CDR-LCRU covers open 100%

(2) CDR-Rpt mag/frame on CDR cam

_____/_____

(1) LMP-Contingency sample into LM

(1) LMP-Re-verify cb configuration OK

1+10

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
EVA-1 pallet to MESA table	0+50	Mount TCU on front of LRV
Check LiOH can pins out		Connect TCU power cable
Remove & discard 16mm cam rack		Unstow rake & move aside on MESA
Unstow & place ECS LiOH in pallet pocket		Open LRV antenna stowage can Unstow LGA from canister
Remove Quad III thermal blankets from geology pallet		Mount LGA in CDR handhold
Offload geology pallet from LM		Point LGA to earth
Mount geology pallet onto LRV		String & connect LGA cable
Check lower left latch - Locked		Unstow HGA from canister
Remove & discard pallet handrails		Mount HGA on LRV
Unstow & place SRC #1 on MESA table		Rotate antenna onto staff
Remove SCB #1 from SRC #1		Unstow cable, discard foam
Close control sample in SRC #1		Connect HGA cable to LCRU
Attach SCB #1 to HTC		
Pull penet pip pins (3) Pull HTC stowage pip pin		Retrieve & carry TV camera/tripod to +X strut
Open HTC & swing out		TV POWER Sw - "OFF"
Pull HTC stowage pip pins (4)		Disconnect & stow TV cable
Remove tool stowage bracket from pallet		Remove TV camera from tripod Mount TV on TCU
Stow tongs on HTC		Connect TV power cable
Assemble & stow handle/scoop on HTC		Connect TCU cable LCRU CB - "CLOSED"
Unstow & transfer penet to pallet		
Unstow & transfer gnomon to CDR seat back		LCRU Power Switch - "INT"
	1+00	CTV poser sw - "ON"
		Deploy LCRU whip antenna
Unstow & attach SCB #2 to HTC		LCRU MODE switch - "PM1/NB"
Unstow SCB #3 & attach to LRV pallet		Check LCRU AGC, TEMP & POWER
Close HTC		LCRU MODE switch TV RMT Open LCRU covers - 100%
Transfer from SCB#1:		Tip antenna aft 45° & deploy
• Core stems to SCB #2:		Point HGA to earth
• 2-20 DSBD's to CDR & LMP floor pan		Retrieve ETB from LM ladder
• Core stem caps to SCB #2		Stow two each 70mm & 16mm mags & 500mm lens camera under CDR seat
Remove rake from MESA & stow on LRV pallet		
Climb LM ladder to porch		Carry ETB to LMP seat
		Place LMP 70mm cam on floor pan
Retrieve cont sample & ingress LM		Mount map holder on LMP handhold
Stow cont sample inside LM		
CB (16) COMM: TV open		Attach BSLSS to LMP seatback
Modulate - PM		Stow ETB on ladder hook
PWR AMPL - OFF		
TLM PCM - LO		Attach LEC to EVA #1 pallet
Attach LEC to overhead handrail		
Transfer pallet into LM		Transfer pallet into LM
	1+10	

LCRU TV
TASK FUNCTION: LMP CDR
PALLET TRANS-LM PWR DN

CDR-8

EVA-1

7/1/71

Tidy up LRV
1+13 [START]
Drive to Nav. Init. Site

NAV CB - CLOSE
LRV Systems - Readout
[NAV ALIGN]

[STOP]

LMP PLSS Ant. - Unstow
1+18 Attach To LMP EMU:
- Hammer
- Core rammer
- Core Tube Caps(Bag #1 pkt.)
- C-Bag #4

[LMP: C-Bag #1 - To CDR]
Tongs - Tether
70mm Cam - To RCU

NAV ALIGN

STA. #1

LMP-8

EVA-1

7/1/71

1+14 Egress
Pallet - Discard
LH Hatch - Close
Descend to Surface
[CDR: LMP PLSS Ant.-Unstow]

MESA Brackets - Remove
Tidy MESA Thermal Blankets

[CDR: Geo Eq - To LMP EMU]
- Hammer
- Core rammer
- Core Tube Caps
- C-Bag #4

C-Bag #1 - To CDR EMU
1+20 Ext Handle/Scoop - Tether
HTC - Check Secure & Closed
Bag Disp. - To 70mm Cam
70mm Cam - To RCU
16mm Cam - f8,1/250,12 FPS

GEO EQUIP

STAT #1

1+10

(1) CDR-Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-Hr Bat 2		Temp RR mtr	
SSD	ROLL	PITCH	
COMPUTED NAV HEADING			

(2) LMP-Jettison Pallet

Geology Equip - LMP EMU:
- Hammer
- Core tube cap dispenser
- Core tube tool
- SCB #4
- Scoop/Ext Hndl (tethered)

Geology Equip - CDR EMU:
- SCB #1
- Tongs (tethered)

NOTE: Core tubes in SCB #1
U-03, L-04, L-10
SESC-blank

NOTE: 20-DSBD NUMBER SERIES
- 156-164, 166-168, 170-177
- 180-182, 186-190, 192-199, 203-206

(1) CDR-Mark depart time ________ (1+25)

(2) LMP-Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

1+30 CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	1+10	
Disconnect LEC from pallet		
Stow LEC inside cabin		Transfer LEC hooks to surface
Remove from pallet & stow food, batteries & LiOH cans		Stow hooks on ladder Stow HGA for traverse LCRU MODE switch - "PM1/WB"
Place pallet on LM floor		Mount LRV Power up LRV
Move through LM hatch		Orient LRV for Nav system initilization
Retrieve & discard pallet		Power down LRV LRV Nav CB - "CLOSE"
Close LM hatch		Nav Reset - Reset
Descend to surface Remove & discard TV stowage bracket		Reade Heading, SSD, Pitch & Roll to MCC
Tidy thermal blankets around MESA & cover cavity		Verify Bearing, Distance & Range - ZERO
Attach geology equipment to EMU		Dismount LRV Attach to LMP EMU: ● Hammer ● Core tube tool ● Core tube cap dispenser ● SCB #4
Attach SCB #1 to CDR EMU	1+20	
Tether handle/scoop		Tether tongs
Check tool stowage bars. Secure & close HTC		Attach 70mm cam/bag disp to EMU
		Mount LRV - Fasten belt
Attach 70mm cam/bag disp to EMU Check 16mm cam set for traverse photography		Power up LRV
Mount LRV - Fasten belt Readout LRV & NAV systems displays		Torque NAV gyro to HOU update
Traverse to check point (17 min)		Traverse to check point (17 min)
	1+30	

NOTE: For purposes of the final edition of the Lunar Surface Procedures, detailed geology traverse information is contained in Section 3.6.

LCRU IV

TASK FUNCTION

LMP	CDR
TRAVERSE TO Checkpoint	TRAVERSE TO Checkpoint

NAV ALIGN
STAT #1

[START] Gyro - To Hou Update

1+25 TRAVEL (0:17)
- •Possible Ray
- •Lineaments, fillets, mounds
- •Raised rille rim (levee)
- •Block distribution

1+42 CPI (0:02) Canyon Crater

1+44 TRAVEL (0:07)
- •Elbow Ejecta distribution
- •Drive close to rim

1+51 Geology Station #1 (0:15)
- •Pan from rim
- •Sample radially(rim/blanket)

CDR-9
EVA-1
7/1/71

GEO EQUIP
STAT #1

LRV Systems - Readout

1+25 TRAVEL (0:17)
- •Possible Ray
- •Lineaments, fillets, mounds
- •Raised rille rim (levee)
- •Block distribution

1+42 CPI (0:02) Canyon Crater

1+44 TRAVEL (0:07)
- •Elbow Ejecta distribution
- •Drive close to rim

1+51 Geology Station #1 (0:15)
- •Pan from rim
- •Sample radially(rim/blanket)

LMP-9
EVA-1
7/1/71

1+30

(1) CDR-Mark arrival time ______ (1+42)
(2) CDR-Readout NAV displays

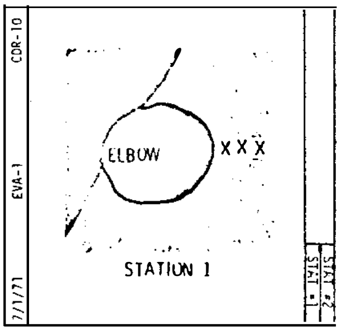
HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

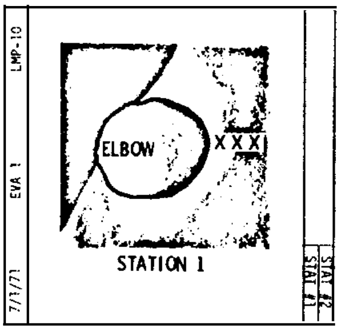
(1) CDR-Mark depart time ______ (1+44)

1+50

MISSION: APPOLO 15, J-1 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+30				
The traverse to the first checkpoint near Canyon Crater will cross the typical smooth mare fill on the approach to the rim of Hadley Rille.					
During this portion of the traverse the crew should observe and describe characteristics of the mare fill material, surface features and block distribution and note any differences between the mare and Rille rim material.					
	1+40				
Arrive at Checkpoint		Arrive at Checkpoint Readout NAV displays			
Traverse to Station #1 (7 min)		Traverse to Station #1 (7 min)		Traverse to Station #1	Traverse to Station #1
The traverse to Station #1 will be around Elbow Crater. The low scarp should be visible around Elbow Crater and there should be observable differences between the mare and Rille rim material. Crew should describe the distribution pattern around Elbow Crater.					
	1+50				





CDR-11 EVA-1 7/1/71 STAT #1 STAT #2

2+06 TRAVEL (0:08)
- Elbow ejecta distribution
- Change in slope toward front
- Change in rock type
- Change in ground texture
- St. George ejecta dist.

2+14 Geology Station #2 (0:45)
- Sample radially
- Comprehensive sample
- Documented sample
- Double core

(Trench - SESC and soil)
(SESC - to CDR C-Bag)
(Stereo pan-100m along front)
(500mm)
(Penetrometer)

LMP-11 EVA-1 7/1/71 STAT #1 STAT #2

2+06 TRAVEL (0:08)
- Elbow ejecta distribution
- Change in slope toward front
- Change in rock type
- Change in ground texture
- St. George ejecta dist.

2+14 Geology Station #2 (0:45)
- Sample radially
- Comprehensive sample
- Documented sample
- Double core

(Trench - SESC and soil)
(SESC - To CDR's C-Bag)
(Stereo pan-100m along front)
(500mm)
(Penetrometer)

1+50

(1) CDR - Mark arrival time ______ (1+51)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Stow gnomon
- Mark depart time ______ (2+06)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

2+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+50			
Arrive Station #1 Readout LRV displays		Arrive Station #1 Park & powerdown LRV	Station #1 Geology	Station #1 Geology
Dismount LRV		Dismount LRV LCRU Sel Sw - FM/TV		
Station #1 geology (15 min)		Point HGA to earth Station #1 geology (15 min)		

Station #1 is located on the the southern part of the Elbow Crater ejecta blanket.

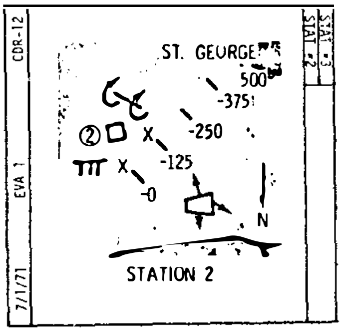
Area #1 tasks:
1. Radial sampling of Elbow Crater
2. 70mm Panorama

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+00			
Check tools secure & HTC closed		Stow Gnomon on seat back Stow HGA	Traverse to Station #2	Traverse to Station #2
Mount LRV		LCRU Sel Sw - PM1/WB Mount LRV		
Readout LRV displays Traverse to Station #2 (8 min)		Power up LRV Traverse to Station #2 (8 min)		

The traverse to Station #2 is along the Apennine Front slope to the North side of St George Crater.

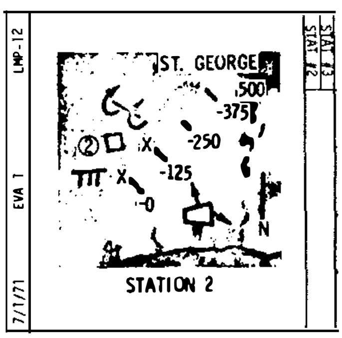
2+10

2+10



(1) CDR - Mark arrival time ______(2+14)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	



At 2+30
(1) CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

2+50

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	2+10	

The crew should look for changes in lithology or ground texture to locate the base of the front and compare the mare and Rille rim material to the Front. A description of the character and distribution of the St George ejecta blanket is desirable.

LMP ACTIVITIES	CDR ACTIVITIES
Arrive Station #2 Readout LRV displays	Arrive Station #2 Park & power down LRV
Dismount LRV	Dismount LRV LCRU Sel Sw - FM/TV Point HGA to earth
Station #2 geology (45 min)	Station #2 geology (45 min)

Geology area #2 is located near the base of the Apennine Front north of St George Crater.

2+20

Area #2 tasks (in order of priority)

1. Radial Sampling of St George Crater (slope permitting)
2. Comprehensive Sample Area at Front
3. Double Core tube
4. 500mm lens camera photography - blocks on St. George Crater rim & Hadley Rille
5. 70mm Stereo pan from high point (100m base)
6. SESC Sample (from bottom of a trench)
7. Penetrometer measurements.

2+50

LMP: Station #2 Geology
CDR: Station #2 Geology

STAT #2 STAT #3

2+59 TRAVEL (0:09)
- Lateral/Vertical changes along front
- Block distribution
- Possible rock flows
- Patterned ground
- Cmpre crater frequency/state
- Observe EVA II route

3+08 Geology Station #3 (0:14)
- Describe "Flow" Mtrl/source
- Vertical/lateral changes
- Documented samples- -"Flow"/Front (-Mare)

3+22 TRAVEL (0:28)
- Observe EVA II route
- Front/Mare relations
- Possible ray material
- Compare to earlier mare
- Extent of "slide" boundary

CDR-12 EVA-1 7/1/71

STAT #2 STAT #3

2+59 TRAVEL (0:09)
- Lateral/Vertical changes along front
- Block distribution
- Possible rock flows
- Patterned ground
- Cmpre crater frequency/state
- Observe EVA II route

3+08 Geology Station #3 (0:14)
- Describe "Flow" Mtrl/source
- Vertical/lateral changes
- Documented samples - -"Flow"/Front (-Mare)

3+22 TRAVEL (0:28)
- Observe EVA II route
- Front/Mare relations
- Possible ray material
- Compare to earlier mare
- Extent of "slide" boundary

LMP-13 EVA-1 7/1/71

2+50

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Stow gnomon
- Mark depart time ________(2+59)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - Mark arrival time______(3+08)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

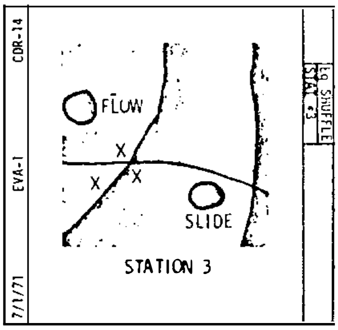
3+10

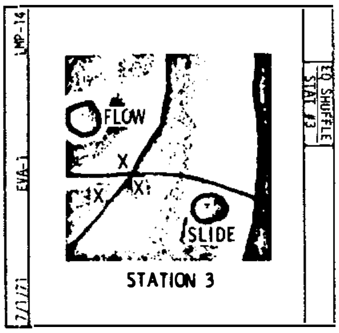
MISSION: APOLLO 15, J-1
EVA: 1

DATE:6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+50				
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel Sw - PM1/WB			
Mount LRV		Mount LRV			
Readout LRV displays Traverse to Station #3 (9 min)		Power up LRV Traverse to Station #3 (9 min)		Traverse to Station #3	Traverse to Station #3
	3+00				
Arrive Station #3 Readout LRV displays		Arrive Station #3 Park & powerdown LRV			
Dismount LRV		Dismount LRV LCRU Sel Sw - FM/TV			
	3+10	Point HGA to earth			

The traverse to Station #3 is along the base of the Front and should approach the edge of a debris flow. Observation and description of the Front material should be made for comparison with the mare material. Appearance of the debris flow should be described.





3+10

(1) CDR - Stow gnomon
- Mark depart time ______ (3+22)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

At 3+30
(1) CDR/LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

3+50

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+10	Point HGA to earth			
Station #3 geology (14 min)		Station #3 geology (14 min)			

Geology area #3 is at the base of the Apennine Front adjacent to an area believed to be a debris flow.

Area #3 tasks (in order of priority)

1. Describe the area and compare to mare & Front
2. Documented samples of the Front & flow material
3. Describe any vertical and lateral changes in the Front. Compare to Area #2.
4. 70mm pan
5. Describe any notable characteristics of the planned EVA-2 route.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Check tools secure & HTC closed	3+20	Stow gnomon on seatback			
		Stow HGA			
		LCRU Sel Sw - PM1/WB			
Mount LRV		Mount LRV		Traverse to LM	Traverse to LM
Readout LRV displays		Power up LRV			
Traverse to LM (28 min)		Traverse to LM (28 min)			

During the return traverse across the mare, observe and describe the characteristics of the debris flow. Make any additional observations of the planned EVA-2 route that are possible. Continue comparison of the Mare/Front/Rille materials. Describe any possible ray patterns that may be observed.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Readout LRV & NAV system displays	3+50	Park & Pwr down LRV - Read NAV to MCC

CREW EVA CHECKLIST

STAT #3
Eq SHUFFLE

3+50 Park LRV
- Heading SE; facing SEQ Bay

Nav CB - Open
STOP
LCRU Sel - TV RMT
HGA - Point To Earth

70mm Cam - To Under Seat
Tongs - To HTC

LMP Geo Equip:
- Core Tube Caps - Discard
- Core rammer - To HTC
- Hammer - To HTC

C-Bag #4 - Remove from LMP
Tidy Velcro Covers
[LMP: Remove C-Bag #1]

C-Bag #4 - Under LMP Seat
C-Bag #2 - To HTC (R)

CDR-15 EVA-1 7/1/71

STAT #3
Eq SHUFFLE

3+50 LRV Systems - Readout
Dismount LRV
LMP Seat - Fold
70mm Cam - Under CDR Seat
Ext Handle & Scoop - To HTC

[CDR; LMP Eq - To LRV]
- Core Tube Caps & rammer
- Hammer
- C-Bag #4 -To LMP Seat bag
- C-Bag #2 -To HTC (R)

C-Bag #1 - Remove from CDR
- To HTC, (L)
Tidy Velcro Covers

LMP-15 EVA-1 7/1/71

CDR-16 EVA-1 7/1/71

3+57 EXPTS Pkg - Offload
UHT - Tether
Carry Bar - To EXPTS Pkg

Drill - To LRV
LRRR - To LRV

HGA - Stow
LCRU Sel - PM1/WB
4+10 START

Drive to ALSEP SITE

CAUTION

Do Not Point HGA or LGA within ±20° of ALSEP Antenna

SITE RQMTS
ALSEP OFFLD

LMP-16 EVA-1 7/1/71

3+55 SEQ Bay Doors - Open
Pwr Pkg - Offload
- Position for Fueling

Pip Pins (4) - Pull
UHT - Tether
Carry Bar - To CDR

Fuel Cask - Tip Down
Dome Tool - Engage & Check
Dome - Remove & Discard

Fuel Tool - Engage & Check
Fuel Element - Into RTG
4+06 Report RTG Fueled

Pwr Pkg - To Carry Bar
SEQ Bay Doors - Close

ALSEP - To Deploy Site

ALSEP LAYOUT
ALSEP OFFLD

VOICE DATA

3+50

(1) CDR - Mark arrival time ______ (3+50)
(1) LMP - Readout LRV Displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

[LMP - Rpt Dome Removal Tool Temp
Label Reading __________]

(1) LMP - Rpt RTG Fueling ________(time)

[LMP - Rpt Fuel Transfer Tool Temp
Label Reading __________]

(2) LMP - SEQ Bay doors - closed

4+10

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Readout LRV and NAV system displays	3+50	Park & pwr down LRV - Read NAV to MCC LRV NAV CB - "OPEN"			
Dismount LRV Lift seat & fold seat support down		Dismount LRV LCRU Switch - TV RMT Point HGA to earth			
Stow 70mm cam under CDR seat Stow ext. handle and scoop on HTC		Stow 70mm cam under CDR seat Stow tongs on HTC Remove hammer, core tube caps & tool from LMP PLSS and stow on HTC		ALSEP OFFLOAD	ALSEP OFFLOAD
Remove SCB #1 from CDR PLSS & stow HTC Open SEQ Bay doors		Remove SCB #4 & stow under LMP seat Remove SCR #2 from under LMP seat and stow on HTC			
Offload ALSEP pkg 2 (pwr pkg)		Offload ALSEP pkg 1 (expts pkg)			
		Remove and discard boom-to-pkg-stick			
Remove & discard boom-to-pkg stick Position pwr pkg for fueling Pull tool stowage pip pins (4)		Move expts pkg clear of SEQ bay			
Unstow UHT'S pass one to CDR tether 2nd UHT		Tether UHT			
Unstow & pass carry bar to CDR Deploy fuel cask lanyard	4+00	Assemble & attach carry car to expts pkg			
Rotate fuel cask down & discard lanyard under LM Unstow & engage dome removal tool		Walk to MESA Unstow drill from MESA			
Check tool securely engaged					
Remove & discard dome/tool Unstow fuel transfer tool Tip power pkg down		Place drill on LMP floor pan & lower seat Remove thermal blanket from over LRRR in Quad III			
Engage fuel transfer tool Check tool securely engaged		Offload LRRR pallet from LM Place pallet on surface & remove LRRR from pallet			
Remove fuel element from cask Insert fuel element into RTG					
Report RTG fueled Remove & discard tool Tip pwr pkg up		Place LRRR on LMP seat			
Attach pwr pkg up Check offload booms retracted Close SEQ bay doors		Secure LRRR on LRV using seat belt			
Carry ALSEP pkgs to deployment site		Stow HGA for traverse LCRU MODE Switch - "PM1/WB"			
	4+10	Mount LRV			

CDR-17 EVA-1 7/1/71

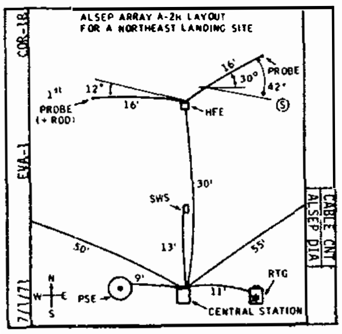
SITE REQUIREMENTS:

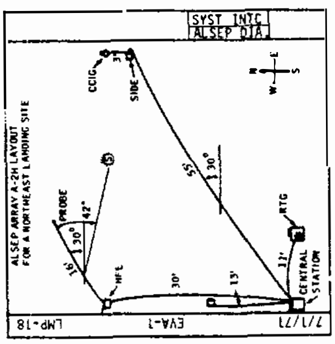
- General - Smooth flat
  - All thermal rad have clear view
- HFE Probes-
  - 200 ft from fresh craters
  - 5 diameters from boulders over 2 ft
  - avoid Topo high (Scale 100's of ft.)
  - Avoid features over 2 ft dia. with slope greater 10°

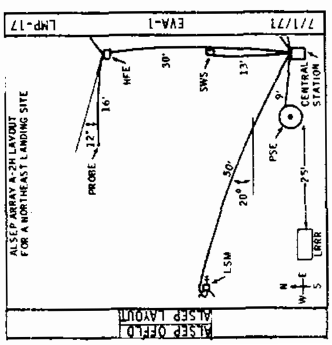
4+15 Park LRV
- Heading North
- Facing C/S Site

LRV Battery Temps - Readout

STOP







4+10

(1) CDR-Readout LRV Displays
-Time Mark-Arrive ALSEP site ______

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR-LRV Bat covers-OPEN _____ (time)

(1) LMP-Rpt Short Sw Amps ______
[Rpt Short Sw Connect ______ (time)]

(1) CDR-Rpt HFE cable connect

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

4+30

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+10	Mount LRV		ALSEP TRAVERSE	ALSEP TRAVERSE
		Power up LRV Drive LRV to ALSEP deployment site			
CAUTION: ALSEP damage may result if radiating HGA or LGA is aimed within 20° of ALSEP antenna					
		Park LRV heading North, facing C/S site Readout LRV battery temps Power down LRV Dismount LRV Open LRV battery covers LCRU MODE switch - "TV/RMT"			
Place pkgs on surface with expts pkg in final position		Point HGA to earth ALSEP deployment plan			
Disconnect pwr pkg from bar Reposition pwr pkg 10'East		Offload LRRR from LRV & set on surface facing sun			
Remove HFE stowage pip pins (3) Tip pwr pkg down	4+20	Offload drill from LRV & set on surface drill facing sun			
Release RTG cable B. bolts (3) Deploy RTG cable & discard cable reel		Release HFE Pallet B. bolts (2) Lift HFE pallet from pwr pkg Carry HFE pallet 15'N C/S		ALSEP INTERCONNECT	HFE DEPLOYMENT
Report shorting switch reading Connect RTG cable to C/S Release subpallet B. bolts (2)		Unstow HFE connector Place HFE pallet on surface Connect HFE cable to C/S			
Lift subpallet from PWR PKG & place 10' N. of PWR PKG		Carry HFE pallet 30' N of C/S, deploying cable			
Release Side B. Bolts (4) & CCIG cover bolt Lift SIDE from subpallet		Place HFE pallet on surface & fold mounting braces			
Remove B. Bolt blocking cable reel Unstow cable reel Deploy SIDE legs & place SIDE on surface		Tip pallet down Release probe box B. Bolts (4) Lift probe box from pallet			
Unstow SIDE cable connector Open EXPTS PKG dust cover	4+30	Separate box and lean probe with tool against pallet			

CREW EVA CHECKLIST

CDR-19 · EVA-1 · 7/1/71 · ALSEP DIA · CABLE CNT

4+18 LRV Battery Covers - Open
LCRU Sel - TV RMT
HGA - Point To Earth
Plan ALSEP Deployment
LRRR - To Surface
- cubes facing sunlight
Drill - To Surface
- Drill facing sunlight

4+21 HFE Pallet - Remove (2 bolts)
- To 15 ft N. C/S
HFE Cable - Connect To C/S
HFE Pallet - To 30 ft N C/S
16 ft of Probes - Keep Clean
[LMP: Remove SIDE from Subp]
4+28 Probe Box - Remove (4 bolts)
Probes - Position
- With Rod - To W, 12°S S/L
- W/O Rod - To E, 42°N S/L

CDR-20 · EVA-1 · 7/1/71 · CORE PROBES

4+34 Elect Box - Remove (4 bolts)
Pallet - Kick Clear
Dust Cover - Remove
Elect Box - Level & Align

Pallet - Discard 16 ft North
[LMP: PSE deploy]
4+37 Drill - To LMP Seat
• DECAL
Drill & Rack - To West Probe
[LMP: SWE & LSM deploy]
Implant Bore Stem Into Surface

Remove RAMMER
Insert Probe Into Stem
Report Probe depth
[LMP: Raise C/S]

LMP-19 · EVA-1 · 7/1/71 · ALSEP DIA · SYST INTC

4+18 Expts Pkg - To Final Position
Pwr Pkg - Position 10 ft East

HFE Pip Pins (3) - Pull
Pwr Pkg - Tip Down

RTG Cable - Deploy
Report Shorting Sw Reading
RTG Cable - Connect

SUBP - Remove from Pwr Pkg
- Bolts (2)

4+26 SIDE - Remove From SUBP
• Bolts (5) - Release
• Lift SIDE from SUBP
• Cable Reel Unstow
• Legs Deploy
• SIDE to Surface

LMP-20 · EVA-1 · 7/1/71 · PSE · SWE · LSM

SIDE Cable Connector - Unstow
C/S Dust Cover - Open
SIDE Cable - Connect To C/S

4+32 Carry Bar - Remove From C/S
C/S - Tip Down
Carry Bar - To SUBP
PSE Stool - Unstow

Prep PSE Site - 9 ft W. C/S
PSE Stool - To Surface

C/S Dust Cover - Remove
PSE - Deploy
• Bolts (4) -Release & Remove
• PSE - To Stool, UHT In
• Girdle Remove, UHT Out
• Skirt - Deploy
• Level
4+40 • Report Alignment

VOICE DATA

4+30

(1) LMP-Rpt SIDE connect

(2) LMP - PSE stool 9' West C/S

(1) CDR-Rpt HFE Deployed - ALIGN & LEVEL

(1) LMP - Rpt PSE Emplaced;
- Rpt PSE Level;
- Rpt PSE Align __________

(1) LMP-Rpt SWE ALIGN & LEVEL

(1) CDR-Rpt start Bore Stem Drilling

4+50

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Open EXTPS PKG dust cover Connect SIDE cable to C/S	4+30			PSE DEPLOY	
		Carry other probe to drill site, deploying cable			
Remove carry bar from C/S					
Tip C/S down & align		Place probe on surface Carry 1st probe to drill site, deploying cable			
Stow carry bar on subpallet Unstow PSE stool from subpallet		Place probe on surface			
Scoop out depression 9' West of C/S for PSE stool		Release electronics box B. Bolts (4)			
Implace PSE stool		Lift electronics box from pallet			
C/S dust cover remove		Remove dust cover			
Release PSE B. Bolts (4)		Kick pallet clear of area Place box on surface, level and align			
Carry PSE to stool					
Remove B. Bolts from PSE		Walk to LRV Erect LMP seat post & lower seat pan			
Place PSE on stool Deploy thermal skirt		Retrieve drill from surface Place drill on LMP seat			
		Push drill SW to test drill Install handle on drill			
	4+40	Remove rack from treadle & deploy rack legs		SWE DEPLOY	
Report PSE level & alignment					
Release SWE B. Bolts (4)		Place rack on surface Remove drill from treadle			
Lift SWE from C/S					
Carry SWE 13' N. C/S, deploying cable		Carry drill & rack to 1st drill site			
Check legs extended & locked Place SWE on surface, level and align		Place rack & drill on surface		LSM DEPLOY	
		Remove & discard stem cover Release stem retaining velcro			
		Assemble first two bore stem sections (one with bit)			-drill
Release LSM B. Bolts (2)					
Remove tie down & discard Lift LMS from C/S		Insert sections into drill chuck			
		Set drill bit down on surface at mark on HFE cable			
Check cable free of sun shield					
Carry LSM 50' WNW, deploying cable		Remove battery thermal shroud			
		Drill bore stem into surface			
		Remove drill from bore stem			
Select LSM site	4+50				

4+50

4+41 SWE - Deploy
- Bolts (4) - Release
- SWE - To 13 ft N. C/S
- Check Legs Locked Down
- SWE - To Surface
- Align & Level
- Check Door Open

4+46 LSM - Remove From C/S
- Bolts (2) - Release
- Tiedown - Pull Horiz
- Square Handle -Lift LSM Off
- Cable - Check Free of C/S

4+51 LSM - Deploy
- LSM - To 50 ft, 8°N Sunline
- Stowage Bracket - Remove
- Legs - Deploy
- Cable - Outside Legs
- LSM - To Surface

PSE SWE LSM — LMP-21 — EVA-1 — 7/1/71

(1) LMP - Rpt LSM ALIGN ________
LEVEL ________

- Foam Collar - Remove
- Sensor Arms - Deploy
- Dust Covers (4) - Discard
- Align & Level
- Report Alignment

- Check LSM Free of Parts
- Check Doors Open

4+59 C/S - Align
C/S Sunshield - Raise
- Bolts - Release
- Antenna Cable - Deploy
- Rear Curtain Cover - Remove
- Check Sunshield Free
- Interior Bolts (3) Release

5+02 •Sunshield - Raise

LMP-22 — EVA-1 — 7/1/71 — LSM C/S C/S

(2) LMP - Rpt LSM doors open

(1) LMP - Rpt C/S ALIGN ________
LEVEL ________

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

5+04 Drill, Rack & Rod - To E Probe

Implant Bore Stem Into Surface
Insert Probe Into Stem

5+20 Report Probe Depth
[LMP: SIDE deploy]
- [Check 16 ft Area Clean
Check Elect Box Level & Align

Drill & Rack - To Core Site
Drill Chuck - Remove & Discard
Treddle To Drill Site

16mm Cam Mag - Change To "D"
16mm Photo - Drill Site
(f8, 12 fps, 1/250)
[LMP: Activate C/S]

5+26 Implant Core Stem - 1 inch/sec
Break Drill from stem

PROBES CORE — CDR-21 — EVA-1 — 7/1/71

(1) CDR - Rpt Probe In-place & Depth ________

Side Covers - Discard
Side Curtain Velcro - Mate

5+06 Antenna Mast - Install
Gimbal - Mount on Mast
Antenna - Mount on Gimbal

Check C/S Alignment

5+10 Antenna - Level & Align

OFF Sets - Enter & Readout
- AZ 35.81
- ELEV 4.71

CHECK Antenna Level & Aligned

LSM C/S C/S — LMP-23 — EVA-1 — 7/1/71

(2) LMP - Verify ALSEP Ant fully seated

5+10

(1) LMP - Rpt Ant Base ALIGN ________
LEVEL ________

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
Select LSM site	4+50	Remove drill from bore stem		First hole-
Remove stowage bracket Deploy legs Align LSM & place on surface with cable outside legs		Reset drill chuck Place drill on surface Assemble 3rd & 4th sections of bore stem		
Remove from collar				
Deploy center sensor arm then other two sensor arms Remove dust covers & PRA cover		Lift & attach drill to bore stem Drill bore stem into surface		
Align and level LSM		Remove drill from bore stem		
Check doors open & LSM free of discarded parts Report level & alignment		Reset drill chuck Place drill on surface Assemble 5th & 6th sections on bore stem		
Change 16mm cam mag		Lift & attach drill to bore stem Drill bore stem into surface		
Start 16mm cam - 12 FPS Return to C/S Align C/S		Remove drill from bore stem Reset drill chuck		
Starting front center & proceeding CW, release/deploy in turn B. Bolts, side cable, antenna cable and rear curtain cover	5+00	Place drill on surface Retrieve probe from probe box	Sunshield DEPLOY	-insert 1st probe-
Release two inter B. Bolts Release center B. Bolt and raise sunshield		Insert probe into bore stem Retrieve probe rod from box		
Remove side curtain covers and discard (3) Check side curtain properly deployed & engage velcro tabs		Push probe to bottom of stem Report probe depth Carry rack, rod and drill to 2nd drill site Place equipment on surface		
Retrieve & install antenna mast		Assemble 1st two bore stem sections Insert sections into drill chuck	ALSEP ANTENNA INSTALLATION	-drill 2nd hole-
Release antenna gimbal B-Bolts		Set drill bit down on surface at mark on HFE cable		
Remove gimbal from subpallet Remove gimbal housing cover		Drill bore stem into surface		
Install gimbal on mast Remove housing & discard Install antenna on gimbal		Remove drill from bore stem		
Check C/S alignment		Reset drill chuck Place drill on surface		
Level & Align antenna base	5+10	Assemble 3rd & 4th sections on bore stem		

5+10

LMP-24 | EVA-1 | 7/1/71 | SIDE | LRRR

5+15 SIDE - Deploy
- SIDE - To 55 ft. 42°N. Sun
- Ground Screen - Implace
- CCIG Cover - Remove
- CCIG - To G/S Tube
- SIDE - To Surface

- Level & Align
- Tube Pin - Pull

- CCIG - To surface

- Safety Pin - Pull
- ~~Report~~ Pin Pulled
- 5+24 ~~Check~~ Level and Alignment

(1) LMP - Rpt Antenna Setting
ELEV ______ AZ ______
(4.71) (35.81)

(1) CDR-Rpt probe in place & depth _____

(1) CDR-Rpt 16mm mag change: Mag ____ on
Mag ____ off

(1) CDR-Rpt 16mm cam-ON (f8,1/250,12fps)
(1) LMP-Rpt side/CCIG ALIGN & LEVEL, Pin pulled

SIDE | LRRR | LMP-25 | EVA-1 | 7/1/71

Shorting Switch - Depress
Check Amps Zero
Astro Switch #1 - Clockwise
5+27 Request Xmitter Turn ON

70mm Cam - To RCU
70mm Mag - To Color, "KK"

LRRR - Deploy
- LRRR - To 25 ft W. C/S
- Alignment Device - Deploy
- Reflector Array - Deploy
- Leveling leg - Deploy

LRRR - Level & Align
Dust Cover - Remove
Check Level & Alignment

(1) LMP-Rpt Short SW Depress _____ (time)
-Rpt Meter Read _______ after Depressing Short SW
-Rpt Astro SW #1 CW ________

(2) LMP-70mm mag ____(KK)/frame_______ to LMP cam

(1) CDR/LMP EMU check

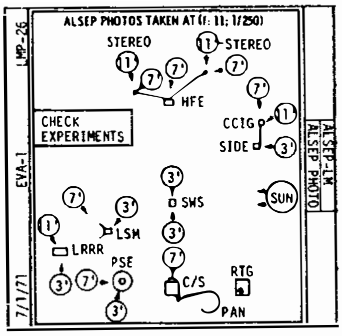
	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

5+30

MISSION: APOLLO 15 DATE:6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10	Lift & attach drill to bore stem Drill bore stem into surface		
		Remove drill from bore stem		
Enter elev 4.71 and azimuth 35.81 offsets Recheck antenna level and alignment		Place drill on surface Assemble 5th & 6th sections on core stem		
Retrieve SIDE near subpallet Carry SIDE 55 ft NE, deploying cable		Lift and attach drill to bore stem Drill bore stem into surface Remove drill from bore stem	SIDE DEPLOY	-insert 2nd probe-
Select SIDE deploy site Remove SIDE dust cover Remove & implace ground screen		Remove & discard drill chuck Place drill on surface Retrieve probe from probe box		
Remove CCIG cover Remove CCIG from cavity		Insert probe into bore stem Retrieve probe rod Push probe to bottom of bore stem		
Mount CCIG in ground screen tube Place SIDE on ground screen Level & align SIDE Pull ground screen tube pin	5+20	Report probe depth Withdraw & discard probe rod Carry rack & drill to coring site near LRV		
Rotate CCIG down onto surface Pull SIDE dust cover pin Report pin pulled Recheck SIDE level & aligned Return to C/S		Implace drill treadle on surface Change 16mm cam mag Start 16mm cam - 12 FPS Open SCB #2 and assemble 1st two core stems		
Depress shorting switch Check shorting switch amps zero Turn Astro Sw #1 clockwise Request X-mitter turn on Retrieve 70mm camera & change mag to color (mag KK) Mount 70mm cam on RCU		Tread sections into drill Lift drill and place core bit into treadle Drill core stem into surface Remove drill from core stem & place on surface	C/S ACTIVATE	-drill deep core-
Retrieve and carry LRRR >25 FT west of central station Place LRRR on surface Pull alignment device pip pin Pull reflector array pip pin Deploy reflector array	5+30	Assemble 3rd & 4th core stem sections Thread sections onto stem Retrieve drill and attach drill to core stem	LRRR	

CREW EVA CHECKLIST



LMP-27 | EVA-1 | 7/1/71 | ALSEP PHOTO / ALSEP-LM

5+35 Photograph LRRR & ALSEP
Note: Deploy LSM Sunshield after LSM Photography

UHT Discard
5+47 Top Off C-Bags #1, 3 & 4

5+59 Mount LRV
Traverse to LM

LRV Systems - Readout
LRV CB's - Pull Bus A,B,C,D
Dismount LRV

70mm Photo - LRV/Dust
(f-11; 1/250;11ft)
- X-Sun (2)
- DN-Sun (1)

CDR-22 | EVA-1 | 7/1/71 | LRRR / CORE

5+37 70mm Cam - Retrieve From LRV
70mm Photo Pan - 7ft S. Stem
70mm Cam - To LRV
[LMP: LRRR deploy]
Core Stem Caps - To C-Bag #1
C-Bag #2 - To LMP Seat
C-Bag #4 - To HTC
Core Tubes - To C-Bag #4

5+42 Check Stem Free In Surface
Drill - Remove From Stem
[LMP: ALSEP photos]
Cap Drill Stem (Black - #A)

Rotate Stem Clockwise & Pull Stem From Treddle

Core Stem Top End - To Vise
Cap Stem, Bit End #B
Stems - to C-Bag #1 (2/pkt.)

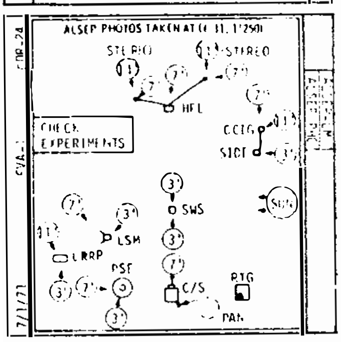
CORE / LRRR | CDR-23 | EVA-1 | 7/1/71

If LMP has not completed ALSEP Deployment, Deploy LRRR and/or Photo ALSEP.

For ALSEP Photography
- 70mm Cam - To RCU
- 70mm Mag - To Color, "KK"

LRRR - Deploy
- LRRR - To 25 ft W. C/S
- Alignment Device - Deploy
- Reflector Array - Deploy
- Leveling leg - Deploy

LRRR - Level & Align
Dust Cover - Remove
Check Level & Alignment



VOICE DATA

5+30

(1) CDR/LMP - EMU check

(1) LMP-Rpt LR^3 ALIGN & LEVEL & DUST CONDITION __________

(1) CDR-Rpt core stem fully inserted

(2) CDR-Rpt 70mm mag/frame (after core photo)
____/____

(1) CDR-Rpt cap sequence of core stem

Section	Caps

(1) LMP-Rpt 70mm mag/frame after ALSEP photos
____/____

(1) LMP-Rpt LSM sunshield deployed ______

5+50

MISSION: APOLLO 15
EVA: 1

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
Deploy reflector array	5+30	Retrieve drill and attach drill to core stem	LRRR DEPLOY	
Pull leveling leg pip pin		Drill core stem into surface		
Deploy leveling leg		Remove drill from core stem & place on surface		
Tip LRRR down				
Level and align LRRR		Assemble 5th & 6th core stem sections		
		Thread sections onto core stem		
Remove dust covers		Retrieve drill and attach drill to core stem		
Recheck level and alignment		Drill core stem into surface		
Photo LRRR & ALSEP		Break drill from stem	ALSEP PHOTOS	
		Retrieve CDR 70mm camera from LRV		
NOTE: Deploy LSM sun shield after LSM photography complete		Obtain photo pans 7 ft South of drill		
		Place 70mm cam on LRV		
		Transfer stem caps from SCB #2 to SCB #1		
		Transfer SCB #2 to LMP underseat bag		
	5+40	Transfer SCB #4 from under LMP seat to HTC		
		Transfer core tubes from SCB #1 to SCB #4		
		Check stem is free enough in surface to be removed without drill power		
		Remove drill from stem		
		Cap drill stem		
		Pull stem from surface & place in vise		
		Cap bit end of stem		
		Disjoint, cap and stow stem sections in SCB #1		
Discard UHT		Discard UHT		
		Strip off outer protective gloves and discard	SAMPLES	SAMPLES
Select samples to fill remaining volume in SCB's #1, #3, & #4		Select samples to fill remaining volume in two sample collection bags(save room for polarimetric samples)		
	5+50			

ALSEP PHO | AT SEP-LM | CDR-25 | EVA-1 | 7/1/71

5+47 LHT - Discard
Top Off C-Bags #1, 3&4

5+57 LRV Battery Covers - Close
HGA - Stow
LCRU Sel - PM1/WB
START

LRV Batt. Temps - Readout

6+01 Park LRV At MESA
•Heading North
•In Sunlight

STOP

LRV Battery Covers - Open.
LCRU Blankets - 35% open
LCRU Sel - TV RMT
HGA - Point To Earth

LMP-28 | EVA-1 | 7/1/71 | CLOSEOUT LM PANS

6+07 SWC - Unstow from MESA
- Deploy 60 ft. NW

Photo SWC: f-11, 1/250
•Stereo Pair, X-Sun, 11 ft
•DN-Sun, 11 ft
•Location

6+15 LM Inspection & Photos
•Pan 12:00/30ft
•Pan 4:00/30ft
•Pan 8:00/30ft

6+23 Flag - Unstow
Flag - To CDR or LRV
Hammer - Retrieve
Staff - Drive 1:30/30 FT

5+50

(1) CDR - LRV BAT COVERS CLOSED ________

(1) CDR - Stow gnomon
- Mark depart time ________
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(2) CDR-LRV parked North heading North
-Mark arrival time ________
(2) LMP-Readout LRV Displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - LRV BAT COVERS OPEN________

(1) LMP - Get Rover Photos

6+10

MISSION: APOLLO 15 DATE: 6/2/71

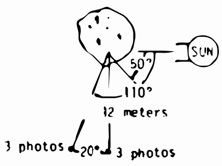
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	5+50	
		Close LRV battery covers
		Stow HGA
		LCRU MODE switch - "PM1/WB"
		Mount & power up LRV
Mount LRV - Fasten belts		Read Battery temps
		Drive LRV to LM
	6+00	
		Park LRV at MESA: heading north in sunlight
Readout LRV displays		
		Power down & dismount LRV
Power down LRV circuit breakers		Open LRV battery covers
		Close LCRU thermal covers - 65%
Dismount LRV		
		LCRU MODE switch - "TV/RMT"
Unstow SWC from MESA		Point HGA to earth
		Retrieve from MESA & install filter on 70mm cam
Carry SWC 60 ft SE of LM		Transfer Reseau cover to LRV
		Retrieve tongs & gnomon from LRV
Remove SWC from stowage can		
	6+10	Select site for polarimetric photography

LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	TRAVERSE TO LM	TRAVERSE TO LM
	SWC DEPLOY	POLARIMETRIC

CDR-26 | EVA-1 | 7/1/71 | FAR FIELD

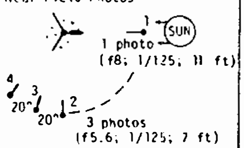
6+12 Filter to 70mm Cam
Tongs & Gnomon - Retrieve
[LMP: SWC deploy]
Polarimetric Photography
Rocky Area - Select
FAR-Field Photos



(f8; 1/125; 74 ft)

CDR-27 | EVA-1 | 7/1/71 | FAR FIELD | NEAR FIELD

6+19 Gnomon Place
Near Field Photos



Collect 4 Rock Samples
[LMP: Photo pans]
Post Sampling Photos
• 1 Down Sun
• 2 X-Sun

Samples to C-Bags
Gnomon & Tongs - Stow
70mm Cam - To LRV

CDR-29 | EVA-1 | 7/1/71 | ETB LOAD | INGRESS

6+25 Flag - Retrieve From LRV
- Mount in Staff
[LMP: Photo CDR/flag]
70mm Photo - LMP/Flag
(f-11, 11ft, 1/250)

6+28 ETB - To CDR Footpan
Collect in ETB
• 70mm Cams (2) (OO),(KK)
• 70mm Mags (2) (NN),(LL)
• 500mm Lens Cam Mag (MM)
• 16mm Mags (3) (CC),(DD)(EE
• Maps
[LMP: Pack SRC #1]
Reseau Cover - To 500mm Cam
500mm Cam - Under CDR Seat
16mm Cam - Point North

ETB - To MESA Table
Bag "Covers" - To ETB

LMP-29 | EVA-1 | 7/1/71 | LM PANS | CLOSEOUT

70mm Photo - CDR/Flag
(f11,1/250,11ft)
70mm Cam - To CDR
[CDR; 70mm Photo LMP]
Hammer - To HTC

6+28 Check C-Bag #1 Contents
•Core stems
•SESC
•Full

C-Bag #1 - To SRC #1
Seal Protectors - Remove
Check Seal - Clean

Close & Seal SRC #1

C-Bag #4 - To MESA
C-Bag #3 - To MESA
6+33 Tidy MESA Blankets

6+10

(2) LMP-Rpt SWC Deployed 60' SE
Rpt 70mm mag/frame (after SWC)
____/____

(1) CDR-Rpt 70mm mag/frame, after ON
(before Polar)
Rpt Filter position ____, ____, ____
(Far Polar) ____, ____, ____

Rpt Filter position (90°) ____, ____, ____
(Near Polar) (110°) ____, ____, ____
(130°) ____, ____, ____

(1) CDR-Rpt 70mm mag/frame (after polar)
____/____
Sample Bags # ____, ____, ____, ____

(1) LMP Rpt 70mm mag/frame (after Pans)
____/____

(2) CDR - gnomon to LRV

(1) CDR/LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

6+30

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove SWC from stowage can	6+10	Select site for polarimetric photography		PHOTOGRAPHY & SAMPLING
Extend SWC staff				
Deploy SWC foil				
Push SWC staff into surface 60 ft SE of LM		Obtain far-field polarimetric photographs 3 photos, 50-110 degree phase angle 3 photos 20 degrees down sun from first photos	LM SITE PHOTOGRAPHY	
Photo SWC X-sun & dn sun				
Return to LM				
Obtain 70mm photo pans around LM at 12:00, 4:00 and 8:00/30 ft; and inspect LM		Place gnomon at sample site		
		Obtain near-field polarimetric photographs 1 photo Dn sun 3 photos, 90-degrees phase 3 photos, 110-degrees phase 3 photos, 130-degrees phase		
		Collect a min. of 4 rock samples in doc. sample bag		
	6+20	Obtain post-sampling photos, X-sun & Dn-sun		
		Retrieve gnomon & walk to LRV		
		Stow samples in SCB #4		
Unstow flag kit from MESA		Stow tongs on HTC		
Remove flag covering		Stow gnomon on LRV	FLAG DEPLOY	FLAG DEPLOY
Keep staff & pass flag to CDR		Select flag deployment site		
Retrieve hammer from HTC				
Drive staff into surface		Deploy & mount Flag in staff		
Photo CDR/Flag				
Pass LMP 70mm cam to CDR		Photo LMP/Flag		
Stow hammer on HTC Remove SCB #1 from HTC & place in SRC #1		Transfer ETB to LRV CDR foot pan Stow 70mm camera in ETB		
Remove SRC #1 seal protector		Trans cam mags (70mm mags LL, NN & 16mm mags CC, DD) from under LRV seats into ETB		
Close & seal SCR #1	6+30			

6+30

LMP-30

EVA-1

7/1/71

Dust Brush - Unstow
Clean EMU'S
[CDR: LMP PLSS Ant. - Stow]
Dust Brush - To Geo Pallet

LRV Check - All Samples & Mags

6+36 Ingress - Carry C-Bag #3
LEC - To Overhead Handrail

6+39 Transfer:
- SRC #1
- ETB

Stow Equipment

6+53 Pass LEC To CDR

Close Hatch

INGRESS

ETB Contents:
- 2-70mm Cam w/mags ____(KK),____(OO)
- 3-70mm mags ____(LL),____(MM),____(NN)
- 3-16mm mags ____(CC),____(DD),____(EE)
- Maps

(2) CDR-Rpt 500mm cam &
BSLSS on LMP SEAT ____

ITEMS TRANS to A/S
- SCB #3 (with LMP)
- SRC #1
- ETB
- SCB #4 (with CDR)

ETB LOAD

INGRESS

6+35 Clean EMU'S
LMP PLSS Antenna - Stow

6+36 [LMP: Ingress]

LEC - To SRC #1
SRC #1 - Transfer

ETB - Transfer
6+46 LEC Hooks - To ladder hook

LCRU Pwr SW - OFF
Ck LCRU Blankets - 35% open
Clean EMU
6+50 Ascend Ladder with $\boxed{\text{C-Bag \#4}}$
Stow LEC On Platform
Ingress LM

CDR-29

EVA-1

7/1/71

(2) CDR - LCRU PWR SW - OFF
- LCRU covers open 35%

6+50

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Close & seal SRC #1	6+30	Trans cam mags (70mm mags LL, NN & 16mm mags CC, DD) from under LRV seat into ETB		EVA CLOSEOUT	EVA CLOSEOUT
Place SCB #4 on SCR #1		Remove mag, MM from 500mm lens cam; stow			
Place SCB #3 on SCB #4		Install Reseau cover on 500mm lens cam & stow cam on LMP seat			
		Remove 16mm mag EE from cam & maps from holder; put in ETB			
Tidy MESA blankets Unstow dust brush from LRV		Attach ETB to SRC table			
Clean CDR's EMU		Clean LMP's EMU			
Ingress LM carrying SCB #3		Stow LMP's PLSS antenna Cover BSLSS & 500mm cam on LMP seat with thermal blanket		EVA TERMINATION	
Attach LEC to handhold					
		Attach LEC to SRC #1			
Transfer SRC #1 into LM		Transfer SRC #1 into LM			
	6+40				
Remove SRC #1 from LEC		Transfer LEC hooks to surface			
Stow SRC #1 in LM		Attach LEC to ETB			
Transfer ETB in LM		Transfer ETB into LM			
Remove ETB from LEC Stow ETB in LM		Transfer LEC hooks to surface			
		Stow LEC on ladder hook			
		LCRU Pwr Switch - OFF			
		Adjust LCRU thermal blankets			
		Clean EMU			
	6+50				

6+50

7+00 (1) CDR - Rpt END EVA-1

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	CREW	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+50	Clean EMU			EVA TERMINATION
		Ascend ladder carry SCB #4			
		Hand SCB #4 to LMP			
Stow SCB #4 in LM					
Pass LEC to CDR		Stow LEC on platform			
Assist CDR - Stow CDR'S PLSS antenna		Ingress			

NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE LUNAR SURFACE CHECKLIST

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	7+00	
END 1st EVA		END 1st EVA

3.2.3 EVA-2

The detailed timeline procedures for EVA-2 are shown on the following vertical format pages with the corresponding crew cuff checklist pages facing. The Voice Data Plan is also included on the facing page.

The detailed sampling and related procedures during the traverse are given in Section 3.2.5 along with those pages of the crew cuff checklist which serve as a guide for the crew while doing these procedures.

CREW EVA CHECKLIST

CDR-2 | EVA 2 | 7/6/71 | EGRESS | H2O XFER

PLSS TO LM H2O TRANSFER

Torso Tiedown - Loosen as reqd
PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - ON
Torso Tiedown - tighten as reqd

LMP-2 | EVA 2 | 7/6/71 | EGRESS | H2O XFER

PLSS TO LM H2O TRANSFER

Torso Tiedown - Loosen as reqd
PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - ON
Torso Tiedown - tighten as reqd

VOICE DATA

EVA 2

CODE

(1) MANDATORY REQUIREMENT FOR DATA AT TIME OR EVENT DESIGNATED

(2) DATA MAY BE DEFERRED UNTIL LATER IN EVA OR DEBRIEFING

NOTE: AT START OF EVA-2

- SUN ANGLE ∿ 28°
- LM SHADOW LENGTH ∿ 13.1m(43.2ft)
- ASTRONAUT SHADOW LENGTH ∿ 3.42m(11.3ft)

EMU STATUS TABLES @ 30 MIN INTERVALS

0+00 (1) CDR/LMP - EVA WATCH START - MARK

0+10

FINAL

JUNE 28, 1971

APOLLO 15

MISSION J-1

NOMINAL TIMELINE

LUNAR SURFACE EVA 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
START EVA WATCH	0+00	START EVA WATCH (CALL "MARK")		PRE-EGRESS OPERATIONS	PRE-EGRESS OPERATIONS
		NOTE: DETAILED PROCEDURES ARE PRESENTED IN "LUNAR SURFACE CHECKLIST," "EQUIPMENT PREP EVA 2" SECTION			
OPEN HATCH	0+10	<u>EGRESS</u>			

H2O XFER
EGRESS

CDR - EVA 2

0+10 Move thru hatch - Comm Ck.
PLSS Antenna - Deploy
Jett bag - Discard
LEC - to LMP
Descend

Pallet #2 - to MESA table
PLSS LiOH cans - check pins
Pallet - transfer
LCRU pwr - INT (Chg. batt if req'd)
ETB - transfer
ETB - to MESA table
Stow LEC on ladder hook

0+22 ETB - to LRV CDR floor pan

CDR-3 | EVA 2 | 7/6/71

H2O XFER
EGRESS

LMP - EVA 2

0+10 CDR PLSS Antenna - Deploy
Jett bag - place in hatch
LEC - to handhold
Recorder - OFF
VOX SENS (2) - MAX
CB Configuration - Verify
Utility & Flood Lts - OFF

Pallet - transfer
ETB - transfer
Stow LEC
Remove pallet equip
Pallet - to floor

0+24 Egress
Pallet - Discard
LM hatch - close
Descend

[CDR: - deploy LMP antenna]

LMP-3 | EVA 2 | 7/6/71

0+10

(2) CDR - Jettison Bag

(1) LMP-confirm "GO" for 2 man EVA

(1) CDR-LCRU covers open 100%

(2) ETB Contents:
- 1-70mm camera w/mag OO (HBW)
- 1-70mm camera w/mag KK (HCEX)
- 4-70mm mags (MM,PP,QQ,RR) (HBW)
- 3-16mm mags (FF,GG,HH)
- Maps

(2) LMP - Jettison Pallet

(1) CDR-Rpt mag/frame on 500mm lens cam (MM) _____/_____

(1) CDR-Rpt mag ____ on 16mm cam (FF)

0+30

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch			EGRESS
Place jett bag in hatch		Toss jett bag in Quad I Hand LEC to LMP			
Attach LEC to handhold Ready ETB for transfer					
		Descend to surface			
		Unstow MESA Pallet #2 and attach to MESA table			
Confirm "GO" for 2-man EVA					
Transfer pallet into LM		Attach LEC to pallet Transfer pallet into LM			
		Switch LCRU - INT pwr (in the event the LCRU batt is discharged, a new batt may be installed at this time)		Pallet & ETB TRANSFER	Pallet & ETB TRANSFER
Disconnect LEC from pallet		(HGA may require alignment, LCRU mode SW is in TV RMT)			
Attach LEC to ETB Assist CDR		Transfer ETB to surface			
	0+20				
Disconnect and stow LEC Remove & stow pallet equipment		Attach ETB to SRC table Stow LEC on ladder hook			
Place pallet on LM floor		Carry ETB to LRV; set in CDR floor pan			
Recorder - OFF Verify VOX Sens (2) - MAX Verify cb config Utility & Floodlights - OFF Move thru hatch		Remove thermal blanket off of LRV LMP seat; stow on +Y strut		EGRESS	EQUIPMENT PREP
Discard pallet into Quad I		Hang B-SLSS on LMP seat back			
Close hatch					
Descend to surface		Push 500mm lens cam toward CDR seat			
		Place CDR 70mm cam on floor pan			
CDR deploys LMP PLSS antenna		Deploy LMP PLSS antenna Stow 70mm (3-PP,QQ,RR) & 16mm (2-GG,HH) mags under CDR seat		EQUIPMENT	
Unstow both LCRU batts from MESA					
Place one LCRU batt in LRV LMP floor pan		Attach mag "MM" to 500mm lens cam & stow cam & reseau cover under CDR seat			
Wrap other LCRU batt in Quad III ther blnkt & place in +Y ftpad	0+30	Attach 16mm mag FF to cam (carry ETB to LMP side)			

CDR-4 | EVA 2 | 7/6/71 | LCRU BATT | GEO EQUIP

0+28 LMP PLSS Ant. - Unstow
ETB contents - to LRV
Mag "MM" - to 500mm Cam

ETB (empty) - to MESA table

0+34 $\boxed{\text{LCRU Batt}}$ - (LMP floor pan)
LCRU pwr - OFF
Change - LCRU batt
LCRU blankets - 100% open
LCRU pwr - INT

Olde LCRU batt-to CDR seat bag

$\boxed{\text{LRV CBs}}$ - close (except AUX)

[LMP: Geo. pallet equip]

LMP-4 | EVA 2 | 7/6/71 | SRC #2 | GEO EQUIP

LCRU batts (2)
- 1 - to LMP floor pan
- 1 - to +Y footpad in blanket (in shadow)

0+31 SRC #2 - to MESA table
Organic sample - close
C-Bag #5 - to HTC (L)

C-Bag #6 - to Pallet
C-Bag #7 - to HTC (R)

Transfer from C-Bag #5 to #7:
- 3 core tubes,(09; 12; 14)
- 2-20 bag disps

Core tube caps - to HTC
SESC #2 - to LMP seat bag
2-20 bag disp - CDR & LMP seats

C-Bag #7 - to LMP seat bag
C-Bag #2 - to HTC (R)

CDR-5 | EVA 2 | 7/6/71 | LCRU BATT | GEO EQUIP

0+38 Tether Tongs
Attach to LMP PLSS:
- C-Bag #2
- Core tube caps (C-Bag #5pkt)
- Hammer
- Core hammer

[LMP:- C-Bag #5 to CDR]
20-Bag disp - 70mm Cam
70mm Cam - to RCU

HGA - stow
LCRU - PM1/WB

0+45 $\boxed{\text{START}}$
Drive to NAV Init site
$\boxed{\text{NAV ALIGN}}$
LRV Systems - Readout

0+49 Drive to Station #4

LMP-5 | EVA 2 | 7/6/71 | SRC #2 | GEO EQUIP

0+39 [CDR: - tools to LMP PLSS]
C-Bag #5 - to CDR PLSS

Tether scoop/ext handle
HTC - close & secure
20 Bag disp - to 70mm Cam

Tidy MESA blankets
70mm Cam - to RCU

0+45 Mount LRV
Drive to NAV Init site
Initialize NAV system

Unstow maps

0+48 Drive to Station #4

0+30

(1) CDR-Rpt mag ____ on 16mm cam (FF)

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) LMP-Rpt Organic Sample Closed

(1) LMP-Rpt equip in SCB #7
- 3 core tubes ____,____,____
- Core tube cap disp
- SESC ____
- 2-20 bag disp

NOTE: Core tubes remaining in SCB #5
U-07, U-05, L-08

SESC #1

Geology Equip - LMP EMU:
- Hammer
- Core tube cap dispenser
- Core tube tool
- SCB #2
- Scoop/Ext hndl (tethered)

Geology Equip - CDR EMU:
- SCB #5
- Tongs (tethered)

(1) LMP-Rpt 70mm mag/frame on cam
____/____

(1) CDR-Rpt 70mm mag/frame on cam
____/____

(1) CDR - Readout LRV displays

HEADING		Volts Bat 1			
BEARING		Volts Bat 2			
DISTANCE		Temp Bat 1			
RANGE		Temp Bat 2			
Amp-Hr Bat 1		Temp LF mtr			
Amp-Hr Bat 2		Temp RF mtr			
Amps Bat 1		Temp LR mtr			
Amps Bat 2		Temp RR mtr			
SSD		ROLL		PITCH	
COMPUTED NAV HEADING					

(1) CDR - Mark depart time ______ (0+49)

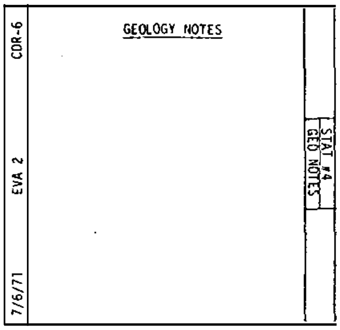
NOTE: 20-DSBD number series
- 252, 253, 255-272
- 273-275,278,281-289,291-296,298

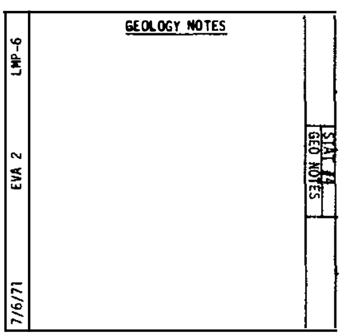
0+50

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
Wrap other LCRU batt in Quad III ther blnkt & place in +Y ftpad	0+30	Attach 16mm mag to cam (carry ETB to LMP side)	PREP	
Unstow SRC #2 & place on MESA table		Insert maps in map holder Place LMP 70mm cam on floor pan		
Remove SCB #5 from SRC & attach to HTC on LRV		Carry ETB to MESA table		
Remove SCB #6 & #7 from Geo. Pallet; attach #6 to front of pallet; #7 to HTC		Retrieve LCRU batt from LMP floor pan Switch LCRU - OFF		
Transfer from SCB #5 to #7: • 3-core tubes • Core tube cap disp - in pkt • SESC - in pocket • 2-20 bag dispensers		Replace LCRU battery		
		Switch LCRU - INT pwr		
Place 2-20 bag disps. on CDR & LMP seats Place SCB #7 under LMP seat		Stow old batt under CDR seat Push LRV C/Bs - in		
Attach SCB #2 to HTC		Tether tongs (from HTC)		
Assist CDR	0+40	Attach to LMP PLSS tool harness • SCB #2 • Core tube cap dispenser • Hammer		
Attach SCB #5 to CDR PLSS tool harness		Assist LMP		
Assemble scoop/ext. handle; tether Attach 20 bag disp. to 70mm cam Attach 70mm cam to EMU		Attach 20 bag disp. to 70mm cam Attach 70mm cam to EMU		
		Stow HGA for traverse		
Tidy MESA blankets		Switch LCRU - PM1/WB		
Mount LRV		Mount LRV		
		Power up LRV		
Unstow geology maps and determine 1st LRV heading		Drive to Nav Init. site Initialize Nav system	LRV NAV INITIALIZE	LRV NAV INITIALIZE
Traverse to checkpoint (11 min.)		Traverse to checkpoint (11 min.)		
	0+50			





0+50

(1) CDR - Mark arrival time ________ (1+00)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR-Rpt depart time ________ (1+02)

(1) CDR/LMP EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

1+10

MISSION: Apollo 15, J-1

EVA: 2

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LRV	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+50			TRAVERSE TO CHECKPOINT	TRAVERSE TO CHECKPOINT
NOTE: For purposes of the final edition of the Lunar Surface Procedures, detailed geology traverse information is contained in Section 3.6.					
Traverse South along smooth mare toward secondary crater cluster.					
Describe smooth mare characteristics. Describe secondary crater cluster characteristics. Photography if appropriate.					
Arrive checkpoint Readout NAV displays	1+00	Arrive checkpoint Readout NAV displays			
Traverse to Station #4 (15 min)		Traverse to Station #14 (15 min)		TRAVERSE TO STATION # 4	TRAVERSE TO STATION # 4
Traverse South along smooth mare on West side of secondary crater cluster.					
Describe smooth mare characteristics. Describe secondary crater cluster characteristics. Photography if appropriate.					
	1+10				

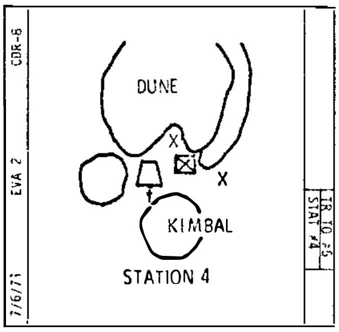
0+49 TRAVEL (0:11)
- •Ray material
- •Mare/secondaries
- •Lineaments, fillets, mounds
- •Block distribution

1+00 CPI (0:02)

1+02 TRAVEL (0:15)

1+17 GEOLOGY STATION #4 (0:20)
- •Cmpre secondary crater mtrl to other units/sample accordingly
- •Check rampart on lee side of Dune
- •Soil/rock chip samples
- •Documented samples (500mm photography) (Trench) (Core tube)

GEO NOTES STAT #4 | CDR-7 | EVA 2 | 7/6/71



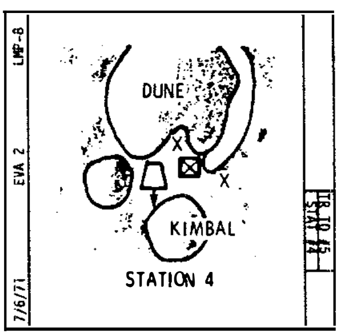
0+49 TRAVEL (0:11)
- •Ray material
- •Mare/secondaries
- •Lineaments, fillets, mounds
- •Block distribution

1+00 CPI (0:02)

1+02 TRAVEL (0:15)

1+17 Geology Station #4 (0:20)
- •Cmpre secondary crater mtrl to other units/sample accordingly
- •Check rampart on lee side of Dune
- •Soil/rock chip samples
- •Documented samples (500mm photography) (Trench) (Core tube)

GEO NOTES STAT #4 | LMP-7 | EVA 2 | 7/6/71



1+10

(1) CDR - Mark arrival time_____(1+17)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

1+30

MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+10				
Arrive Station #4 Readout LRV displays		Arrive Station #4 Park & power down LRV		STATION #4 GEOLOGY	STATION #4 GEOLOGY
Dismount LRV		Dismount LRV LCRU SEL SW - FM/TV Point HGA to earth			
Station #4 geology (20 min)		Station #4 geology (20 min)			
	1+20				

Secondary crater cluster located

south of a 400 meter crater.

AREA #4 TASKS (in order of priority)

1. Soil/rake sample
2. Documented samples
3. Pan
4. 500mm lens camera photography of Front
5. Exploratory trench
6. Single core tube thru secondary ejecta
7. Observe and describe crater interior and ejecta pattern.

Documented samples should include typical & exotic rock types and soil material.

Compare the crater ejecta with other geological units.

1+30

1+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

1+37 TRAVEL (0:10)
- Possible flow to west
- Mare/Front
- Front base
- Lateral variations
- Block Fields
- Patterned ground
- Rockslides/debris flows
- Blocky craters
- Large blocks

STAT #4 TR TO #5

CDR-9 EVA 2 7/6/71

(1) CDR - Stow gnomon
- Mark depart time ______(1+37)

(2) LMP-Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

1+37 TRAVEL (0:10)
- Possible flow to west
- Mare/Front
- Front base
- Lateral variations
- Block Fields
- Patterned ground
- Rockslides/debris flows
- Blocky craters
- Large blocks

STAT #4 TR TO #5

LMP-9 EVA 2 7/6/71

(1) CDR - Mark arrival time ______(1+47)

(1) LMP - Readout NAV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

1+50

MISSION: Apollo 15, J-1 DATE: 6/2/71

EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	1+30	
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB
Mount LRV		Mount LRV
Readout LRV displays Traverse to 1st Checkpoint(10min)		Power up LRV Traverse to 1st Checkpoint(10min)
	1+40	

Traverse South along smooth mare SW of secondary crater cluster to base of FRONT.

Describe smooth mare characteristics.

Describe secondary crater cluster characteristics & crater forms.

Photography if appropriate.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Arrive 1st Checkpoint Readout NAV displays		Arrive 1st Checkpoint Readout NAV displays
	1+50	

LCRU TV

TASK FUNCTION

LMP: TRAVERSE TO 1st CHECKPOINT; READOUT NAV

CDR: TRAVERSE TO 1st CHECKPOINT; READOUT NAV

CDR-10 | EVA 2 | 7/6/71

1+47 CP2 (0:04)(147°/0.39 to Spur)

1+51 TRAVEL (0:10)

- Access to Spur Crater (possible Stat. #7)
- Spur to CP3 (096°/0.75)
- Spur to Window (122°/1.41)
- Check distribution of secondary material

2+01 CP3 (0:04) (146°/0.81 to Window Crater)

TR TO #5 | STAT #5

1+50

(1) CDR - Mark depart time _____ (1+51)

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Mark arrival time _______ (2+01)

(1) LMP - Readout NAV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

LMP-10 | EVA 2 | 7/6/71

1+47 CP2 (0:04)(147°/0.39 to Spur)

1+51 TRAVEL (0:10)

- Access to Spur Crater (possible Stat.#7)
- Spur to CP3 (098°/0.75)
- Spur to Window (122°/1.41)
- Check distribution of secondary material

2+01 CP3 (0:04) (146°/0.81 to Window Crater)

STAT #5 | TR TO #5

(1) CDR - Mark depart time ________ (2+05)

(1) CDR - Mark arrival time ________ (2+10)

2+10

MISSION: Apollo 15, J-1 DATE: 6/2/71

EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+50				
Traverse to 2nd checkpoint (10 min)		Traverse to 2nd checkpoint (10 min)		TRAVERSE TO 2nd CHECKPOINT	TRAVERSE TO 2nd CHECKPOINT
Traverse East along Front. Determine position of base of Front (if possible) and select optimum sample areas for return traverse. Photography if appropriate. Describe any possible debris flows or downslope movement.					
	2+00				
Arrive 2nd checkpoint Readout NAV displays		Arrive 2nd checkpoint Readout NAV displays		READOUT NAV	READOUT NAV
Traverse to 3rd checkpoint (5 min)		Traverse to 3rd checkpoint (5 min)		TRAVERSE TO 3rd CHECKPOINT	TRAVERSE TO 3rd CHECKPOINT
Traverse East along Front. Same observation activities as above.					
Arrive 3rd checkpoint	2+10	Arrive 3rd checkpoint			

2+10

(1) LMP - Readout NAV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

2+05 TRAVEL (0:05)
- Access to Window crater (Possible Station 6)
- (096°/1.11 to Front Crater)

2+10 CP4 (0:04)

2+14 TRAVEL (0:12)

2+26 GEOLOGY STATION #5 (0:51)
- Documented samples
  South Rim of Crater
  Radial direction from north rim
- Trench/south rim
- Stereo pan-100m. along Frt
  (500mm.)
  (70mm stereo upslope)

TR TO #5 / STAT #5 — CDR-11 — EVA 2 — 7/6/71

(1) CDR - Mark depart time ________ (2+14)

2+05 TRAVEL (0:05)
- Access to Window crater (Possible Station 6)
- (096°/1.11 to Front Crater)

2+10 CP4 (0:04)

2+14 TRAVEL (0:12)

2+26 Geology Station #5 (0:51)
- Documented samples
  South Rim of Crater
  Radial direction from north rim
- Trench/south rim
- Stereo pan-100m. along Frt
  (500mm)
  (70mm stereo upslope)

TR TO #5 / STAT #5 — LMP-11 — EVA 2 — 7/6/71

(1) CDR - Mark arrival time ______ (2+26)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

2+30

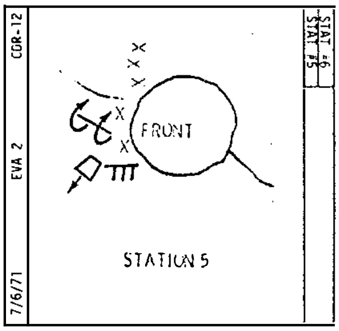
MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

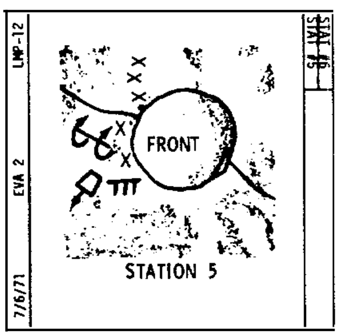
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Arrive 3rd checkpoint Readout NAV displays	2+10	Arrive 3rd checkpoint Readout NAV displays		READOUT NAV	READOUT NAV
Traverse to Station #5 (12 min)		Traverse to Station #5 (12 min)		TRAVERSE TO STATION #5	TRAVERSE TO STATION #5
Traverse along Front and make observations and descriptions shown above.					
	2+20				
Arrive Station #5 Readout LRV displays		Arrive Station #5 Park & power down LRV		STATION #5 GEOLOGY	STATION #5 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #5 geology (53 min)		Station #5 geology (53 min)			
	2+30				

CREW EVA CHECKLIST

VOICE DATA

2+30





At 3+00
(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

3+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+30			STATION #5 GEOLOGY	STATION #5 GEOLOGY

Station #5 in the area at the base of the Front near the rim of Front Crater.

Area #5 tasks (in order of priority)

1. Documented samples-upslope side of Front Crater
2. Documented samples-North rim of Front Crater at sharp 80 meter crater on rim
3. Stereo pan (70mm cam) with 100 meter base along Front
4. Exploratory trench upslope of Front Crater
5. 500mm lens camera photography-targets of opportunity
6. 70mm camera stereo pairs upslope-targets of opportunity

3+10

STAT #5 STAT #6

3+17 TRAVEL (0:14)
- (Front to Window 276°/1.11)
- Return to Stat #6
- 16mm photos from LRV

3+31 GEOLOGY STATION #6 (0:40)
- Possible stop Window crater
  - Describe sample area
  - Compare Front/other units
  - Documented Samples
    (Trench)
    (Core tube)
    (500mm)
    (70mm. stereo upslope)

4+11 TRAVEL (0:08)
- Return to Station 7
  (Window to Spur 303°/1.41)

CDR-13 EVA 2 7/6/71

3+10

(1) CDR - Stow gnomon
- Mark depart time ______ (3+19)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

STAT #5 STAT #6

3+17 T AVEL (0:14)
- (Front to Window 276°/1.11)
- Return to Stat #6
- 16mm photos from LRV {f4;1/250 12 fps

3+31 Geology Station #6 (0:40)
- Possible stop Window crater
  - Describe sample area
  - Compare Front/other units
  - Documented Samples
    (Trench)
    (Core tube)
    (500mm)
    (70mm stereo upslope)

4+11 TRAVEL (0:08)
- Return to Station 7
  (Window to Spur 303°/1.41)

LMP-13 EVA 2 7/6/71

3+30

MISSION: Apollo 15, J-1
EVA: 2

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+10				
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW-PM1/WB		TRAVERSE TO STATION #6	TRAVERSE TO STATION #6
Mount LRV		Mount LRV			
Readout LRV displays Traverse to Station #6 (14 min)		Power up LRV Traverse to Station #6 (14 min)			
	3+20				
	3+30				

Traverse along base of Front to vicinity of Station #6 observing lateral variations in material and surface textures.

Search for blocky areas along Front which are suitable for sampling (ie, craters, block fields, etc).

Photography if appropriate.

3+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Mark arrival time______(3+33)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

At 4+00
(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

4+10

MISSION: APOLLO 15, J-1
EVA: 2

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+30			
Arrive Station #6 Readout LRV DISPLAYS		Arrive Station #6 Park & Power down LRV	STATION #6 GEOLOGY	STATION #6 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth		
Station #6 geology (40 min)		Station #6 geology (40 min)		

Station #6 area is along the Front on the slope in intercrater areas or on crater rims. Primary areas are selected by crew based upon previous observations.

Area #6 tasks (in order of priority)

1. Description of Front area to be sampled, comparing with other surface units.
2. Documented samples of Front material.
3. Pan
4. Exploratory trench
5. Core tube
6. 500mm lens camera photography (blocks, outcrops, etc.)
7. 70mm stereo pairs of upslope targets of opportunity

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Check tools secure & HTC closed	4+10	Stow gnomon on seatback

CDR-14 EVA 2 7/6/71

4+19 GEOLOGY STATION #7 (0:40)
- Possible stop Spur Crater
- Same as Station 6
- Summarize Front Observation

4+59 TRAVEL (0:26)
- Front/Mare
- Block distribution
- Secondary deposit dist
- Patterned ground
- Possible rock flows

STAT #7 STAT #8

4+10

(1) CDR - Stow gnomon
- Mark depart time ______ (4+13)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

LMP-14 EVA 2 7/6/71

4+19 Geology Station #7 (0:40)
- Possible stop Spur Crater
- Same as Station 6
- Summarize Front Observation

4+59 TRAVEL (0:26)
- Front/Mare
- Block distribution
- Secondary deposit dist
- Patterned ground
- Possible rock flows

STAT #7 STAT #8

(1) CDR - Mark arrival time ______ (4+21)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

At 4+30

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

4+50

MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+10			
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB		
Mount LRV		Mount LRV		
Readout LRV displays Traverse to Station #7 (8 min)		Power up LRV Traverse to Station #7 (8 min)	TRAVERSE TO STATION # 7	TRAVERSE TO STATION # 7

The traverse to Area #7 is also along the base of the Front. Things to look for are lateral variations in the material, surface textures and blocky areas along the front which are suitable for sampling.

Photographic documentation of these features is desirable.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+20			
Arrive Station #7 Readout LRV displays		Arrive Station #7 Park & Power down LRV	STATION # 7 GEOLOGY	STATION # 7 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth		
Station #7 geology (40 min)		Station #7 geology (40 min)		

Area #7 is also located along the base of the Front in intercrater areas or on crater rim. The crew, based upon previous area observations, should use discretion in selecting the specific areas to be investigated.

<u>Area #7 tasks</u> (in order of priority)

1. Detailed description of the sampling area
2. Comparison of this area to other Front areas and the mare and Rille units.
3. Documented samples
4. 70mm panorama

4+50

4+50

(1) CDR - Stow gnomon
- Mark depart time______(5+01)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

5+10

MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+50			

Area #7 tasks (cont'd)

5. Exploratory trench
6. Core tube - if conditions warrant
7. 500mm lens camera photography of blocky areas, outcrops, etc.
8. 70mm stereo pairs of worthwhile targets of opportunity up-slope.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB
Mount LRV	5+00	Mount LRV
Readout LRV displays Traverse to Station #8 (26 min)		Powerup LRV Traverse to Station #8 (26 min)

TRAVERSE TO STATION #8 (LMP) | TRAVERSE TO STATION #8 (CDR)

In traversing from Area #7 to Area #8 the surface characteristics should change from the blocky Front material to a smoother mare material. The traverse will pass along the southwestern edge of a secondary crater cluster.

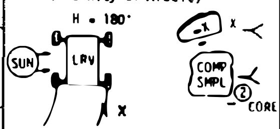
Things to look for during this portion of the traverse are the secondary crater deposits and their relationship to surrounding terrain and eastern edge of the debris flow from the Front.

Photographic documentation of these features is desirable.

5+10

CDR-15 | EVA 2 | 7/6/71 | STAT #8

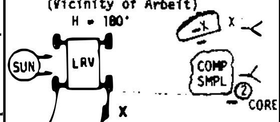
5+25 GEOLOGY STATION #8 (0:45)
(Vicinity of Arbeit)



- Comprehensive sample
- Double core sample
- Pan
- Soil mech trench
  - SESC #1
  - Samples
- Penetrometer Tests
  - Soil mech trench
  - Core tube site
  - LRV track

LMP-15 | EVA 2 | 7/6/71 | STAT #8

5+25 Geology Station #8 (0:45)
(Vicinity of Arbeit)



- Comprehensive sample
- Double core sample
- Pan
- Soil mech trench
  - SESC #1
  - Samples
- Penetrometer Tests
  - Soil mech trench
  - Core tube site
  - LRV track

CDR-16 | EVA 2 | 7/6/71 | STAT #8

5+25 STATION #8

STOP
LCRU sel - FM/TV

16mm Cam - fresh mag
(f8;1/250;12 FPS)

Comprehensive Sample
- LMP 70mm cam - to LRV
- Rake
- 1 bag rocks
- 1 bag soil

5+35 Double Core Tube Sample
- X-Sun photos only
- 16mm Cam - fresh mag
  (f8;1/250,12 FPS)

LMP-16 | EVA 2 | 7/6/71 | STAT #8

5+25 STATION #8
LRV system - readout
Dismount LRV
Rake - install on ext. handle
[CDR: Change 16mm mag]
[CDR: Place gnomon]
Comprehensive Sample
- LMP 70mm cam - to LRV
- Rake
- 1 bag rocks
- 1 bag soil

5+35 Double Core Tube Sample
[CDR: Photo]
[CDR: Place gnomon for trch]

5+10

(1) CDR - Mark arrival time______(5+27)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

5+30

MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10				
	5+20				
Arrive Station #8 Readout LRV displays		Arrive Station #8 Park & Power down LRV		STATION #8 GEOLOGY	STATION #8 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #8 geology (45 min)		Station #8 geology (45 min)			
	5+30				

5+30

— (1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

CDR-17 | EVA 2 | STAT #8 | 7/6/71

5+42 Soil Mechanics Trench
- •Photo: X-SUN; Dn-Sun
- •Pan (70mm cam)(CDR)
- •Collect samples (CDR) (no gnomon)

Photo trench
- •Vert. wall(X-Sun,7ft,stereo)
- •Long axis(Dn-Sun,7ft,stereo)

5+48 Sample trench
- •SESC 75% full - to CDR C-Bag
- •1/2 bag: bottom, top, side

[LMP: Clean trench bottom]

5+53 Install penetro 0.5 cone

LMP-17 | EVA 2 | STAT #8 | 7/6/71

5+42 Soil Mechanics Trench
[CDR: Photo]

5+48 Sample trench
- •SESC 75% full - to CDR C-Bag
- •1/2 bag: bottom, top, side

5+53 Clean trench bottom
[CDR: Install penetro cone]
Penetro - install on ext. hdle

— At 6+00

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

CDR-18 | EVA 2 | STAT #8 | 7/6/71

5+55 Penetrometer tests

#1- Adj. trench
- • Photo in surf (X-Sun, 7')

#2- Trench bottom
- • Photo in surf (X-Sun, 7')

#3- LRV track
- • Photo in surf(X-Sun, 7')

#4- Adjacent to LRV track
- • Photo in surf (X-Sun, 7')

Install penetro plate (CDR)

#5- Core tube site
- • Photo imprint(X-Sun,7'Stereo)

#6- Trench bottom
- • Photo imprint(X-Sun,7'Stereo)

LMP-18 | EVA 2 | STAT #8 | 7/6/71

5+55 Penetrometer tests

#1- Adj. trench
[CDR: Photo]

#2- Trench bottom
[CDR: Photo]

#3- LRV track
[CDR: Photo]

#4- Adjacent to LRV track
[CDR: Photo]
[CDR: Install penetro plate]

#5- Core tube site
[CDR: Photo]

#6- Trench bottom
[CDR: Photo]

6+10

MISSION: Apollo 15, J-1 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRV	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+30			STATION #8 GEOLOGY	STATION #8 GEOLOGY

Sampling area #8 should be located in the smoother Mare material but near a substantial crater.

Area #8 tasks (in order of priority)

1. Comprehansive sample area
2. Double core tube
3. Documented samples of the large crater
   look for filleted rock samples and equidimensional rock samples (large & small)
4. 70mm panorama
5. Soil mechanic trench
   Dry trench
   SESC #1
   Possible buried rock
6. Penetrometer

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	6+00	
Check tools secure & HTC closed	6+10	Stow gnomon on seatback

CDR-19 | EVA 2 | 7/6/71 | STAT #8

#7- Collapse trench side
• Photo mtrl. or imprint
(X-Sun, 7', stereo)

6+08 [LMP: Remove ext. handle]
Stow penetro, cone on LRV
[LMP: Change 16mm Mag]
[LMP: Mount LRV]

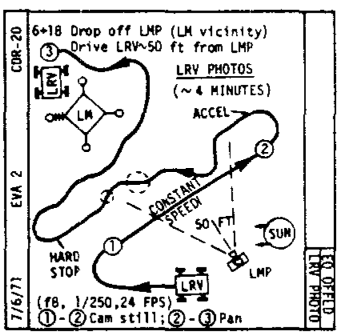
HGA - stow
LCRU - PM1/WB
START

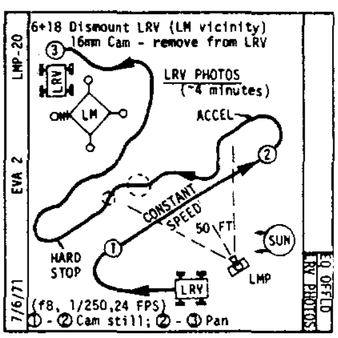
6+10 Return to LM
• Ray/Secondaries
• Lineaments/Fillets/Mounds
• Block Distribution

LMP-19 | EVA 2 | 7/6/71 | STAT #8

#7- Collapse trench side
(1/3 depth from edge)
[CDR: Photo]
6+08 Penetro - remove ext. handle
[CDR: Stow Penetro]
16mm cam - change mag
Mount LRV

6+10 Return to LM
• Ray/Secondaries
• Lineaments/Fillets/Mounds
• Block Distribution





6+10

(1) CDR - Stow gnomon
- Mark depart time ______ (6+12)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - Mark arrival time ______ (6+20)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(2) CDR-Rpt tools off LMP PLSS & stowed
- Hammer
- Core tube tool
- Core tube cap disp
- SCB #2

6+30

MISSION: Apollo 15, J-1 DATE: 6/2/71

EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+10	Stow HGA LCRU Sel SW - PM1/WB			
Mount LRV Readout LRV displays		Mount LRV			
Traverse to LM (08 min)		Power up LRV Traverse to LM (08 min)		TRAV TO LM	TRAV TO LM
The traverse to the LM should cover a smooth Mare surface which could be compared with terrain previously traversed. If possible, observe and describe ray materials.					
Arrive at LM Readout NAV & LRV displays	6+20	Arrive at LM Park LRV at MESA; point North, X-Sun in sun		EVA CLOSEOUT	EVA CLOSEOUT
Power down LRV C/Bs		Power down LRV switches			
Dismount LRV		Dismount LRV			
Photo LRV; X-Sun (2), Dn-Sun (1)		Align HGA toward Earth			
Stow 70mm cam/bags on LMP seat		Switch LCRU - TV RMT Open LRV batt dust covers Stow 70mm cam/bags on CDR seat			
Assist CDR		Remove from LMP PLSS tool harness • Core tube cap disp. - discard • Hammer - stow on HTC • SCB #2 - stow on HTC			
Remove SCB #5 from CDR PLSS tool harness; tidy velcro covers		Tidy harness velcro covers Assist LMP			
Place SCB #5 in SRC #2		Stow tongs on HTC			
		Carry ETB to LRV CDR footpad			
	6+30				

Crew EVA Checklist

CDR-21 | EVA 2 | 7/6/71 | LRV PHOTO EQ OFFLD

6+23 STOP at MESA - North, X-Sun

LCRU - TV RMT
HGA - align
LRV batt - open dust covers

70mm Cam - CDR seat
Remove from LMP PLSS:
- Core tube cap disp - discard
- Hammer - to HTC
- Core rammer - to HTC
- C-Bag #2 - to HTC (R)

Tidy velcro covers
[LMP: - Remove CDR C-Bag #5]
Tongs - to HTC

6+32 ETB - to LRV CDR floorpan
20-Bag Disps - to CDR bag
[LMP: Pack SRC #2]

LMP-21 | EVA 2 | 7/6/71 | LRV PHOTOS EQ OFFLD

6+23 Return to MESA
16mm cam - install on LRV
LRV systems - readout
Pwr down CBs

Photo LRV; (f11,1/250,11 ft)
- X-Sun (2)
- Dn-Sun (1)

70mm Cam - to LMP seat
[CDR: tools from LMP PLSS]
Ext. handle/scoop - to HTC
C-Bag #5 - remove from CDR
Tidy velcro covers

C-Bag #5 - to SRC #2
Remove seal protectors
Close & seal SRC #2

C-Bag #2 - to MESA
C-Bag #6 - to MESA

CDR-22 | EVA 2 | 7/6/71 | INGRESS ETB PACK

Reseau cover - to 500mm cam

Collect in ETB:
- 70mm cams (2) RR,QQ
- 70mm mags (3) KK,OO,PP
- 500mm cam mag - MM
- 16mm mags (4) EE,FF,GG,HH
- Maps

16mm Cam - Point North

6+38 Clean EMU's
LMP PLSS Ant. - Stow

ETB(empty) - to MESA table

[LMP: Ingress]

LMP-22 | EVA 2 | 7/6/71 | EVA 3-EGR INGRESS

Unstow dust brush
6+38 Clean EMU's
Dust brush - Geo pallet
[CDR: stow LMP antenna]

LRV Check - all samples?

6+41 Ingress - carry C-Bag #6
Attach LEC
Transfer:
- SRC #2
- ETB

Stow equipment

Stow C-Bag #2 (from CDR)

Pass LEC to CDR
Assist CDR ingress

7+00 Close hatch

Voice Data

6+30

(1) CDR/LMP-EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR-Rpt 70mm cam w/mags/frame to ETB
____/____
____/____

(1) CDR-Rpt 70mm mags/frame in ETB
(MM) ____/____
____/____
____/____

(1) CDR-Rpt 16mm mags ____, ____ in ETB

(1) CDR-Rpt 16mm mag ____ from cam to ETB
-Rpt maps in ETB

(2) CDR-Rpt BSLSS & 500mm cam on LMP seat

ETB Contents:
- 2-70mm cam w/mags ____(QQ), ____(PP)
- 4-70mm mags __(KK),__(MM),__(OO),__(RR)
- 3-16mm mags ____ (FF), ____ (GG), ____ (HH)
- Maps

(2) Items transferred to A/S
- SCB #6 (with LMP)
- SRC #2
- ETB
- SCB #2 (with CDR)

(1) CDR - LCRU covers open 65%

6+50

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove SRC seal protector Close & seal SRC #2	6+30	Remove 20-bag disps from both CDR & LMP 70mm cam; stow cams in ETB, bags in CDR seat bag			
Remove SCB #2 from HTC and place on MESA		Remove mag MM from 500mm lens cam; stow in ETB; cam on LMP seat			
Remove SCB #6 from front of Geo. pallet and place on MESA		Transfer 70mm mags KK,OO,RR & 16mm mags FF,GG from under LRV seat into ETB			
Unstow dust brush from geo pallet					
Clean CDR's EMU		Clean LMP's EMU & stow LMP PLSS antenna			
Stow dust brush in geo pallet		Remove 16mm mag HH from cam & maps from holder; stow in ETB (carry ETB to LMP side)			
Check all samples removed from LRV					
Ingress; carry SCB #6 into LM		Attach ETB to MESA table		INGRESS	
		Place B-SLSS & 500mm lens cam on LMP seat; cover with thermal blanket			
	6+40				
Attach LEC to handhold		Attach LEC to SRC #2		EVA TERMINATION	
Transfer SRC #2 into LM		Transfer SRC #2 into LM			
Remove SRC #2 from LEC Stow SRC #2 in LM		Transfer LEC hooks to surface Attach LEC to ETB			
Transfer ETB into LM		Transfer ETB into LM			
Remove ETB from LEC					
Stow ETB in LM		Transfer LEC hooks to surface Stow LEC on ladder hook Turn LCRU pwr switch - OFF			
		Adjust LCRU thermal blankets			
	6+50				

6+50

ETB PACK
INGRESS

Transfer:
- SRC #2
- ETB

Stow LEC

LCRU Pwr - OFF
LCRU blankets - 65% open

Clean EMU

6+54 Ascend ladder; carry $\boxed{\text{C-Bag \#2}}$
Hand C-Bag #2 to LMP
Stow LEC on platform

Ingress

CDR-23
EVA 2
7/6/71

7+00 (1) CDR-Rpt END EVA-2

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	CRUTV	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+50				
		Ascend ladder; carry SCB #2			INGRESS
Stow SCB #2 in LM Pass LEC to CDR		Hand SCB #2 to LMP Stow LEC on platform			EVA TERMINATION
Assist CDR; stow CDR's PLSS antenna		Ingress			
End 2nd EVA	7+00	End 2nd EVA			

NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE "LUNAR SURFACE CHECKLIST"

3.2.4 EVA-3

The detailed timeline procedures for EVA-3 are shown in the following vertical format pages with the corresponding crew cuff checklist pages facing. The Voice Data Plan is also included on the facing page.

The detailed sampling and related procedures during the traverse are given in Section 3.2.5 along with those pages of the crew cuff checklist which serve as a guide for the crew doing these procedures.

EVA 3

CODE

(1) MANDATORY REQUIREMENT FOR DATA
AT TIME OR EVENT DESIGNATED

(2) DATA MAY BE DEFERRED UNTIL
LATER IN EVA OR DEBRIEFING

NOTE: AT START OF EVA-3

- SUN ANGLE ∿ 39°
- LM SHADOW LENGTH ≈ 8.6m(28.4 ft)
- ASTRONAUT SHADOW LENGTH ≈ 2.24m(7.4 ft)

EMU STATUS TABLES @ 30 MIN INTERVALS

0+00 (1) CDR/LMP - EVA WATCH START - MARK

0+10

FINAL

JUNE 28, 1971

APOLLO 15

MISSION J-1

NOMINAL TIMELINE

LUNAR SURFACE EVA 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
START EVA WATCH	0+00	START EVA WATCH (CALL "MARK")		PRE-EGRESS OPERATIONS	PRE-EGRESS OPERATIONS
		NOTE: DETAILED PROCEDURES ARE PRESENTED IN "LUNAR SURFACE CHECKLIST," "EQUIPMENT PREP EVA "3" SECTION			
OPEN HATCH	0+10	EGRESS			

CDR-24 | EVA 3 | 7/6/71 | LCRU BATT EGRESS

CDR - EVA 3

0+10 Move thru hatch - Comm Ck.
PLSS Antenna - Deploy
Jett bag - Discard
LEC to LMP
Descend

ETB xfer
ETB - to MESA table
Stow LEC on ladder hook

ETB - to LRV CDR floorpan
LCRU pwr - INT

0+20 LMP PLSS antenna - Unstow

INGRESS EVA 3-EGR | LMP-23 | EVA 2 | 7/6/71

LMP - EVA 3

0+10 COR PLSS Antenna - Deploy
Jett bag - place in hatch
LEC - to handhold
Recorder - OFF
VOX SENS (2) - MAX
CB Configuration - Verify
Utility & Flood Lts - OFF

ETB - transfer
Stow LEC

0+18 Egress
LM hatch - close
Descend
[COR: deploy LMP antenna]

LCRU batt(+Y pad)-LMP fl/pan

EGRESS LCRU BATT | CDR-25 | EVA 3 | 7/6/71

ETB contents - to LRV
Mag "MM" - to 500mm Cam
P.O. Pkg. - leave in ETB

0+27 ETB(empty) - to MESA table

$\boxed{\text{LCRU Batt}}$ - (LMP floorpan)
LCRU pwr - OFF
Change - LCRU batt
LCRU blankets - 100% open
0+31 LCRU pwr - INT

Olde LCRU batt - LRV

$\boxed{\text{LRV CBs}}$ - closed (except AUX)

[LMP: Geo. pallet equip.]

0+10

(2) CDR - Jettison Bag

ETB Contents:
- 2-70mm cam w/mags SS(HBW) & TT(HCEX)
- 4-70mm mags MM,UU,VV,WW(HBW)
- 2-16mm mags II, JJ
- MAPS

(1) CDR-LCRU covers open 100%

(1) CDR-Rpt mag/frame or CDR cam
____/____

(1) CDR-Rpt mag/frame or 500mm Lens Cam
(MM)____/____

(1) CDR-Rpt mag _____ on 16mm cam

(1) CDR-Rpt mag/frame on LMP cam
____/____

(2) LMP-SCB #7 contents:
- 3 Core tubes L-12, L-14, U-09
- SESC #2

0+30

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch - comm check
Place Jett bag in hatch		
Attach LEC to handhold		Toss Jett bag in Quad I Hand LEC to LMP
Confirm "GO" for 2-man EVA		Descend to surface
Transfer LEC hooks into LM		Transfer LEC hooks into LM
Attach LEC to ETB Assist CDR		Transfer ETB to surface
Disconnect and stow LEC Recorder - OFF		Attach ETB to SRC table
Verify VOX Sens (2) - Max Verify cb config Utility & Floodlights - OFF Move thru hatch Close hatch		Stow LEC on ladder hook Carry ETB to LRV; set in CDR floor pan
Descend to surface		Switch LCRU-INT pwr. (HGA may need alignment)
CDR deploys LMP PLSS antenna	0+20	Deploy LMP PLSS antenna
Retrieve LCRU batt from +Y footpad; place in LMP floor pan		Remove thermal blanket from LMP seat - discard Hang B-SLSS on LMP seat back Push 500mm lens cam toward CDR seat
Unstow B-SLSS bag from MESA & stow on Geo. pallet forward hooks		Place CDR 70mm cam on floor pan Stow 70mm (3-UU,VV,WW) & 16mm (1-JJ) mags under CDR seat Attach mag "MM" to 500mm lens cam & stow under CDR seat
Remove SCB #7 from under LMP seat & attach to HTC		Attach 16mm mag II to cam (carry ETB to LMP side) Insert maps in map holder
		Place LMP 70mm cam on floor pan
Remove 2-20 bag dispensers from SCB #7 and place on CDR and LMP seats		Carry ETB to SRC table
		Retr LCRU batt from LMP flr pan
Remove SCB #8 from pallet & attach to HTC		Switch LCRU pwr - OFF Replace LCRU battery
	0+30	

LCRU TV

TASK FUNCTION

LMP	CDR
	EGRESS
TRANSFER PREP	
EGRESS	EQUIPMENT PREP & LCRU/COMM ACTIVATION

0+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

Geology Equip - LMP EMU:
- Hammer
- Core tube cap dispenser
- Core tube tool
- SCB #8
- Scoop/Ext. Hndl (tethered)

Geology Equip - CDR EMU:
- SCB #7
- Tongs (tethered)

NOTE: 20-DSBD number series
- 207-223, 229-230, 301
- 231-235, 237-251

(1) CDR - Readout LRV displays

HEADING		Volts Bat 1	
BEARING		Volts Bat 2	
DISTANCE		Temp Bat 1	
RANGE		Temp Bat 2	
Amp-Hr Bat 1		Temp LF mtr	
Amp-Hr Bat 2		Temp RF mtr	
Amps Bat 1		Temp LR mtr	
Amps Bat 2		Temp RR mtr	
SSD	ROLL	PITCH	
COMPUTED NAV HEADING			

(1) CDR - Mark depart time________(0+42)

CDR-26 EVA 3 7/6/71

0+32 Tether Tongs
Attach to LMP PLSS:
- C-Bag #8
- Core tube caps (HTC)
- Hammer
- Core rammer

[LMP:- C-Bag #7 - to CDR]
20-Bag disp - 70mm Cam
70mm Cam - to RCU

HGA - stow
LCRU - PM1/WB

0+39 START
Drive to NAV Init site
NAV ALIGN
LRV Systems - Readout

0+42 Drive to Station △

STAT #9 GEO EQUIP

LMP-24 EVA 2 7/6/71

B-SLSS bag - to pallet front(R)
C-Bag #7 (LMP seat bag)-HTC(L)

20 bag disp-to CDR & LMP seat
0+29 C-Bag #8 - to HTC (R)
[CDR: - tools to LMP PLSS]

C-Bag #7 - to CDR PLSS

0+35 Tether scoop/ext handle
HTC - close & secure
20-Bag disp - to 70mm Cam
70mm Cam - to RCU

0+39 Mount LRV
Drive to NAV Init site
Initialize NAV system
Unstow maps

0+42 Drive to Sation △

STAT #2 GEO EQUIP

(1) CDR - Mark arrival time______(0+49)
(1) LMP - Readout NAV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

0+50

MISSION: APOLLO 15 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+30			
		Switch LCRU - INT pwr Stow old batt under CDR seat Push LRV C/Bs - in Tether tongs		
Assist CDR		Attach to LMP PLSS tool harness: • SCB #8 • Core tube cap dispenser • Hammer		
Attach SCB #7 to CDR PLSS tool harness Assemble scoop/ext. handle; tether		Assist LMP Attach 20 bag disp to 70mm cam		
Close HTC		Attach 70mm cam to EMU		
Attach 20 bag disp to 70mm cam		Stow HGA for traverse		
Attach 70mm cam to EMU				
Mount LRV		Switch LCRU - PM1/WB Mount LRV Power up LRV Drive to Nav init site Align LGA	LRV NAV INIT	LRV NAV INIT
Unstow geology maps and determine 1st LRV heading	0+40	Initialize Nav system		
NOTE: For purposes of the final edition of the Lunar Surface Procedures, detailed geology traverse information is contained in Section 3.6.				
Traverse to Supplementary Sample Stop (7 min)		Traverse to Supplementary Sample Stop (7 min)	TRAV TO SUPP SAMPLE STOP	TRAV TO SUPP SAMPLE STOP
The traverse to the supplementary sample stop is toward the Rille passing the ALSEP site. The surface should be compared to the Rim approach.				
Arrive Supplementary Sample Stop Readout LRV displays		Arrive Supplementary Sample Stop Park & powerdown LRV		
	0+50			

0+50

GEO EQUIP STAT #9

0+42 TRAVEL (0:07)
- Possible ray
- Fillets, lineaments, mounds
- Block distribution

0+49 SUPPLEMEMTARY SMPLE STOP (0:05)
- Soil/rock sample

0+54 TRAVEL (0:12)
- Mare/raised rille rim(levee)

1+06 GEOLOGY STATION #9 (0:50)
- Describe rille rim and wall
- 500mm (Vert/Horiz/Targ. Op)
- Comprehensive sample
  (away from Rille rim)
- Documented sample
- Core (single or double)
- Trench (soil)
- Doc. sample - Rim Crater
  (Scarp Crater)
- Penetrometer

CDR-27 EVA 3 7/11/71

(1) CDR - Stow gnomon
- Mark depart time ______ (0+54)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

GEO EQUIP STAT #9

0+42 TRAVEL (0:07)
- Possible ray
- Fillets, lineaments, mounds
- Block distribution

0+49 SUPPLEMENTARY SMPL STOP (0:05)
- Soil/rock sample

0+54 TRAVEL (0:12)
- Mare/raised rille rim(levee)

1+06 Geology Station #9 (0:50)
- Describe rille rim and wall
- 500mm (Vert/Horiz/Targ. Op)
- Comprehensive Sple
  (away from Rille Rim)
- Documented Sample
- Core (Single or double)
- Trench (soil)
- Doc. smple - Rim Crater
  (Scrap crater)
- Penetrometer

LMP-25 EVA 3 7/6/71

(1) CDR - Mark arrival time ______ (1+06)

(1) LMP - Readout LRV displays

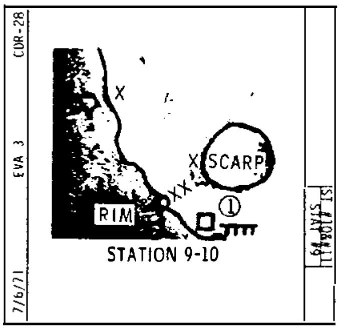
HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

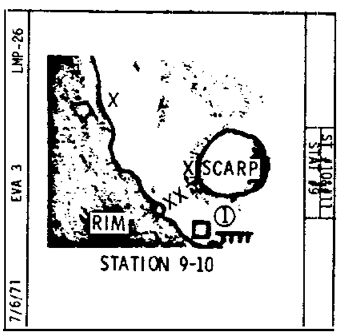
1+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Dismount LRV Supplementary Sample Stop (5 min)	0+50	Dismount LRV Supplementary Sample Stop (5 min)		SUPP SAMPLE STOP	SUPP SAMPLE STOP
Area Tasks: soil/rock sample 70mm panorama					
Check tools secure & HTC closed		Stow gnomon on seatback			
Mount LRV Readout LRV displays		Mount LRV Power up LRV			
Traverse to Station #9 (12 min)		Traverse to Station #9 (12 min)		TRAVERSE TO STATION #9	TRAVERSE TO STATION #9
The traverse to Station #9 continues across the Mare surface to the rim of Hadley Rille turning to the NW at the rim and proceeding to the terrace. Comparison of the smooth Mare to the rim material should continue.					
	1+00				
Arrive Station #9		Arrive Station #9 Park & Power down LRV		STATION #9 GEOLOGY	STATION #9 GEOLOGY
Readout displays Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #9 geology (50 min)		Station #9 geology (50 min)			
	1+10				

1+10


CDR-28
EVA 3
7/6/71
SCARP
RIM
STATION 9-10


LMP-26
EVA 3
7/6/71
SCARP
RIM
STATION 9-10

1+50

MISSION: APOLLO 15, J-1 DATE: 6/2/71

EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR

1+10

The Station #9 area is on the rim of the Rille at the southern end of the terrace.

Area #9 tasks (in order of priority)

1. Observe and describe Rille and far wall
2. 500mm lens camera photography of Rille (provides first part of wide base stereo to be completed at Sta #10). Targets that will be visible from Sta #10 should be selected.
3. Comprehensive sample area
4. Single or double core tube
5. 70mm panorama
6. Documented samples of crater at edge of Rille
7. Possible 70mm pan at edge of crater
8. Penetrometer

STATION #9 GEOLOGY

STATION #9 GEOLOGY

1+50

STAT #9
ST #10&11

1+56 TRAVEL (0:03)
- Changes in rim character
- Possible outcrops

1+59 GEOLOGY STATION #10 (0:10)
- 500mm
  Same targets as St. 9
- Documented sample at crater or rim

2+09 TRAVEL (0:06)
- Changes in rim character
- Possible outcrops

2+15 GEOLOGY STATION #11 (0:19)
- Describe rille and far wall
- 500mm (Vert/Horiz/Targ Op)
- Documented Samples
  - Rille rim
  - South twin
- Compare rim mtrl to other

CDR-29
EVA 3
7/6/71

STAT #9
ST #10&11

1+56 TRAVEL (0:03)
- Changes in rim character
- Possible outcrops

1+59 Geology Station #10 (0:10)
- 500mm
  Same targets as St. 9
- Documented sample at crater or rim

2+09 TRAVEL (0:06)
- Changes in rim character
- Possible outcrops

2+15 Geology Station #11 (0:19)
- Describe rille and far wall
- 500mm (Vert/Horiz/Targ. Op)
- Documented Samples
  - Rille rim
  - South twin
- Compare rim mtrl to other

LMP-27
EVA 3
7/6/71

1+50

(1) CDR - Stow gnomon
- Mark depart time______(1+56)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - Mark arrival time______(1+59)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Stow gnomon
- Mark depart time______(2+09)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

2+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71

EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	1+50	
Check tools secure & HTC closed		Stow gnomon on seat back Stow HGA LCRU Sel SW - PM1/WB
Mount LRV		Mount LRV
Readout LRV displays Traverse to Station #10 (3 min)		Powerup LRV Traverse to Station #10 (3 min)
Arrive Station #10 Readout LRV displays		Arrive Station #10 Park & Power down LRV
Dismount LRV	2+00	Dismount LRV LCRU Sel Sw - FM/TV Point HGA to earth
Station #10 geology (10 min)		Station #10 geology (10 min)

Station #10 is located farther along the Rille at the terrace.

Area #10 tasks (in order of priority)

1. 500mm lens camera photography (provides second part of wide base stereo began at Sta #9) Same targets should be used.
2. Documented samples from crater on rim of Rille
3. 70mm panorama

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB
Mount LRV		Mount LRV
Read LRV displays Traverse to Station #11 (6 min)		Powerup LRV Traverse to Station #11 (6 min)
	2+10	

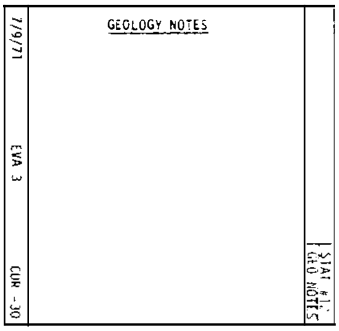
LCRU / TV

TASK FUNCTION

LMP: TRAV TO STA #10 — STATION #10 GEOLOGY

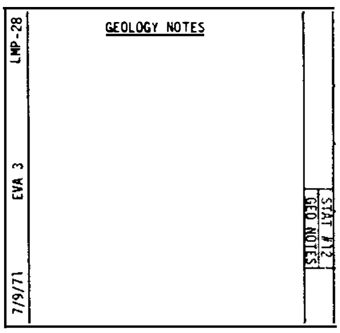
CDR: TRAV TO STA #10 — STATION #10 GEOLOGY

2+10



(1) CDR - Mark arrival time_____(2+15)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	



2+30

MISSION: DATE: 6/2/71
EVA:

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+10			TRAVERSE TO STATION #11	TRAVERSE TO STATION #11
The traverse to Station #11 is along the Rille rim to the morth end of the terrace. Description and comparison of Rille and rim material should continue.					
Arrive Station #11 Readout LRV displays		Arrive Station #11 Park & Power down LRV		STATION #11 GEOLOGY	STATION #11 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #11 Geology (19 min)		Station #11 Geology (19 min)			
Station #11 is located on the rim of Hadley Rille at the NW end of the terrace.					
	2+20				
Area #11 tasks (in order of priority) 1. Observe and describe the Rille and far wall and compare with previous observations 2. 500mm lens camera photography 3. Documented samples from the rim and from the crater on the edge of the Rille. 4. 70mm panoraga 5. Comparison of Rille rim material with other terrain.					
	2+30				

2+34 TRAVEL (0:07)
•Rille rim/mare/North Cmplx
•Possible secondaries/ray
•Observe crater chain

2+41 SUPPLEMENTARY SMPL STOP (0:05)
•Soil/rock sample

2+46 TRAVEL (0:12)
•Mare/North Complex
•Possible secondaries/ray
•Observe crater chain

2+58 Geology Station #12 (0:23)
•Documented samples
-Crater ejecta
-Rim of Rio
-North Complex Material
•Describe Chain/Link/Rio
(Core tube)

GEO NOTES STAT #12 | LMP-29 | EVA 3 | 7/9/71

2+34 TRAVEL (0:07)
•Rille rim/mare/North Cmplx
•Possible secondaries/ray
•Observe crater chain

2+41 SUPPLEMENTARY SMPL STOP (0:05)
•Soil/rock sample

2+46 TRAVEL (0:12)
•Mare/North Complex
•Possible secondaries/ray
•Observe crater chain

2+58 Geology Station #12 (0:23)
•Documented samples
-Crater ejecta
-Rim of Rio
-North Complex Material
•Describe Chain/Link/Rio
(Core tube)

GEO NOTES STAT #12 | LMP-29 | EVA 3 | 7/9/71

2+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Stow gnomon
- Mark depart time ______ (2+34)
(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - Mark arrival time ______ (2+41)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR - Stow gnomon
- Mark depart time ______ (2+46)
(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

2+50

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU ACTIVITY	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+30				
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB			
Mount LRV		Mount LRV			
Readout LRV displays Traverse to Supplementary Sample Stop (7 min)		Power Up LRV Traverse to Supplementary Sample Stop (7 min)		TRAV TO SUPP SAMPLE STOP	TRAV TO SUPP SAMPLE STOP

The traverse to the Supplementary Sample Stop moves away from the Rille rim across the Mare toward the North Complex. Observe and describe changes in material in moving away from the rim, across the Mare and entering the North Complex.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU ACTIVITY	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+40				
Arrive Supplementary Sample Stop Readout LRV displays		Arrive Supplementary Sample Stop Park & Powerdown LRV		SUPP SAMPLE STOP	SUPP SAMPLE STOP
Dismount LRV Supplementary Sample Stop (5 min)		Dismount LRV Supplementary Sample Stop (5 min)			

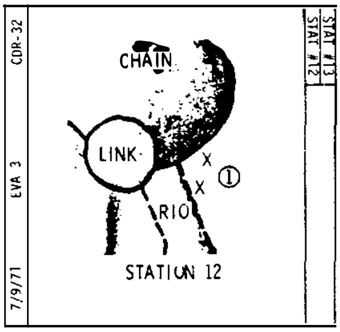
Area tasks:
soil/rock sample
70mm panorama

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU ACTIVITY	TASK FUNCTION LMP	TASK FUNCTION CDR
Check tools secure & HTC closed		Stow gnomon on seatback			
Mount LRV		Mount LRV			
Readout displays Traverse to Station #12 (12 min)		Powerup LRV Traverse to Station #12 (12 min)		TRAV TO STA #12	TRAV TO STA #12

The traverse to Station #12 is further into the North Complex to a position on the SW rim of Chain Crater. Observe and describe characteristics of the crater chain which originate at Chain Crater. Also, observe possible secondary craters.

2+50

2+50

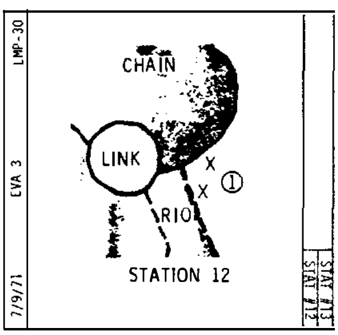


(1) CDR - Mark arrival time______(2+58)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		



3+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+50				
Arrive Station #12 Readout LRV displays		Arrive Station #12 Park & Powerdown LRV			
Dismount LRV		Dismount LRV LCRU Sel SW - TV RMT			
Arrive Station #12 Readout LRV displays		Arrive Station #12 Park & Powerdown LRV		STATION #12 GEOLOGY	STATION #12 GEOLOGY
Dismount LRV		Dismount LRV LCUR Sel SW - FM/TV			
	3+00	Point HGA to earth			
Station #12 Geology (23 min)		Station #12 Geology (23 min)			

Station #12 is an area located on the southwestern rim of Chain Crater in the North Complex at a junction of elongate depression.

Area #12 tasks (in order of priority)

1. Documented samples of crater ejecta
2. Documented samples of North Complex material
3. 70mm panorama
4. Core tube (if possible)
5. Description of wall of crater and relation to elongate depression
6. Attempt to determine if crater is endogenetic or impact

3+10

3+10

STAT #12 STAT #13
3+21 TRAVEL (0:08)
•Intercrater area
•Ejecta from chain
•North Cmplx/Mare relations
3+29 GEOLOGY STATION #13 (0:50)
•Areas of Interest
-Pluton rim
-Icarus
-Observe Scarps to North
-Observe Eaglecrest
•Documented Samples
•Pans/Stereo Pans
(Core)
(500mm)
(Trench/soil)
(Penetrometer)
LMP-33 EVA 3 7/9/71

(1) CDR - Stow gnomon
- Mark depart time ______ (3+21)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

3+21 TRAVEL (0:08)
•Intercrater area
•Ejecta from chain
•North Cmplx/Mare relations

3+29 Geology Station #13 (0:50)
•Areas of Interest
-Pluton rim
-Icarus
-Observe Scarps to North
-Observe Eaglecrest
•Documented Samples
•Pans/Stereo Pans
(Core)
(500mm)
(Trench/soil)
(Penetrometer)

STAT #12 STAT #13 LMP-31 EVA 3 7/9/71

(1) CDR - Mark arrival time ______ (3+29)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

3+30

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

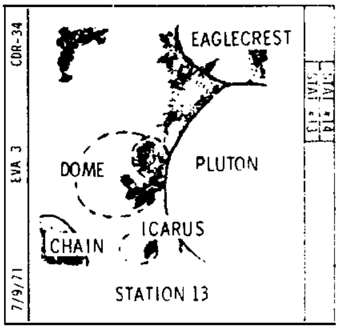
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	3+10	
Check tools secure & HTC CLOSED		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB
Mount LRV	3+20	Mount LRV
Readout LRV displays Traverse to Station #13 (8 min)		Power up LRV Traverse to Station #13 (8 min)
Arrive Station #13 Readout LRV displays		Arrive Station #13 Park & Powerdown LRV
	3+30	

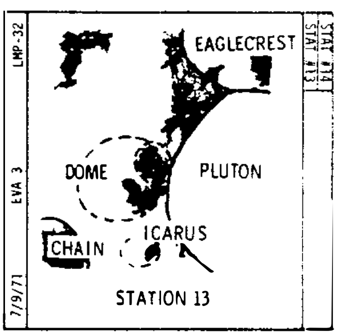
The traverse to Station #13 is within the North Complex and lies between Chain and Pluton Craters. Observe the intercrater area and compare with previous surfaces. Compare the ejecta between craters and attempt to denote differences.

TASK FUNCTION — LCRU/TV; LMP: TRAVERSE TO STATION #13; CDR: TRAVERSE TO STATION #13

3+30 (1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		





At 4+00
(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

4+10

MISSION: APOLLO 15, J-1

DATE: 6/2/71

EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Dismount LRV	3+30	Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #13 geology (53 min)		Station #13 geology (53 min)		STATION #13 GEOLOGY	STATION #13 GEOLOGY

The Station #13 area is a multiple objective stop located near the end of the North Complex Scarp between Chain and Pluton Craters.

The principle areas of interest in this portion of the North Complex are:

a) Icarus Crater on the western rim of Pluton Crater

b) Pluton Crater

c) Eaglecrest Crater

d) Scarps

These areas, depending upon the characteristics and accessibility should be tasked as follows: (discretion of the crew is necessary)

Area #13 tasks (in order of priority)

1. Documented samples
2. 70mm panorama or stereo pans
3. Core tubes
4. Exploratory trench
5. Soil sample
6. 500mm Lens camera photography of targets of opportunity
7. Penetrometer measurements

4+10

4+10

(1) CDR - Stow gnomon
- Mark depart time ______ (4+22)

(2) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

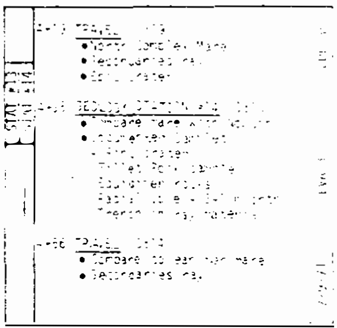
4+30

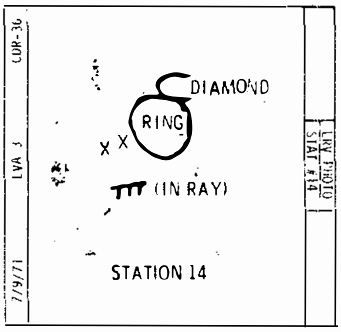
MISSION: APOLLO 15, J-1 DATE: 6/2/71

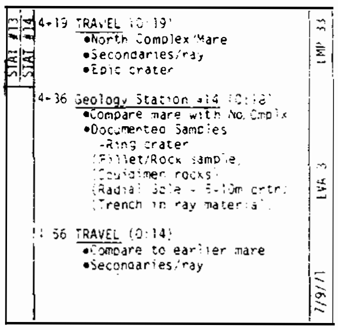
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+10				
Check tools secure & HTC closed	4+20	Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB			
Mount LRV		MOUNT LRV			
Readout LRV displays Traverse to Station #14 (19 min)		Powerup LRV Traverse to Station #14 (19 min)		TRAVERSE TO STATION #14	TRAVERSE TO STATION #14
	4+30				

The traverse to Station #14 is from the North Complex area into the Mare region where rays and unusual debris may be visible. Observation and description of these materials is desirable.


4+19 TRAVEL
•North Complex Mare
4+36 GEOLOGY STATION #14
4+56 TRAVEL
STAT #13 STAT #14



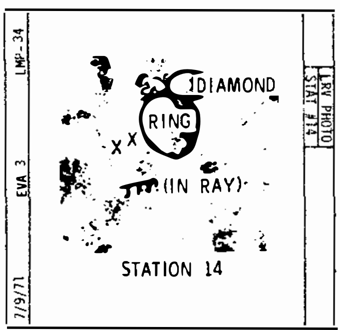

STAT #13 STAT #14

4+19 TRAVEL (0:19)
•North Complex Mare
•Secondaries/ray
•Epic crater

4+36 Geology Station #14 (0:18)
•Compare mare with No. Cmplx
•Documented Samples
-Ring crater
(Fillet/Rock sample,
(Boulder rocks)
(Radial Sple - 5-10m cntr)
(Trench in ray material)

4+56 TRAVEL (0:14)
•Compare to earlier mare
•Secondaries/ray

LMP 33
LVA 3
7/9/71



4+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Mark arrival time_____ (4+41)

(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

4+50

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+30				
Arrive Station #14 Readout LRV displays		Arrive Station #14 Park & Powerdown LRV			
	4+40				
Arrive Station #14 Readout LRV displays		Arrive Station #14 Park & Powerdown LRV		STATION #14 GEOLOGY	STATION #14 GEOLOGY
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth			
Station #14 geology (20 min)	:a is loca	Station #14 geology (20 min)			

The Station #14 area is located near ring Crater south of the North Complex in the Mare.

Area #14 tasks (in order of priority)

1. Compare blocks and Mare material with North Complex
2. Documented smaples of Mare material
3. Filleted rock sample
4. Collect some equidimensional rocks
5. Radial sample of 5-10m crater

4+50

4+50

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR - Stow gnomon
- Mark depart time______(5+01)

(2) LMP - Readout LRV displays

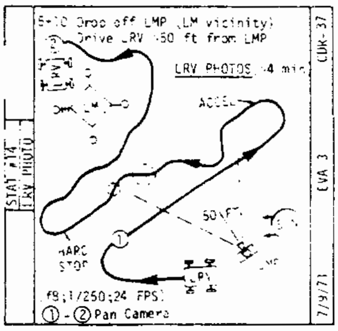
HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	

5+10

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

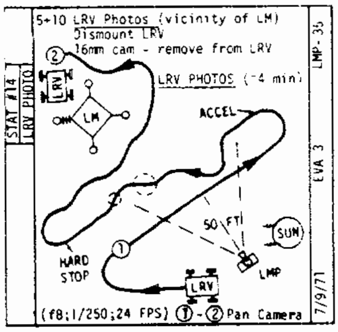
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+50				
Area #14 tasks (cont'd) 6. 70mm panorama 7. Exploratory trench in ray material					
Check tools secure & HTC closed		Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB			
Mount LRV	5+00	Mount LRV			
Readout LRV displays Traverse to LM (14 min)		Powerup LRV Traverse to LM (14 min)		TRAVERSE TO LM	TRAVERSE TO LM
The traverse to the LM continues across the Mare surface where secondary distribution may be visible. Any differences in material should be observed and described.					
	5+10				

5+10



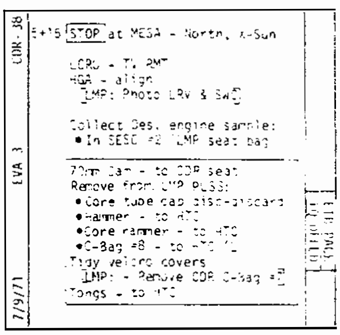
(1) CDR - Mark arrival time ________ (5+15)
(1) LMP - Readout LRV displays

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF mtr	
RANGE		Temp RF mtr	
Amp-Hr Bat 1		Temp LR mtr	
Amp-HR Bat 2		Temp RR mtr	



(1) LMP-Rpt 70mm mag/frame (after LRV photos) ____/____

(2) CDR-Rpt tools off LMP PLSS & stowed
- SCB #8
- Hammer
- Core tube tool
- Core tube cap disp


CDR-38
5+15 STOP at MESA - North, X-Sun

LCRU - TV RMT
HGA - align
[LMP: Photo LRV & SWC]

Collect Des. engine sample:
• In SESC #2 (LMP seat bag

70mm Cam - to CDR seat
Remove from LMP PLSS:
• Core tube cap disp-discard
• Hammer - to HTC
• Core rammer - to HTC
• C-Bag #8 - to HTC
Tidy velcro covers
[LMP: - Remove CDR C-Bag #7]
Tongs - to HTC

EVA 3
7/9/71

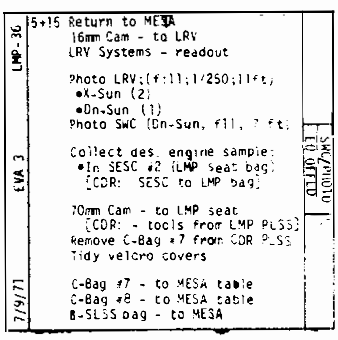

LMP-36
5+15 Return to MESA
16mm Cam - to LRV
LRV Systems - readout

Photo LRV;(f:11;1/250;11ft)
• X-Sun (2)
• Dn-Sun (1)
Photo SWC (Dn-Sun, f11, 7 ft)

Collect des. engine sample:
• In SESC #2 (LMP seat bag)
[CDR: SESC to LMP bag]

70mm Cam - to LMP seat
[CDR: - tools from LMP PLSS]
Remove C-Bag #7 from CDR PLSS
Tidy velcro covers

C-Bag #7 - to MESA table
C-Bag #8 - to MESA table
B-SLSS bag - to MESA

SWC/PHOTO
EQ OFFLD
EVA 3
7/9/71

(1) CDR-Rpt 6-70mm mags in ETB

____(MM), ____(SS), ____(TT), ____(UU), ____(VV), ____(WW)

(1) CDR-Rpt 16mm mag ____ (II) in ETB

5+30

MISSION: APOLLO 15, J-1 DATE: 6/2/71
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10				
Arrive at LM. Readout LRV displays		Arrive at LM Park LRV at MESA; point North, X-sun in sun		EVA CLOSEOUT	EVA CLOSEOUT
		Powerdown LRV			
Dismount LRV		Dismount LRV			
Photo LRV; X-Sun (2), Dn-Sun(1)		Align HGA toward earth			
Assist CDR		LCRU Sel SW-TV RMT Collect Contaminated sample under LM in SESC			
	5+20	Place SESC in SCB			
Stow 70mm cam/bags on LMP seat Assist CDR		Open LRV batt dust covers, stow 70mm cam/bags on CDR seat Remove from LMP PLSS tool harness			
Remove SCB #7 from CDR PLSS tool harness; tidy velcro covers		• Core tube cap disp - discard • Hammer - stow on HTC • SCB #8 - stow on HTC			
Place SCB #7 on MESA table		Tidy harness velcro covers Assist LMP			
Remove SCB #8 from HTC and place on MESA table		Stow tongs on HTC Carry ETB to LRV CDR floor pan			
Remove B-SLSS bag from Geo. pallet and place on MESA		Remove penetrometer recording drum & place in sample bag; stow in ETB			
Check all samples removed from LRV		Remove mag UU from CDR 70mm cam & stow in ETB			
		Remove mags VV,MM from LMP 70mm & 500mm lens cam; stow mags in ETB			
Unstow dust brush from LRV, stow on ladder		Transfer all cam mags (70mm-SS,TT WW & 16mm-II) from under LRV seat into ETB			
Remove 16mm cam from LRV (install new mag from ETB if reqd)		Stow maps in ETB (carry ETB to LMP side)			
	5+30	Attach ETB to MESA table			

P.O. [illegible] - [illegible]
ETB - [illegible] CDR floorpan

Stow in ETB:
- Pentro drum in sample bag
- CDR 70mm cam; [illegible]
- 70mm mags (4) SS,TT,VV,[illegible]
- 500mm cam mag - [illegible]
- 16mm mag [illegible]
- Maps

5+30 ETB - to MESA table

P.O. Pkg - operate
- stow in ETB

HGA - stow
LCRU - PWR/[illegible]B

5+38 START
NAV sys. - RESET
[LMP: Photo CDR on LRV]

EQ OFFLD
LTG PACK

5+27 LRV check - all samples?
Dust brush - ladder hook

5+29 16mm Cam - retrieve from LRV
Change mag - if available

Photo CDR on LRV - 16mm cam
(f8;1250;24 FPS)
16mm Cam - to MESA

5+36 SWC - retrieve foil
SWC foil - to bag (MESA)
SWC bag - to ETB

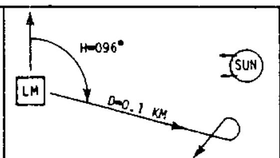
Photo CDR return - 16mm Cam
16mm mag - to ETB

ETB - check contents

EQ OFFLD
SWC/PHOTO

LMP-37 EVA 3 7/9/71

CDR-40 EVA 3 7/9/71



Drive Heading 096°
At Distance 0.1 Km
Turn left to Heading 255°
Stop crossing outbound tracks

5+41 STOP
Bus A, C, Aux CBs - closed
LRV batt - open dust covers

INGRESS
LRV PACK

LMP-38 EVA 3 7/9/71

5+47 Clean EMU's
[CDR: Stow LMP antenna]

Ingress - carry B-SLSS bag
Attach LEC
Transfer:
- C-Bag #7
- ETB

LEC - discard on porch
Stow equipment & samples

Stow C-Bag #8 (from CDR)

Assist CDR ingress

6+02 Close hatch

INGRESS

VOICE DATA

5+30

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR-Verify all mags & samples are off LRV

(1) CDR-Verify LCRU covers open 100%

(1) LMP-Rpt SWC foil stowed (ETB)

(1) LMP-Rpt 16mm mag ____ (JJ) in ETB

ETB Contents:
- 6-70mm mags___(MM),___(SS),___(TT),___(UU),___(VV),___(WW)
- 2-16mm mags _____ (II), _____ (JJ)
- SWC (in bag)
- SESC #2
- Maps

Items transferred into A/S
- BSLSS Sample Bag (with LMP)
- ETB
- SCB #7
- SCB #8 (with CDR)

(1) CDR-check LM area to verify all samples & mags transferred

5+50

MISSION: APOLLO 15 DATE: 6/2/71

EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	5+30	
		Stow HGA for traverse
Photo CDR driving LRV		Switch LCRU - PM1/WB Mount LRV
		Power up LRV
		Drive LRV 300' east of LM on heading of 096° until Dist shows 0.1 Km then head LRV to 255° and park
Stow 16mm cam on MESA Retrieve SWC foil		Power down switches Pull CBs (except Bus A&C & AUX)
		Dismount LRV
		Align HGA Open LRV battery dust covers Switch LCRU - EXT pwr - TV/RMT
Place SWC foil in bag from MESA		Open LCRU dust covers 100%
Stow SWC in ETB	5+40	Return To LM
Remove 16mm mag JJ from cam and stow in ETB; check all items in ETB		
Clean CDR's EMU		Clean LMP's EMU; stow LMP PLSS antenna
Ingress, carry B-SLSS bag into LM		Attach LEC to SCB #7
Attach LEC to handhold Transfer SCB #7 into LM		Transfer SCB #7 into LM
		Transfer LEC hooks to surface
Remove SCB #7 from LEC		Attach LEC to ETB
Transfer ETB into LM		Transfer ETB into LM
Remove ETB from LEC	5+50	

LCRU TV | TASK FUNCTION: LMP, CDR

INGRESS - EVA TERMINATION

5+50

LRV PACK | INGRESS

LCRU Pwr - EXT
LCRU Sel - TV RMT

HGA - align
[LMP: Retrieve SWC]

5+45 Return to LM
[LMP: Photo CDR - Smile]
Clean EMUs
LMP PLSS ant. - stow
Transfer:
•C-Bag #7
•ETB

Clean EMU
5+46 Ascend ladder; carry $\boxed{\text{C-Bag \#8}}$
Hand C-Bag #8 to LMP
Discard LEC
Ingress

CDR-41 EVA 3 7/9/71

6+00 (1) CDR - Rpt END EVA-3

MISSION: APOLLO 15
EVA: 3

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Discard LEC on porch	5+50	Clean EMU
		Ascend ladder; carry SCB #8
Stow samples and equipment in LM		
Stow SCB #8 in LM		Hand SCB #8 to LMP Discard LEC
Assist CDR; stow CDR's PLSS antenna		Ingress
End 3rd EVA	6+00	End 3rd EVA

NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE "LUNAR SURFACE CHECKLIST"

LCRU TV | TASK FUNCTION: LMP | CDR

INGRESS - EVA TERMINATION

3.2.5 Sampling and Related Procedures

The techniques utilized in obtaining and documenting the lunar surface samples and in performing the Lunar Field Geology and Soil Mechanics objectives are presented in the following pages and are shown on a vertical timeline format. The task times indicated in the format are approximate and are used primarily for reference.

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

CORE TUBE SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove core tube from CDR's sample bag	0	Place gnomon nearby			
Assemble core tube/ext handle - report number		Remove hammer from LMP PLSS tool carrier			
Hold core tube upright on surface and press into surface by hand		Take stereo pair X-sun f8,1/250,7 ft			
Steady extension handle as CDR hammers		Drive tube into surface (comment on difficulty)			
Photo tube & prominent feature X-sun f8,1/250,15 ft with Focus 74		Remove core from surface			
		Obtain core tube cap from LMP PLSS & cap tube			
Assist CDR		Remove core tube from ext hndl			
Get extension handle from CDR & tether		Get core tube tool from LMP PLSS & seat core follower against core			
		Stow core in collection bag and core tube tool & hammer on LMP PLSS			
Proceed to next sample	5	Pick up gnomon Proceed to next sample			

NOTE: Double and triple core tube procedures are similar to the above except that the cap of the lower tube must be removed to mate the lower tube to the upper tube. The caps are replaced when the tubes are disassembled. The double core requires an additional 2 minutes and the triple an additional 4 minutes.

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

SINGLE SAMPLE DOCUMENTATION

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Describe sample	0	Describe sample & place gnomon down-sun with pointer leg at sample & color chart at 45° to sun			
Take down-sun photo at f11,1/250,11 ft		Take stereo pair X-sun at f8,1/250,7 ft			
Prepare sample bag (if reqd) & report bag number		Collect sample (tongs)			
Add soil to sample (scoop) if desired.					
Seal sample bag and place in collection bag		Take X-sun after photo f8,1/250,7 ft			
Take locator photo using prominent feature X-sun at f8,1/250,15 ft with focus at 74		Describe area of sample			
NOTE: Locator photo may be taken before sampling		Pick up gnomon			
Proceed to next sample	5	Proceed to next sample			

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

COMPREHENSIVE SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM.	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove rake from pallet	1	Select area for optimum rock distribution & place gnomon.			
Assemble rake/ext hndl					
Describe sample area		Describe area, relate to surrounding terrain.			
Take before photo down-sun f11,1/250,11 ft		Mark off area to be sampled			
		Take X-sun stereo pair f8,1/250,7 ft			
Get sample bag, report number & hold for CDR to fill		Use rake, collect 1 Kg of rocks 3/8" - 1 1/2" (approx one sample bag)			
Close sample bag, seal & stow in collection bag		Get sample bag, report number & hold for LMP to fill			
Use scoop, collect 1 kg of fines (approx one sample bag)	5				
Take locator photo using prominent features X-sun f8,1/250,15 ft Focus 74		Close sample bag, seal & stow in collection bag			
		Take after photo X-sun f8,1/250,7 ft			
Disassemble rake/ext hndl		Complete area description			
Stow rake on pallet					
Tether ext hndl/scoop					
Proceed to next sample	10				

MISSION: APOLLO 15 DATE: June 28, 1971

EVA: PHOTO POLARIMETRIC SURVEY (Far & Near)

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0	Install polar filter on camera			
		Assume a position X-sun from distant feature to be photographed (approx 12m or more away) Reset camera f5.6,1/125,74 ft			
		Take 3 photos: f5.6,1/125,74 ft, Filter L* f5.6,1/125,74 ft, Filter C f5.6,1/125,74 ft, Filter R			
		Report filter positions Move down-sun ∿ 20° from first position Take 3 photos: f5.6,1/125,74 ft, Filter R* f5.6,1/125,74 ft, Filter C f5.6,1/125,74 ft, Filter L			
** Take before photo down-sun f11,1/250,11 ft		Select site for near polar series & place gnomon			
	5	Assume position 7 ft from area			
** Take locator photo using prominent feature X-sun f8,1/250,15 ft, Focus 74		Take 3 photos each at: 90° phase Filter L, C, R* 110° phase Filter R, C, L* 130° phase Filter L, C, R*			
Get sample bags, report number & hold for CDR.		Collect minimum of 4 rock samples from area in documented sample bags			
Close bags, seal & stow in collection bags					
*L=left, C=center, R=right for filter position which can be used in any order but must be reported to MCC **Can be taken by CDR if required		Retrieve gnomon			
	10	Proceed to next sample			

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

RADIAL SAMPLING

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Describe area to be sampled radially	0	Select ∿ 10m crater on smooth surface & place gnomon			
		Take partial pan from opposite sides of crater			
Get sample bags, report numbers & hold for CDR to fill		Select soil/rock samples (on a ray if possible): 1 - one crater dia from rim 1 - 1/2 crater dia from rim 1 - on rim 1 - center of crater (if poss) 1 - 1/2 crater dia from rim 1 - one crater dia from rim			
Close bags, real & stow in collection bags					
		Retrieve gnomon			
Proceed to next sample	10	Proceed to next sample			

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

SMALL TRENCH SAMPLE (EXPLORATORY)

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Take locator photo using prominent feature X-sun f8,1/250,15 ft, FOCUS 74	0	Select area to be sampled & place gnomon			
Use scoop, dig trench 3-8 inches deep 10° off sunline					
Take after photo down-sun f11,1/250,11 ft		Take after photos, stereo pair X-sun f8,1/250,7 ft			
If samples taken, using scoop collect soil samples from inside trench and surface		If samples taken, get sample bags, report number & hold for LMP to fill			
		Close bags, seal & stow in collection bag			
		Retrieve gnomon			
Proceed to next sample	5	Proceed to next sample			

MISSION: APOLLO 15 DATE: June 28, 1971
EVA:

SOIL MECHANICS TRENCH

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0	Select area to be sampled & place gnomon			
		Describe area			
Take before photo down-sun f11,1/250,11 ft		Take stereo pair X-sun f8,1/250,7 ft			
Using scoop, dig trench ∿ 8 inches wide, ∿ 12 inches deep, 10° off sunline, soil excavated down-sun		Continue area description			
		Describe trench condition while being dug			
Take after stereo pair down-sun f11,1/250,7 ft showing sunlit wall		Take after stereo pair X-sun f8,1/250,7 ft (same position as before stereo pair)			
Take after stereo pair X-sun f8,1/250,7 ft from side opposite CDR's before shots		Take after stereo pair up-sun f5.6,1/250,7 ft showing shadowed wall			
	5				
Stand in excavated soil pile to leave footprint, photo X-sun f8,1/250,5 ft					
Using scoop take following samples: Soil, bottom of trench for SESC (3/4 full)		Get SESC, open & hold for LMP - Remove seal protectors Close SESC, seal & stow in collection bag			
Soil sample - bottom of trench Soil sample - side of trench (one minimum but one for each strata) Soil sample - top of trench		Get sample bags report numbers & hold for LMP to fill			
		Close bags, seal & stow in collection bag			
		Retrieve gnomon			
Proceed to next sample	10	Proceed to next sample			

MISSION: APOLLO 15 DATE: June 28, 1971

EVA:

PENETROMETER TEST

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Unstow penetrometer from pallet, attach to ext hndl	0	Select area for penetrometer test & place gnomon			
Attach cone or plate to penetrometer					
Index penetrometer drum to next position					
Move reference plane to the tip (fully extended) position					
Position penetrometer vertically on surface		Take locator photo using prominent feature			
Press tip into surface with downward force on ext hndl (If cone penetration, attempt 1 inch per sec penetration rate)		X-sun f 8, 1/250, 15 ft, FOCUS 74			
Withdraw penetrometer from surface & move reference plane full up		Take after stereo pair X-sun f 8, 1/250, 7 ft when penetrometer removed			
Restow penetrometer on pallet		Retrieve gnomon			
Proceed to next sample	5	Proceed to next sample			

3.3 PHOTOGRAPHY DATA

Figure 3.3-1 summarizes the various kinds of photographic routines the crew goes through in the course of their lunar surface operations. The illustrations are taken from the crew's cuff checklist.

The photographic techniques utilized for documented samples and for documenting core tube samples is very similar to those used in Apollo 14. That is, for a documented sample, the CDR takes a cross-sun stereo pair from 7 feet before sampling while the LMP takes a down-sun photo from 11 feet. The CDR then takes an after photo cross-sun from 7 feet and the LMP takes a cross-sun location photo from 15 feet using a prominent geological feature. To document a core tube sample, the CDR takes a stereo pair cross-sun with core tube in contact with the surface, before driving. The CDR then takes a single cross-sun locator photo with core tube fully inserted. After removal of the core tube, the CDR usually takes a photograph cross-sun of the hole left in the surface.

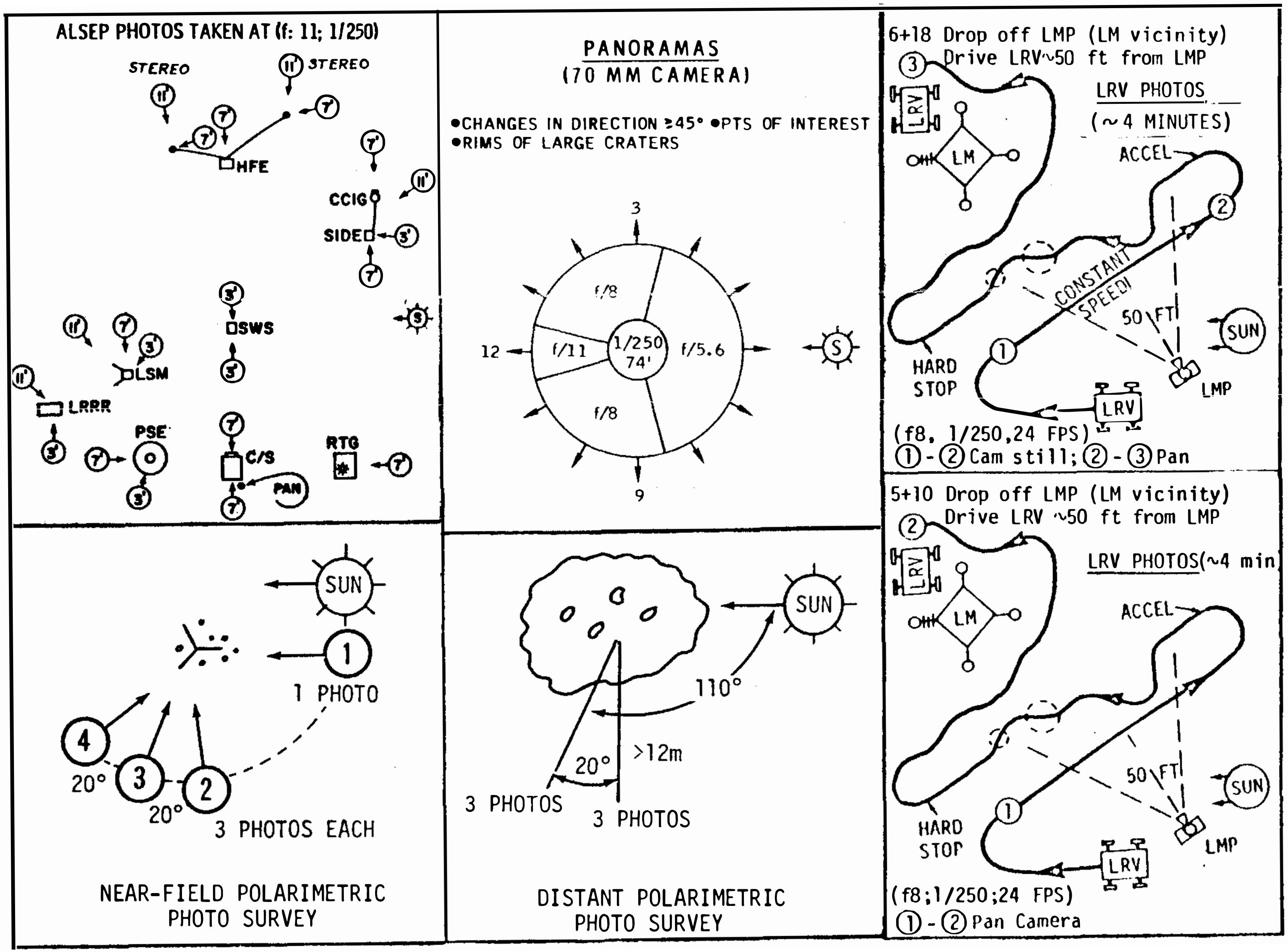
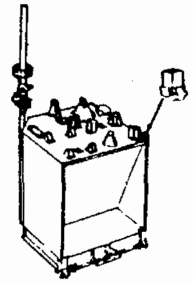


Figure 3.3-1 Lunar Surface Photography Data

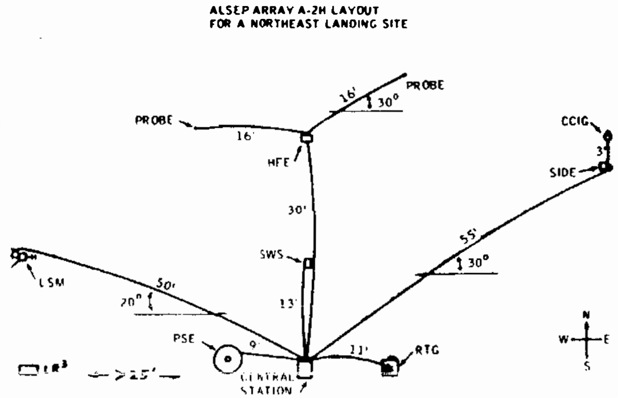
Sec. 3.4 ALSEP DEPLOYMENT AND EQUIPMENT DATA

The ALSEP deployment site is selected in a location not less than 100 meters due West of the LM such that he LM ascent engine blast will not create a dust cloud or otherwise disturb the deployed experiments. The ALSEP site should be fairly level and relatively free of boulders and craters which may interface with nominal deployment procedures or thermal characteristics. The experiments and central station should not be deployed in a shadow, near a large boulder nor in a crater. Pertinent ALSEP experiment deployment data is summarized in Figure 3.4-1. Included also in this figure is an ALSEP layout which depicts the relative positions of the experiments with respect to C/S after deployment is complete.

1. CENTRAL STATION (C/S)



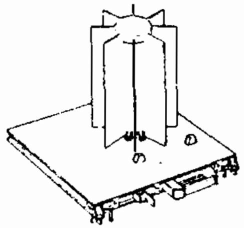
The Central Station is deployed West of the RTG, leveled within 5° of vertical using bubble level and aligned within ±5° of East-West using a gnomon and partial compass rose on the C/S. When sunshield is deployed the sides face East, West and South
The ALSEP Antenna is attached to C/S and must be leveled to within 0.5° of vertical using the bubble level and aligned within ±0.5° of the sun line as determined by the sun shadow reference line. The crewman then sets the Azimuth and Elevation dials to the predetermined settings in his cuff checklist.



6. LUNAR SURFACE MAGNETOMETER (LSM)

The LSM is deployed approximately 14 meters WNW of C/S and aligned within ±3° of the sun line using the sun shadow device provided. The crewman will report final alignment to within ±1° by reading the shadowgraph. The LSM is leveled within ±3° of vertical using the bubble level.

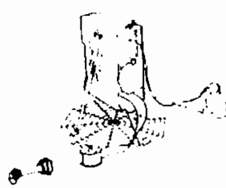
2. RADIOISOTOPE THERMOELECTRIC GENERATOR (RTG)



The RTG is located approximately 3 to 3.5 meters away from and within ±20° East of C/S. The RTG should be approximately level and not located in a depression as a maximum view of space is required for heat radiation.

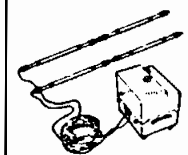
The astronaut will read the shorting switch ammeter, connect it to C/S and actuate the switch at the proper time.

4. SUPRATHERMAL ION DETECTOR EXPERIMENT (SIDE)



The SIDE incorporates a cold cathode Ion gage (CCIG). These experiments are deployed approximately 15 meters NE of C/S with the SIDE on a ground screen. The SIDE is leveled within 5° of vertical and aligned with arrow East, to within ±5° of the sun line using the UHT as a gnomon. The CCIG is deployed such that the aperture faces North.

7. HEAT FLOW EXPERIMENT (HFE)

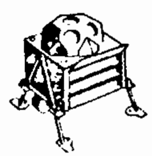


The HFE is deployed 8 to 10 meters North of C/S, aligned within ±5° of the plane of the ecliptic using the UHT as a gnomon and leveled within 5° using a bubble level. The HFE probes are deployed 5 to 6 meters from the electronics package and a minimum of 12 meters from the RTG. The HFE probe holes are drilled with the ALSD within 15° of vertical and should be located 60 meters from fresh craters and at least 5 diameters away from boulders greater than 2/3 meter across at the surface.

3. PASSIVE SEISMIC EXPERIMENT (PSE)

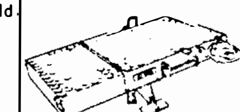
The PSE is deployed approximately 3 meters West of C/S on a stool designed to provide good mechanical contact and thermal insulation with the lunar surface. The PSE must be out of the field-of-view of the C/S radiator (North) and leveled within 5° of vertical on the bubble level. Initial alignment is within ±20° of West before removing PSE girdle. Fine alignment is reported within ±5° using the compass rose after the thermal shroud deployment.

5. SOLAR WIND SPECTROMETER (SWS)



The SWS is deployed approximately 4 meters North of C/S and oriented so that the lowered side points North. The SWS is oriented with arrow pointing to EAST and leveled within 5° of horizontal about the N-S axis. The SWS is aligned such that gnomon shadow is parallel to the sunshield.

8. LASER RANGING RETRO-REFLECTOR (LRRR)



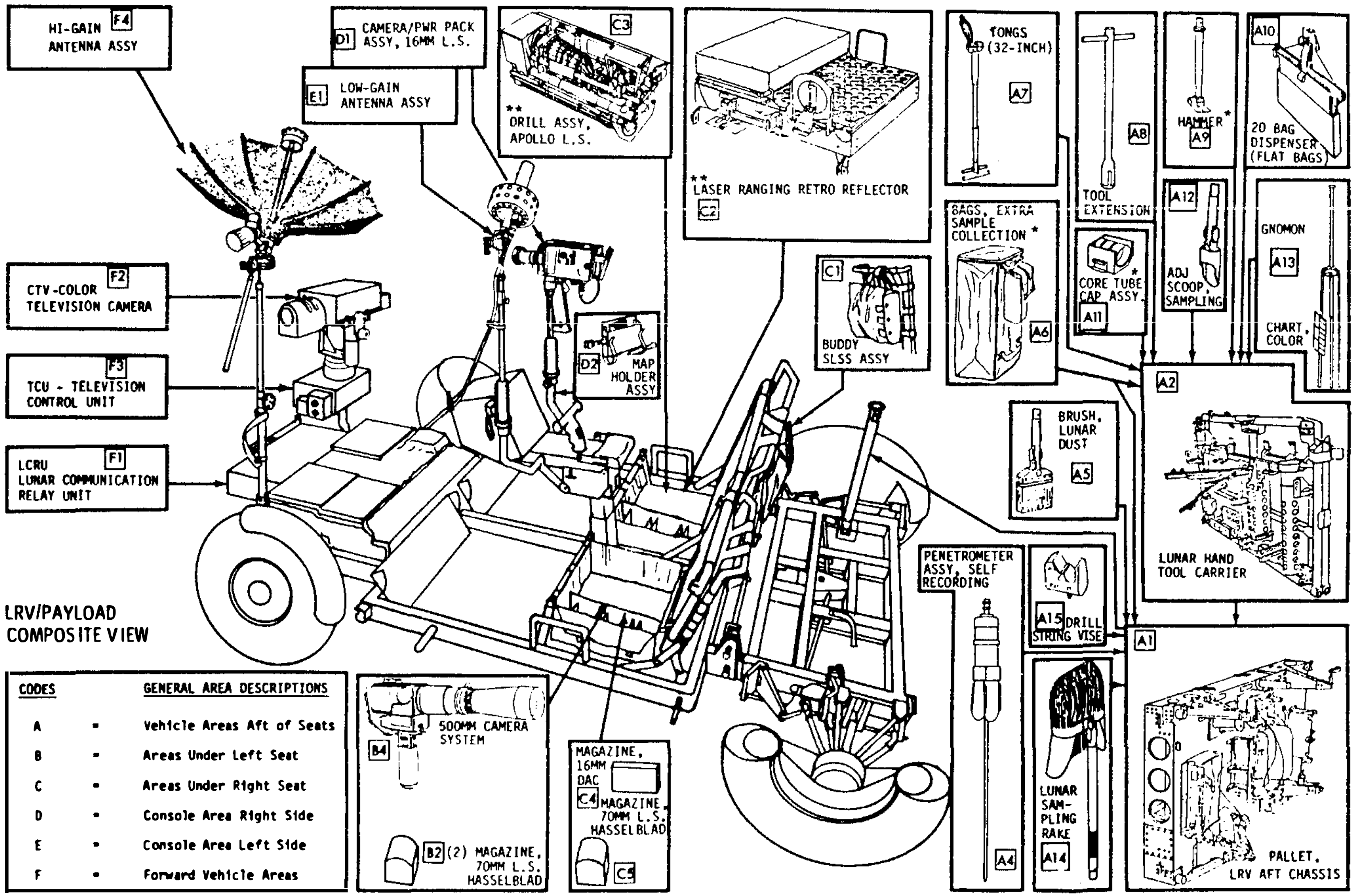
The Apollo 15 LRRR is an array of 300 quartz crystals arranged to reflect lasar beams aimed from earth. The LRRR will be deployed by the astronaut at a distance greater than 8 meters due West of C/S, leveled within 5° using a bubble level and aligned within ±3° using the sun compass provided. The quartz crystal array is inclined to a preset angle of 26.8° with the horizontal.

FIGURE 3.4-1 APOLLO LUNAR SURFACE EXPERIMENTS DATA

3.5 GEOLOGY EQUIPMENT AND DATA

The illustration in Figure 3.5-1 summarizes the lunar surface geology equipment and traverse support equipment as stowed on the LRV and PLSS tool carrier in support of the astronauts field geology activities. Those items marked (*) are normally stowed on the LMP's PLSS tool harness although they can also be stowed in the areas indicated.

Figures 3.5-2, 3.5-3, and 3.5-4 provide a pictorial sequence for Lunar Surface Geology Equipment and Sample Management for EVA's 1, 2 & 3. These diagrams provide a means for tracking the movement of the various items of equipment utilized on the lunar surface, including equipment transfers from and to the Ascent Stage.



CODES		GENERAL AREA DESCRIPTIONS
A	-	Vehicle Areas Aft of Seats
B	-	Areas Under Left Seat
C	-	Areas Under Right Seat
D	-	Console Area Right Side
E	-	Console Area Left Side
F	-	Forward Vehicle Areas

**Only carried on LRV from LM to ALSEP site

FIGURE 3.5-1 LUNAR FIELD GEOLOGY EQUIPMENT AND LRV STOWAGE

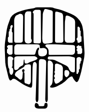
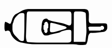
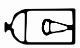
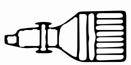
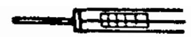
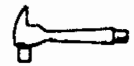
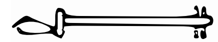
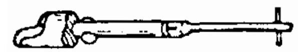
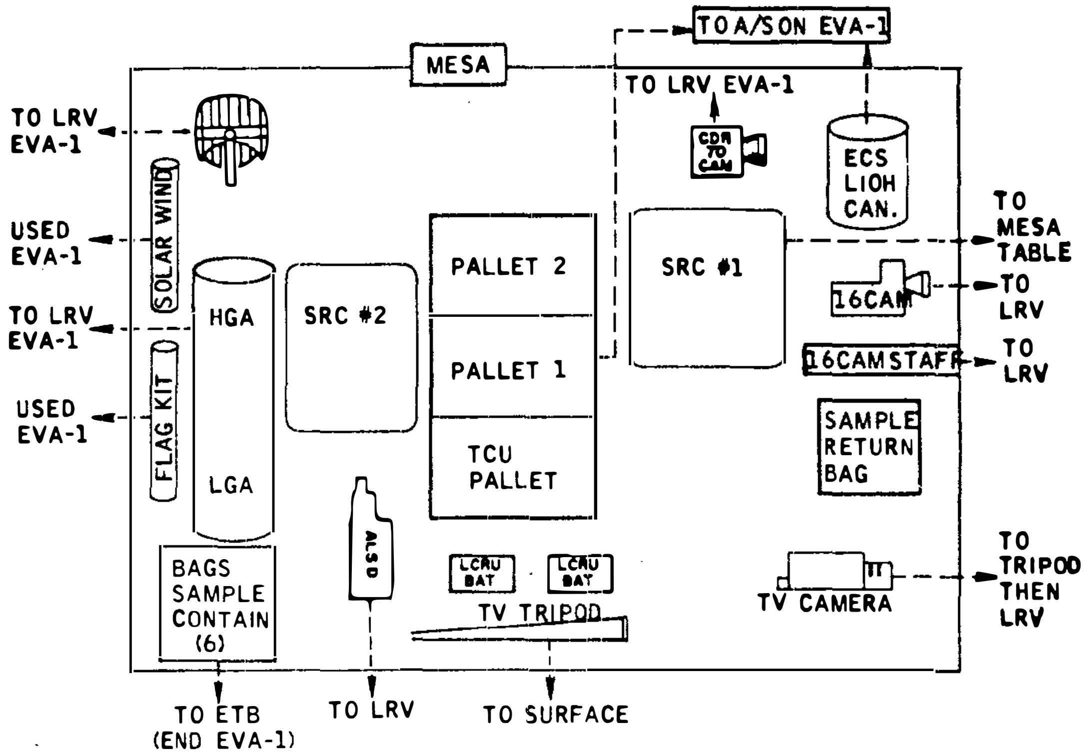
SESC	-	Special Environmental Sample Container
U 03, L 10	-	Core tubes (ex. Upper tube -#03, Lower tube -#10)
C A	-	Core tube cap assy (w/3 caps)
R	-	Core tube tool assy
S S S S S S	-	Set of 6 core stems
C A	-	Core stem cap assy
	-	Lunar surface rake
	-	Penetrometer
	-	Penetrometer (Data recording section only)
LS	-	Large Samples
S	-	Small Samples
ALSD	-	Apollo Lunar Surface Drill
	-	Dust brush
CUFF ✓LIST	-	Crew cuff checklist
MAPS EVA-1	-	Lunar surface maps (EVA specified)
HOLDER	-	LRV mapholder
LRV ✓ LIST	-	LRV checklist
BSLSS	-	Buddy Secondary Life Support System
	-	Gnomon
ORG. CONT. SAMP.	-	Organic Control Sample
	-	Hammer
	-	Tongs
	-	Extension Handle
	-	Extension Handle/Scoop Assy
20-DSBD 1001	-	20-Documented Sample Bag Dispenser
MAG HBW / LMP 70 CAM	-	LMP 70mm camera w/mag
MAG HBW / CDR 70 CAM	-	CDR 70mm camera w/mag
MAG HBW / LL70 CAM	-	500mm Lens Camera w/mag
70 HBW	-	70mm Magazine w/HBW film
70 HCEX	-	70mm Magazine w/HCEX film
16	-	16mm Magazine w/CEX film
LCRU BAT	-	LCRU Battery
LCRU BATT(U)	-	LCRU Battery (used)

Table 3.5-1 <u>LEGEND FOR</u>

<u>LUNAR FIELD GEOLOGY EQUIPMENT & SAMPLE MANAGEMENT</u>

FIGURE 3.5-2a EVA-1 PRE-GEOLOGY TRAVERSE
(MESA AND ETB TRANSFERS TO LRV)



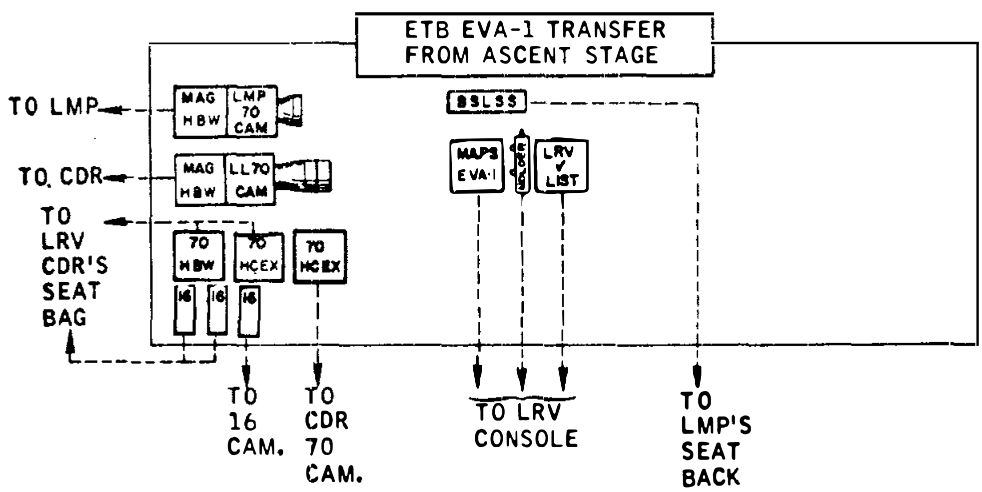
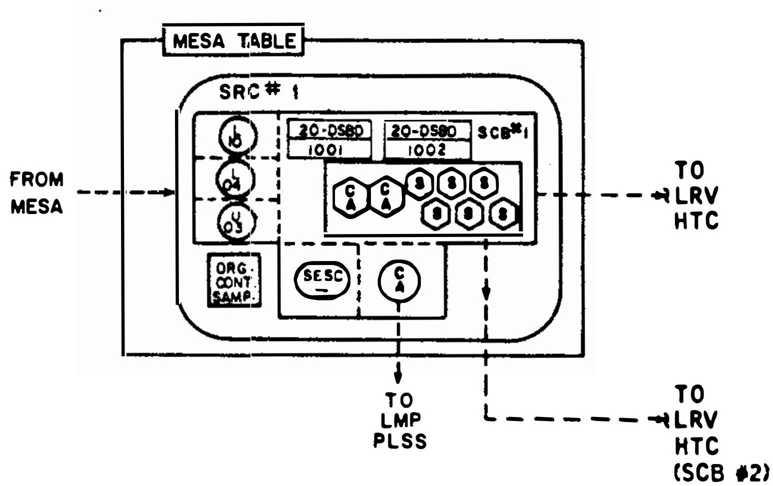


FIGURE 3.5-2b EVA-1 PRE-GEOLOGY TRAVERSE
(MESA TABLE LOADING AND TRANSFER TO LRV)



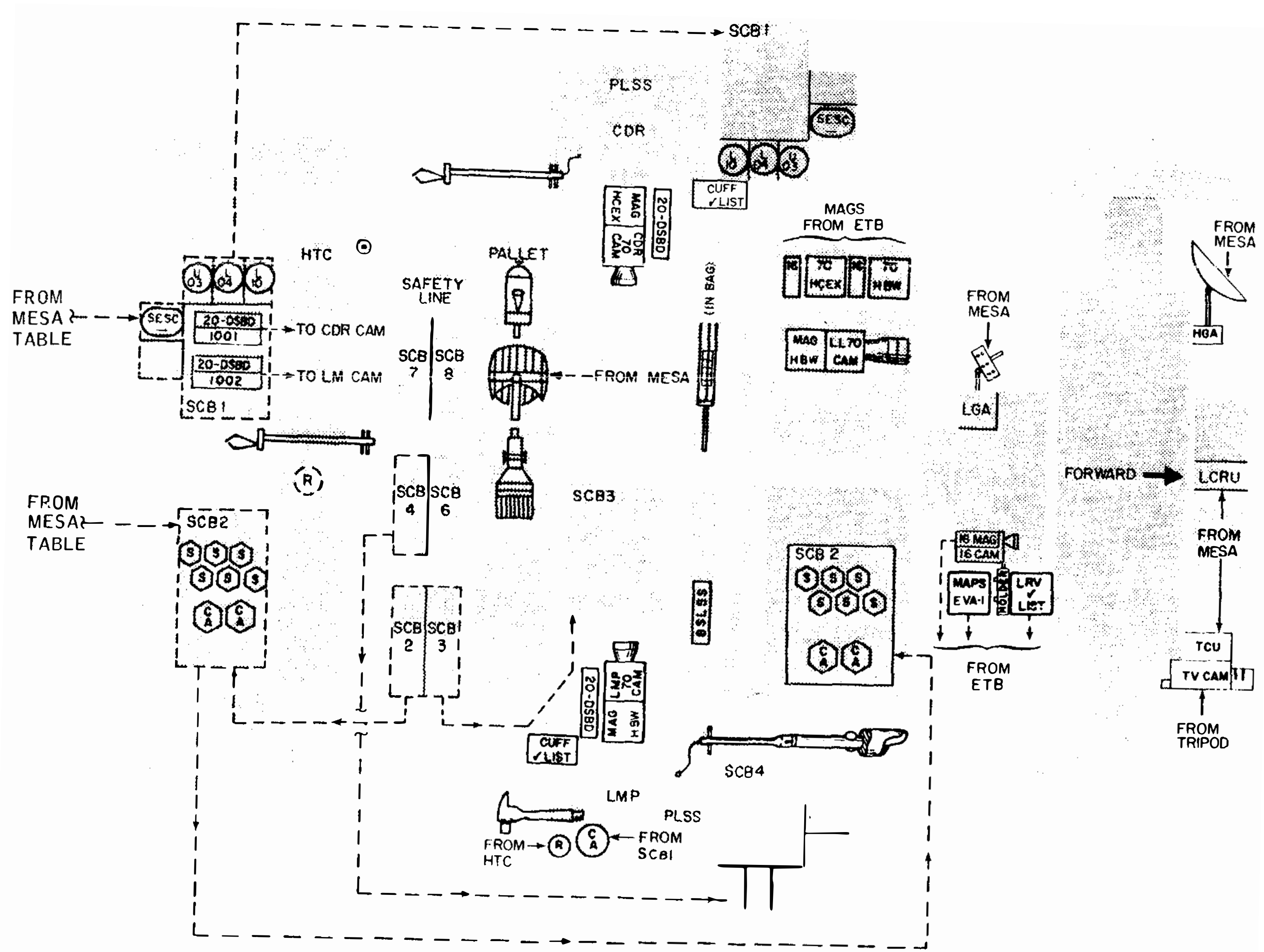
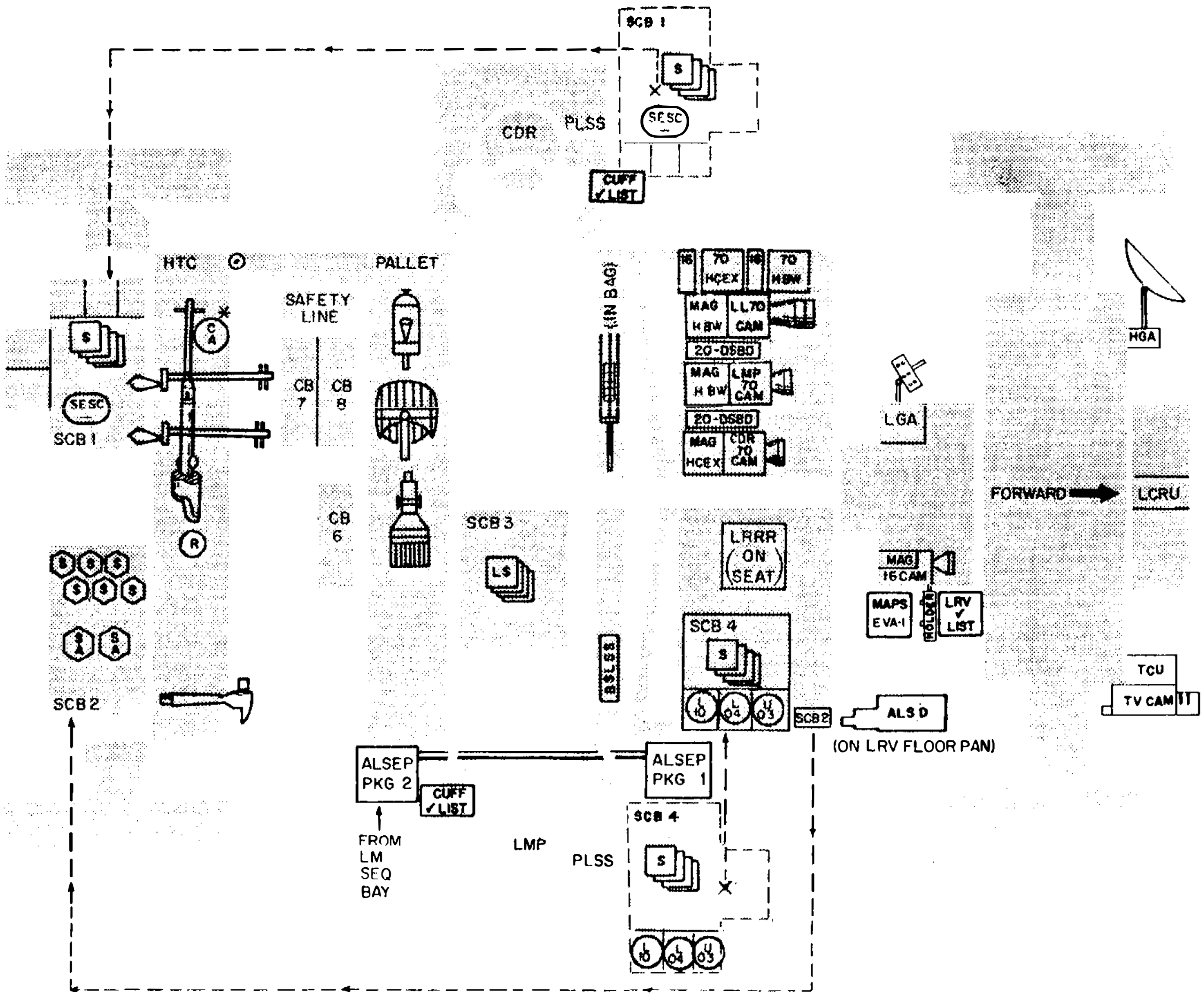
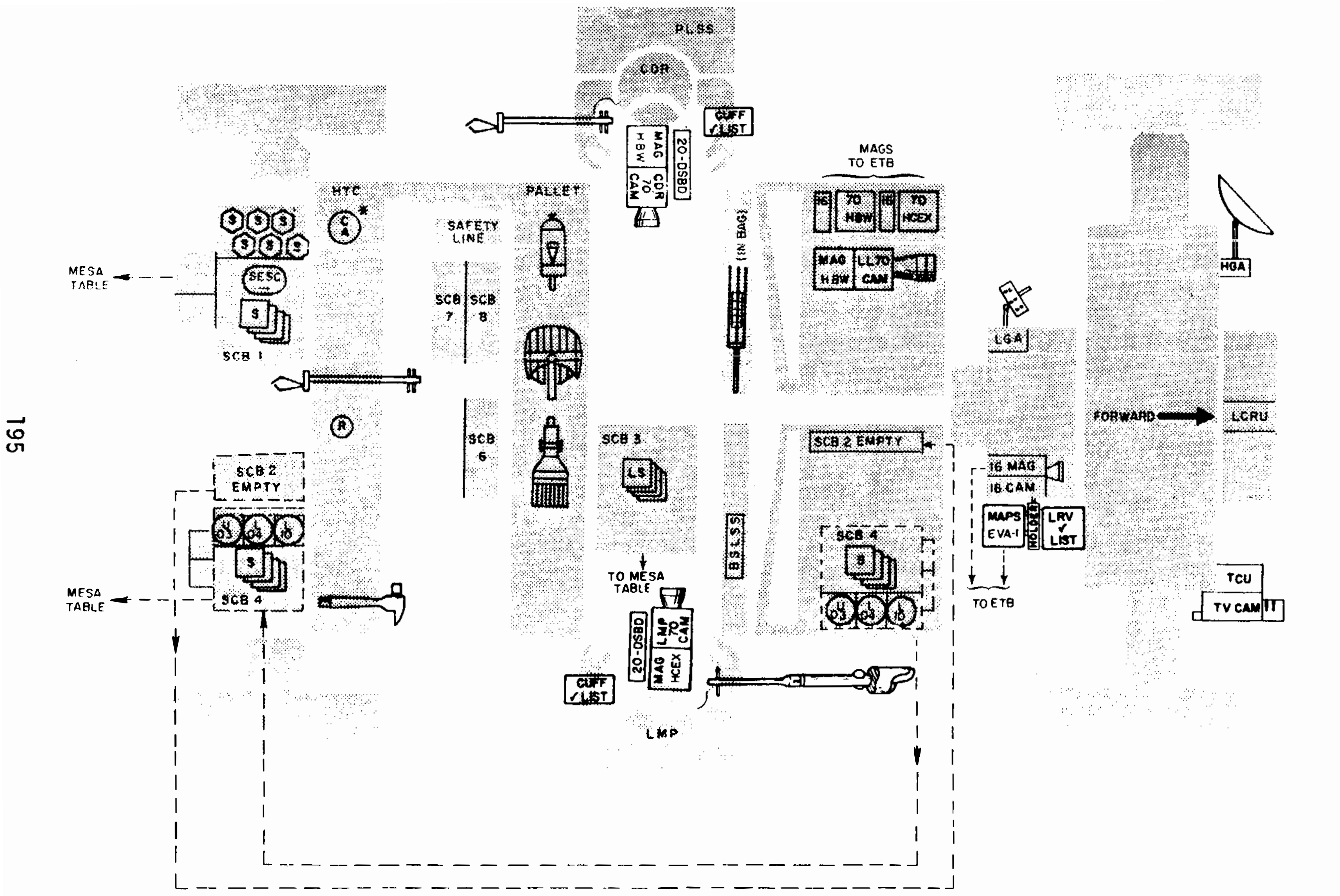


FIGURE 3.5-2c EVA-1 PRE-GEOLOGY TRAVERSE



* IF CAPS UNUSED

FIGURE 3.5-2d EVA-1 PRE-ALSEP DEPLOYMENT



* IF ANY UNUSED

FIGURE 3.5-2e EVA-1 ARRIVAL BACK AT LM - POST ALSEP

FIGURE 3.5-2f EVA-1 LRV TRANSFERS TO MESA AND LM

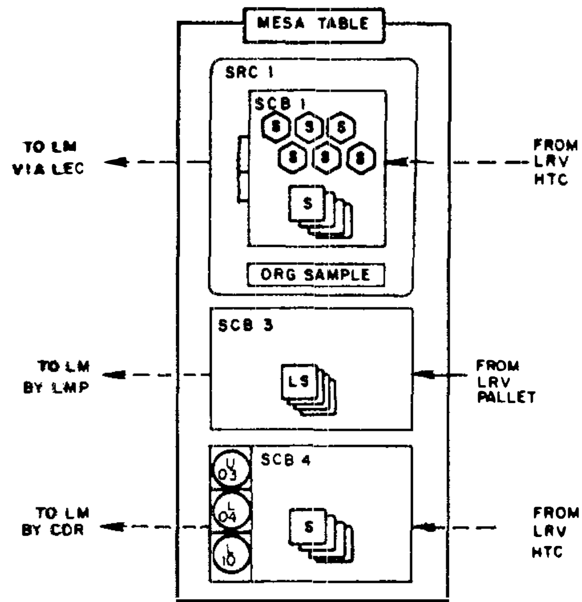
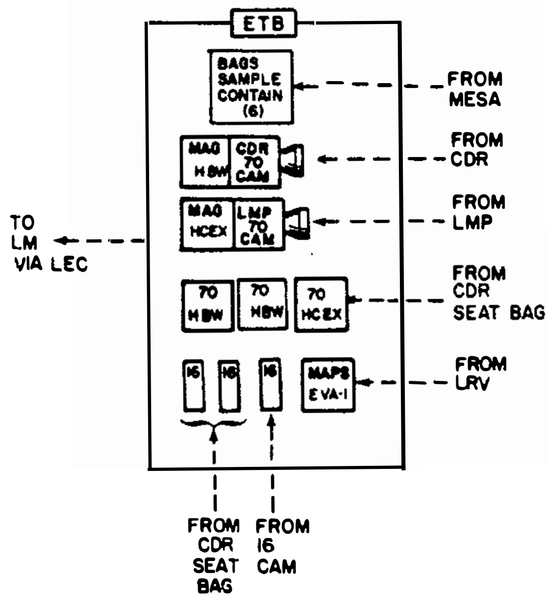


FIGURE 3.5-2g EVA-1 ON LMP INGRESS
(ETB TRANSFER TO LM)



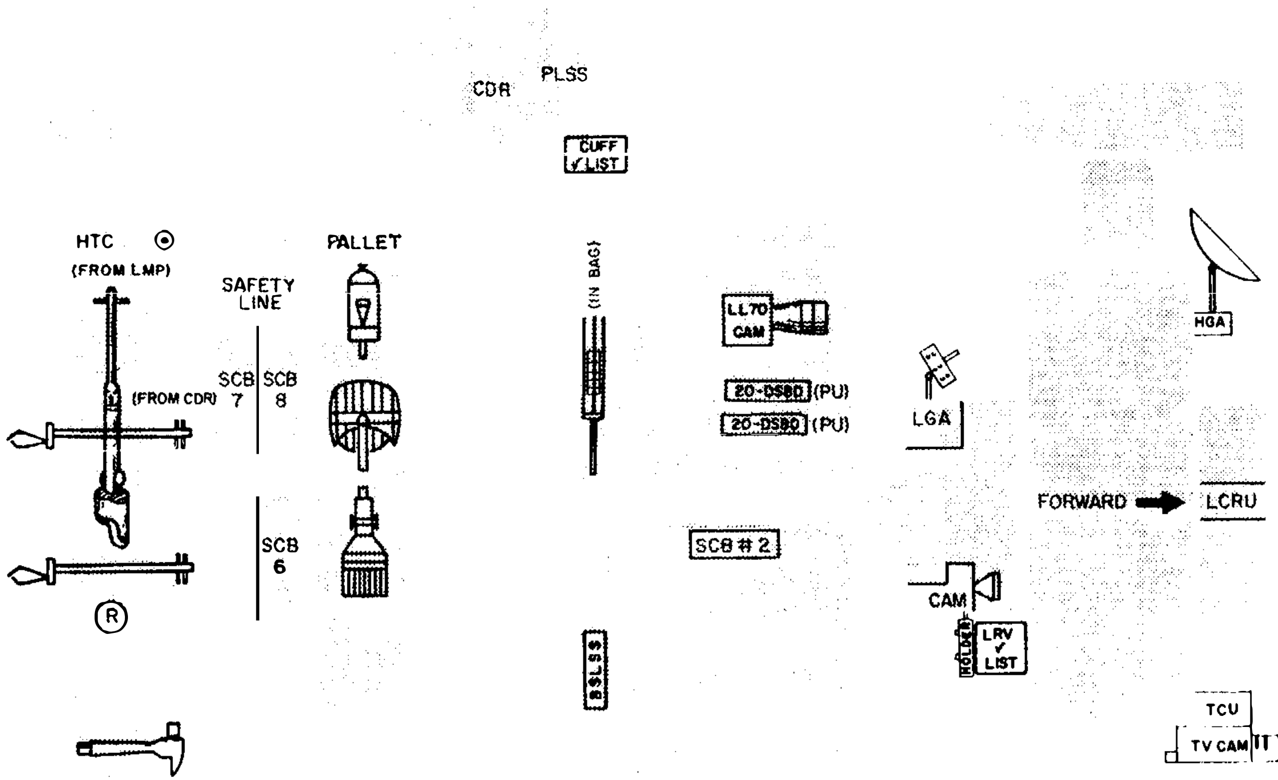


FIGURE 3.5-2h EVA-1 ON LMP INGRESS

FIGURE 3.5-3a EVA-2 PRE-GEOLOGY TRAVERSE
(MESA AND ETB TRANSFERS TO LRV)

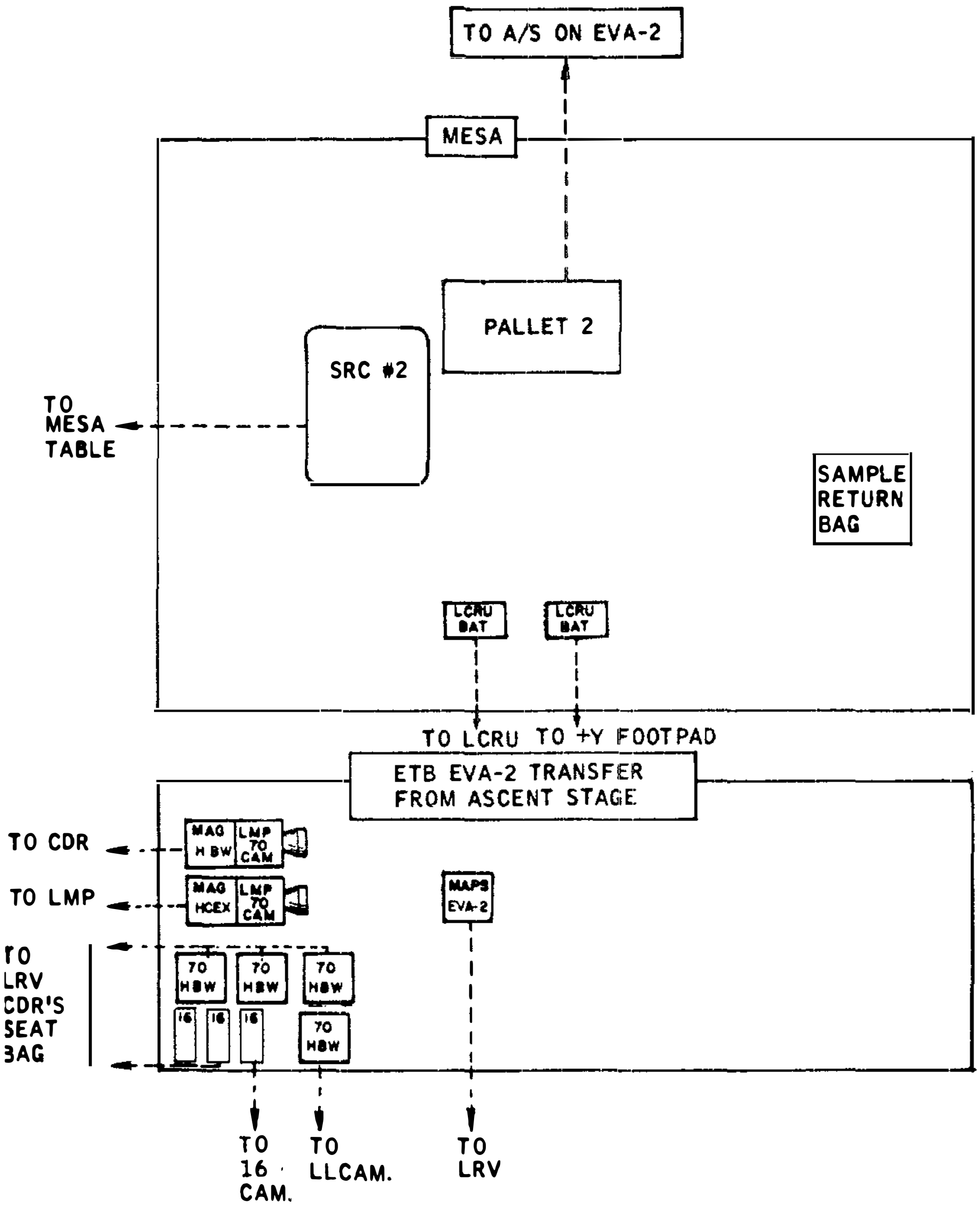
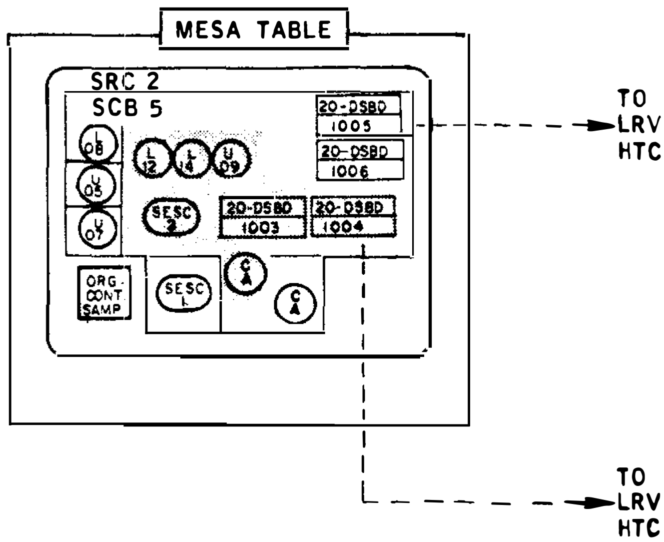


FIGURE 3.5-3b EVA-2 PRE-GEOLOGY TRAVERSE
(MESA TABLE LOADING AND TRANSFER TO LRV)



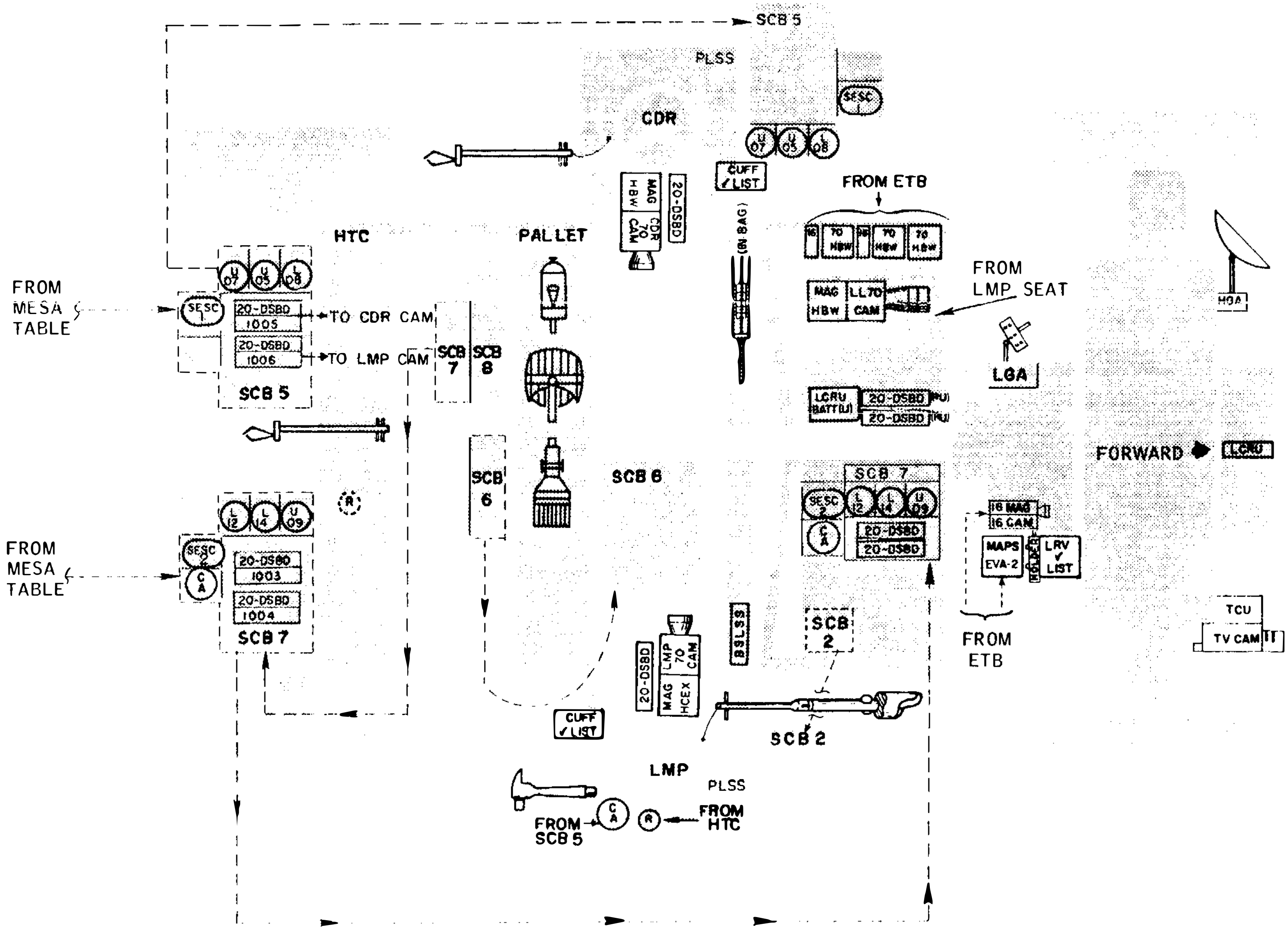


FIGURE 3.5-3c EVA-2 PRE-GEOLOGY TRAVERSE

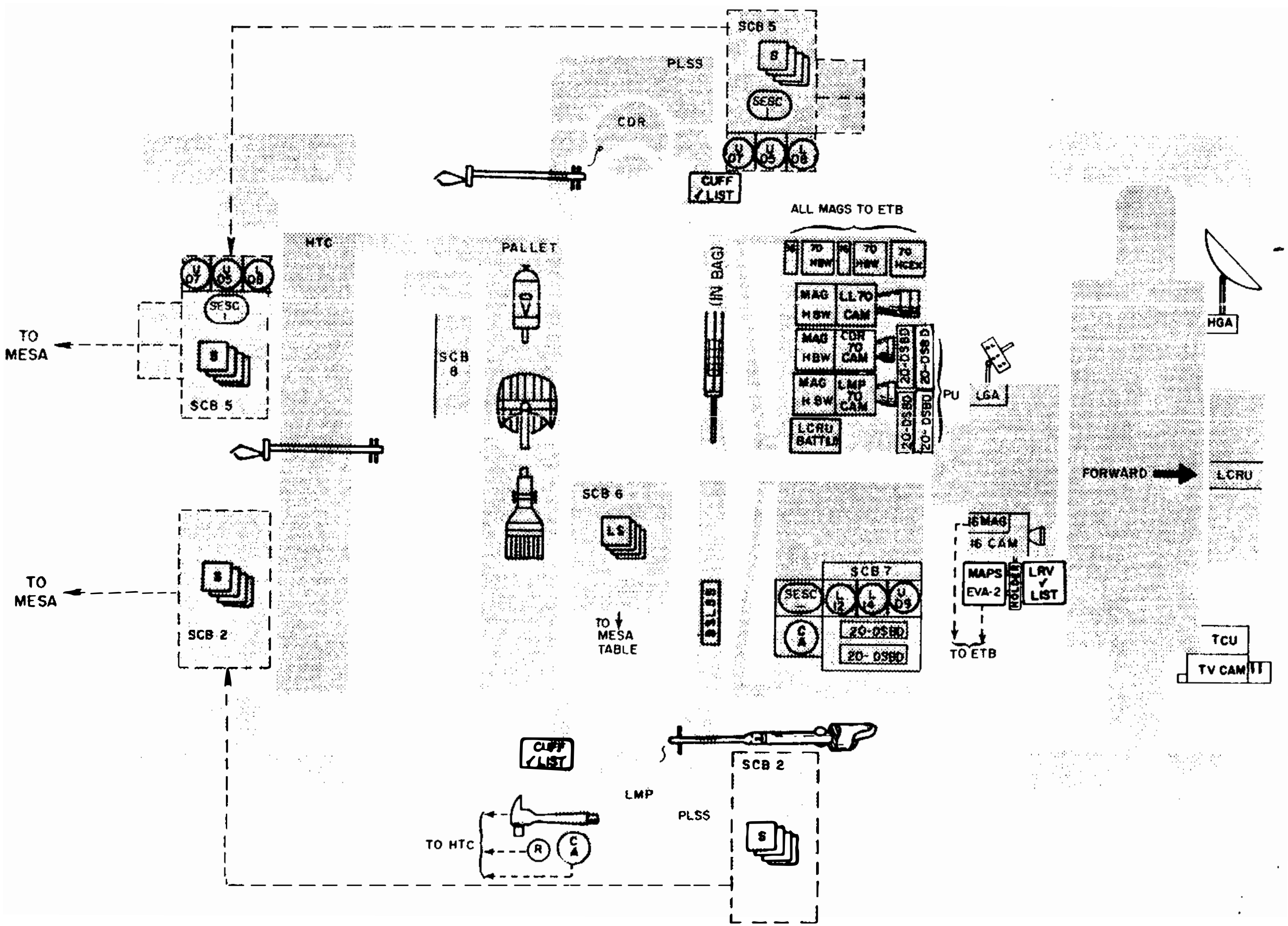


FIGURE 3.5-3d EVA-2 ARRIVAL BACK AT LM

FIGURE 3.5-3e EVA-2 ON ARRIVAL BACK AT LM (LRV TRANSFERS TO MESA AND LM)

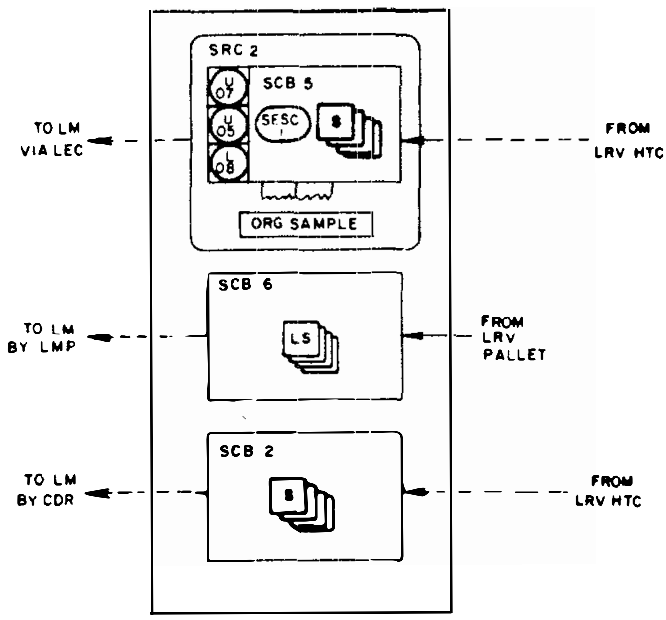
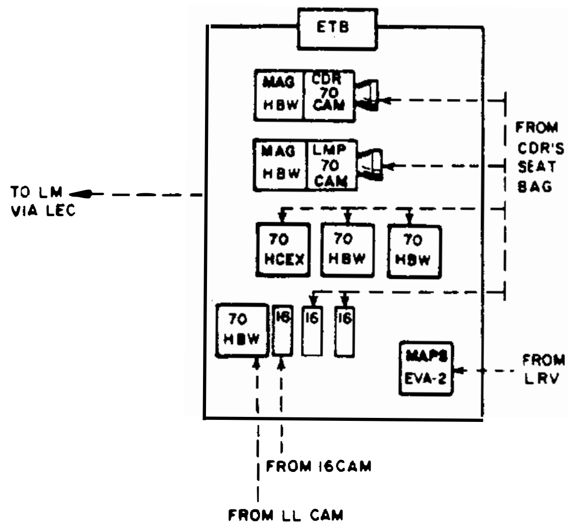


FIGURE 3.5-3f EVA-2 ON LMP INGRESS (ETB TRANSFER TO LM)



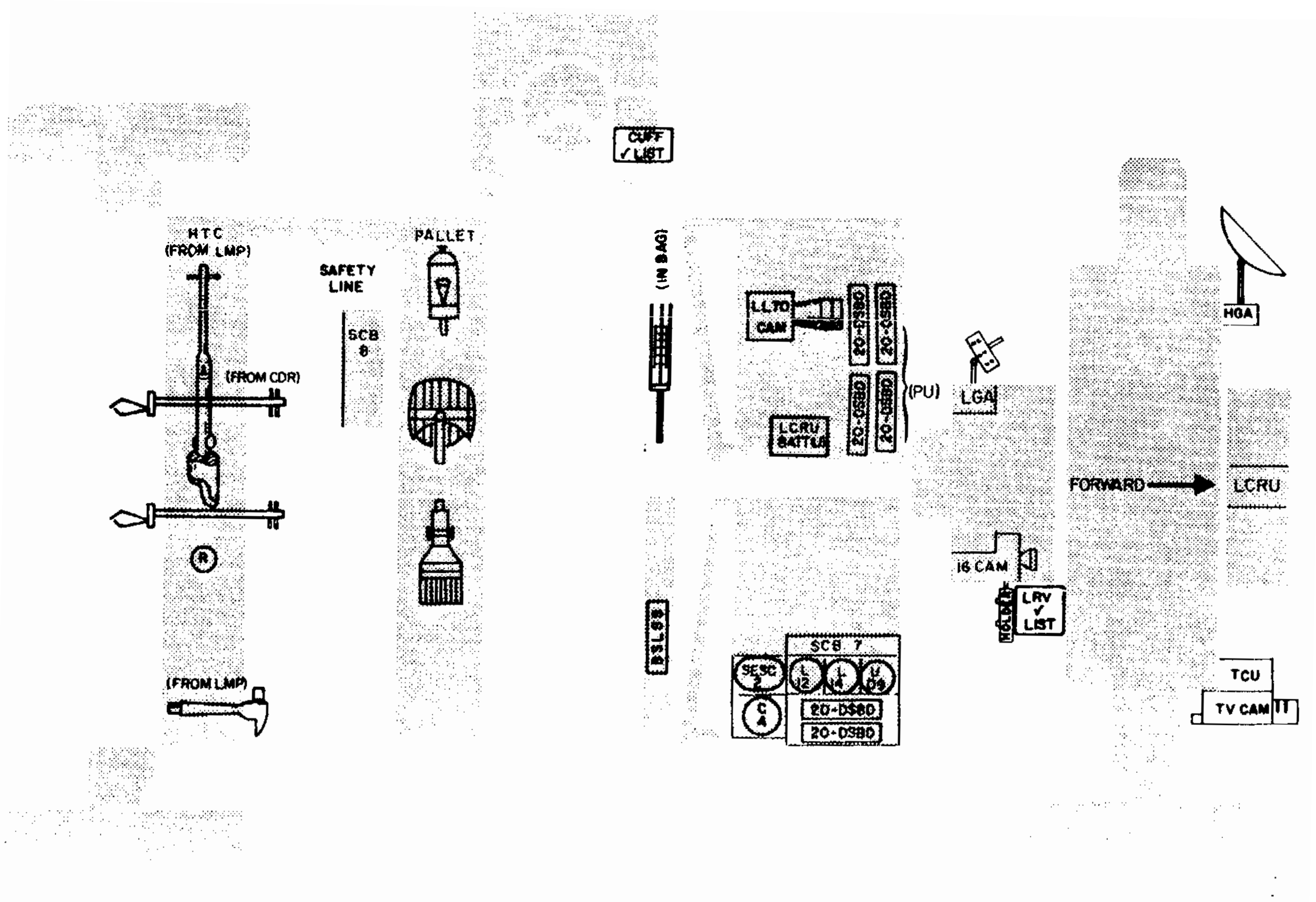
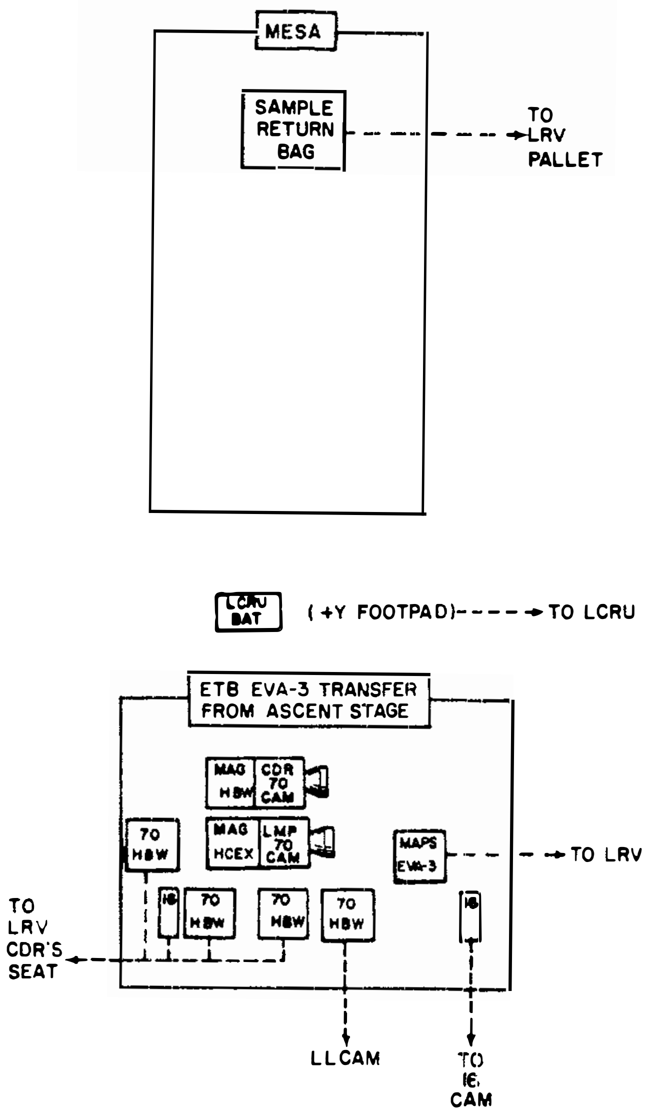


FIGURE 3.5-3g EVA-2 ON LMP INGRESS

FIGURE 3.5-4a EVA-3 PRE-GEOLOGY TRAVERSE

(MESA AND ETB TRANSFERS TO LRV)



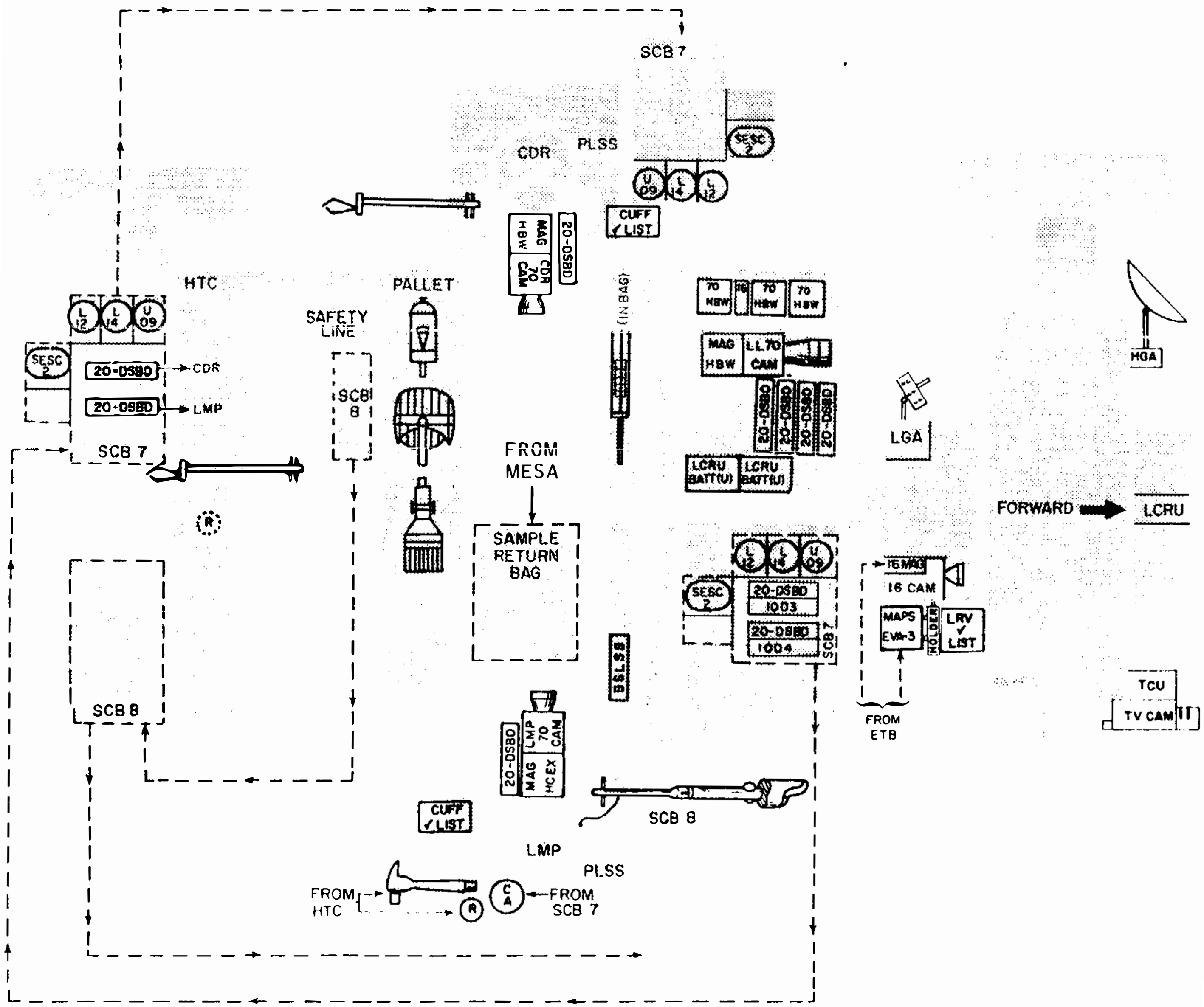


FIGURE 3.5-4b EVA-3 PRE-GEOLOGY TRAVERSE

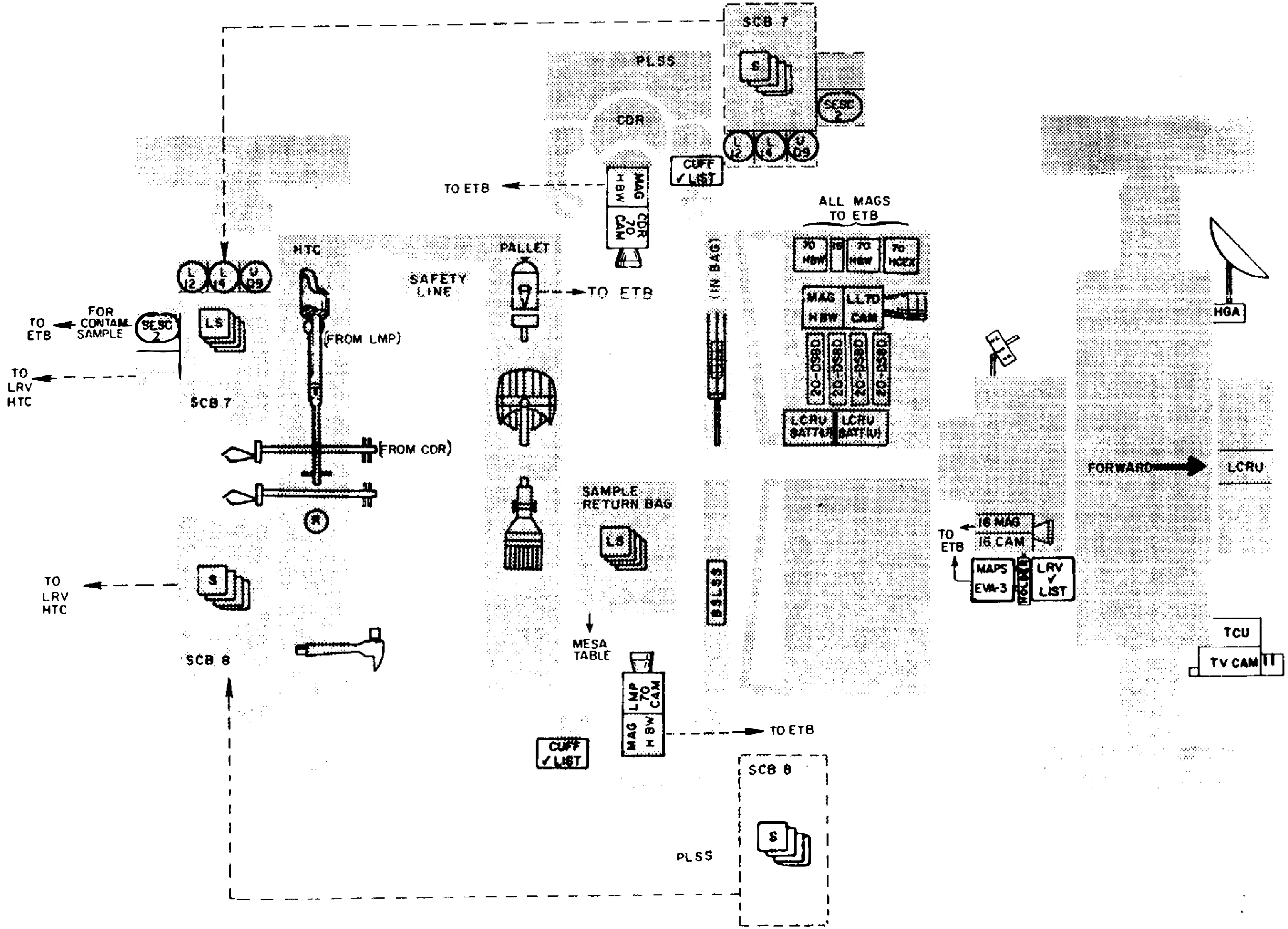
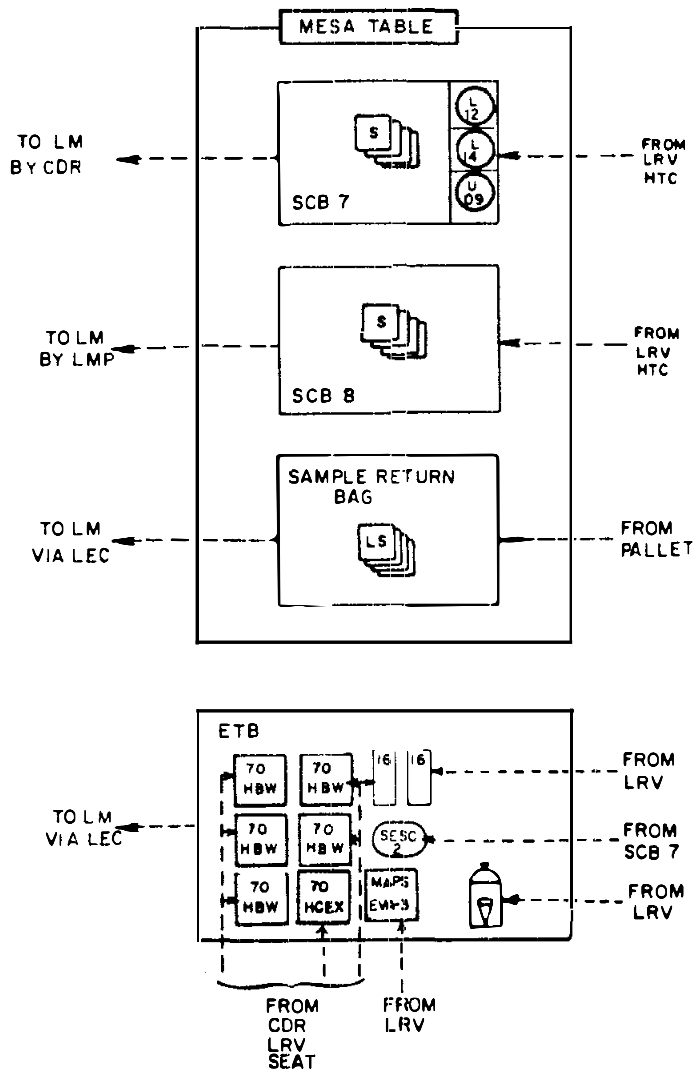


FIGURE 3.5-4c EVA-3 ARRIVAL BACK AT LM

FIGURE 3.5-4d EVA-3 ON ARRIVAL BACK AT LM
(LRV TRANSFER TO MESA AND LM)



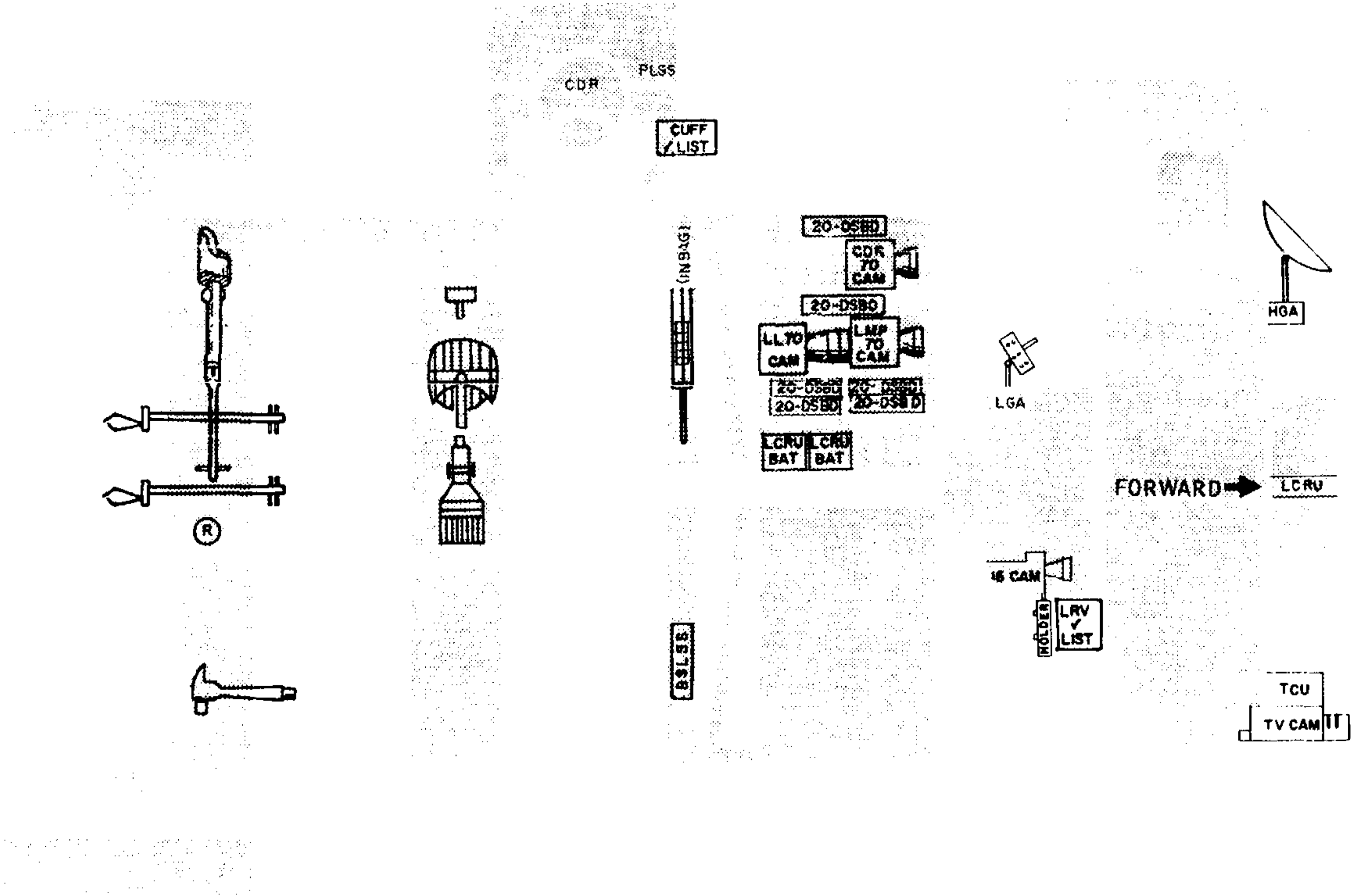


FIGURE 3.5-4e EVA-3 ON LMP INGRESS

3.6 EVA TRAVERSES

3.6.1 Traverse Assumptions and Ground Rules

The assumptions used in planning the Apollo 15 LRV traverses at the Hadley-Apennine lunar landing site are summarized in this section.

EVA Periods

Three EVA periods of 7, 7, and 6 hours duration respectively are planned for the Apollo 15 mission. These EVA periods result from consideration of crew work/rest cycles and the capability of the -7 portable life support system (PLSS). The first EVA is scheduled to begin approximately 15 hours after lunar landing. The second and third EVA periods are scheduled to begin approximately 37 and 57 1/2 hours after touchdown, respectively.

Crew Metabolic Rates

Effective metabolic rates for the crewmen during three basic types of lunar surface activities are estimated for determining the rate at which the PLSS consumables are used during the EVA's. These metabolic rates are estimated to be as follows:

Activity	Metabolic Rate ($\dot{Q}met$)
LRV Riding	600 BTU/hour
Normal Working	950 BTU/hour
Contingency Walking @ 3.3 km/hour	1440 BTU/hour (1200 BTU/hr + 20% uncertainty)

-7 PLSS Consumables

The consumables performance of the -7 PLSS is based on the expected quantity of each consumable charged/loaded, with the appropriate unusable quantity subtracted. The usable quantity of each consumable has also allowed a 30-minute reserve to remain in the PLSS at the end of each EVA. Assumed -7 PLSS consumable quantities are as follows:

Battery

The -7 PLSS battery capability is independent of the crewman metabolic rate, and is estimated to be:

Battery rating	23.1 amp-hours
Pre-EVA checkout usage	-1.1 amp-hours
Remaining capability	22.0 amp-hours

PLSS electrical load during EVA is 2.6 amperes, with an additional 0.243 ampere telemetry uncertainty. Hence, the battery provides approximately 7 hours of EVA capability with the 30-minute reserve.

Oxygen

The primary oxygen system of the -7 PLSS provides the following usable quantity of oxygen for use during an EVA.

Charge weight @ 1420 psia	1.804 lbs
Penalties & residuals	-0.354 lbs
Usable O_2	1.450 lbs
30 minutes O_2 reserve	-0.102 lbs
Available O_2 for EVA	1.348 lbs

The available O_2 is consumed at the rate of;

$$\dot{W}_{O_2} = 1.65 \times 10^{-4} (\dot{Q}met) + \dot{W}_{lk}, \text{ lbs/hr}$$

Oxygen leak rates from the EMU ($\dot{W}_{lk}$) have been assumed constant throughout each EVA as follows:

EVA	$\dot{W}_{lk}$, lbs/hr
1	0.01
2	0.02
3	0.03

Feedwater

The -7 PLSS feedwater cooling capability is based on use of both the main tank and auxiliary tank quantities.

Total Loading	11.90 lbs
Losses	-1.04 lbs
Usable feedwater	10.86 lbs

The 30-minute feedwater reserve is provided by the quantity remaining in the slave to the sublimator after the reservoir (tank) has been depleted (warning tone activated). The 10.86 pounds of feedwater, at 1038 BTU per pound heat of vaporization, provides 11,272 BTU cooling capacity.

The PLSS cooling capacity is used at the rate;

$$\dot{Q}_t = 1.245\ \dot{Q}_{met} + 149\ \text{BTU/hr} + \dot{Q}_{hl},\ \text{BTU/hr}$$

The EMU heat leak ($\dot{Q}_{hl}$) for the Apollo 15 mission is estimated to be:

EVA	$\dot{Q}_{hl}$ (BTU/hr)
1	-40
2	+230
3	+250

These heat leaks are estimated using the average sun elevation angle during each EVA period and the terrain effects. Dust effects on the thermal performance are included for the second and third EVA's.

Lithium Hydroxide

The -7 PLSS lithium hydroxide consumption rate, although a function of the crewman's metabolic rate, has been found to be far in excess of that required for the planned 7 hour EVA's and is therefore not a constraint in the traverse planning.

LRV Speeds/Traverse Distances

It has been assumed that the LRV can maintain 8 kilometers per hour average speed over the Hadley-Apennine terrain for the nominal traverse. For emergency return to the LM, the requirement at the most distant station is 8.4 km/hr.

The distance traveled is assumed to be the measured distance from the traverse route on the Hadley-Apennine area map, multiplied by a 1.1 factor to account for slopes and wander.

Traverse Constraints

The maximum radius of operation from the LM with the LRV shall not exceed the ride-back range of the BSLSS, or the walk-back capability of the crew with a properly functioning PLSS.

BSLSS Time Limit

Travel time on the BSLSS is 0.95 hour, resulting from the 1.25 hours OPS duration (3.8 #/hr flow rate), less the 5 minutes required for connecting the transport water buddy hose, and the 13 minutes required for LM ingress.

Walk-Back Limit

Failure of the LRV during a traverse requires that the crew have the capability to walk back to the LM and ingress. This walk-back capability limit is defined by the PLSS consumables remaining at the time of LRV failure, and the walk-back speed (assumed to be 3.3 km/hr). The traverse is designed so as to retain this walk-back capability throughout. The additional time available in excess of the walk-back requirement varies during the traverse; no specific time requirements have been allocated for packing samples and equipment to be carried back or for close-out at the LM.

3.6.2 Traverse Maps and Station Tasks

The Apollo 15 Hadley Apennine Landing area is shown in Figure 3.6-1 and the LRV traverses from the LM landing site are displayed in Figure 3.6-2. Figure 3.6-3 shows the Hadley Apennine landing area with the prominent features named for descriptive purposes. Figure 3.6-4 is a profile view of the primary Apollo 15 landing site as it should appear to the crewman as he stands in the docking tunnel during the SEVA. Tables 3.6-1, 3.6-2 and 3.6-3 contain the station tasks and traverse times for EVA 1, 2, and 3 respectively while Table 3.6-4 is a summary timetable for the geology stations and traverses between stations.

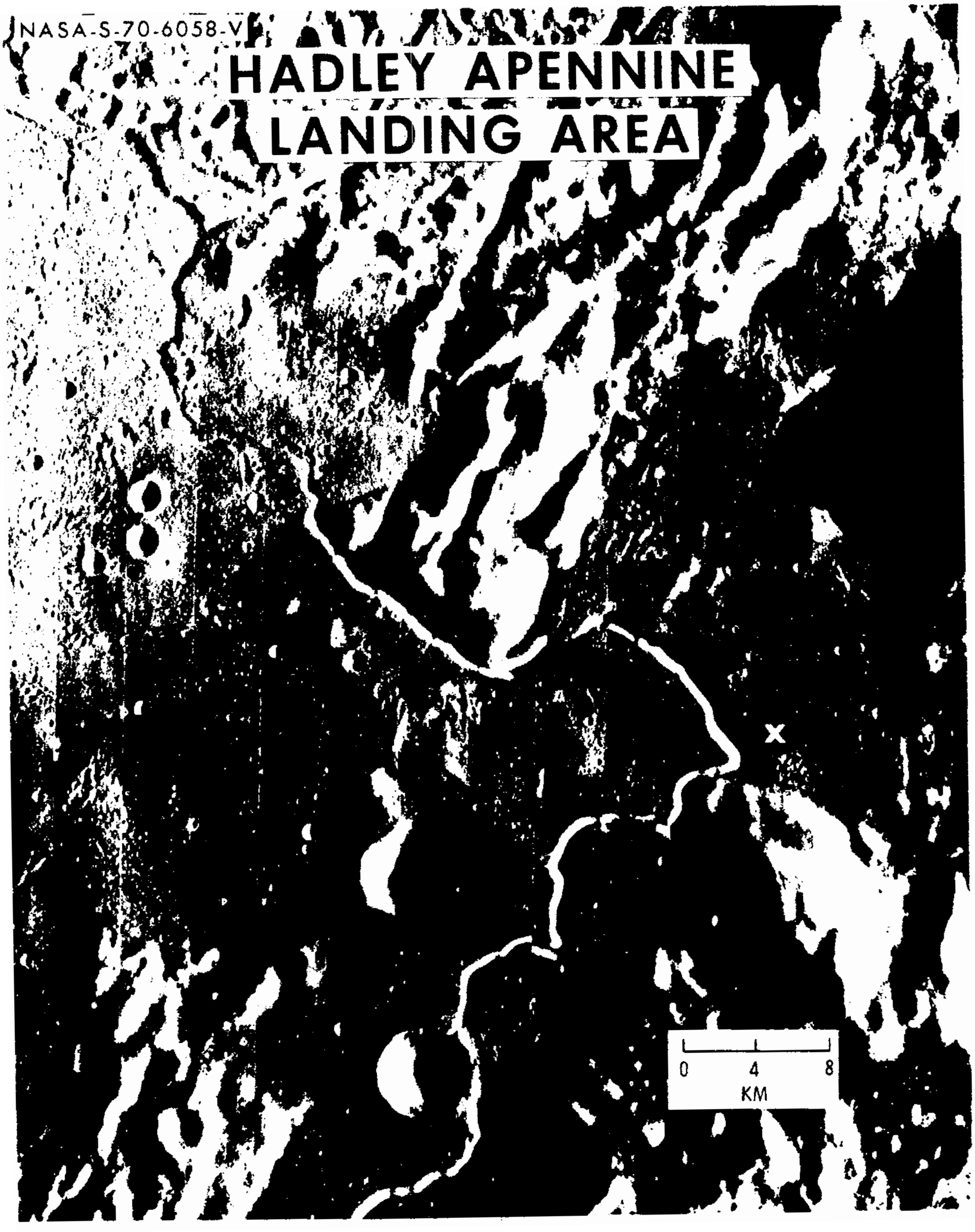


Figure 3.6-1 Hadley Apennine Landing Area

Figure 3.6-1

Figure 3.6-2 LRV Traverses EVA-1,2,3 (SUMMARY)

Figure 3.6-3 Hadley Apennine Features & Names

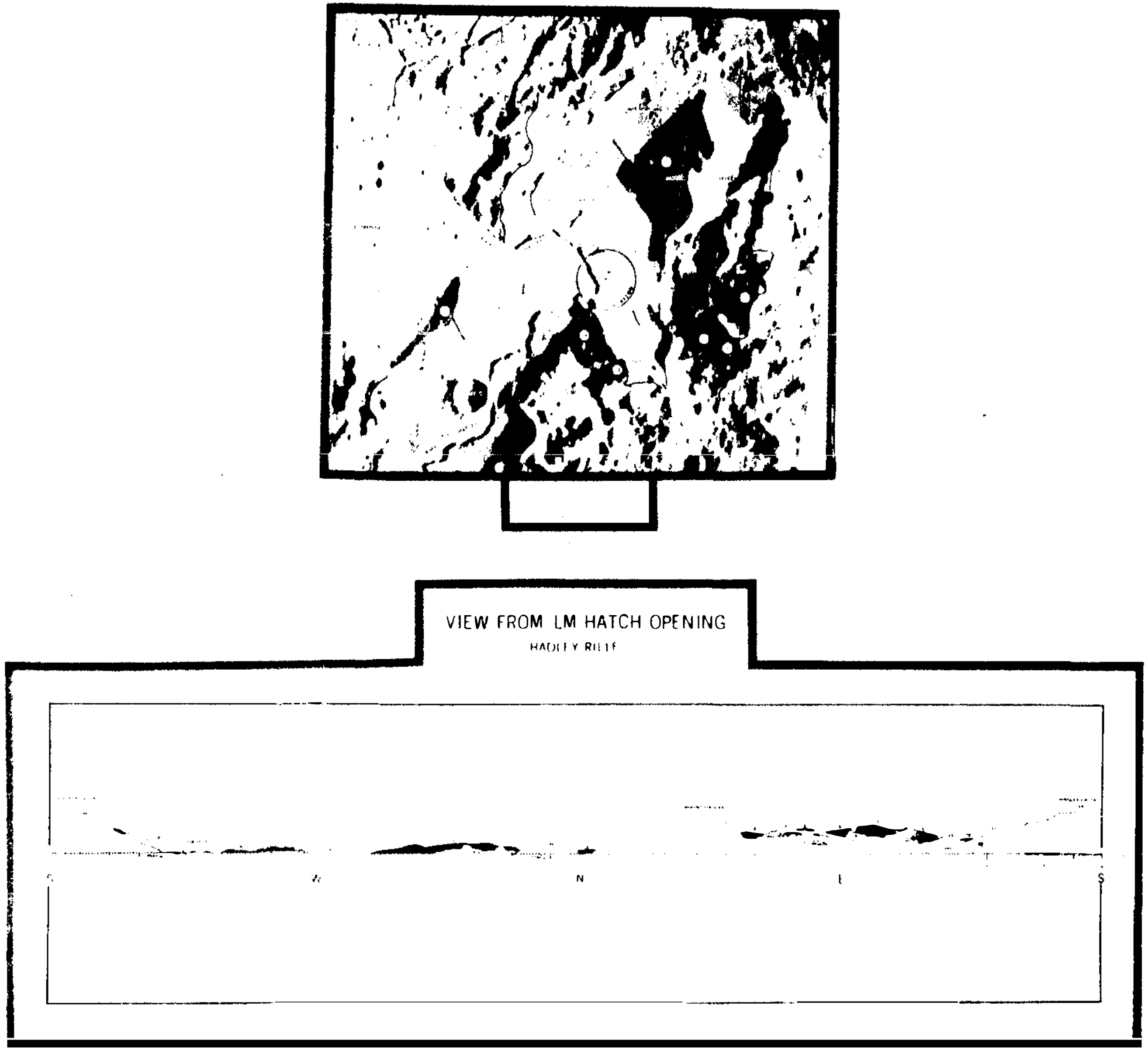


Figure 3.6-4

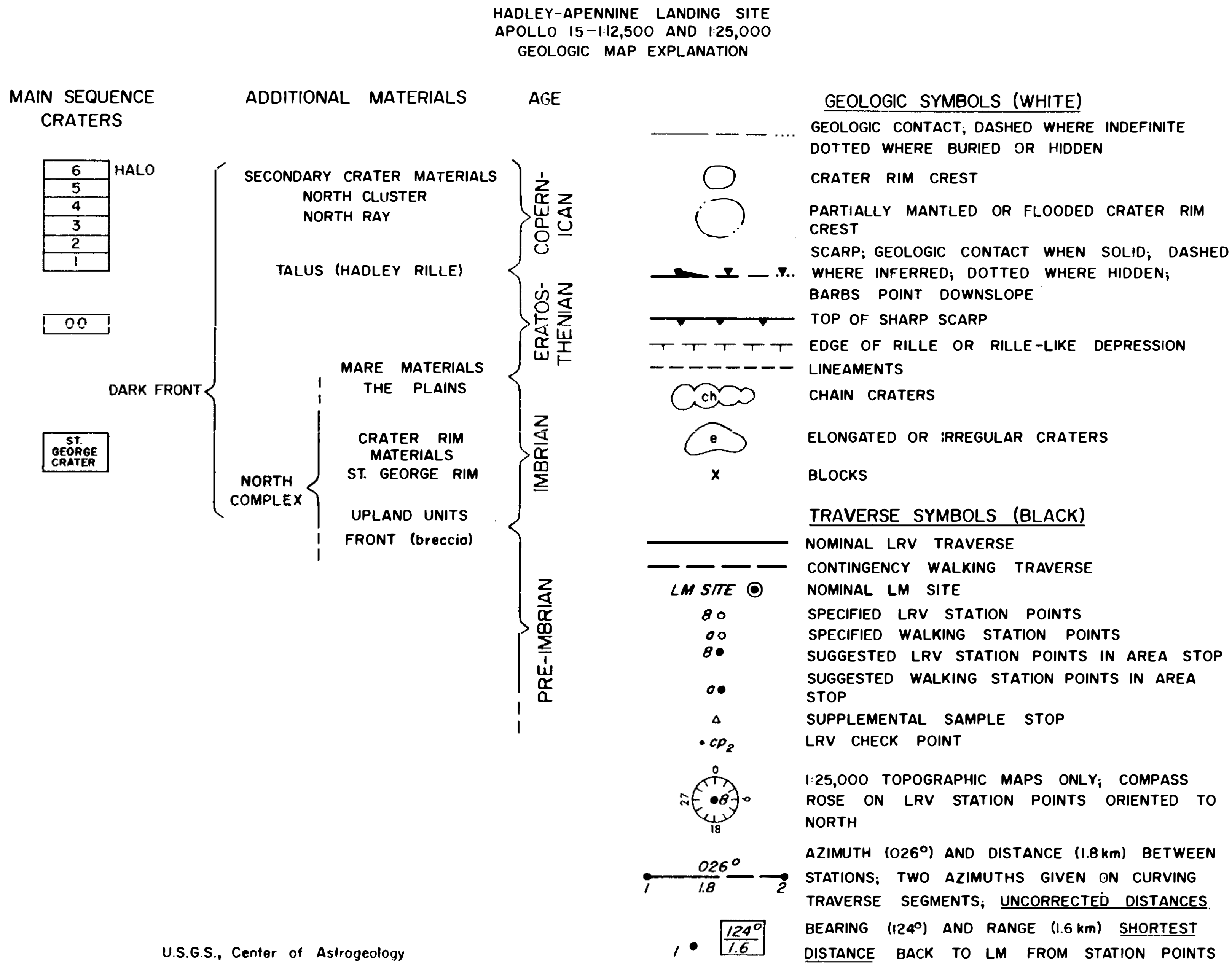


Figure 3.6-5 1:25,000 & 1:12,500 Geologic Map Explanation

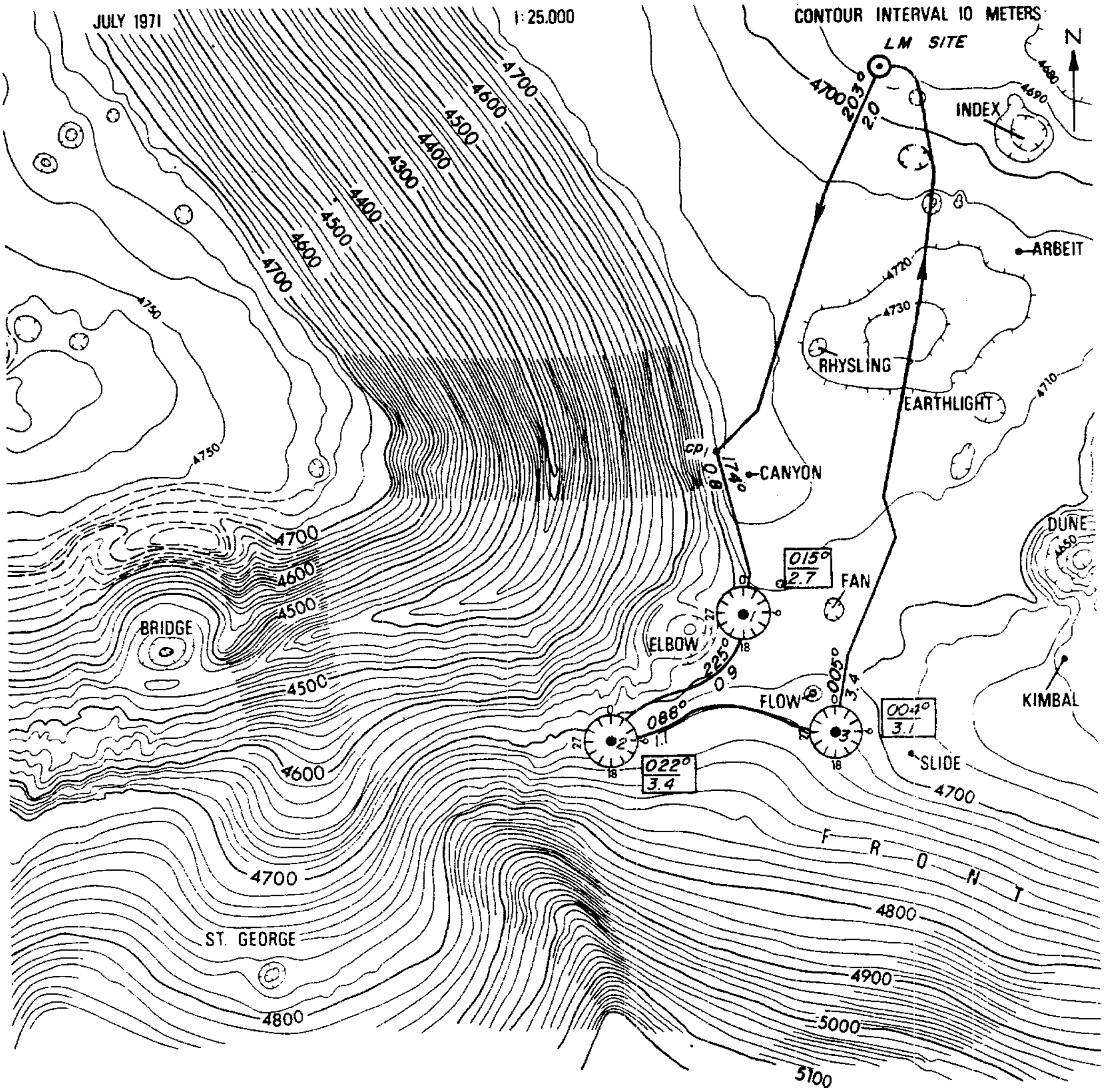


Figure 3.6-6a EVA-1 1:25,000 Contour Map

HADLEY RILLE
EVA-I


JULY 1971
1:25,000
GRID INTERVAL 250 METERS
N
RIMA HADLEY
INDEX
THE PLAINS
TALUS
BRIDGE
ELBOW
CRESCENT
DUNE
ST. GEORGE RIM
DARK FRONT
HADLEY RILLE EVA-1
Figure 3.6-6b EVA-1 1:25,000 Traverse Map

 Figure 3.6-6b

Table 3.6-1

EVA I - LRV EXPLORATION TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	1:25	SMOOTH MARE	SEE LUNAR SURFACE PROCEDURES DOCUMENT
TRAVEL	1:25	0:17	ACROSS TYPICAL SMOOTH MARE FILL TOWARD RIM OF HADLEY RILLE	OBSERVE AND DESCRIBE TRAVERSE OVER SMOOTH MARE FILL MATERIAL DESCRIBE SURFACE FEATURES AND BLOCK DISTRIBUTION NOTE ANY DIFFERENCES BETWEEN MARE AND RILLE RIM MATERIAL
CHECK POINT	1:42	0:02	NEAR CANYON CRATER	
TRAVEL	1:44	0:07	AROUND ELBOW CRATER	OBSERVE LOW SCARP AROUND ELBOW CRATER OBSERVE ANY DIFFERENCES BETWEEN RILLE RIM MATERIAL AND MARE MATERIAL OBSERVE DISTRIBUTION OF EJECTA AROUND ELBOW CRATER
1	1:51	0:15	NEAR SOUTHERN PART OF ELBOW CRATER EJECTA BLANKET	RADIAL SAMPLING OF ELBOW CRATER PAN
TRAVEL	2:06	0:08	TO APENNINE FRONT SLOPE NORTH OF ST. GEORGE CRATER	LOOK FOR CHANGES IN LITHOLOGY OR GROUND TEXTURE AS INDICATIONS OF BASE OF FRONT COMPARE MARE AND RILLE RIM MATERIAL TO APENNINE FRONT OBSERVE CHARACTER AND DISTRIBUTION OF ST. GEORGE EJECTA BLANKET

EVA I - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
2	2:14	0:45	NEAR BASE OF APENNINE FRONT NORTH OF ST. GEORGE CRATER	RADIAL SAMPLE OF ST. GEORGE CRATER AS SLOPE PERMITS COMPREHENSIVE SAMPLE AREA AT APENNINE FRONT DOUBLE CORE TUBE 500-mm LENS CAMERA PHOTOGRAPHY - BLOCKS ON ST. GEORGE RIM AND HADLEY RILLE STEREO PAN FROM HIGH POINT - 100 m BASE ALONG FRONT FILL SESC AT APENNINE FRONT PENETROMETER
TRAVEL	2:59	0:09	ACROSS BASE OF APENNINE FRONT TO EDGE OF POSSIBLE DEBRIS FLOW	OBSERVE APENNINE MATERIAL AND RELATION TO MARE SURFACE
3	3:08	0:14	AT BASE OF APENNINE FRONT ADJACENT TO POSSIBLE DEBRIS FLOW	EXAMINE FLOW AND COMPARE TO MARE AND FRONT DOCUMENTED SAMPLES OF APENNINE FRONT AND 'FLOW' MATERIAL OBSERVE AND DESCRIBE VERTICAL AND LATERAL CHANGES IN APENNINE FRONT; COMPARE TO PREVIOUS STOP PAN OBSERVE CHARACTERISTICS OF EVA II ROUTE

EVA I - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	3:22	0:28	FROM BASE OF APENNINE FRONT ACROSS MARE TO LM	OBSERVE CHARACTERISTICS AND EXTENT OF POSSIBLE DEBRIS FLOW OBSERVE AREA TO BE TRAVERSED ON EVA II COMPARE MARE MATERIAL TO APENNINE FRONT AND RILLE RIM OBSERVE POSSIBLE RAY MATERIAL
LM	3:50	3:10	SMOOTH MARE	ALSEP DEPLOYMENT EVA CLOSEOUT

Figure 3.6-7a EVA-2 1:25,000 Contour Map

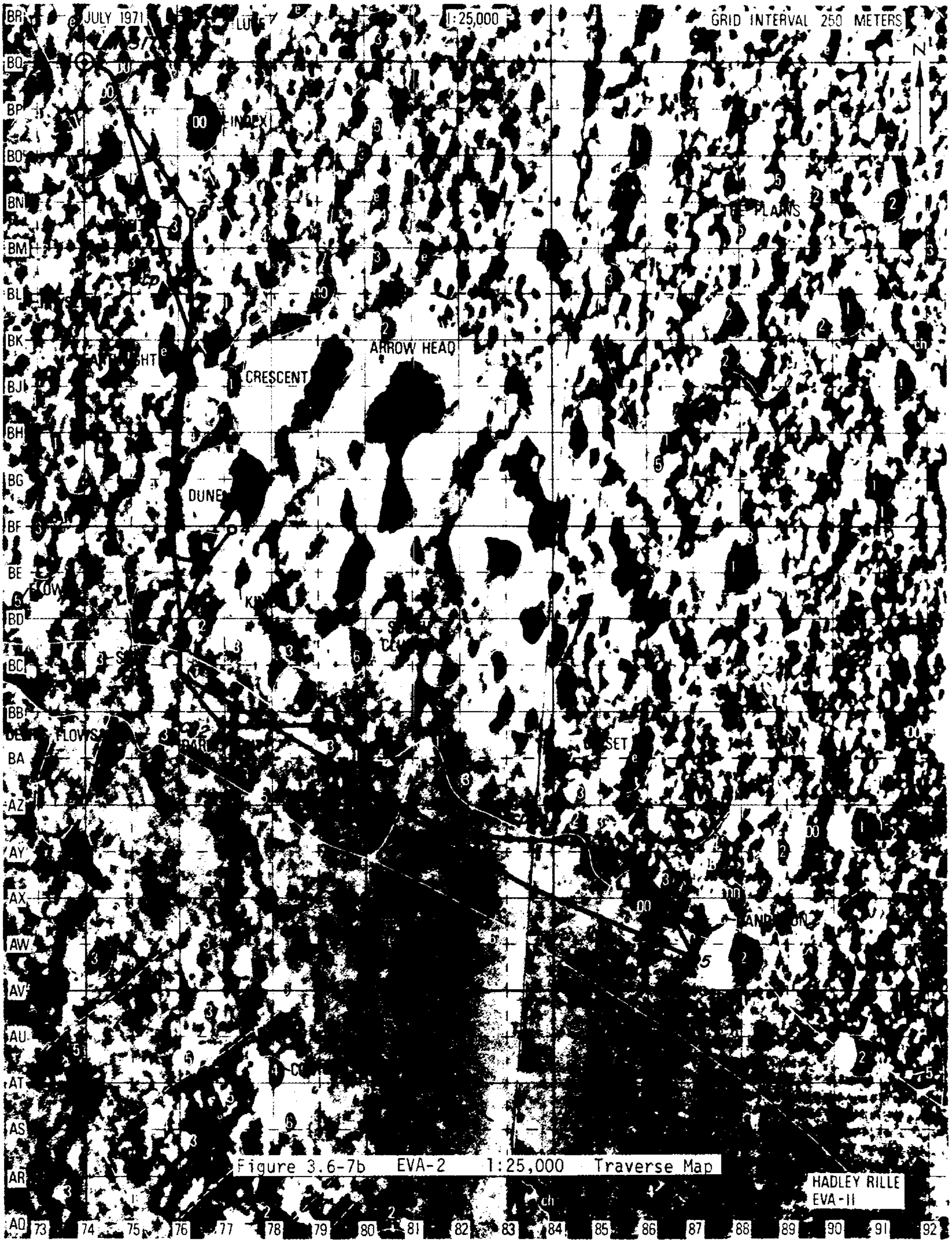


Figure 3.6-7b EVA-2 1:25,000 Traverse Map

Table 3.6-2

EVA II - LRV EXPLORATION TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	0:49	SMOOTH MARE	EGRESS LM, PREPARE FOR TRAVERSE
TRAVEL	0:49	0:11	SOUTH ALONG SMOOTH MARE TOWARD SECONDARY CRATER CLUSTER	OBSERVE SMOOTH MARE CHARACTERISTICS OBSERVE SECONDARY CRATER CLUSTER CHARACTERISTICS PHOTOGRAPHY AS APPROPRIATE
CHECK POINT	1:00	0:02	-	-
TRAVEL	1:02	0:15	SOUTH ALONG SMOOTH MARE ON WEST SIDE OF SECONDARY CRATER CLUSTER TO STATION 4	SAME AS ABOVE
4	1:17	0:20	SECONDARY CRATER CLUSTER: SOUTH OF DUNE CRATER	SOIL/RAKE SAMPLE DOCUMENTED SAMPLING PAN 500-mm LENS CAMERA PHOTOGRAPHY OF APENNINE FRONT EXPLORATORY TRENCH POSSIBLE CORE TUBE THROUGH SECONDARY EJECTA OBSERVE CRATER INTERIOR AND EJECTA SAMPLE TYPICAL AND EXOTIC ROCK TYPES COMPARE SECONDARY CRATER MATERIAL TO OTHER TERRAIN GEOLOGIC UNITS

EVA II - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	1:37	0:10	SOUTH ALONG SMOOTH MARE SW OF SECONDARY CRATER CLUSTER TO BASE OF APENNINE FRONT	OBSERVE SMOOTH MARE CHARACTERISTICS OBSERVE SECONDARY CRATER CLUSTER CHARACTERISTICS AND CRATER FORMS PHOTOGRAPHY AS APPROPRIATE
CHECK POINT	1:47	0:04		
TRAVEL	1:51	0:10	EAST ALONG APENNINE FRONT	TRAVERSE ALONG APENNINE FRONT; DETERMINE POSITION OF BASE OF FRONT AND SEARCH FOR OPTIMUM SAMPLING AREAS FOR STOPS ON RETURN LEG OF TRAVERSE PHOTOGRAPHY AS APPROPRIATE OBSERVE POSSIBLE DEBRIS FLOWS, DOWNSLOPE MOVEMENT, AND LOOK FOR SOURCE
CHECK POINT	2:01	0:04		
TRAVEL	2:05	0:05	EAST ALONG APENNINE FRONT	SAME AS ABOVE
CHECK POINT	2:10	0:04		
TRAVEL	2:14	0:12	ALONG APENNINE FRONT TO AREA STOP 5	SAME AS ABOVE

EVA II - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
AREA STOP 5	2:26	0:53	AT BASE OF APENNINE FRONT NEAR RIM OF FRONT CRATER	DOCUMENTED SAMPLES FROM UPSLOPE SIDE OF FRONT CRATER IN APENNINE FRONT DOCUMENTED SAMPLES FROM NORTHERN RIM OF FRONT CRATER; PARTICULARLY AT SHARP 80-m CRATER ON RIM STEREO PAN; 100-m SEPARATION ALONG APENNINE FRONT EXPLORATORY TRENCH UPSLOPE OF FRONT CRATER 500-mm LENS CAMERA PHOTOGRAPHY OF TARGETS OF OPPORTUNITY 70-mm CAMERA STEREO PAIRS UPSLOPE AT TARGETS OF OPPORTUNITY
TRAVEL	3:19	0:14	ALONG BASE OF APENNINE FRONT TO VICINITY OF STOP 6	OBSERVE LATERAL VARIATIONS IN MATERIAL AND SURFACE TEXTURES SEARCH FOR BLOCKY AREAS ALONG APENNINE FRONT WHICH ARE SUITABLE FOR SAMPLING (CRATERS, ETC.) PHOTOGRAPHY AS APPROPRIATE

EVA II - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
6	3:33	0:40	ALONG BASE OF APENNINE FRONT ON SLOPE IN INTERCRATER AREAS OR ON CRATER RIMS; CHOSEN AT CREW'S DISCRETION BASED ON PREVIOUS OBSERVATIONS	STOPS SHOULD INCLUDE THE FOLLOWING ACTIVITIES WHICH SHOULD BE MODIFIED ACCORDING TO THE LOCAL GEOLOGY: DESCRIPTION OF APENNINE FRONT IN SAMPLING AREA COMPARISON OF APENNINE FRONT AND MATERIAL TO OTHER SURFACE UNITS DOCUMENTED SAMPLES OF APENNINE FRONT MATERIAL PAN EXPLORATORY TRENCH POSSIBLE CORE TUBE 500-mm LENS CAMERA PHOTOGRAPHY OF BLOCKS, OUTCROPS, ETC. 70-mm CAMERA STEREO PAIRS UPSLOPE AT TARGETS OF OPPORTUNITY
TRAVEL	4:13	0:08	ALONG BASE OF APENNINE FRONT TO STATION 7	USE TRAVEL ACTIVITY ABOVE
7	4:21	0:40	SAME AS ABOVE	SAME AS STATION 6 ACTIVITY AT THE LAST APENNINE FRONT STOP; BASED ON PREVIOUS OBSERVATIONS ALONG FRONT, CREW USES DISCRETION TO COMPLETE SAMPLING

EVA II - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	5:01	0:26	FROM BASE OF APENNINE FRONT ALONG SOUTHWESTERN EDGE OF SECONDARY CRATER CLUSTER	OBSERVE SECONDARY CRATER DEPOSITS AND RELATION TO OTHER TERRAIN OBSERVE EASTERN EDGE OF POSSIBLE DEBRIS FLOW FROM APENNINE FRONT PHOTOGRAPHY AS APPROPRIATE
8	5:27	:45	IN MARE MATERIAL NEAR ARBEIT CRATER	COMPREHENSIVE SAMPLE AREA DOUBLE CORE TUBE DOCUMENTED SAMPLING OF LARGE MARE CRATER POSSIBLE FILLET/ROCK SAMPLE POSSIBLE LARGE AND SMALL EQUIDIMENSIONAL ROCK SAMPLES PAN TRENCH POSSIBLE BURIED ROCK SAMPLE FILL SESC PENETROMETER
TRAVEL	6:12	0:08	ACROSS SMOOTH MARE	COMPARE MARE MATERIAL WITH OTHER TERRAIN OBSERVE POSSIBLE RAY MATERIAL
LM	6:20	0:40	SMOOTH MARE	EVA CLOSEOUT

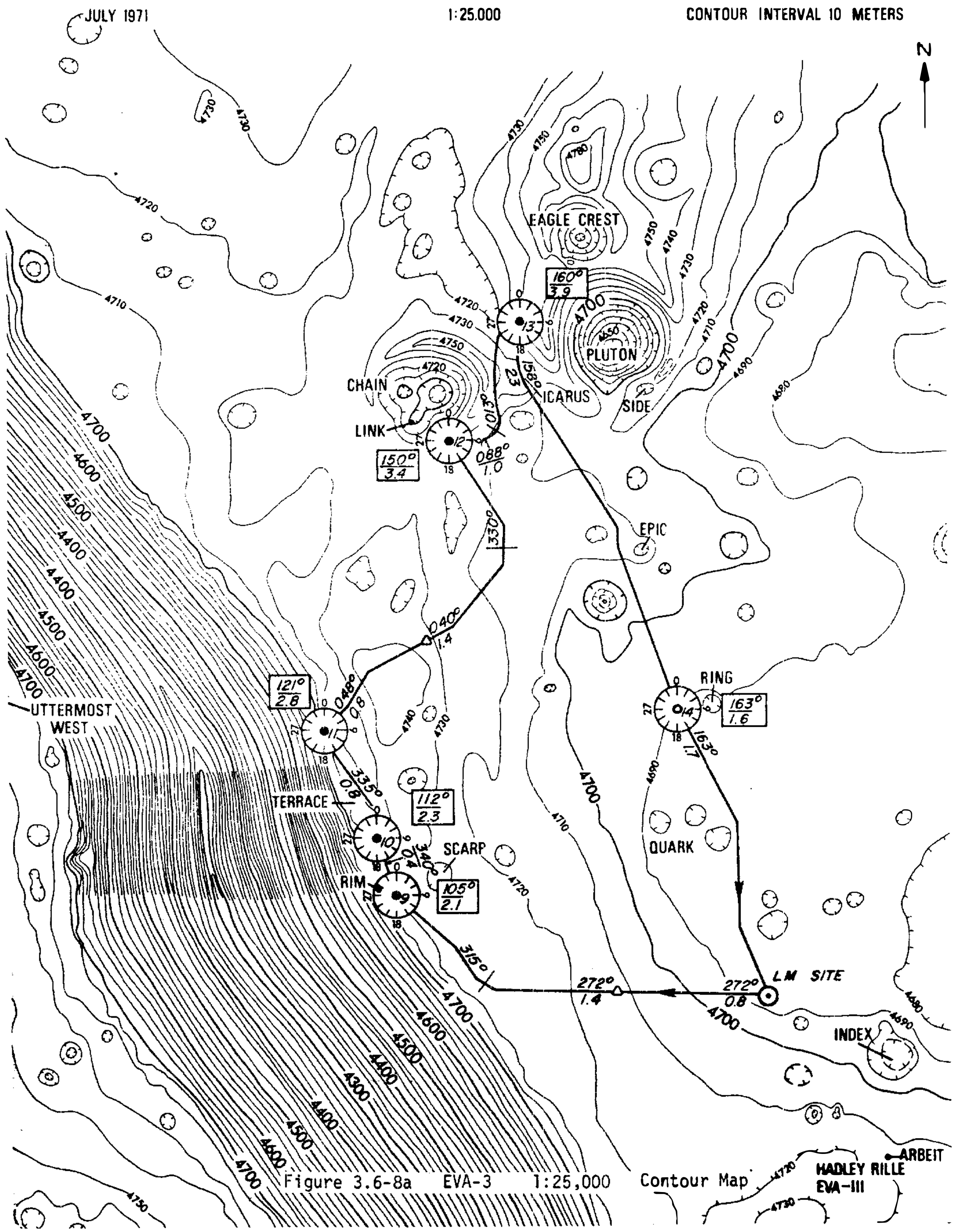


Figure 3.6-8a EVA-3 1:25,000 Contour Map

Figure 3.6-8b EVA-3 1:25,000 Traverse Map

Table 3.6-3

EVA III - LRV EXPLORATION TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	0:42	SMOOTH MARE	EGRESS LM, PREPARE FOR TRAVERSE
TRAVEL	0:42	0:07	ACROSS SMOOTH MARE BETWEEN LM AND RIM OF HADLEY RILLE	COMPARE SMOOTH MARE MATERIAL TO RILLE RIM MATERIAL
SUPPLEMENTARY SAMPLE STOP	0:49	0:05	SMOOTH MARE BETWEEN LM AND RIM OF HADLEY RILLE	SOIL/ROCK SAMPLE PAN
TRAVEL	0:54	0:12	ACROSS SMOOTH MARE TO RILLE RIM TURNING NW AT RILLE RIM TO THE TERRACE	COMPARE SMOOTH MARE MATERIAL TO RILLE RIM MATERIAL
9	1:06	0:50	AT RIM OF HADLEY RILLE AT SOUTHERN END OF THE TERRACE	OBSERVE AND DESCRIBE RILLE AND FAR WALL 500-mm LENS CAMERA PHOTOGRAPHY COMPREHENSIVE SAMPLE AREA SINGLE (DOUBLE) CORE TUBE PAN DOCUMENTED SAMPLING OF CRATER AT EDGE OF RILLE POSSIBLE PAN ON EDGE OF CRATER PENETROMETER
TRAVEL	1:56	0:03	ALONG RILLE RIM AT THE TERRACE	CONTINUED DESCRIPTION OF RILLE AND RIM MATERIAL PHOTOGRAPHY AS APPROPRIATE

EVA III - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
10	1:59	0:10	ALONG RILLE RIM AT THE TERRACE	500-mm LENS CAMERA PANORAMIC PHOTOGRAPHY - PROVIDES STEREO BASE FOR STATION 9; SAME TARGETS SHOULD BE PHOTOGRAPHED DOCUMENTED SAMPLE FROM CRATER ON RILLE RIM PAN
TRAVEL	2:09	0:06	ALONG RILLE RIM TO NORTH END OF THE TERRACE	CONTINUED DESCRIPTION OF RILLE AND RILLE RIM MATERIAL PHOTOGRAPHY AS APPROPRIATE
11	2:15	0:19	AT RIM OF HADLEY RILLE AT NW END OF THE TERRACE	OBSERVE AND DESCRIBE RILLE AND FAR RILLE WALL; COMPARE TO PREVIOUS OBSERVATIONS 500-mm LENS CAMERA PHOTOGRAPHY DOCUMENTED SAMPLES OF RILLE RIM AND CRATER AT EDGE OF RILLE PAN COMPARE RILLE RIM MATERIAL TO OTHER TERRAIN
TRAVEL	2:34	0:07	LEAVE RILLE RIM AND TRAVERSE ACROSS MARE TOWARD NORTH COMPLEX	OBSERVE CHANGES IN MATERIAL BETWEEN RILLE RIM, MARE, AND NORTH COMPLEX

EVA III - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
SUPPLEMENTARY SAMPLE STOP	2:41	0:05	BETWEEN RILLE RIM AND NORTH COMPLEX	SOIL/ROCK SAMPLE PAN
TRAVEL	2:46	0:12	BETWEEN SUPPLEMENTARY SAMPLE STOP AND CHAIN CRATER IN THE NORTH COMPLEX	OBSERVE CHANGES IN MATERIAL BETWEEN RILLE RIM, MARE, AND NORTH COMPLEX OBSERVE CHARACTERISTICS OF CRATER CHAIN ORIGINATING IN CHAIN CRATER OBSERVE POSSIBLE SECONDARY CRATERS
12	2:58	0:23	SOUTHEASTERN RIM OF CHAIN CRATER IN NORTH COMPLEX AT JUNCTION OF ELONGATE DEPRESSION	DOCUMENTED SAMPLE OF CRATER EJECTA DOCUMENTED SAMPLE OF NORTH COMPLEX MATERIAL PAN POSSIBLE CORE TUBE DESCRIBE WALL OF CRATER AND RELATION TO ELONGATE DEPRESSION ATTEMPT TO DETERMINE IF CRATER IS ENDOGENETIC OR IMPACT
TRAVEL	3:21	0:08	IN NORTH COMPLEX BETWEEN CHAIN AND PLUTON CRATERS	OBSERVE INTERCRATER AREA IN NORTH COMPLEX AND COMPARE EJECTA BETWEEN CRATERS CONTINUE TO COMPARE NORTH COMPLEX TO OTHER TERRAIN TYPES

EVA III - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
AREA STOP 13	3:29	0:53	MULTIPLE OBJECTIVE STOP AT END OF NORTH COMPLEX SCARP BETWEEN CHAIN AND PLUTON CRATERS	THE FOLLOWING LIST OUTLINES SOME OF THE MORE IMPORTANT AREAS OF INTEREST IN THE NORTH COMPLEX AREA: ICARUS CRATER ON WESTERN RIM OF PLUTON CRATER PLUTON CRATER EAGLECREST CRATER SCARPS BASED ON THE CHARACTERISTICS AND ACCESSIBILITY OF EACH OF THESE POINTS OF INTEREST THE FOLLOWING TASKS SHOULD BE COMPLETED AT THE DISCRETION OF THE CREW: DOCUMENTED SAMPLING PAN OR STEREO PAN POSSIBLE CORE TUBE EXPLORATORY TRENCH SOIL SAMPLE 500-mm LENS CAMERA TARGETS OF OPPORTUNITY PENETROMETER
TRAVEL	4:22	0:19	FROM NORTH COMPLEX INTO MARE REGION WITH POSSIBLE SECONDARIES FROM RAY	OBSERVE AND DESCRIBE DIFFERENCES IN MATERIAL AND SURFACE TEXTURES BETWEEN NORTH COMPLEX AND MARE NOTE AMOUNT OF SECONDARY CRATERING PHOTOGRAPHY AS APPROPRIATE

EVA III - LRV EXPLORATION TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
14	4:41	0:20	RING CRATER SOUTH OF NORTH COMPLEX IN MARE	COMPARE BLOCKS AND MARE MATERIAL WITH NORTH COMPLEX DOCUMENTED SAMPLE OF MARE MATERIAL POSSIBLE FILLET/ROCK SAMPLE POSSIBLE LARGE AND SMALL EQUIDIMENSIONAL ROCK SAMPLES POSSIBLE RADIAL SAMPLING OF FRESH 5-10 m CRATER PAN EXPLORATORY TRENCH IN RAY MATERIAL
TRAVEL	5:01	0:14	MARE IN REGION BETWEEN NORTH COMPLEX AND LM	DESCRIBE DIFFERENCES BETWEEN THIS AREA AND OTHER MARE AREAS NOTE DISTRIBUTION OF POSSIBLE SECONDARIES
LM	5:15	0:45	SMOOTH MARE FILL	EVA CLOSEOUT

Table 3.6-4

HADLEY-APENNINE

30 MIN. RESERVES
RIDING RATE 8 KM/HR
WALKING RATE 3.0 KM/HR

Rev.
15 June 1971

Station No.	Station Stop Time (Min)	Traverse Dist. Map (Km)	Traverse Dist. Corr (Km)	Ride Time (Min)	Accum Dist. (KM)	Station Reached Data EVA Time (Hr:Min)	Station Reached Data Btu Remain (Btu)	Station Reached Data O_2 Remain (Lbs)	Station Stop Complete Data EVA Time (Hr:Min)	Station Stop Complete Data Btu Remain (Btu)	Station Stop Complete Data O_2 Remain (Lbs)	Return Distance Corr. (Km)	Conting. Ride-Back Max. Speed Reqd 0 Min (Km/Hr)	Conting. Ride-Back Max. Speed Reqd 10 Min-LRV (Km/Hr)	Walk-Back Time to LM (Hr:Min)	Conting. Walk-Back Complete Btu Margin (Hr:Min)	Conting. Walk-Back Complete O_2 Margin (Hr:Min)	Conting. Walk-Back Complete Amp Hour Margin (Hr:Min)
									TRAVERSE I							10 MIN AT LRV BEFORE WALK-BACK		
LM	85	0	0	0	0	0	11,408	1.383	1:25	9,552	1.135	0	0	0	0	0	0	0
C.P.	2	2.0	2.20	17	2.20	1:42	9,313	1.103	1:44	9,269	1.097	2.2	2.13	2.54	0:44	5:43	4:55	4:22
1	15	0.8	0.88	7	3.08	1:51	9,171	1.083	2:06	8,844	1.040	3.1	3.00	3.58	1:02	5:00	4:12	3:43
2	45	0.9	0.99	7	4.07	2:13	8,726	1.025	2:58	7,691	0.894	4.1	3.97	4.73	1:22	3:24	2:56	2:29
3	14	1.1	1.21	9	5.28	3:07	7,549	0.876	3:21	7,227	0.835	3.75	3.63	4.33	*0:56	*3:24	*2:55	*2:32
LM	**190	3.4	3.74	28	9.02	3:49	6,821	0.780	6:59	2,672	0.226	0	0	0	0	0	0	0
TOTALS	351	8.2	9.02	68					6:59									
	**Includes ALSEP																	
									TRAVERSE II									
LM	49	0	0	0	0	0	11,719	1.303	0:49	10,469	1.154	0	0	0	0	0	0	0
C.P.	2	1.3	1.43	11	1.43	1:00	10,274	1.131	1:02	10,223	1.125	1.45	1.40	1.67	0:29	5:41	5:08	5:18
4	20	1.8	1.98	15	3.41	1:17	9,954	1.094	1:37	9,444	1.032	3.4	3.29	3.93	1:08	4:21	3:48	4:05
C.P.	4	1.2	1.32	10	4.73	1:47	9,248	1.012	1:51	9,139	1.000	4.2	4.07	4.85	1:24	3:27	3:16	3:34
C.P.	4	1.2	1.32	10	6.05	2:01	8,943	0.979	2:05	8,834	0.967	5.5	5.32	6.35	1:50	2:44	2:31	2:55
C.P.	4	0.6	0.66	5	6.71	2:10	8,737	0.956	2:14	8,628	0.944	6.2	6.0	7.16	2:04	2:28	2:10	2:32
5	53	1.4	1.54	12	8.25	2:26	8,398	0.920	3:19	6,959	0.758	7.5	7.26	8.66	2:30	0:44	0:31	1:01
6	40	1.7	1.87	14	10.12	3:33	6,681	0.729	4:13	5,594	0.607	5.6	5.42	6.47	1:52	0:42	0:30	0:45
7	40	1.0	1.10	08	11.22	4:21	5,431	0.589	5:01	4,344	0.467	4.5	4.36	5.20	1:30	0:24	0:13	0:19
8	45	3.1	3.41	26	14.63	5:27	3,880	0.414	6:12	2,732	0.277	1.1	1.07	1.27	*0:17	*1:00	*0:46	*0:22
LM	40	1.0	1.1	8	15.73	6:20	2,582	0.259	7:00	1,562	0.137	0	0	0	0	0	0	0
TOTALS	301	14.3	15.73	119					7:00									
									TRAVERSE III									
LM	42	0	0	0	0	0	11,719	1.303	0:42	10,599	1.170	0	0	0	0	0	0	0
S.S.S.	5	0.80	0.88	7	0.88	0:49	10,468	1.155	0:54	10,334	1.139	.90	.87	1.04	0:18	5:34	5:14	5:37
9	50	1.40	1.54	12	2.42	1:06	10,111	1.114	1:56	8,778	0.955	2.4	2.32	2.77	0:48	4:06	3:37	4:06
10	10	0.35	0.39	03	2.81	1:59	8,721	0.949	2:09	8,454	0.917	2.8	2.71	3.23	0:56	3:43	3:15	3:45
11	19	0.75	0.83	06	3.64	2:15	8,338	0.904	2:34	7,831	0.843	3.6	3.48	4.16	1:12	3:00	2:31	3:04
S.S.S.	05	0.80	0.88	7	4.52	2:41	7,700	0.828	2:46	7,567	0.813	3.6	3.48	4.16	1:12	2:50	2:21	2:52
12	23	1.40	1.54	12	6.06	2:58	7,344	0.787	3:21	6,731	0.714	4.3	4.16	4.97	1:26	2:01	1:32	2:04
13	53	1.00	1.10	8	7.16	3:29	6,571	0.696	4:22	5,158	0.528	4.4	4.30	5.14	1:29	0:58	0:30	1:00
14	20	2.30	2.53	19	9.69	4:41	4,788	0.485	5:01	4,281	0.425	1.9	1.84	2.19	*0:28	*1:30	*1:08	*1:22
LM	45	1.70	1.87	14	11.56	5:15	4,006	0.394	6:00	2,806	0.251	0	0	0	0	0	0	0
TOTALS	272	10.5	11.56	88					6:00							*4.0 KM/HR RATE		
EVA TOTALS	15:24	33.0	36.31	4:35					19:59									

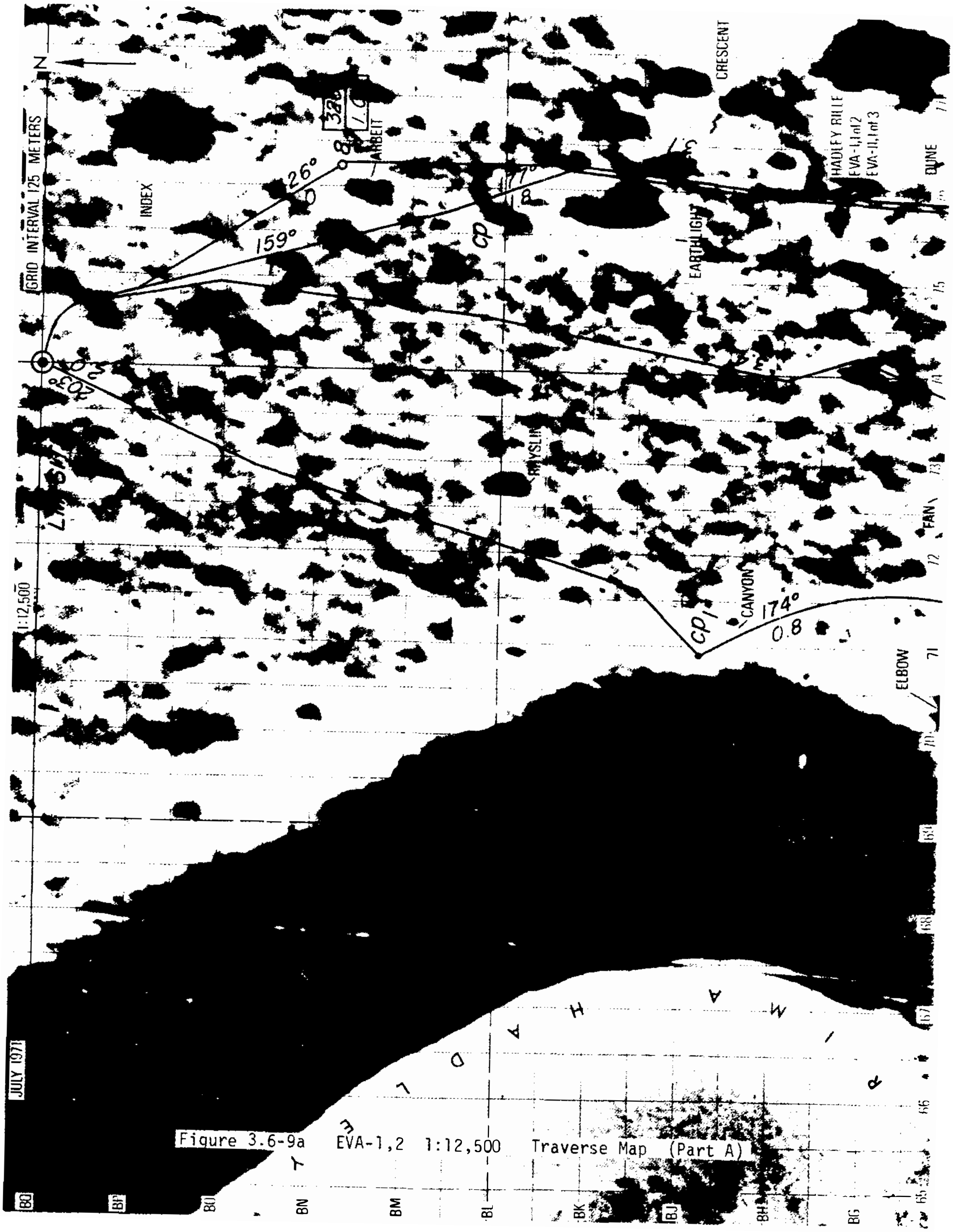


Figure 3.6-9a EVA-1,2 1:12,500 Traverse Map (Part A)

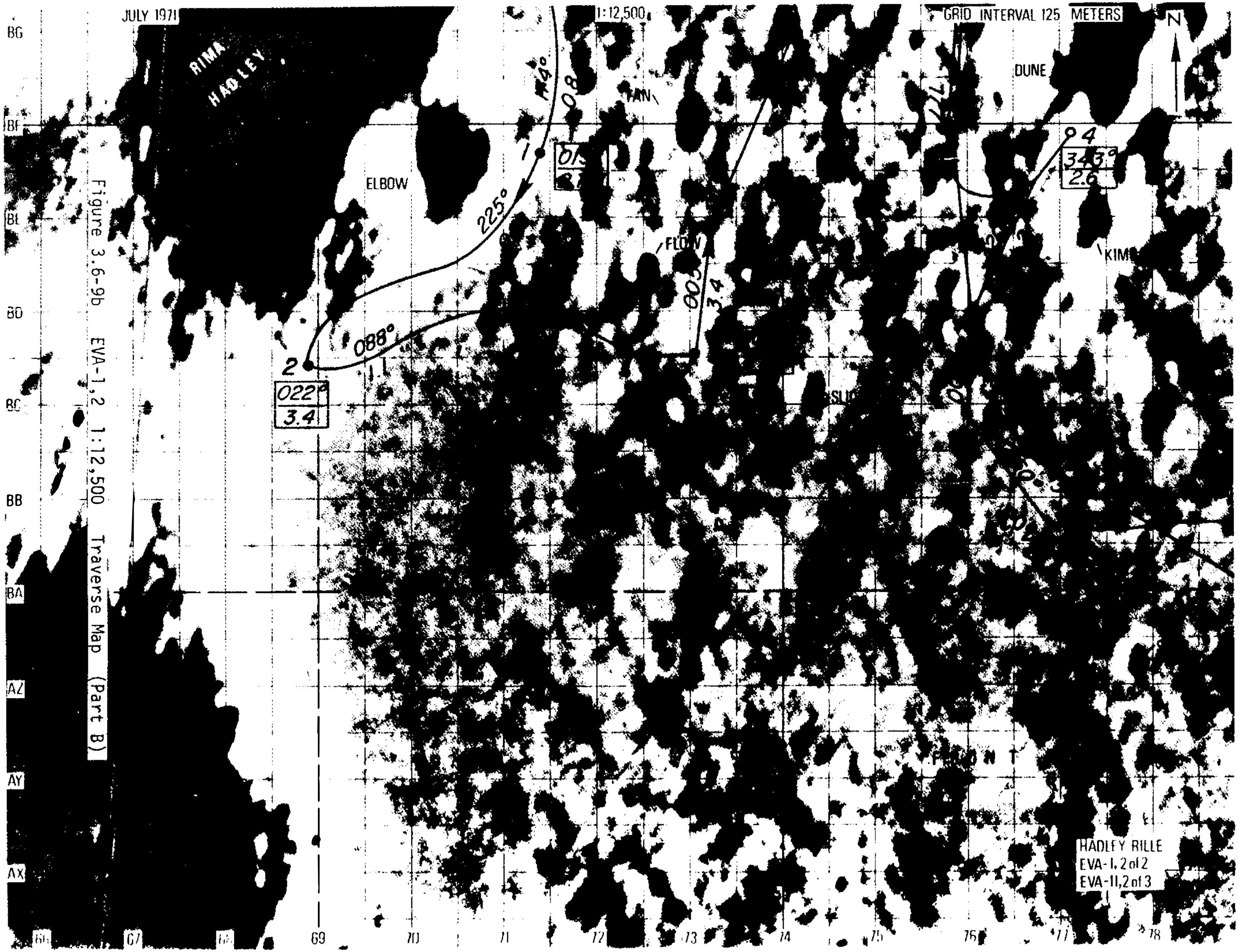


Figure 3.6-9b EVA-1,2 1:12,500 Traverse Map (Part B)

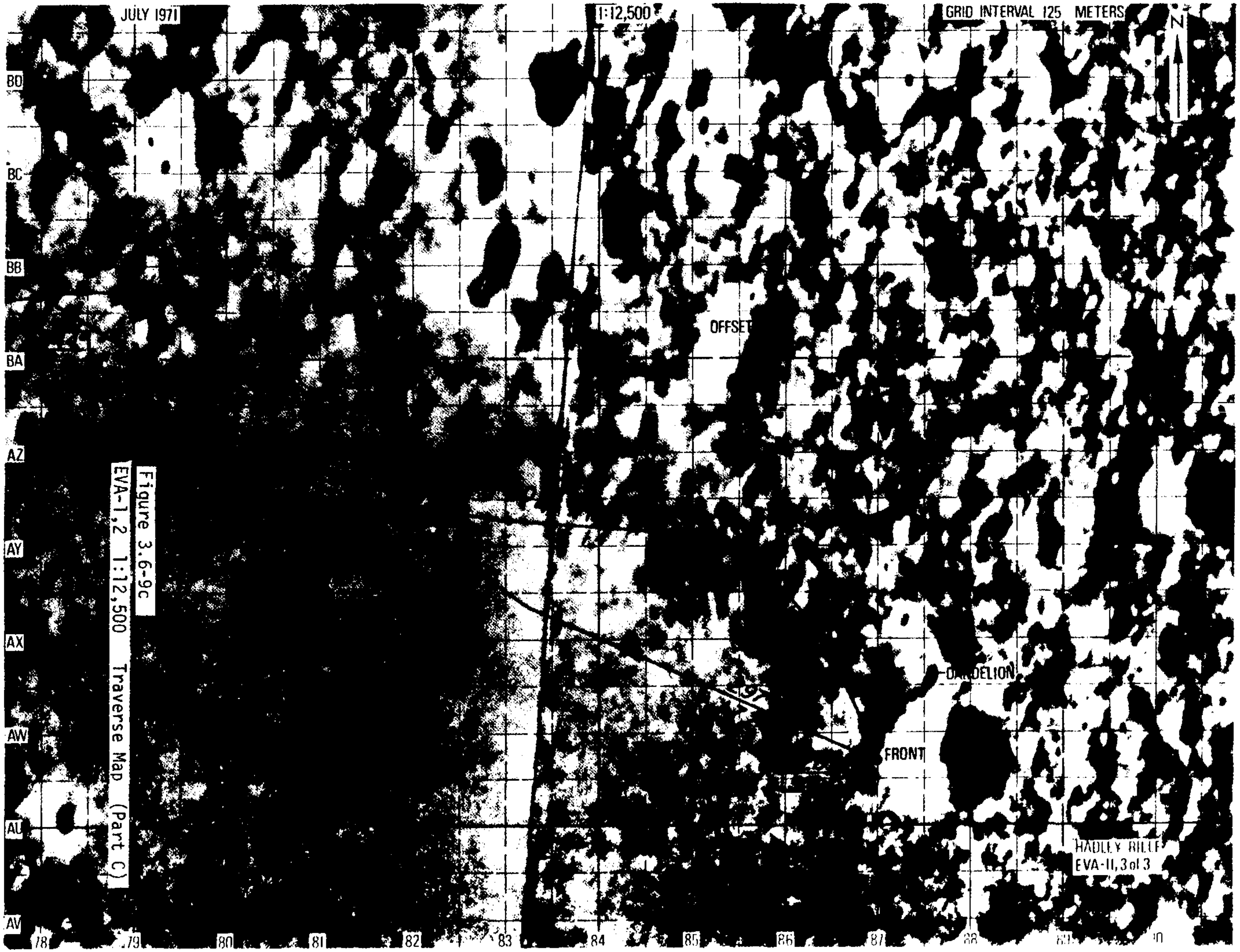


Figure 3.6-9c
EVA-1,2 1:12,500 Traverse Map (Part C)

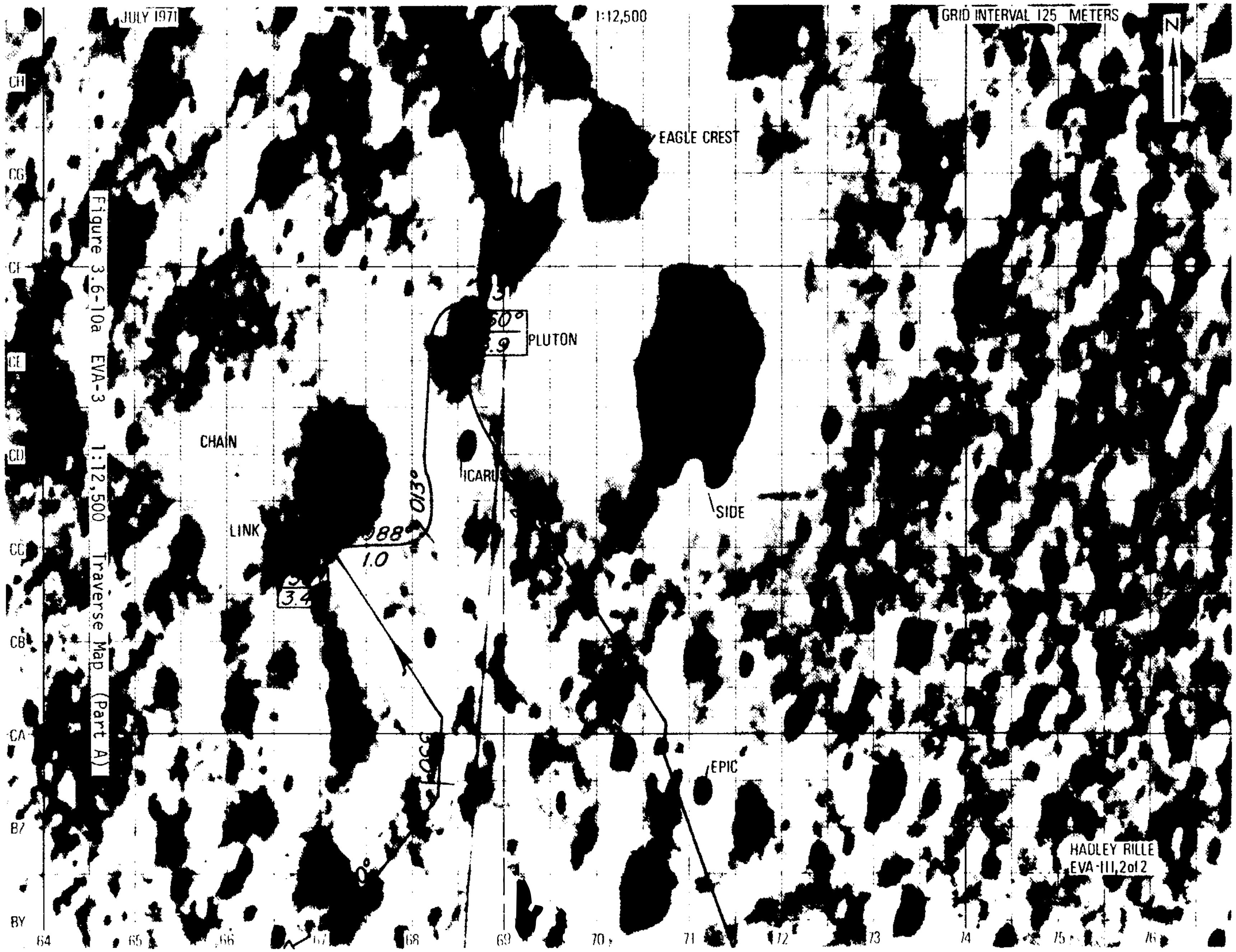


Figure 3.6-10a EVA-3 1:12,500 Traverse Map (Part A)

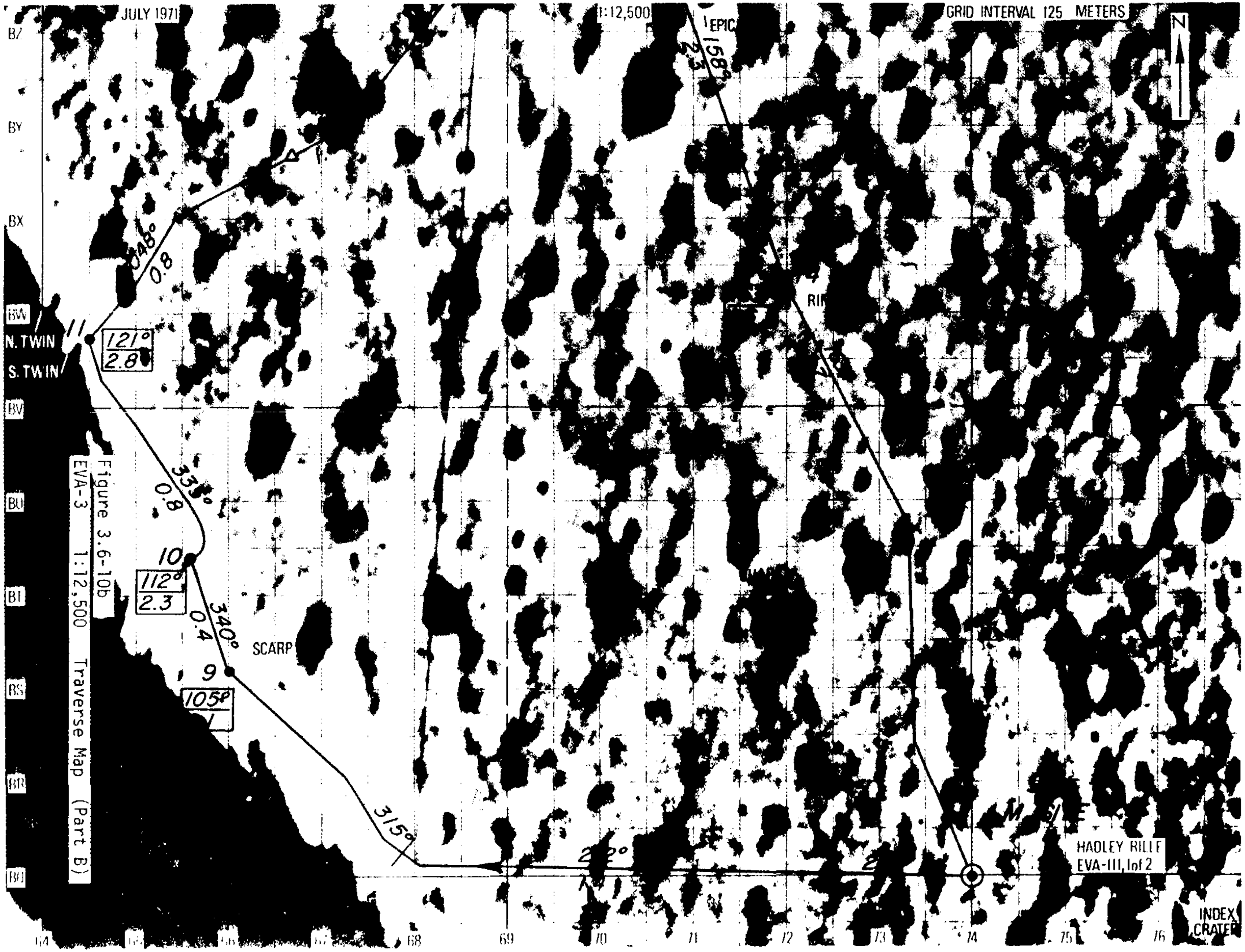


Figure 3.6-10b EVA-3 1:12,500 Traverse Map (Part B)

3.7 Lunar Rover Vehicle

The Apollo 15, J-1, mission is the first to use a vehicle to transport the crew and equipment on extended geology traverses. The benefits derived from using the LRV during the geology traverses include:

1) Decreased metabolic rates while driving,
2) Decreased traverse time between geology sites and,
3) Increased communications capability.

The intent of this section is to provide operational data relative to the LRV systems, operations, performance and constraints. In addition, a section is provided showing the decal and checklist used in operating the vehicle on the lunar surface.

3.7.1 Systems

The LRV (see figure 3.7-1) is a four wheel, electrically powered, crew controlled, vehicle designed to accommodate two crewmen and stowed ancillary equipment (see figure 3.1-6 LRV stowage) for lunar surface traverses. Control of the LRV during the traverse is effected by either of the two crewmen operating the hand controller located between them. The functions of the hand controller are shown in figure 3.7-2. The crewman in the left seat nominally has a control advantage since the "T" handle is biased in his direction.

Selection of power sources for the steering motors (2) and the drive motors (4), monitoring of parameters and operation of the navigation system is possible by either crewman using the control and display console. The functions of the control and display console which are not intuitively obvious are briefly described in figure 3.7-2. For a complete description of the LRV systems refer to the Lunar Roving Vehicle Operation's Handbook dated April 19, 1971.

3.7.2 Operations

The following table is a compendium of the functions performed on and with the LRV during the lunar surface EVA operations. As such, it is designed to supplement data on LRV operations as specified in the integrated EVA vertical timelines, by providing detail procedures. The delineation of these functions is by EVA and the procedures referenced within each function are given in chronological order.

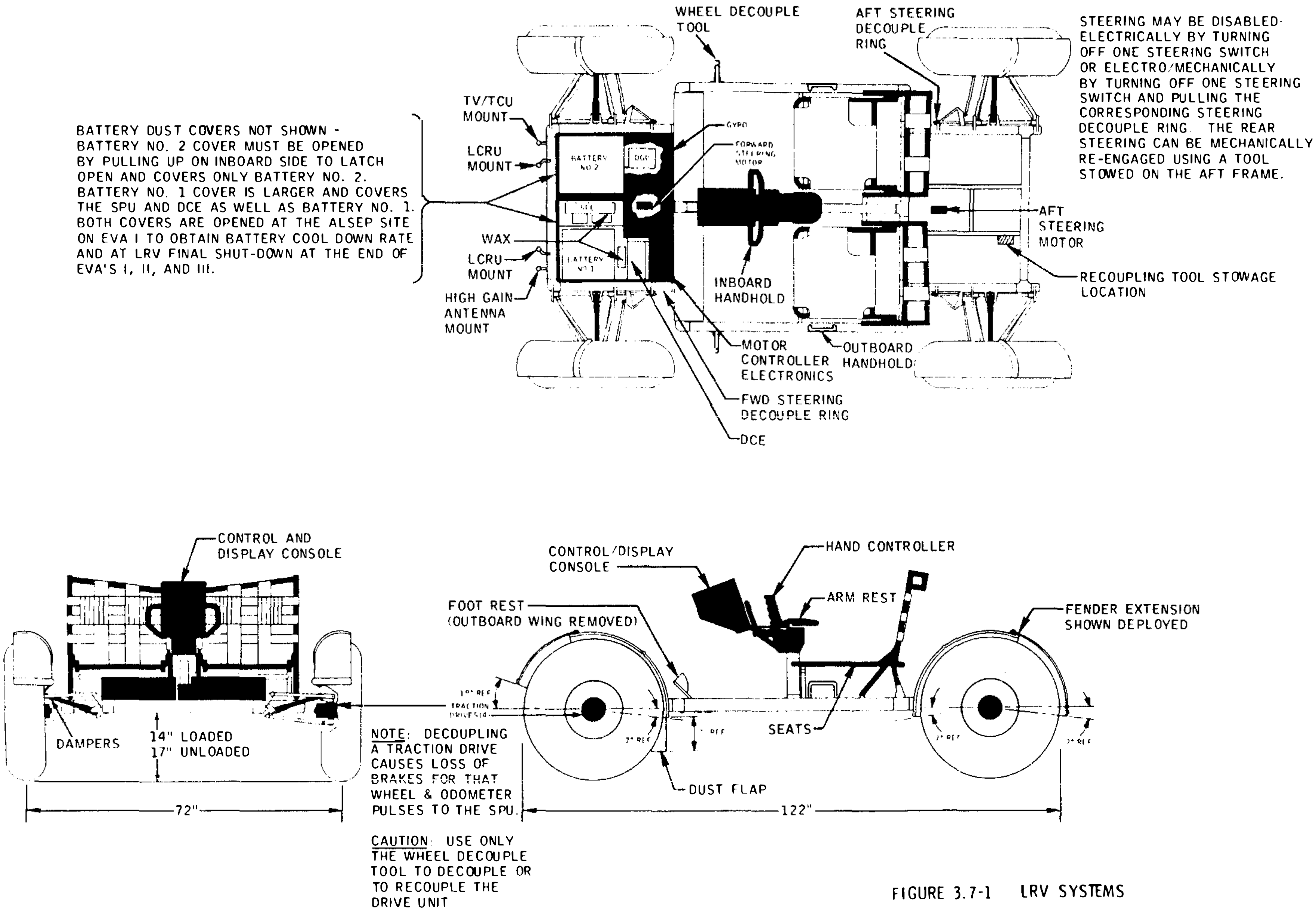


FIGURE 3.7-1 LRV SYSTEMS

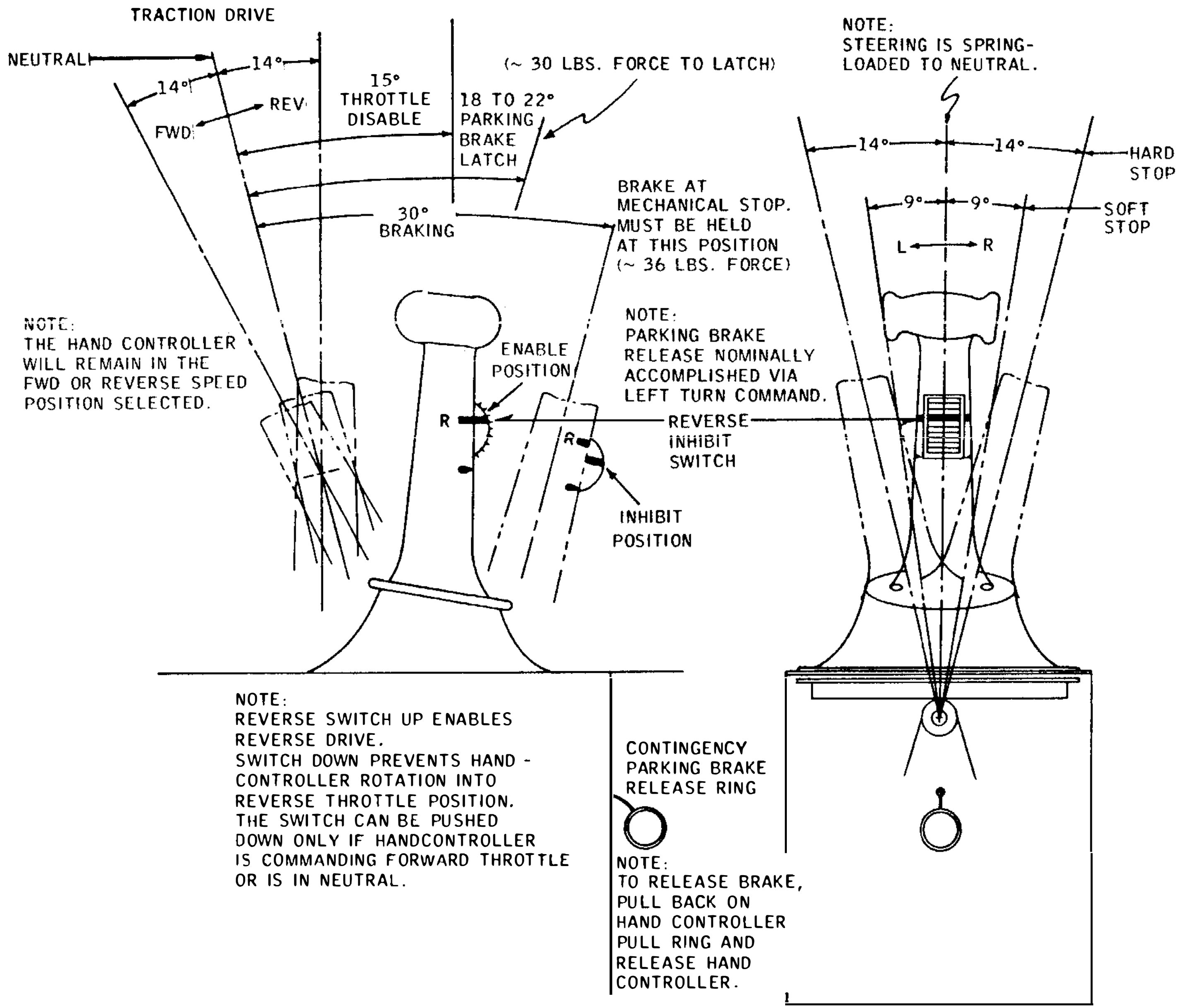


FIGURE 3.7-2 LRV HANDCONTROLLER FUNCTIONS

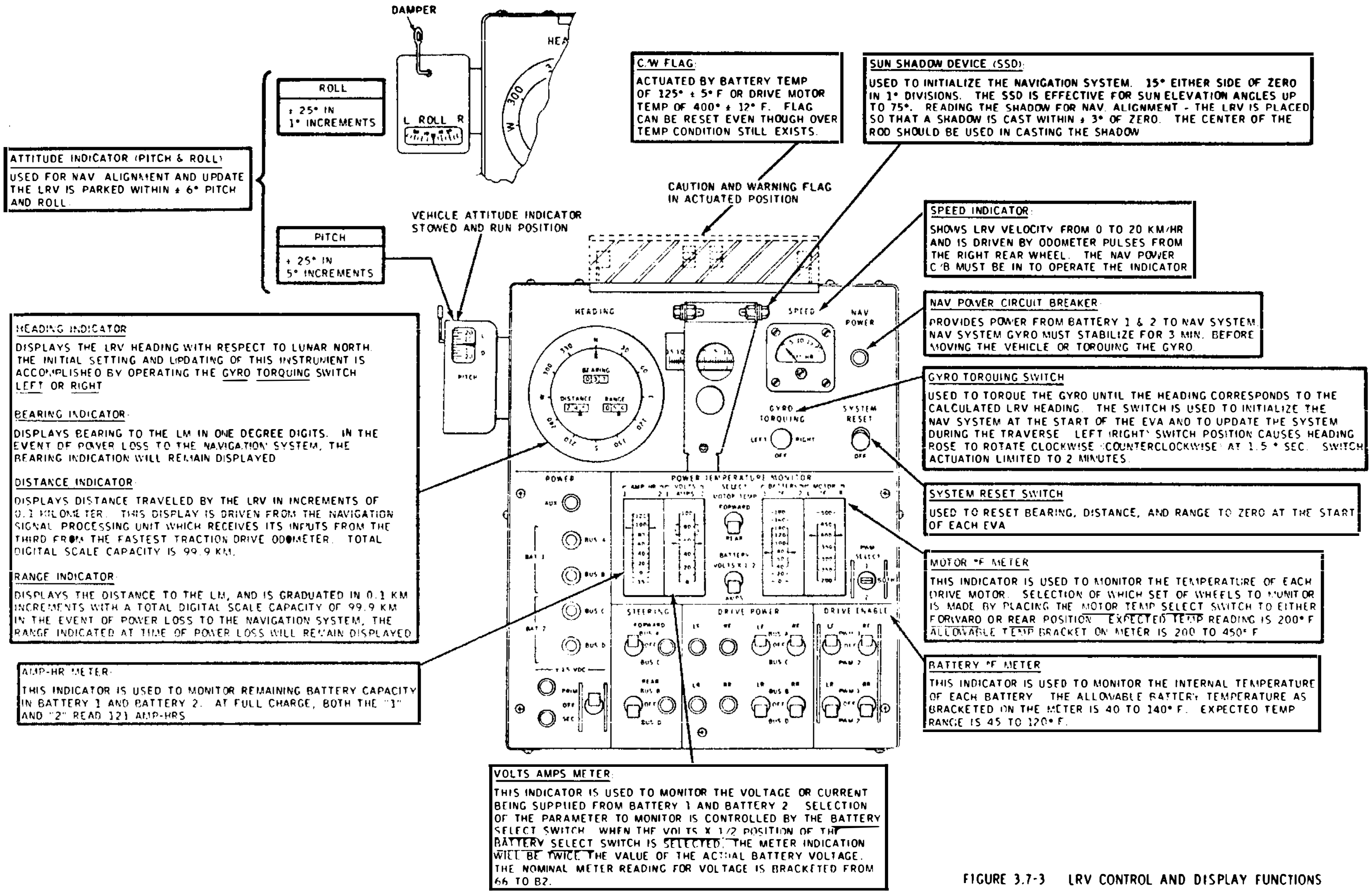


FIGURE 3.7-3 LRV CONTROL AND DISPLAY FUNCTIONS

TABLE 3.7-1 LRV OPERATIONAL FUNCTIONS

EVA 1	EVA TIME	FUNCTION	PROCEDURE
	0+30	Deploy and set-up	Table 3.7-2
	0+42	LRV Power-up	Table 3.7-3.A
	1+12	Navigation Alignment	Table 3.7-4
	-	Geology/Science Sites	
		A) Nominal	Table 3.7-5.A
		B) Nav update	Table 3.7-5.B
	5+55	LRV close-out	Table 3.7-5.A
EVA 2			
	0+	LRV power-up	Table 3.7-3.B
	0+45	Navigation Alignment	Table 3.7-4
	-	Geology/Science Sites	
		A) Nominal	Table 3.7-5.A
		B) Nav Update	Table 3.7-5.B
	6+20	LRV close-out	Table 3.7-6.B
EVA 3			
	0+38	Navigation Alignment	Table 3.7-4
	-	Geology/Science Sites	
		A) Nominal	Table 3.7-5.A
		B) Nav Update	Table 3.7-5.B
	5+15	LRV close-out	Table 3.7-6.C

TABLE 3.7-2

LRV OFF-LOAD FROM LM AND LRV SET-UP

1. Release LRV insulation blanket

2. Inspect right and left lower support arm latches to verify indicator marks aligned.

3. Release left hand deployment tape stowed in nylon bag attached to lower left support arm by velcro tapes.

4. Stow left hand deployment tape by draping it over a LM landing strut for convenient future access.

5. Release deployment cable from teflon clips on left side of LRV center chassis and deploy cable to maximum length and at 45° angle from Quad I toward ladder.

6. Release right hand deployment tape stowed in nylon bag attached to lower right support arm by velcro tape. Hold tape and move away from LRV deployment area.

7. Ascend LM ladder and pull LRV deployment D-handle. Verify LRV moves outward from LM about 4 degrees.

8. Descend LM ladder. Grasp deployment cable, monitor deployment activity and maintain tension on deployment cable.

9. Pull right hand deployment tape. Verify LRV rotates outward from LM.

10. Continue to pull right hand tape. When the tape marks appear (the vehicle is outboard at about 45 degrees) verify that:

    (a) Aft chassis unfolds and locks in position.
    (b) Rear wheels unfold and tethered rear wheel struts fall free.
    (c) Forward chassis is released from console post and returns to 35 degree position.

11. Continue to pull right hand tape. Verify that:

    (a) Center/aft chassis rotates until rear wheels contact lunar surface.
    (b) Rear wheels slide on surface permitting center/aft chassis to move away from LM.

    NOTE: If wheels fail to slide, deployment cable may be pulled to permit center/aft chassis to move away from LM.

12. Continue to pull right hand tape. Verify that:

    (a) Rear wheels are on the surface.
    (b) Forward chassis continues to unfold and locks in position.
    (c) Forward wheels unfold.

13. Release right hand tape and at chassis RR grasp outer braked reel cable and remove cable pin and discard cable and pin outside work area.

14. At chassis LR grasp outer braked reel cable and remove cable pin and discard cable and pin outside work area.

15. Pull left hand tape. Verify that forward chassis lowers until all wheels contact lunar surface and support vehicle weight and 45° cable is slack.

    NOTE: If wheels fail to slide, deployment cable may be pulled to move LRV away from LM.

16. Coil deployment cable and remove cable release pin and chassis delatch fitting pin. Discard cable and deployment hardware outside of work area.

17. Erect LRV geology pallet mounting post.

18. Deploy rear fender extension (right and left)

19. Check rear hinge pins engaged (right and left)

20. Check rear steering decouple ring sealed (right)

21. Erect seats (right and left)

22. Attach seat support leg velcro strap to outboard handhold (right and left)

23. Lower arm rest (right)

24. Release inboard handhold tiedown (left)

25. Pull console "T" handle and rotate 90°; lower console while raising inboard handhold (right and left)

26. Lock console/handhold inplace, T handle 90°, velcro T handle strap (right and left)

27. Remove tripod and stow toehold (wheel decouple tool) (right and left)

28. Release velcro tiedowns and erect footrest (right and left)

29. Check front hinge pins engaged (right and left)

30. Deploy front fender extension (right and left)

31. Verify battery covers closed (right and left)

32. Pull saddle release cable verify telescoping rods fall free (left)

33. Pull attitude indicator and C&W pins and discard. (left)

TABLE 3.7-3.A

POWER-UP (EVA 1)

1. Check hand controller operation.
2. Set parking brake and Verify Reverse INHIBIT Switch - DOWN.
3. BUS A, BUS B, BUS C, BUS D Circuit Breakers - Close.
4. $\pm$ 15 VDC PRIM and SEC Circuit Breakers - Close.
5. STEERING FORWARD AND REAR Circuit Breakers - Close.
6. DRIVE POWER LF, RF, LR, RR Circuit Breakers - Close.
7. Report BAT 1 and BAT 2 AMPS indications.
8. BATTERY Switch - VOLTS x 1/2.
9. Report BAT 1 and BAT 2 VOLTS indications.
10. BATTERY Switch - AMPS.
11. Report BAT 1 and BAT 2 temp (°F) indications.
12. Report BAT 1 and BAT 2 AMP-HR indications.
13. PWM SELECT Switch - BOTH.
14. DRIVE ENABLE LF and RF Switches - PWM 1.
15. DRIVE ENABLE LR and RR Switches - PWM 2.

16. $\pm$ 15 VDC Switch - SEC.

17. STEERING FORWARD Switch - BUS A.

18. STEERING REAR Switch - BUS D.

CAUTION

> The hand controller should be in park brake position and the drive enable switches must be set to an active PWM prior to setting any drive power switch to an energized bus. If the drive power switch is turned on and the corresponding drive enable switch is not selected to an active PWM, then full power will be applied to the corresponding drive motor when the hand controller is released from brake position. Should this condition occur, the hand controller should be immediately returned to park brake position.

19. DRIVE POWER LF AND RF Switches - BUS A.

20. DRIVE POWER LR AND RR Switches - BUS D.

21. Release parking brake and Place Reverse INHIBIT Switch - UP position.

    NOTE: The LRV driver may now back away from LM. LRV driver should request other crewman to direct and monitor any backing operations from an off-vehicle position.

22. Stop LRV and set parking brake. Reset Reverse INHIBIT Switch (push switch DOWN).

23. Release parking brake and drive to MESA area for equipment loading.

TABLE 3.7-3.B

POWER-UP (EVA 2&3)

1. Check hand controller set parking brake and Verify Reverse INHIBIT Switch - DOWN.
2. BUS A, BUS B, BUS C, BUS D Circuit Breakers - Close.
3. Report BAT 1 and BAT 2 AMP-HR indications.
4. Report BAT 1 and BAT 2 VOLTS indications.
5. Report BAT 1 and BAT 2 AMPS indications.
6. Report BAT 1 and BAT 2 temp (°F) indications.
7. Verify PWM SELECT Switch - BOTH.
8. Verify DRIVE ENABLE LF and RF Switches - PWM 1.
9. Verify DRIVE ENABLE LR and RR Switches - PWM 2.
10. $\pm$ 15 VDC Switch - PRIM
11. STEERING FORWARD Switch - BUS A.
12. STEERING REAR Switch - BUS D.
13. DRIVE POWER LF AND RF Switches - BUS A.
14. DRIVE POWER LR AND RR Switches - BUS D.
15. Release parking brake and Drive to nav alignment site.

TABLE 3.7-4
NAVIGATION ALIGNMENT

1. Drive LRV to area level within $\pm$ 6° of zero for pitch and roll.

2. Deploy Sun Shadow Device (SSD)

3. Park heading down sun within $\pm$ 3° SSD.

   Hand controller to parking brake position
   Power down switches

4. NAV power CB - CLOSE

   NOTE: Do not torque gyro or move LRV for 3 minutes.

5. Report SSD, pitch and roll readings

6. Stow SSD and attitude indicator

7. Move SYSTEM RESET switch momentarily to RESET and return to OFF position.

8. Verify bearing, distance & range indicators zero.

9. Operate GYRO TORQUING switch to LEFT or RIGHT position to correct HEADING indicator as required.

10. Power-up LRV

TABLE 3.7-5.A
GEOLOGY/SCIENCE SITE NOMINAL

1. Stop LRV and set hand controller in parking brake position; Neutral throttle, reverse inhibit switch - down

2. Power down as follows:

   (a) DRIVE POWER Switches (4) - OFF.
   (b) STEERING Switches (2) - OFF.
   (c) $\pm$ 15 VDC Switch - OFF.

3. Report LRV readings in the following ORDER:

   (a) Heading
   (b) Bearing
   (c) Distance
   (d) Range
   (e) Amp-Hr Batt 1
   (f) Amp-Hr Batt 2
   (g) Temp Batt 1
   (h) Temp Batt 2
   (i) Temp LF motor
   (j) Temp RF motor
   (k) Temp LR motor
   (l) Temp RR motor

4. Align HGA.

5. LCRU mode switch:

   a) TV RMT (near the LM) or,
   b) FM/TV (on the traverse)

6. Perform science requirements
7. Return to LRV
8. Stow Gnomon
9. LCRU mode switch to PM1/WB
10. Stow HGA
11. Mount LRV and fasten seat belt
12. Verify handcontroller in parking brake position and reverse inhibit switch down.
13. $\pm$ 15 VDC switch - PRIM
14. STEERING FORWARD Switch - BUS A
15. STEERING REAR switch - BUS D
16. DRIVE POWER LF and RF switches - BUS A
17. DRIVE POWER LR and RR switches - BUS D
18. Release parking brake.

TABLE 3.7-5.B
GEOLOGY/SCIENCE SITE-NAV UPDATE

1. Drive to area level within ± 6° of zero for pitch and roll.

2. Deploy SSD and head down sun within ± 3° SSD.

3. Stop LRV and set hand controller in parking brake position. Reverse inhibit switch - down.

4. Report SSD, pitch and roll readings.

5. Stow SSD and attitude indicator

6. Power down as follows:

   (a) DRIVE POWER Switches (4) - OFF.
   (b) STEERING Switches (2) - OFF.
   (c) ± 15 VDC Switch - OFF.

7. Report LRV readings in the following ORDER:

   (a) Heading
   (b) Bearing
   (c) Distance
   (d) Range
   (e) Amp-Hr Batt 1
   (f) Amp-Hr Batt 2
   (g) Temp Batt 1
   (h) Temp Batt 2
   (i) Temp LF motor
   (j) Temp RF motor
   (k) Temp LR motor
   (l) Temp RR motor

8. Align HGA.

9. LCRU mode Switch:

   (a) TV RMT (near the LM)
   (b) FM/TV (on the traverse)

10. Perform stop science requirements

11. Return to LRV

12. Stow Gnomon

13. LCRU mode switch to PM1/WB

14. Stow HGA

15. Mount LRV and fasten seat belt

16. Verify handcontroller in parking brake position and reverse inhibit switch down.

17. Report heading and Torque Gyro to Houston update as required.

18. $\pm$ 15 VDC switch - PRIM

19. Steering forward switch - BUS A

20. Steering REAR switch - BUS D

21. Drive power LF and RF switches - BUS A

22. Drive power LR and RR switches - BUS D

23. Release parking brake.

TABLE 3.7-6.A

EVA 1 Closeout

1. Position LRV near MESA - Cross sun, Heading NORTH, set parking brake and verify REVERSE INHIBIT switch - DOWN.

2. DRIVE POWER LF, RF, LR & RR switches - OFF

3. STEERING FORWARD and REAR switches - OFF

4. $\pm$ 15 VDC switch - OFF

5. BUS A, BUS B, BUS C & BUS D CB's - OPEN

6. Report LRV readings in following order:

   (a) AMP-Hr Batt 1
   (b) Amp-Hr Batt 2
   (c) Temp Batt 1
   (d) Temp Batt 2
   (e) Temp LF motor
   (f) Temp RF motor
   (g) Temp LR motor
   (h) Temp RR motor

7. Egress LRV align Hi-gain Ant

8. LCRU mode sw - TV RMT

9. LRV battery covers - OPEN

10. Prior to LM ingress
   (a) LCRU power switch - OFF
   (b) LCRU thermal blanket - place large (65%) blanket over mirrors.

TABLE 3.7-6.B

EVA 2 Closeout

1. Position LRV near MESA - Cross sun, Heading NORTH, set parking brake and verify REVERSE INHIBIT switch - DOWN.

2. Report BEARING, DISTANCE and RANGE.

3. DRIVE POWER LF, RF, LR & RR switches - OFF

4. STEERING FORWARD and REAR switches - OFF

5. ± 15 VDC switch - OFF

6. NAV POWER circuit breaker - OPEN

7. BUS A, BUS B, BUS C & BUS D CB's - OPEN

8. Report LRV readings in following order
   (a) Amp-Hr Batt 1
   (b) Amp-Hr Batt 2
   (c) Temp Batt 1
   (d) Temp Batt 2
   (e) Temp LF motor
   (f) Temp RF motor
   (g) Temp LR motor
   (h) Temp RR motor

9. Egress LRV align Hi-gain Ant

10. LCRU mode sw - TV RMT

11. LRV battery covers - OPEN

12. Prior to LM ingress
   (a) LCRU power switch - OFF
   (b) LCRU thermal blanket - Place small (35%) blanket over mirrors.

TABLE 3.7-6.C

EVA 3 Closeout

1. Position LRV near MESA - Set parking brake and verify REVERSE INHIBIT switch - DOWN.

2. Report BEARING, DISTANCE and RANGE

3. DRIVE POWER LF, RF, LR & RR switches - OFF

4. STEERING FORWARD and REAR switches - OFF

5. $\pm$ 15 VDC switch - OFF

6. Report LRV readings in following order:
   (a) Amp-Hr Batt 1
   (b) Amp-Hr Batt 2
   (c) Temp Batt 1
   (d) Temp Batt 2
   (e) Temp LF motor
   (f) Temp RF motor
   (g) Temp LR motor
   (h) Temp RR motor

7. Egress LRV and align Hi-gain Ant

8. LCRU mode switch - TV RMT

   NOTE: Off-load equipment and then drive to final LRV parking site.

9. Stow Hi-gain Ant and LCRU mode switch - PM1/WB.

10. Ingress LRV verify parking brake, reverse inhibit switch - DOWN.

11. $\pm$ 15 VDC switch - PRIM

12. Steering FORWARD switch - BUS A.

13. Steering REAR switch - BUS D.

14. Drive Power LF & RF switches - BUS A

15. Drive power LR & RR switches - BUS D.

16. NAV RESET switch to RESET momentarily then to - OFF.

17. Verify BEARING, DISTANCE and RANGE - ZERO.

18. Drive on a HEADING of 096° until the DISTANCE indicator reads 0.1 km; BEARING indicator should read 276°. Turn left to a HEADING of 255° and stop at outbound tracks.

19. Set parking brake.

20. Drive power LF, RF, LR & RR switches - OFF.

21. Steering FORWARD and REAR switches - OFF.

22. $\pm$ 15 VDC switch - OFF.

23. NAV POWER CB - OPEN.

24. BUS B and BUS D CB's - OPEN

25. AUX power CB - CLOSED.

26. Egress LRV align Hi-gain Ant and LCRU mode switch - TV RMT.

27. LRV battery covers - OPEN.

3.7.3 Performance and Constraints

The purpose of this section is to provide LRV performance, constraints and operating limitations which are of general interest.

Detailed performance and constraint characteristics may be found in the LRV Operations Handbook, Appendix A.

Velocity, steering and braking capabilities and limitations are shown in figures 3.7.3-1, 3.7.3-2 and 3.7.3-3, respectively.

Slopes, positive or negative, significantly effect the LRV characterictic. An observation that can be made from these figures is that increasing slopes decrease speed, improve steering and dynamic stability, and stopping distance as compared to a 0° slope. Figure 3.7.3-4 is intended to further refine the data provided in figure 3.7.3-3 to include the effects of various hand controller braking positions on stopping distance vs slopes for 8 km/hour.

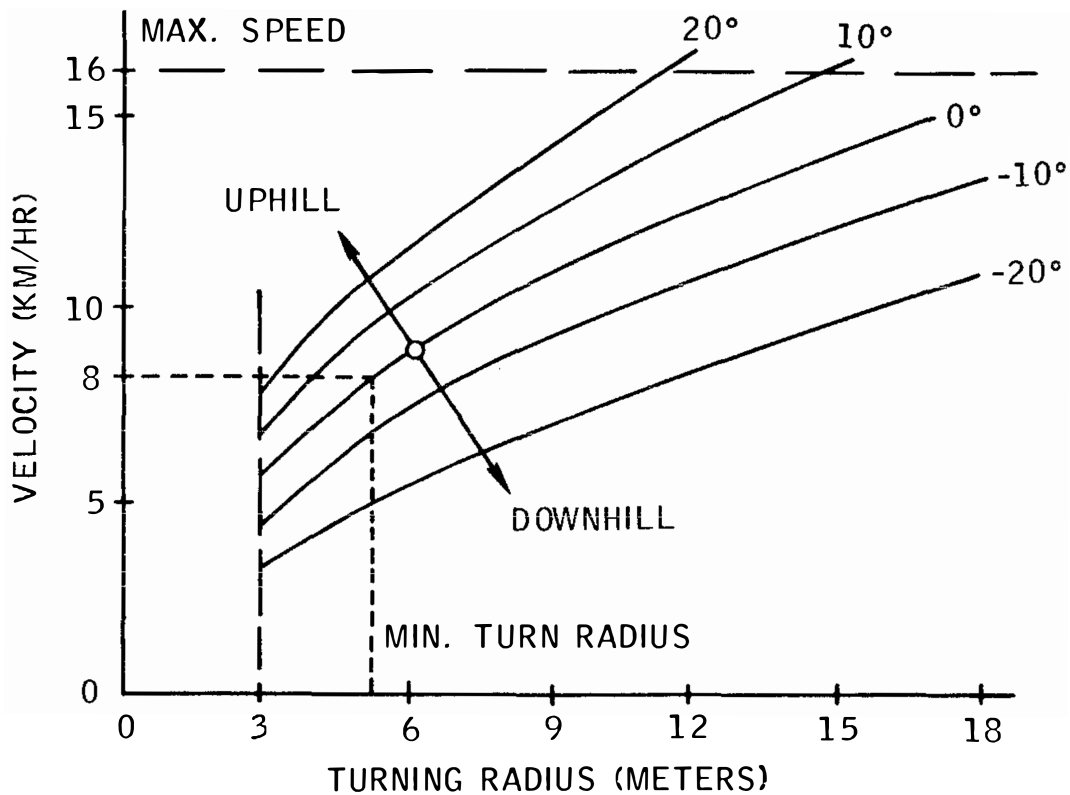
Table 3.7.3-1 is compendium of LRV operating limits, constraints, and requirements of crew operation. These are generally presented without comment.

FIGURE 3.7.3-1 APOLLO 15 LRV VELOCITY CONSTRAINTS (KM/HR)

CONSTRAINTS	SLOPE	SMOOTH MARE	ROUGH MARE	HUMMOCKY UPLAND	ROUGH UPLAND
SPEED CAPABILITY TORQUE LIMITED	0°	9.2	8.6	9.05	8.6
	5°	7.6	7.3	7.6	7.2
	10°	5.8	5.5	5.8	5.6
SUSPENSION LIMIT LOADS		>16	8.5	>16	8
		12" BUMP @ 14 KM/HR →			
WHEEL FATIGUE LOADS		13	8.5	8	7
CONTROLLABILITY 13° SIDE SLIP ANGLE		6 M TURN @ 5.5 KM/HR →			
		12 M @ 10 KM/HR →			

NOTE: MIDRANGE P.S.D.
1.5 FACTOR OF SAFETY ON SUSPENSION LOAD
1.65 LIFT FACTOR ON FATIGUE
AVERAGE SLOPE J-1 2 DEGREES

FIGURE 3.7.3-2 DYNAMIC STABILITY - STEERING STABILITY



COEFFICIENT OF FRICTION: $\mu = 0.6$

EXAMPLE: ON LEVEL GROUND AT 8 KM/HR, SLIDING BEGINS AT A TURN RADIUS OF 5.2 METERS.

FIGURE 3.7.3-3 STOPPING DISTANCE VERSUS INITIAL VELOCITY FOR VARIOUS SLOPES

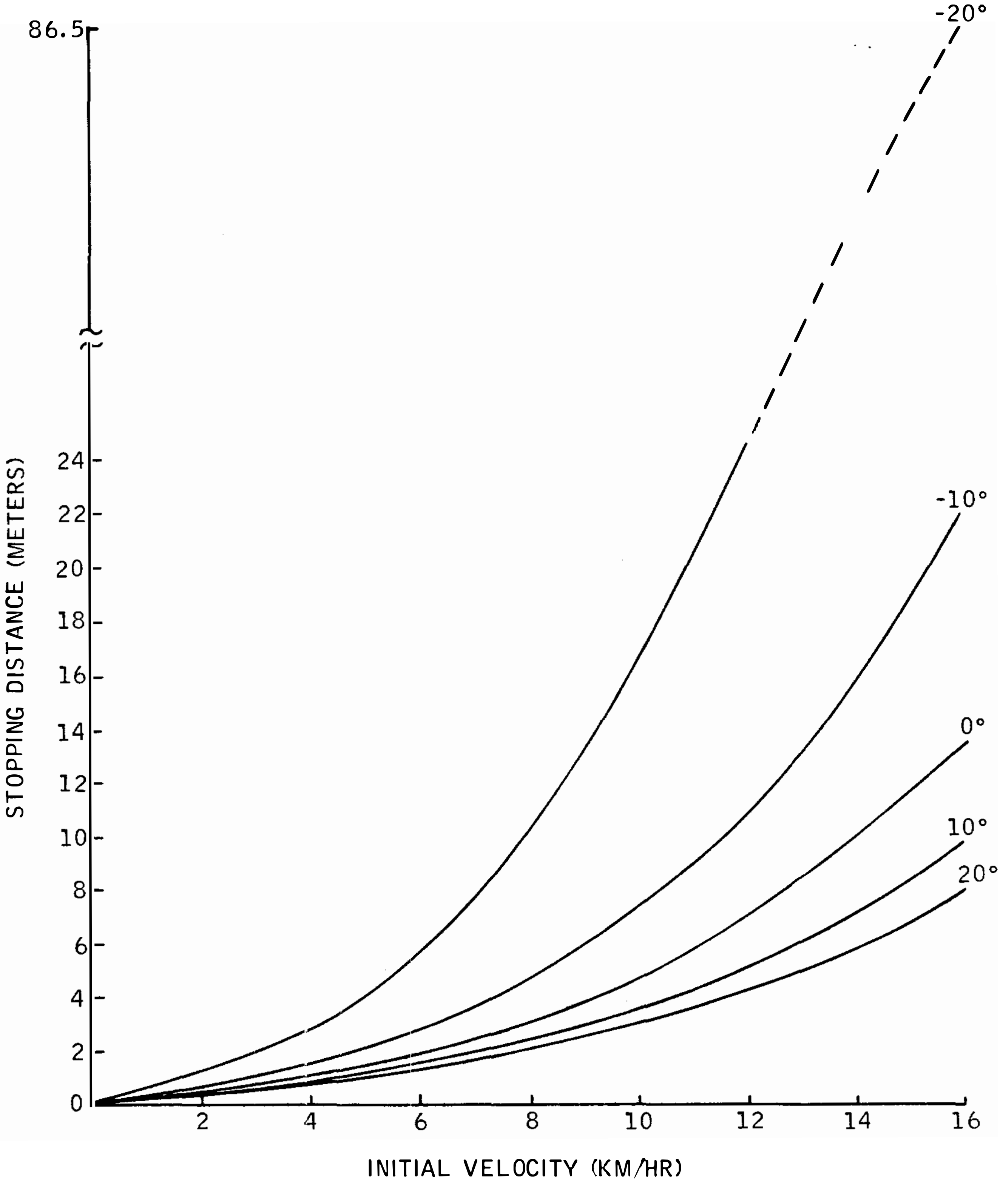


FIGURE 3.7.3-4 LRV STOPPING DISTANCE VS. HANDCONTROLLER PULL FORCE FOR 8 KM/HR

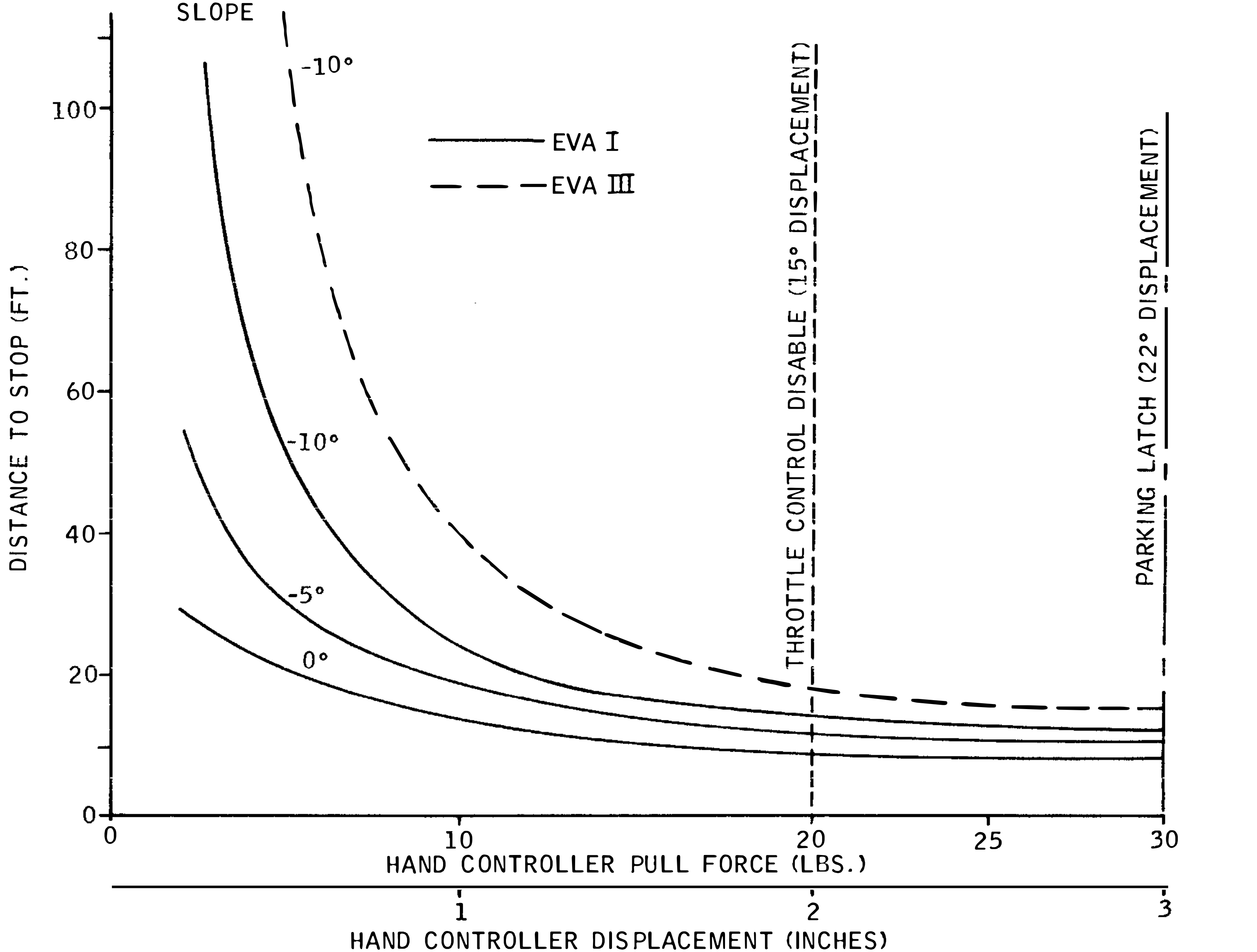


Table 3.7.3-1 LRV Operating Limits, Constraints & Requirements

1. The LRV velocity should not exceed 5 km/hour while traversing to the ALSEP site with the LR^3 on the LMP seat.

2. The NAV power circuit breaker must be closed for at least 1-1/2 minutes before torquing the gyro or repositioning the LRV.

3. The navigation system gyro must not be torqued continuously for more than two (2) minutes.

   NOTE: Since the heading indicator torques at a rate of 1.5°/sec the heading could be torqued 180° in 2 minutes.

4. To minimize heading errors for navigation system initial alignment and updates, the LRV should be parked such that the pitch and roll is within ± 6° of zero, (roll being the most critical) and the Sun Shadow Devices (SSD) within ± 3°.

5. The attitude indicator and the SSD should be read to MCC within the tolerances noted below to minimize heading errors:
   Pitch within 2 1/2°, Roll within 1° and SSD within 1°.
   Further the shadow cast on the SSD scale should be read from the center of the rod.

6. Park the LRV cross sun heading North between EVA's in the sun light

7. Open the LRV battery covers at the end of each EVA.

8. The LCRU thermal blankets will be open (i.e. % of mirror showing) as per the following schedule:

   (a) EVA 1, EVA 2 & EVA 3 - 100%
   (b) Between EVA's 1&2 - 35%
   (c) Between EVA's 2&3 - 65%
   (d) Subsequent to EVA 3 - 100%

9. The LRV shall be parked at the conclusion of EVA 3 as per the following parameters:
   (a) Distance 300 ft + 25 ft
   (b) LRV to LM bearing 276°
   (c) LRV heading 255°

10. Caution: While driving, an open operating corridor shall be maintained on either side of the LRV. For a velocity of
hr the driving corridor should be 17 feet. Possible co
guard against steering failures.

11. Caution: The drive enable switches must be set to an <u>active</u> PWM prior to setting any drive power switch to an energized bus. If the drive power switch is turned on and the corresponding drive enable switch is not selected to an active PWM, then full power will be applied to the corresponding drive motor when the hand controller is released from brake position.

12. Warning: The EMU should not brush against the LRV wire wheels at any time. This constraint is to protect the man and the suit not the LRV. Possible condition: Wire breakage on wheel.

13. Warning: The gloved hand is not to be used to decouple or recouple a traction drive unit. The decouple tool is specifically provided for this operation. Possible condition: Overtemp drive unit.

3.7.4 Decals and Checklists

The LRV Operations Decal which is located on the console immediately ahead of the LRV handcontroller is shown in figure 3.7-3.5. The LRV/LCRU Malfunction Procedures Checklist shown in figure 3.7-3.6 is included as part of the onboard Flight Data File and is stowed in the LRV mapholder.

POWER UP

HAND CONTROLLER
BRAKE - ON, REV - DOWN
CB: ALL CLOSED
(EX. AUX + NAV)
HOU:AMP HR, AMPS,
VOLTS, TEMPS
PWM SELECT - BOTH
DRIVE ENBL:
FWD - PWM 1
AFT -PWM 2
+15VDC - SEC
STEER: FWD - BUS A
AFT - BUS D
DRIVE PWR:
FWD - BUS A
AFT - BUS D
BRAKE - RELEASE
REVERSE - UP
BACK CLEAR OF LM
BRAKE - ON, REV - DOWN

STOP

BRAKE - ON, REV - DOWN
DRIVE PWR (4) - OFF
STEERING (2) - OFF
+15 VDC - OFF
HOU: NAV, AMP HR, TEMPS
LCRU: LM - TV RMT
TRAV - FM/TV

NAV ALIGN

STOP 3° SSD, 6° R&P
CB: NAV - CLOSE (3 MIN)
SYS RSET - RSET
BRNG, DIST, RNG - ZERO
SYS RSET - OFF
ROLL, PITCH, SSD, HDNG
GYRO TORQ TO HOU UPDATE
SSD - STOW

START

*GNOMON*GNOMON*
LCRU - PM1/WB
+15 VDC - PRIM
STEER: FWD - BUS A
AFT - BUS D
DRIVE PWR:
FWD - BUS A
AFT - BUS D

CLOSEOUT

STOP AT NAV SITE
HOU: BEARING, DIST, RNG
STOP AT LM, HEAD NORTH
CB: NAV - OPEN
BUS A, B, C, D - OPEN
HOU: LCRU COVERS
LCRU POWER - OFF
BATT COVERS OPEN
EVA 3 - CB: AUX, BUS A,
BUS C - CLOSED
LCRU - EXT PWR, TV RMT

Figure 3.7-3.5 LRV Operations Decal

Figure 3.7-3.6 LRV/LCRU Malfunction Procedures Checklist

LRV:

AMPS NOT BALANCED

1. DRIVE POWER Sw (4) - OFF (individually)	Drive Motor Short
	DRIVE POWER - OFF DRIVE ENABLE - OFF
2. DRIVE ENABLE Sw (4) - PWM 1	PWM 2 Failure
	PWM SELECT Sw - PWM 1
3. DRIVE ENABLE Sw (4) - PWM 2	PWM 1 Failure
	PWM SELECT Sw - PWM 2
4. DRIVE POWER Sw (4) - alt. pos.	Drive Motor Power Circuit Open For One Bus
5. DRIVE POWER Sw (4) - OFF (individually) Isolate motor not drawing current	Open Circuit in Motor Not Drawing Current
	DRIVE POWER - OFF DRIVE ENABLE - OFF
6. Monitor AH meter. Reconfig. to load share as required	Cause Not Determined

LOSS OF DRIVE FROM ALL WHEELS

1. $\pm$15 VDC Sw - alt. pos.	$\pm$15 VDC Circuitry
2. Set Parking Brake DRIVE ENABLE Sw (4) - PWM 2 PWM SELECT Sw - PWM 2 $\pm$15 VDC CB (2) - close	PWM 1 Shorted
3. Set Parking Brake DRIVE ENABLE Sw (4) - PWM 1 PWM SELECT Sw - PWM 1 $\pm$15 VDC CB (2) - close	PWM 2 Shorted
4. DRIVE POWER Sw (4) - OFF (individually) $\pm$15 VDC CB (2) - close	DCE Shorted
5. STEERING POWER Sw (2) - OFF (individually) $\pm$15 VDC CB (2) - close	Steering Shorted

Figure 3.7-3.6 (Cont'd)

LOSS OF VOICE COMM with MSFN (LCRU)

LCRU:

LGA: AGC <2

MODE - FM/TV (HGA) → LGA or Rcvr 1
CB LRV AUX - Close
POWER - EXT → 16.8V Batt Power

AGC >2 & POWER >1

MODE-PM1/NB (LGA) → Downlink Sig Proc

MODE-FM/TV (HGA) → S-B Xmtr or Rcvr 1 Audio

Traverse Mode: Swap Ant Connectors
MODE-PM2/NB (LGA)

AGC >2 & POWER <1

CB LCRU - CLOSE → 28V Overload

If CB opens: MODE-FM/TV (HGA)
CB LCRU - Close → S-Band Xmtr Short

Traverse Mode: Swap Ant Connectors
MODE-PM2/NB (LGA)

CB LRV AUX - Close
POWER - EXT → 28V Batt Power

HGA: AGC <2.5

MODE-PM1/WB (LGA) → HGA or Rcvr 2
CB LRV AUX - Close
POWER - EXT → 16.8V Batt Power

AGC >2.5 & POWER >1

MODE - PM2/NB (HGA) → Downlink Sig Proc

MODE - PM1/WB (LGA) → S-B Xmtr or Rcvr 2 Audio

AGC >2.5 & POWER <1

CB LCRU - Close → 28V Overload

If CB Opens: MODE - PM1/WB(LGA)
CB LCRU - Close → S-Band Xmtr Short
CB LRV AUX - Close
POWER - EXT → 28V Batt Power

SECTION 4.0

CONTINGENT PLANS

4.0 CONTINGENT PLANS

4.0 CONTINGENT PLANS

4.1 General Description

In lunar manned operations, it is expected that the EVA timeline will vary a small amount due to the new environment as well as small changes that occur in equipment operation. If the activity timeline or equipment operation changes sufficiently that the flexibility of the timeline or equipment cannot compensate to accomplish the planned activities, a contingency plan must be used to continue the EVA.

This section is devoted to pre-mission variations in EVA timeline and contingency EVA planning. The procedures to resolve unexpected equipment operation or malfunction are found in detail in the contingency procedures in Reference 7.

Since it is not possible nor feasible to define specific plans to cover every possible contingency, pre-mission defined timeline guides will be utilized for realtime resolution of problems and timeline changes are a result of these problems. There are, however, certain contingency situations that could occur which would not allow sufficient time for efficient revision of the EVA timeline plan. It is for this category of contingency that the following pre-planned timelines are included in this section: Two Man EVA-1,2,3 Walking Traverses (inoperable LRV); One Man EVA-1,2,3 (operable LRV); Minimum Time EVA. These plans, if utilized in conjunction with the off-nominal EVA planning data included in section 4.3, will permit efficient realtime modification of the nominal EVA plan in the event a contingency situation develops.

The requirement for a walking traverse occurs when the LRV cannot be deployed from the LM or becomes inoperative after deployment. Preplanning for this contingency is necessary because it represents a significant impact to the nominal timeline plan. The primary objective of conducting a geology traverse to the Front remains. However, because of the distances involved and the greater time required for crewman to walk the distance, there is insufficient time for the Front traverse and ALSEP deployment during the first EVA, the ALSEP deployment will be deferred until EVA-2.

In a One-Man EVA-1 with an operational LRV, the primary objective, again, is to conduct a geology traverse to the Front with the result that the ALSEP deployment is deferred until EVA-2 because of insufficient time for one crewman to accomplish both tasks during a single EVA.

4.1.1 EVA-1 Two Man Walking Traverse

The maximum impact to the EVA-1 timeline plan occurs if insurmountable problems are encountered during LRV deployment and initial test driving of the LRV. Assuming a 30 minute troubleshooting period is unsuccessful, the remainder of the EVA is modified to reflect loss of the LRV.

The EVA-1 surface activities for the first 30 minutes are nominal with the CDR and the LMP performing the egress functions, MESA and TV deployment, ETB transfer and collection of the contingency sample. Both crewmen then begin to deploy the LRV. (For the purpose of this plan it will be assumed that a LRV malfunction occurs in the latter stages of the LRV post-deployment checklist and test drive at approximately 45 minutes into the timeline.) After troubleshooting the LRV with engineering assistance from MCC-Hou, the LRV is abandoned.

The CDR proceeds to the Quad III area, opens the thermal blanket and offloads the geology pallet to the +Y footpad. After removing the upper handrail he then removes the HTC from the geology pallet, deploys the legs and places it on the surface in a position convenient for use as interim stowage for tools and equipment. He then removes SCB #2 and #3 from the geology pallet and attaches them to the HTC.

The LMP meanwhile has unstowed the EVA-1 pallet from the MESA and placed the LM ECS LiOH can into the pallet pocket. He then climbs the ladder to the LM porch, retrieves the CSRC and ingresses the LM. After stowing the CSRC the CDR assists the LMP in transferring the EVA-1 pallet into the cabin. The LMP offloads the pallet equipment then egresses the cabin bringing the empty pallet which is subsequently discarded under the LM. After closing the hatch the LMP descends again to the surface.

While the LMP completes his cabin activity the CDR unstows and opens SRC #1. He then removes 70mm magazines KK and OO from the ETB and places them in SCB #3. The CDR's 70mm camera is unstowed from the MESA and magazine NN from the ETB is installed.

Both crewmen assist in configuring the PLSS tool carriers for the walking traverse. The hammer, tongs, extension handle, scoop and core tube tool removed from the HTC and geology pallet and attached to the EMU. SCB #2 is placed on the right side of the LMP's PLSS and SCB #3 is attached to the left side. The core tube cap dispenser is removed from SCB #1 and attached to the PLSS tool carrier. The 20-DSBD's are removed from SCB #1 and attached to the camera brackets. SCB #1 is attached to the left side of the CDR's PLSS and SCB #4 is removed from the geology pallet and attached to the right side. The BSLSS is removed from the ETB and attached to the back of the CDR's PLSS and the LCRU with the LGA is attached to the back of the LMP's PLSS. Following a preliminary checkout of the LCRU, the crewmen don the 70mm camera, retrieve and deploy the gnomon and depart on the geology traverse to the Front. The EVA-1 traverse is shown in Figures 4.3-1, 413-2a&b, and 4.3-3a&b. The EVA-1 geology station activities are shown in tabular form in Table 4.3-1 for the walking traverse. Table 4.3-4 is a summary timetable for the walking traverse and station activities.

Upon completion of the traverse and return to the LM, the crewmen offload the SCB's, tools, LCRU and BSLSS from the LMP's and CDR's EMU/PLSS and interim stow them in appropriate locations on the MESA and HTC. The CDR will then retrieve the polarizing filter from the MESA stowage location, select an appropriate site for the experiment and performs the far and near polarimetric photography experiment.

The LMP meanwhile will deploy the SWE and perform the LM Site Photography, taking panoramas at 4,8 and 12 o'clock as well as other areas of interest around the DPS engine and footpads.

Both crewmen then unstow the Flag and deploy it within view of the TV camera. After documenting the Flag deployment the crew then begin the EVA closeout activities.

SCB #1 is filled and placed into SRC #1. Core tubes from SCB #1 are stowed in SCB #4 and remaining samples from SCB #2 are stowed in the SCB #3 or #4. Spare 70mm magazines in SCB #3 are placed in the ETB, as are the 70mm cameras.

The LMP gets SCB #3, climbs the ladder and ingresses the LM. After transferring the SRC and ETB into the cabin, the CDR gets SCB #4 and climbs the ladder. After stowing the LEC on the porch and handing SCB #4 to the LMP, the CDR terminates the EVA by ingressing the cabin.

4.1.2 EVA-2 Two Man Walking Traverse

The second EVA period begins in a manner quite similar to the nominal EVA-2 in that the CDR egresses to the LM porch, discards the jettison bag, hands the LEC to the LMP and then descends to the lunar surface. After the EVA-2 pallet is unstowed from the MESA and a LiOH canister stowed in the pallet pocket, the LEC is attached and the pallet is transferred into the LM. The LMP then attaches the ETB to the LEC and the ETB is transferred to the surface where the CDR hangs it from the MESA table. Next the CDR unstows the ALSD and places it on the surface and then retrieves the 70mm camera from the ETB to photograph the LMP's egress.

The LMP, after stowing the equipment from the EVA-2 pallet, configures the LM cabin for surface operations and then moves through the hatch bringing the empty pallet which he discards into the Quad I area. He closes the hatch and descends to the lunar surface.

After pointing the TV camera to view the SEQ Bay area (Quad II), both crewmen begin the ALSEP offload operations as described in Section 3.1.2. The traverse to the ALSEP site remains unchanged except that instead of driving the LRV, the CDR carries the HTC and the ALSD while the LMP carries the ALSEP barbell. The LRRR remains in the Quad III stowage location until later in the EVA. Upon reaching the ALSEP site, the ALSD and HTC are placed in a position to deploy the Heat Flow Exp and the ALSEP is deployed as described also in Section 3.1.2 except that following Central Station activation the LMP returns to the LM to retrieve the LRRR and both 70mm cameras. With his camera mounted on the EMU, the LMP carries the LRRR and the CDR's camera to the ALSEP site. After leaving the CDR's camera on the HTC, the LMP deploys the LRRR and proceeds with the ALSEP photography.

After completing the deep core drilling, the CDR then collects documented samples from the ALSEP area until the LMP has completed his ALSEP photography.

Upon completing the ALSEP deployment, both crewmen return to the LM, bringing the HTC to reconfigure for the geology traverse.

The LMP opens the MESA blankets and removes two LCRU batteries, one of which will be wrapped in a piece of thermal blanket and stowed in the +Y footpad and the other will be installed in the LCRU. The LMP removes SCB #7 from the geology pallet and transfers equipment from SCB #5 which was removed from SRC #2 and placed on the HTC by the CDR. The equipment transferred to the SCB #7 is as follows: 3 core tubes, one core tube cap dispenser, one SESC, two 20-DSDB. SCB #7 is then stowed in the +Y footpad.

The CDR transfers the core stems and 2-20 DSBD's in SCB #2 into SRC #2 and then attaches SCB #2 to the LMP's PLSS tool harness. He also attaches SCB #6, the core tube cap dispenser, the hammer, the core tube tool and the LCRU to the LMP's PLSS tool harness and then sets the LCRU Select switch to PM1/WB. The LMP in turn attaches SCB #5 and the BSLSS to the CDR's PLSS tool harness. The spare 70mm mags are stowed in SCB #6 and the two 20-DSBD's in the SRC are attached to the 70mm cameras which are then mounted on the EMU. The tongs and extension handle/scoop are tethered and MESA blankets tidied. After retrieving the map from the ETB, the CDR and LMP depart on the geology traverse shown in Figures 4.3-1, 4.3-2a&b and 4.3-3a. The geology station activities are shown in tabular form in Table 4.3-2 for the walking traverse. Table 4.3-4 is a summary time-table for the walking traverse and station activities.

After completing the geology traverse the CDR and LMP return to the LM. The CDR switches the LCRU to OFF and removes it from the LMP's PLSS, placing it in the sun. SCB #5 and the BSLSS are removed from the CDR's PLSS and placed on the SRC. The CDR removes the hammer, core tube tool, core tube cap dispenser, SCB #2 and #6 from the LMP's PLSS, placing the tools on the HTC and the bags on the MESA. The BSLSS is stowed in the sun. Cameras are doffed and placed into the ETB after the 20-DSBD's are removed. The tongs and extension handle/scoop are untethered and stowed on the HTC.

The CDR then removes the six core stems (the deep core) from the SRC and places them in SCB #5 and after SCB #5 is filled with samples from the other collection bags, it is stowed in SRC #2 and the SRC is closed and sealed.

After the EMU's have been cleaned the LMP climbs the LM ladder carrying SCB #6 and ingresses the LM. After reconnecting the LEC, SRC #2 and the LEC are transferred into the cabin. The CDR then stows the LEC on the ladder hook, adjusts the LCRU thermal blankets, retrieves SCB #2 and climbs the LM ladder to the porch where he hands the SCB to the LMP and in turn receives the upper end of the LEC which he stows on the porch rail. The CDR then ingresses the cabin, terminating the EVA-2 activity.

4.1.3 EVA-3 Two Man Walking Traverse

The activities in the third contingency EVA period begin with the CDR's egress to the LM porch where he receives and discards a jettison bag and hands the LEC to the LMP. He then descends to the surface and the ETB is transferred down and attached to the MESA table. The CDR then retrieves the LCRU battery from the +Y footpad and installs it in the LCRU. The LMP, after configuring the LM cabin for surface activity, egresses and descends to the surface.

The CDR retrieves SCB #7 from the +Y footpad and attaches it to the HTC. The 2-20 DSBD's are removed from SCB #7 and placed on the MESA table. The core tube cap dispenser is also unstowed from SCB #7 and attached to the LMP's PLSS tool harness along with the hammer, core tube tool, SCB #8, BSLSS sample bag and the LCRU. The LMP then attaches SCB #7 and the BSLSS to the CDR's PLSS tool harness. The LCRU is switched on in the PM1/WB mode. Next the tongs and extension handle/scoop are tethered and the 20-DSBD's are attached to the cameras. After mounting the cameras on the EMU and getting the maps from the ETB, the CDR and LMP depart on the geology traverse. The EVA-3 geology traverse is shown in Figures 4.3-1, 4.3-2a&b, 4.3-3a&b. The EVA-3 station activities are shown in tabular form in Table 4.3-3 for the walking traverse. Table 4.3-4 is a summary timetable for the walking traverse and station activities. Upon completing the geology traverse, the crew returns to the LM for closeout activities.

The LMP removes the BSLSS and SCB #7 from the CDR's PLSS, attaches SCB #7 to the HTC and places the BSLSS on the MESA. The LCRU is removed from the LMP's PLSS and placed on the surface and the LMP then photographs the area under the descent engine prior to collecting the contaminated sample. Then, using the scoop/extension handle the contaminated sample is collected and placed into the SESC the CDR has opened and held for the LMP. The CDR then removes the SESC seal protectors and seals the SESC and places it in the ETB. After the LMP has completed the contingency sample area photographs, the BSLSS is removed from the CDR's PLSS and SCB #8 from the LMP's tool harness, both crewmen doff their PLSS tool harnesses. The LMP then retrieves the SWS foil, places it in the SWC bag and stows it in the ETB.

If time permits and the failed LRV is at the LM, the CDR unstows the TCU and mounts the TV camera on the TCU. The Y-cable for the LCRU/TCU is stripped from the LRV and attached to the TCU. He then unstows and assembles the HGA and carries the TCU/TV and the HGA to the LM launch observation site approximately 300 feet East of the LM on a heading of 096°. The LMP, after completing the SWC task, carries the LCRU to the observation site. The HGA and TCU staffs are implanted in the surface (using rocks for support if required) and the GCTA system is interconnected. The HGA is aimed toward earth and the TCU is oriented and leveled as much as possible. The LCRU is switched to internal power and the TV RMT mode is selected. The LMP photographs the GCTA installation after the LCRU covers have been adjusted and the crew returns to the LM.

The LMP removes his 70mm, stows it in the ETB and then retrieves the dust brush to clean the EMU's. The LMP then climbs the LM ladder carrying the BSLSS sample bag and ingresses the LM. After the LEC is attached to the handhold and to SCB #7, SCB #7 is transferred into the LM. Next the ETB is attached to the LEC and transferred into the LM.

The LMP then activates the LM tracking light and the CDR verifies the light is operating. The CDR makes a final check of the area, then climbs the ladder carrying SCB #8 which he hands to the LMP. After receiving and discarding the LEC the CDR ingresses the cabin to terminate the EVA-3 activity.

4.1.7 Contingency EVA - Minimum Time, One Man

During a lunar landing mission, many factors which influence the LM's lunar stay capability may allow only a very limited amount of time in which to perform any EVA activity. For this situation, only those lunar surface objectives having the highest priority and which can be accomplished in a short period of time without being contingent on a previous task are considered. Figure 4.1-_ is presented as a summary timeline for the Contingency EVA Minimum Time - One Man EVA and the tasks included are those which meet the above criteria. The highest priority task is that of documenting the character of the landing site by sampling and photographing the area. The area is sampled using the Contingency Sample Collection device and the characteristics of the landing site are obtained by verbal description and 70mm camera photography.

After egressing the cabin, the EVA crewman pauses at the top of the ladder to deploy the MESA. He then descends to the lunar surface and utilizes only the amount of time for environmental familiarization he feels is necessary to assure himself that he can proceed safely with the remaining EVA tasks. He will then proceed to transfer the ETB containing the CSRC and a magazine for the 70mm camera to the lunar surface. After attaching the ETB to the MESA he will unstow the CSRC, deploy the handle and bag and then collect a sample in an undisturbed area, preferably within view of the crewman still in the LM cabin. The handle of the CSRC is then removed and the CSRC bag detached, folded, sealed and hung on the lower ladder rung. The crewman then unstows the 70mm camera from the MESA, mounts it on the EMU and then installs a magazine from the ETB. The crewman takes a 360° pan from the +Z (12 o'clock) position as well as any additional photographs he feels are necessary to sufficiently document the landing site (within allowable time constraints). The crewman then stows the camera and the CSRC in the ETB and transfers the ETB into the ascent stage where the IVA crewman offloads these items and prepares the LEC/ETB for jettison. The crewman then climbs the ladder to the LM porch and before ingressing, receives the LEC/ETB from inside the cabin, and discards it. He then proceeds to ingress the LM and terminates the EVA.

The IVA crewman's task during the EVA is to monitor and photograph the EVA crewman's activity using the 70mm camera and the 16mm sequence camera. He is also responsible for reading the contingency procedures to the EVA crewman and supply him with supporting information as required. The IVA crewman also assists with the ETB transfers and takes care of stowing the ETB contents.

Secondary coverage of the EVA crewman's activity is accomplished during realtime with the MESA-mounted TV camera which has been pre-set and oriented to cover the general area of the lower LM ladder.

The EVA crewman's surface activity is confined mainly to the areas which can be monitored by the IVA crewman. Thus, practically all of the surface activity can be documented with the sequence camera.

4.2 Detailed Procedures - Contingency EVA's

4.2.1 EVA-1 Two Man Walking Traverse

The following pages present detailed step-by-step procedures, in a vertical timeline format, for the EVA-1 Two Man Walking Traverse. These procedures are based upon the assumption that LRV failure occurs at the point of test driving the vehicle (0+45 into EVA-1) and that the geology traverse will be accomplished during EVA-1 and the ALSEP will be deployed in EVA-2. The geology station activities will be similar to those in the nominal EVA-1 traverse. The exceptions, notably, are those in which the necessary equipment is not available due to absence of the LRV and that the between station traverse times will be increased to reflect the walking traverse rate.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+30				
NOTE: For the purpose of this timeline plan, it is assumed that the EVA activities are nominal up to 45 minutes into the EVA at which time a LRV malfunction occurs.					
	0+40				
Remove 16mm mag CC from ETB and attach to camera					
Photo CDR/LRV		Test drive LRV - Park LRV in Quad IV near MESA			
Stow 16mm cam on LRV LMP handhold Troubleshoot LRV (30 min Max)		[LRV will not function] Troubleshoot LRV (30 min Max)			
	0+50				

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+50				
	1+00				
	1+10				

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+10				
Abandon LRV		Abandon LRV			
Unstow and attach EVA-1 pallet to MESA table		Remove Quad III thermal blankets from geology pallet			
Remove & discard 16mm cam rack Unstow & place ECS LiOH in pallet pocket		Offload geology pallet from LM and place on +Y footpad			
Stow ETB on MESA table Attach LEC to EVA-1 pallet		Remove & discard pallet handrails Pull HTC stowage pip pin Remove straps around HTC legs			
Climb LM ladder to porch		Open HTC and swing out Pull hinge pin lanyard to release HTC			
	1+20				
Retrieve cont sample & ingress LM Stow cont sample inside LM		Deploy HTC legs and place HTC on surface near +Y footpad Pull HTC stowage pip pins (4)			
Attach LEC to overhead handrail		Remove stowage bracket Stow tongs on HTC			
Transfer pallet into LM		Transfer pallet into LM			
Disconnect LEC from pallet Stow LEC inside cabin		Unstow SCB #2 & #3 from geology pallet & place on HTC			
Remove from pallet & stow: food, batteries, LiOH cans		Remove 70mm mags KK, OO from ETB & stow in SCB #3			
Place pallet on LM floor Move through LM hatch		Unstow CDR's 70mm cam from MESA & attach mag NN from ETB & leave cam in ETB			
Retrieve & discard pallet Close LM hatch		Unstow and open SCB #1 Remove & stow in SRC: 6 core stems, 2 core stem cap disp, 2-20 DSBD, 1 core tube cap disp			
Descend to surface	1+30				

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Descend to surface	1+30				
Attach to CDR's PLSS: • SCB #1 to left side • SCB #2 to right side		Attach to LMP's PLSS: • Hammer (from HTC) • Core tube tool (from HTC) • SCB #2 to left side • SCB #4 (from pallet) to right side • Core tube cap dispenser			
Assemble & tether ext hndl/scoop					
Close lid on SRC #1		Tether tongs			
Open LRV antenna can		Unstow the LCRU from MESA			
Unstow LGA		Attach LCRU to back of LMP's PLSS			
Hand LGA to CDR		Install LGA on LCRU & connect antenna cable			
Assist CDR with LCRU checkout		LCRU cb-closed LCRU Pwr Sw - INT LCRU Sel Sw - PM1/NB Check LCRU AGC, Temp & Power LCRU Sel Sw - PM1/WB			
	1+40	Tidy MESA thermal blankets			
Remove BSLSS from ETB & attach to CDR's PLSS					
Attach 70mm cam/bag disp to EMU Retrieve traverse maps and sun compass from ETB		Attach 70mm cam/bag disp to EMU Unstow gnomon, deploy and carry on geology traverse Orient TV in dir of traverse			
Depart on Geology Traverse		Depart on Geology Traverse			

NOTE: The geology traverse & task information for the EVA-1 Walking Traverse is contained in Section 4.3, Table 4.3-1

1+50

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+50				
Arrive at LM	6+00	Arrive at LM Orient TV to view LM area			
Remove SCB #1 & #2 from CDR PLSS & stow on HTC		Remove SCB #3 & #4 from LMP PLSS & place on LRV seat			
Remove BSLSS from CDR PLSS & stow in sun		Remove LCRU from LMP PLSS & stow in sun			
Stow samples from SCB #2 in SCB #1		Remove hammer, core tube tool & core tube cap disp from LMP PLSS & stow on HTC			
Remove 6 core stems & 2 core stem cap disp from SRC #1 & stow in SCB #2 (on HTC)					
Unstow SWC from MESA		Retrieve from MESA & install filter on 70mm cam			
Carry SWC 60 ft SE of LM		Retrieve gnomon			
		Select site for polarimetric photography			
Remove SWC from stowage can					
Extend SWC staff					
Deploy SWC foil	6+10	Obtain far-field polarimetric photographs			

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Deploy SWC foil	6+10	Obtain far-field polarimetric photographs • 3 photos, 50-110 degree phase angle • 3 photos 20 degrees down-sun from first photos			
Push SWC staff into surface					
Photo SWC X-sun & dn-sun					
Return to LM		Place gnomon at sample site			
Obtain 70mm photo pans around LM at 12:00, 4:00 and 8:00/30 ft; photo descent engine/surface (Quads II & III) and inspect LM		Obtain near-field polarimetric photographs • 1 photo down-sun • 3 photos, 90 degrees phase • 3 photos, 110 degrees phase • 3 photos, 130 degrees phase			
		Collect a min. of 4 rock samples in doc. sample bag			
		Obtain post-sampling photos, X-sun & dn-sun			
	6+20				
		Retrieve gnomon & walk to LM			
		Stow samples in SCB #4			
Unstow flag kit from MESA		Stow tongs on HTC			
Remove flag covering		Stow gnomon on HTC			
Keep staff & pass flag to CDR		Select flag deployment site			
Retrieve hammer from HTC					
Drive staff into surface		Deploy & mount flag in staff			
Photo CDR/Flag Pass LMP 70mm cam to CDR		Photo LMP/Flag			
Stow hammer on HTC Remove SCB #1 from HTC & place in SRC #1		Stow 70mm camera in ETB			
Remove SRC #1 seal protector					
Close and seal SRC #1	6+30	Transfer all cam mags from SCB #3 to ETB			

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Close and seal SRC #1	6+30	Transfer all cam mags from SCB #3 to ETB			
Place SCB #4 on SRC #1		Remove mag from 500mm lens cam & stow in ETB			
Place SCB #3 on SCB #4		Stow 500mm lens cam on MESA			
Tidy MESA thermal blankets		Unstow dust brush from Quad III pallet			
Unstow dust brush from geo pallet					
Clean CDR's EMU		Clean LMP's EMU			
Stow dust brush on geo pallet Ingress LM carrying SCB #3		Stow LMP's PLSS antenna			
Attach LEC to handhold		Attach LEC to SRC #1			
Transfer SRC #1 into LM	6+40	Transfer SRC #1 into LM			
Remove SRC #1 from LEC		Transfer LEC hooks to surface			
Stow SRC #1 in LM		Attach LEC to ETB			
Transfer ETB into LM		Transfer ETB into LM			
Remove ETB from LEC Stow ETB in LM		Transfer LEC hooks to surface			
		Stow LEC on ladder hook			
		LCRU Pwr Sw - OFF Adjust LCRU thermal blankets			
		Clean EMU			
	6+50				

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EVA: 1, Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+50	Clean EMU Ascend ladder carry SCB #4			
Stow SCB #4 in LM		Hand SCB #4 to LMP			
Pass LEC to CDR		Stow LEC on platform			
Assist CDR - Stow CDR's PLSS antenna		Ingress			
END 1st EVA	7+00	END 1st EVA			

NOTE: Detailed Procedures for final EVA closeout are presented in the Lunar Surface Checklist

4.2.2 EVA-2 TWO MAN WALKING TRAVERSE

The following pages present detailed step-by-step procedures, in a vertical timeline format, for the EVA-2 Two Man Walking Traverse with the assumption that the LRV has not been usable on EVA-1. In this case, the ALSEP is deployed on EVA-2 followed by the geology traverse. These procedures are also included in the Lunar Surface Checklist. The geology station activities will be similar to those in the nominal EVA-2 traverse. The exceptions, notably, are those in which the necessary equipment is not available due to absence of the LRV. The between station traverse times are increased to reflect the walking rate.

MISSION: Apollo 15, J-1 DATE: 5/24/71

EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch			
Place jett bag in hatch		Toss jett bag in Quad I Hand LEC to LMP			
Attach LEC to handhold					
Ready ETB for transfer		Descend to surface			
Confirm "GO" for 2-Man EVA		Unstow MESA Pallet #2 and attach to MESA table			
		Unstow ECS LiOH canister & place in pallet bag Attach LEC to pallet			
Transfer pallet into LM		Transfer pallet into LM			
		Describe additional LM site characteristics			
Disconnect LEC from pallet					
Attach LEC to ETB					
Transfer ETB to surface		Transfer ETB to surface			
	0+20				
Disconnect and stow LEC Remove & stow pallet equipment		Attach ETB to SRC table Stow LEC on ladder hook			
Place pallet on LM floor Recorder - OFF Verify VOX Sens (2) - Max Verify CB configuration Utility & Floodlights - OFF Move thru hatch		Unstow drill from MESA & place on surface			
Discard pallet into Quad I		Get 70mm cam from ETB & photo LMP egress			
Close hatch					
Descend to surface					
CDR deploys LMP PLSS antenna		Deploy LMP PLSS antenna Position TV to view ALSEP offload			
Open SEQ bay doors					
	0+30	Offload ALSEP pkg 1 (expts pkg)			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+30	Offload ALSEP pkg 1 (expt pkg)			
Offload ALSEP pkg 2 (pwr pkg)					
		Remove and discard boom-to-pkg-stick			
Remove & discard boom-to-pkg stick Position pwr pkg for fueling Pull tool stowage pip pins (4)		Move pkg clear of SEQ bay			
Unstow UHT'S, pass one to CDR tether 2nd UHT		Tether UHT			
Unstow & pass carry bar to CDR Deploy fuel cask lanyard		Assemble & attach carry bar to expts pkg			
Rotate fuel cask down & stow lanyard Unstow & engage dome removal tool Check tool securely engaged		Assist LMP with RTG fueling as required			
Remove & discard dome/tool Unstow fuel transfer tool Tip power pkg down					
Engage fuel transfer tool Check tool securely engaged					
Remove fuel element from cask Insert fuel element into RTG Report RTG fueled		Check offload booms retracted Close SEQ bay doors			
Removed & discard tool Tip pwr pkg up Attach pwr pkg to carry bar	0+40	Position TV to view ALSEP trav			
		Get traverse map from ETB & stow on HTC			
Carry ALSEP pkgs to deployment site		Tidy MESA blankets Carry ALSD and HTC to ALSEP site			
	0+50				

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+50				
		Survey ALSEP site			
Place pkgs on surface with expts pkg in final position		Place ALSD & HTC on surface Orient ALSD to face sun			
Disconnect pwr pkg from bar					
Reposition pwr pkg 10' East					
Remove HFE stowage pip pins (2)					
Tip pwr pkg down Release RTG cable B. bolts (3) Deploy RTG cable & discard cable reel		Release HFE pallet B. bolts (2) Lift HFE pallet from pwr pkg Carry HFE pallet 15'N C/S			
Report shorting switch amps		Unstow HFE connector			
Connect RTG cable to C/S		Place HFE pallet on surface Connect HFE cable to C/S			
Release subpallet B. bolts (2)					
Lift subpallet from PWR PKG & place 10' N. of PWR PKG		Carry HFE pallet 30' N of C/S, deploying cable			
Release SIDE B. Bolts (4) & CCIG cover bolt Lift SIDE from subpallet		Place HFE pallet on surface & fold mounting braces			
Remove B. Bolt blocking cable reel Unstow cable reel	1+00	Tip pallet down Release probe box B. Bolts (4)			
Deploy SIDE legs & place SIDE on surface		Lift probe box from pallet			
Unstow SIDE cable connector Open EXPTS PKG dust cover Connect SIDE cable to C/S		Separate box and lean probe with tool against pallet			
Remove carry bar from C/S		Carry other probe to drill site, deploying cable			
Tip C/S down & align		Place probe on surface			
Stow carry bar on subpallet		Carry 1st probe to drill site, deploying cable			
Unstow PSE stool from subpallet Scoop out depression for stool		Place probe on surface			
Implace PSE stool 9' West of C/S C/S dust cover remove		Release electronics box B. Bolts (4)			
Release PSE B. Bolts (4)		Lift electronics box from pallet Remove dust cover Kick pallet clear of area			
Carry PSE to stool		Place box on surface, level and align			
Remove B. Bolts from PSE					
Place PSE on stool	1+10	Deploy ALSD brackets on HTC			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Place PSE on stool	1+10	Deploy ALSD brackets on HTC			
		Retrieve drill from surface Place drill on HTC			
Report PSE level & alignment		Push drill SW to test drill Deploy rack legs and remove rack from treadle			
Release SWE B. Bolts (4)					
Lift SWE from C/S		Place rack on surface Remove drill from treadle			
Carry SWE 13' N. C/S, deploying cable		Carry drill & rack to 1st drill site			
Check legs extended & locked Place SWE on surface, level and align		Place rack & drill on surface			
		Remove & discard stem cover Release stem retaining velcro			
Release LSM B. Bolts (2) Remove tie down & discard		Assemble first two bore stem sections (one with bit)			
Lift LSM from C/S		Insert sections into drill chuck			
Check cable free of sun shield		Set drill bit down on surface at mark on HFE cable			
Carry LSM 50' WNW, deploying cable	1+20	Remove battery thermal shroud Drill bore stem into surface			
Select LSM site					
Remove stowage bracket Deploy legs		Remove drill from bore stem			
Align LSM & place on surface with cable outside legs		Reset drill chuck Place drill on surface			
Remove from collar		Assemble 3rd & 4th sections of bore stem			
Deploy center sensor arm then other two sensor arms		Lift & attach drill to bore stem Drill bore stem into surface			
Remove dust covers & PRA cover					
Align and level LSM		Remove drill from bore stem			
		Reset drill chuck Place drill on surface			
		Assemble 5th & 6th sections on bore stem			
		Lift & attach drill to bore stem Drill bore stem into surface			
Check doors open & LSM free of discarded parts	1+30				

MISSION: Apollo 15, J-1
EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Check doors open & LSM free of discarded parts	1+30				
Report level & alignment Return to C/S		Remove drill from bore stem Reset drill chuck			
Starting front center & proceeding CW, release/deploy in turn B. Bolts, side cable, antenna cable and back sunscreen		Place drill on surface Retrieve probe from probe box			
Release two inter B. Bolts Release center B. Bolt and raise sunshield		Insert probe into bore stem Retrieve probe rod from box			
Remove sunscreen covers and discard (3)		Push probe to bottom of stem Report probe depth			
Check sunscreens properly deployed & engage velcro tabs		Carry rack, rod and drill to 2nd drill site			
Retrieve & install antenna mast		Place equipment on surface Assemble 1st two bore stem sections			
Release antenna gimbal B-Bolts		Insert sections into drill chuck Set drill bit down on surface at mark on HFE cable			
Remove gimbal from subpallet Remove gimbal housing cover		Drill bore stem into surface			
Install gimbal on mast Remove housing & discard		Remove drill from bore stem			
Install antenna on gimbal	1+40	Reset drill chuck Place drill on surface			
Check C/S alignment					
Level & Align antenna base		Assemble 3rd & 4th sections on bore stem			
		Lift & attach drill to bore stem Drill bore stem into surface			
		Remove drill from bore stem			
Enter elev 4.71 and azimuth 35.81 offsets		Place drill on surface			
Recheck antenna level and alignment		Assemble 5th & 6th sections on core stem			
Retrieve SIDE near subpallet					
Carry SIDE 55 ft NE, deploying cable		Lift and attach drill to bore stem Drill stem into surface			
Select SIDE deploy site Remove SIDE dust cover		Remove drill from bore stem Remove & discard drill chuck			
Remove & implace ground screen		Place drill on surface Retrieve probe from probe box			
Remove CCIG cover		Insert probe into bore stem			
Remove CCIG from cavity	1+50	Retrieve probe rod			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove CCIG from cavity	1+50	Retrieve probe rod			
Mount CCIG in ground screen tube		Push probe to bottom of bore stem			
Pull ground screen tube pin		Report probe depth			
Place SIDE on ground screen		Withdraw & discard probe rod			
Level & align SIDE		Carry rack & drill to coring site (position HTC as required)			
Rotate CCIG down onto surface					
Pull SIDE dust cover pin Report pin pulled		Implace drill treadle on surface			
Recheck SIDE level & aligned Return to C/S		Open SCB #2 and assemble 1st two core stems			
Depress shorting switch Check shorting switch amps zero Turn Astro Sw #1 clockwise		Thread sections into drill Lift drill and place core bit into treadle			
Request X-mitter turn on Return to LM		Drill core stem into surface			
		Remove drill from core stem & place on surface Assemble 3rd & 4th core stem sections			
		Thread sections onto stem			
	2+00	Retrieve drill and attach drill to core stem Drill core stem into surface			
		Remove drill from core stem & place on surface			
Remove thermal blanket from over LRRR in Quad III Offload LRRR pallet from LM		Assemble 5th & 6th core stem sections			
Place pallet on surface & remove LRRR from pallet		Thread sections onto core stem			
		Retrieve drill and attach drill to core stem			
Get LMP 70mm cam from ETB & mount on EMU (carry CDR's 70mm cam to ALSEP site-leave on HTC)		Drill core stem into surface			
Retrieve and carry LRRR >25FT west of central station		Retrieve CDR 70mm camera from HTC Obtain photo pans 7 ft X-sun from drill and 3 ft either side of 7 ft pt. Place 70mm cam on HTC			
		Pull drill/ stem from surface to expose 1st joint			
		Remove drill from stem			
	2+10				

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+10	Remove drill from stem			
		Remove stem caps from SCB #2 Cap core stem top section Retrieve stem wrench			
Place LRRR on surface Pull alignment device pip pin Pull reflector array pip pin Deploy reflector array		Pull stem from treadle, breaking each joint as it comes thru treadle Place stem on HTC Cap stem bit end			
Pull leveling leg pip pin Deploy leveling leg		Disjoint, cap, and stow stem sections in SCB #2			
Tip LRRR down					
Level and align LRRR					
Remove dust covers		Discard UHT Strip off outer protective gloves and discard			
Recheck level and alignment Photo LRRR & ALSEP		Collect documented samples from ALSEP area until LMP completes ALSEP photos			
NOTE: Deploy LSM sun shield after LSM photography complete	2+20				
Discard UHT		Carry HTC			
Retrun to LM	2+30	Return to LM			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Return to LM	2+30	Return to LM			
Open MESA thermal blankets		Unstow & open SRC #2			
Unstow both LCRU batts from MESA		Remove SCB #5, stow on HTC			
Hand one batt to CDR - wrap other batt in Quad III therm blanket & stow in +Y footpad		Replace LCRU battery			
Unstow SCB #7 from geo pallet & open		Switch LCRU - INT pwr			
Transfer from SCB #5 on HTC to #7: • 3-core tubes • Core tube cap disp - in pkt • SESC - in pocket • 2-20 bag dispensers		Transfer core stems in SCB #2 (on HTC) to SRC #2			
	2+40	Attach to LMP PLSS tool harness: • SCB #2 & #6 • Core tube cap dispenser • Hammer • Core tube tool • LCRU			
Place SCB #7 in +Y footpad					
Place one 20 bag dispenser on each 70mm camera					
Replace mag KK on LMP camera with mag PP		LCRU Sel Sw - PM1/WB			
Attach to CDR PLSS tool harness: SCB #5 BSLSS		Stow spare 70mm Mags QQ & RR in SCB #6			
Tether scoop/ext handle		Tether tongs			
Attach 70mm cam to EMU		Attach 70mm cam to EMU			
		Get traverse maps from ETB			
Tidy MESA blankets		Orient TV to traverse direction			
Depart on geology traverse		Depart on geology traverse			
	2+50				

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+10				
NOTE: The geology traverse & task information for the EVA-2 Walking Traverse is contained in Section 4.3, Table 4.3-2					
	6+20				
Arrive back at LM		Arrive back at LM			
Stow 70mm cam in ETB		Orient TV to view LM			
Remove BSLSS & SCB #5 from CDR PLSS		Stow 70mm cam in ETB			
Place BSLSS in sun and SCB #5 on MESA table		Remove LCRU from LMP PLSS & place in sun			
Stow scoop/ext handle on HTC Assist CDR		Assist LMP Remove from LMP PLSS tool harness • Core tube cap disp. - discard • Hammer - stow on HTC • SCB #2 & #6 - stow on HTC • Core tube tool - stow on HTC			
	6+30	Tidy harness velcro covers			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+30	Tidy harness velcro covers Remove BSLSS from LMP PLSS & stow in sun (in thermal blanket)			
Remove SCB #6 from HTC & carry to MESA Remove 70mm mags from SCB #6 & stow in ETB		Remove core stems from SRC #1 and stow in SCB #5			
Leave SCB #6 on MESA		Fill SCB #5 with doc samples from SCB #6 (as required) and place in SRC #1			
Remove SCB #2 from HTC and place on MESA		Remove SRC seal protector Close & seal SRC #2			
Unstow dust brush from geo pallet Clean CDR's EMU					
		Clean LMP's EMU & stow LMP PLSS antenna			
Ingress; carry SCB #6 into LM		Stow dust brush on geo pallet			
		Tidy MESA thermal blankets			
		Stow maps in ETB			
Attach LEC to handhold	6+40	Attach LEC to SRC #2			
Transfer SRC #2 into LM		Transfer SRC #2 into LM			
Remove SRC #2 from LEC Stow SRC #2 in LM		Transfer LEC hooks to surface Attach LEC to ETB			
Transfer ETB into LM		Transfer ETB into LM			
Remove ETB from LEC Stow ETB in LM		Transfer LEC hooks to surface Stow LEC on ladder hook			
		Adjust LCRU thermal blankets			
	6+50	Clean EMU			

MISSION: Apollo 15, J-1 DATE: 5/24/71
EVA: 2 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+50	Clean EMU			
		Ascend ladder; carry SCB #2			
Stow SCB #2 in LM Pass LEC to CDR		Hand SCB #2 to LMP Stow LEC on platform			
Assist CDR; stow CDR's PLSS antenna		Ingress			
End 2nd EVA	7+00	End 2nd EVA			

NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE "LUNAR SURFACE CHECKLIST"

4.2.3 EVA-3 TWO MAN WALKING TRAVERSE

The following pages present detailed step-by-step procedures, in a vertical timeline format, for the EVA-3 Two Man Walking Traverse. These procedures are also included in the Lunar Surface Checklist. The geology traverse contains station activities similar to those in the nominal EVA traverse. The exceptions, notably, are those in which the necessary equipment is not available due to absence of the LRV. The between station traverse times are increased to reflect the walking rate.

MISSION: Apollo 15, J-1 DATE: 5/25/71
EVA: 3 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch			
Place Jett bag in hatch					
		Toss Jett bag in Quad I			
Attach LEC to handhold		Hand LEC to LMP			
Confirm "GO" for 2-man EVA		Decend to surface			
Transfer LEC hooks into LM		Transfer LEC hooks into LM			
Attach LEC to ETB Assist CDR		Transfer ETB to surface			
Disconnect and stow LEC		Attach ETB to SRC table			
Recorder-OFF Verify VOX Sens (2) - Max Verify cb config Utility & floodlights - OFF		Stow LEC on ladder hook			
Move thru hatch Close hatch		Retrieve LCRU batt from +Y footpad			
Decend to surface		Change LCRU batt			
CDR deploys LMP PLSS antenna	0+20	Deploy LMP PLSS antenna			
Unstow BSLSS bag from MESA & stow on HTC		Get SCB #7 from +Y footpad & stow on HTC			
Stow spare 70mm mags (from ETB) in SCB #8		Remove 2 - 20 bag disp from SCB #7 & place on MESA table			
Remove SCB #7 from HTC & attach to CDR PLSS tool harness		Remove core tube cap disp from SCB #7 & place on LMP PLSS tool harness			
Attach BSLSS to CDR PLSS					
Assist CDR		Unstow & attach to LMP PLSS tool harness: • Hammer • Core tube tool • SCB #8 (from geo pallet) • BSLSS sample bag • LCRU			
		LCRU Pwr Sw - INT LCRU Sel Sw - PM1/WB			
Tether scoop/ext handle		Tether tongs			
Install 20 bag disp on 70mm cam		Install 20 bag disp on 70mm cam			
Mount 70mm cam on EMU	0+30	Mount 70mm cam on EMU			

MISSION: Apollo 15, J-1 DATE: 5/25/71
EVA: 3 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Mount 70mm cam on EMU	0+30	Mount 70mm cam on EMU			
Get traverse maps from ETB		Orient TV in traverse direction			
Depart on geology traverse		Depart on geology traverse			

NOTE: The geology traverse & task information for the Eva-3 Walking Traverse is contained in Section 4.3, Table 4.3-3

0+40

0+50

MISSION: Apollo 15, J-1 DATE: 5/25/71
EVA: 3 Two Man Walking Travers

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10				
Arrive back at LM		Arrive back at LM			
Assist CDR		LCRU Pwr Sw - OFF Remove LCRU from LMP PLSS & place on surface			
Remove SCB #7 from CDR PLSS & stow on HTC		Discard tongs Stow 70mm cam in ETB			
Photo surface under descent engine		Remove SESC from SCB #7 & open			
Collect contaminated sample in SESC		Hold SESC for LMP			
Photo contaminated sample area	5+20	Close & seal SESC - stow in SCB #7			
Discard scoop/ext handle		Remove SCB #8 & BSLSS sample bag from LMP PLSS tool harness & stow on MESA table			
Doff BSLSS and PLSS tool harness & discard		Doff PLSS tool harness & discard			
Retrieve SWC foil		(Do following sequence ONLY if LRV is at LM) Unstow TCU power cable Unstow TCU & place on LRV seat Remove LCRU Y-cable from LRV & attach to TCU Retrieve TV camera and carry to LRV			
Place SWC foil in bag from MESA & stow in ETB		TV pwr sw - OFF Remove TV from tripod Mount TV on TCU Connect TV power cable Unstow HGA from canister			
Get LCRU & carry to site 300' East of LM approx heading 096°		Carry HGA & TV/TCU to site 300' East of LM approp heading 096°			
Assist CDR	5+30	Implace TCU staff in surface			

MISSION: Apollo 15, J-1 DATE: 5/25/71
EVA: 3 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Assist CDR	5+30	Implace TCU staff in surface			
Unstow HGA cable & discard foam					
Connect cable to LCRU		Connect TCU to LCRU			
Implace HGA staff in surface and align HGA		Level TCU/TV (prop up with rocks if reqd)			
		Switch LCRU - INT pwr - TV RMT			
Photo installation with 70mm cam					
		Adjust LCRU dust covers			
Return to LM		Return to LM			
Doff 70mm cam, remove mag & stow in ETB		Remove 70mm mags from SCB #8 & stow in ETB			
Unstow dust brush from geo pallet					
	5+40				
Clean CDR's EMU		Clean LMP's EMU; stow LMP PLSS antenna			
Ingress, carry BSLSS bag into LM		Attach LEC to SCB #7			
Attach LEC to handhold					
Transfer SCB #7 into LM					
Remove SCB #7 from LEC		Transfer LEC hooks to surface			
		Attach LEC & ETB			
		Transfer ETB into LM			
Transfer ETB into LM					
Remove ETB from LEC Discard LEC to porch		Clean EMU			
CB(16) LTG TRACK - Close SW: EXTERIOR LTG-TRACK (CDR Check light on)		Check LM Dock light - ON			
SW: EXTERIOR LTG - OFF	5+50	Check area			

MISSION: Apollo 15, J-1 DATE: 5/25/71
EVA: 3 Two Man Walking Traverse

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
SW: EXTERIOR LTG - OFF CB(16) LTG TRACK - Open	5+50	Check area			
Stow equipment & samples in LM		Ascend ladder; carry SCB #8			
Stow SCB #8 in LM		Hand SCB #8 to LMP Discard LEC			
Assist CDR; stow CDR's PLSS antenna		Ingress			

NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE LUNAR SURFACE CHECKLIST

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
End 3rd EVA	6+00	End 3rd EVA

4.2.4 EVA-1 ONE MAN LRV TRAVERSE

To be supplied in a supplement to the Lunar Surface Procedures.

4.2.5 EVA-2 ONE MAN LRV TRAVERSE

To be supplied in a supplement to the Lunar Surface Procedures.

4.2.6 EVA-3 ONE MAN LRV TRAVERSE

To be supplied in a supplement to the Lunar Surface Procedures.

4.2.7 DETAILED PROCEDURES - MINIMUM TIME EVA - ONE MAN

The following pages are step-by-step timeline procedures for a minimum time one-man-EVA. These procedures are on the same vertical timeline format as a normal EVA. Since the EVA crewman will not have a cuff checklist for this contingency, the IVA crewman will read the procedure to the EVA crewman and supply supporting information as required.

MISSION: Apollo 15, J-1 DATE: June 1, 1971
EVA: ONE MAN - MINIMUM TIME

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+00	Check cabin pressure "ZERO" - Feedwater - ON Open Hatch			
		NOTE: Detailed procedures are presented in "Lunar Surface Checklist", "Equipment Prep EVA 1" section.			
	0+10	Move thru hatch			

MISSION: Apollo 15, J-1 DATE: June 1, 1971
EVA: ONE MAN - MINIMUM TIME

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+10	Move thru hatch			
Prepare LEC					
Pass LEC to EVA Crewman		Deploy LEC			
		Descend to top of ladder Deploy MESA			
Photo EVA Crewman descend with 70mm camera		Descend to footpad			
LM 16mm Seq Cam - ON (12 FPS)		Check ascent capability to lower ladder rung			
NOTE: Monitor & photograph EVA crewman using 70mm camera and LM 16mm Seq Cam.		Step to surface			
Read procedures to EVA crewman		Check and discuss mobility and stability			
	0+20	Report LM status			
Transfer ETB to surface		Transfer ETB Hang on MESA			
16mm Cam - OFF Change Mag 16mm Cam - ON		Unstow CSRC & deploy handle and bag Collect sample Remove handle & close bag Hang sample on ladder			
		Rest/Check EMU			
		Unstow 70mm Camera from MESA			
		Remove mag LL from ETB and install on camera			
		Attach camera to EMU			
		Check surface locomotion capability			
	0+30				

MISSION: Apollo 15 J-1 DATE: June 1, 1971
EVA: ONE MAN - MINIMUM TIME

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+30				
16mm cam - OFF Change mag 16mm Cam - ON (12 FPS)					
		Describe landing site and LM landing condition			
		Obtain +Z panorama			
16mm Cam - OFF					
	0+40	Stow 70mm Cam and Contingency sample in ETB			
Transfer ETB into cabin		Transfer ETB into cabin			
Remove 70 mm cam and contingency sample from ETB		Clean EMU			
Pass LEC/ETB to CDR		Climb ladder to porch Receive & discard LEC/ETB			
		Ingress - Go to Post EVA Procedures			
	0+50				

4.3 EVA WALKING TRAVERSES

4.3.1 Traverse Assumptions and Ground Rules

The walking traverse plans contained in this document are based upon an LRV failure occurring at the point of the LRV test drive in EVA-1. These plans can be readily modified for LRV failure occurring later in any of the succeeding EVA's. The traverse times and station stops were constructed using a nominal walking rate of 2.75 Km/hr and a maximum walking rate of 4.0 Km/hr.

4.3.2 Traverse Maps and Station Tasks

The traverse maps for the walking traverses EVA-1,2,3 are shown in Figures 4.3-1, 4.3-2 and 4.3-3 and the station tasks are presented in tabular form in Tables 4.3-1, 4.3-2 and 4.3-3 for EVA-1,2 and 3 respectively.

NASA-S-71-2252-V

Figure 4.3-1 Walking Traverses EVA-1,2,3 (SUMMARY)

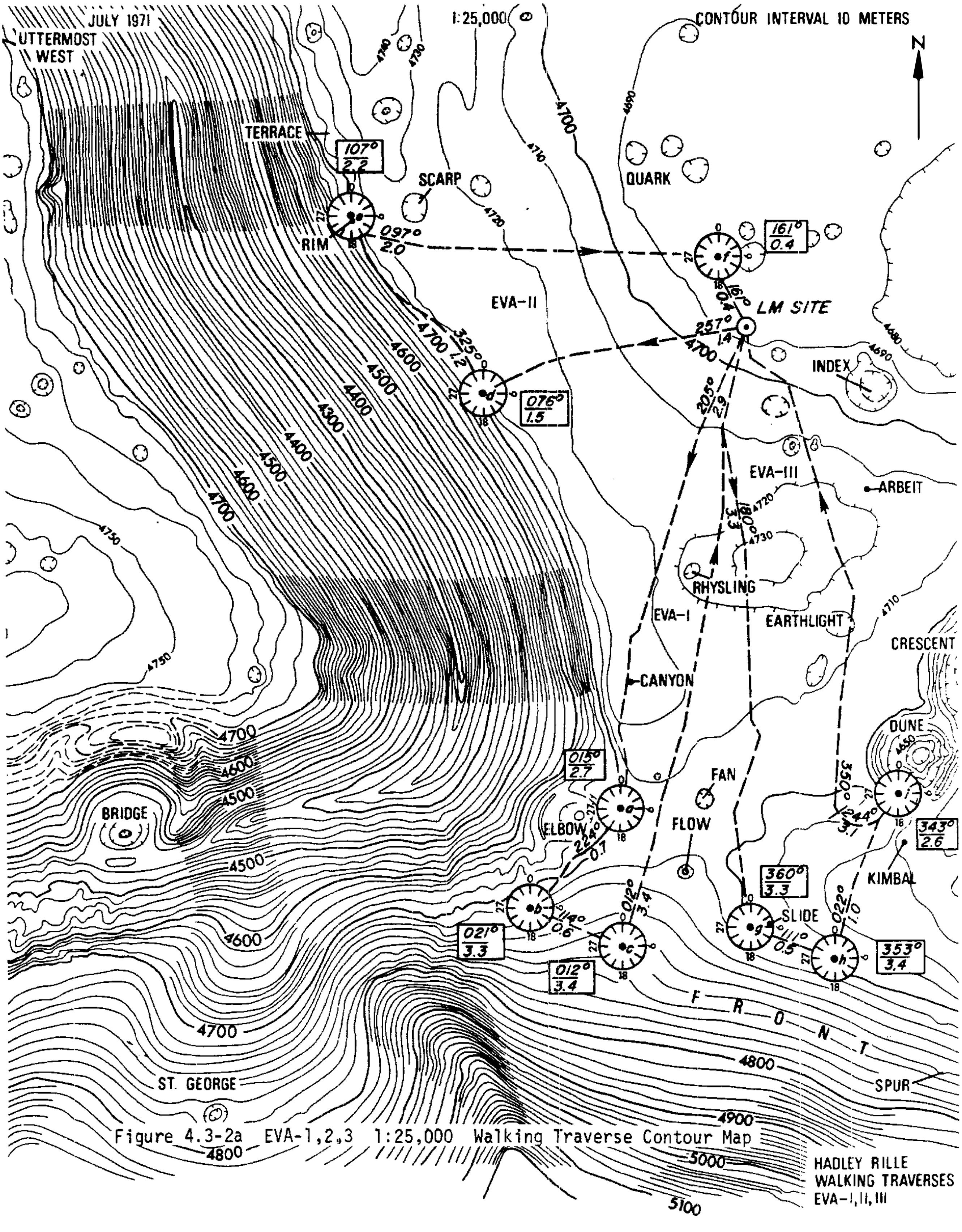


Figure 4.3-2a EVA-1,2,3 1:25,000 Walking Traverse Contour Map

Figure 4.3-2b EVA-1,2,3 1:25,000 Walking Traverse Map

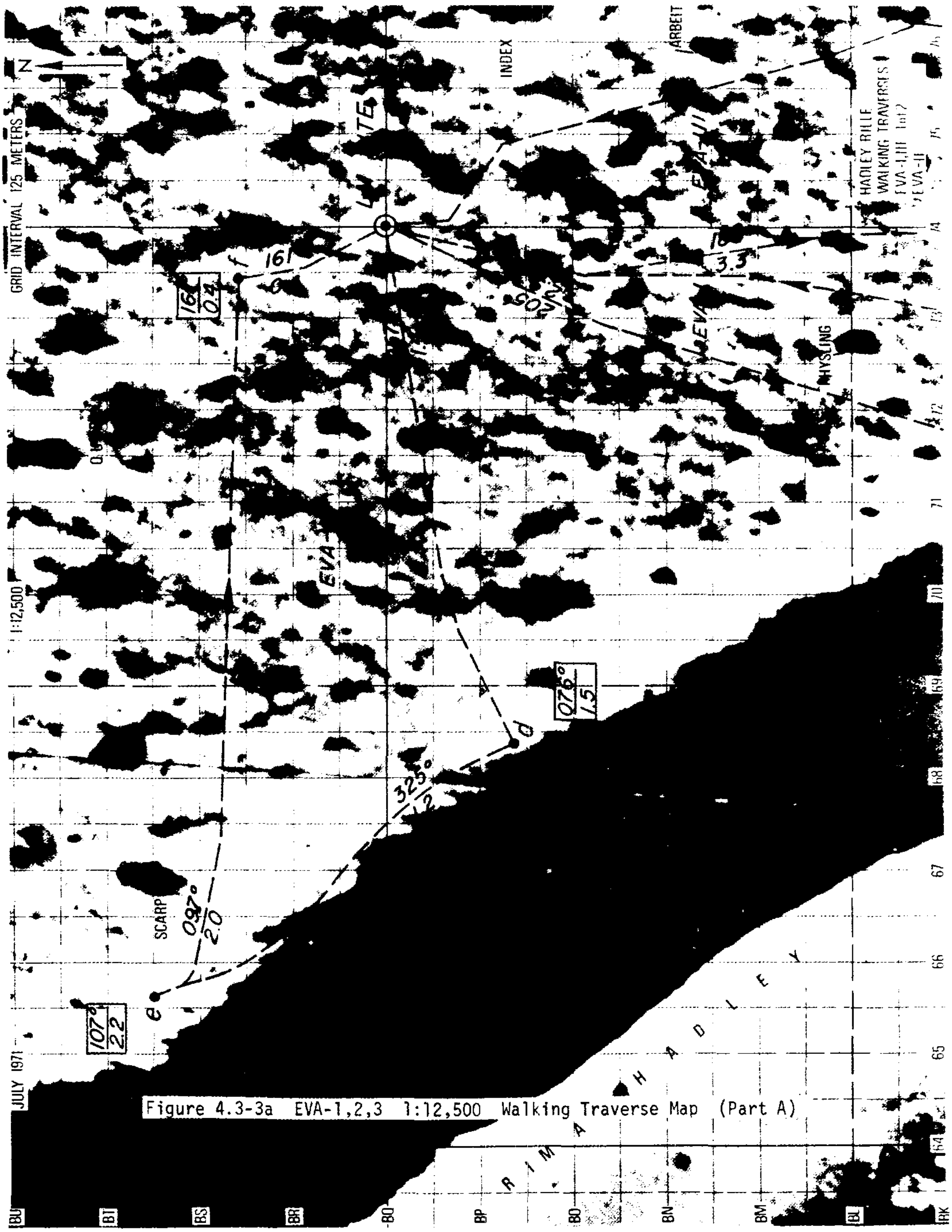


Figure 4.3-3a EVA-1,2,3 1:12,500 Walking Traverse Map (Part A)

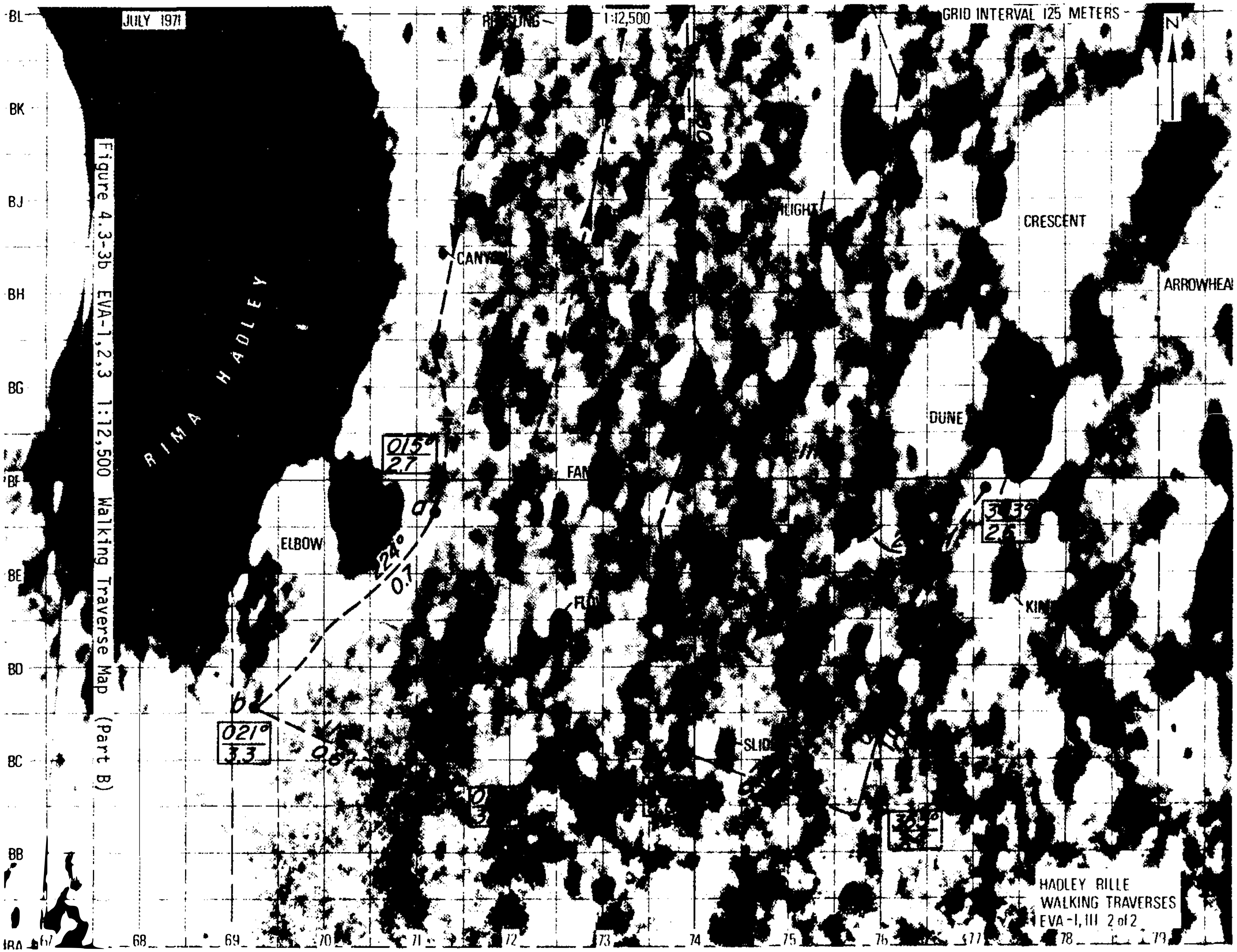


Figure 4.3-3b EVA-1,2,3 1:12,500 Walking Traverse Map (Part B)

Table 4.3-1

EVA I WALKING TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	1:43	SMOOTH MARE	SEE SECTION ____
TRAVEL	1:43	1:10	ACROSS TYPICAL SMOOTH MARE FILL TOWARD RIM OF HADLEY RILLE	OBSERVE AND DESCRIBE TRAVERSE OVER SMOOTH MARE FILL MATERIAL DESCRIBE SURFACE FEATURES AND BLOCK DISTRIBUTION NOTE ANY DIFFERENCES BETWEEN MARE AND RILLE RIM MATERIAL
a	2:53	0:15	NEAR SOUTHERN PART OF ELBOW CRATER EJECTA BLANKET	RADIAL SAMPLING OF ELBOW CRATER PAN
TRAVEL	3:08	0:17	TO APENNINE FRONT SLOPE NORTH OF ST. GEORGE CRATER	LOOK FOR CHANGES IN LITHOLOGY OR GROUND TEXTURE AS INDICATIONS OF BASE OF FRONT COMPARE MARE AND RILLE RIM MATERIAL TO APENNINE FRONT OBSERVE CHARACTER AND DISTRIBUTION OF ST. GEORGE EJECTA BLANKET
b	3:25	0:43	NEAR BASE OF APENNINE FRONT NORTH OF ST. GEORGE CRATER	RADIAL SAMPLE OF ST. GEORGE CRATER AS SLOPE PERMITS COMPREHENSIVE SAMPLE AREA AT APENNINE FRONT DOUBLE CORE TUBE STEREO PAN FROM HIGH POINT - 100 m BASE ALONG FRONT FILL SESC AT APENNINE FRONT

EVA I WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	4:08	0:13	ACROSS BASE OF APENNINE FRONT ADJACENT TO POSSIBLE DEBRIS FLOW	OBSERVE APENNINE MATERIAL AND RELATION TO MARE SURFACE
C	4:21	0:16	AT BASE OF APENNINE FRONT ADJACENT TO POSSIBLE DEBRIS FLOW	EXAMINE FLOW AND COMPARE TO MARE AND FRONT DOCUMENTED SAMPLES OF APENNINE FRONT AND 'FLOW' MATERIAL OBSERVE AND DESCRIBE VERTICAL AND LATERAL CHANGES IN APENNINE FRONT; COMPARE TO PREVIOUS STOP PAN OBSERVE CHARACTERISTICS OF EVA III ROUTE
TRAVEL	4:37	1:23	FROM BASE OF APENNINE FRONT ACROSS MARE TO LM	OBSERVE CHARACTERISTICS AND EXTENT OF POSSIBLE DEBRIS FLOW OBSERVE AREA TO BE TRAVERSED ON EVA III COMPARE MARE MATERIAL TO APENNINE FRONT AND RILLE RIM OBSERVE POSSIBLE RAY MATERIAL
LM	6:00	1:00	SMOOTH MARE	LM AREA ACTIVITIES EVA CLOSEOUT

Table 4.3-2

EVA II WALKING TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	2:48	SMOOTH MARE	EGRESS LM ALSEP DEPLOYMENT PREPARE FOR TRAVERSE
TRAVEL	2:48	0:34	ACROSS SMOOTH MARE BETWEEN LM AND RIM OF HADLEY RILLE	COMPARE SMOOTH MARE MATERIAL TO RILLE RIM MATERIAL
d	3:22	0:31	AT RIM OF HADLEY RILLE	OBSERVE AND DESCRIBE RILLE AND FAR WALL 500-mm LENS CAMERA PHOTOGRAPHY COMPREHENSIVE SAMPLE AREA SINGLE (DOUBLE) CORE TUBE PAN DOCUMENTED SAMPLING OF CRATER AT EDGE OF RILLE
TRAVEL	3:53	0:29	ALONG RILLE RIM TO TERRACE	DESCRIPTION OF RILLE AND RIM MATERIAL PHOTOGRAPHY AS APPROPRIATE
e	4:22	0:28	RILLE RIM AT TERRACE	OBSERVE AND DESCRIBE RILLE AND FAR RILLE WALL; COMPARE TO PREVIOUS OBSERVATIONS 500-mm LENS CAMERA PHOTOGRAPHY DOCUMENTED SAMPLES OF RILLE RIM AND CRATER AT EDGE OF RILLE PAN COMPARE RILLE RIM MATERIAL TO OTHER TERRAIN

EVA II WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	4:50	0:48	FROM RILLE RIM EAST ACROSS MARE	OBSERVE CHANGES IN MATERIAL BETWEEN RILLE RIM AND MARE
f	5:38	0:37	160 m CRATER IN MARE	COMPREHENSIVE SAMPLE AREA DOUBLE CORE TUBE DOCUMENTED SAMPLING OF LARGE MARE CRATER POSSIBLE FILLET/ROCK SAMPLE POSSIBLE LARGE AND SMALL EQUIDIMENSIONAL ROCK SAMPLES PAN TRENCH POSSIBLE BURIED ROCK SAMPLE FILL SESC
TRAVEL	6:15	0:10	ACROSS SMOOTH MARE	COMPARE MARE MATERIAL WITH OTHER TERRAIN OBSERVE POSSIBLE RAY MATERIAL
LM	6:25	0:35	SMOOTH MARE	EVA CLOSEOUT

Table 4.3-3

EVA III WALKING TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	0:22	SMOOTH MARE	EGRESS LM, PREPARE FOR TRAVERSE
TRAVEL	0:22	1:19	SOUTH ALONG SMOOTH MARE ON WEST SIDE OF SECONDARY CRATER CLUSTER TO BASE OF APENNINE FRONT	OBSERVE SMOOTH MARE CHARACTERISTICS OBSERVE SECONDARY CRATER CLUSTER CHARACTERISTICS PHOTOGRAPHY AS APPROPRIATE
g	1:41	0:48	SLIDE CRATER NEAR BASE OF APENNINE FRONT	DOCUMENTED SAMPLES: SLIDE CRATER IN APENNINE FRONT OTHER AREAS STEREO PAN; 100-m SEPARATION ALONG APENNINE FRONT EXPLORATORY TRENCH UPSLOPE OF SLIDE CRATER 70-mm CAMERA STEREO PAIRS UPSLOPE AT TARGETS OF OPPORTUNITY
TRAVEL	2:29	0:12	EAST ALONG APENNINE FRONT	TRAVERSE ALONG APENNINE FRONT OBSERVE POSSIBLE DEBRIS FLOWS, SOURCE AND DOWNSLOPE MOVEMENT PHOTOGRAPHY AS APPROPRIATE
h	2:41	0:34	AT BASE OF APENNINE FRONT NEAR SMALL CRATER	DESCRIPTION OF APENNINE FRONT IN SAMPLING AREA COMPARISON OF APENNINE FRONT AND MATERIAL TO OTHER SURFACE UNITS DOCUMENTED SAMPLES OF APENNINE FRONT MATERIAL PAN EXPLORATORY TRENCH POSSIBLE CORE TUBE 70-mm CAMERA STEREO PAIRS OF TARGETS OF OPPORTUNITY UPSLOPE

EVA III WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	3:15	0:24	FROM BASE OF APENNINE FRONT TO SOUTH OF DUNE CRATER IN SECONDARY CLUSTER	OBSERVE SECONDARY CRATER DEPOSITS AND RELATION TO OTHER TERRAIN OBSERVE EASTERN EDGE OF POSSIBLE DEBRIS FLOW FROM APENNINE FRONT PHOTOGRAPHY AS APPROPRIATE
i	3:39	0:21	SECONDARY CRATER CLUSTER: SOUTH OF DUNE CRATER	SOIL SAMPLE DOCUMENTED SAMPLING PAN EXPLORATORY TRENCH POSSIBLE CORE TUBE THROUGH SECONDARY EJECTA OBSERVE CRATER INTERIOR AND EJECTA SAMPLE TYPICAL AND EXOTIC ROCK TYPES COMPARE SECONDARY CRATER MATERIAL TO OTHER TERRAIN UNITS
TRAVEL	4:00	1:15	ALONG WEST SIDE OF SECONDARY CRATER CLUSTER, AND ACROSS SMOOTH MARE	OBSERVE SECONDARY CRATER DEPOSITS COMPARE MARE MATERIAL WITH OTHER TERRAIN OBSERVE POSSIBLE RAY MATERIAL
LM	5:15	0:45	SMOOTH MARE	EVA CLOSEOUT

Table 4.3-4

HADLEY-APENNINE - Walking Traverses

30 Min Reserves
Walk Rate 2.75 KM/HR
Walk Back Rate 4.0 KM/HR

10 June 1971

Station No.	Station Stop Time (Min)	Traverse Dist		Walk Time (Min)	Accum Dist. (KM)	Station Reached Data			Station Stop Complete Data			Return Distance Corr. (Km)	Conting. Walk-Back Max. Speed Reqd		Walk-Back Time to LM (Hr:Min)	Conting. Walk-Back Complete		
		Map (Km)	Corr (Km)			EVA Time (Hr:Min)	Btu Remain (Btu)	O_2 Remain (Lbs)	EVA Time (Hr:Min)	Btu Remain (Btu)	O_2 Remain (Lbs)		0 Min (Km/Hr)	10 Min-0/H (Km/Hr)		Btu Margin (Hr:Min)	O_2 Margin (Hr:Min)	Amp Hour Margin (Hr:Min)
									Traverse I									
LM	103	0	0	0	0	0	11,408	1.383	1:43	9159	1.082	0	-	-	-	-	-	-
a	15	2.9	3.19	70	3.19	2:53	7566	0.870	3:08	7238	0.827	3.19	3.09	3.68	0:48	3:53	3:05	2:54
b	43	0.7	0.77	17	3.96	3:25	6834	0.775	4:08	5845	0.650	3.96	3.83	4.57	0:59	2:19	1:47	1:42
c	16	0.55	0.61	13	4.57	4:21	5528	0.610	4:37	5183	0.566	3.96	3.83	4.57	0:59	1:50	1:18	1:14
LM	60	3.45	3.80	83	8.37	6:00	3288	0.313	7:00	1978	0.138	0	-	-	-	-	-	-
TOTALS	237	7.60	8.37	183					7:00									
									Traverse II									
LM	168*	0	0	0	0	0	11,719	1.303	2:48	7435	0.791	0	-	-	-	-	-	-
d	31	1.4	1.54	34	1.54	3:22	6542	0.684	3:53	5752	0.589	1.54	1.49	1.78	0:23	2:48	2:15	2:33
e	28	1.2	1.32	29	2.86	4:22	4987	0.497	4:50	4273	0.412	2.64	2.55	3.05	0:40	1:25	0:51	1:20
f	37	2.0	2.20	48	5.06	5:38	2999	0.259	6:15	2055	0.146	0.44	0.426	0.508	0:07	0:48	0:15	0:28
LM	35	0.4	0.44	10	5.50	6:25	1801	0.115	7:00	908	0.009	0	-	-	-	-	-	-
TOTALS	299	5.0	5.50	121					7:00									
		*Includes	ALSEP															
									Traverse III									
LM	22	0	0	0	0	0	11,719	1.303	0:22	11,132	1.233	0	-	-	-	-	-	-
g	48	3.3	3.63	79	3.63	1:41	8772	0.972	2:29	7392	0.820	3.63	3.514	4.192	0:54	2:36	2:33	3:25
h	34	0.5	0.55	12	4.18	2:41	7034	0.780	3:15	6067	0.673	3.96	3.833	4.573	0:59	1:42	1:39	2:35
i	21	1.0	1.10	24	5.28	3:39	5391	0.594	4:00	4858	0.530	3.43	3.32	3.96	0:51	1:23	1:06	1:59
LM	45	3.1	3.41	75	8.69	5:15	2796	0.285	6:00	1596	0.142	0	-	-	-	-	-	-
TOTALS	170	7.9	8.69	190					6:00									
EVA TOTALS	11:46	20.5	22.56	8:14					20:00									

4.4 OFF-NOMINAL PLANNING DATA

The Off-Nominal Planning Data is to be supplied in a Contingency Supplement to the Lunar Surface Procedures.

SECTION 5.0

APPENDIX

5.0 APPENDIX

5.0 APPENDIX

5.1 APPREVIATIONS

ALSD	-	Apollo Lunar Surface Drill
ALSEP	-	Apollo Lunar Surface Experiments Package
A/S	-	Ascent Stage
BSLSS	-	Buddy Secondary Life Support System
CCIG	-	Cold Cathode Ion Gage
CDR	-	Commander
C/S	-	Central Station
CSC	-	Contingency Sample Container
CSRC	-	Contingency Sample Return Container
DC	-	Data Camera
DSBD	-	Documented Sample Bag Dispenser
ECS	-	Environmental Control System
EMU	-	Extravehicular Mobility Unit
EVA	-	Extra Vehicular Activity
GCTA	-	Ground Controlled Television Assembly
HCEX	-	Hi-speed Colar Exterior
HFE	-	Heat Flow Experiment
HGA	-	High Gain Antenna
HTC	-	Hand Tool Carrier
LCRU	-	Lunar Communication Relay Unit
LEC	-	Lunar Equipment Conveyor
LGA	-	Low Gain Antenna
LiOH	-	Lithium Hydroxide
LM	-	Lunar Module
LMP	-	Lunar Module Pilot
LRRR	-	Laser Ranging Retro Reflector
LRV	-	Lunar Roving Vehicle
LSM	-	Lunar Surface Magnetometer
MCC-HOU	-	Mission Control Center - Houston
MESA	-	Modularized Equipment Stowage Assembly
MSFN	-	Manned Space Flight Network
NE	-	Northeast
PLSS	-	Primary Life Support System
PRA	-	Parabolic Reflector Assembly
PSE	-	Passive Seismic Experiment
RCU	-	Remote Control Unit
RHSC	-	Right Hand Side Console (LM)
RTG	-	Radio-isotope Thermoelectric Generator
S-Bag	-	Sample Collection Bag (on crew cuff checklist only)

SCB	-	Sample Collection Bag
SESC	-	Special Environmental Sample Container
SEVA	-	Standup EVA
SIDE	-	Suprathermal Ion Detector Experiment
SRC	-	Sample Return Container
SWC	-	Solar Wind Composition
SWE	-	Solar Wind Experiment
TCU	-	Television Control Unit
TD	-	Touchdown
UHT	-	Universal Handling Tool
WNW	-	West North West

5.2 Lunar Surface Operational Constraints

5.2.1 Introduction

The lunar surface operational constraints presented in this section are restricted to the flight crew operational constraints which are concerned with lunar surface extravehicular acticity. The constraints presented here are further restricted to the lunar surface EVA constraints for the fourth Lunar landing mission. Excluded are spacecraft constraints except where those constraints have a direct bearing on the crew members during the EVA operations.

By definition, a lunar surface constraint is any limitation imposed on lunar equipment design, operational procedure or sequence, etc. due to an equipment, human or environmental characteristic.

5.2.2 Constraint Classification

The constraints are divided into five different categories. The activity or equipment being constrained determines the category of the constraint. The constraints which fall into two or more categories are classified as GENERAL.

Each constraint is also identified according to the impact on the mission that a violation of the constraint violation are considered in determining the violation classification. Multiple malfunctions and the different possible contingencies are not considered. The constraints violation classification is enclosed in parentheses following the constraint.

5.2.2.1 Constraint Categories

<u>Mission Operations</u>:

Constraints on mission operations that are necessary due to considerations of a lunar surface activity.

<u>Lunar Surface Operations</u>:

Constraints on lunar surface operations that are necessary due to equipment design and/or the lunar environment.

Equipment Operation:

Constraints on equipment operation that are necessary due to the equipment design.

General:

Constraints that apply to two or more phases of the Apollo lunar landing mission.

5.2.2.2 Violation Classification

Critical:

A constraint that is necessary to prevent a compromise of mission safety. A violation of a critical constraint would jeopardize the safety of the crew or equipment essential to the completion of the mission.

Major:

A constraint that is necessary to prevent the compromise of the mission requirement.

Minor:

A constraint that cannot be classified as CRITICAL or MAJOR but is necessary to optimize lunar surface activities.

5.2.3 Lunar Surface Operations Constraints

Spacecraft Attitude:

Lunar surface EVA operations will not be conducted when the angle of the LM X-axis with the local gravity vector exceeds 15°. This attitude may arise from the combination of all factors such as asymetric compression of the landing gear struts and terrain conditions. (CRITICAL) (Provisional, documentation to substantiate is unavailable)

Landing Site Slope:

The maximum topographical slope on which lunar surface EVA operations will be conducted will be that which the astronaut can safely negotiate unassisted. This is presently established as 15°. (CRITICAL) (Reference: Unpublished report of test "Crewman Capability Investigation", by Dr. D. L. Lind, Astronaut, Partial Gravity Simulator, Building 5, MSC, November 8, 1968).

LM Forward (+Z) Hatch Operations:

The forward hatch may be left fully open during the EVA (up to 3 hours) provided: (CRITICAL) (GAEC LM Engineering Memorandum LMO-510-1201, April 24, 1969)

1) The cabin temperature, GF 1641T, must be between 60°F and 90°F at the beginning of the EVA,

2) The sun vector is outside a 65° cone about the +Z axis.

Otherwise, the limit is:

1) 15 minutes for hatch fully open or

2) For the duration of the EVA provided the door is no more than 3 inches from the closed position, using the door snubber device for control.

Forward Contamination Control:

Fecal bags and other human wastes will be processed with a disinfactant and double-bagged prior to jettisoning. It is preferred that these be returned to earth by transferring to the CSM. As alternatives the wastes will be stowed in the descent stage if possible. Otherwise, it will be left on the lunar surface. (MINOR)

Extravehicular Communications System:

The first crewman to the lunar surface will operate in the relay mode. For two-man EVA operations the dual mode is nominal. (MAJOR) (Reference: NASA, Land, C.K., "Performance Analysis of The Extravehicular Communication System," MSC Internal Note EB-R-68-14, May 16, 1969).

OPS Metabolic Capability:

The maximum heat removal of the Oxygen Purge System (OPS) is about 950 BTU/HR average over the period in which the man is storing 300 BTU. The heat removal capacity of the OPS is 475 BTU's. (CRITICAL). (Reference: Zieglschmid, J. F. M.D.; Results Eighth Lunar Surface Operations Planning Meeting; June 7, 1968).

LiOH Cannister

The LiOH Cartridge of the PLSS can be stored at temperatures within the limits of Fig. 4.5-29 of Apollo Operations Handbook, Vol. IV, EMU Data Book, Amend. 18 (7/3/69). LiOH efficiency is reduced if these limits are not reached or exceeded. The cartridge should not be exposed to an ambient pressure of less than 0.5 psia for more than 15 minutes (cartridge as stowed is sealed to the spacecraft environment. Exposure to ambient pressures less than 0.5 psia causes the water in the LiOH to vaporize which limits its use time in the EMU to 60 minutes maximum. (CRITICAL)

SEQ Bay

The Scientific Equipment Bay doors must be closed after the ALSEP is removed from the bay in order to maintain LM thermal control. (CRITICAL) (Reference: Discussion Between: GAEC Engineers and Lunar Surface Operations Office Engineers; July 25, 1967).

PLSS Battery

The PLSS battery and LiOH canister must be replaced prior to the second and third EVA's. (CRITICAL) (Reference: CF721-70-256; Lunar Surface Operations Office; Twenty-Seventh Lunar Surface Operations Planning Meeting, August 7, 1970).

5.2.4 Equipment Operation Constraints

Still Camera (Hasselblad):

Film Environment - This film magazine should not be exposed to vacuum conditions for periods in excess of 5 hours. The film temperature must be maintained in the range of 50-100°F. (MAJOR)

Sequence (Data Acquisition) Camera:

Magazine Temperature - The film magazine limits 130°F as indicated by temperature gage on side of magazine (MAJOR) (Ref: NASA R. Gerlach in Minutes Third Meeting Lunar Surface Operations Planning Meeting, 1/19/68).

Color Television Camera

1. Optical Line-of-Sight should not be pointed within 45° of the sun. (MINOR). It is not desirable that the TV be pointed at low light level areas with high contrast bright zones for long time periods. May result in a temporarily degraded picture.

NOTE: Camera setting under these conditions (not to exceed 30 minutes) lens aperture f:22, zoom 25mm, ALC switch on AVERAGE.

2. Bright scenes or with crewmen in picture for long periods require camera to be reset to PEAK on ALC switch. (MAJOR)

3. Dust contamination of TCU unit and drive mechanism should be avoided. (MAJOR)

4. Color TV camera should not be placed in the shade if not operating, but may be in shade for not longer than one hour if camera is operating. (MAJOR)

5. Camera case, particularly the mirrors, should be kept as free from dirt as possible. (MAJOR)

NOTE: No time constraint on operation in sunlight if case is clean.

6. Camera warmup time is ≤ 1 minute under temperature limits anticipated for Apollo missions. (15-20 sec for color wheel motor to come up to speed).

(Reference: Telecon J. Feltus/B. Perry office/EE2 to Lunar Surface Operations Office CG33, June 17, 1970.)

Apollo Lunar Surface Experiments Package (ALSEP) (See ref. 3 and 9)

The ALSEP will be deployed a minimum of 300 feet from the LM on the Z-axis. The 300 foot minimum distance to the emplacement area is due to the necessity of ALSEP deployment out of the LM acent blast area. The walk to the deployment area is timed to prevent excess RTG warmup and thereby avoid thermal problems for the crewman. (MAJOR)

1. ALSEP Hold Points
   The following list of hold points is provided. The sequence of the ALSEP deployment may be stopped after the completion of any one of the hold points, to be continued at some later time by going to the next series of tasks. (MAJOR) (Reference: Clayton, J. F.; Bendix Aerospace; Letter October 27, 1967.)

   1a) Remove Packages #1 and #2; close SEQ Bay door; emplace ALSEP packages with experiments in and facing the sun.

   1b) Tilt fuel cask; dome not removed.

   1c) Tilt fuel cask; remove dome, do not defuel.

   1d) Fuel RTG, offload LRRR carry ALSEP to deployment site; remove HFE and SIDE subpallets from Package no. 2; carry Package no. 1 to implace site (do not deploy); inter-connect RTG cable (do not actuate shorting switch); offload SIDE/CCIG; inter-connect HFE, SIDE/CCIG cables.

   1e) Deploy Package No. 1 as well as Package No. 2; release and remove experiments; raise sunshield; deploy experiments (IF DESIRED).

   1f) Deploy experiments and complete ALSEP tasks. A hold point exists after each experiment is deployed.

2. ALSEP Deployment
   The ALSEP is deployed a minimum of 300 feet from the LM. The individual experiment constraints are as follows: (The Central Station/Package No. 1 is used as a reference with an imaginary clock superimposed on its top so that 12 o'clock falls on the back of the package). (MAJOR)

2a) RTG

PARAMETER	CONSTRAINT
Separation Between RTG and Central Station	9 to 12 ft. Limited by 13 ft cable. Hot RTG should be away from Central Station to avoid contact with astronaut, and to provide maximum heat radiation to free space.
RTG Orientation from Central Station	$\pm 20°$ East of Central Station as visually determined by astronaut to minimize thermal load on Central Station.
RTG Deployment Site	Horizontal site. Pallet must be horizontal $\pm 10°$, as visually determined by astronaut. No mechanical provisions for astronaut to level RTG. Astronaut will avoid craters and slopes which impede dissipation of heat from RTG.
RTG Alignment	No critical constraints. Astronaut will align so as to favor RTG cable exit toward Central Station.
Interrelation	Nominal Current Readings:

Time after fueling	Short Circuit Current
10 min.	4-6 amps
20 min.	5-7 amps
30 min.	6-8 amps
>35 min.	7-8 amps

After the connection is made and the shorting switch is depressed, the ammeter reading goes to zero.

2b) ALSEP Central Station

PARAMETER	CONSTRAINT
Central Station-to-LM Separation	300 to 1000 ft. This distance is required to keep ALSEP out of the LM ascent debris blast area.
Central Station Orientation from LM	Due West or East of LM, preferably West. Must not be deployed in shadow on LM.
Central Station Deployment Site	Approximately horizontal, as visually determined by astronaut to provide stable base for antenna. Astronaut must avoid craters and slopes which would degrade thermal control of unit.
Central Station Leveling	5° of vertical as noted by astronaut on bubble level. Leveling procedure interacts with alignment procedure.
Central Station Alignment	±5° of East-West as aligned by astronaut using partial compass rose. Alignment affects thermal control capability of Central Station. Closed or curtained sides of Central Station must face East-West.
Interrelation	Central Station, as with most ALSEP subsystems, requires clear field-of-view for both thermal control and scientific data reasons. Central Station must not be shaded from the sun on the lunar surface prior to deployment. ALSEP design allows deployment when sun angle is between 5 and 45 degrees. ALSEP may be removed from LM when bottom of SEQ Bay is from 18 to 60 in. from lunar surface and with a 15 degree tilt in any direction.

Central Station Antenna

PARAMETER	CONSTRAINT
Site Selection	Attach to Central Station
Antenna Leveling	±0.5° ov vertical. Astronaut will use bubble level to adjust. Level adjustment interacts with alignment.
Antenna Alignment	±0.5° of East-West line as determined by sundial. When shadow coincides with shadow reference line, alignment is within ±0.5°.
Antenna Azimuth Setting	Astronaut will set dial to value indicated on Cuff Checklist for landing site chosen to assure adequate signal strength for life of ALSEP.
Antenna Elevation Setting	Astronaut will set dial to value indicated on Cuff Checklist for landing site chosen to assure adequate signal strength for life of ALSEP.

2c) SIDE/CCIG

PARAMETER	CONSTRAINT
SIDE/CCIG - Central Station Separation	50 to 60 feet from Central Station, limited by 60-foot cable
SIDE orientation from Central Station	Northeast of Central Station as visually determined by astronaut.
CCIG orientation from Central Station	Orifice must point away from Central Station and away from LM.
SIDE/CCIG Deployment Site	Approximately level spot. Unobstructed view in front of orifice. SIDE placed on screen, CCIG of screen.
SIDE leveling	$\pm 5°$ of level by use of bubble reference (bubble free from case).
SIDE alignment	$\pm 5°$ of E-W line, with arrow marked "E" toward East (sun)
CCIG alignment	$\pm 20°$ of N-S line, arrow pointing North
Special Requirements	CCIG onifice must point away from all man-made objects($\pm 90°$)
	CCIG includes a strong magnet which would affect LSM if separation is less than 80'.

2d) PSE

PARAMETER	CONSTRAINT
PSE-to-Central Station Separation	8 to 9 ft. Limited by 10 ft cable.
PSE-to-RTG Separation	15 feet minimum from RTG necessary to avoid thermal input from RTG.
PSE Orientation from Central Station	Northwest of Central Station, on opposite side from the RTG, visually determined by astronaut.
PSE Deployment Site	Approximately level spot.
PSE Leveling	Must be coarse leveled by astronaut within ± 5 degrees of vertical. Five degrees is the limit of the automatic, fine-leveling gimbal system.
PSE Alignment	Astronaut must rough align within ± 20 degrees of lunar East, before opening PSE shroud, by pointing arrow on the sensor girdle towards the sun. Fine alignment will be p rformed by the astronaut after removing girdle and spreading the thermal shroud. Astronaut will read and record, to the nearest degree, the intersection of the shadow of the gnomon on the compass rose. Final azimuth alignment must be known within ± 5 degrees accuracy with reference to lunar North or South.
Interrelation	PSE must be no less than 10 ft from other units to minimize pickup of stray vibrations by PSE and to minimize thermal inputs.

2e) LSM

PARAMETER	CONSTRAINT
Site Selection	Deploy LSM 40 to 48 feet Northwest of the Central Station limited by 50-foot cable. This separation is required to minimize EMI effects on LSM sensors.
Alignment	Align the LSM to within $\pm 3°$ of East-West sun line. Astronaut should read the shadowgraph within $\pm 1°$. Alignment is critical because thermal control is critical and exact alignment is required to interpret LSM scientific data.
Leveling	LSM should be placed in an approximately level spot, free from loose material. Level the LSM to within $\pm 3°$ of vertical using bubble level. Note: LSM must be a minimum of 80' from the SIDE/CCGE which contains a strong magnet.

2f) SWS

PARAMETER	CONSTRAINT
SWS Site Selection	Deploy SWS 12 to 15 feet north of Central Station. Orient SWS so that louvered side (radiator) points approximately due North.
Leveling	Level the SWS to within 5° of horizontal about N-S axis. SWS should be placed in an approximately horizontal spot to avoid thermal perturbations. Due to A-frame construction, there is a pendulum effect about E-W axis; SWS should swing freely. No fine leveling about N-S axis is necessary since N-S orientation is determined from sun sensor TM data. Note that sun shade has swung to its up position in contact with the sensor mounting plate. If not, raise it.
Alignment	Align SWS by rotating about a vertical axis so that the shadow cast by the north edge of the sensor assembly cupola runs parallel to the edge of the sun shield.
Fine Alignment	Fine align the SWS box by touching the box with the handling tool near the bottom on the south side to see whether it swings freely on its E-W pivot. If not free, move the leg assemblies farther apart so that the instrument swings freely and recheck alignment.
Remarks	Louvered side (radiator) should be away from RTG and Central Station due to thermal control requirements.

2g) HFE

PARAMETER	CONSTRAINTS
Site Selection	Deploy the HFE Electronics Package 25 to 30 feet north of the Central Station. HFE Electronics Package should be placed in an approximately level area, removed from any surface irregularities or rocks that may obscure the field-of-view of the HFE sunshield reflector.
Alignment	Align the HFE Electronics Package to within $\pm 5°$ of the plane of the ecliptic or lunar equator. This is accomplished by rotating package until shadow cast by UHT covers alignment decal. Radiator must face away from equator. Deploy the Probes 15 to 19 feet from the Electronics Package maintaining 40 foot minimum separation between Probes and RTG.
	When the HFE bore holes have been drilled with the ALSD, the probes should be inserted and should be vertical within $\pm 15°$ as determined visually by the astronaut.
Leveling	Level the HFE Electronics Package to within 5° of vertical using bubble level. Bubble should be free from case circle to be within 5°.
Remarks	If feasible, the HFE Probes should be placed at least 200 feet from fresh craters with surrounding strewn fields of stones.

2g) HFE (Cont'd)

PARAMETER	CONSTRAINTS
	The HFE Probes should be at least 5 diameters from large isolated blocks (boulders) greater than 2 feet across exposed at the surface. Try to avoid topographic features greater than two feet in diameter, such as craters or hummocks that have a relief greater than 10 to 1, (slope of 10°). On the scale of 100's of feet topographic highs should be avoided and depressions preferred to assure thickest possible regolith. The HFE should be at least 10 feet from all other experiments and at least 20 feet from the PSE and at least 25 feet from the RTG.

2h) LRRR

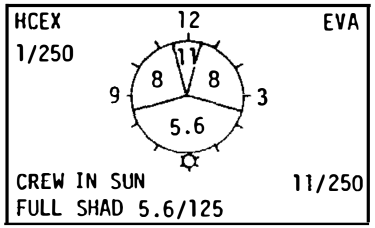
PARAMETER	CONSTRAINTS
LRRR - LM Separation	Minimum mandatory distance is 300 to 500 feet due West of LM. A deployment distance of greater than 500 feet is requested to minimize dust fallout from LM ascent engine blast.
Leveling	Must be leveled by astronaut using bubble level within 5 degrees with respect to indicator. It should be noted that the optical performance of the reflector degrades as the off axis angle increases. It is therefore, necessary to aim the array as accurately as possible toward the center of the earth's libration position.
Elevation	Astronaut must deploy the leveling leg which sets the elevation angle. For Hadley Rille site, the elevation angle is 26.8 degrees to the horizontal.
Alignment	Astronaut will align LRRR using sun compass, then report azimuth alignment by noting where shadow cast by gnomon falls on the index marks. Index marks are set for specific landing site and deployment date.

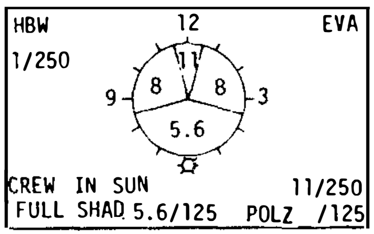
5.3 ALSEP AND SCIENTIFIC EQUIPMENT PROCEDURES

The detailed procedures for deploying the ALSEP experiments will be included in the Contingency Supplement to the Lunar Surface Procedures.

5.4 Equipment Decals

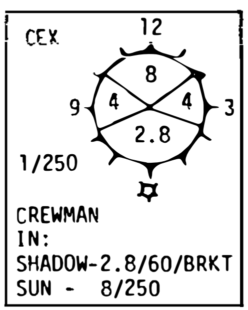
Decals are provided as required to supplement the crew cuff checklists and to provide detail information for off nominal operations or tasks that require ordered step-by-step operation. Figure 5.4-1 represents the operational decals to be utilized by the Apollo 15 crew during their Lunar Surface activity.





ALSEP PKG MANUAL OFFLOAD

1. PULL SMALL LANYARD TO REMOVE BOOM-TO-STICK PIP PIN
2. REMOVE OFFLOAD LANYARD FROM PKG HANDLE
3. PULL WHITE END OF LANYARD TO UNSTOW PKG FROM LM
4. DISCONNECT WHITE LANYARD END FROM PKG
5. VELCRO LANYARD TO SIDE, CLEAR OF PKG
6. PULL PKG FROM SEQ BAY
7. PLACE PKG ON SURFACE
8. REMOVE & DISCARD STICK



PUSH SW TO TEST

PULL PIN 2 (LEFT SIDE)

TURN LOCK 3 (BOTTOM RIGHT) CCW

TURN LOCK 4 (RIGHT SIDE) CCW
PULL FREE-THEN PULL LANYARD

PUSH RACK LEG FROM CLIP-EXTEND
& LOCK TOP 2 LEGS-LOCK BRACE

REMOVE & INSTALL HANDLE-BLACK
PIN UP FIRST

REMOVE RACK-EXTEND & LOCK 3 RD
LEG-PLACE RACK ON SURFACE

PULL PIN 1 (RACK COVER)-REMOVE
RACK COVER & DISCARD

PULL PIN 5 (DRILL COLLAR)- &
SWING COLLAR UP

RESET CHUCK & REMOVE DRILL

REMOVE THERMAL COVER
BEFORE DRILLING

FIGURE 5.4-1 EQUIPMENT DECALS

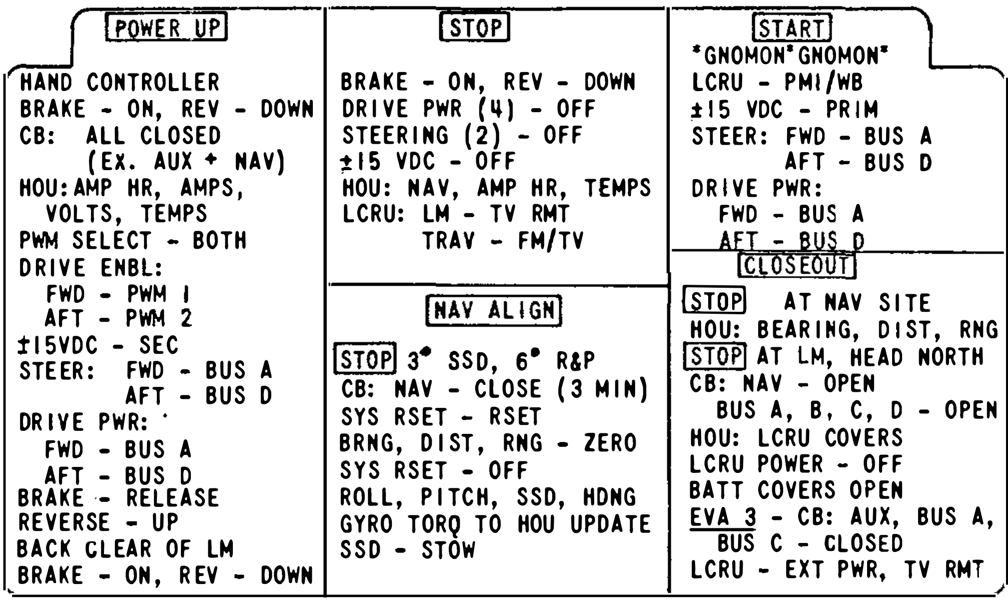


Figure 5.4-2 LRV Operations Decal

5.5 References

(1) Office of Manned Space Flight: Apollo Flight Mission Assignments, Document M-D MA5000-11, SE010-000-1; 11 July 1969

(2) Systems Engineering Division, Apollo Spacecraft Program Office: Mission Requirements. SA-510/CSM-112/LM-10, J-1 Type Mission. Lunar Landing SPD9-R-056, MSC, 4 Jan 1971

(3) ALSEP Familiarization Course Handout The Bendix Corp., Aerospace Systems Division, 1 May 1970

(4) Crew Procedures Division, CPD: Apollo 15 Timeline, AS-510/CSM-112/LM-10 (Preliminary dtd April 20,1971)

(5) Lunar Surface Project Office: Flight System Familiarization Manual The Bendix Corp., Aerospace Systems Division, 1 August 1967 (Revised 15 April, 1969; chg 1 Dec 15, 1970)

(6) Crew Procedurew Division, CPD: Photographic and TV Procedures, Apollo 15 (April 30, 1971)

(7) Lunar Missions Office, S & AD: Scientific Experiments and Equipment Contingency Procedures, Mission J-1/Apollo 15 Preliminary dated April 1, 1971

(8) Contingency Procedures, ALSEP Array #2 the Bendix Corporation, Aerospace Systems Division, ATM 1003, May 1971.

(9) Lunar Surface Project Office, E&D; and Lunar Missions Office, S&AD: Alignment, Leveling and Deployment Constraints for Apollo 15 Lunar Scientific Experiments Document conveyed by memo

(10) Lunar Surface Project Office: Data Book, ALSEP MP05, BSR-3087 dated 1 March 1971; Rev A May 1971.

(11) FCD: ALSEP LUNAR SURFACE Experiments Package Systems Handbook, ALSEP A2, dated March 24, 1971.

(12) FCD: Lunar Surface Television Operations Plan April 30,1971 and revisions (if any).

(13) Apollo Operation Handbook MSC 01372-1 Vol I Rev V March 1971 and MSC 01372-2 Vol II June 1971