



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(FOR ALL LAUNCH DATES)

APOLLO 15

FINAL

LUNAR SURFACE PROCEDURES

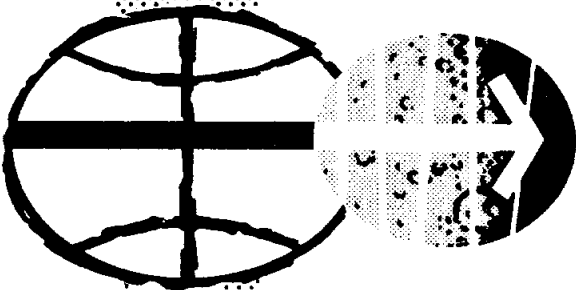
~~REVISION~~
~~LUNAR SURFACE PROCEDURES~~
~~HOUSTON, TEXAS~~

PREPARED BY

LUNAR SURFACE PROCEDURES SECTION

EVA/IVA PROCEDURES BRANCH

CREW PROCEDURES DIVISION



MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

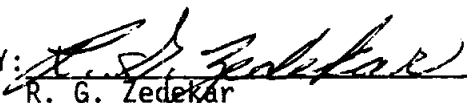
JULY 9, 1971

FINAL

APOLLO 15


LUNAR SURFACE PROCEDURES

JULY 9, 1971

APPROVED BY: 
R. G. Zedekar
Chief, Lunar Surface Procedures Section


D. C. Schultz
Chief, EVA/IVA Branch


J. W. Bilodeau
Chief, Crew Procedures Division


Donald K. Slayton
Director of Flight Crew Operations

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.



J. H. Roberts
Lunar Surface Procedures Section



T. O. Montgomery
General Electric Co.



J. G. Olmsted
General Electric Co.



R. V. Blevins
General Electric Co.

CONTENTS

	Page
Preface	
List of Tables and Figures	v-vii
1.0 INTRODUCTION	1
2.0 MISSION DESCRIPTION	3
2.1 Mission Objectives	3
2.2 Mission Lunar Surface Priorities	4
2.3 EVA Requirements	5
2.4 Lunar Landing Site Description	6
2.5 Scientific Objectives of the Hadley-Apennine Region	7
2.5.1 Apennine Mountains	7
2.5.2 Hadley Rille	7
2.5.3 Mare Materials	8
2.5.4 Possible Volcanic Landforms	8
2.5.5 Secondary Crater Clusters	8
2.6 Lunar Surface Activity for 67 Hour Stay	8
3.0 NOMINAL LUNAR SURFACE EVA	17
3.1 EVA General Description	17
3.1.1 SEVA	17
3.1.2 EVA-1	21
3.1.3 EVA-2	35
3.1.4 EVA-3	39
3.2 Detailed EVA Timeline Procedures	43
3.2.1 SEVA	43
3.2.2 EVA-1	49
3.2.3 EVA-2	91
3.2.4 EVA-3	129
3.2.5 Sampling and Related Procedures	165
3.3 Lunar Surface Photography Data	175
3.4 ALSEP Deployment and Equipment Data	179
3.5 Geology Equipment and Data	183
3.6 EVA Traverses	217
3.6.1 Traverse Assumptions and Ground Rules	217
3.6.2 Traverse Maps and Station Tasks	220
3.7 Lunar Rover Vehicle	261
3.7.1 Systems	261
3.7.2 Operations	261
3.7.3 Performance & Constraints	280

CONTENTS (Cont'd.)

	<u>Page</u>
3.7.4 Decals and Checklists	287
4.0 CONTINGENT PLANS	293
4.1 General Description	293
4.1.1 EVA-1 Two Man Walking Traverse	294
4.1.2 EVA-2 Two Man Walking Traverse	295
4.1.3 EVA-3 Two Man Walking Traverse	297
4.1.4 EVA-1 One Man LRV Traverse	*
4.1.5 EVA-2 One Man LRV Traverse	*
4.1.6 EVA-2 One Man LRV Traverse	*
4.1.7 Min Time EVA - One Man	299
4.2 Detailed Contingency EVA Timeline	301
4.2.1 EVA-1 Two Man Walking Traverse	301
4.2.2 EVA-2 Two Man Walking Traverse	319
4.2.3 EVA-3 Two Man Walking Traverse	345
4.2.4 EVA-1 One Man LRV Traverse	357
4.2.5 EVA-2 One Man LRV Traverse	357
4.2.6 EVA-3 One Man LRV Traverse	357
4.2.7 Min Time EVA - One Man	359
4.3 EVA Walking Traverses.	367
4.3.1 Traverse Assumptions and Ground Rules	367
4.3.2 Traverse Maps and Station Tasks	367
4.4 Off-Nominal Planning	383
5.0 APPENDIX	385
5.1 Abbreviations	385
5.2 Operational Constraints	387
5.3 ALSEP and Scientific Equipment Procedures	403
5.4 Equipment Decals	405
5.5 References	409

* To be supplied in a Supplement
to the Lunar Surface Procedures

<u>Figure Number</u>	<u>Figure</u>	<u>Page</u>
2.6-1	Lunar Surface Activity Summary Timeline For 67 Hour Stay.	11
3.1-1	Summary Timeline SEVA	19
3.1-2	Summary Timeline - Nominal Lunar Surface EVA-1.	23
3.1-3	LRV Deployment Sequence	25
3.1-4	MESA Stowage.	26
3.1-5	Probable Areas for Near - LM Lunar Surface Activities.	27
3.1-6	Summary Timeline - Nominal Lunar Surface EVA-2.	37
3.1-7	Summary Timeline - Nominal Lunar Surface EVA-3.	41
3.3-1	Lunar Surface Photography Data.	177
3.4-1	Apollo Lunar Surface Experiments Data	181
3.5-1	Lunar Field Geology Equipment and LRV Stowage	185
3.5-2	EVA-1 Lunar Surface Equipment & Sample Management	188
3.5-2a	EVA-1 MESA and ETB Transfers to LRV	188
3.5-2b	EVA-1 MESA Table Loading and Transfers to LRV	189
3.5-2c	EVA-1 Pre-Geology Traverse.	191
3.5-2d	EVA-1 Pre-ALSEP Deployment.	193
3.5-2e	EVA-1 Arrival Back at LM - Post ALSEP	195
3.5-2f	EVA-1 LRV Transfers to MESA and LM.	196
3.5-2g	EVA-1 ETB Transfer to LM.	197
3.5-2h	EVA-1 On LMP Ingress.	199
3.5-3	EVA-2 Lunar Surface Equipment & Sample Management	200
3.5-3a	EVA-2 MESA and ETB Transfers to LRV	200
3.5-3b	EVA-2 MESA Table Loading and Transfers to LRV	201
3.5-3c	EVA-2 Pre-Geology Traverse.	203
3.5-3d	EVA-2 Arrival Back at LM.	205
3.5-3e	EVA-2 LRV Transfers to MESA and LM.	206
3.5-3f	EVA-2 ETB Transfer to LM.	207
3.5-3g	EVA-2 On LMP Ingress.	209
3.5-4	EVA-3 Lunar Surface Equipment & Sample Management	210
3.5-4a	EVA-3 MESA and ETB Transfers to LRV	210
3.5-4b	EVA-3 Pre-Geology Traverse.	211
3.5-4c	EVA-3 Arrival Back at LM.	213
3.5-4d	EVA-3 LRV Transfers to MESA and LM.	214
3.5-4e	EVA-3 On LMP Ingress.	215
3.6-1	Hadley Apennine Landing Area.	221
3.6-2	LRV Traverses EVA-1,2,3 (Summary)	223
3.6-3	Hadley Apennine Features & Names.	225
3.6-4	Profile of Hadley Apennine Landing Site	227
3.6-5	LEGEND - 1:25,000 & 1:12,500 Geologic Map	229
	Explanation	
3.6-6a	EVA-1 1:25,000 Contour Map.	230
3.6-6b	EVA-1 1:25,000 Traverse Map	231
3.6-7a	EVA-2 1:25,000 Contour Map.	236

Figure(cont'd)

3.6-7b	EVA-2	1:25,000	Traverse Map.	237
3.6-8a	EVA-3	1:25,000	Contour Map	244
3.6-8b	EVA-3	1:25,000	Traverse Map.	245
3.6-9a	EVA-1,2	1:12,500	Traverse Map (Part A).	254
3.6-9b	EVA-1,2	1:12,500	Traverse Map (Part B).	255
3.6-9c	EVA-1,2	1:12,500	Traverse Map (Part C).	257
3.6-10a	EVA-3	1:12,500	Traverse Map (Part A).	258
3.6-10b	EVA-3	1:12,500	Traverse Map (Part B).	259
3.7-1	LRV Systems			262
3.7-2	LRV Handcontroller Functions.			263
3.7-3	LRV Control and Display Functions			264
3.7-3.1	Apollo 15 LRV Velocity Constraints.			281
3.7-3.2	LRV Dynamic Stability - Steering Stability.			282
3.7-3.3	Stopping Distance vs Initial Velocity - Various Slopes.			283
3.7-3.4	LRV Stop Distance vs Handcontroller Pull Force.			284
3.7-3.5	LRV Operations Decal.			289
3.7-3.6	LRV/LCRU Malfunction Procedures Checklist			240
4.3-1	Walking Traverses EVA-1,2,3 (Summary).			369
4.3-2a	EVA-1,2,3	1:25,000	Walking Traverse Contour Map	370
4.3-2b	EVA-1,2,3	1:25,000	Walking Traverse Map	371
4.3-3a	EVA-1,2,3	1:12,500	Walking Traverse Map (Part A).	372
4.3-3b	EVA-1,2,3	1:12,500	Walking Traverse Map (Part B).	373
4.3-4	Off-Nominal Planning Data			*
5.4-1	Equipment Decals.			406
5.4-2	LRV Operations Decal.			407

* To be supplied in a Supplement to the Lunar Surface Procedures

<u>Table Number</u>	<u>Table</u>	<u>Page</u>
2.6-1	Loose Equipment Left on Lunar Surface.	13
2.6-2	Equipment Transferred Between A/S-Surface-A/S.	15
3.5-1	LEGEND - Lunar Field, Geology Equipment & Sample Mgmt.	187
3.6-1	EVA-1 Traverse and Station Tasks (Nominal)	233
3.6-2	EVA-2 Traverse and Station Tasks (Nominal)	239
3.6-3	EVA-3 Traverse and Station Tasks (Nominal)	247
3.6-4	Summary Traverse/Task Timetable EVA-1, 2, 3.	253
3.7-1	LRV Operational Functions.	265
3.7-2	LRV Off-load From LM and LRV Set-up Procedures	266
3.7-3a	LRV Power-Up (EVA 1) Procedures.	269
3.7-3b	LRV Power-Up (EVA-2, 3) Procedures	271
3.7-4	LRV Navigation Alignment Procedures.	272
3.7-5a	LRV Procedures - Geology/Science Site (Nominal).	273
3.7-5b	LRV Nav Up-date - Geology/Science Site	275
3.7-6a	LRV Closeout EVA-1	277
3.7-6b	LRV Closeout EVA-2	278
3.7-6c	LRV Closeout EVA-3	279
3.7.3-1	LRV Operating Limits, Constraints & Requirements	285
4.3-1	EVA-1 Walking Traverse and Station Tasks	375
4.3-2	EVA-2 Walking Traverse and Station Tasks	377
4.3-3	EVA-3 Walking Traverse and Station Tasks	379
4.3-4	Summary Walking Traverse/Task Timetable EVA-1, 2, 3.	381

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

SECTION 1.0

INTRODUCTION

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.

<u>Mission and Lunar Surface Priority</u>	<u>Detailed Objectives and Experiments</u>
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 Apennine Front (S-059)
- 4) ALSEP Deployment
- 5) Laser 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 $\sim 25^\circ$ 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 unforeseen 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 preceding 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 pre-planned 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. Jettison During EVA-1: (In a Jettison Bag)
 2 - OPS Pallets
 3 - Arm rests
 Used LiOH cartridge & Bracket
 BSLSS Bag

2. Discarded On Lunar Surface During EVA-1
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. Operational Equipment Deployed and Left On EVA-1
 Flag
 TV Camera
 LRV
 ALSEP: PSE, LSM, HFE, SIDE/CCIG, SWE
 LRRR
 SWC

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

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

6. Jettisoned During EVA-3 (In Jettison Bag)
 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. Discarded on Lunar Surface During EVA-3
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. Jettisoned to Lunar Surface After EVA-3 (In Jettison Bag)
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. Transferred to Surface EVA-1
 - ETB and contents
 - Map holder w/lunar surface maps and LRV checklist
 - 3-70mm mags (2-HCEX mags KK,NN, 1-HBW mag 00)
 - 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. Transferred into Ascent Stage EVA 1
 - 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 00)

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 00, 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 paragraph 3.1.4.

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 lunar 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 lunar surface 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	<ul style="list-style-type: none"> ● STAND ON ASCENT ENGINE COVER ● OBSERVE AND DESCRIBE LM SITE ● 70 MM VERTICAL STEREO PAN ● GENERAL SURFACE DESCRIPTION 			
19 LM PILOT ACTIVITY	<ul style="list-style-type: none"> ● 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

NAME	INITIAL	ORIGIN	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
R. BLEVINS	<i>RB</i>		MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
DR./C. HENDRICKS	<i>CH</i>	GE	<p style="text-align: center;">APOLLO 15 SUMMARY TIMELINE</p> <p style="text-align: center;">LUNAR SURFACE SEVA</p> <p style="text-align: center;">FIGURE 3.1-1</p> <p>PREPARED BY GENERAL ELECTRIC HOUSTON PROGRAM</p>
			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, in turn, 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.

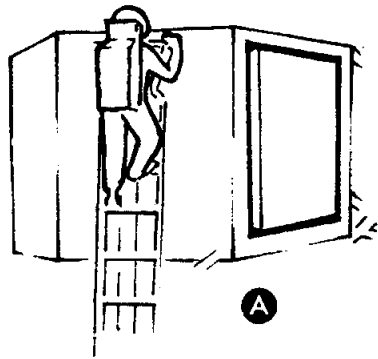
The LMP after making a final check of the LM cabin proceeds to egress to the LM porch. After partially closing the hatch he then descends the ladder to the lunar surface where he spends a few moments becoming acclimated to the lunar environment and making his initial observations of the terrain in the 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 degrees from vertical. The LMP then descends the ladder to assist the CDR with the LRV offload.

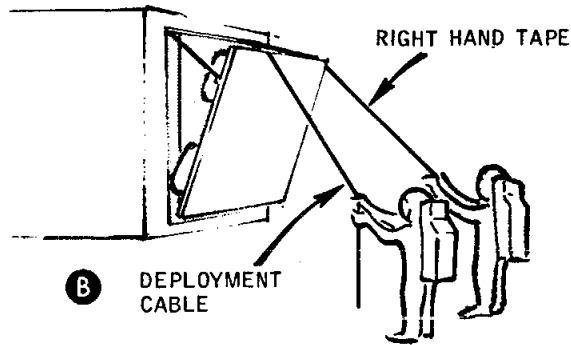
The CDR, having observed the LRV unlock and initial movement to the 4° position, now pulls the right-hand LRV offload tape until the rear wheels rest on the lunar surface. (Note: The LMP will assist by maintaining tension on the aft deploy cable.) With the rear wheels resting on the lunar surface, the right and left outrigger cables are detached and the CDR begins to pull the left-hand offload 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



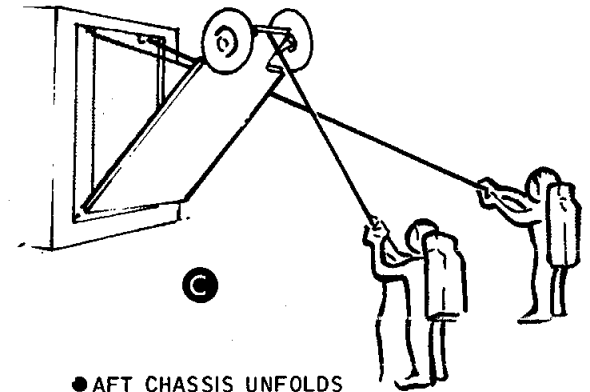
A

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



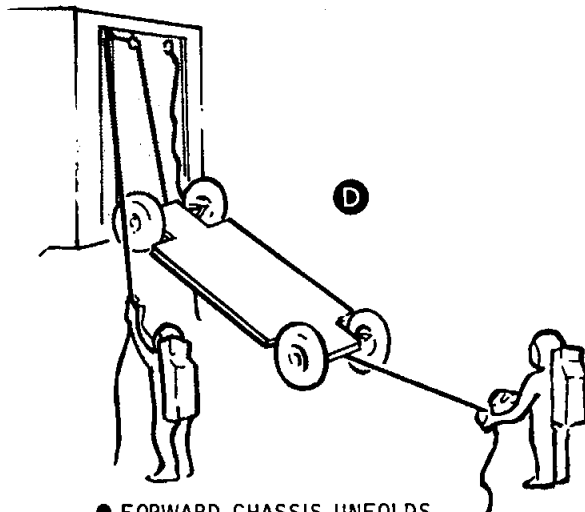
B

- ASTRONAUT LOWERS LRV FROM STORAGE BAY WITH RIGHT HAND TAPE



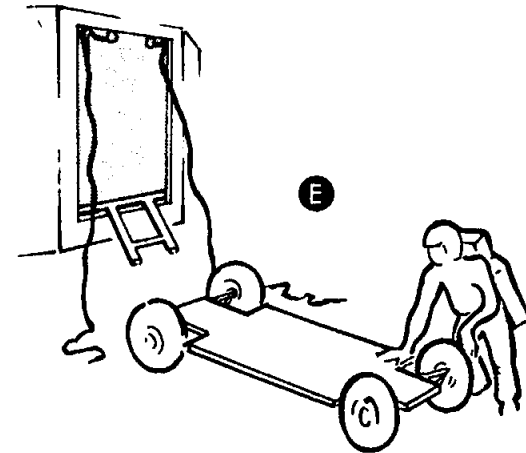
C

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



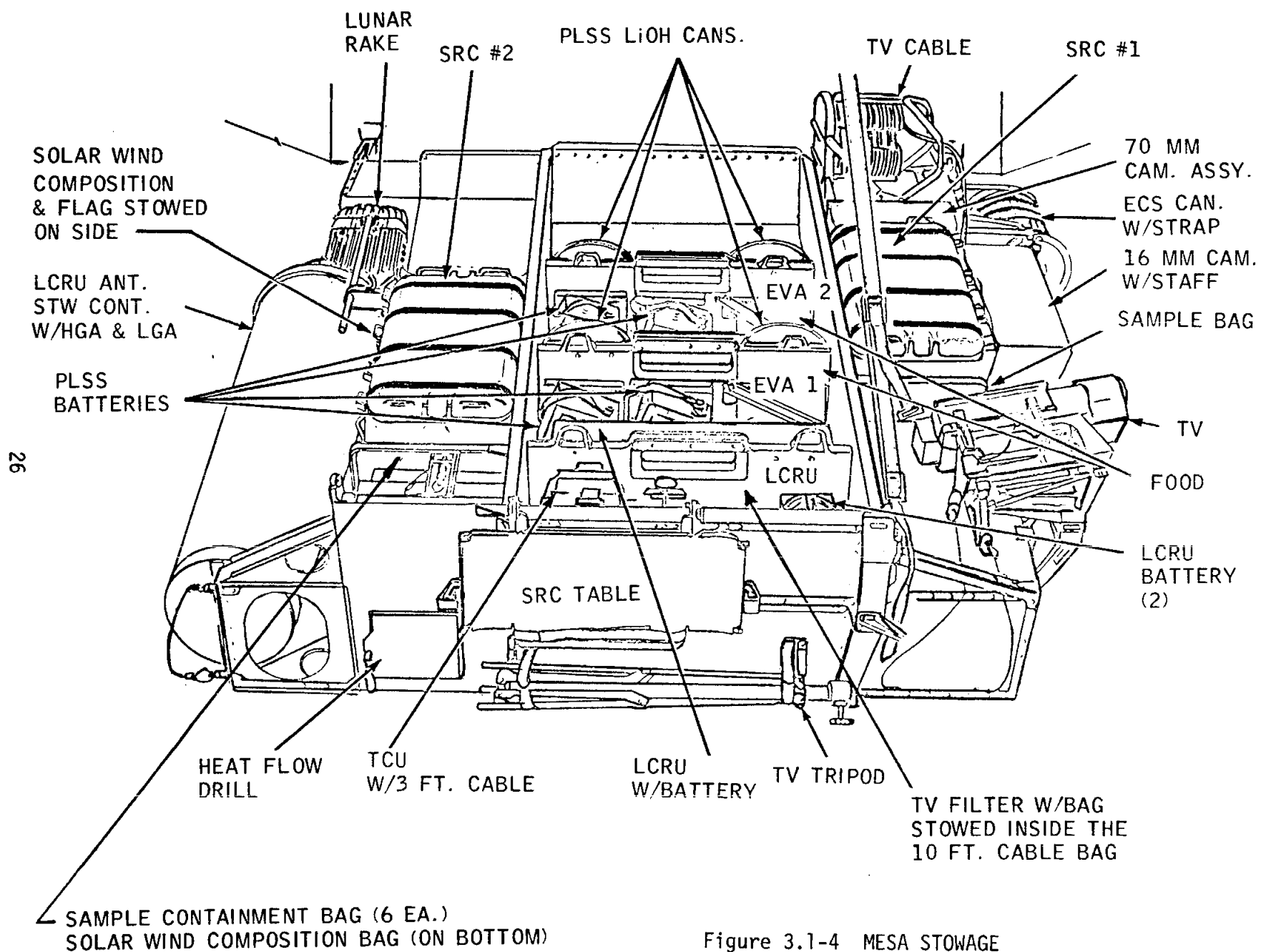
D

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



E

- ASTRONAUT DISCONNECTS SSE



26

Figure 3.1-4 MESA STOWAGE

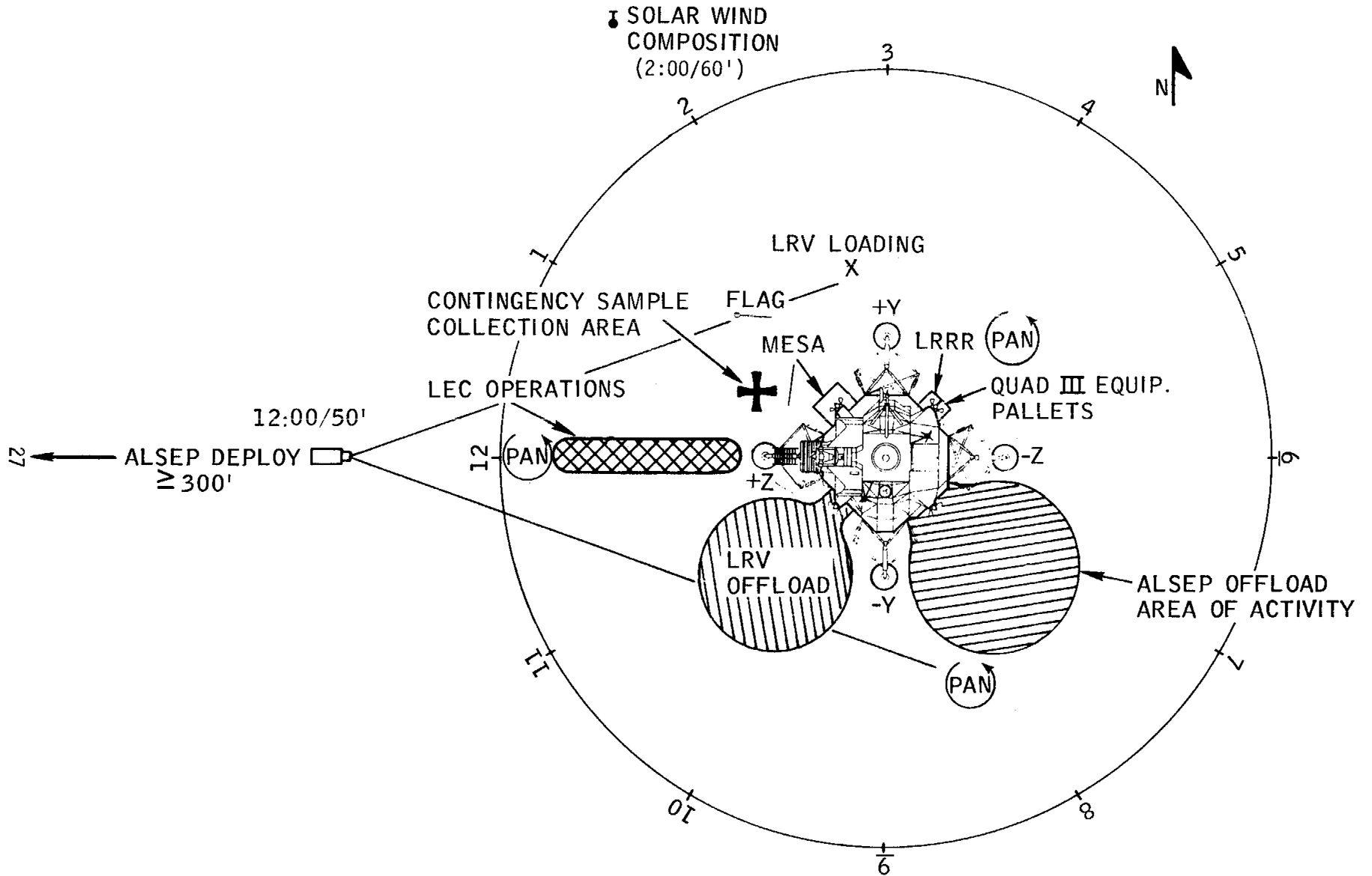


FIGURE 3.1-5 PROBABLE AREAS FOR NEAR LM LUNAR SURFACE ACTIVITIES

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 under-seat 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.

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E Q C A M	TASK FUNCTION	
				L M P	C D R
	0+00	Stand on Ascent Engine cover with head and shoulders protruding through docking tunnel hatch			
		Describe terrain 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 terrain, surface conditions and landmark features as observed through LM windows		Hand 70mm camera to LMP			
Interim stow 70mm camera		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			
		Receive 500mm lens camera from LMP			
Hand 500mm lens camera to CDR		Do long lens photography of Front, Rille, North Complex, Boulder fields and any other prominent features			
		Hand 500mm lens camera to LMP			
Interim stow 500mm lens camera	0+20				

MISSION: APOLLO 15
 EVA: SEVA

DATE: 4/19/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E O C A M	TASK FUNCTION	
				L M P	C D R
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 noticeable 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

EVA-1	<u>PLSS TO LM H2O TRANSFER</u>	EGRESS H2O TIEOFF
	Torso Tiedown - Loosen as reqd PLSS Pump - OFF Disconnect PLSS H2O Connect LM H2O CB(16) ECS: LCG Pump - CLOSE	
7/1/71	<u>LM TO PLSS H2O TRANSFER</u>	
	CB(16) ECS: LCG Pump - OPEN Disconnect LM H2O Connect PLSS H2O PLSS Pump - ON Torso Tiedown - Tighten as reqd	

EVA-1	<u>PLSS TO LM H2O TRANSFER</u>	EGRESS H2O TIEOFF
	Torso Tiedown - Loosen as reqd PLSS Pump - OFF Disconnect PLSS H2O Connect LM H2O CB(16) ECS: LCG Pump - CLOSE	
7/1/71	<u>LM TO PLSS H2O TRANSFER</u>	
	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	TASK FUNCTION	
			JSA	Code
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	<u>EGRESS</u>		

CREW EVA CHECKLIST

VOICE DATA

0+10

HATCH EGRESS	CDR - EVA 1		CDR-3
	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	
HATCH EGRESS	EVA-1		7/1/71
	0+20	ETB - Transfer Down ETB - To Ladder Hook MESA Height - Adjust Blankets - Open [LMP: Egress] LMP PLSS Ant. - Unstow	

(1) LMP - Deploy CDR PLSS antenna

(2) CDR - Jettison Bag

HATCH EGRESS	LMP - EVA 1		LMP-3
	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	
HATCH EGRESS	EVA-1		7/1/71
	0+20	ETB - Transfer LEC - Stow to Side Egress Hatch - Close Descend to Surface [CDR: LMP PLSS Ant.-Unstow]	

(1) CDR - Stability & Mobility discussion

CDR - LM check

CDR - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

HATCH EGRESS	CDR-4		LMP-3
	0+29	[TV] Tripod - Unstow TV Camera - To Tripod TV - Position 12:00/50 Ft. Lens - Set f-11, 12.5mm, Pk. Check How TV Reception	
HATCH EGRESS	EVA-1		7/1/71
	0+37	[LMP] Thermal Blanket - Remove Cl - 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	

(1) LMP - Stability & Mobility discussion

(2) LMP - Verify cb configuration - OK

HATCH EGRESS	LMP-4		LMP-3
	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	
HATCH EGRESS	EVA-1		7/1/71
	0+36	LRV - Setup •Chassis Hinge Pins - Check •Battery Covers-Check Closed	

(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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	L C G I V	TASK FUNCTION			
				L M P	C D R		
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				TV DEPLOY	EGRESS
Remove from handhold & stow LEC Move through hatch		Hang ETB on LEC stowage hook Adjust MESA height Loosen MESA blanket around TV camera					
Close hatch		Open MESA blankets Deploy LMP PLSS antenna					
Descend to surface		Unstow, deploy, and place TV tripod on surface					
Deploy PLSS antenna		Unstow and mount TV camera on tripod					
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		Remove LRV thermal blanket					
Climb LM ladder & place cont sample on platform	0+30	Check walking hinges latched Deploy left LRV offload tape across secondary strut					

LRV OFFLD LCRU HF	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	CDR-5
	0+46 LCRU Post Locks - Lift Velcro Tab - Release TCU Cable - To Batt Cover LCRU - To LRV Cable - Connect TCU - To LRV Cable - Connect [LMP: EVA 1 Pallet to MESA] Rake - To MESA Side LGA - To Handhold LGA Cable - Connect To LCRU	EVA-1 7/1/71

LRV DPLY 16mm LRV	0+42 16mm Cam - Assemble Mag"CC" - Install on 16mm Cam 16mm Photo - GDR/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	LMP-5 EVA-1
	0+50 EVA #1 Pallet - To MESA Table PLSS LiOH Cans - Check Pins 16mm Cam Bracket - Discard LiOH Can(Band Off) - To Pallet	7/1/71

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

- (2) LMP-Rpt 16mm mag _____ on 16mm 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

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

0+50

MISSION: APOLLO 15
 EVA: 1

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LM	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
Descend to ladder for LRV deploy		Deploy LRV aft cable & place on lunar surface		
Pull D-handle to release LRV		Deploy right LRV offload tape		
Descend to surface		Check LRV released from LM		
Pull LRV aft cable as required to offload LRV from LM		Pull offload tape until rear wheels rest on surface		
		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 left rear fender extension		
Deploy right rear fender extension		Ck left rear hinge pins engaged		
Ck rear steering decouple ring seal		Erect left seat		
Ck right rear hinge pins engaged		Release handhold tiedown		
Erect right seat				
Lower the armrest		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		Remove & stow toehold		
Erect footrest	0+40	Erect footrest	LRV CONFIG & TRAVER PREP	LRV CONFIGURATION
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				
Remove 16mm mag from ETB & attach to camera		Test drive LRV - Park LRV in Quad IV near MESA		
Photo CDR/LRV 16mm Cam (f8,1/250,24fps)		Power down LRV		
Stow 16mm cam on LRV. LMP hndhold		Dismount LRV		
Unstow 70mm cam from MESA		Lift LCRU mounting post locks		
Remove filter from 70mm cam & stow		Release Y-cable velcro tab		
Remove Reseau Cover from 70mm cam & stow		Unstow TCU connector & discard adapter		
Remove 70mm mag, NN from ETB & attach to 70mm cam		Unstow LCRU from MESA		
Stow 70mm cam in CDR floor pan		Mount LCRU on front of LRV		
		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

VOICE DATA

0+50

CDR-6 EVA-1 7/9/71	0+53 [HWA] - 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	LTP UNP UNP
	0+56 [TV] / Tripod to +2 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	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)	LTP UNP UNP
	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)	

HGA & TV ETB-UNP 7/1/71	1+01 Whip Antenna - Deploy LCRU Sel - PH1/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]	CDR-2 EVA-1 7/1/71
	1+09 LEC - To Pallet #1 Pallet #1 - Transfer LEC Hooks - To Ladder Hook HGA - Stow 1+12 LCRU Sel - PH1/NB	

GEO PALLET LTP UNP EVA-1 7/1/71	1+05 Rake - To Pallet Secure HTC for Driving Check Lanyards Clear of Wheels [CDR: LMP PLSS Ant. - Stow]	LMP-7 EVA-1 7/1/71
	1+06 Ascend Ladder Cont. Sample - Retrieve Ingress LM Cont Sample - Stow CB(16) COMM: TV - OPEN MODULATE - PH 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	

(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

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

PALLET TRANS-LM PWR DN

CDR-8	1+13	Tidy up LRV [START] Drive to Nav. Init. Site NAV CB - CLOSE LRV Systems - Readout [NAV ALIGN] [STOP]	SUBSYS APTS # 4-335
	EVA-1	1+18	
7/1/71		LMP PLSS Ant. - Unstow 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	

LMP-8	1+14	Egress Pallet - Discard LM 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	SUBSYS APTS # 4-335
	EVA-1	1+20	
7/1/71		Ext Handle/Scoop - Tether HTC - Check Secure & Closed Bag Disp. - To 70mm Cam 70mm Cam - To RCU 16mm Cam - f8, 1/250, 12 FPS	

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-bTank

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	

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

CDR/LMP EMU check

1+30

CREW EVA CHECKLIST

VOICE DATA

1+30

LAV ALTON STAT #1	[START] Gyro - To How Update	CDR-9 EVA-1 7/1/71
	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)	

GEO EQUIP STAT #1	LRV Systems - Readout	LMP-9 EVA-1 7/1/71
	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)	

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

HEADING		Temp: Bat 1
BEARING		Temp: Bat 2
DISTANCE		Temp: LR ctr
RANGE		Temp: RR ctr
Amp: Hr: Bat 1		Temp: LR ctr
Amp: RR: Bat 2		Temp: RR ctr

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

1+50

EVA: 1

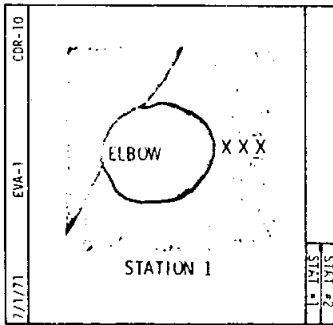
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LMP	CDR	TASK FUNCTION
	1+30 +				
<p>The traverse to the first checkpoint near Canyon Crater will cross the typical smooth mare fill on the approach to the rim of Hadley Rille.</p> <p>During this portion of the traverse the crew should observe and describe characteristics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

LMP
 CDR
 Traverse to Station #1
 Traverse to Station #1

CREW EVA CHECKLIST

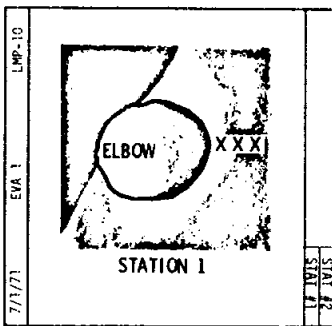
VOICE DATA

1+50



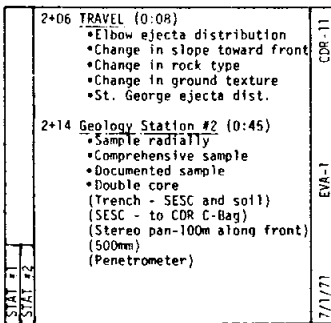
- (1) CDR - Mark arrival time _____ (1+51)
- (1) LMP - Readout LRV displays

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

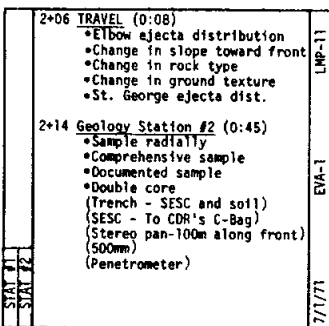
	CDR	LMP
02		
FLAGS		
PRESS		
COOL		



- (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	



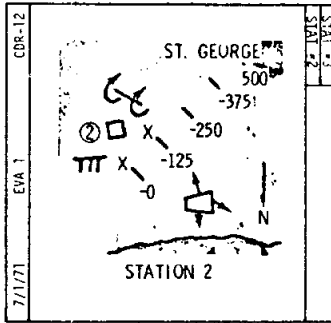
2+10

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	1+50			
Arrive Station #1 Readout LRV displays		Arrive Station #1 Park & powerdown LRV		
Dismount LRV		Dismount LRV		
Station #1 geology (15 min)		LCRU Sel Sw - FM/TV Point HGA to earth Station #1 geology (15 min)	Station #1 Geology	Station #1 Geology
<p>Station #1 is located on the the southern part of the Elbow Crater ejecta blanket.</p> <p>Area #1 tasks: 1. Radial sampling of Elbow Crater 2. 70mm Panorama</p>				
	2+00			
Check tools secure & HTC closed		Stow Gnomon on seat back Stow HGA		
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)	Traverse to Station #2	Traverse to Station #2
<p>The traverse to Station #2 is along the Apennine Front slope to the North side of St George Crater.</p>				
	2+10			

CREW EVA CHECKLIST

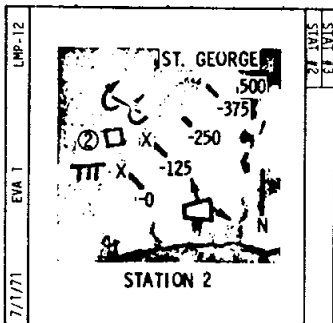
VOICE DATA

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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
2+10				
<p>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.</p>				
Arrive Station #2 Readout LRV displays		Arrive Station #2 Park & power down LRV		
Dismount LRV		Dismount LRV LCRU Sel Sw - FM/TV		
Station #2 geology (45 min)		Point HGA to earth Station #2 geology (45 min)		
<p>Geology area #2 is located near the base of the Apennine Front north of St George Crater.</p>				
2+20				
<p><u>Area #2 tasks (in order of priority)</u></p> <ol style="list-style-type: none"> 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				
			Station #2 Geology	Station #2 Geology

CREW EVA CHECKLIST

VOICE DATA

2+50

STAT #2	STAT #3	2+59 TRAVEL (0:09)	CDR-13
		<ul style="list-style-type: none"> Lateral/Vertical changes along front Block distribution Possible rock flows Patterned ground Compare crater frequency/state Observe EVA II route 	
STAT #2	STAT #3	3+08 Geology Station #3 (0:14)	EVA-1
		<ul style="list-style-type: none"> Describe "Flow" Mtri/source Vertical/lateral changes Documented samples - "Flow"/Front (-Mare) 	
STAT #2	STAT #3	3+22 TRAVEL (0:28)	7/1/71
		<ul style="list-style-type: none"> Observe EVA II route Front/Mare relations Possible ray material Compare to earlier mare Extent of "slide" boundary 	

(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	

STAT #2	STAT #3	2+59 TRAVEL (0:09)	LMP-13
		<ul style="list-style-type: none"> Lateral/Vertical changes along front Block distribution Possible rock flows Patterned ground Compare crater frequency/state Observe EVA II route 	
STAT #2	STAT #3	3+08 Geology Station #3 (0:14)	EVA-1
		<ul style="list-style-type: none"> Describe "Flow" Mtri/source Vertical/lateral changes Documented samples - "Flow"/Front (-Mare) 	
STAT #2	STAT #3	3+22 TRAVEL (0:28)	7/1/71
		<ul style="list-style-type: none"> Observe EVA II route Front/Mare relations Possible ray material Compare to earlier mare Extent of "slide" boundary 	

(1) CDR - Mark arrival time _____ (3+08)

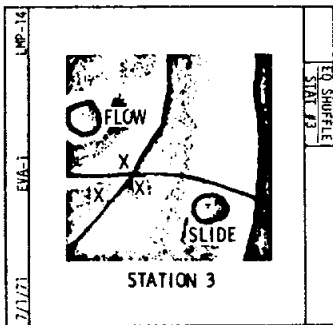
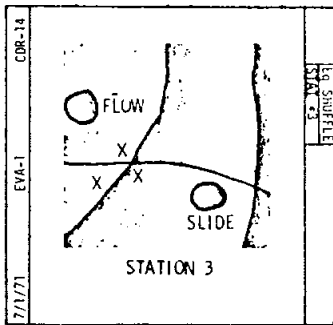
(1) LMP - Readout LRV displays

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

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

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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Station #3 geology (14 min)	3+10	Point HGA to earth Station #3 geology (14 min)		
<p>Geology area #3 is at the base of the Apennine Front adjacent to an area believed to be a debris flow.</p> <p><u>Area #3 tasks</u> (in order of priority)</p> <ol style="list-style-type: none"> 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. 				
Check tools secure & HTC closed	3+20	Stow gnomon on seatback Stow HGA LCRU Sel Sw - PMI/WB Mount LRV		
Mount LRV Readout LRV displays Traverse to LM (28 min)		Power up LRV Traverse to LM (28 min)	Traverse to LM	Traverse to LM
<p>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.</p>				
Readout LRV & NAV system displays	3+50	Park & Pwr down LRV - Read NAV to MCC		

CREW EVA CHECKLIST

VOICE DATA

EVA-1 7/1/71	EVA-1 7/1/71	3+50 Park LRV •Heading SE, facing SEQ Bay Nav CB - Open [STOP] LCRU Sel - TV RMT HGA - Point To Earth	CDR-15
		70mm Can - 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)	

EVA-1 7/1/71	EVA-1 7/1/71	3+50 LRV Systems - Readout Dismount LRV LMP Seat - Fold 70mm Can - 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	EVA-1 7/1/71	3+57 [EXPTS] Pkg - Offload UNIT - Tether Carry Bar - To EXPTS Pkg [Drill] - To LRV [HRR] - To LRV HGA - Stow LCPU Sel - PH1/WB 4+10 [START] Drive to ALSEP SITE CAUTION Do Not Point HGA or LGA within +20° of ALSEP Antenna	SITE POINTS ALSEP OFFLOAD

EVA-1 7/1/71	EVA-1 7/1/71	3+55 SEQ Bay Doors - Open Pwr Pkg - Offload - Position for Fueling Pip Pins (4) - Pull UNIT - 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 LANDOUT ALSEP OFFLOAD

- 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 _____]

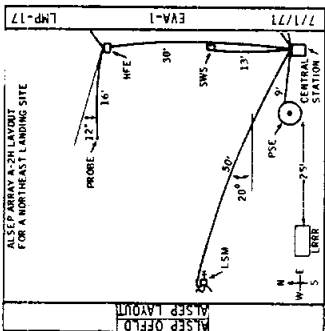
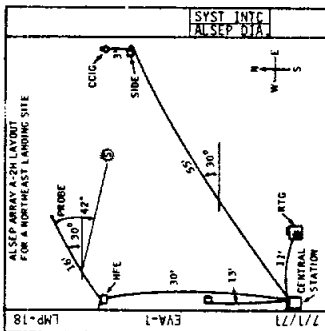
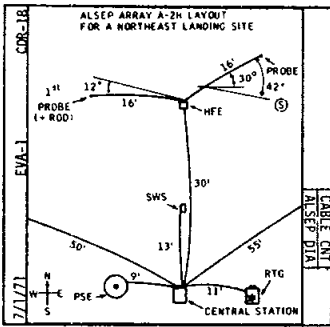
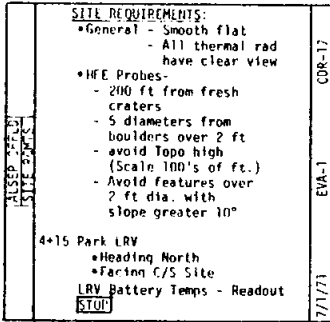
- (1) LMP - Rpt RTG Fueling _____ (time)

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

- (2) LMP - SEQ Bay doors - closed

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

4+10



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

READING	Temp Bat 1
READING	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		

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

CREW EVA CHECKLIST

VOICE DATA

<p>ALSEP DTA CABLE CNT</p>	<p>4+18 LRV Battery Covers - Open LCRU Sel - TV RMT HCA - Point To Earth Plan ALSEP Deployment LRRR - To Surface - cubes facing sunlight Drill - To Surface - Drill facing sunlight</p> <p>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]</p> <p>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</p>	<p>CDR-19 EVA-1 7/1/71</p>	<p>4+30</p>	<p>(1) LMP-Rpt SIDE connect</p> <p>(2) LMP - PSE stool 9' West C/S</p>
<p>CDR-20 EVA-1 7/1/71</p>	<p>4+34 Elect Box - Remove (4 bolts) Pallet - Kick Clear Dust Cover - Remove Elect Box - Level & Align</p> <p>Pallet - Discard 16 ft North [LMP: PSE deploy]</p> <p>4+37 Drill - To LMP Seat • [DECAL] Drill & Rack - To West Probe [LMP: SWE & LSH Deploy] Implant Bore Stem into Surface</p> <p>Remove [RAMMER] Insert Probe into Stem Report Probe depth [LMP: Raise C/S]</p>	<p>CDR-19 EVA-1 7/1/71</p>		<p>(1) CDR-Rpt HFE Deployed - ALIGN & LEVEL</p> <p>(1) LMP - Rpt PSE Emplaced; - Rpt PSE Level; - Rpt PSE Align _____</p>
<p>ALSEP DTA SIST - IN C</p>	<p>4+18 Expts Pkg - To Final Position Pwr Pkg - Position 10 ft East</p> <p>HFE Pip Pins (3) - Pull Pwr Pkg - Tip Down</p> <p>RTG Cable - Deploy Report Shorting Sw Reading RTG Cable - Connect</p> <p>SUBP - Remove from Pwr Pkg - Bolts (2)</p> <p>4+26 SIDE - Remove From SUBP • Bolts (5) - Release • Lift SIDE from SUBP • Cable Reel Unstow • Legs Deploy • SIDE to Surface</p>	<p>LMP-19 EVA-1 7/1/71</p>		<p>(1) LMP-Rpt SWE ALIGN & LEVEL</p>
<p>LMP-20 EVA-1 7/1/71</p>	<p>SIDE Cable Connector - Unstow C/S Dust Cover - Open SIDE Cable - Connect To C/S</p> <p>4+32 Carry Bar - Remove From C/S C/S - Tip Down Carry Bar - To SUBP PSE Stool - Unstow</p> <p>Prep PSE Site - 9 ft W. C/S PSE Stool - To Surface</p> <p>C/S Dust Cover - Remove PSE - Deploy • Bolts (4) -Release & Remove • PSE - To Stool, UMT In • Girdle Remove, UMT Out • Skirt - Deploy • Level • Report Alignment</p>	<p>CDR-19 EVA-1 7/1/71</p>		<p>(1) CDR-Rpt start Bore Stem Drilling</p>

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Open EXTPS PKG dust cover Connect SIDE cable to C/S	4+30			
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		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		
Carry PSE to stool		Place box on surface, level and align		
Remove B. Bolts from PSE		Walk to LRV		
Place PSE on stool		Erect LMP seat post & lower seat pan		
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		
Report PSE level & alignment		Place rack on surface		
Release SWE B. Bolts (4)		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 rack & drill on surface		
Place SWE on surface, level and align		Remove & discard stem cover		
		Release stem retaining velcro		
Release LSM B. Bolts (2)		Assemble first two bore stem sections (one with bit)		
Remove tie down & discard		Insert sections into drill chuck		
Lift LMS from C/S		Set drill bit down on surface at mark on HFE cable		
Check cable free of sun shield		Remove battery thermal shroud		
Carry LSM 50' WNW, deploying cable		Drill bore stem into surface		
		Remove drill from bore stem		
Select LSM site	4+50			

TASK FUNCTION	
LMP	CDR
PSE DEPLOY	
SWE DEPLOY	
LSM DEPLOY	
	-drill

CREW EVA CHECKLIST

VOICE DATA

PRE SWE, LSM	4+41 SWE - Deploy	LMP-21
	<ul style="list-style-type: none"> • 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	
	<ul style="list-style-type: none"> • Bolts (2) - Release • Tiedown - Pull Horiz • Square Handle - Lift LSM Off • Cable - Check Free of C/S 	EVA-1
	4+51 LSM - Deploy	7/1/71
	<ul style="list-style-type: none"> • LSM - To 50 ft, 8°N Sunline • Stowage Bracket - Remove • Legs - Deploy • Cable - Outside Legs • LSM - To Surface 	

LMP-22	<ul style="list-style-type: none"> • Foam Collar - Remove • Sensor Arms - Deploy • Dust Covers (4) - Discard • Align & Level • Report Alignment 	S/O, S/S
	<ul style="list-style-type: none"> • Check LSM Free of Parts • Check Doors Open 	
EVA-1	4+59 C/S - Align	7/1/71
	C/S Sunshield - Raise	
	<ul style="list-style-type: none"> • Bolts - Release • Antenna Cable - Deploy • Rear Curtain Cover - Remove • Check Sunshield Free • Interior Bolts (3) Release 	
	5+02 Sunshield - Raise	

PROBE CORE	5+04 Drill, Rack & Rod - To E Probe	CDR-21
	Implant Bore Stem Into Surface Insert Probe Into Stem 5+20 Report Probe Depth [LMP: SIDE deploy]	
	<ul style="list-style-type: none"> • Check 16 ft Area Clean • Check Elect Box Level & Align 	
	Drill & Rack - To Core Site	EVA-1
	Drill Chuck - Remove & Discard	
	Treddie 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	7/1/71
	Break Drill from stem	

LSM, C/S	Side Covers - Discard	LMP-23
	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	EVA-1
	OFF Sets - Enter & Readout	
	• AZ 35.81	
	• ELEV 4.71	
	CHECK Antenna Level & Aligned	7/1/71

4+50

(1) LMP - Rpt LSM ALIGN LEVEL _____

(2) LMP - Rpt LSM doors open

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

(1) CDR/LMP - EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

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

(2) LMP - Verify ALSEP Ant fully seated

5+10

(1) LMP - Rpt Ant Base ALIGN LEVEL _____

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

CREW EVA CHECKLIST

VOICE DATA

7/1/71	EVA-1	5+15	SIDE - Deploy •SIDE - To 55 ft, 42°N, Sun •Ground Screen - Implac •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	LMP-24	LRRR	3015
		LMP-1				

7/1/71	EVA-1	5+27	Shorting Switch - Depress Check Amps Zero Astro Switch #1 - Clockwise 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	LMP-25	LRRR	3015
		LMP-1				

5+10

(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

(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

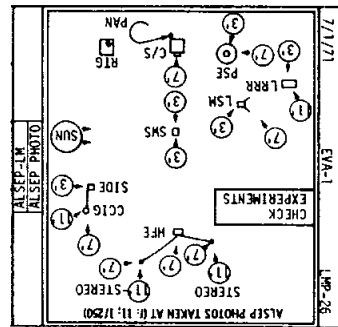
5+30 (1) CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION			
			LMP	CDR		
	5+10	Lift & attach drill to bore stem Drill bore stem into surface				
		Remove drill from bore stem				
Enter elev <u>4.71</u> and azimuth <u>35.81</u> 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 Insert probe into bore stem Retrieve probe rod				
Remove CCIG cover Remove CCIG from cavity		Push probe to bottom of bore stem				
Mount CCIG in ground screen tube	5+20	Report probe depth Withdraw & discard probe rod				
Place SIDE on ground screen Level & align SIDE Pull ground screen tube pin		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			C/S ACTIVATE	-drill 11 deep core-
Retrieve and carry LRRR >25 FT west of central station		Remove drill from core stem & place on surface Assemble 3rd & 4th core stem sections				
Place LRRR on surface Pull alignment device pip pin Pull reflector array pip pin		Thread sections onto stem				
Deploy reflector array	5+30	Retrieve drill and attach drill to core stem				

5+30

(1) CDR/LMP - EMU check



5+35

(1) LMP-Rpt LR³ ALIGN & LEVEL & DUST CONDITION

5+35 Photograph LRRR & ALSEP after LSM photography
NOTE: Deploy LSM Sunshield after LSM photography
LMT Discard
5+47 Top Off C-Bags #1, 3 & 4
5+59 Mount LRV
LRV Systems - Readout
LRV CB's - Pull Bus A,B,C,D
Dismount LRV
70mm Photo - LRV/Dust
X-Sun (2)
DN-Sun (1)

(1) CDR-Rpt core stem fully inserted

5+42 Check Stem Free In Surface
[LMP: ALSEP photos]
Drill - Remove from Stem
Cap Drill Stem (Black - NA)
Rotate Stem Clockwise & Pull Stem from Treadle
Core Stem Top End - To Wise Cap Stem, Bit End #8
Stems - to C-Bag #1 (2/pkt.)

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

5+37 70mm Cam - Retrieve from LRV
70mm Photo Pan - 7ft 5. 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 HIC
Core Tubes - To C-Bag #4

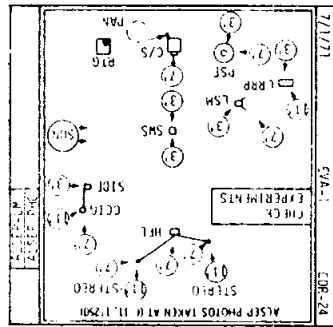
(1) CDR-Rpt cap sequence of core stem

Section	Caps

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

(1) LMP-Rpt LSM sunshield deployed

80



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 M, C/S
Alignment Array - Deploy
Alignment Array - Deploy
Leveling leg - Deploy
LRRR - Level & Align
Dust Cover - Remove
Check Level & Alignment

5+50

MISSION: APOLLO 15
 EVA: 1

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	L C R U I V	TASK FUNCTION					
				L M A	C D R				
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		Assemble 5th & 6th core stem sections							
Level and align LRRR		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							
NOTE: Deploy LSM sun shield after LSM photography complete		Retrieve CDR 70mm camera from LRV							
		Obtain photo pans 7 ft South of drill							
		Place 70mm cam on LRV							
		Transfer stem caps from SCB #2 to SCB #1							
		5+40				Transfer SCB #2 to LMP underseat bag	■	ALSEP	PHOTOS
						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								
	Select samples to fill remaining volume in two sample collection bags (save room for polarimetric samples)								
Select samples to fill remaining volume in SCB's #1, #3, & #4	5+50		■	SAMPLES	SAMPLES				

CREW EVA CHECKLIST

VOICE DATA

ALSEP PHO ALSEP-M	5+47 UNIT - Discard Top Off C-Bags #1, 384	CDP-25 EVA-1 7/1/71
	5+57 LRV Battery Covers - Close HGA - Stow LCRU Sel - PHI/WB START	
	LRV Batt. Temps - Readout	
	6+03 Park LRV At MESA •Heading North •In Sunlight STOP	
	LRV Battery Covers - Open. LCRU Blankets - 35% open LCRU Sel - TV RHT HGA - Point to Earth	

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		

LMP-28 EVA-1	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	CLOSEOUT IN PAIR 7/1/71
	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	

(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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	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			█	
Unstow SWC from MESA		LCRU MODE switch - "TV/RMT"	█	
Carry SWC 60 ft SE of LM		Point HGA to earth	█	
		Retrieve from MESA & install filter on 70mm cam	█	
Remove SWC from stowage can		Transfer Reseau cover to LRV	█	
		Retrieve tongs & gnomon from LRV	█	
	6+10	Select site for polarimetric photography	█	

CREW EVA CHECKLIST

VOICE DATA

6+10

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

3 photos ← 20° → 3 photos
(f8; 1/125; 74 ft)

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

6+19 Gnomon Place
Near Field Photos

3 photos (f5.6; 1/125; 7 ft)

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

Sampler to C-Bags
Gnomon & Tongs - Stow
70mm Cam - To IRV

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

Rpt Filter position _____, _____, _____
(Far Polar) _____, _____, _____

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

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) (00), (KY)
• 70mm Mags (2) (NR), (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

(1) CDR-Rpt 70mm mag/frame (after polar)

Sample Bags # _____, _____, _____, _____

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

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
• SESE
• 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

(2) CDR - gnomon to LRV

6+30

(1) CDR/LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION			
			LM	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
Photo SWC X-sun & dn sun						3 photos, 50-110 degree phase angle
Return to LM						3 photos 20 degrees down sun from first photos
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	■	■	LM SITE PHOTOGRAPHY	
		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				
		Obtain post-sampling photos, X-sun & Dn-sun				
	6+20	Retrieve gnomon & walk to LRV	■	■	FLAG DEPLOY	
		Stow samples in SCB #4				
Unstow flag kit from MESA		Stow tongs on HTC				
Remove flag covering		Stow gnomon on LRV				
Keep staff & pass flag to CDR		Select flag deployment site				
Retrieve hammer from HTC		Deploy & mount Flag in staff				
Drive staff into surface		Photo LMP/Flag				
Photo CDR/Flag						
Pass LMP 70mm cam to CDR						
Stow hammer on HTC		Transfer ETB to LRV CDR foot pan				
Remove SCB #1 from HTC & place in SRC #1	Stow 70mm camera in ETB					
Remove SRC #1 seal protector	6+30	Trans cam mags (70mm mags LL, NN & 16mm mags CC, DD) from under LRV seats into ETB	■	■		
Close & seal SCR #1						

CREW EVA CHECKLIST

VOICE DATA

7/1/71	LMP-30	Dust Brush - Unstow Clean EMU'S [CDR: LMP PLSS Ant. - Stow] Dust Brush - To Geo Pallet	SERVING
	EVA-1	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	

EVA-1 LMP-30 LMP-33		6+35 Clean EMU'S LMP PLSS Antenna - Stow	CDR-29
		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 [C-Bag #4] Stow LEC On Platform Ingress LM	

6+30

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)

6+50

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

MISSION: APOLLO 15
 EVA: 1

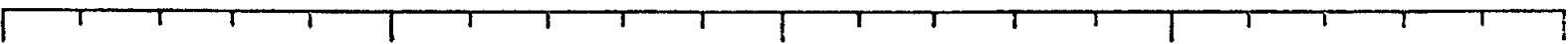
DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
Tidy MESA blankets Unstow dust brush from LRV		Remove 16mm mag EE from cam & mags from holder; put in ETB		
Clean CDR's EMU		Attach ETB to SRC table		
		Clean LMP's EMU		
		Stow LMP's PLSS antenna		
Ingress LM carrying SCB #3		Cover BSLSS & 500mm cam on LMP seat with thermal blanket		
Attach LEC to handhold		Attach LEC to SRC #1		
Transfer SRC #1 into LM		Transfer SRC #1 into LM		
	6+40		EVA TERMINATION	
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) GDR - Rpt END EVA-1



MISSION: APOLLO 15
 EVA: 1

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE LUNAR SURFACE CHECKLIST				
	7+00	END 1st EVA		
END 1st EVA				

EVA TERMINATION

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

VOICE DATA

EVA 2

7/6/71	EVA 2	CDR-2	<p><u>PLSS TO LM H2O TRANSFER</u></p> <p>Torso Tiedown - Loosen as reqd PLSS Pump - OFF Disconnect PLSS H2O Connect LM H2O CB(16) ECS: LCG Pump - CLOSE</p> <p><u>LM TO PLSS H2O TRANSFER</u></p> <p>CB(16) ECS: LCG Pump - OPEN Disconnect LM H2O Connect PLSS H2O PLSS Pump - ON Torso Tiedown - tighten as reqd</p>	EGRESS 583167

7/6/71	EVA 2	LMP-2	<p><u>PLSS TO LM H2O TRANSFER</u></p> <p>Torso Tiedown - Loosen as reqd PLSS Pump - OFF Disconnect PLSS H2O Connect LM H2O CB(16) ECS: LCG Pump - CLOSE</p> <p><u>LM TO PLSS H2O TRANSFER</u></p> <p>CB(16) ECS: LCG Pump - OPEN Disconnect LM H2O Connect PLSS H2O PLSS Pump - ON Torso Tiedown - tighten as reqd</p>	EGRESS 583167

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

EVA CHECK PROCESS	CDR - EVA 2	CDP-3
	0+10 Move thru hatch - Comm Ck. PLSS Antenna - Deploy Jett bag - Discard LEC - to LMP Descend Pallet #2 - to MESA table PLSS L10H cans - check pins Pallet - transfer LCRU pwr - INT? (Chg. batt if req'd) ETR - transfer ITB - to MESA table Stow LEC on ladder hook 0+22 [ETB] - to LRV CDR floor pan	

EVA CHECK PROCESS	LMP - EVA 2	LMP-3
	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]	

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 00 (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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION		
			L	M	CDR
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch			EGRESS
Place jett bag in hatch		Toss jett bag in Quad I			
Attach LEC to handhold		Hand LEC to LMP			
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) (HGA may require alignment, LCRU mode SW is in TV RMT)			
Disconnect LEC from pallet	0+20	Transfer ETB to surface			Pallet & ETB TRANSFER
Attach LEC to ETB					
Assist CDR					
		Attach ETB to SRC table			
Disconnect and stow LEC		Stow LEC on ladder hook			
Remove & stow pallet equipment					
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	0+30	Remove thermal blanket off of LRV LMP seat; stow on +Y strut			EQUIPMENT PREP
Move thru hatch		Hang B-SLSS on LMP seat back			
Discard pallet into Quad I					
Close hatch		Push 500mm lens cam toward CDR seat			
Descend to surface		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			
Unstow both LCRU batts from MESA		Attach mag "MM" to 500mm lens cam & stow cam & reseau cover under CDR seat			
Place one LCRU batt in LRV LMP floor pan		Attach 16mm mag FF to cam (carry ETB to LMP side)			
Wrap other LCRU batt in Quad III ther blnkt & place in +Y ftpad					

CREW EVA CHECKLIST

VOICE DATA

7/6/71	EVA 2	CDR-3	0+28 LMP PLSS Ant. - Unstow ETB contents - to LRV Mag "MM" - to 500mm Cam ETC (empty) - to MESA table	LMP-4 L-103 L-104
		0+34 [LCRU Batt] - (LMP floor pan) LCRU pwr - OFF Change - LCRU batt LCRU blankets - 100% open LCRU pwr - INT 01de LCRU batt-to CDR seat bag [LRV CB] - close (except AUX) [LMP: Geo. pallet equip]		

7/6/71	EVA 2	LMP-4	LCRU batts (2) #1 - to LMP floor pan #1 - to +Y footpad in blanket (in shadow)	L-103 L-104
		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)		

7/6/71	EVA 2	CDR-5	LCRU BATT RCU 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 - PH1/1B 0+45 [START] Drive to NAV Init site [NAV ALIGN] LRV Systems - Readout 0+49 Drive to Station #4	

7/6/71	EVA 2	LMP-5	SRC #2 RCU 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
 EVA: 2

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
Transfer from SCB #5 to #7: • 3-core tubes • Core tube cap disp - in pkt • SESC - in pocket • 2-20 bag dispensers		Switch LCRU - OFF		
Place 2-20 bag disps. on CDR & LMP seats		Replace LCRU battery		
Place SCB #7 under LMP seat		Switch LCRU - INT pwr		
Attach SCB #2 to HTC		Stow old batt under CDR seat Push LRV C/Bs - in		
Assist CDR		Tether tongs (from HTC)		
	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		
Tidy MESA blankets		Stow HGA for traverse		
Mount LRV		Switch LCRU - PM1/WB		
		Mount LRV		
		Power up LRV		
Unstow geology maps and determine 1st LRV heading		Drive to Nav Init. site Initialize Nav system		
Traverse to checkpoint (11 min.)		Traverse to checkpoint (11 min.)	▨	LRV NAV INITIALIZE
	0+50		▨	LRV NAV INITIALIZE

CREW EVA CHECKLIST

VOICE DATA

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

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

0+50



1+10

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

HEADING		Temp Bat 1	
BEARING		Temp Bat 2	
DISTANCE		Temp LF meter	
RANGE		Temp RR meter	
App Hr: Bat 1		Temp LR meter	
App RR: Bat 2		Temp RR meter	

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

- (1) CDR/LMP EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

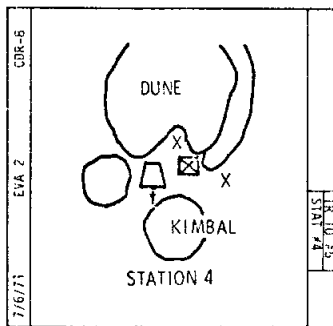
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	0+50			
<p>NOTE: For purposes of the final edition of the Lunar Surface Procedures, detailed geology traverse information is contained in Section 3.6.</p> <p>Traverse South along smooth mare toward secondary crater cluster.</p> <p>Describe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

CREW EVA CHECKLIST

VOICE DATA

1+10

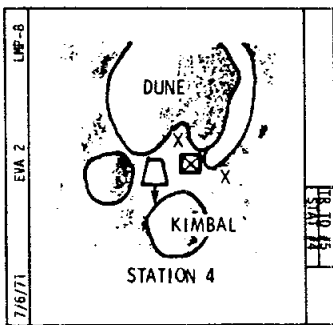
GEO NOTES STAT #4	0+49 TRAVEL (0:11)	COR-7 EVA 2 7/6/71
	<ul style="list-style-type: none"> •Ray material •Mare/secondaries •Lineaments, Fillets, mounds •Block distribution 	
	1+00 CP1 (0:02)	
	1+02 TRAVEL (0:15)	
1+17 GEOLOGY STATION #4 (0:20)		
<ul style="list-style-type: none"> •Compare secondary 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) 		



- (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	

GEO NOTES STAT #4	0+49 TRAVEL (0:11)	LMP-7 EVA 2 7/6/71
	<ul style="list-style-type: none"> •Ray material •Mare/secondaries •Lineaments, Fillets, mounds •Block distribution 	
	1+00 CP1 (0:02)	
	1+02 TRAVEL (0:15)	
1+17 Geology Station #4 (0:20)		
<ul style="list-style-type: none"> •Compare 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) 		



1+30

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

TASK FUNCTION	
LMP	CDR
STATION #4 GEOLOGY	STATION #4 GEOLOGY

CREW EVA CHECKLIST

VOICE DATA

1+30

(1) CDR/LMP-EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

STAT #4 TR 10 JS	1+37 TRAVEL (0:10)	CDR-9
	<ul style="list-style-type: none"> •Possible flow to west •Mare/Front •Front base •Lateral variations •Block Fields •Patterned ground •Rocks/ides/debris flows •Blocky craters •Large blocks 	
	EVA 2	7/16/71

(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	

STAT #7 TR 10 JS	1+37 TRAVEL (0:10)	LMP-9
	<ul style="list-style-type: none"> •Possible flow to west •Mare/Front •Front base •Lateral variations •Block Fields •Patterned ground •Rocks/ides/debris flows •Blocky craters •Large blocks 	
	EVA 2	7/16/71

(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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LEA	CDR
	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		Power up LRV		
Traverse to 1st Checkpoint(10min)		Traverse to 1st Checkpoint(10min)	TRAVERSE TO 1st CHECKPOINT	TRAVERSE TO 1st CHECKPOINT
	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.		
Arrive 1st Checkpoint Readout NAV displays		Arrive 1st Checkpoint Readout NAV displays	READOUT NAV	READOUT NAV
	1+50			

CREW EVA CHECKLIST

VOICE DATA

CDR-10	1+47 CP2 (0:04)(147°/0.39 to Spur)
	1+51 TRAVEL (0:10) <ul style="list-style-type: none"> • Access to Spur Crater (possible Stat. #7) • Spur to CP3 (098°/0.75) • Spur to Window (122°/1.41) • Check distribution of secondary material
EVA 2	2+01 CP3 (0:04) (146°/0.81 to Window Crater)
7/16/71	STAT #5

LMP-10	1+47 CP2 (0:04)(147°/0.39 to Spur)
	1+51 TRAVEL (0:10) <ul style="list-style-type: none"> • Access to Spur Crater (possible Stat. #7) • Spur to CP3 (098°/0.75) • Spur to Window (122°/1.41) • Check distribution of secondary material
EVA 2	2+01 CP3 (0:04) (146°/0.81 to Window Crater)
7/16/71	STAT #5

1+50

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

(1) CDR/LMP-EMU check

	CDR	LMP
O2		
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	

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

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

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

TO: 15 START: 25	2+05 TRAVEL (0:05)	CDR-11
	<ul style="list-style-type: none"> 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)	EVA 2
	<ul style="list-style-type: none"> Documented samples South Rim of Crater Radial direction from north rim Trench/south rim Stereo pan-100m. along Frt (500mm.) (70mm stereo upslope) 	7/6/71

TO: 15 START: 25	2+05 TRAVEL (0:05)	LMP-11
	<ul style="list-style-type: none"> 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)	EVA 2
	<ul style="list-style-type: none"> Documented samples South Rim of Crater Radial direction from north rim Trench/south rim Stereo pan-100m. along Frt (500mm.) (70mm stereo upslope) 	7/6/71

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	

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

(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
 EVA: 2

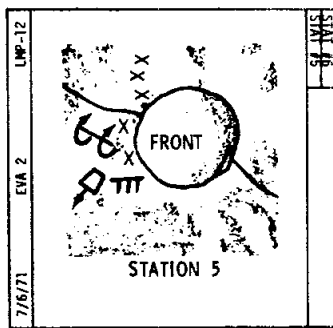
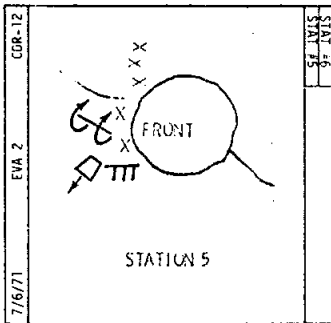
DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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



3+10

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

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	2+30			
				
	<p>Station #5 in the area at the base of the Front near the rim of Front Crater.</p> <p>Area #5 tasks (in order of priority)</p> <ol style="list-style-type: none"> 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			

CREW EVA CHECKLIST

VOICE DATA

STAT #5 STAT #6	3+17 TRAVEL (0:14)	CDR-13 EVA 2 7/6/71
	<ul style="list-style-type: none"> •(Front to window 276°/1.11) •Return to Stat #6 •16mm photos from LRV 	
STAT #6	3+31 GEOLOGY STATION #6 (0:40)	EVA 2 7/6/71
	<ul style="list-style-type: none"> •Possible stop Window crater -Describe sample area -Compare Front/other units -Documented Samples (Trench) (Core tube) (500mm) (70mm. stereo upslope) 	
STAT #6	4+11 TRAVEL (0:08)	EVA 2 7/6/71
	<ul style="list-style-type: none"> •Return to Station 7 (window to Spur 303°/1.41) 	

STAT #6	3+17 TRAVEL (0:14)	LMP-13 EVA 2 7/6/71
	<ul style="list-style-type: none"> •(Front to Window 276°/1.11) •Return to Stat #6 (4:1/250) •16mm photos from LRV 12 fps 	
STAT #6	3+31 Geology Station #6 (0:40)	EVA 2 7/6/71
	<ul style="list-style-type: none"> •Possible stop Window crater -Describe sample area -Compare Front/other units -Documented Samples (Trench) (Core tube) (500mm) (70mm stereo upslope, 	
STAT #6	4+11 TRAVEL (0:08)	EVA 2 7/6/71
	<ul style="list-style-type: none"> •Return to Station 7 (Window to Spur 303°/1.41) 	

3+10



3+30

- (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	

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

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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LE	RD
	3+30			
Arrive Station #6 Readout LRV DISPLAYS		Arrive Station #6 Park & Power down LRV		
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV		
Station #6 geology (40 min)		Point HGA to earth Station #6 geology (40 min)		
<p>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.</p>				
<p>Area #6 tasks (in order of priority)</p> <ol style="list-style-type: none"> 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 				
Check tools secure & HTC closed	4+10	Stow gnomon on seatback		

CREW EVA CHECKLIST

VOICE DATA

4+10

EVA 2	7/6/71	COR-14	4+19 GEOLOGY STATION #7 (0:40)	STAT 8*
			<ul style="list-style-type: none"> • Possible stop Spur Crater • Same as Station 6 • Summarize Front Observation 	
			4+59 TRAVEL (0:26)	
			<ul style="list-style-type: none"> • Front/Hare • Block distribution • Secondary deposit dist • Patterned ground • Possible rock flows 	

- (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	

- (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	

EVA 2	7/6/71	LMP-14	4+19 Geology Station #7 (0:40)	STAT 8*
			<ul style="list-style-type: none"> • Possible stop Spur Crater • Same as Station 6 • Summarize Front Observation 	
			4+59 TRAVEL (0:26)	
			<ul style="list-style-type: none"> • Front/Hare • Block distribution • Secondary deposit dist • Patterned ground • Possible rock flows 	

At 4+30

- (1) CDR/LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

4+50

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	4+10			
Check tools secure & HTC closed		Stow gnomon on seatback		
		Stow HGA		
Mount LRV		LCRU Sel SW - PM1/WB		
		Mount LRV		
Readout LRV displays		Power up LRV		
Traverse to Station #7 (8 min)		Traverse to Station #7 (8 min)		
<p>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.</p> <p>Photographic documentation of these features is desirable.</p>				
			TRAVERSE TO STATION # 7	TRAVERSE TO STATION # 7
	4+20			
Arrive Station #7		Arrive Station #7		
Readout LRV displays		Park & Power down LRV		
Dismount LRV		Dismount LRV		
		LCRU Sel SW - FM/TV		
		Point HGA to earth		
Station #7 geology (40 min)		Station #7 geology (40 min)		
<p>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.</p> <p><u>Area #7 tasks (in order of priority)</u></p> <ol style="list-style-type: none"> Detailed description of the sampling area Comparison of this area to other Front areas and the mare and Rille units. Documented samples 70mm panorama 				
	4+50		STATION # 7 GEOLOGY	STATION # 7 GEOLOGY

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
O2		
FLAGS		
PRESS		
COOL		

5+10

CREW EVA CHECKLIST

VOICE DATA

5+25 GEOLOGY STATION #8 (0:45)
(Vicinity of Arbelt)
H = 180'

CDR-15
EVA 2
7/6/71

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

5+25 Geology Station #8 (0:45)
(Vicinity of Arbelt)
H = 180'

LMP-15
EVA 2
7/6/71

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

5+25 STATION #8

CDR-16
EVA 2
7/6/71

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)

8# IVIS

5+25 STATION #8

LMP-16
EVA 2
7/6/71

LRV system - readout
Dismount LRV
Rake - install on ext. handle
[CDR: Change 16mm neg]
[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 track]

8# IVIS

5+10

5+30

- (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	

STAT #8	5+42 <u>Soil Mechanics Trench</u>	CDR-17
	<ul style="list-style-type: none"> •Photo: X-SUN; Dn-Sun •<u>Cam</u> (70mm cam)(CDR) •Collect samples (CDR) (no gnomon) 	
	<u>Photo trench</u>	EVA 2
	<ul style="list-style-type: none"> •Vert. wall(X-Sun,7ft,stereo) •Long axis(Dn-Sun,7ft,stereo) 	
	5+48 <u>Sample trench</u>	7/6/71
	<ul style="list-style-type: none"> •SESC 75% full - to CDR C-Bag •1/2 bag: bottom, top, side 	
	[LMP: Clean trench bottom]	
	5+53 Install penetro <u>0.5 cone</u>	

5+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

STAT #8	5+42 <u>Soil Mechanics Trench</u>	LMP-17
	[CDR: Photo]	
	5+48 <u>Sample trench</u>	EVA 2
	<ul style="list-style-type: none"> •SESC 75% full - to CDR C-Bag •1/2 bag: bottom, top, side 	
	5+53 Clean trench bottom	7/6/71
	[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	5+55 Penetrometer tests	EVA 2
	<ul style="list-style-type: none"> #1- Adj. trench •Photo in surf (X-Sun, 7') 	
	<ul style="list-style-type: none"> #2- Trench bottom •Photo in surf (X-Sun, 7') 	8# IVIS
	<ul style="list-style-type: none"> #3- LRV track •Photo in surf(X-Sun, 7') 	
	<ul style="list-style-type: none"> #4- Adjacent to LRV track •Photo in surf (X-Sun, 7') 	7/6/71
	Install penetro <u>plate</u> (CDR)	
	<ul style="list-style-type: none"> #5- Core tube site •Photo imprint(X-Sun,7'Stereo) 	
	<ul style="list-style-type: none"> #6- Trench bottom •Photo imprint(X-Sun,7'Stereo) 	

LMP-18	5+55 Penetrometer tests	EVA 2
	<ul style="list-style-type: none"> #1- Adj. trench [CDR: Photo] 	
	<ul style="list-style-type: none"> #2- Trench bottom [CDR: Photo] 	STAT #8
	<ul style="list-style-type: none"> #3- LRV track [CDR: Photo] 	
	<ul style="list-style-type: none"> #4- Adjacent to LRV track [CDR: Photo] [CDR: Install penetro plat@] 	7/6/71
	<ul style="list-style-type: none"> #5- Core tube site [CDR: Photo] 	
	<ul style="list-style-type: none"> #6- Trench bottom [CDR: Photo] 	

6+10

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	5+30		STATION #8 GEOLOGY	STATION #8 GEOLOGY
<p>Sampling area #8 should be located in the smoother Mare material but near a substantial crater.</p> <p style="text-align: center;">↓</p> <p><u>Area #8 tasks</u> (in order of priority)</p> <ol style="list-style-type: none"> 1. Comprehensive 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 				
	6+00			
	6+10	Stow gnomon on seatback		
Check tools secure & HTC closed				

CREW EVA CHECKLIST

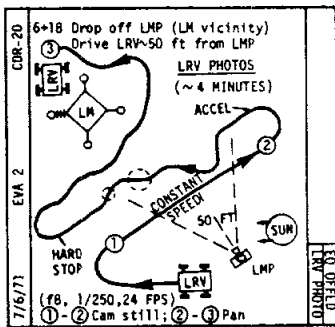
6+10

STAT #8	#7- Collapse trench side • Photo mtrl. or imprint (X-Sun, 7', stereo)	CDR-19
	6+08 [LMP: Remove ext. handle] Stow penetro, cone on LRV [LMP: Change 16mm Mag] [LMP: Mount LRV]	EVA 2
	HGA - stow LCRU - PH1/WB START	7/6/71
	6+10 Return to LM •Ray/Secondaries •Lineaments/Fillets/Mounds •Block Distribution	

STAT #8	#7- Collapse trench side (1/2 depth from edge) [CDR: Photo]	LMP-19
	6+08 Penetro - remove ext. handle [CDR: Stow Penetro] 16mm cam - change mag Mount LRV	EVA 2
	6+10 Return to LM •Ray/Secondaries •Lineaments/Fillets/Mounds •Block Distribution	7/6/71

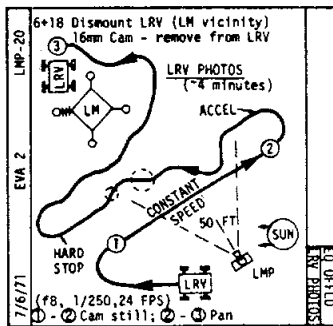
- (1) CDR - Stow gnomon
 - Mark depart time _____ (6+12)
- (1) LMP - Readout LRV displays

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
 EVA: 2

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Mount LRV Readout LRV displays Traverse to LM (08 min)	6+10	Stow HGA LCRU Sel SW - PM1/WB Mount LRV Power up LRV Traverse to LM (08 min)	TRAV TO LM	TRAV TO LM
<p>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.</p>				
Arrive at LM Readout NAV & LRV displays Power down LRV C/Bs Dismount LRV Photo LRV; X-Sun (2), Dn-Sun (1) Stow 70mm cam/bags on LMP seat Assist CDR Remove SCB #5 from CDR PLSS tool harness; tidy velcro covers Place SCB #5 in SRC #2	6+20	Arrive at LM Park LRV at MESA; point North, X-Sun in sun Power down LRV switches Dismount LRV Align HGA toward Earth Switch LCRU - TV RMT Open LRV batt dust covers Stow 70mm cam/bags on CDR seat Remove from LMP PLSS tool harness <ul style="list-style-type: none"> • Core tube cap disp. - discard • Hammer - stow on HTC • SCB #2 - stow on HTC Tidy harness velcro covers Assist LMP Stow tongs on HTC Carry ETB to LRV CDR footpad	EVA CLOSEOUT	EVA CLOSEOUT
	6+30			

CREW EVA CHECKLIST

VOICE DATA

LRV PHOTOS EQ ON/OFF	6+23 STOP at MESA - North, X-Sun	CDR-21
	LCRU - TV RMT HGA - align LRV batt - open dust covers	EVA 2
	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	EVA 2
	6+32 ETB - to LRV CDR floorpan 20-Bag Disps - to CDR bag [LMP: Pack SRC #2]	7/6/71

LRV PHOTOS EQ ON/OFF	6+23 Return to MESA	LMP-21
	16mm cam - install on LRV LRV systems - readout Pwr down CBs	EVA 2
	Photo LRV; (f11,1/250,11 ft) • X-Sun (2) • On-Sun (1)	EVA 2
	70mm Cam - to LMP seat [CDR: tools from LMP PLSS] Ext. handle/scoop - to HTC C-Bag #5 - remove from CDR Tidy velcro covers	EVA 2
	C-Bag #5 - to SRC #2 Remove seal protectors Close & seal SRC #2	7/6/71
	C-Bag #2 - to MESA C-Bag #6 - to MESA	

LMP-22	Reseau cover - to 500mm cam	LMP-21
	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	
EVA 2	16mm Cam - Point North	EVA 2
7/6/71	6+38 Clean EMU's LMP PLSS Ant. - Stow ETB(empty) - to MESA table [LMP: Ingress]	

LMP-22	Unstow dust brush	LMP-21
	6+38 Clean EMU's Dust brush - Geo pallet [CDR: stow LMP antenna] [LRV Check] - all samples?	
EVA 2	6+41 Ingress - carry C-Bag #6 Attach LEC Transfer: • SRC #2 • ETB Stow equipment Stow C-Bag #2 (from CDR)	EVA 2
7/6/71	Pass LEC to CDR Assist CDR ingress 7+00 Close hatch	

6+30

(1) CDR/LMP-EMU check

	CDR	LMP
02		
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 mags 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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU V	TASK FUNCTION	
				LMP	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 & mags from holder; stow in ETB (carry ETB to LMP side)			
Check all samples removed from LRV		Attach ETB to MESA table			
Ingress; carry SCB #6 into LM		Place B-SLSS & 500mm lens cam on LMP seat; cover with thermal blanket			
	6+40				
Attach LEC to handhold		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 Turn LCRU pwr switch - OFF Adjust LCRU thermal blankets			
	6+50				

INGRESS
EVA TERMINATION

CREW EVA CHECKLIST

VOICE DATA

ETB PACK	Transfer: •SRC #2 •ETB Stow LEC LCRU Pwr - OFF LCRU blankets - 65% open Clean EMU 6+54 Ascend ladder; carry C-Bag #2 Hand C-Bag #2 to LMP Stow LEC on platform Ingress	CDR-23
PROGRESS		EVA 2 7/16/71

6+50

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

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 $\sim 39^\circ$
- LM SHADOW LENGTH $\approx 8.6\text{m}(28.4 \text{ ft})$
- ASTRONAUT SHADOW LENGTH $\approx 2.24\text{m}(7.4 \text{ ft})$

EMU STATUS TABLES @ 30 MIN INTERVALS

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

0+10

CDR-24	<u>CDR - EVA 3</u>	SEMP LIVE LOG
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	7/6/71

(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

LMP-23	<u>LMP - EVA 3</u>	EVA 2
EVA 3	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 ETB - transfer Stow LEC 0+18 Egress LM hatch - close Descend [CDR: deploy LMP antenna] LCRU batt(+f pad)-LMP f1/pan	7/6/71

(1) CDR-LCRU covers open 100%

CDR-25	<u>ETB Contents</u>	EVA 3
LCRU BATT	ETB contents - to LRV Mag "MM" - to 500mm Cam P.O. Pkg. - leave in ETB 0+27 ETB(empty) - to MESA table [LCRU Batt] - (LMP floorpan) LCRU pwr - OFF Change - LCRU batt LCRU blankets - 100% open 0+31 LCRU pwr - INT 01de LCRU batt - LRV [LRV CBs] - closed (except AUX) [LMP: Geo. pallet equip.]	7/6/71

(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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Assist CDR; deploy CDR PLSS antenna	0+10	Move thru hatch - comm check		EGRESS
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		Descend to surface		
Transfer LEC hooks into LM		Transfer LEC hooks into LM		
Attach LEC to ETB		Transfer ETB to surface		
Assist CDR		Attach ETB to SRC table		
Disconnect and stow LEC Recorder - OFF		Stow LEC on ladder hook		
Verify VOX Sens (2) - Max		Carry ETB to LRV; set in CDR floor pan		
Verify cb config				
Utility & Floodlights - OFF				
Move thru hatch				
Close hatch				
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			

0+30

CDR-26	EVA 3	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	STAT #9 REC EQUIP
		HGA - stow LCRU - PH1/WB	
7/6/71		0+39 START Drive to NAV Init site NAV ALIGN LRV Systems - Readout	
		0+42 Drive to Station 4	

(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. Hnd1 (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)

LMP-24	EVA 2	B-SLSS bag - to pallet front(R) C-Bag #7 (LMP seat bag)-HTC(L)	STAT #9 REC EQUIP
		20 bag disp-to CDR & LMP seat	
7/6/71		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 Station 4	

(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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU FUNCTION	
			LMP	CDR
	0+30			
Assist CDR		Switch LCRU - INT pwr Stow old batt under CDR seat Push LRV C/Bs - in Tether tongs		
		Attach to LMP PLSS tool harness: • SCB #8 • Core tube cap dispenser • Hammer		
Attach SCB #7 to CDR PLSS tool harness		Assist LMP		
Assemble scoop/ext. handle; tether		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 Initialize Nav system		
Unstow geology maps and determine 1st LRV heading	0+40		LRV NAV INIT	LRV NAV INIT
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	0+50	Arrive Supplementary Sample Stop Park & powerdown LRV		

0+50

GEO EQUIP STATION #9	0+42 TRAVEL (0:07)	CDR-27 EVA 3 7/31/71
	<ul style="list-style-type: none"> •Possible ray •Fillets, lineaments, mounds •Block distribution 	
	0+49 SUPPLEMENTARY SMPL STOP (0:05)	
	0+54 TRAVEL (0:12)	
	<ul style="list-style-type: none"> •Mare/raised rille rim(levee) 	
	1+06 GEOLOGY STATION #9 (0:50)	
	<ul style="list-style-type: none"> •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 	

- (1) CDR - Stow gnomon
- Mark depart time _____ (0+54)
- (2) LMP - Readout LRV displays

READING	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
O2		
FLAGS		
PRESS		
COOL		

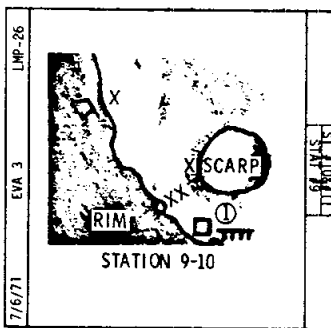
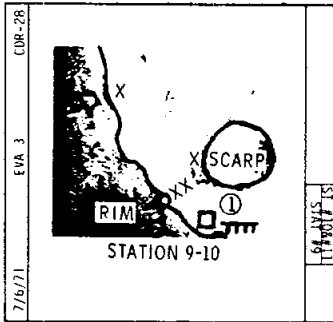
GEO EQUIP STATION #9	0+42 TRAVEL (0:07)	LMP-25 EVA 3 7/6/71
	<ul style="list-style-type: none"> •Possible ray •Fillets, lineaments, mounds •Block distribution 	
	0+49 SUPPLEMENTARY SMPL STOP (0:05)	
	0+54 TRAVEL (0:12)	
	<ul style="list-style-type: none"> •Mare/raised rille rim(levee) 	
	1+06 Geology Station #9 (0:50)	
	<ul style="list-style-type: none"> •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 (Scarp crater) •Penetrometer 	

- (1) CDR - Mark arrival time _____ (1+06)
- (1) LMP - Readout LRV displays

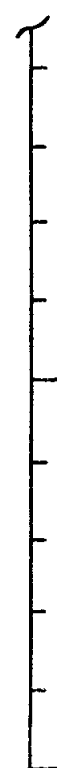
HEADING	Temp Bat 1
BEARING	Temp Bat 2
DISTANCE	Temp LF mtr
RANGE	Temp RF mtr
Amp-Hr Bat 1	Temp LR mtr
Amp-HR Bat 2	Temp RR mtr

1+10

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LAB	COORD
Dismount LRV	0+50	Dismount LRV	SUPP SAMPLE STOP	SUPP SAMPLE STOP
Supplementary Sample Stop (5 min)		Supplementary Sample Stop (5 min)		
Area Tasks: soil/rock sample 70mm panorama				
Check tools secure & HTC closed		Stow gnomon on seatback	TRAVERSE TO STATION #9	TRAVERSE TO STATION #9
Mount LRV		Mount LRV		
Readout LRV displays		Power up LRV		
Traverse to Station #9 (12 min)		Traverse to Station #9 (12 min)		
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		
Station #9 geology (50 min)		Point HGA to earth Station #9 geology (50 min)		
	1+10			



1+10



1+50

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	1+10 ↓			
<p>The Station #9 area is on the rim of the Rille at the southern end of the terrace.</p> <p><u>Area #9 tasks</u> (in order of priority)</p> <ol style="list-style-type: none"> 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 				
	1+50		STATION #9 GEOLOGY	STATION #9 GEOLOGY

STAT #9 ST #10&11	1+56 TRAVEL (0:03)	CDR-29 EVA 3 7/6/71
	1+59 GEOLOGY STATION #10 (0:10)	
	2+09 TRAVEL (0:06)	
	2+15 GEOLOGY STATION #11 (0:19)	

STAT #9 ST #10&11	1+56 TRAVEL (0:03)	LMP-27 EVA 3 7/6/71
	1+59 Geology Station #10 (0:10)	
	2+09 TRAVEL (0:06)	
	2+15 Geology Station #11 (0:19)	

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
App-HR Bat 1	Temp LR mtr
App-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
App-HR Bat 1	Temp LR mtr
App-HR Bat 2	Temp RR mtr

(1) CDR/LMP-EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

2+10

- (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
App-HR Bat 1	Temp LR mtr
App-HR Bat 2	Temp RR mtr

TASK FUNCTION	LMP ACTIVITIES		EVA TIME	CDR ACTIVITIES	
	ROOM	PERF		ROOM	PERF

TRAV TO STA #10		STATION #10 GEOLOGY	TRAV TO STA #10		STATION #10 GEOLOGY
1+50					
	Check tools secure & HTC closed		Stow gnomon on seat back		
	Mount LRV		LCRU Set SW - PM1/WB		
	Readout LRV displays		Mount LRV		
	Traverse to Station #10 (3 min)		Powerup LRV		
			Traverse to Station #10 (3 min)		
	Arrive Station #10		Arrive Station #10		
	Readout LRV displays		Park & Power down LRV		
	Dismount LRV		Dismount LRV		
	Station #10 geology (10 min)		Station #10 geology (10 min)		
	Station #10 is located farther along the Rille at the terrace.		Point HGA to earth		
			LCRU Set SW - FM/TV		
			2+00 Dismount LRV		
			2+10		
	1. 500mm lens camera photography (provides second part of wide base stereo began at Sta #9)				
	2. Documented samples from crater on rim of Rille				
	3. 70mm panorama				
	Check tools secure & HTC closed		Stow gnomon on seatback		
	Mount LRV		LCRU Set SW - PM1/WB		
	Read LRV displays		Mount LRV		
	Traverse to Station #11 (6 min)		Powerup LRV		
			Traverse to Station #11 (6 min)		
					2+10
					141

CREW EVA CHECKLIST

VOICE DATA

2+10

7/9/71	GEOLOGY NOTES	STAT #11 GEO NOTES
EVA 3		
CDR -30		

- (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	

7/9/71	GEOLOGY NOTES	STAT #12 GEO NOTES
EVA 3		
LMP-28		

2+30

MISSION:
EVA:

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	2+10			
The traverse to Station #11 is along the Rille rim to the north end of the terrace. Description and comparison of Rille and rim material should continue.			TRAVERSE TO STATION #11	TRAVERSE TO STATION #11
Arrive Station #11 Readout LRV displays		Arrive Station #11 Park & Power down LRV		
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 GEOLOGY	STATION #11 GEOLOGY
Station #11 is located on the rim of Hadley Rille at the NW end of the terrace.				
	2+20			
<u>Area #11 tasks (in order of priority)</u>				
<ol style="list-style-type: none"> 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 panora 5. Comparison of Rille rim material with other terrain. 				
	2+30			

CREW EVA CHECKLIST

VOICE DATA

GEO NOTES STAT #12	2+34 TRAVEL (0:07)	LMP-29 EVA 3 7/19/71
	<ul style="list-style-type: none"> • Rille rim/mare/North Cmplx • Possible secondaries ray • Observe crater chain 	
	2+41 SUPPLEMENTARY SMPL STOP (0:05)	
	<ul style="list-style-type: none"> • Soil/rock sample 	
	2+46 TRAVEL (0:12)	
	<ul style="list-style-type: none"> • Mare/North Complex • Possible secondaries ray • Observe crater chain 	
	2+58 GEOLOGY STATION #12 (0:23)	
	<ul style="list-style-type: none"> • Documented samples <ul style="list-style-type: none"> - Crater ejecta - Rim of Rio - North Complex Material • Describe Chain/Link/Rio (Core tube) 	

GEO NOTES STAT #12	2+34 TRAVEL (0:07)	LMP-29 EVA 3 7/19/71
	<ul style="list-style-type: none"> • Rille rim/mare/North Cmplx • Possible secondaries/ray • Observe crater chain 	
	2+41 SUPPLEMENTARY SMPL STOP (0:05)	
	<ul style="list-style-type: none"> • Soil/rock sample 	
	2+46 TRAVEL (0:12)	
	<ul style="list-style-type: none"> • Mare/North Complex • Possible secondaries/ray • Observe crater chain 	
	2+58 Geology Station #12 (0:23)	
	<ul style="list-style-type: none"> • Documented samples <ul style="list-style-type: none"> - Crater ejecta - Rim of Rio - North Complex Material • Describe Chain/Link/Rio (Core tube) 	

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

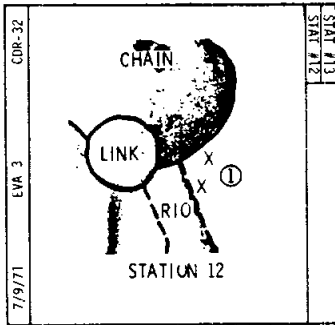
HEADING		Temp Bat 1
BEARING		Temp Bat 2
DISTANCE		Temp LF mtr
RANGE		Temp RF mtr
Amp-Hr Bat 1		Temp LR mtr
Amp-HR Bat 2		Temp RR mtr

2+50

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LEG	CDR
	2+30			
Check tools secure & HTC closed		Stow gnomon on seatback	TRAV TO SUPP SAMPLE STOP	TRAV TO SUPP SAMPLE STOP
Mount LRV		Stow HGA		
Readout LRV displays		LCRU Sel SW - PM1/WB		
Traverse to Supplementary Sample Stop (7 min)		Mount LRV		
		Power Up LRV		
		Traverse to Supplementary Sample Stop (7 min)		
<p>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.</p>				
	2+40			
Arrive Supplementary Sample Stop		Arrive Supplementary Sample Stop	SUPP SAMPLE STOP	SUPP SAMPLE STOP
Readout LRV displays		Park & Powerdown LRV		
Dismount LRV		Dismount LRV		
Supplementary Sample Stop (5 min)		Supplementary Sample Stop (5 min)		
<p>Area tasks: soil/rock sample 70mm panorama</p>				
Check tools secure & HTC closed		Stow gnomon on seatback	TRAV TO STA #12	TRAV TO STA #12
Mount LRV		Mount LRV		
Readout displays		Powerup LRV		
Traverse to Station #12 (12 min)		Traverse to Station #12 (12 min)		
<p>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.</p>				
	2+50			

CREW EVA CHECKLIST

VOICE DATA



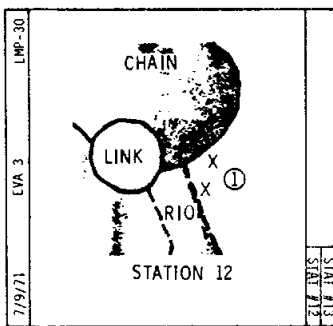
2+50

- (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
 EVA: 3

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	2+50		STATION #12 GEOLOGY	STATION #12 GEOLOGY
Arrive Station #12 Readout LRV displays		Arrive Station #12 Park & Powerdown LRV		
Dismount LRV		Dismount LRV LCRI Sel SW - TV RMT		
Arrive Station #12 Readout LRV displays		Arrive Station #12 Park & Powerdown LRV		
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)		
<p>Station #12 is an area located on the southwestern rim of Chain Crater in the North Complex at a junction of elongate depression.</p> <p><u>Area #12 tasks</u> (in order of priority)</p> <ol style="list-style-type: none"> 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)	LVA 3 7/19/71	CDR-31
	<ul style="list-style-type: none"> •Intercrater area •Ejecta from chain •North Crpix/Mare relations 		
STAT #12 STAT #13	3+25 GEOLOGY STATION #13 (0:50)	LVA 3 7/19/71	LVA 3 7/19/71
	<ul style="list-style-type: none"> •Areas of Interest <ul style="list-style-type: none"> -Pluton rim -Icarus -Observe Scarps to North -Observe Eaglecrest •Documented Samples <ul style="list-style-type: none"> •Pans, Stereo Pans (Core) (500mm) (Trench/soil) (Penetrometer) 		

STAT #12 STAT #13	3+21 TRAVEL (0:08)	LVA 3 7/19/71	LMP-31
	<ul style="list-style-type: none"> •Intercrater area •Ejecta from chain •North Crpix/Mare relations 		
STAT #12 STAT #13	3+29 Geology Station #13 (0:50)	LVA 3 7/19/71	LVA 3 7/19/71
	<ul style="list-style-type: none"> •Areas of Interest <ul style="list-style-type: none"> -Pluton rim -Icarus -Observe Scarps to North -Observe Eaglecrest •Documented Samples <ul style="list-style-type: none"> •Pans/Stereo Pans (Core) (500mm) (Trench/soil) (Penetrometer) 		

- (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	

- (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
 EVA: 3

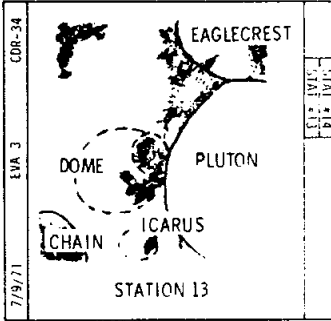
DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION	
				LMP	CDR
	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)			
<p>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.</p>					
Arrive Station #13 Readout LRV displays	3+30	Arrive Station #13 Park & Powerdown LRV			

3+30

(1) CDR/LMP - EMU check

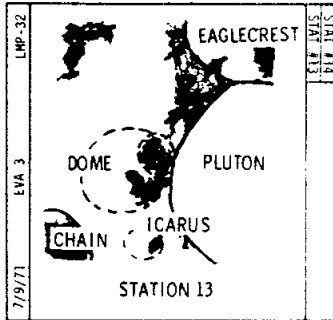
	CDR	LMP
02		
FLAGS		
PRESS		
COOL		



At 4+00

(1) CDR/LMP-EMU check

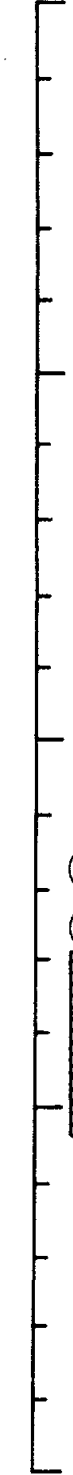
	CDR	LMP
02		
FLAGS		
PRESS		
COOL		



4+10

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Dismount LRV	3+30	Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth	STATION #13 GEOLOGY	STATION #13 GEOLOGY
Station #13 geology (53 min)		Station #13 geology (53 min)		
<p>The Station #13 area is a multiple objective stop located near the end of the North Complex Scarp between Chain and Pluton Craters.</p> <p>The principle areas of interest in this portion of the North Complex are:</p> <ul style="list-style-type: none"> a) Icarus Crater on the western rim of Pluton Crater b) Pluton Crater c) Eaglecrest Crater d) Scarps <p>These areas, depending upon the characteristics and accessibility should be tasked as follows: (discretion of the crew is necessary)</p> <p>Area #13 tasks (in order of priority)</p> <ul style="list-style-type: none"> 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 3		Temp LR mtr	
Amp-Hr Bat 2		Temp RR mtr	

4+30

MISSION: APOLLO 15, J-1
 EVA: 3

DATE: 6/2/71

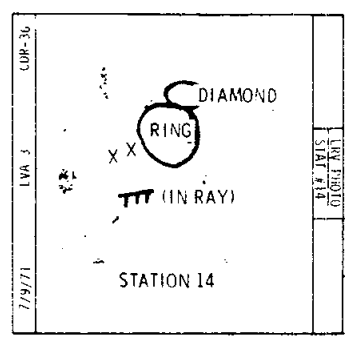
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	4+10			
Check tools secure & HTC closed	4+20	Stow gnomon on seatback Stow HGA LCRU Sel SW - PM1/WB		
Mount LRV		MOUNT LRV		
Readout LRV displays		Powerup LRV		
Traverse to Station #14 (19 min)		Traverse to Station #14 (19 min)		
<p>The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

4+30

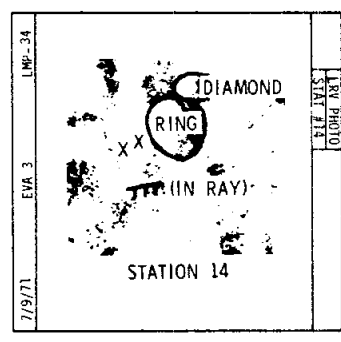
(1) CDR/LMP-EMU check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

STAT #10	STAT #14	FILE	STATS	DIR	PHOTO	DATE	TIME
4-19	TRAVEL (0-19)						
	<ul style="list-style-type: none"> •North Complex Mare •Secondaries/ray •Epic crater 						
4-36	Geology Station #14 (0-14)						
	<ul style="list-style-type: none"> •Compare mare with No. Cplx •Documented Samples <ul style="list-style-type: none"> - Ring crater - Pilliet/Rock sample - Bouldermer rocks •Radial Scale - 5-10m center •Trench in ray material 						
4-56	TRAVEL (0-14)						
	<ul style="list-style-type: none"> •Compare to earlier mare •Secondaries/ray 						



STAT #10	STAT #14	FILE	STATS	DIR	PHOTO	DATE	TIME
4-19	TRAVEL (0-19)						
	<ul style="list-style-type: none"> •North Complex Mare •Secondaries/ray •Epic crater 						
4-36	Geology Station #14 (0-14)						
	<ul style="list-style-type: none"> •Compare mare with No. Cplx •Documented Samples <ul style="list-style-type: none"> - Ring crater - Pilliet/Rock sample - Bouldermer rocks •Radial Scale - 5-10m center •Trench in ray material 						
4-56	TRAVEL (0-14)						
	<ul style="list-style-type: none"> •Compare to earlier mare •Secondaries/ray 						



- (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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
Dismount LRV		Dismount LRV LCRU Sel SW - FM/TV Point HGA to earth		
Station #14 geology (20 min)		Station #14 geology (20 min)	STATION #14 GEOLOGY	STATION #14 GEOLOGY
<p>The Station #14 area is located near ring Crater south of the North Complex in the Mare.</p> <p><u>Area #14 tasks (in order of priority)</u></p> <ol style="list-style-type: none"> 1. Compare blocks and Mare material with North Complex 2. Documented samples 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
O2		
FLAGS		
PRESS		
COOL		

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

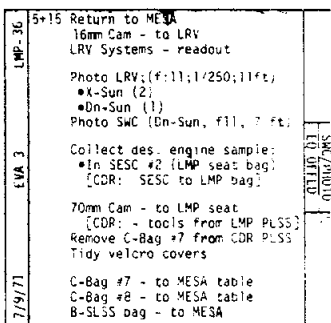
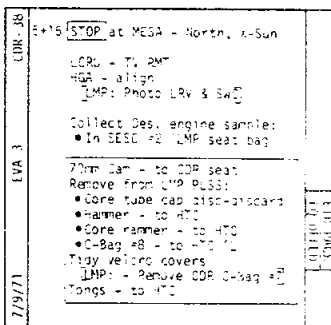
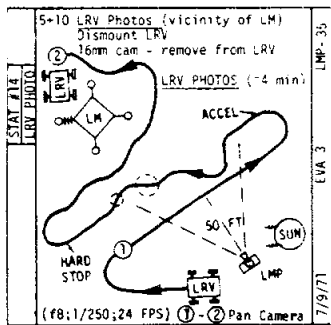
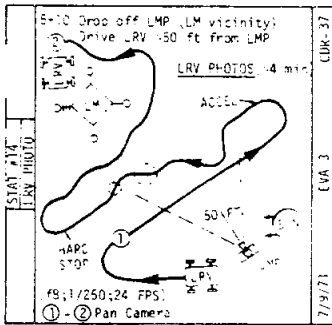
HEADING	Temp Bat 1
BEARING	Temp Bat 2
DISTANCE	Temp LR mtr
RANGE	Temp RR mtr
Amp-Hr Bat 1	Temp LR mtr
Amp-Hr Bat 2	Temp RR mtr

5+10

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU		TASK FUNCTION	
			LM	CDR	LM	CDR
	4+50		X	X		
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					

CREW EVA CHECKLIST

VOICE DATA



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

- (1) CDR-Rpt 6-70mm mags in ETB

- (1) CDR-Rpt 16mm mag _____ (II) in ETB

5+30

MISSION: APOLLO 15, J-1
 EVA: 3

DATE: 6/2/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	5+10			
Arrive at LM. Readout LRV displays		Arrive at LM Park LRV at MESA; point North, X-sun in sun		
		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			
Stow 70mm cam/bags on LMP seat Assist CDR		Place SESC in SCB Open LRV batt dust covers, stow 70mm cam/bags on CDR seat		
Remove SCB #7 from CDR PLSS tool harness; tidy velcro covers		Remove from LMP PLSS tool harness • 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 mags in ETB (carry ETB to LMP side)		
	5+30	Attach ETB to MESA table		

CREW EVA CHECKLIST

VOICE DATA

LEO OFFLED
LMB PACK

P.O. Pkg - to MESA
ETB - to LMP, LDP floorplan

Slow in ETB

- Centro drum in sample bag
- CDR 70mm cam; LL
- 70mm mags (4): SS, TT, VV, d.
- 500mm cam mag - MM
- 16mm mag (1); II
- Maps

5+30 ETB - to MESA table
P.O. Pkg - operate
- stow in ETC

4GA - stow
LCRU - PM1/%B

5+38 **START**
NAV sys. - RESET
[LMP: Photo CDR on LRV]

LEO OFFLED
SWC/PHOTO

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

CDR-40
EVA 3

LM → H=096° → SUN
D=0.1 KM

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

7/9/71

LMP-38
EVA 3

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

7/9/71

5+30 (1) CDR/LMP - EMU check

	CDR	LMP
O2		
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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	5+30			
Photo CDR driving LRV		Stow HGA for traverse 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			

INGRESS - EVA TERMINATION

CREW EVA CHECKLIST

VOICE DATA

5+50

LRY PACK INGRESS	LCRU Pwr - EXT LCRU Sel - TV RMT	CDR-41
	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	EVA 3
	Clean EMU 5+46 Ascend ladder; carry [C-Bag #8] Hand C-Bag #8 to LMP Discard LEC Ingress	7/9/71

6+00 (1) CDR - Rpt END EVA-3

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
 EVA:

DATE: June 28, 1971

CORE TUBE SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEC CAM	TASK FUNCTION	
				LMP	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			
Assist CDR		Obtain core tube cap from LMP PLSS & cap tube			
Get extension handle from CDR & tether		Remove core tube from ext hndl			
		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			
<p>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.</p>					

MISSION: APOLLO 15
EVA:

DATE: June 28, 1971

COMPREHENSIVE SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E C O N A M	TASK FUNCTION	
				L M P	C D R
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	S E R I E S	TASK FUNCTION	
				L M P	C D R
	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 3 photos each at: 90° phase Filter L, C, R* 110° phase Filter R, C, L* 130° phase Filter L, C, R*			
** Take locator photo using prominent feature X-sun f8,1/250,15 ft, Focus 74		Collect minimum of 4 rock samples from area in documented sample bags			
Get sample bags, report number & hold for CDR.		Retrieve gnomon			
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	10	Proceed to next sample			

MISSION: APOLLO 15
 EVA:

DATE: June 28, 1971

RADIAL SAMPLING

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E Q C A M	TASK FUNCTION	
				L M P	C D R
Describe area to be sampled radially Get sample bags, report numbers & hold for CDR to fill Close bags, seal & stow in collection bags Proceed to next sample	0	Select ~ 10m crater on smooth surface & place gnomon			
			Take partial pan from opposite sides of crater		
			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		
			Retrieve gnomon		
	10	Proceed to next sample			

MISSION: APOLLO 15

DATE: June 28, 1971

EVA: SOIL MECHANICS TRENCH

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
	10			
Proceed to next sample		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.

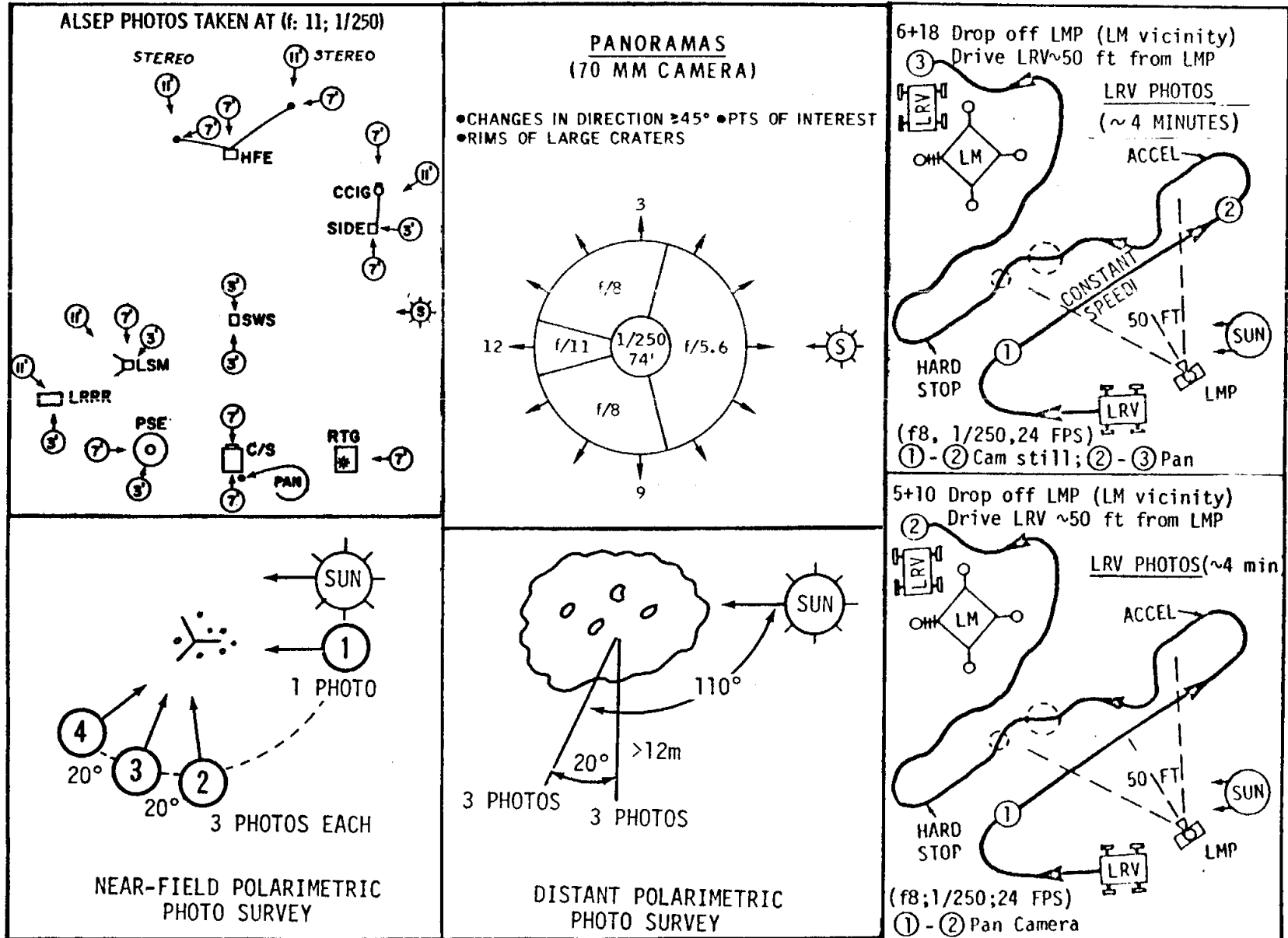


Figure 3.3-1 Lunar Surface Photography Data

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 the 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.

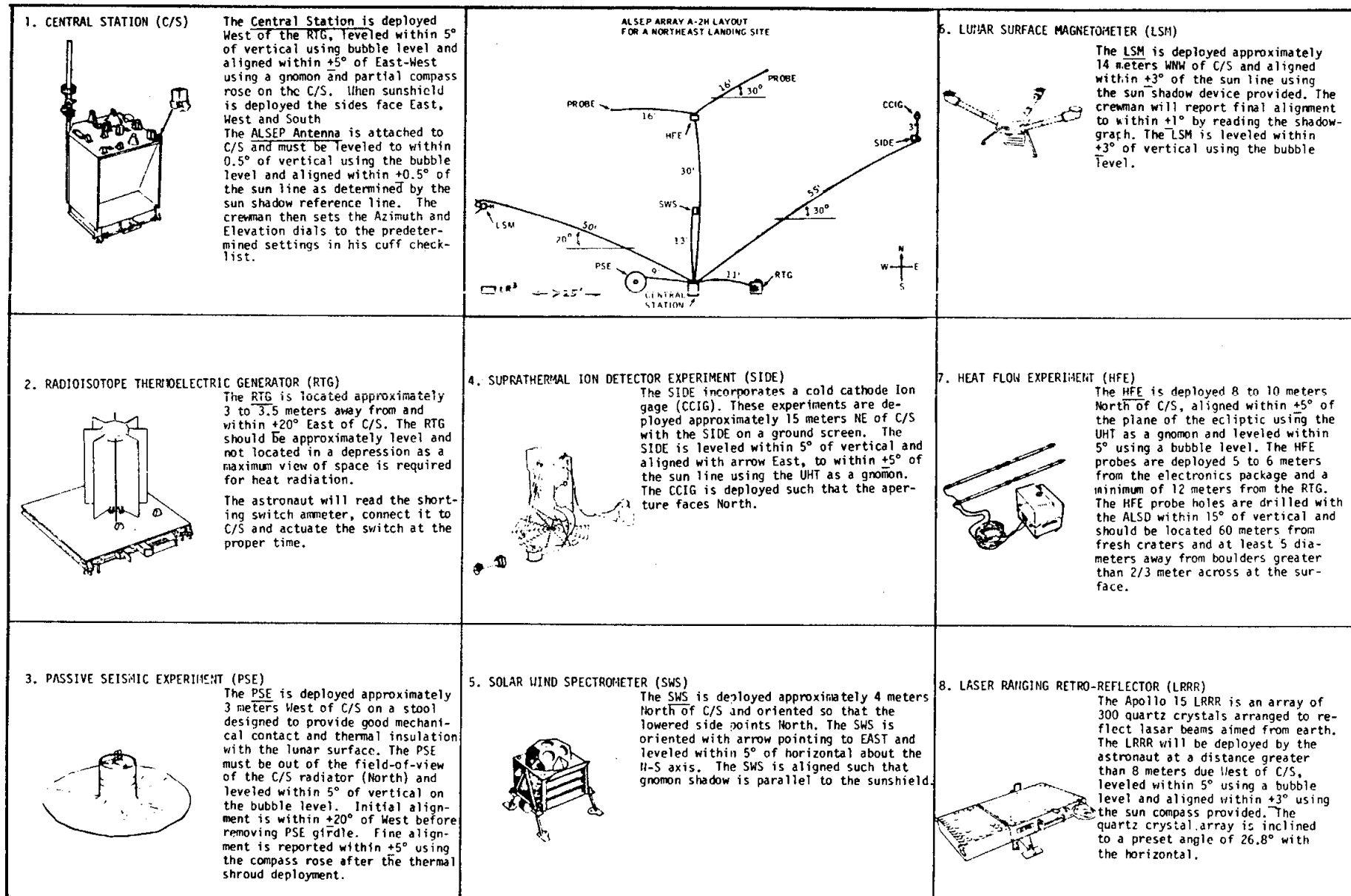


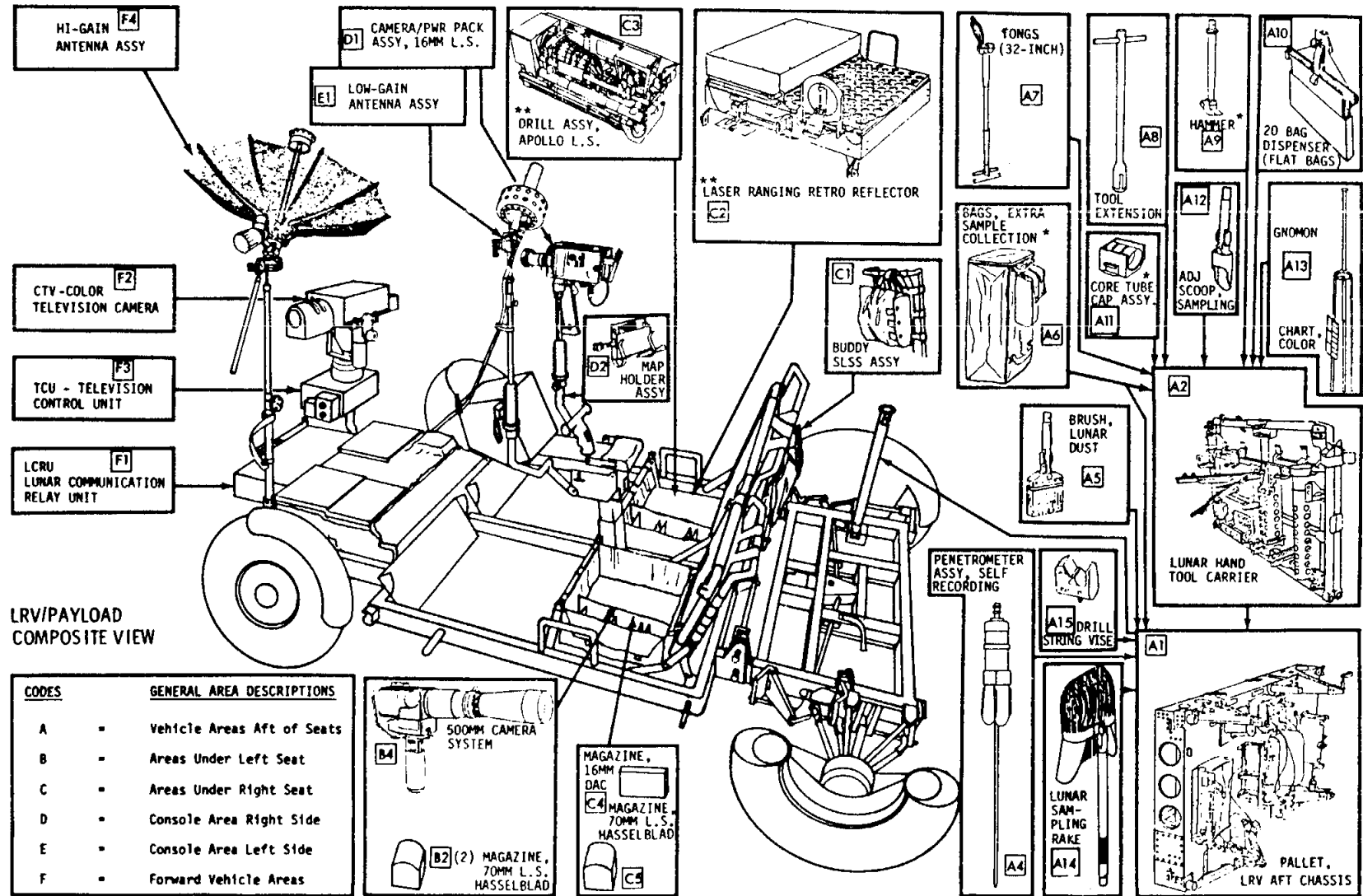
FIGURE 3.4-1 APOLLO LUNAR SURFACE EXPERIMENTS DATA

3.5

GEOLOGY EQUIPMENT AND DATA








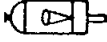



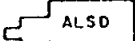
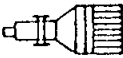





The illustration in Figure 3.5-1 summarizes the lunar surface geology equipment and traverse support equipment as stowed on the LRV and PLSS tool carrier in support of the astronauts field geology activities. Those items marked (*) are normally stowed on the LMP's PLSS tool harness although they can 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.



**Only carried on LRV from LM to ALSEP site

FIGURE 3.5-1 LUNAR FIELD GEOLOGY EQUIPMENT AND LRV STOWAGE

-  - Special Environmental Sample Container
-  - Core tubes (ex. Upper tube -#03, Lower tube -#10)
-  - Core tube cap assy (w/3 caps)
-  - Core tube tool assy
-  - Set of 6 core stems
-  - Core stem cap assy
-  - Lunar surface rake
-  - Penetrometer
-  - Penetrometer (Data recording section only)
-  - Large Samples
-  - Small Samples
-  - Apollo Lunar Surface Drill
-  - Dust brush
-  - Crew cuff checklist
-  - Lunar surface maps (EVA specified)
-  - LRV mapholder
-  - LRV checklist
-  - Buddy Secondary Life Support System

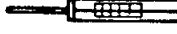

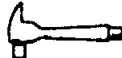


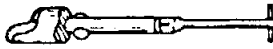


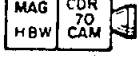






-  - Gnomon
-  - Organic Control Sample
-  - Hammer
-  - Tongs
-  - Extension Handle
-  - Extension Handle/Scoop Assy
-  - 20-Documented Sample Bag Dispenser
-  - LMP 70mm camera w/mag
-  - CDR 70mm camera w/mag
-  - 500mm Lens Camera w/mag
-  - 70mm Magazine w/HBW film
-  - 70mm Magazine w/HCEX film
-  - 16mm Magazine w/CEX film
-  - LCRU Battery
-  - LCRU Battery (used)

Table 3.5-1 LEGEND FOR
LUNAR FIELD GEOLOGY EQUIPMENT & SAMPLE MANAGEMENT

FIGURE 3.5-2a EVA-1 PRE-GEOLOGY TRAVERSE
(MESA AND ETB TRANSFERS TO LRV)

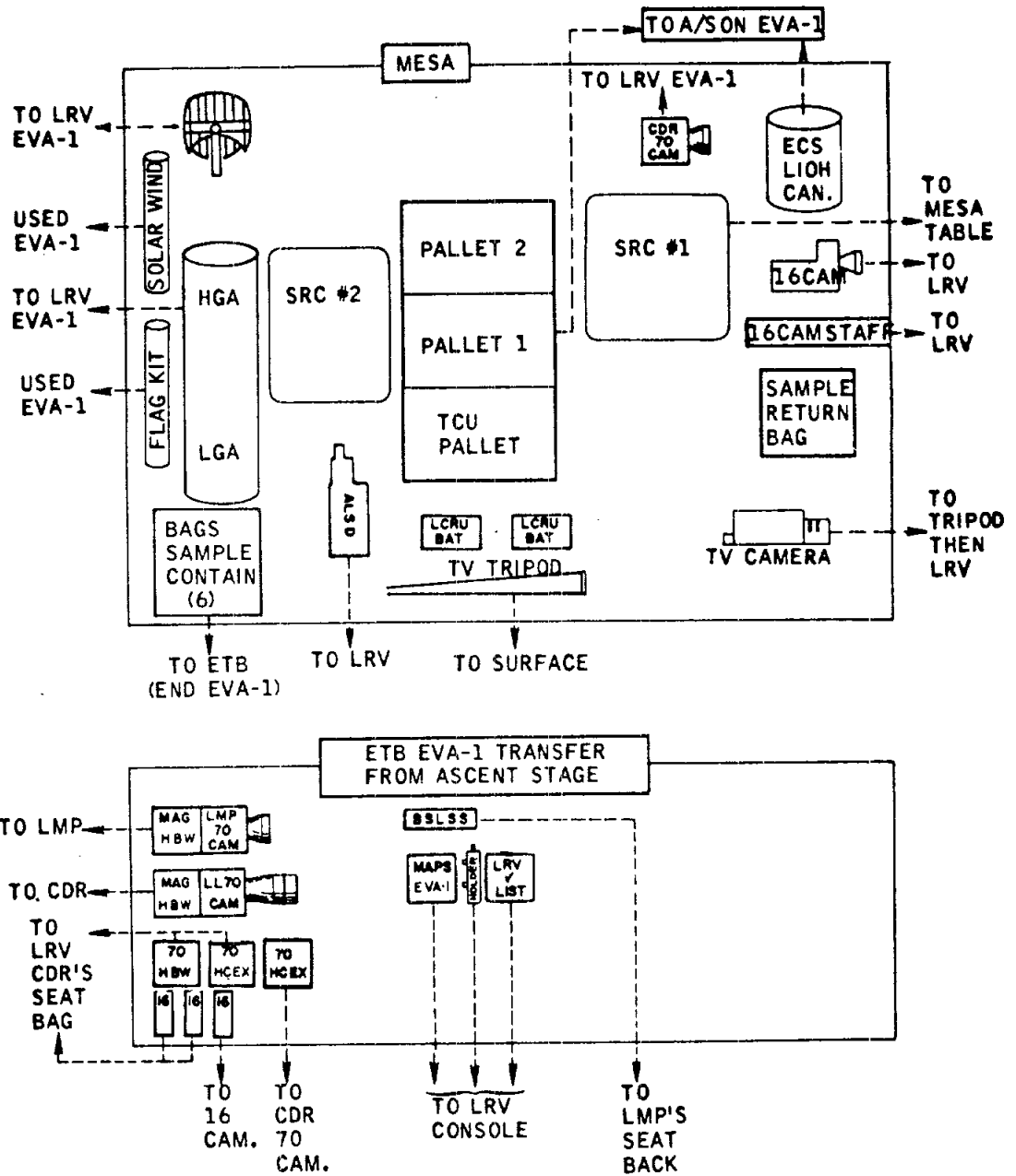
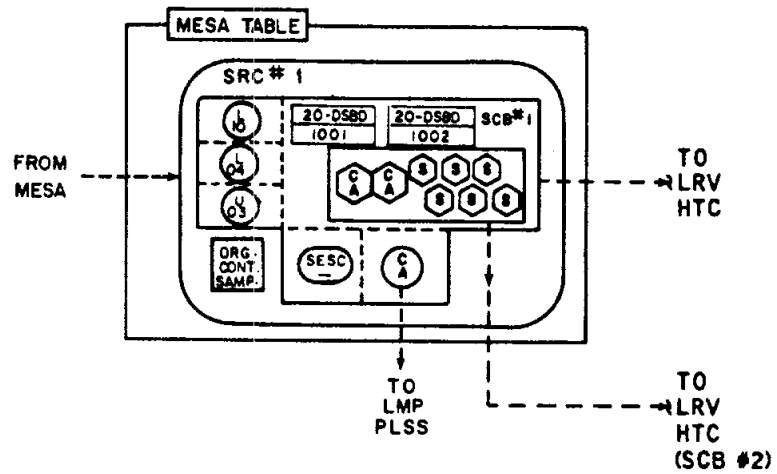


FIGURE 3.5-2b EVA-1 PRE-GEOLOGY TRAVERSE
 (MESA TABLE LOADING AND TRANSFER TO LRV)



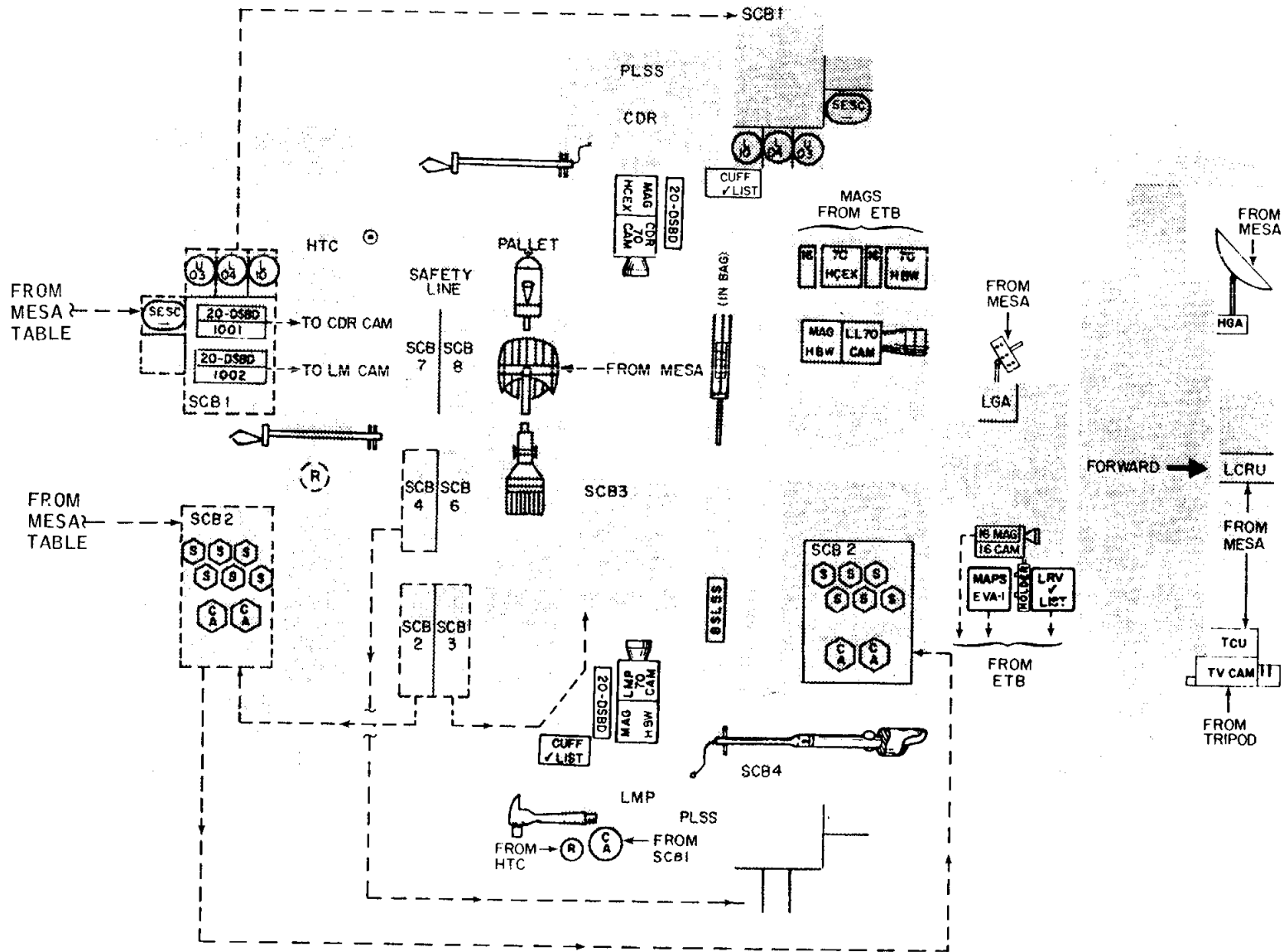


FIGURE 3.5-2c EVA-1 PRE-GEOLOGY TRAVERSE

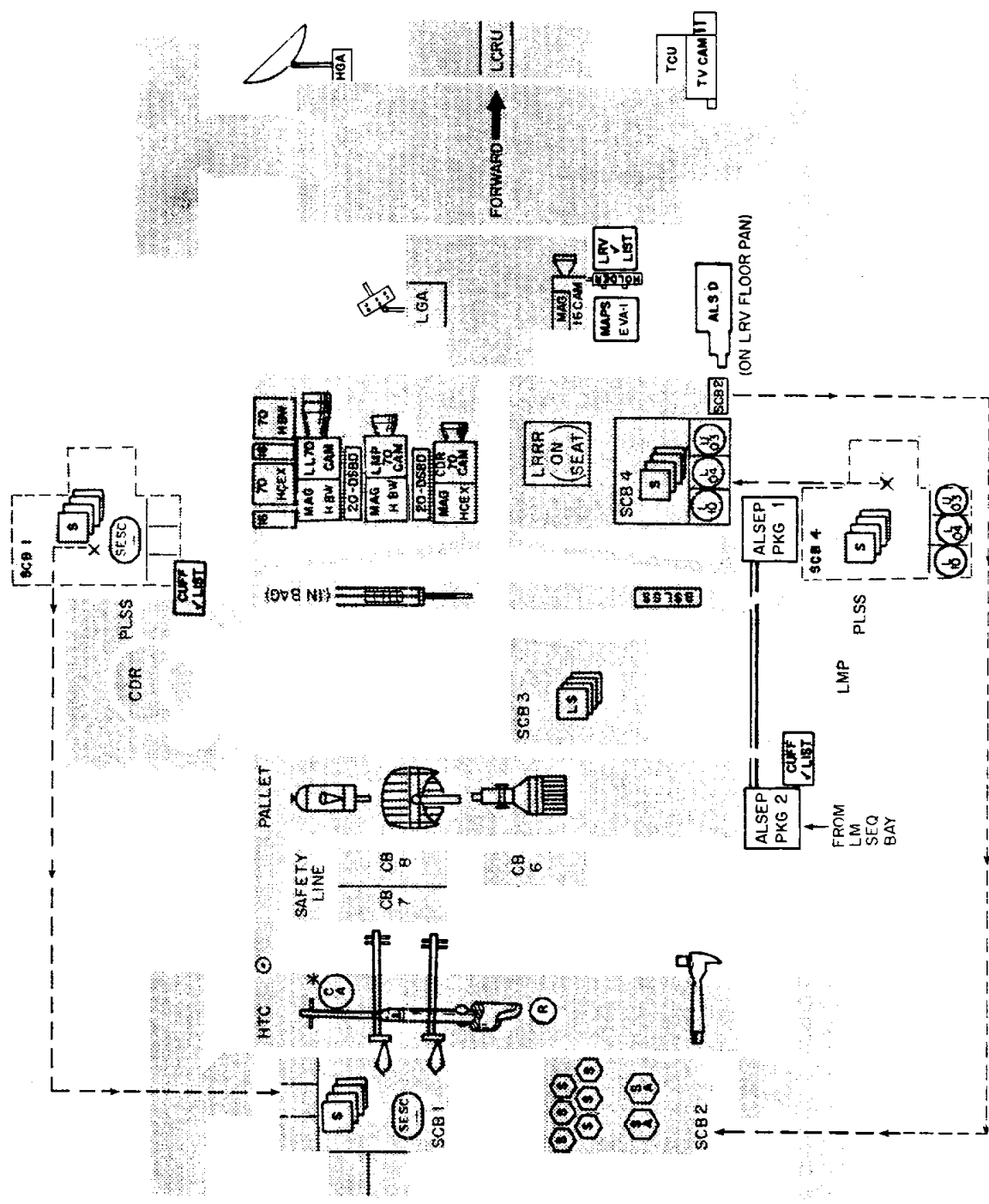
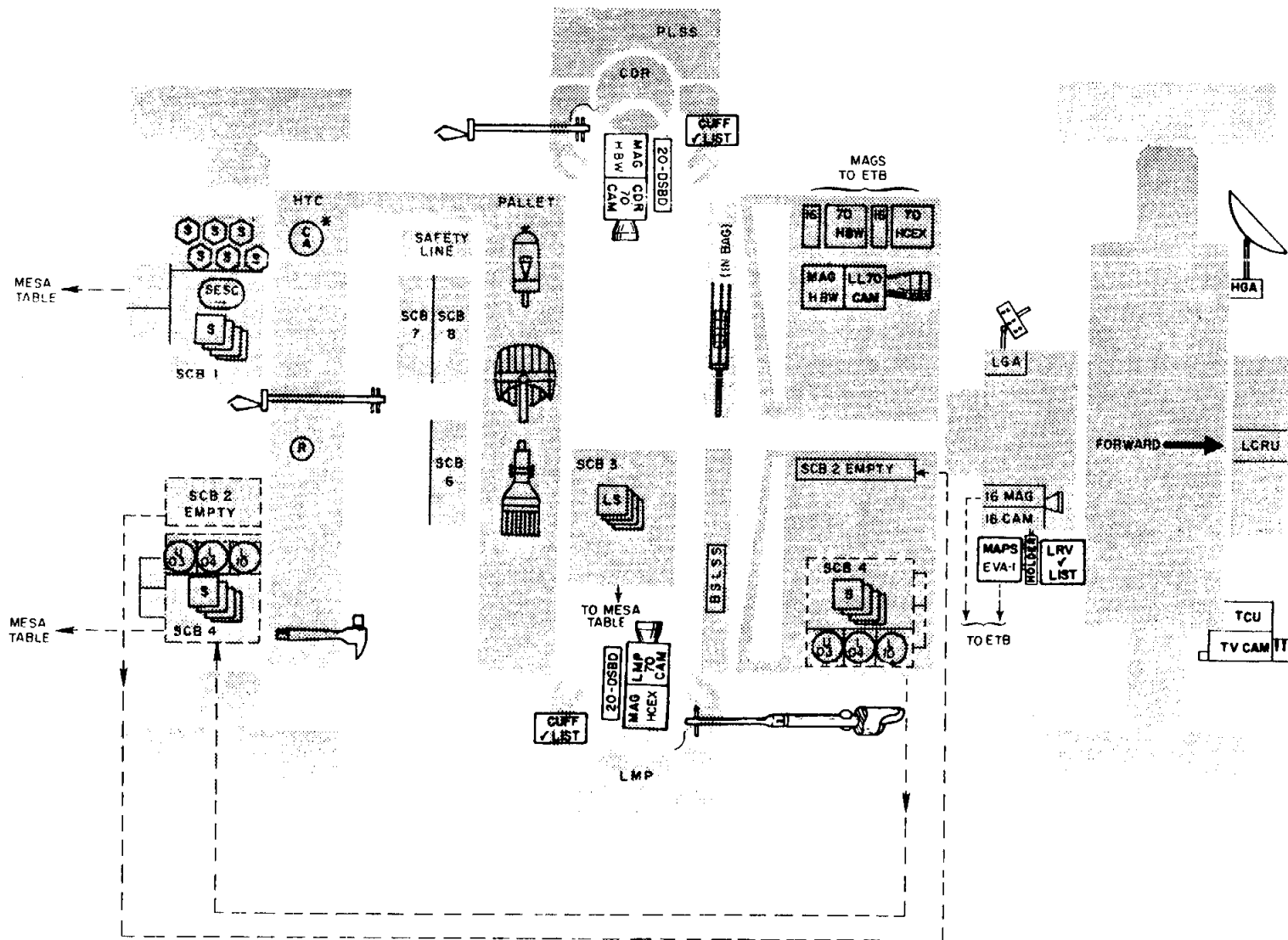


FIGURE 3.5-2d EVA-1 PRE-ALSEP DEPLOYMENT

* IF CAPS UNUSED



* 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

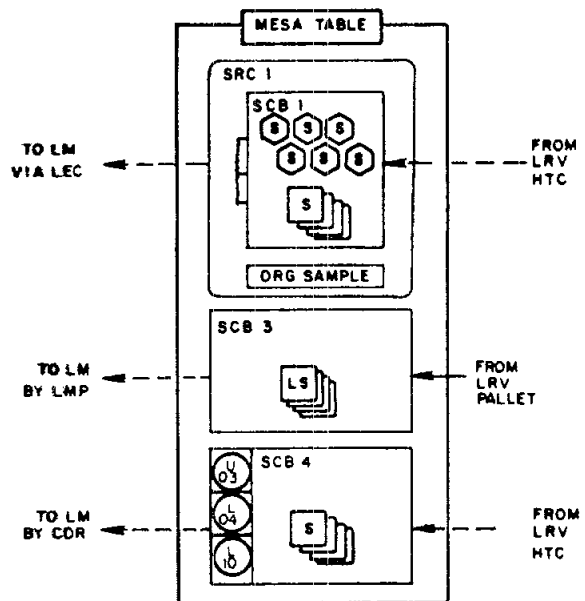
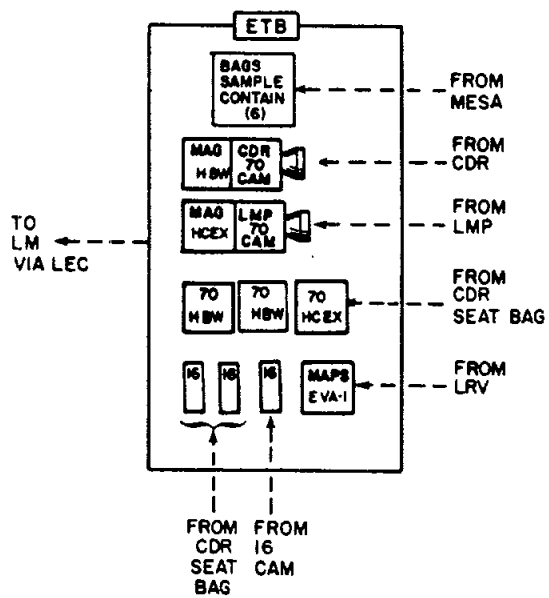


FIGURE 3.5-2g EVA-1 ON LMP INGRESS
 (ETB TRANSFER TO LM)



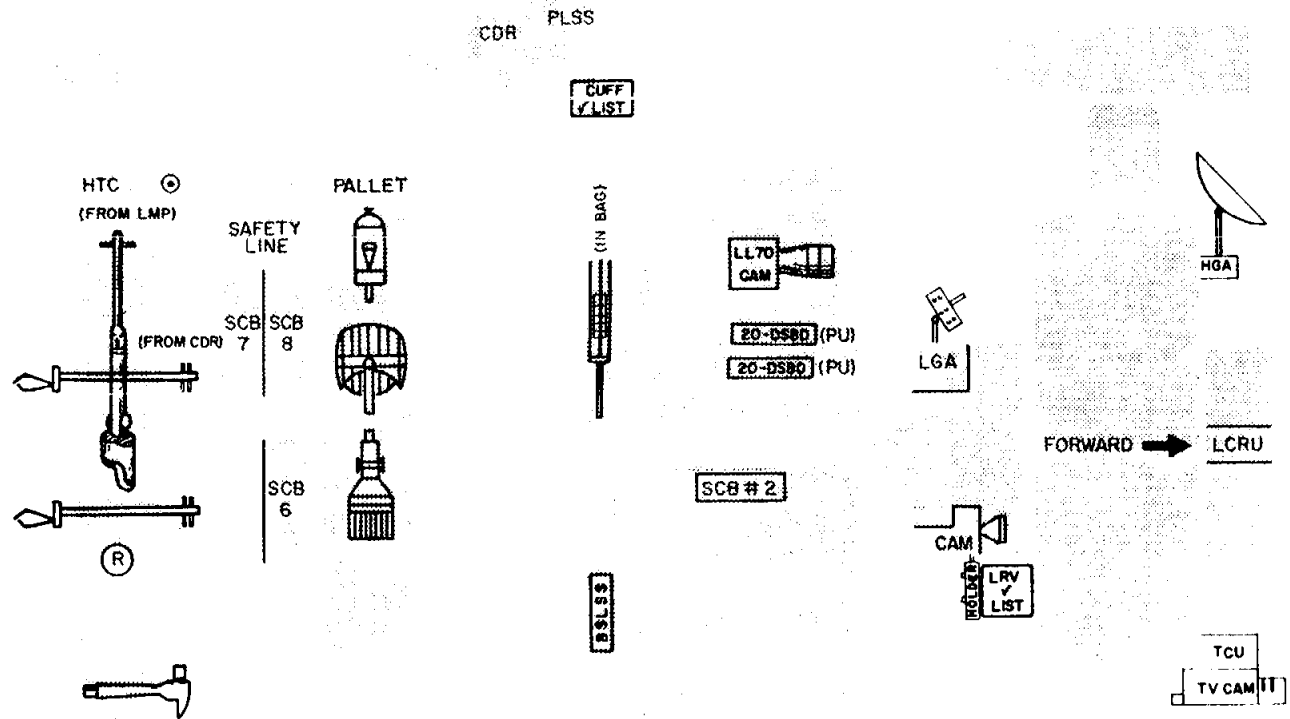


FIGURE 3.5-2h EVA-1 ON LMP INGRESS

FIGURE 3.5-3a EVA-2 PRE-GEOLOGY TRAVERSE
 (MESA AND ETB TRANSFERS TO LRV)

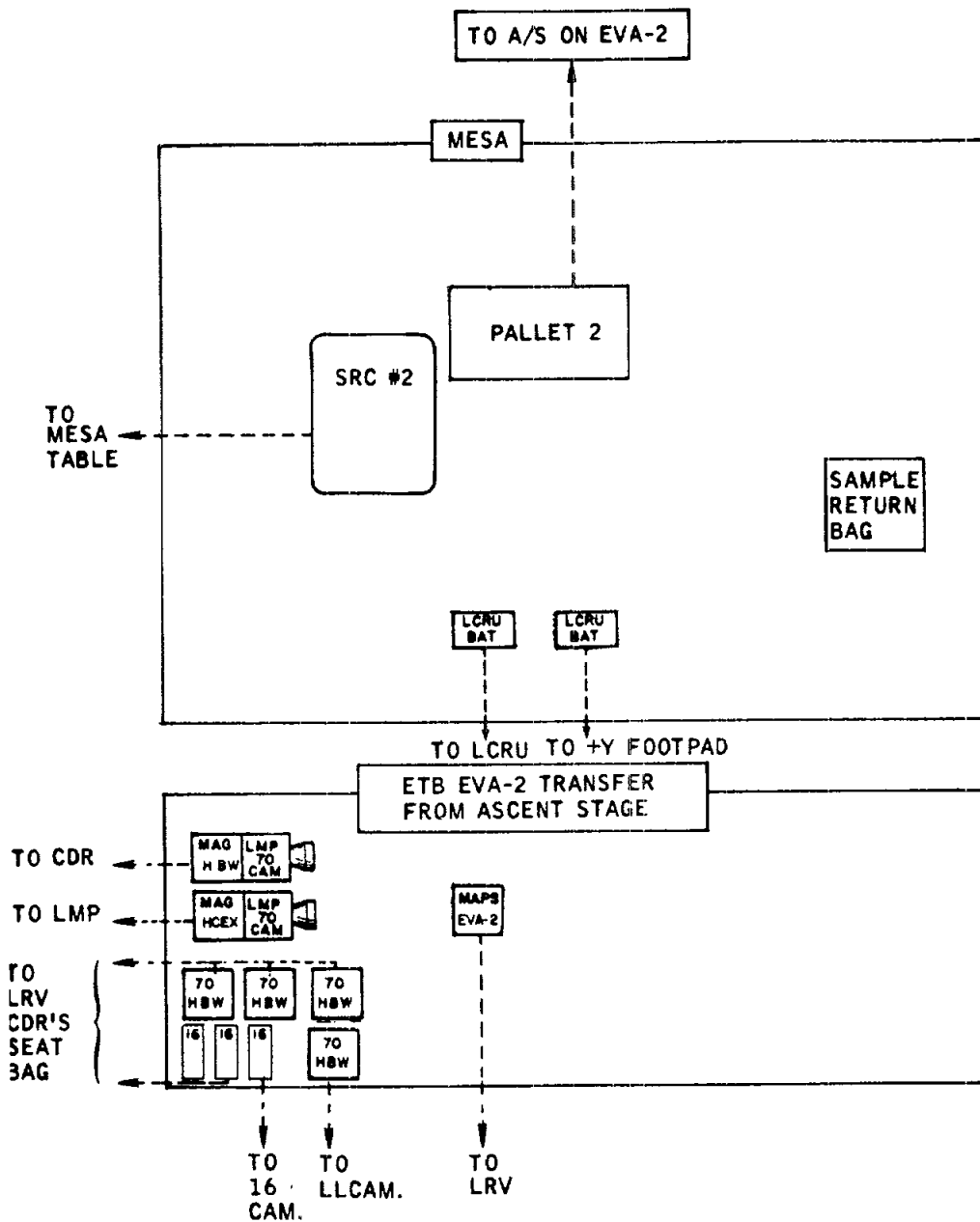
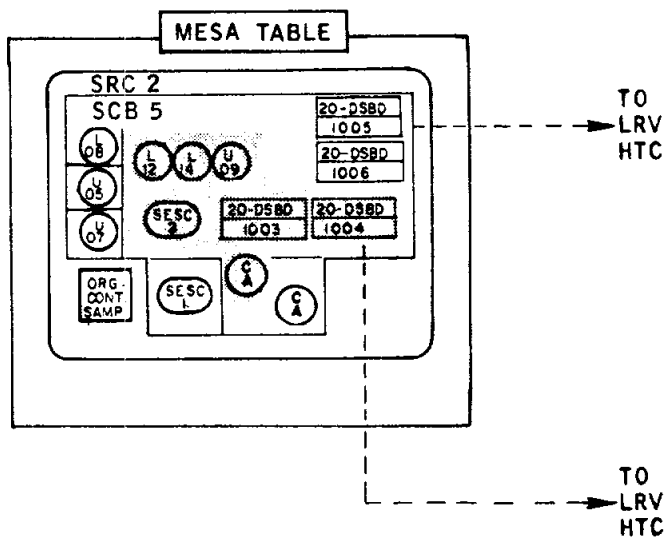


FIGURE 3.5-3b EVA-2 PRE-GEOLOGY TRAVERSE
 (MESA TABLE LOADING AND TRANSFER TO LRV)



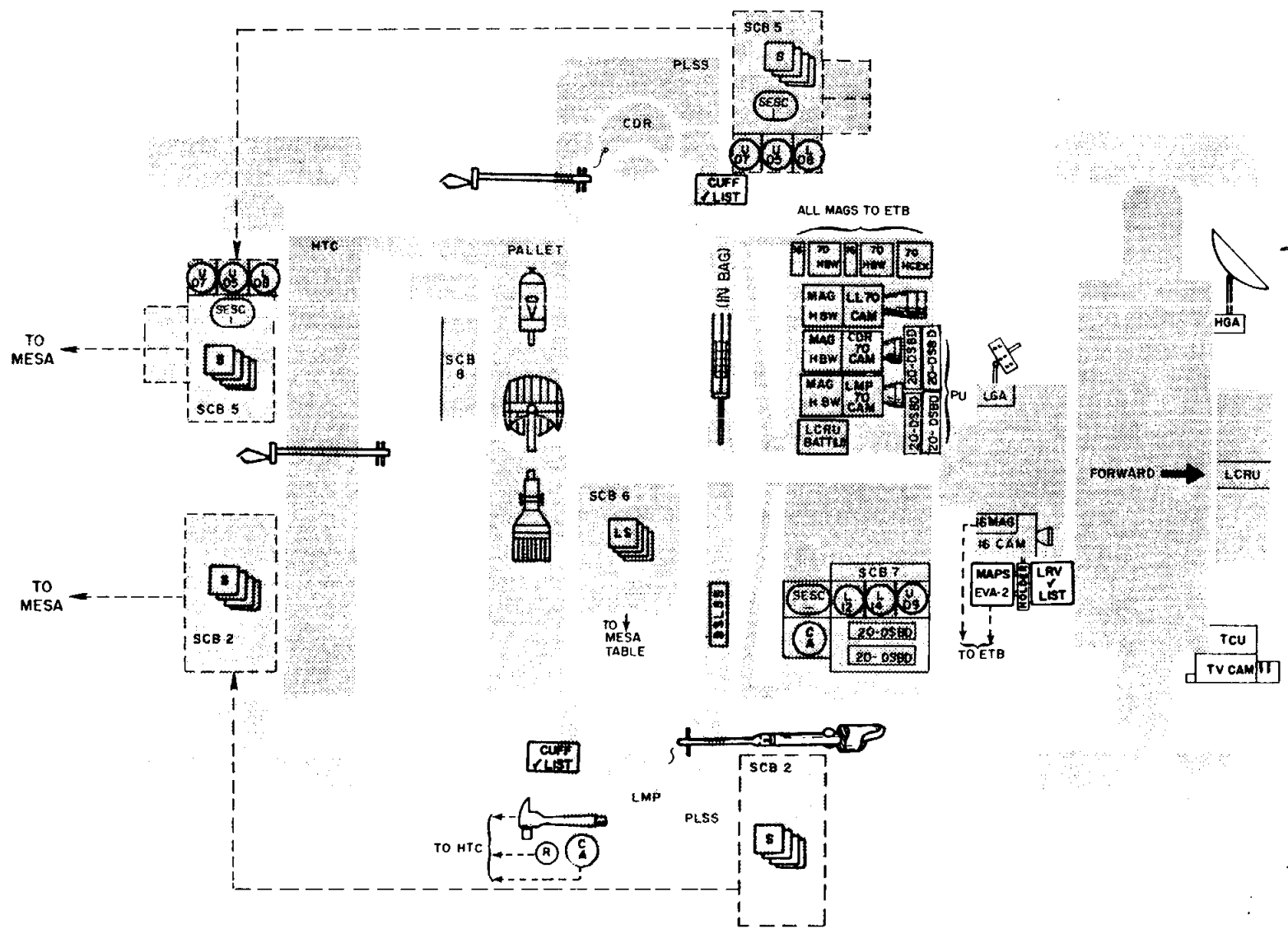


FIGURE 3.5-3d EVA-2 ARRIVAL BACK AT LM

FIGURE 3.5-3e EVA-2 ON ARRIVAL BACK AT LM
 (LRV TRANSFERS TO MESA AND LM)

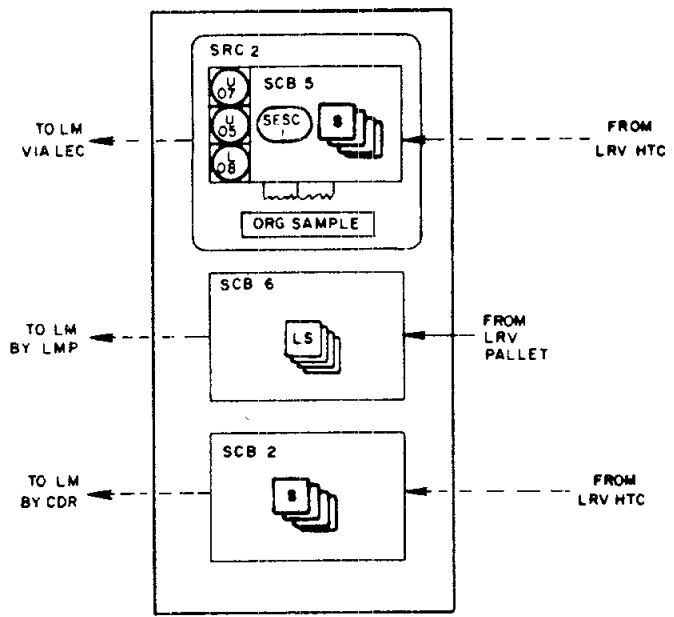


FIGURE 3.5-3f EVA-2 ON LMP INGRESS
 (ETB TRANSFER TO LM)

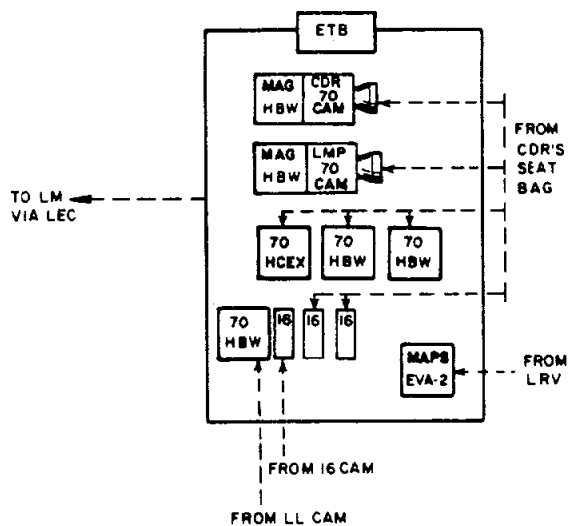
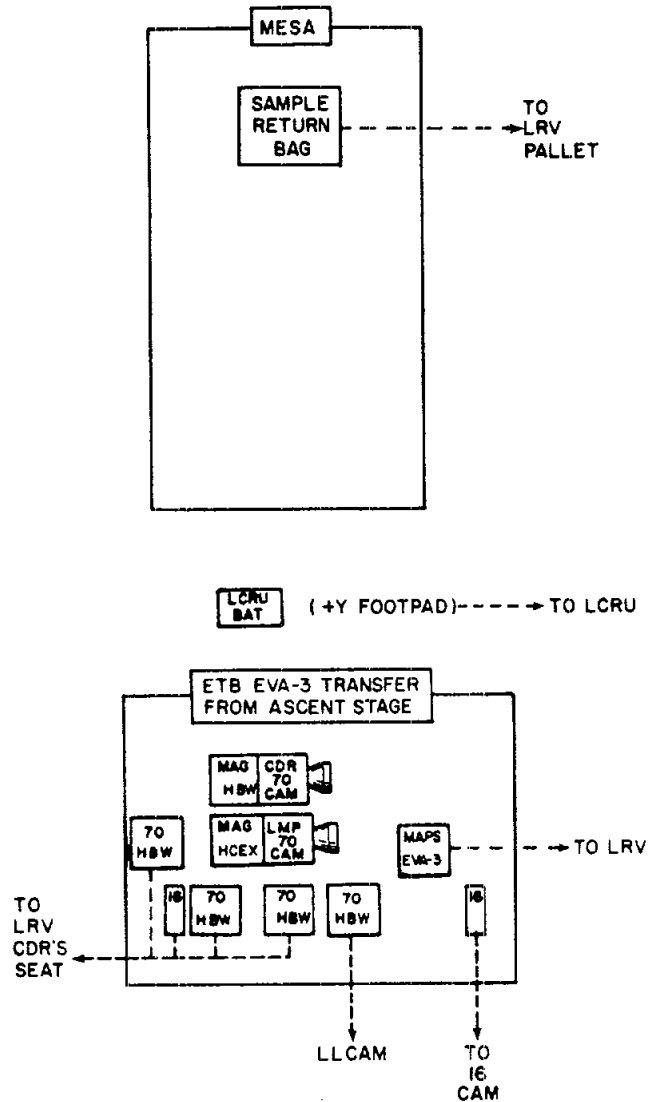


FIGURE 3.5-4a EVA-3 PRE-GEOLOGY TRAVERSE
 (MESA AND ETB TRANSFERS TO LRV)



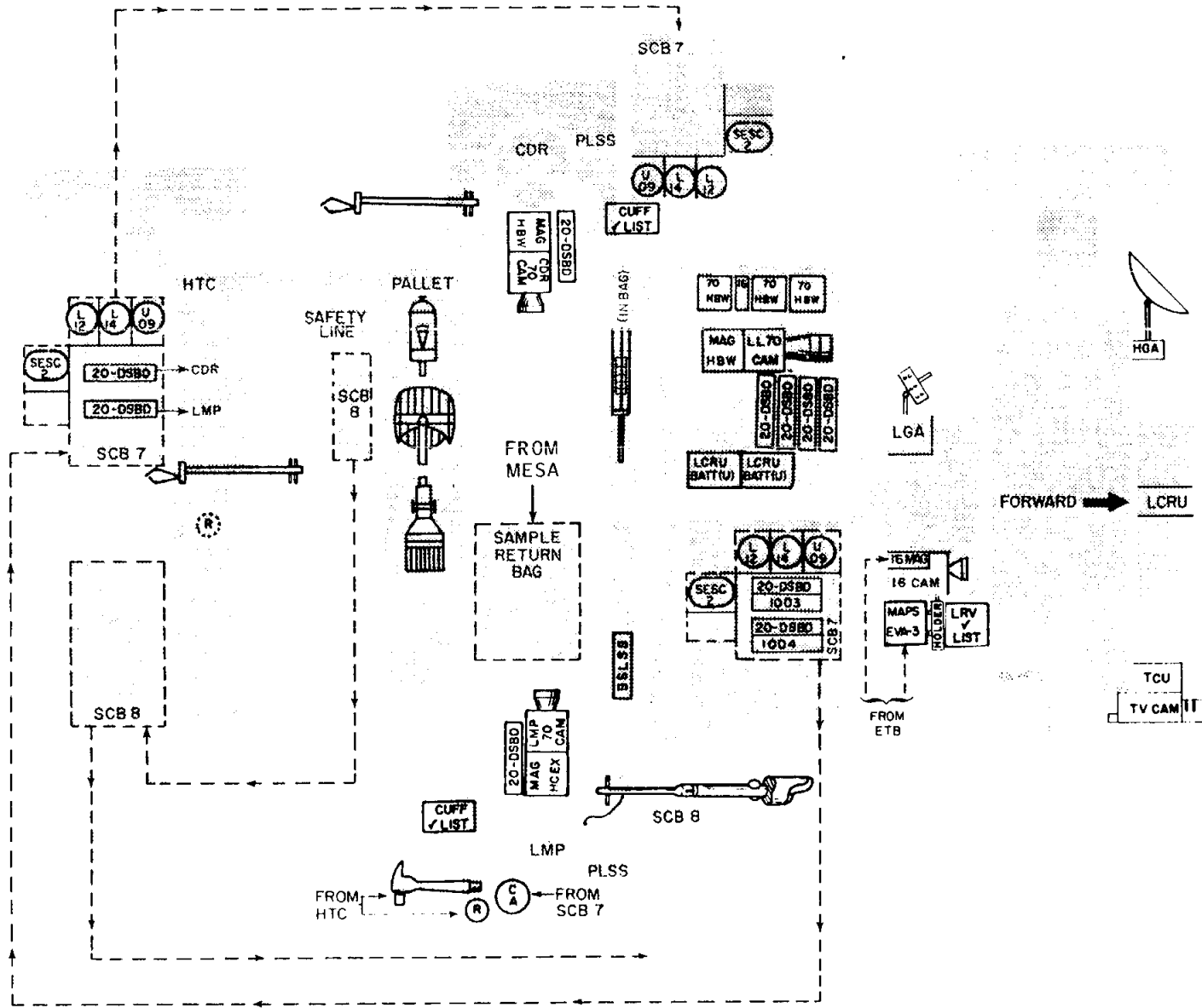


FIGURE 3.5-4b

EVA-3 PRE-GEOLOGY TRAVERSE

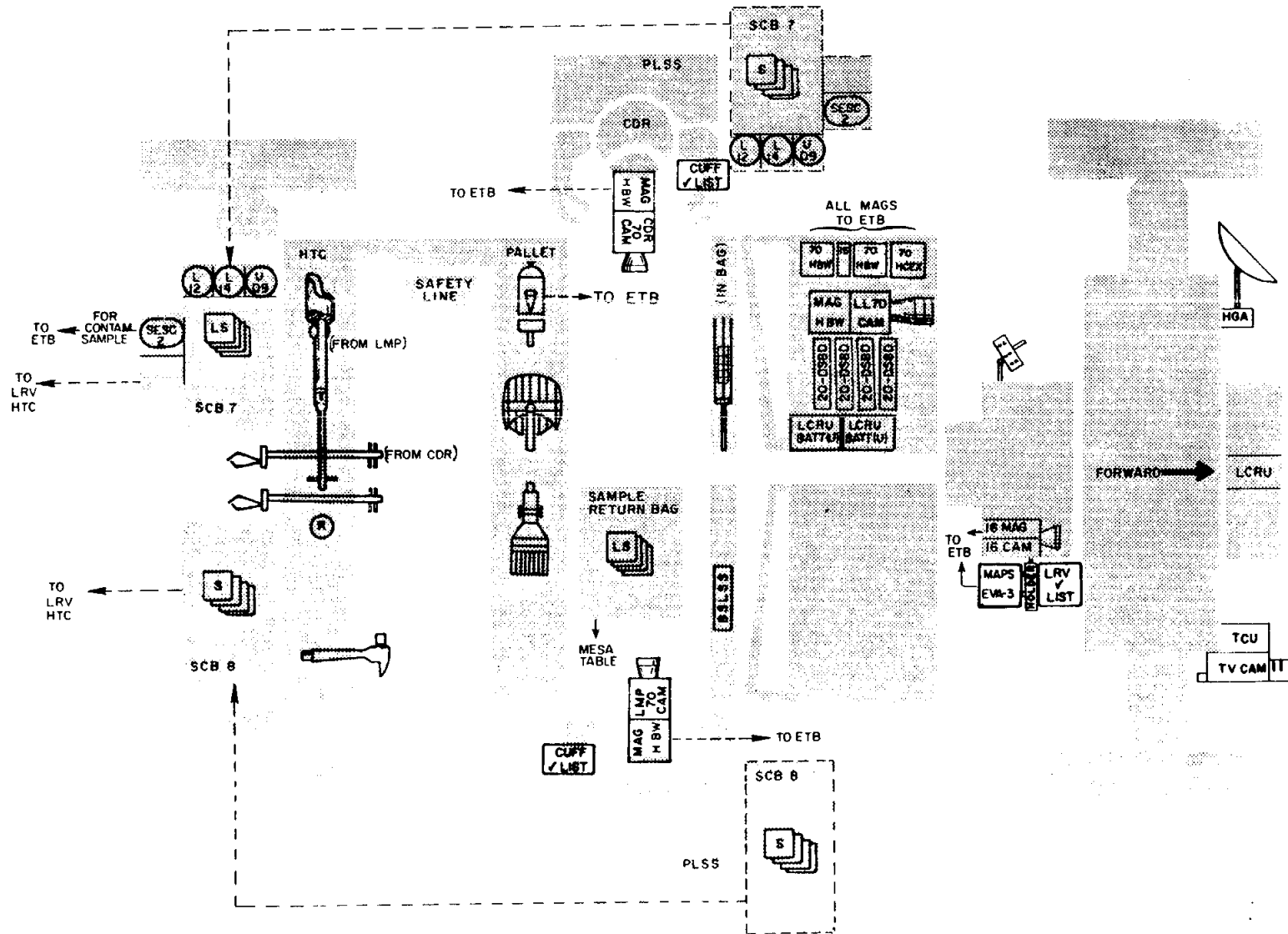
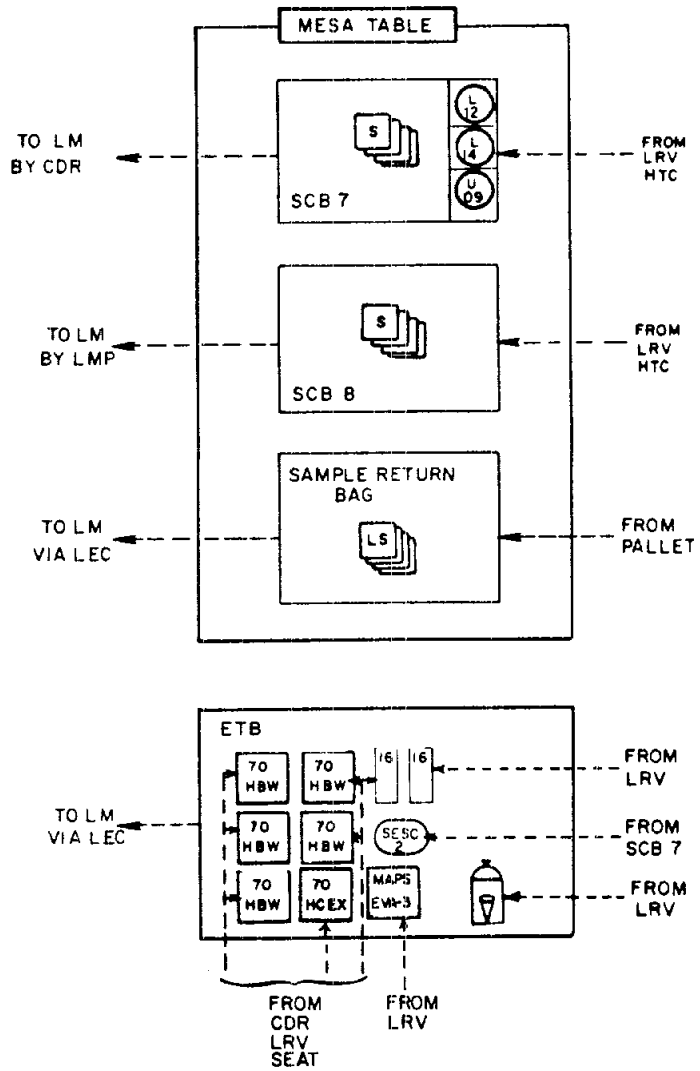


FIGURE 3.5-4c EVA-3 ARRIVAL BACK AT LM

FIGURE 3.5-4d EVA-3 ON ARRIVAL BACK AT LM
 (LRV TRANSFER TO MESA AND LM)



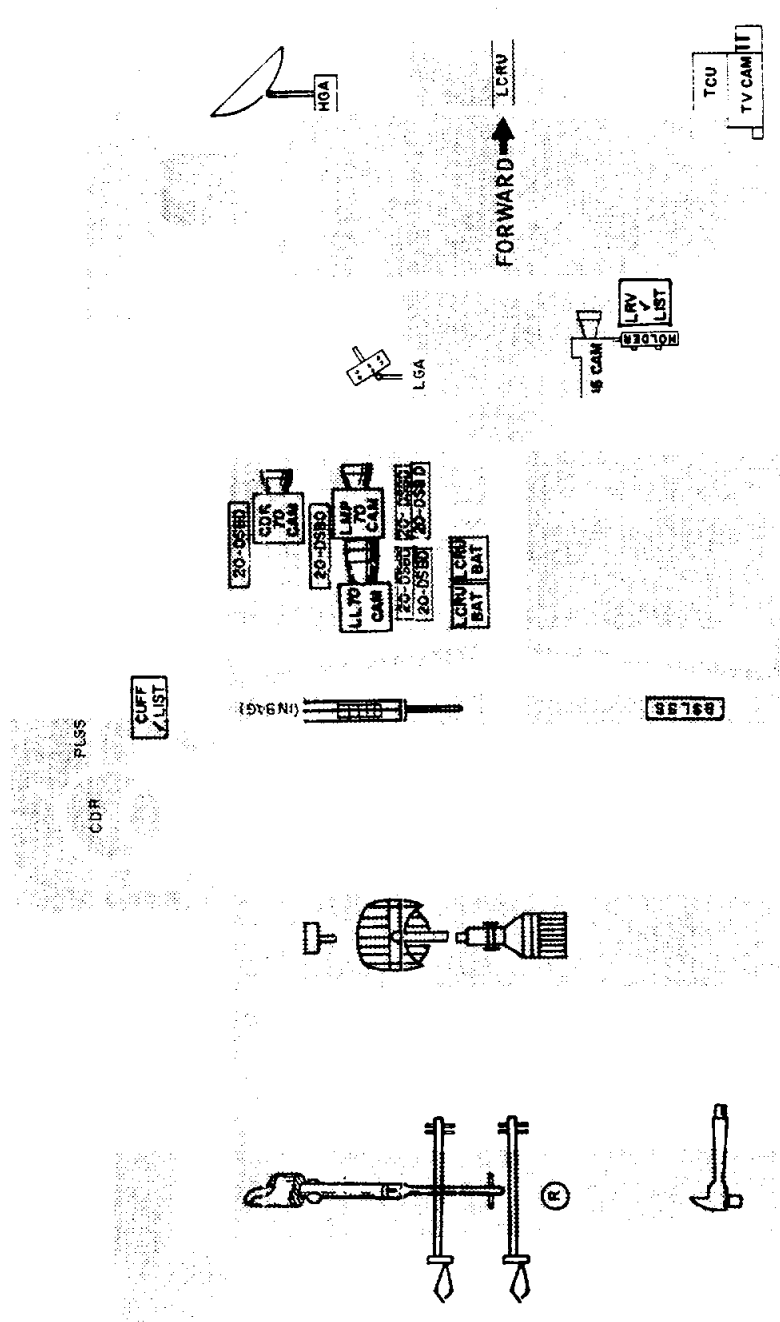


FIGURE 3.5-4e EVA-3 ON LMP INGRESS

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:

<u>Activity</u>	<u>Metabolic Rate (\dot{Q}_{met})</u>
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 O₂ 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:

<u>EVA</u>	<u>\dot{W}_{lk}, lbs/hr</u>
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:

<u>EVA</u>	<u>\dot{Q}_{hl} (BTU/hr)</u>
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.

HADLEY APENNINE LANDING AREA

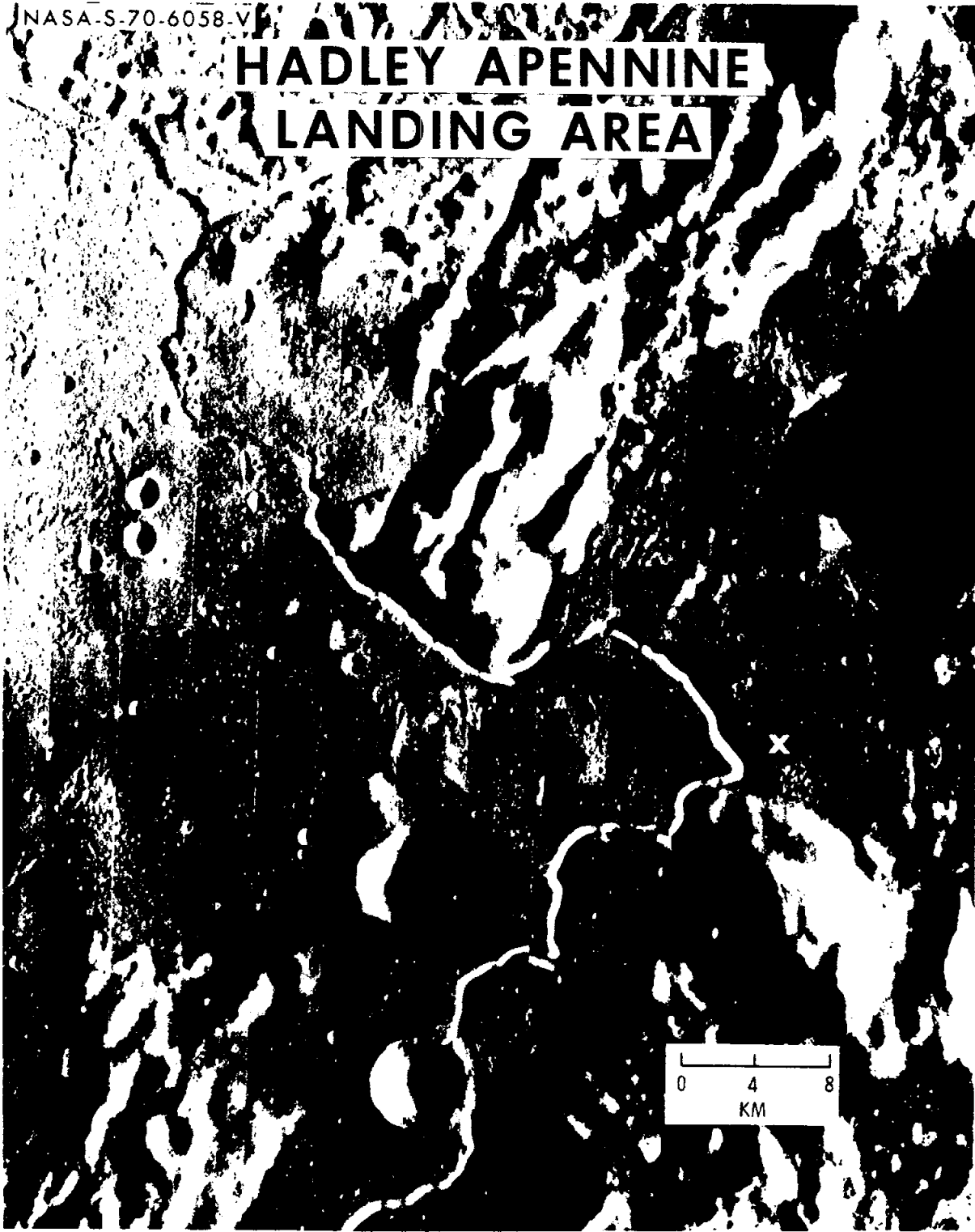


Figure 3.6-1 Hadley Apennine Landing Area

Figure 3.6-1

HADLEY APENNINE



Figure 3.6-2 LRV Traverses EVA-1,2,3 (SUMMARY)

HADLEY - APENNINE



Figure 3.6-3 Hadley Apennine Features & Names

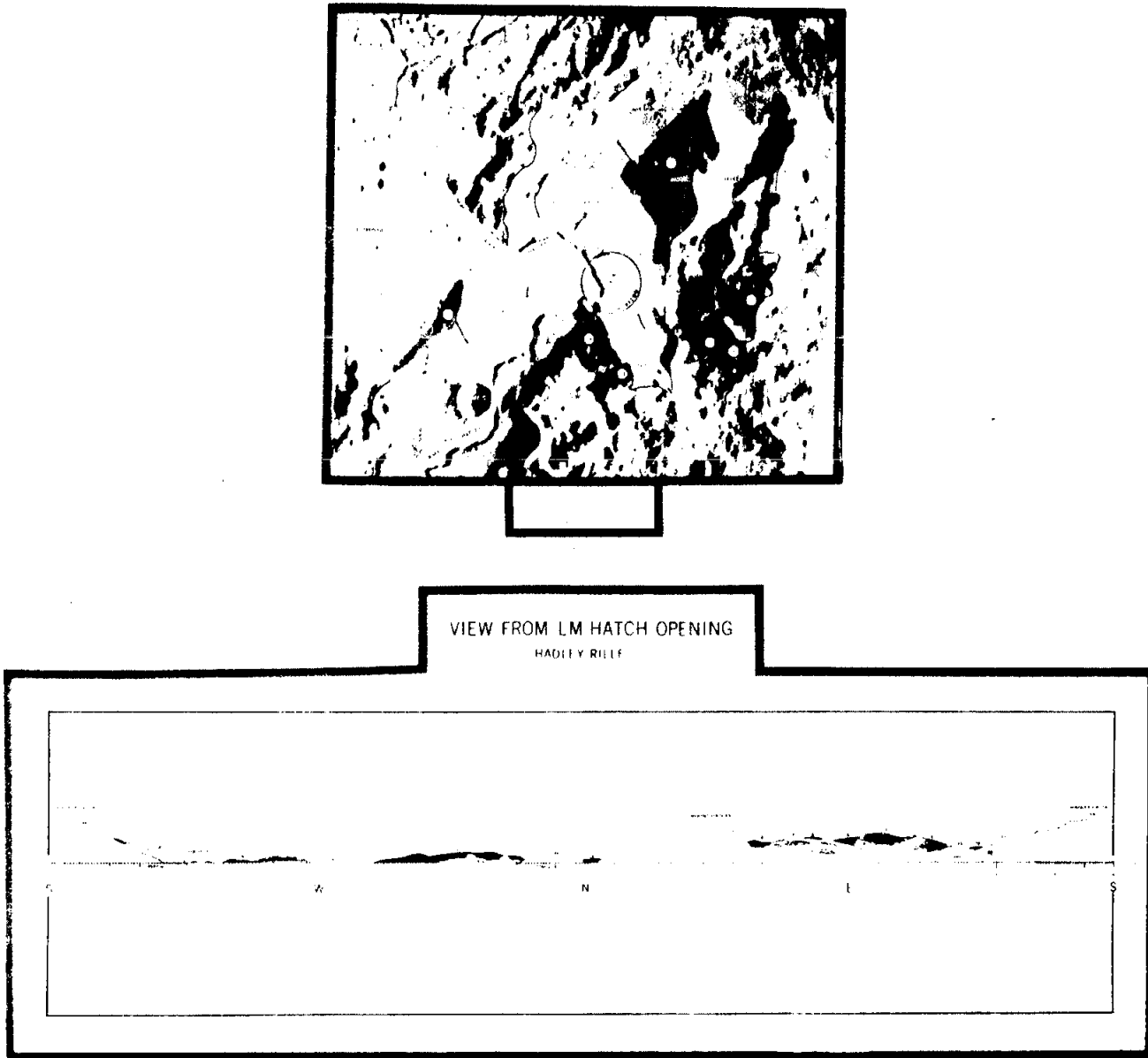
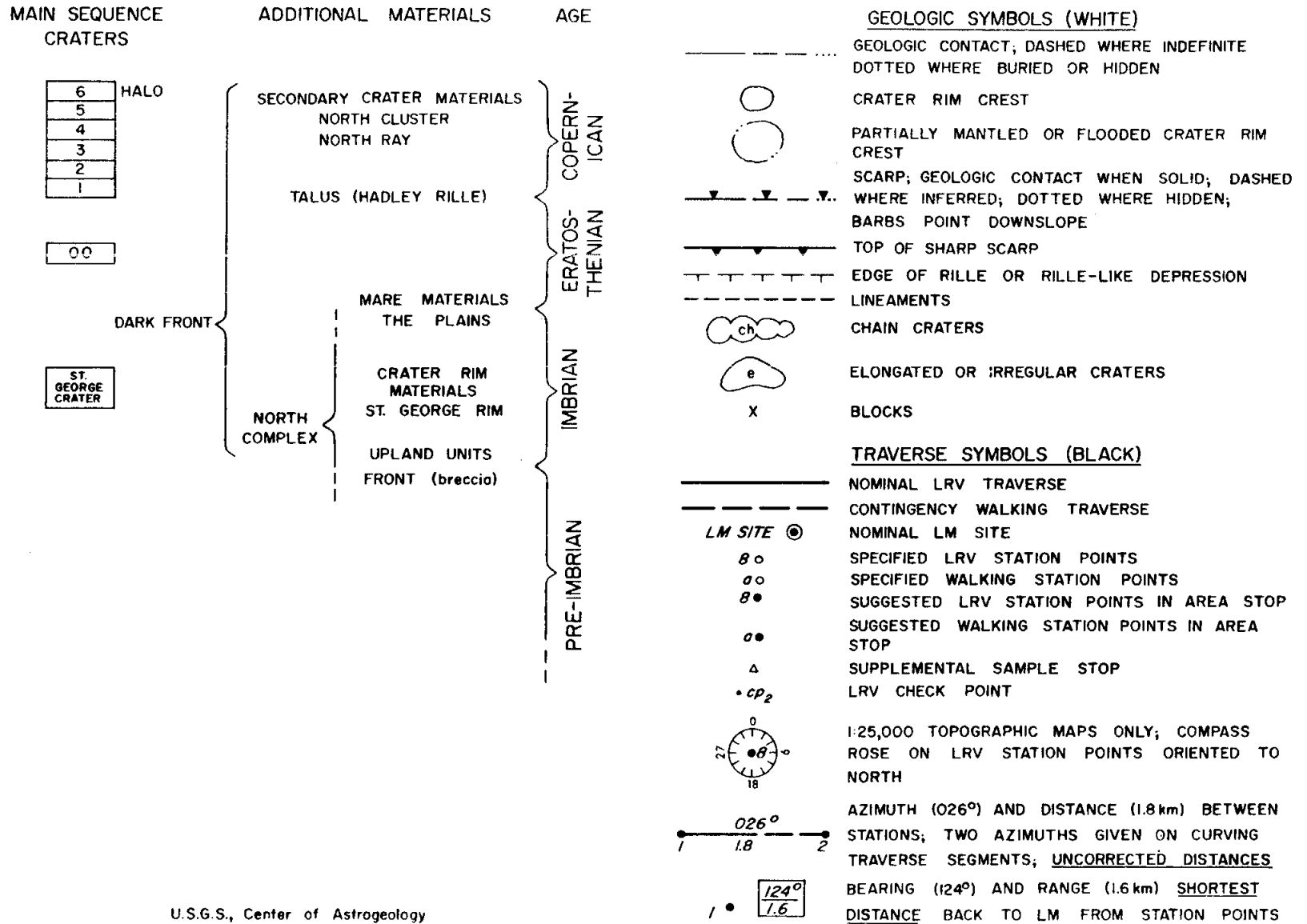


Figure 3.6-4

HADLEY-APENNINE LANDING SITE
 APOLLO 15-1:12,500 AND 1:25,000
 GEOLOGIC MAP EXPLANATION

229



U.S.G.S., Center of Astrogeology

Figure 3.6-5 1:25,000 & 1:12,500 Geologic Map Explanation

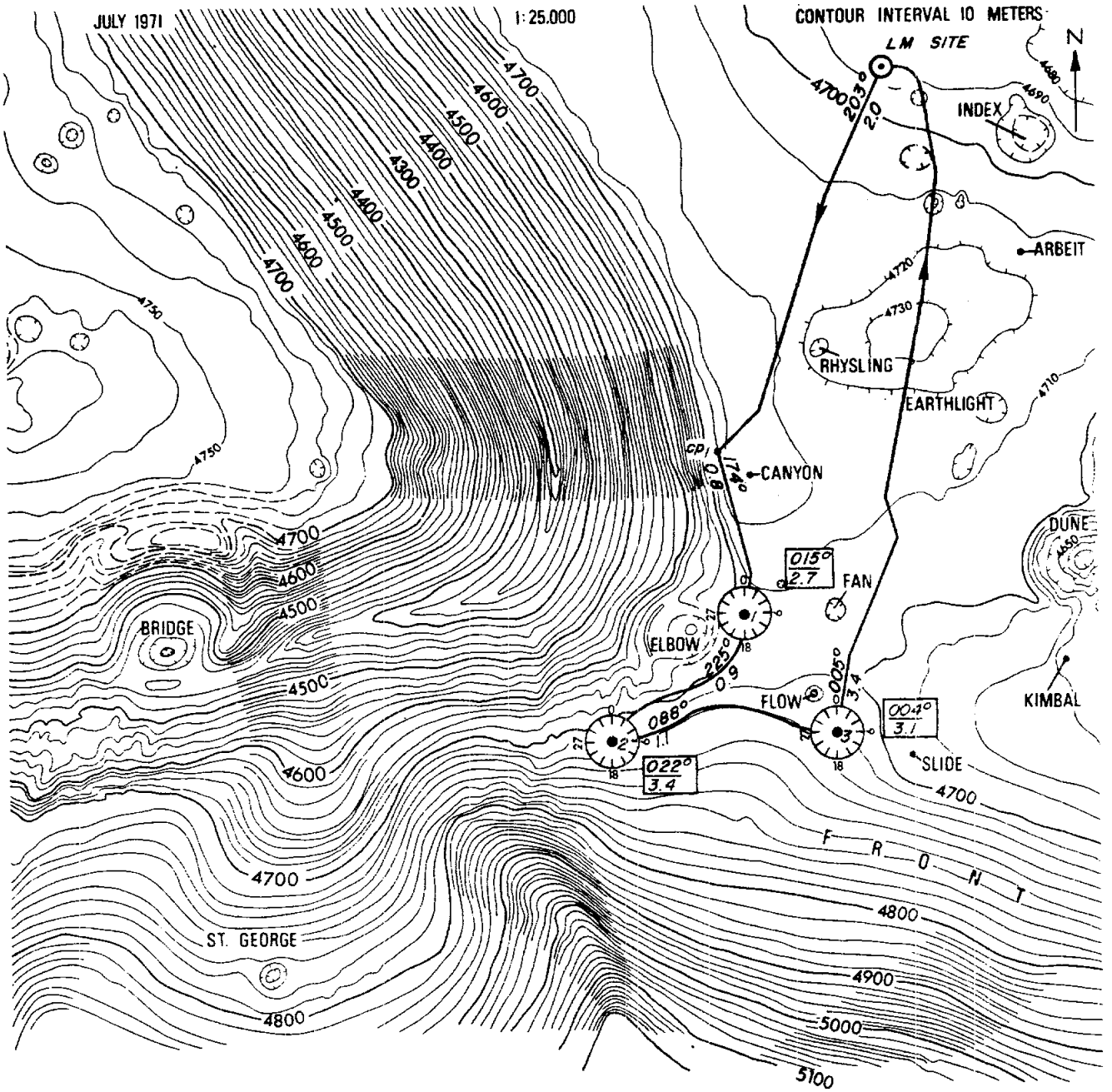


Figure 3.6-6a EVA-1 1:25,000 Contour Map

HADLEY RILLE
EVA-1



Table 3.6-1
EVA I - LRV EXPLORATION TRAVERSE

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

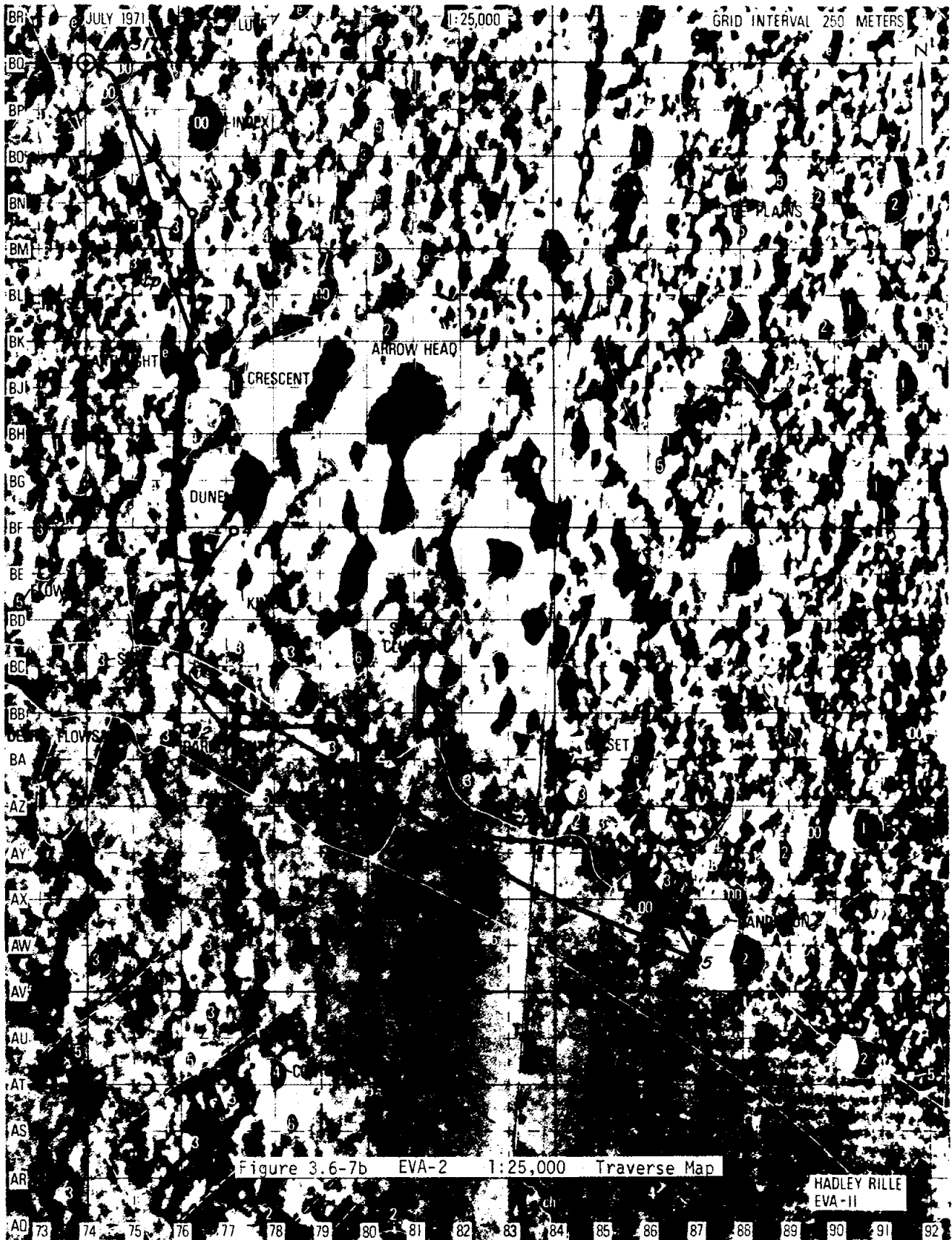


Table 3.6-2
EVA II - LRV EXPLORATION TRAVERSE

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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 SECOND- ARY 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)

240

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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 USE TRAVEL ACTIVITY ABOVE
TRAVEL	4:13	0:08	ALONG BASE OF APENNINE FRONT TO STATION 7	
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

JULY 1971

1:25,000

CONTOUR INTERVAL 10 METERS

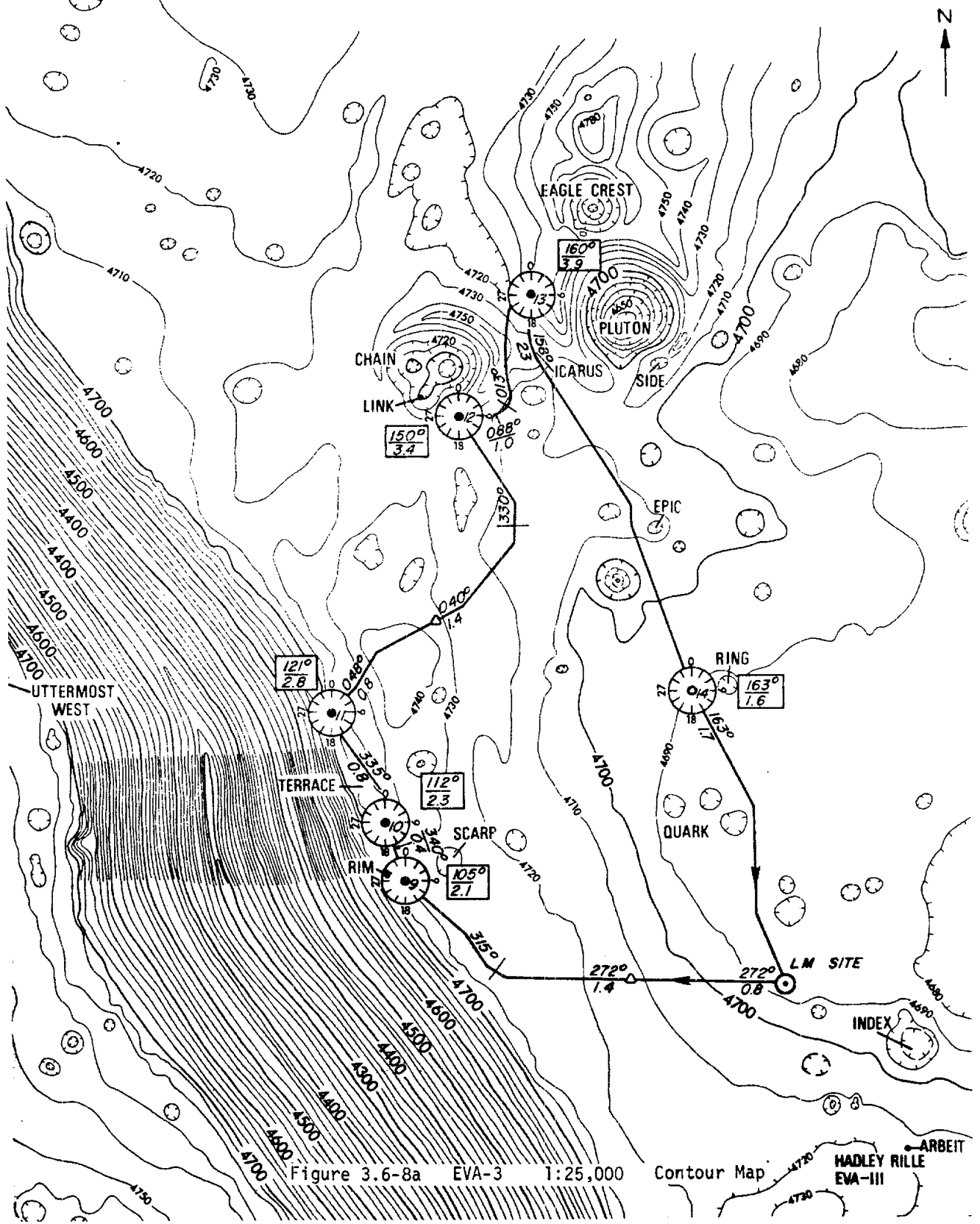


Figure 3.6-8a EVA-3 1:25,000

Contour Map HADLEY RILLE EVA-III



Figure 3.6-8b EVA-3 1:25,000 Traverse Map HADLEY RILLE EVA-III

Table 3.6-3
EVA III - LRV EXPLORATION TRAVERSE

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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 MARF TOWARD NORTH COMPLEX	OBSERVE CHANGES IN MATERIAL BETWEEN RILLE RIM, MARE, AND NORTH COMPLEX

EVA III - LRV EXPLORATION TRAVERSE (CONT)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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 RELA- TION 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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
AREA STOP 13	3:29	0:53	MULTIPLE OBJECTIVE STOP AT END OF NORTH COMPLEX SCARP BETWEEN CHAIN AND PLUTON CRATERS	<p>THE FOLLOWING LIST OUTLINES SOME OF THE MORE IMPORTANT AREAS OF INTEREST IN THE NORTH COMPLEX AREA:</p> <p>ICARUS CRATER ON WESTERN RIM OF PLUTON CRATER PLUTON CRATER EAGLECREST CRATER SCARPS</p> <p>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:</p> <p>DOCUMENTED SAMPLING PAN OR STEREO PAN POSSIBLE CORE TUBE EXPLORATORY TRENCH SOIL SAMPLE 500-mm LENS CAMERA TARGETS OF OPPORTUNITY PENETROMETER</p>
TRAVEL	4:22	0:19	FROM NORTH COMPLEX INTO MARE REGION WITH POSSIBLE SECONDARIES FROM RAY	<p>OBSERVE AND DESCRIBE DIFFERENCES IN MATERIAL AND SURFACE TEXTURES BETWEEN NORTH COMPLEX AND MARE NOTE AMOUNT OF SECONDARY CRATERING PHOTOGRAPHY AS APPROPRIATE</p>

EVA III - LRV EXPLORATION TRAVERSE (CONT)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

253

Station No.	Station Stop Time (Min)	Traverse Dist.		Ride Time (Min)	Accum Dist. (KM)	Station Reached Data			Station Stop Complete Data			Return Distance Corr. (Km)	Conting. Ride-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-LRV (Km/HR)		Btu Margin (Hr:Min)	O ₂ Margin (Hr:Min)	Amp Hour Margin (Hr:Min)	
		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	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																		
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										
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										
EVA	15:24	33.0	36.31	4:35					19:59										
TOTALS																			

*4.0 KM/HR RATE

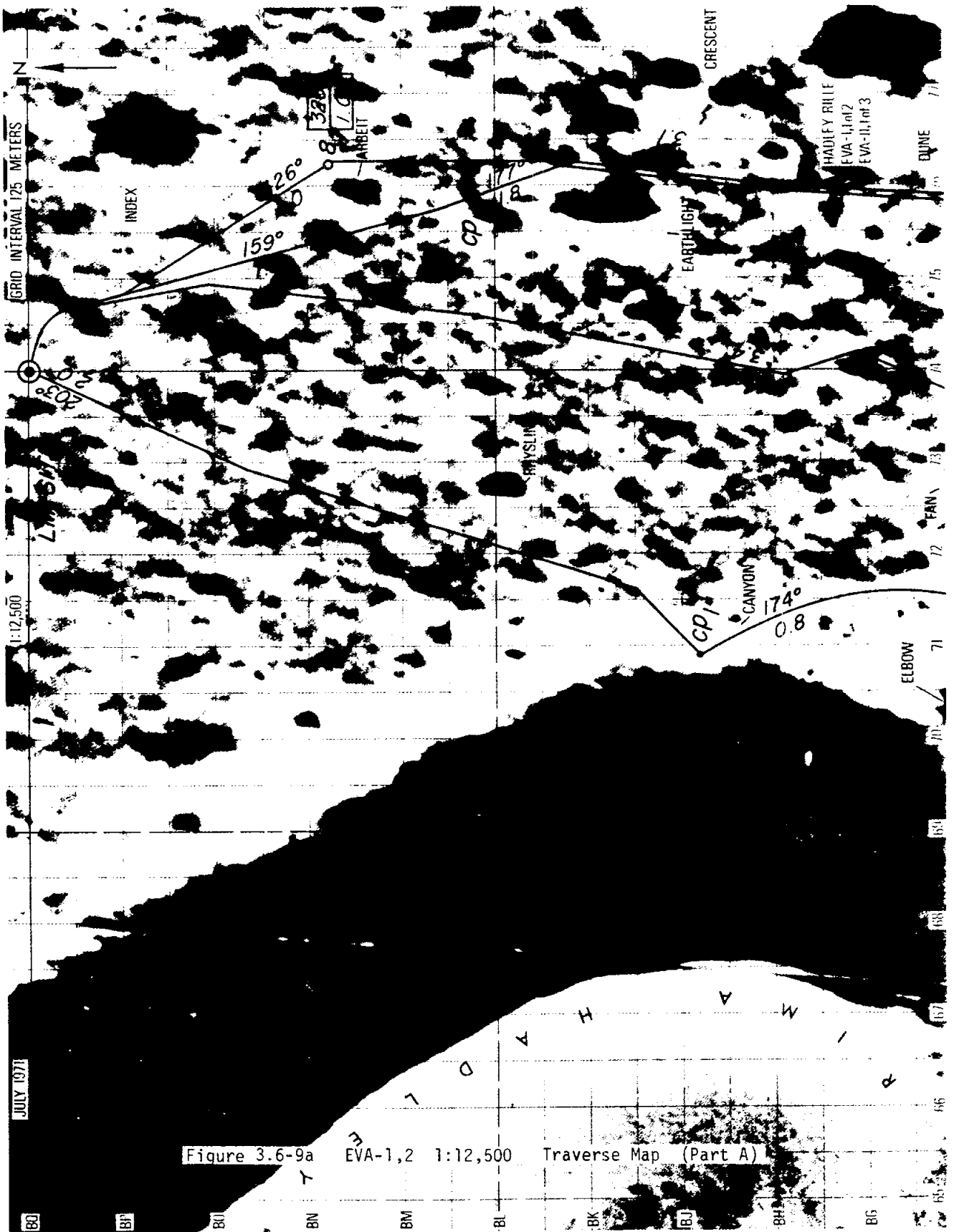


Figure 3.6-9a EVA-1,2 1:12,500 Traverse Map (Part A)

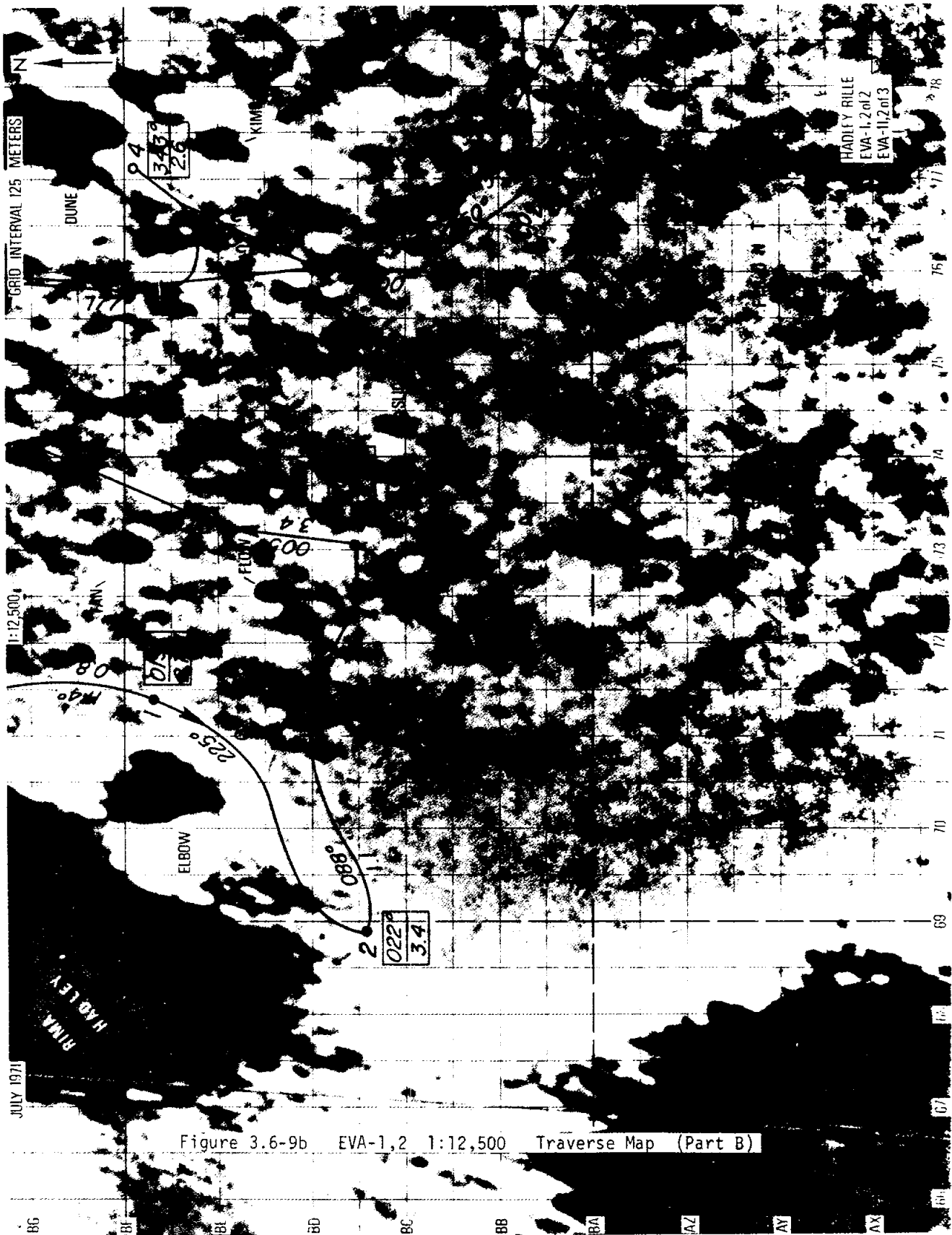


Figure 3.6-9b EVA-1,2 1:12,500 Traverse Map (Part B)



Figure 3.6-9c
 EVA-1,2 1:12,500 Traverse Map (Part C)

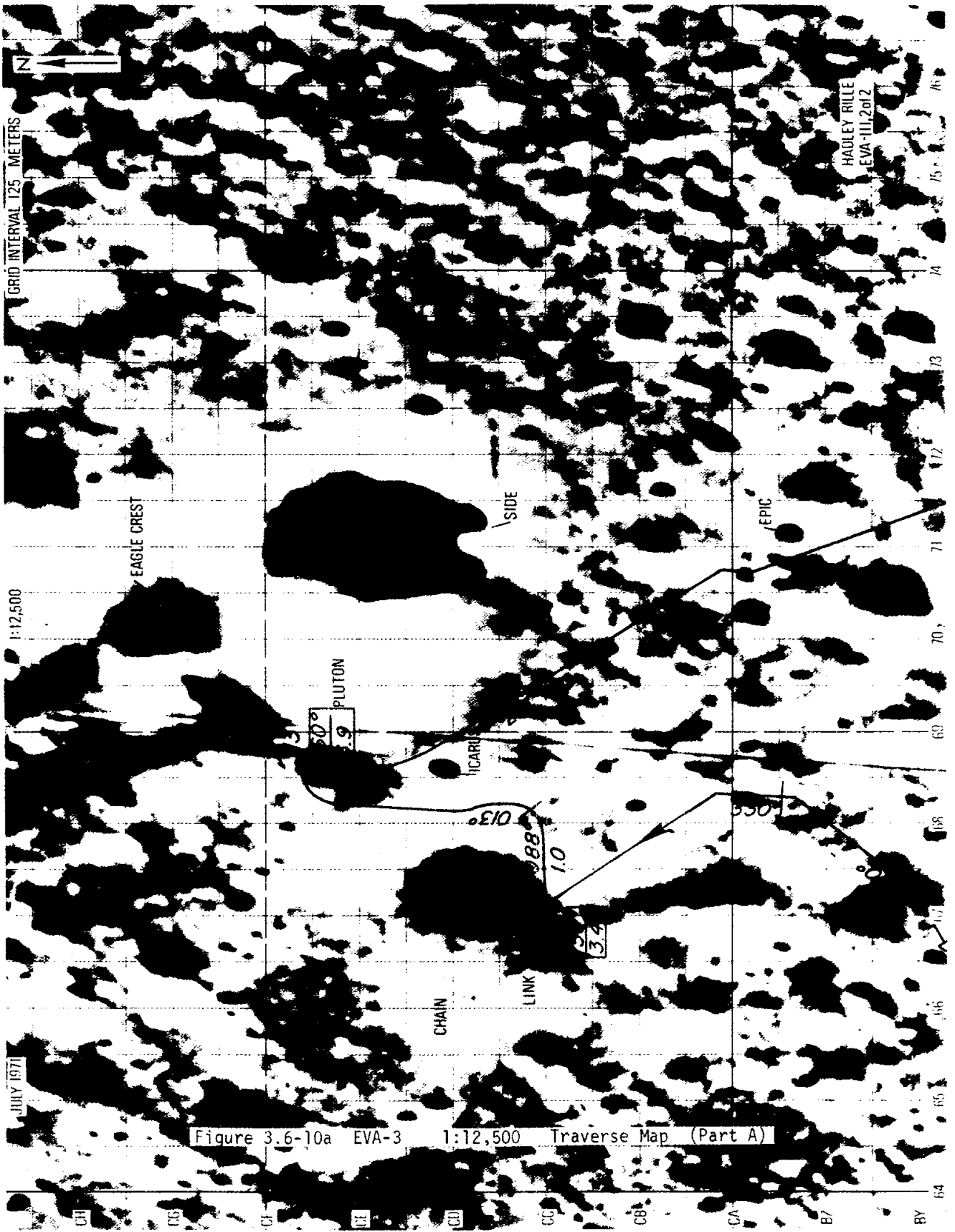
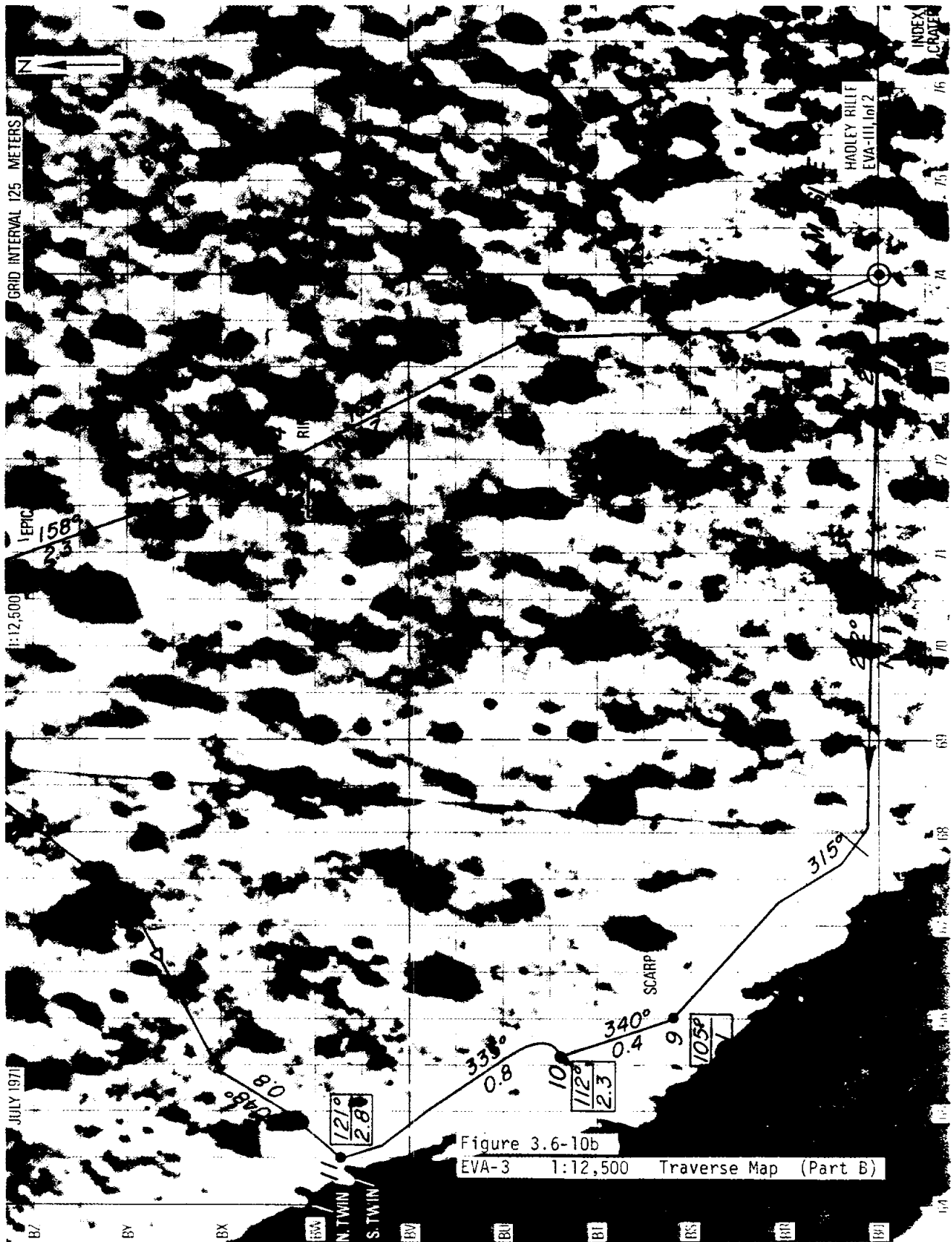


Figure 3.6-10a EVA-3 1:12,500 Traverse Map (Part A)



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

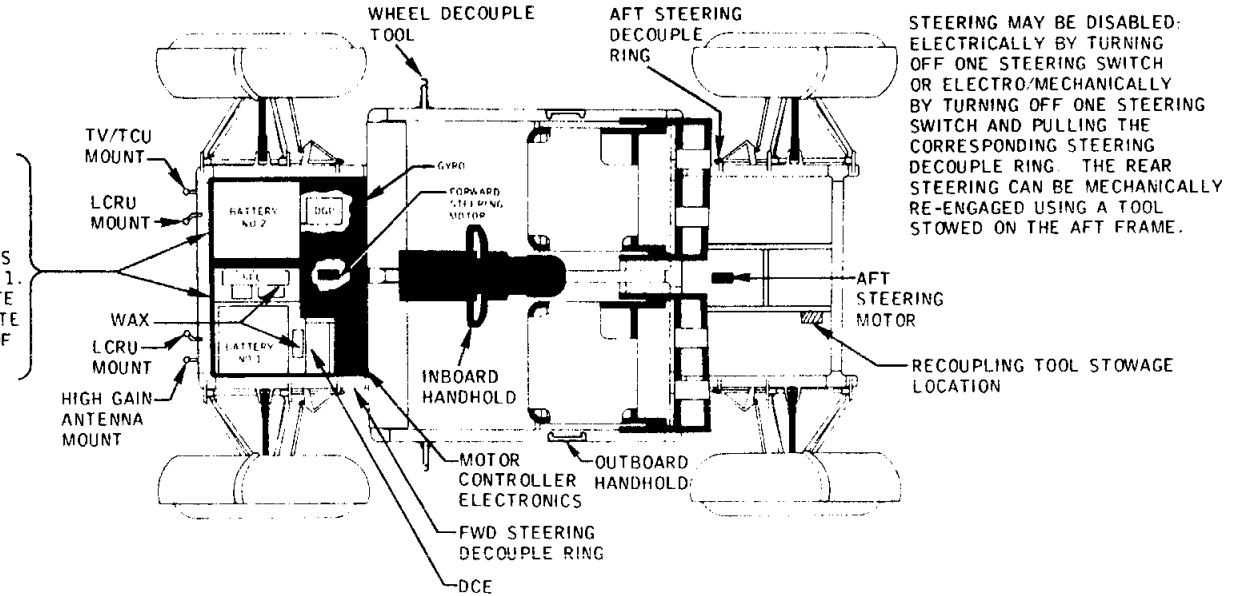
The LRV (see figure 3.7-1) is a four wheel, electrically powered, crew controlled, vehicle designed to accommodate two crewmen and stowed ancillary equipment (see figure 3.1-6 LRV stowage) for lunar surface traverses. Control of the LRV during the traverse is effected by either of the two crewmen operating 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.

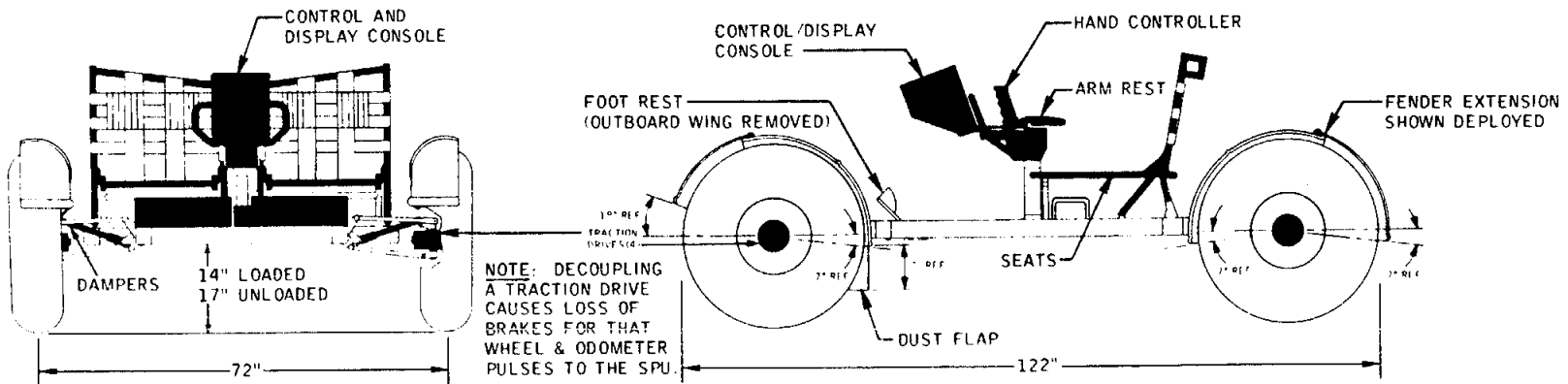
3.7.2 Operations

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.

BATTERY DUST COVERS NOT SHOWN - BATTERY NO. 2 COVER MUST BE OPENED BY PULLING UP ON INBOARD SIDE TO LATCH OPEN AND COVERS ONLY BATTERY NO. 2. BATTERY NO. 1 COVER IS LARGER AND COVERS THE SPU AND DCE AS WELL AS BATTERY NO. 1. BOTH COVERS ARE OPENED AT THE ALSEP SITE ON EVA I TO OBTAIN BATTERY COOL DOWN RATE AND AT LRV FINAL SHUT-DOWN AT THE END OF EVA'S I, II, AND III.



STEERING MAY BE DISABLED: ELECTRICALLY BY TURNING OFF ONE STEERING SWITCH OR ELECTRO/MECHANICALLY BY TURNING OFF ONE STEERING SWITCH AND PULLING THE CORRESPONDING STEERING DECOUPLE RING. THE REAR STEERING CAN BE MECHANICALLY RE-ENGAGED USING A TOOL STOWED ON THE AFT FRAME.



NOTE: DECOUPLING A TRACTION DRIVE CAUSES LOSS OF BRAKES FOR THAT WHEEL & ODOMETER PULSES TO THE SPU.

CAUTION: USE ONLY THE WHEEL DECOUPLE TOOL TO DECOUPLE OR TO RECOUPLE THE DRIVE UNIT.

FIGURE 3.7-1 LRV SYSTEMS

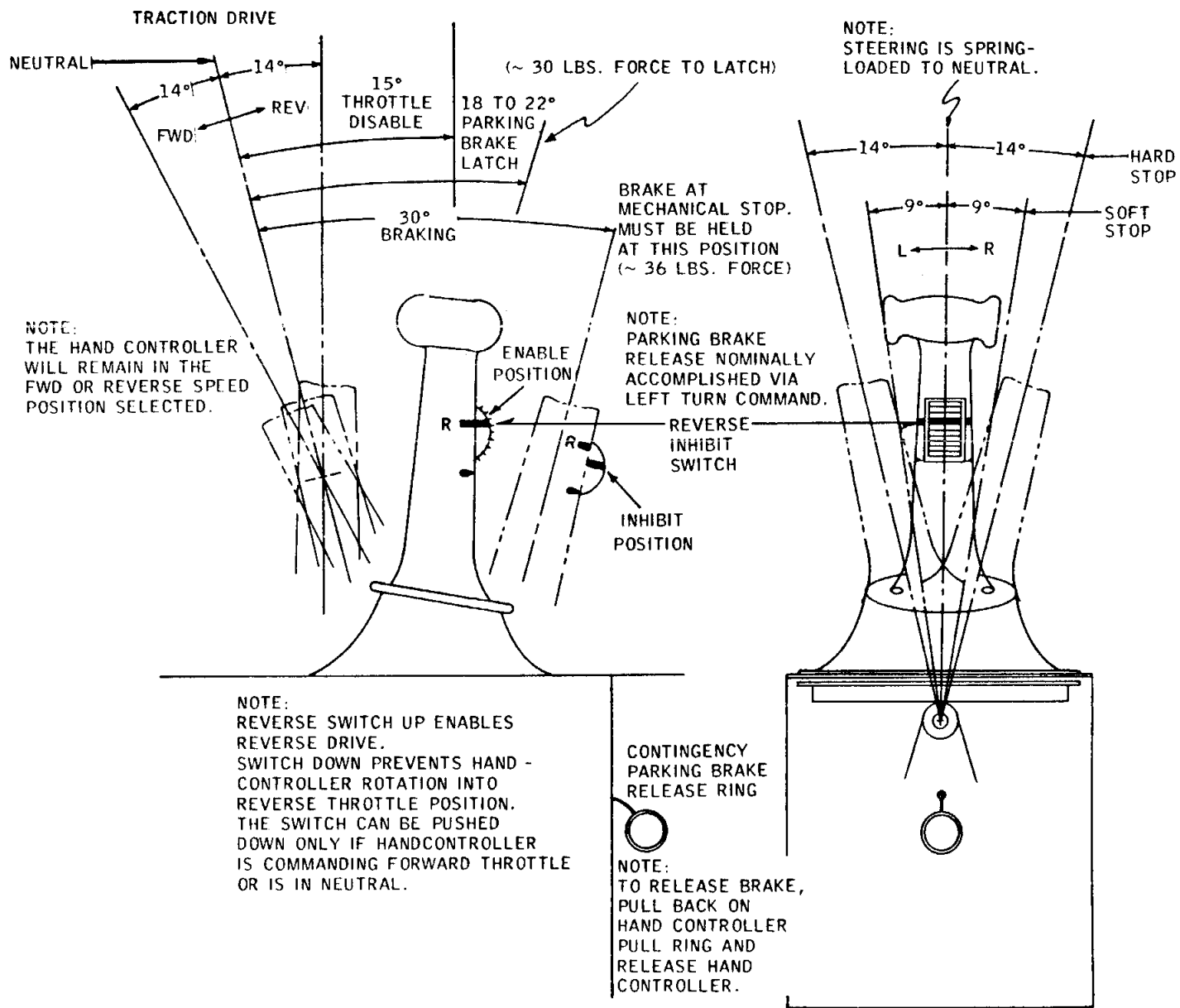


FIGURE 3.7-2 LRV HANDCONTROLLER FUNCTIONS

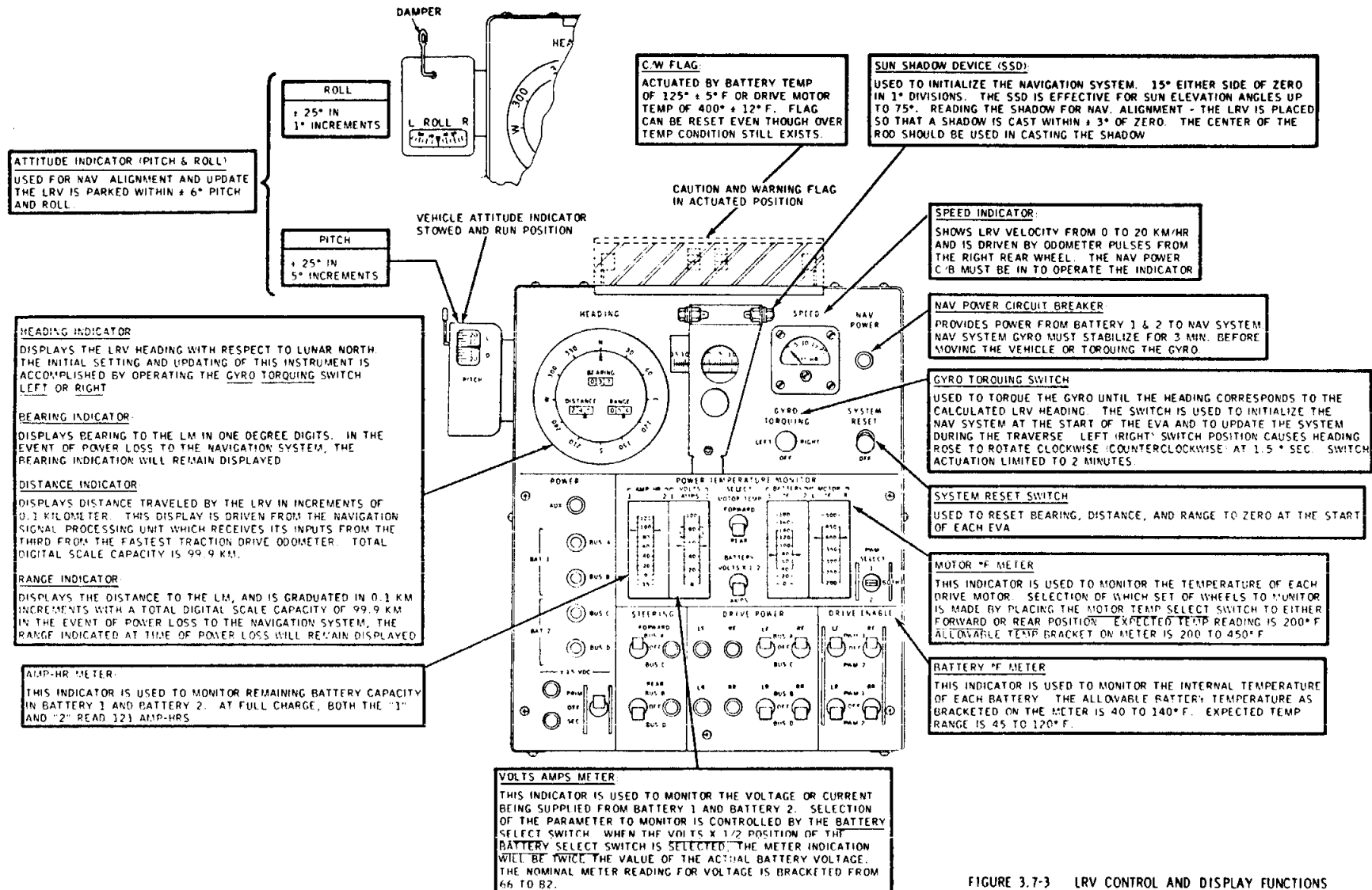


FIGURE 3.7-3 LRV CONTROL AND DISPLAY FUNCTIONS

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 B) Nav update	Table 3.7-5.A 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 B) Nav Update	Table 3.7-5.A 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 B) Nav Update	Table 3.7-5.A 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 in place, 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 ($^{\circ}$ 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. + 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. ± 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 $\pm 6^\circ$ of zero for pitch and roll.
2. Deploy Sun Shadow Device (SSD)
3. Park heading down sun within $\pm 3^\circ$ 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) + 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. ± 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 $\pm 6^\circ$ of zero for pitch and roll.
2. Deploy SSD and head down sun within $\pm 3^\circ$ 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. ± 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. + 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. ± 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. ± 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.



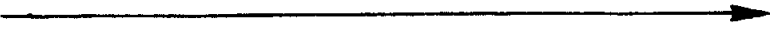
Detailed performance and constraint characteristics may be found in the LRV Operations Handbook, Appendix A.

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 characteristic. 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.

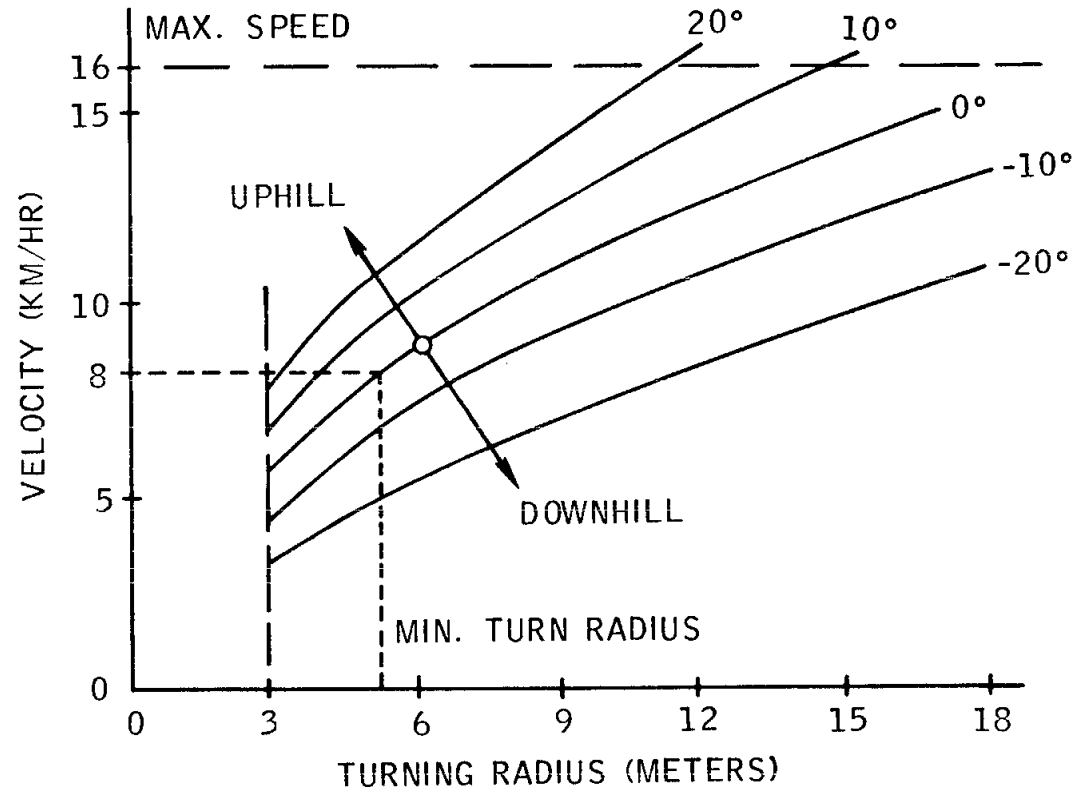
FIGURE 3.7.3-1 APOLLO 15 LRV VELOCITY CONSTRAINTS (KM/HR)

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 			

281

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

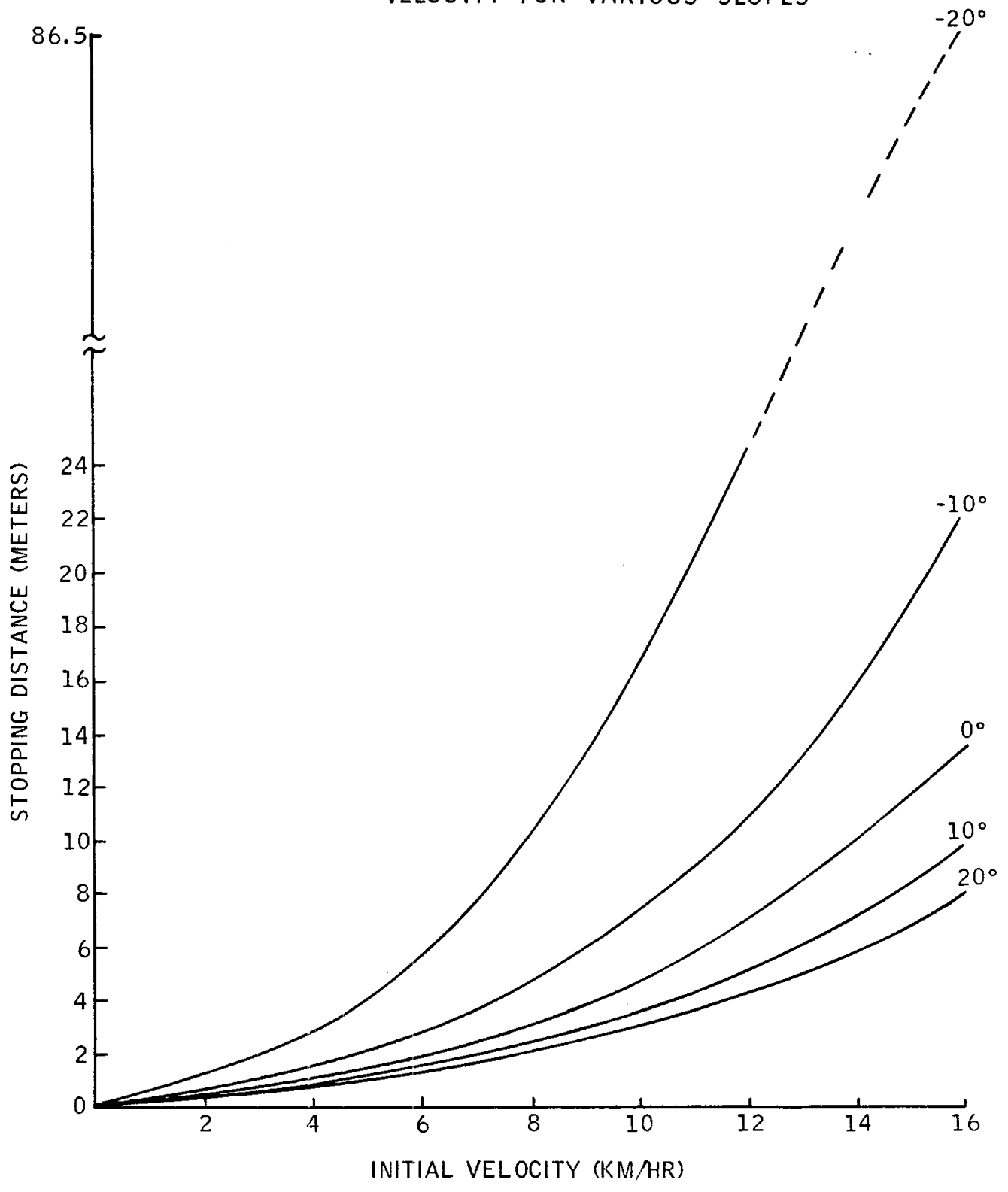


FIGURE 3.7.3-4 LRV STOPPING DISTANCE VS. HANDCONTROLLER PULL FORCE FOR 8 KM/HR

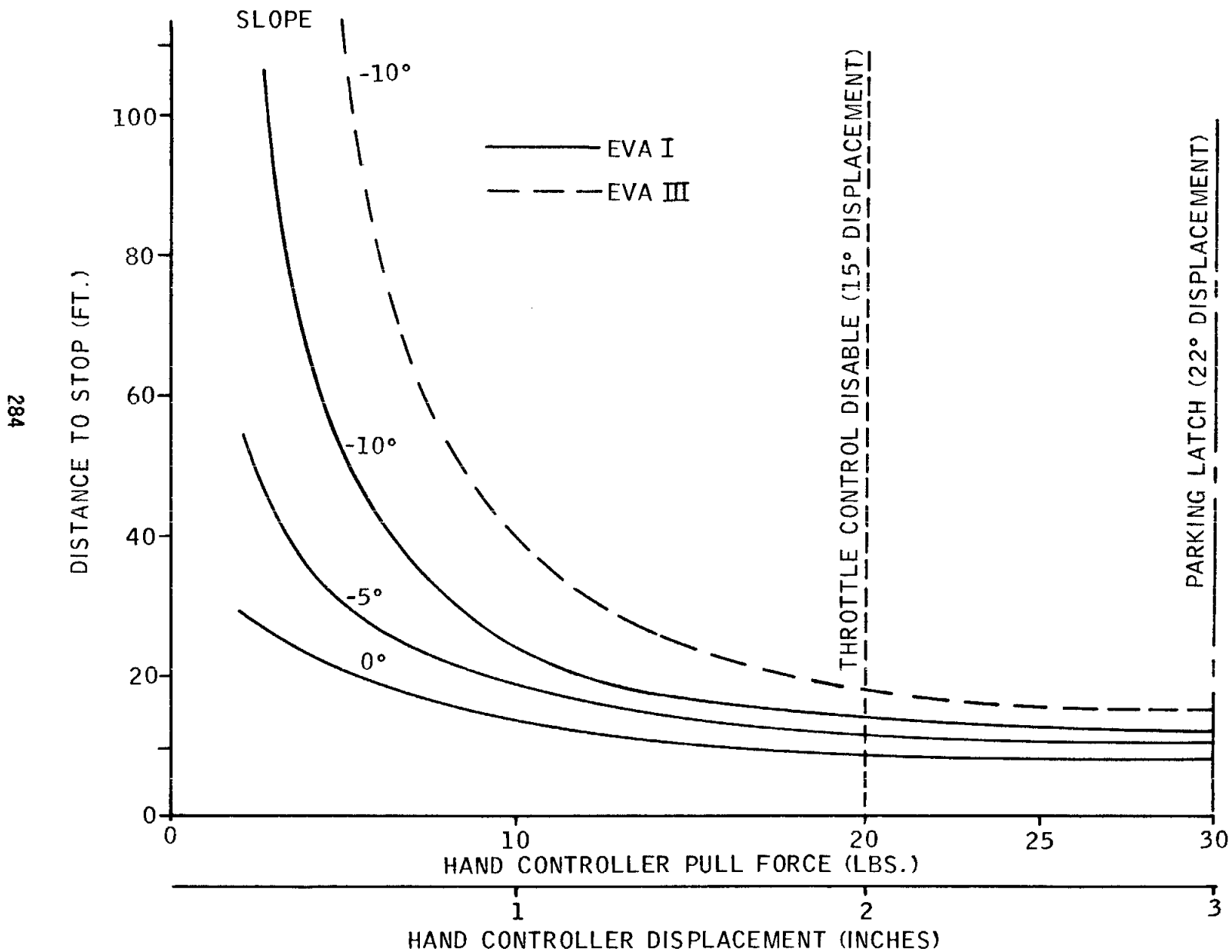


Table 3.7.3-1 LRV Operating Limits, Constraints & Requirements

1. The LRV velocity should not exceed 5 km/hour while traversing to the ALSEP site with the LR³ 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 $\pm 6^\circ$ of zero, (roll being the most critical) and the Sun Shadow Devices (SSD) within $\pm 3^\circ$.
5. The attitude indicator and the SSD should be read to MCC within the tolerances noted below to minimize heading errors:
Pitch within $2\ 1/2^\circ$, 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 5 km/hr the driving corridor should be 17 feet. Possible corridor guard against steering failures.

11. Caution: 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.
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 on-board Flight Data File and is stowed in the LRV mapholder.

POWER UP	STOP	START
HAND CONTROLLER BRAKE - ON, REV - DOWN CB: ALL CLOSED (EX. AUX + NAV) HOU: AMP HR, AMPS, VOLTS, TEMPS PWM SELECT - BOTH DRIVE ENBL:	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	*GNOMON*GNOMON* LCRU - PM1/WB +15 VDC - PRIM STEER: FWD - BUS A AFT - BUS D DRIVE PWR: FWD - BUS A AFT - BUS D
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	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	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. +15 VDC Sw - alt. pos. | +15 VDC Circuitry |
| 2. Set Parking Brake
DRIVE ENABLE Sw (4) - PWM 2
PWM SELECT Sw - PWM 2
+15 VDC CB (2) - close | PWM 1 Shorted |
| 3. Set Parking Brake
DRIVE ENABLE Sw (4) - PWM 1
PWM SELECT Sw - PWM 1
+15 VDC CB (2) - close | PWM 2 Shorted |
| 4. DRIVE POWER Sw (4) - OFF (individually)
+15 VDC CB (2) - close | DCE Shorted |
| 5. STEERING POWER Sw (2) - OFF (individually)
+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 timetable 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 obser-

vation 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.

CONTINGENT PLANS

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.

MISSION: APOLLO 15, J-1
 EVA: 1, Two Man Walking Traverse

DATE: 5/18/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E Q C A M	TASK FUNCTION	
				L M P	C D R
	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		[LRV will not function]			
Troubleshoot LRV (30 min Max)		Troubleshoot LRV (30 min Max)			
	0+50				

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		Offload geology pallet from LM and place on +Y footpad		
Unstow & place ECS LiOH in pallet pocket		Remove & discard pallet handrails		
Stow ETB on MESA table		Pull HTC stowage pip pin		
Attach LEC to EVA-1 pallet		Remove straps around HTC legs		
Climb LM ladder to porch		Open HTC and swing out		
	1+20	Pull hinge pin lanyard to release HTC		
Retrieve cont sample & ingress LM		Deploy HTC legs and place HTC on surface near +Y footpad		
Stow cont sample inside LM		Pull HTC stowage pip pins (4)		
Attach LEC to overhead handrail		Remove stowage bracket		
Transfer pallet into LM		Stow tongs on HTC		
Disconnect LEC from pallet		Transfer pallet into LM		
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, 00 from ETB & stow in SCB #3		
Place pallet on LM floor		Unstow CDR's 70mm cam from MESA & attach mag NN from ETB & leave cam in ETB		
Move through LM hatch		Unstow and open SCB #1		
Retrieve & discard pallet		Remove & stow in SRC:		
Close LM hatch		6 core stems, 2 core stem cap disp, 2-20 DSBD, 1 core tube cap disp		
Descend to surface	1+30			

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION	
				LMP	CDR
	5+50				
Arrive at LM	6+00	Arrive at LM			
Remove SCB #1 & #2 from CDR PLSS & stow on HTC		Orient TV to view LM area			
Remove BSLSS from CDR PLSS & stow in sun		Remove SCB #3 & #4 from LMP PLSS & place on LRV seat			
Stow samples from SCB #2 in SCB #1		Remove LCRU from LMP PLSS & stow in sun			
Remove 6 core stems & 2 core stem cap disp from SRC #1 & stow in SCB #2 (on HTC)		Remove hammer, core tube tool & core tube cap disp from LMP PLSS & stow on HTC			
Unstow SWC from MESA		Retrieve from MESA & install filter on 70mm cam			
Carry SWC 60 ft SE of LM		Retrieve gnomon			
Remove SWC from stowage can		Select site for polarimetric photography			
Extend SWC staff					
Deploy SWC foil	6+10	Obtain far-field polarimetric photographs			

MISSION: APOLLO 15, J-1
 EVA: 1, Two Man Walking Traverse

DATE: 5/18/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SECTION	TASK FUNCTION	
				LMP	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			

MISSION: APOLLO 15, J-1
 EVA: 1, Two Man Walking Traverse

DATE: 5/18/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION		
			SUBS	LMP	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		Stow LMP's PLSS antenna			
Ingress LM carrying SCB #3					
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		Transfer LEC hooks to surface			
Stow ETB in LM		Stow LEC on ladder hook			
		LCRU Pwr Sw - OFF			
		Adjust LCRU thermal blankets			
		Clean EMU			
	6+50				

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
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
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		
Transfer pallet into LM		Attach LEC to pallet		
		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		Attach ETB to SRC table		
Remove & stow pallet equipment		Stow LEC on ladder hook		
Place pallet on LM floor		Unstow drill from MESA & place on surface		
Recorder - OFF				
Verify VOX Sens (2) - Max				
Verify CB configuration				
Utility & Floodlights - OFF				
Move thru hatch				
		Get 70mm cam from ETB & photo LMP egress		
Discard pallet into Quad I				
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
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION		
			S	LMP	CDR
	0+50				
Place pkgs on surface with expts pkg in final position		Survey ALSEP site			
Disconnect pwr pkg from bar		Place ALSD & HTC on surface			
Reposition pwr pkg 10' East		Orient ALSD to face sun			
Remove HFE stowage pip pins (2)					
Tip pwr pkg down					
Release RTG cable B. bolts (3)		Release HFE pallet B. bolts (2)			
Deploy RTG cable & discard cable reel		Lift HFE pallet from pwr pkg			
		Carry HFE pallet 15'N C/S			
Report shorting switch amps					
Connect RTG cable to C/S		Unstow HFE connector			
Release subpallet B. bolts (2)		Place HFE pallet on surface			
Lift subpallet from PWR PKG & place 10' N. of PWR PKG		Connect HFE cable to C/S			
Release SIDE B. Bolts (4) & CCIG cover bolt					
Lift SIDE from subpallet		Carry HFE pallet 30' N of C/S, deploying cable			
Remove B. Bolt blocking cable reel	1+00	Place HFE pallet on surface & fold mounting braces			
Unstow cable reel		Tip pallet down			
Deploy SIDE legs & place SIDE on surface		Release probe box B. Bolts (4)			
Unstow SIDE cable connector		Lift probe box from pallet			
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					
Tip C/S down & align		Carry other probe to drill site, deploying cable			
Stow carry bar on subpallet		Place probe on surface			
Unstow PSE stool from subpallet		Carry 1st probe to drill site, deploying cable			
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			
Carry PSE to stool		Remove dust cover			
Remove B. Bolts from PSE		Kick pallet clear of area			
		Place box on surface, level and align			
Place PSE on stool	1+10	Deploy ALSD brackets on HTC			

MISSION: Apollo 15, J-1
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION		
			S E Q U E N C E	L M P	C D R
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)		Assemble first two bore stem sections (one with bit)			
Remove tie down & discard		Insert sections into drill chuck			
Lift LSM from C/S		Set drill bit down on surface at mark on HFE cable			
Check cable free of sun shield	1+20	Remove battery thermal shroud Drill bore stem into surface			
Carry LSM 50' WNW, deploying cable		Remove drill from bore stem			
Select LSM site		Reset drill chuck Place drill on surface			
Remove stowage bracket Deploy legs		Assemble 3rd & 4th sections of bore stem			
Align LSM & place on surface with cable outside legs		Lift & attach drill to bore stem Drill bore stem into surface			
Remove from collar		Remove drill from bore stem			
Deploy center sensor arm then other two sensor arms		Reset drill chuck Place drill on surface			
Remove dust covers & PRA cover		Assemble 5th & 6th sections on bore stem			
Align and level LSM		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	S E C O N D A M	TASK FUNCTION	
				L M P	C D R
Check doors open & LSM free of discarded parts	1+30				
Report level & alignment		Remove drill from bore stem			
Return to C/S		Reset drill chuck			
Starting front center & proceeding CW, release/deploy in turn B.		Place drill on surface			
Bolts, side cable, antenna cable and back sunscreen		Retrieve probe from probe box			
Release two inter B. Bolts		Insert probe into bore stem			
Release center B. Bolt and raise sunshield		Retrieve probe rod from box			
Remove sunscreen covers and discard (3)		Push probe to bottom of stem			
Check sunscreens properly deployed & engage velcro tabs		Report probe depth			
		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			
Remove gimbal from subpallet		Set drill bit down on surface at mark on HFE cable			
Remove gimbal housing cover		Drill bore stem into surface			
Install gimbal on mast		Remove drill from bore stem			
Remove housing & discard		Reset drill chuck			
Install antenna on gimbal	1+40	Place drill on surface			
Check C/S alignment		Assemble 3rd & 4th sections on bore stem			
Level & Align antenna base		Lift & attach drill to bore stem			
		Drill bore stem into surface			
		Remove drill from bore stem			
Enter elev <u>4.71</u> and azimuth <u>35.81</u> offsets		Place drill on surface			
Recheck antenna level and alignment		Assemble 5th & 6th sections on core stem			
Retrieve SIDE near subpallet		Lift and attach drill to bore stem			
Carry SIDE 55 ft NE, deploying cable		Drill stem into surface			
		Remove drill from bore stem			
Select SIDE deploy site		Remove & discard drill chuck			
Remove SIDE dust cover		Place drill on surface			
Remove & implace ground screen		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
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		Implace drill treadle on surface		
Pull SIDE dust cover pin		Open SCB #2 and assemble 1st two core stems		
Report pin pulled		Thread sections into drill		
Recheck SIDE level & aligned		Lift drill and place core bit into treadle		
Return to C/S		Drill core stem into surface		
Depress shorting switch		Remove drill from core stem & place on surface		
Check shorting switch amps zero		Assemble 3rd & 4th core stem sections		
Turn Astro Sw #1 clockwise		Thread sections onto stem		
Request X-mitter turn on		Retrieve drill and attach drill to core stem		
Return to LM		Drill core stem into surface		
	2+00	Remove drill from core stem & place on surface		
		Assemble 5th & 6th core stem sections		
Remove thermal blanket from over LRRR in Quad III		Thread sections onto core stem		
Offload LRRR pallet from LM		Retrieve drill and attach drill to core stem		
Place pallet on surface & remove LRRR from pallet		Drill core stem into surface		
Get LMP 70mm cam from ETB & mount on EMU (carry CDR's 70mm cam to ALSEP site-leave on HTC)		Retrieve CDR 70mm camera from HTC		
Retrieve and carry LRRR >25FT west of central station		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		
	2+10	Remove drill from stem		

MISSION: Apollo 15, J-1
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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 stem from treadle, breaking		
Pull alignment device pip pin		each joint as it comes thru		
Pull reflector array pip pin		treadle		
Deploy reflector array		Place stem on HTC		
		Cap stem bit end		
Pull leveling leg pip pin		Disjoint, cap, and stow stem		
Deploy leveling leg		sections in SCB #2		
Tip LRRR down				
Level and align LRRR				
		Discard UHT		
Remove dust covers		Strip off outer protective gloves		
		and discard		
Recheck level and alignment		Collect documented samples from		
Photo LRRR & ALSEP		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
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
Return to LM	2+30	Return to LM		
Open MESA thermal blankets		Unstow & open SRC #2		
Unstow both LCRU batts from MESA Hand one batt to CDR - wrap other batt in Quad III therm blanket & stow in +Y footpad		Remove SCB #5, stow on HTC 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		
Place SCB #7 in +Y footpad Place one 20 bag dispenser on each 70mm camera	2+40	Attach to LMP PLSS tool harness: • SCB #2 & #6 • Core tube cap dispenser • Hammer • Core tube tool • LCRU		
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		
Tidy MESA blankets		Get traverse maps from ETB Orient TV to traverse direction		
Depart on geology traverse		Depart on geology traverse		
	2+50			

MISSION: Apollo 15, J-1
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	CDR
	6+30			
Remove SCB #6 from HTC & carry to MESA		Tidy harness velcro covers		
Remove 70mm mags from SCB #6 & stow in ETB		Remove BSLSS from LMP PLSS & stow in sun (in thermal blanket)		
Leave SCB #6 on MESA		Remove core stems from SRC #1 and stow in SCB #5		
Remove SCB #2 from HTC and place on MESA		Fill SCB #5 with doc samples from SCB #6 (as required) and place in SRC #1		
Unstow dust brush from geo pallet		Remove SRC seal protector		
Clean CDR's EMU		Close & seal SRC #2		
		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		Transfer LEC hooks to surface		
Stow SRC #2 in LM		Attach LEC to ETB		
Transfer ETB into LM		Transfer ETB into LM		
Remove ETB from LEC		Transfer LEC hooks to surface		
Stow ETB in LM		Stow LEC on ladder hook		
		Adjust LCRU thermal blankets		
	6+50	Clean EMU		

MISSION: Apollo 15, J-1
 EVA: 2 Two Man Walking Traverse

DATE: 5/24/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
			LMP	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		
NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE "LUNAR SURFACE CHECKLIST"				
End 2nd EVA	7+00	End 2nd EVA		

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
 EVA: 3 Two Man Walking Traverse

DATE: 5/25/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E C O N D A M	TASK FUNCTION	
				L M P	C D R
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		Transfer ETB to surface			
Assist CDR		Attach ETB to SRC table			
Disconnect and stow LEC		Stow LEC on ladder hook			
Recorder-OFF		Retrieve LCRU batt from +Y footpad			
Verify VOX Sens (2) - Max		Change LCRU batt			
Verify cb config					
Utility & floodlights - OFF					
Move thru hatch					
Close hatch					
Decend to surface					
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		Unstow & attach to LMP PLSS tool harness:			
Assist CDR		• 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
 EVA: 3 Two Man Walking Traverse

DATE: 5/25/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E Q C A M	TASK FUNCTION	
				L M P	C D R
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				

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SECOCAM	TASK FUNCTION	
				LMP	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
 EVA: 3 Two Man Walking Traverse

DATE: 5/25/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E C O N D A R Y	TASK FUNCTION	
				L M P	C D R
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
 EVA: 3 Two Man Walking Traverse

DATE: 5/25/71

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	S E Q U E N C E	TASK FUNCTION	
				L M P	C D R
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 PRE- SENTED IN THE LUNAR SURFACE CHECKLIST					
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
 EVA: ONE MAN - MINIMUM TIME

DATE: June 1, 1971

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION		
			S E O C A M	L M P	C D R
	0+10	Move thru hatch			
Prepare LEC					
Pass LEC to EVA Crewman		Deploy LEC			
Photo EVA Crewman descend with 70mm camera		Descend to top of ladder Deploy MESA			
LM 16mm Seq Cam - ON (12 FPS)		Descend to footpad			
NOTE: Monitor & photograph EVA crewman using 70mm camera and LM 16mm Seq Cam. Read procedures to EVA crewman		Check ascent capability to lower ladder rung			
		Step to surface			
		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
 EVA: ONE MAN - MINIMUM TIME

DATE: June 1, 1971

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION	
				LMP	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.

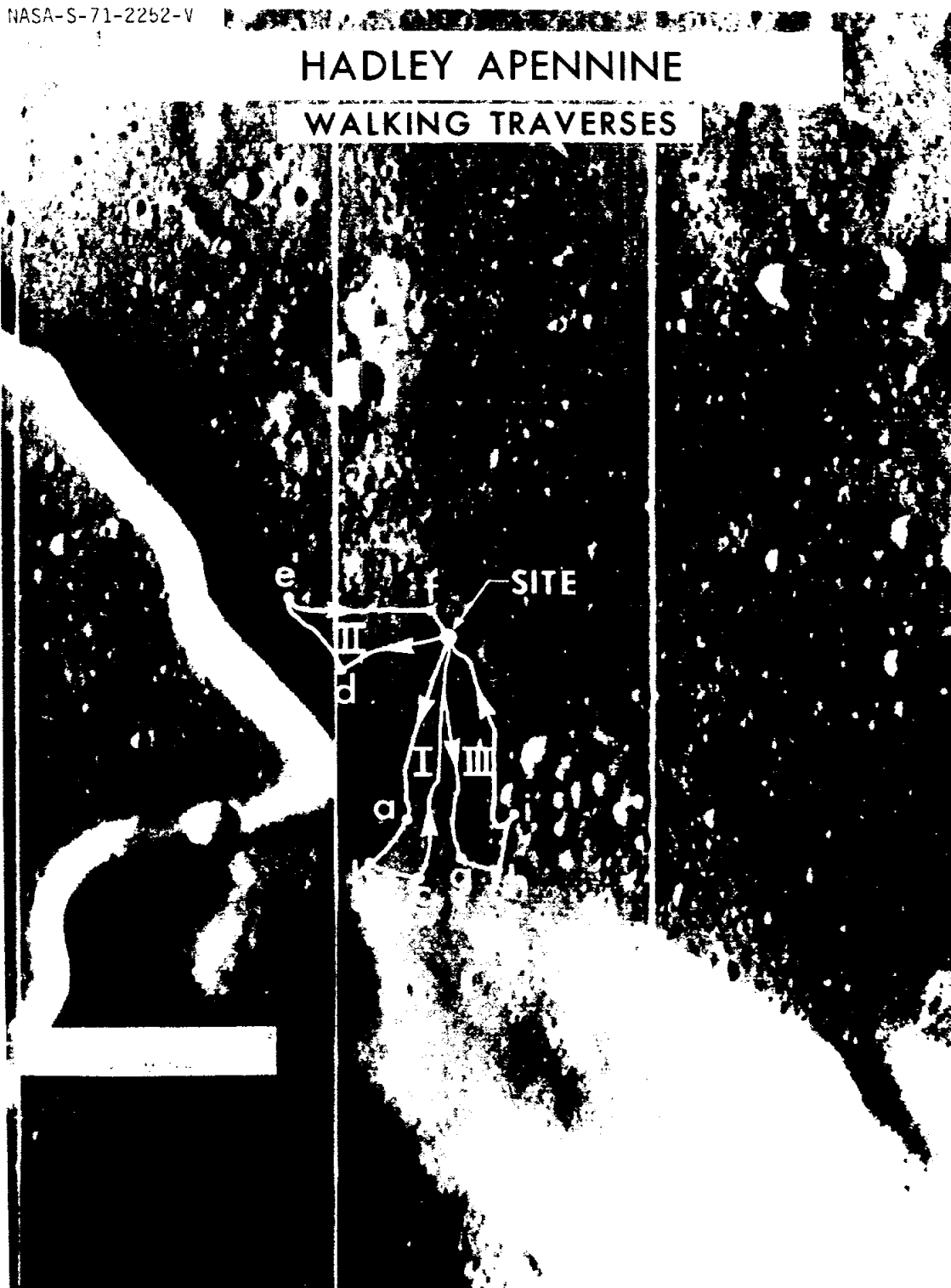


Figure 4.3-1 Walking Traverses EVA-1,2,3 (SUMMARY)

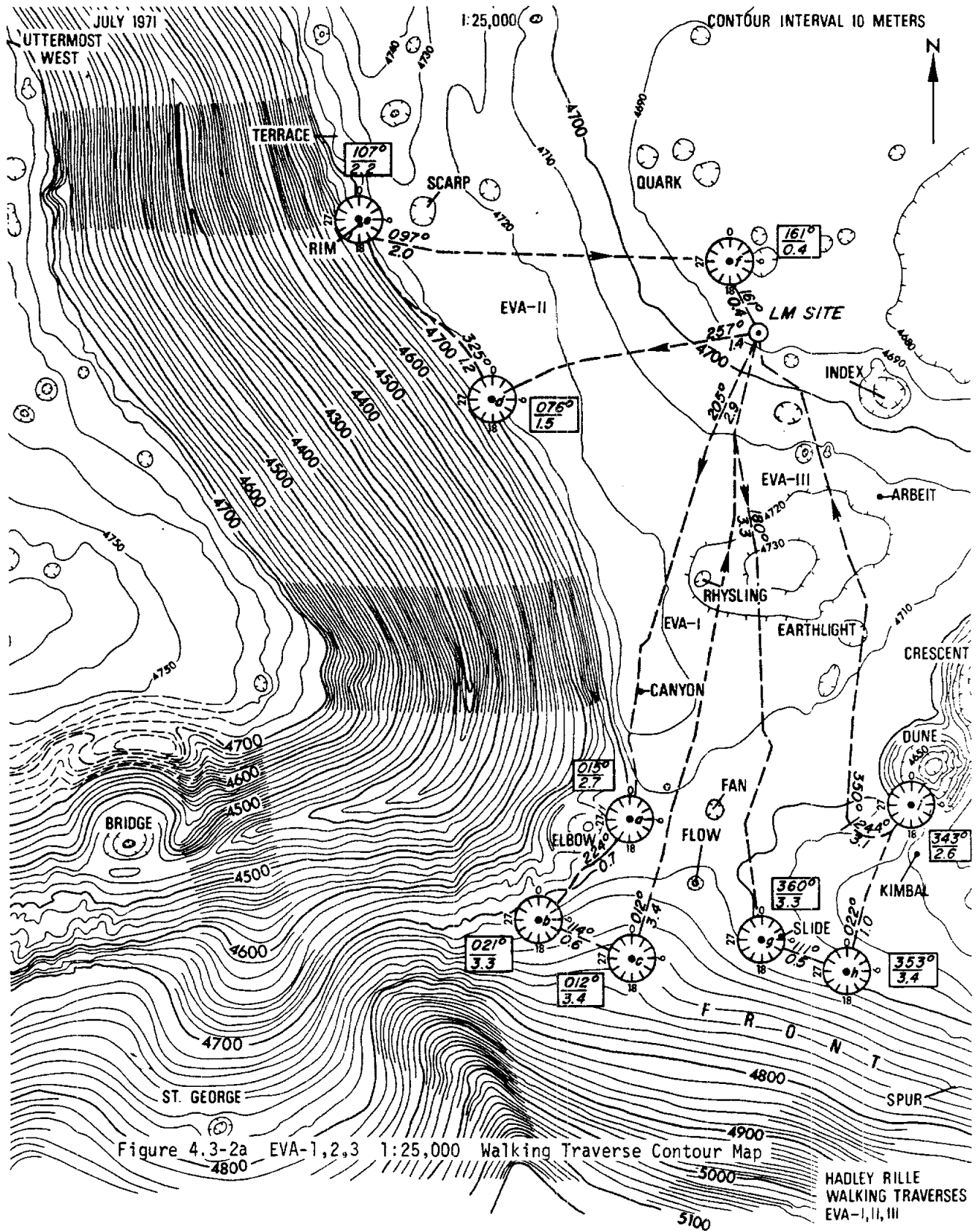


Figure 4.3-2a



Table 4.3-1
EVA I WALKING TRAVERSE

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>SEGMENT TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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)

<u>STATION/ ACTIVITY</u>	<u>ELAPSED TIME AT START</u>	<u>TIME</u>	<u>GEOLOGICAL FEATURES</u>	<u>OBSERVATIONS AND ACTIVITIES</u>
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

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 activity. 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 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

Mission Operations:

Constraints on mission operations that are necessary due to considerations of a lunar surface activity.

Lunar Surface Operations:

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 asymmetric 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 disinfectant 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 ascent 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	$\pm 20^\circ$ 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 $\pm 10^\circ$, 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	<p>Nominal Current Readings:</p> <table border="0" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: center;"><u>Time after fueling</u></th> <th style="text-align: center;"><u>Short Circuit Current</u></th> </tr> </thead> <tbody> <tr> <td>10 min.</td> <td>4-6 amps</td> </tr> <tr> <td>20 min.</td> <td>5-7 amps</td> </tr> <tr> <td>30 min.</td> <td>6-8 amps</td> </tr> <tr> <td>>35 min.</td> <td>7-8 amps</td> </tr> </tbody> </table> <p>After the connection is made and the shorting switch is depressed, the ammeter reading goes to zero.</p>	<u>Time after fueling</u>	<u>Short Circuit Current</u>	10 min.	4-6 amps	20 min.	5-7 amps	30 min.	6-8 amps	>35 min.	7-8 amps
<u>Time after fueling</u>	<u>Short Circuit Current</u>										
10 min.	4-6 amps										
20 min.	5-7 amps										
30 min.	6-8 amps										
>35 min.	7-8 amps										

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	$\pm 0.5^\circ$ of vertical. Astronaut will use bubble level to adjust. Level adjustment interacts with alignment.
Antenna Alignment	$\pm 0.5^\circ$ of East-West line as determined by sundial. When shadow coincides with shadow reference line, alignment is within $\pm 0.5^\circ$.
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	+5° of level by use of bubble reference (bubble free from case).
SIDE alignment	+5° of E-W line, with arrow marked "E" toward East (sun)
CCIG alignment	+20° of N-S line, arrow pointing North
Special Requirements	CCIG onifice must point away from all man-made objects(+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	<p>Astronaut must rough align within ± 20 degrees of lunar East, before opening PSE shroud, by pointing arrow on the sensor girdle towards the sun.</p> <p>Fine alignment will be performed 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.</p>
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 $\pm 3^\circ$ of East-West sun line. Astronaut should read the shadowgraph within $\pm 1^\circ$. 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 $\pm 3^\circ$ of vertical using bubble level. <u>Note:</u> 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	<p>Align the HFE Electronics Package to within $\pm 5^\circ$ 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.</p> <p>When the HFE bore holes have been drilled with the ALSD, the probes should be inserted and should be vertical within $\pm 15^\circ$ as determined visually by the astronaut.</p>
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

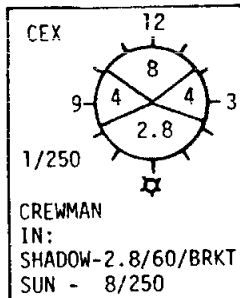
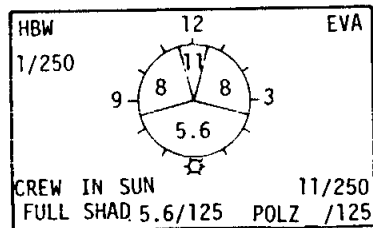
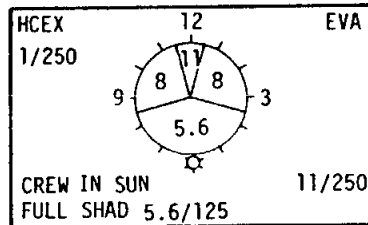
PARAMETER	CONSTRAINTS
LRRR - LM Separation	Minimum mandatory distance is 300 to 500 feet due West of LM. A deployment distance of greater than 500 feet is requested to minimize dust fallout from LM ascent engine blast.
Leveling	Must be leveled by astronaut using bubble level within 5 degrees with respect 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

<p style="text-align: center;">POWER UP</p> <p>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</p>	<p style="text-align: center;">STOP</p> <p>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</p>	<p style="text-align: center;">START</p> <p>*GNOMON*GNOMON* LCRU - PMI/WB ±15 VDC - PRIM STEER: FWD - BUS A AFT - BUS D DRIVE PWR: FWD - BUS A AFT - BUS D</p>
	<p style="text-align: center;">NAV ALIGN</p> <p>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</p>	<p style="text-align: center;">CLOSEOUT</p> <p>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</p>

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