FINAL

APOLLO 16

LUNAR SURFACE PROCEDURES

MARCH 16, 1972

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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 and Ground Systems, Houston Programs. The information contained herein represents the Final Lunar Surface Procedures for Apollo 16, Mission J-2, the sixth manned lunar landing mission. This document will be updated via errata pages to reflect changes as necessary.

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INTRODUCTION

This Final Apollo 16 Lunar Surface Procedures Document is used to document the planning for lunar surface EVA operations on Mission J-2, 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 73 hour stay of the LM vehicle on the lunar surface. The first, second and third EVA's are each planned for seven hours of activity from depressurization to repressurization of the LM. Several alternate operation plans are included in this edition 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, et cetera.

EMU operations and procedures (including contingency) are covered in the EMU AOH, Reference 7.

Photographic and TV camera operations 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 are included. 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 task 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-511/CSM-113/LM-11 J-2 Type Mission currently in effect as of the date of this document.

2.0 MISSION DESCRIPTION

The following information is taken from the "Mission Requirements, SA-511/CSM-113/LM-11 J-2 Type Mission, Lunar Landing," and its approved revisions.

2.1 MISSION OBJECTIVES

The following primary mission objectives have been assigned to this mission by the Office of Manned Space Flight (OMSF) in the Mission Implementation Plan (Reference 1):

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

2) Emplace and activate surface experiments.

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

Detailed objectives have been derived from the OMSF-assigned primary objectives, placed in order of priority, and detailed to the extent necessary for mission planning.

2.2 LUNAR SURFACE PRIORITIES

The detailed objectives and experiments are listed below in their order of priority. Accomplishment of the detailed objectives and detailed experiments planned for the lunar surface will not be jeopardized for the sake of those planned for lunar orbit or coasting flight.

Priority	Detailed Objectives and Experiments
	Lunar Surface
1	Documented Sample Collection at highest priority traverse station (Part of Lunar Geology Investigation)
2	Heat Flow (S-037) (Part of Apollo 16 ALSEP)
3	Lunar Surface Magnetometer (S-034) (Part of Apollo 16 ALSEP)
4	Passive Seismic (S-031) (Part of Apollo 16 ALSEP)
5	Active Seismic (S-033) (Part of Apollo 16 ALSEP)
6	Drill Core Sample Collection (Part of Lunar Geology Investigation)
7	Lunar Geology Investigation (S-059) (Portions other than priority items 1 and 6 above)
8	Far UV Camera/Spectroscope (S-201)
9	Solar Wind Composition
10	Soil Mechanics (S-200)
11	Portable Magnetometer (S-198)
12	Cosmic Ray Detector (Sheets) (S-152)

EVA REQUIREMENTS

The stay time on the lunar surface is open-ended and the planned maximum will not exceed approximately 73 hours. After checkout of the LM to assess its launch capability, the LM will be depressurized to allow egress of astronauts to the surface. The nominal plan will provide for three periods of simultaneous EVA by both astronauts. The first EVA period will be up to approximately 7 hours in duration and will be constrained by a maximum of 18 hours between the time of crew wake up on the day of landing to the time of repressurization after the first EVA period. The second and third EVA periods will be approximately 7 hours each in duration.

Traverse planning will provide for returning the crew to the LM under each of the following single-failure conditions.

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

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

Traverse planning will not be provided for dual failure conditions such as two PLSS failures or an LRV failure combined with a PLSS failure. ALSEP deployment operations will be accomplished during the first EVA within the limitations and constraints defined in the CSM/LM Spacecraft Data Book, SNA-8-D-027, Vol. V, ALSEP Data Book for Apollo 16.

Television transmission will be provided as early as practicable during the EVA period. Television coverage will include an astronaut descending to the lunar surface, an external view of the landed LM, a panorama of distant terrain features and an astronaut conducting lunar surface activities. Television coverage will be provided by the GCTA during each science stop when using the LRV.

Photography will be employed throughout the EVA to document the activities and observations.

Figure 2.3-1 gives sun elevation and azimuth at the Descartes site as a function of date, GMT and GET. Table 2.3-1 gives earth and sun elevations and azimuths at the nominal EVA start times for this mission.

START EVA	AZIMUTH		ELEVATION		APPROX. EARTH CRESCENT SIZE
	EARTH	SUN	EARTH	SUN	
1	-41°	87°	78°	14°	45%
2	-39°	84°	77°	25°	35.5%
3	-38°	82°	75°	37°	26.5%

Note: All data based on a nominal launch date and time

TABLE 2.3-1: EARTH/SUN AZIMUTH AND ELEVATIONS AT NOMINAL EVA START TIMES FOR DESCARTES

LANDING SITE DESCRIPTION

Descartes, the J-2 Mission landing area, is located in a highlands region lying in the southeastern portion of the moon. The landing area of interest lies to the southwest of the Mare Tranquillitatis, north of the Descartes Crater, and several hundred kilometers west northwest of the Theophilus Crater. The landing coordinates are 8°59'55" S latitude, 15°31'12" E longitude based upon preliminary Apollo 14 triangulation measurements.

The Descartes area is characterized by hilly, grooved, and furrowed terrain (Descartes Mountains) which appears to be morphologically similar to many terrestrial areas of volcanism. This area is also the site of an extensive development of highland plains material (Cayley formation), a geological unit of widespread occurrence in the lunar highlands.

This region is important to the lunar geologist since knowledge of the composition, age, and extent of magmatic differentiation in a highland volcanic complex is particularly important in understanding lunar volcanism and its contribution to the evolution of the lunar highlands. A comparison with similar mare complexes provides an evaluation of wide spectrum of lunar volcanic activity. An understanding of the composition and age of the highland plains material also adds to the knowledge of the processes which modify large areas of the lunar highlands.

DETAILED SCIENTIFIC OBJECTIVES OF THE DESCARTES REGION[1]

The landing site for the J-2 Mission is the Descartes area of the moon. The relationship between the Descartes region and previous Apollo landing sites is shown in Figure 2.5-1. A more detailed view of the Descartes region is shown in Figure 2.5-2. The Descartes region lies in the lunar southern highlands and is unique in that it is the highest topographic region on the near side of the moon. Since no recognizable gravity anomalies are associated with this region, this mountainous plateau apparently must extend to a great depth to be isostatic.

The portion of the Descartes region which has been selected for the LM touchdown point and the synthesis of candidate traverse routes and activities is shown in Figure 2.5-3. This figure shows two other candidate landing points that were considered in the selection process. The selected landing point, Point 2, provides for the accomplishment of objectives associated with the Descartes landing site and is located at the coordinates of 15°31'12" E and 8°59'55" S based on preliminary triangulation measurements. The geological rationale for selection of this landing site is presented in the following paragraphs.

The lunar highlands appear to consist of three major types of deposits: (1) undivided pre-Imbrian materials and older degraded crater materials, (2) ejecta blankets composed of material ejected by the major basin-forming events, (e.g., Mare Imbrium formation) that are typified by the Apollo 14 Fra Mauro and Apollo 15 Apennine Mountains highland areas,and (3) volcanic constructional materials that are exemplified by the Descartes highland region, the Apollo 16 lunar landing site.

The Descartes area is an outstanding location to sample and study the petrochemistry of two volcanic constructional units of the lunar highlands: the Cayley formation unit* and the Kant Planteau unit, of which two separate and distinct portions are present.

Fresh craters of various sizes, also present within the candidate landing area, allow sampling of these highland units to varying depths. The mounded floors of craters within this landing area, up to 1 kilometer in diameter, suggest that a lower layer of unknown origin has been penetrated.

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*The Cayley formation unit and Cayley Plains are used as interchangeable terms in this section. Cayley formation is a general geological term whereas Cayley Plains is associated with the Cayley formation unit peculiar to the Descartes landing site.

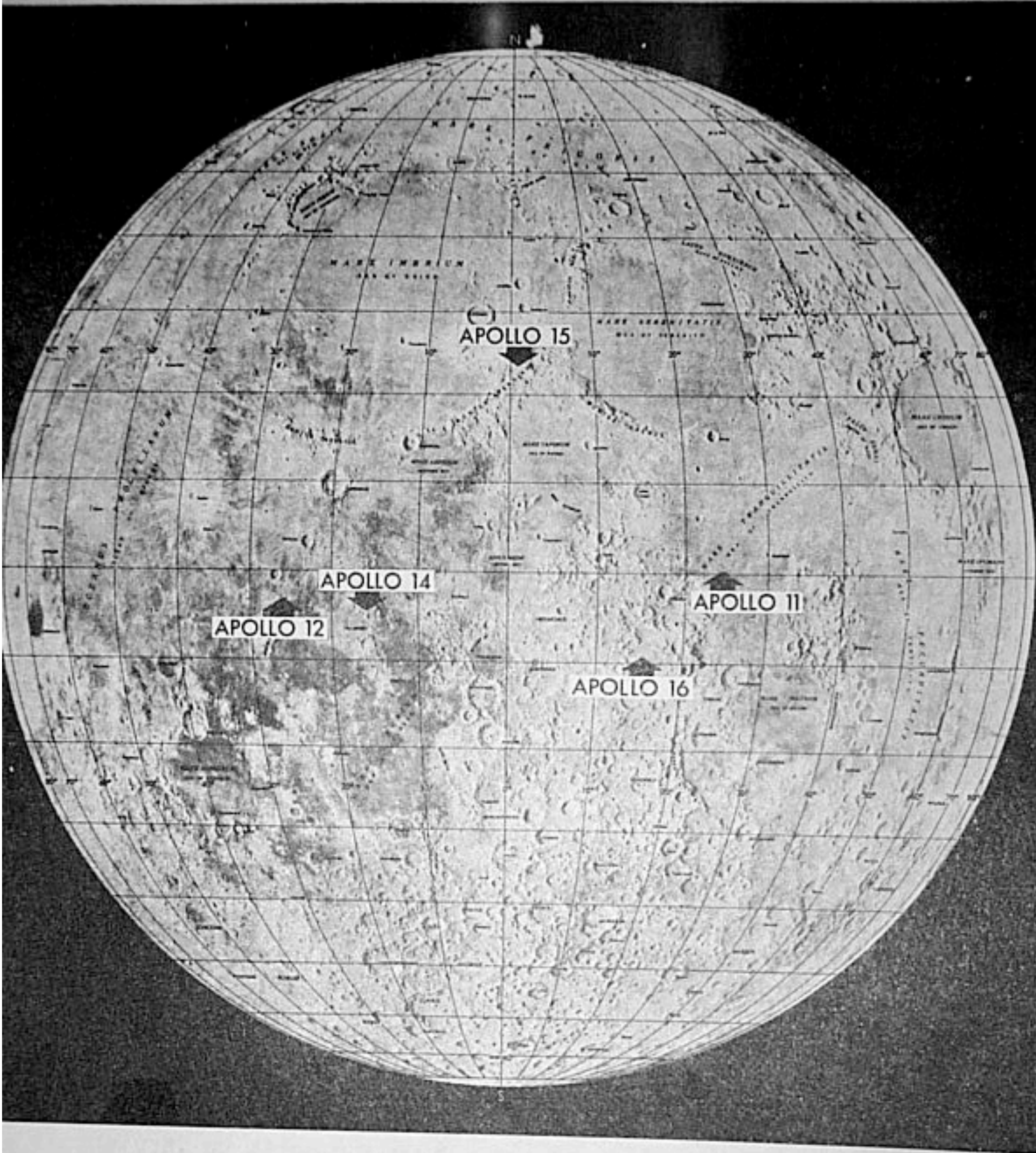


FIGURE 2.5-1 APOLLO 16 LANDING SITE

FIGURE 2.5-2 LM LANDING SITE IN THE DESCARTES AREA

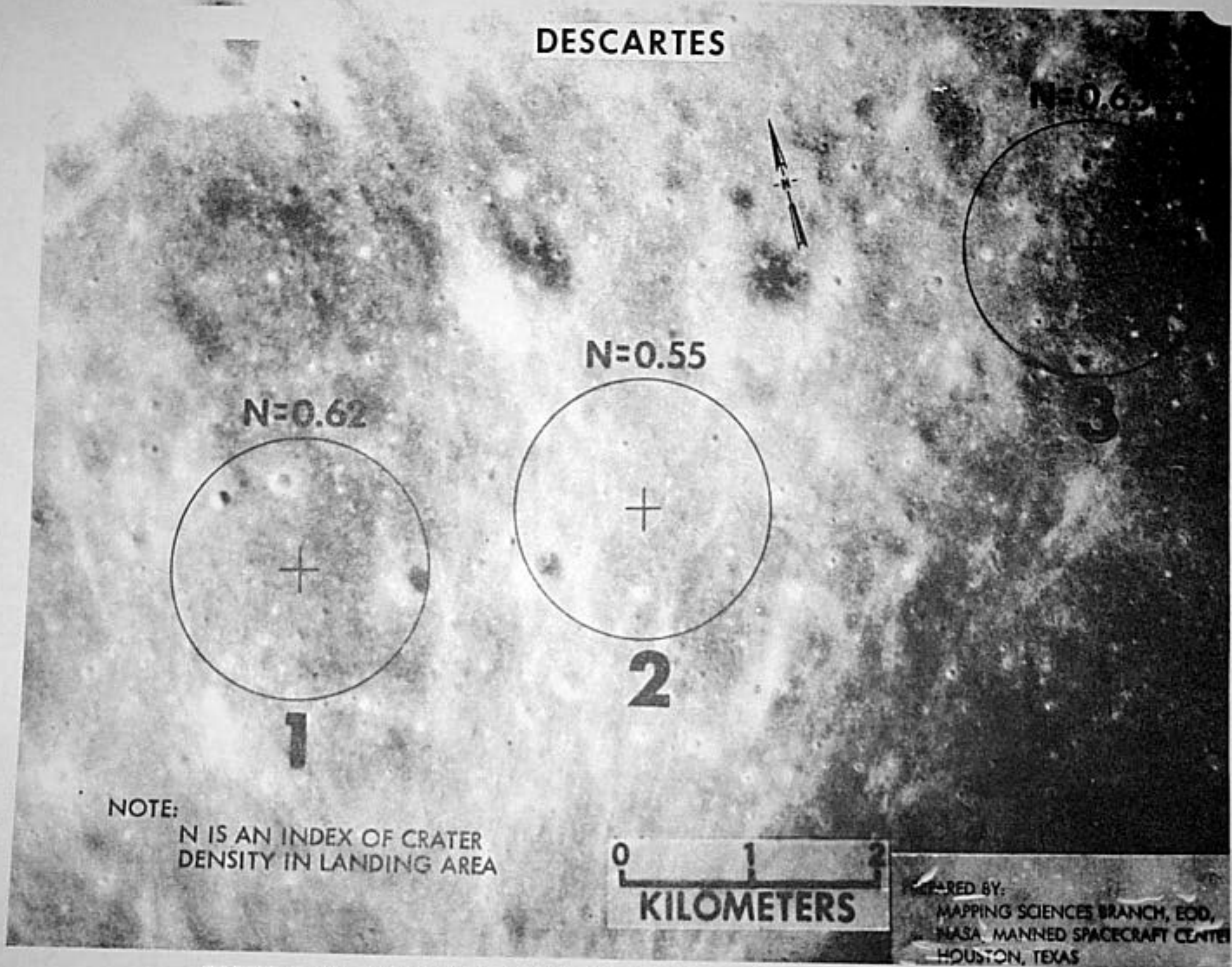


FIGURE 2.5-3 CANDIDATE LANDING POINTS IN DESCARTES REGION

The Cayley formation unit is highland plains material consisting mostly of smooth to undulating terrain probably resulting from fluid volcanic flow rock and pyroclastic detritus. This unit is the largest single identifiable rock unit on the near side of the moon (covers 7 percent of near side surface) except for mare regions. The Descartes Mountains (edge of Kant Plateau unit) are composed of hilly and furrowed highland plateau material that is probably the product of more viscous volcanic flow rock, pyroclastics, and their associated cones. This type of unit covers 4.3 percent of the near side of the moon. This landing site provides a unique opportunity to accomplish dating and other studies of the morphological evolution of young, bright-rayed craters. The geological information obtained can be applied to infer ages of other visible craters of apparently similar construction.

The specified geological features recommended for sampling in the proposed landing area (Figure 2.5-3) are as follows:

a) Cayley Plains which include young, bright-rayed craters (North Ray, South Ray)

b) South Descartes Mountains (Stone Mountain)

c) North Descartes Mountains (Smokey Mountains)

d) Subdued craters and crater chains

2.5.1 Cayley Plains (North Ray, South Ray)

Since the proposed landing area is on the smooth phase of this unit, LM vicinity samples will provide material of this unit. Bright-rayed craters of sizes up to 1 kilometer in diameter penetrate this unit, and would permit selective sampling to a depth of about 200 meters.

Exposed in the east wall of the bright-rayed North Ray Crater (Figure 2.5-4) and recognizable as a scarp-forming unit to the south and east of the crater is the youngest stratigraphic unit of the Cayley formation. In addition, a lower stratigraphic layer lying approximately 150 to 200 meters below the present surface is indicated by mounds in the floors of all craters of about 1 kilometer in diameter. Speculations as to the origin of this lower layer include: another type of Cayley constructional unit; Imbrium basin ejecta; Nectaris basin ejecta; or pre-Imbrium local source material. Detailed sampling should provide the correct answer. Crater rim sampling alone should determine if pre-Imbrium material is present or not.

Excellent samples of the Cayley Plains would be provided by radial sampling of the bright rays emanating from North Ray and South Ray Craters (Figure 2.5-4). Investigations should also be made of the seemingly rimless craters in this area and of the one very dark crater west of the selected landing point.

2.5.2 South Descartes Mountains (Stone Mountain)

These hills form the north edge of a bright, hilly, and furrowed unit that extends southward 100 kilometers to the crater Descartes and eastward 50 kilometers across the Kant Plateau. The Kant Plateau unit is recognizable at several highland areas on the near side of the moon and becomes more prevalent on the far side. This unit appears to have been formed of very viscous lava, morphologically the opposite of mare lava. Samples from these hills will provide material from a large regional highland volcanic unit, the Kant Plateau.

2.5.3 North Descartes Mountains (Smokey Mountains)

This feature might be a pre-Imbrium crater wall although it is more probably a volcanic constructional form. Sampling would establish whether ancient breccias are present from a different region of the moon or if these hills are just another area of highland volcanics. Samples supporting either hypothesis would

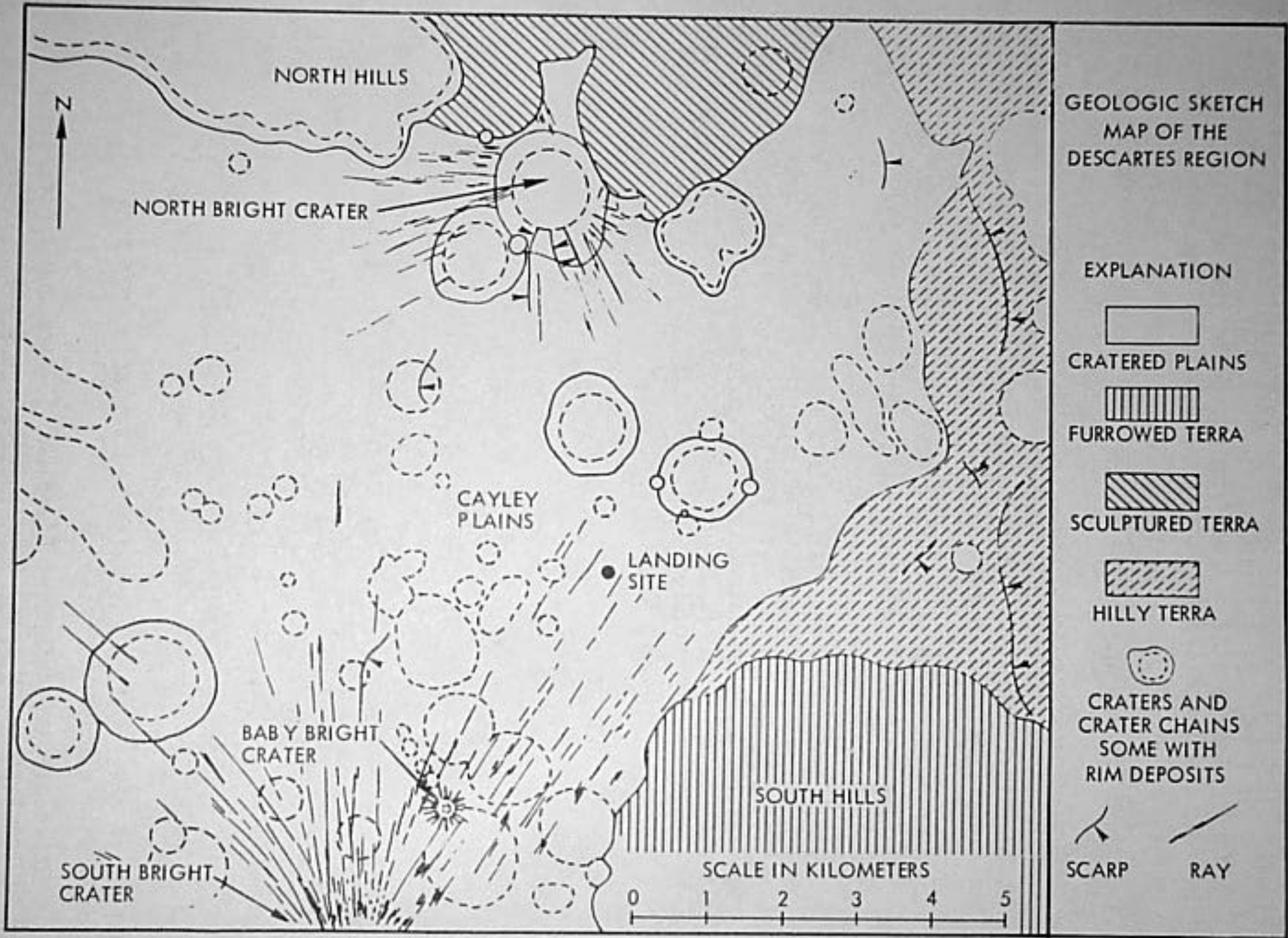


FIGURE 2.5-4 GEOLOGIC UNITS IN DESCARTES LANDING AREA

afford valuable data. A desirable area to sample this unit would be a large crater at the south base of these hills.

2.5.4 Subdued Craters and Crater Chains

A number of craters and crater chains, marginally accessible from the proposed landing area, appear to be the result of ejecta from the crater Theophilus (or possibly Cryillus). The largest group close to the landing area is west of the North Hills. The morphology of this crater type will aid in understanding the details of formation of large secondary craters and their rate of degradation. The deepest samples of Cayley formation might be collected from the rim.

A small group of irregular craters east of North Ray Crater and against the base of North Hills are either primary impact craters or a secondary crater chain similar to those farther west. It is desirable that these craters be observed and sampled, although the three previous units are more important from the standpoint of lunar geology studies.

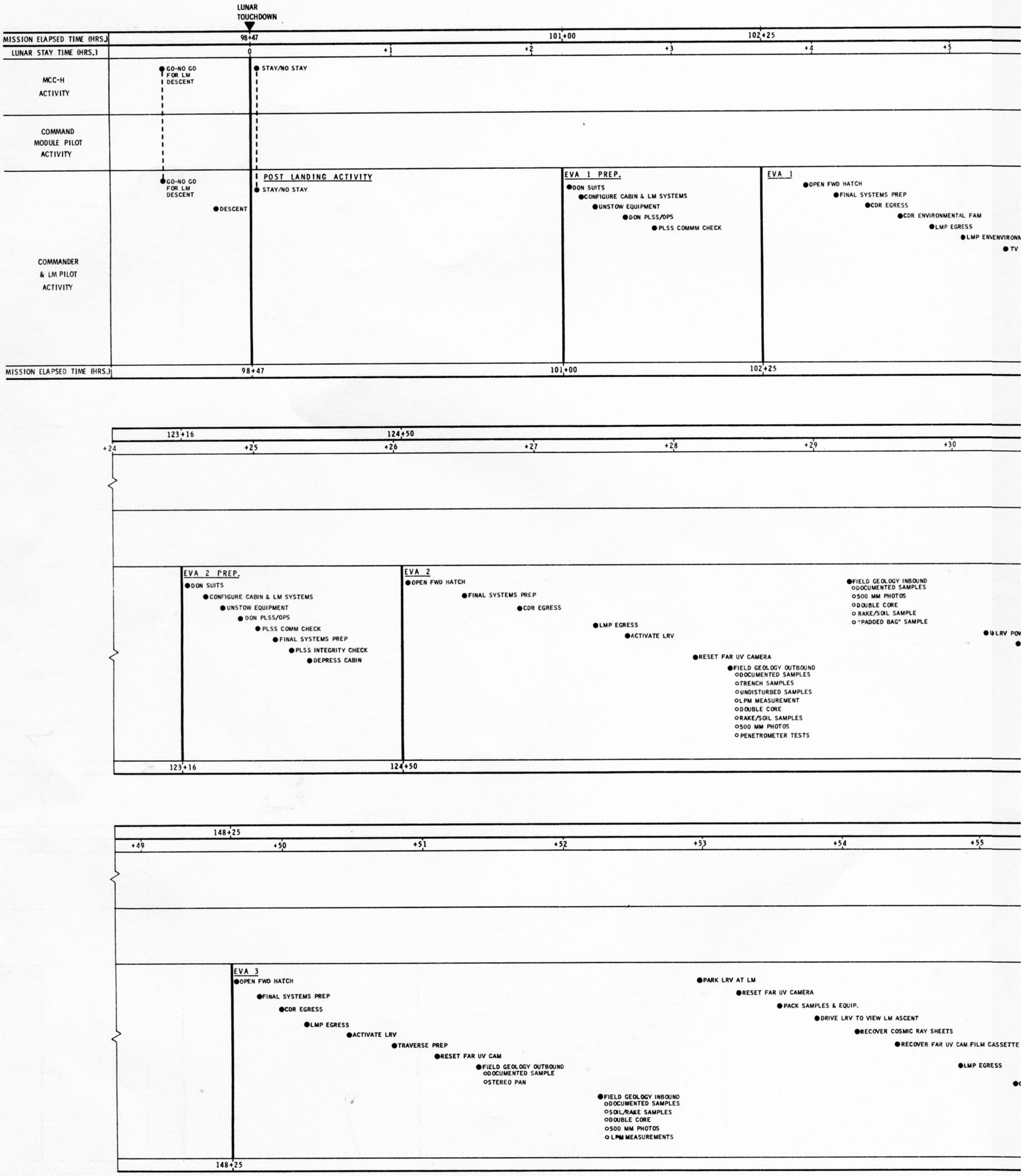
(1) Data in this section was extracted verbatim from the following dociment:

Science Mission Support Division, Science and Applications Directorate: Mission Science Planning Document, AS-511/CSM-113/LM-11 (Apollo 16) MSC-04143, 18 October 1971.

2.6 LUNAR SURFACE ACTIVITY FOR 73 HOUR STAY

The nominal plan is for the Commander and the Lunar Module Pilot to remain on the lunar surface for approximately 73 hours. A summary time-line for the lunar surface stay is presented in Figure 2.6-1.

Table 2.6-1 lists the loose equipment which the Apollo 16 crew will leave behind on the lunar surface, divided as to EVA in which this gear is abandoned. Table 2.6-2 lists the equipment which is transferred by the crew between the LM ascent stage and the lunar surface during EVA operations. The data of Table 2.6-2 is supplemented by explanatory diagrams in Section 3.5 of this document.



LUNAR TOUCHDOWN
MISSION ELAPSED TIME (HRS.)
98+47
101+00
102+25
LUNAR STAY TIME (HRS.)
0
+1
+2
+3
+4
+5
MCC-H ACTIVITY
GO-NO GO FOR LM DESCENT
STAY/NO STAY
COMMAND MODULE PILOT ACTIVITY
COMMANDER & LM PILOT ACTIVITY
GO-NO GO FOR LM DESCENT
DESCENT
POST LANDING ACTIVITY
STAY/NO STAY
EVA 1 PREP.
DON SUITS
CONFIGURE CABIN & LM SYSTEMS
UNSTOW EQUIPMENT
DON PLSS/OPS
PLSS COMM CHECK
EVA 1
OPEN FWD HATCH
FINAL SYSTEMS PREP
CDR EGRESS
CDR ENVIRONMENTAL FAM
LMP EGRESS
LMP ENVENVIRONM
TV
MISSION ELAPSED TIME (HRS.)
98+47
101+00
102+25
123+16
124+50
+24
+25
+26
+27
+28
+29
+30
EVA 2 PREP.
DON SUITS
CONFIGURE CABIN & LM SYSTEMS
UNSTOW EQUIPMENT
DON PLSS/OPS
PLSS COMM CHECK
FINAL SYSTEMS PREP
PLSS INTEGRITY CHECK
DEPRESS CABIN
EVA 2
OPEN FWD HATCH
FINAL SYSTEMS PREP
CDR EGRESS
LMP EGRESS
ACTIVATE LRV
RESET FAR UV CAMERA
FIELD GEOLOGY OUTBOUND
DOCUMENTED SAMPLES
TRENCH SAMPLES
UNDISTURBED SAMPLES
LPM MEASUREMENT
DOUBLE CORE
RAKE/SOIL SAMPLES
500 MM PHOTOS
PENETROMETER TESTS
FIELD GEOLOGY INBOUND
DOCUMENTED SAMPLES
500 MM PHOTOS
DOUBLE CORE
RAKE/SOIL SAMPLE
"PADDED BAG" SAMPLE
LRV POV
123+16
124+50
148+25
+49
+50
+51
+52
+53
+54
+55
EVA 3
OPEN FWD HATCH
FINAL SYSTEMS PREP
CDR EGRESS
LMP EGRESS
ACTIVATE LRV
TRAVERSE PREP
RESET FAR UV CAM
FIELD GEOLOGY OUTBOUND
DOCUMENTED SAMPLE
STEREO PAN
FIELD GEOLOGY INBOUND
DOCUMENTED SAMPLES
SOIL/RAKE SAMPLES
DOUBLE CORE
500 MM PHOTOS
LPM MEASUREMENTS
PARK LRV AT LM
RESET FAR UV CAMERA
PACK SAMPLES & EQUIP.
DRIVE LRV TO VIEW LM ASCENT
RECOVER COSMIC RAY SHEETS
RECOVER FAR UV CAM FILM CASSETTE
LMP EGRESS
148+25

109+25

+5 +6 +7 +8 +9 +10 +11 +12

MS PREP
R EGRESS
● CDR ENVIRONMENTAL FAM
● LMP EGRESS
● LMP ENVENVIRONMENTAL FAM
● TV DEPLOY
● LRV OFFLOAD & CONFIGURATION
● OFFLOAD QUAD III PALLET
● DEPLOY HIGH GAIN ANTENNA
● LM INSPECTION
● FAR UV CAM DEPLOYMENT
● FLAG DEPLOY
● ALSEP OFFLOAD & PREP
● COSMIC RAY ACTIVATION
● LRV NAV ALIGN
● ALSEP TRAVERSE
● ALSEP DEPLOY
● CORE DRILLING
● GEOLOGY TRAVERSE
○ DOCUMENTED SAMPLES
○ SOIL/RAKE SAMPLE
○ LPM MEASUREMENTS
○ GRAN PRIX
○ 500 MM PHOTOS
● ARM ASE
● RESET FAR UV CAMERA
● SRC #1 PACKING
● LMP INGRESS
● CABIN REPRESS

EVA 1 POST
● CONFIGURE LM SYSTEMS
● CREW STATUS REPORTS
● DOFF & RECHARGE PLSS/OPS
● REPLACE PLSS BATTS & LIOH
● DOFF SUITS
● CONFIGURE CABIN
● STOW SAMPLES
● DEBRIEF

109+25

131+50 133+50

+30 +31 +32 +33 +34 +35 +36 +37

OLOGY INBOUND
NTED SAMPLES
PHOTOS
CORE
OIL SAMPLE
D BAG" SAMPLE
● LRV POWER DOWN
● RESET FAR UV CAMERA
● SRC #2 PACKING
● LMP INGRESS
● CDR INGRESS
● CABIN REPRESS

EVA 2 POST
● CONFIGURE LM SYSTEMS
● CREW STATUS REPORTS
● DOFF & RECHARGE PLSS/OPS
● REPLACE PLSS BATTS & LIOH
● DOFF SUITS
● CONFIGURE CABIN
● WEIGH & STOW SAMPLES

EAT PERIOD

131+50 133+50

155+25 157+35 159+15 167+15

+55 +56 +57 +58 +59 +60 +68 +69 9

/ LM ASCENT
ER COSMIC RAY SHEETS
● RECOVER FAR UV CAM FILM CASSETTE
● LMP EGRESS
● CDR INGRESS
● CABIN REPRESS

EVA 3 POST
● CONFIGURE LM SYSTEMS
● CREW STATUS REPORT
● DOFF PLSS/OPS
● WEIGH & STOW SAMPLES
● PREP EQUIP. FOR JETTISON
● DEPRESS CABIN
● JETTISON EQUIP.
● REPRESS. CABIN
● DEBRIEF.

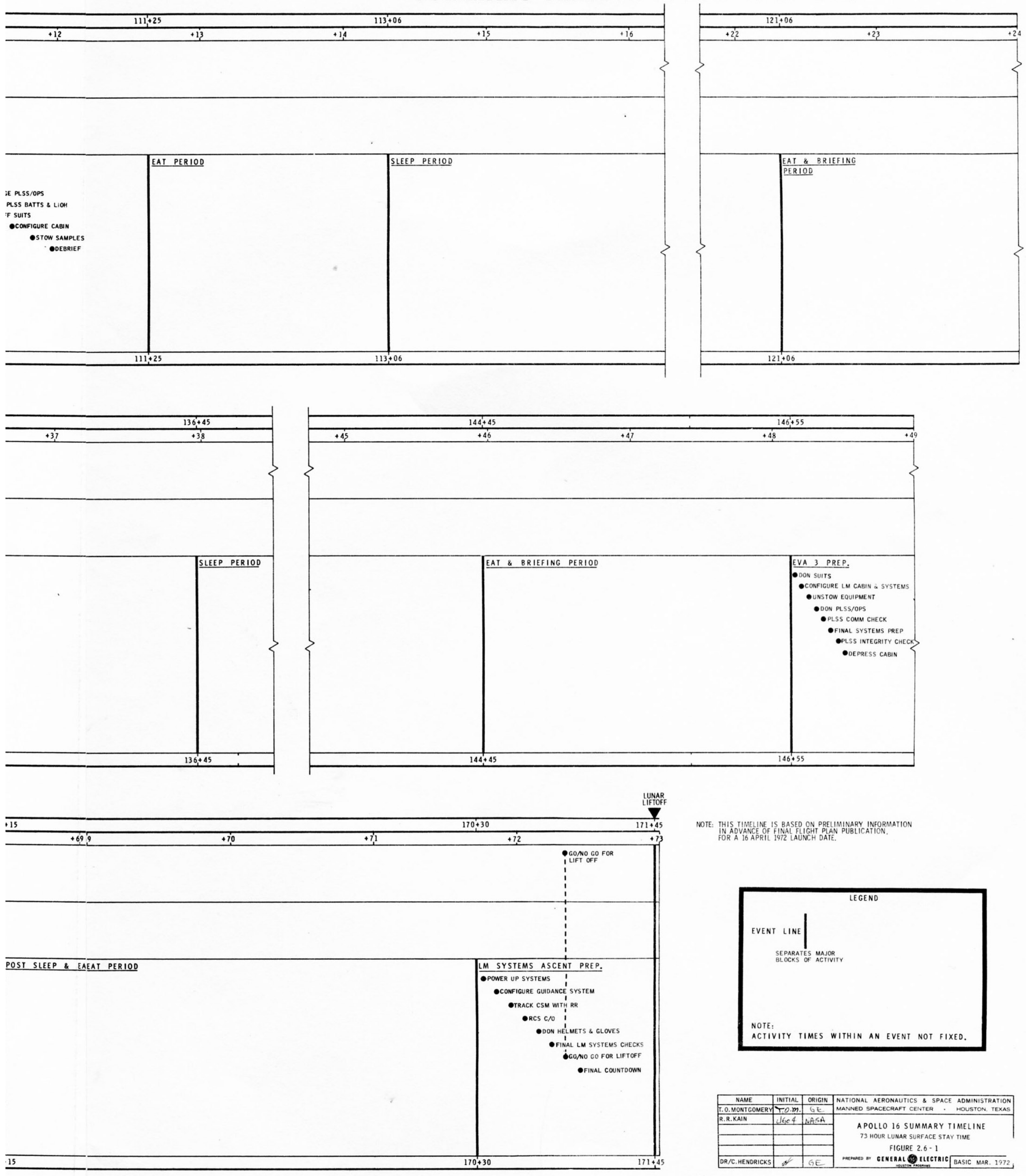
EAT PERIOD

SLEEP PERIOD

POST SLEEP & EAEAT

155+25 157+35 159+15 167+15

APOLLO 16 LUNAR SURFACE ACTIVITY SUMMARY TIMELINE FOR 73 HOUR STAY



NOTE: THIS TIMELINE IS BASED ON PRELIMINARY INFORMATION IN ADVANCE OF FINAL FLIGHT PLAN PUBLICATION, FOR A 16 APRIL 1972 LAUNCH DATE.

LEGEND

EVENT LINE — SEPARATES MAJOR BLOCKS OF ACTIVITY

NOTE:
ACTIVITY TIMES WITHIN AN EVENT NOT FIXED.

NAME	INITIAL	ORIGIN	
T.O. MONTGOMERY	T.O.M.	GE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
R.R. KAIN		NASA	APOLLO 16 SUMMARY TIMELINE 73 HOUR LUNAR SURFACE STAY TIME
			FIGURE 2.6-1
DR/C. HENDRICKS		GE	PREPARED BY GENERAL ELECTRIC HOUSTON PROGRAMS — BASIC MAR. 1972

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
   Camera Bag & padding
   500 mm Cam Reseau Cover

2. Discarded On Lunar Surface During EVA-1
   Misc Pip Pins and Fastenings
   Thermal Covers
   MESA Brackets
   ALSEP RTG Dome Removal Tool and Fuel Transfer Tool
   PSE Girdle
   ALSEP Subpallet
   Lunar Surface Drill, Treadle, Rack & Extractor Assy
   TV Tripod
   LCRU/GTCA Pallet
   Pallet 1
   SRC Dust Skirt and Seal Protector
   Bore/Core stems bag & protectors

3. Operational Equipment Deployed and Left On EVA-1
   Flag
   TV Camera, LCRU, TCU, HGA, LGA
   LRV
   ALSEP: PSE, LSM, HFE, ASE
   SWC
   UV Camera
   Quad III Pallet with hand tools and LPM

4. Jettison During EVA-2
   1 LM ECS LiOH Cartridge and Canister
   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
   2 LCG (SPARES)

7. Discarded on Lunar Surface During EVA-3

LRV w/TV, TCU, LCRU, 1-LCRU Battery
Hand Tool Carrier w/tools
Penetrometer (less drum) with accessories
Cosmic Ray Frame
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
2 lens Brushes
BSLSS
Dust Brush
Unused Documented Sample Bags
Reseau Plate Cover
Sun Compass
Far UV Camera
Lunar Portable Magnetometer

8. Jettisoned to Lunar Surface After EVA-3

2 PLSS
TIED IN ISS
  2 pr Lunar Boots
  2 RCU
  Retractable Tethers
  1 Armrest

9. Jettisoned to Lunar Surface Prior to L/O

2 ICG
2 Hammocks
Sleep Restraint
Waste Receptacle
Helmet/EVA Int. Stow.
ETB
2 LCG Adapters
1 LM ECS LiOH cartridge and Cannister

10 Discarded after LM A/S Launch

1-LM Descent Stage

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

1. <u>Transferred to Surface EVA-1</u>
   ETB and contents
   - Map holder w/lunar surface maps, LRV Cklist and Sun Compass
   - 4-70mm mags
   - 3-16mm mags
   - 500mm lens camera w/lens and Mag
   - 1-70mm camera w/mag
   - BSLSS
   - Bag Dispenser Brkt
   - 2 Lens Brush
   - 2-Padded Bags

   Empty EVA-1 Pallet

2. <u>Transferred into Ascent Stage EVA-1</u>
   EVA-1 pallet
   SCB (1 or 2)
   SRC #1
   ETB and contents
   - Lunar surface maps
   - 2-70mm mags
   - 3-16mm mags
   - Mag from 500mm lens camera
   - 2-70mm cameras w/mags

3. <u>Transferred to surface EVA-2</u>
   ETB and contents
   - Lunar surface maps
   - 3-70mm mags
   - 3-16mm mags
   - Mag for 500mm lens camera
   - 2-70mm cameras w/mags

   Empty EVA-2 pallet

4. <u>Transferred into Ascent Stage EVA-2</u>
   EVA 2 pallet w/ECS LiOH canister
   SCB (1 or 2)
   SRC #2
   ETB and contents
   - Lunar surface maps
   - 2-70mm mags
   - 3-16mm mags
   - Mag from 500mm lens camera
   - 2-70mm cameras w/mags
   - 2-Padded Bags

5. <u>Transferred to surface EVA-3</u>

ETB and contents
- Lunar surface maps
- 2-70mm mags
- 4-16mm mags (or all unused)
- 2 Mags for 500mm lens camera
- 2-70mm cameras w/mags (Polarizing Filter on LMP Camera)

6. <u>Transferred into Ascent Stage EVA-3</u>

SCB (Several)

BSLSS Sample Bag (Big Rock Bag)

ETB and contents
- Lunar surface maps
- 5-70mm mags
- 4-16mm mags
- Mag from 500mm lens camera (70mm)
- Solar Wind Composition (bagged)
- Cosmic Ray Sheets (in bag)
- UV Camera film cassette
- Penetrometer Drum

3.0 NOMINAL LUNAR SURFACE EVA

3.1 EVA GENERAL DESCRIPTION

On Apollo 16, the CDR and LMP will spend 73 hours on the lunar surface at the Descartes site of which as many as 21 hours will be spent in actual EVA activities. There will be three 7-hour EVA's scheduled as shown in Figure 2.6-1, the summary timeline for the 73 hour total stay period. The EVA periods are separated by periods of LM cabin activity including housekeeping, nutrition and sleeping.

Figures 3.1-1, 3.1-5 and 3.1-6 are the summary timelines for EVA's 1, 2 and 3, respectively.

3.1.1 EVA 1

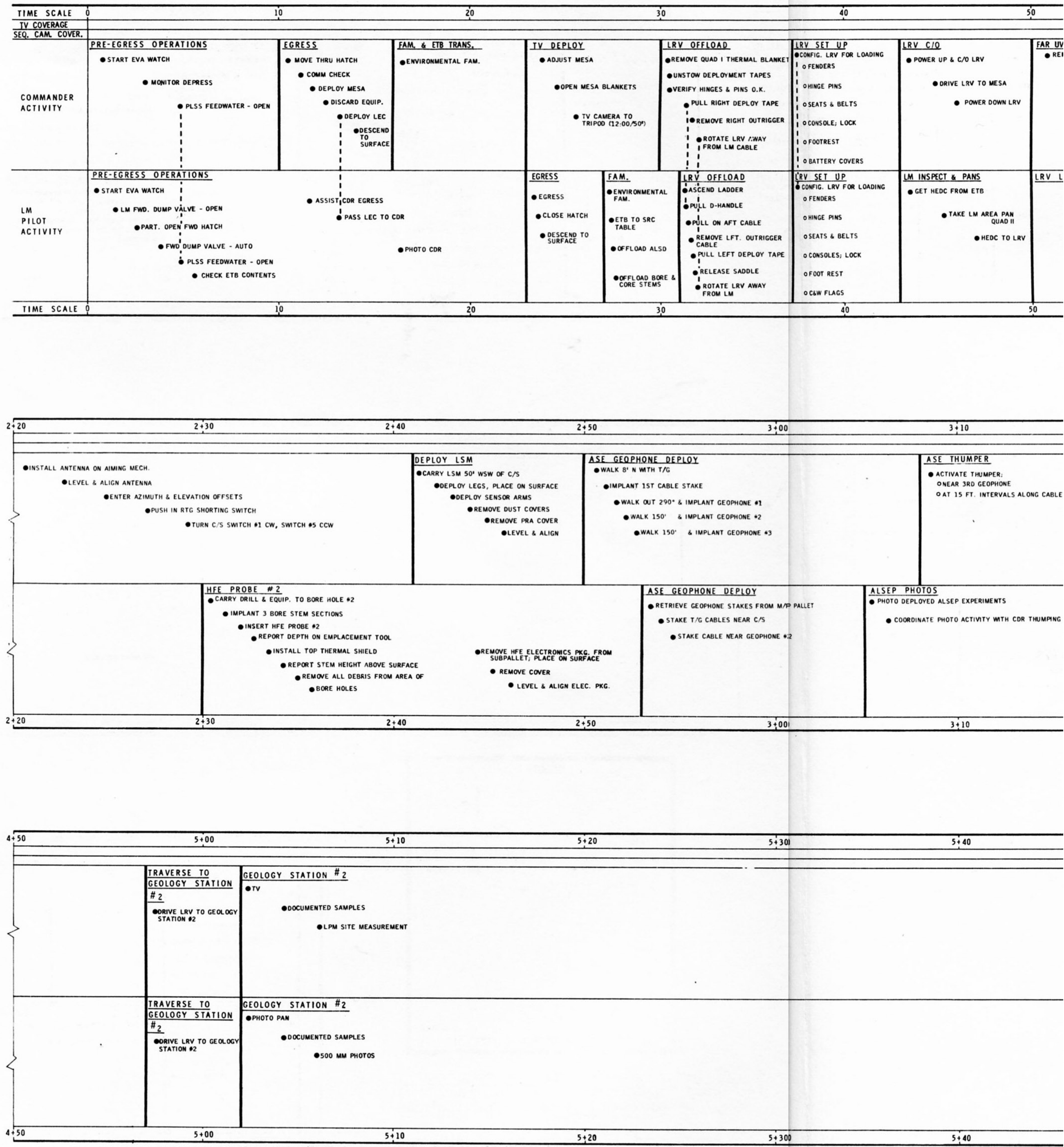
EVA 1 commences approximately four hours after touchdown at Descartes. The crew has described the general lunar scene as they see it from the windows of the LM (the nominal landing yaw orientation is +Z axis pointing due west), gone through systems checks, had a light snack, and are prepared to embark on their first EVA, equipped with their Extravehicular Mobility Units comprising their spacesuits, life support, communications, sun visors and boots.

EVA 1 features ALSEP deployment, and a modicum of geological - geophysical investigation, westerly to Spook and Flag Craters.

The CDR egresses first, bringing out a jettison bag filled with expended gear. This he drops, then pulls a lanyard to deploy the MESA (Modularized Equipment Stowage Assembly), Figure 3.1-2, and descends to the lunar surface. He has a bag of cameras and film magazines with him as he descends.

After a brief time of familiarization to the surface conditions, the CDR proceeds to place the color TV (which has been viewing him from the MESA) on a tripod some distance away (see Figure 3.1-3).

The LMP egresses soon after the CDR. He also spends some time acclimating to lunar 1/6 G conditions, then unloads the lunar drill and its boring and coring equipment from the MESA.


TIME SCALE
TV COVERAGE
SEQ. CAM. COVER.
0
10
20
30
40
50
COMMANDER ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
MONITOR DEPRESS
PLSS FEEDWATER - OPEN
EGRESS
MOVE THRU HATCH
COMM CHECK
DEPLOY MESA
DISCARD EQUIP.
DEPLOY LEC
DESCEND TO SURFACE
FAM. & ETB TRANS.
ENVIRONMENTAL FAM.
TV DEPLOY
ADJUST MESA
OPEN MESA BLANKETS
TV CAMERA TO TRIPOD (12:00/50')
LRV OFFLOAD
REMOVE QUAD I THERMAL BLANKET
UNSTOW DEPLOYMENT TAPES
VERIFY HINGES & PINS O.K.
PULL RIGHT DEPLOY TAPE
REMOVE RIGHT OUTRIGGER
ROTATE LRV AWAY FROM LM CABLE
LRV SET UP
CONFIG. LRV FOR LOADING
FENDERS
HINGE PINS
SEATS & BELTS
CONSOLE; LOCK
FOOTREST
BATTERY COVERS
LRV C/O
POWER UP & C/O LRV
DRIVE LRV TO MESA
POWER DOWN LRV
FAR UV
LM PILOT ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
LM FWD. DUMP VALVE - OPEN
PART. OPEN FWD HATCH
FWD DUMP VALVE - AUTO
PLSS FEEDWATER - OPEN
CHECK ETB CONTENTS
ASSIST CDR EGRESS
PASS LEC TO CDR
PHOTO CDR
EGRESS
EGRESS
CLOSE HATCH
DESCEND TO SURFACE
FAM.
ENVIRONMENTAL FAM.
ETB TO SRC TABLE
OFFLOAD ALSD
OFFLOAD BORE & CORE STEMS
LRV OFFLOAD
ASCEND LADDER
PULL D-HANDLE
PULL ON AFT CABLE
REMOVE LFT. OUTRIGGER CABLE
PULL LEFT DEPLOY TAPE
RELEASE SADDLE
ROTATE LRV AWAY FROM LM
LRV SET UP
CONFIG. LRV FOR LOADING
FENDERS
HINGE PINS
SEATS & BELTS
CONSOLES; LOCK
FOOT REST
C&W FLAGS
LM INSPECT & PANS
GET HEDC FROM ETB
TAKE LM AREA PAN QUAD II
HEDC TO LRV
LRV L
2+20
2+30
2+40
2+50
3+00
3+10
INSTALL ANTENNA ON AIMING MECH.
LEVEL & ALIGN ANTENNA
ENTER AZIMUTH & ELEVATION OFFSETS
PUSH IN RTG SHORTING SWITCH
TURN C/S SWITCH #1 CW, SWITCH #5 CCW
DEPLOY LSM
CARRY LSM 50' WSW OF C/S
DEPLOY LEGS, PLACE ON SURFACE
DEPLOY SENSOR ARMS
REMOVE DUST COVERS
REMOVE PRA COVER
LEVEL & ALIGN
ASE GEOPHONE DEPLOY
WALK 8' N WITH T/G
IMPLANT 1ST CABLE STAKE
WALK OUT 290° & IMPLANT GEOPHONE #1
WALK 150' & IMPLANT GEOPHONE #2
WALK 150' & IMPLANT GEOPHONE #3
ASE THUMPER
ACTIVATE THUMPER;
NEAR 3RD GEOPHONE
AT 15 FT. INTERVALS ALONG CABLE
HFE PROBE #2
CARRY DRILL & EQUIP. TO BORE HOLE #2
IMPLANT 3 BORE STEM SECTIONS
INSERT HFE PROBE #2
REPORT DEPTH ON EMPLACEMENT TOOL
INSTALL TOP THERMAL SHIELD
REPORT STEM HEIGHT ABOVE SURFACE
REMOVE ALL DEBRIS FROM AREA OF BORE HOLES
REMOVE HFE ELECTRONICS PKG. FROM SUBPALLET; PLACE ON SURFACE
REMOVE COVER
LEVEL & ALIGN ELEC. PKG.
ASE GEOPHONE DEPLOY
RETRIEVE GEOPHONE STAKES FROM M/P PALLET
STAKE T/G CABLES NEAR C/S
STAKE CABLE NEAR GEOPHONE #2
ALSEP PHOTOS
PHOTO DEPLOYED ALSEP EXPERIMENTS
COORDINATE PHOTO ACTIVITY WITH CDR THUMPING
4+50
5+00
5+10
5+20
5+30
5+40
TRAVERSE TO GEOLOGY STATION #2
DRIVE LRV TO GEOLOGY STATION #2
GEOLOGY STATION #2
TV
DOCUMENTED SAMPLES
LPM SITE MEASUREMENT
TRAVERSE TO GEOLOGY STATION #2
DRIVE LRV TO GEOLOGY STATION #2
GEOLOGY STATION #2
PHOTO PAN
DOCUMENTED SAMPLES
500 MM PHOTOS

50 | 1+00 | 1+10 | 1+20 | 1+30 | 1+40

/O LRV
LRV TO MESA
POWER DOWN LRV

FAR UV CAM OFFLOAD & DEPLOY
- REMOVE THERM. COVER
- TEAR BAGS
- REMOVE UV CAMERA FROM LM
- DEPLOY UV CAMERA
- ALIGN UV CAMERA

LRV LOAD UP
- QUAD III PALLET TO LRV
- CONFIG. TOOLS & HTC
- SRC #1 SCB TO LRV (IF AHEAD OF LMP)
- REMOVE LCRU PALLET FROM MESA

FLAG DEPLOY
- UNSTOW FLAG
- DEPLOY FLAG
- PHOTO LMP
- STOW HEDC

ALSEP OFFLOAD
- REMOVE RTG PACKAGE
- REMOVE ALSEP TOOLS
- ASSEMBLE CARRY BAR
- ROTATE RTG PKG DOWN
- ASSIST LMP FUEL RTG

ALSEP TRAVERSE
- RESET FAR UV CAMERA
- PULL COSMIC RAY - RED RING
- CLOSE SEQ BAY DOORS
- INITIALIZE LRV NAV
- DRIVE LRV TO ALSEP SITE
- AT C/S HEAD 290° FOR 30
- PARK LRV 60 FT. SSE
- CONFIG. LCRU CO

PANS
OM ETB
E LM AREA PAN QUAD II
- HEDC TO LRV

LRV LOAD UP
- INSTALL ON LRV
  - LCRU
  - TCU
  - LGA
  - HGA
  - TV CAMERA
- CONFIGURE LCRU COMM
- ETB CONTENTS TO LRV
- ETB (EMPTY) TO SRC TABLE
- SRC #1 SCB TO LRV
- ALSD TO LRV
- BORE & CORE STEMS TO LRV

INGRESS
- REMOVE EVA I PALLET FROM MESA
- INGRESS LM WITH PALLET
- POWER DOWN COMM
- UNSTOW PALLET CONTENTS

EGRESS & FLAG DEPLOY
- EGRESS
- CLOSE HATCH
- DISCARD PALLET
- DESCEND TO SURFACE
- RETRIEVE HEDC FROM LRV
- PHOTO CDR

ALSEP OFFLOAD
- OPEN SEQ BAY DOORS
- REMOVE EXP. PACKAGE
- ROTATE CASK DOWN
- REMOVE CASK DOME
- REMOVE FUEL ELEMENT
- INSERT FUEL ELEMENT INTO RTG

ALSEP TRAVERSE
- CARRY ALSEP TO DEPLOYMENT SITE

50 | 1+00 | 1+10 | 1+20 | 1+30 | 1+40

---

10 | 3+20 | 3+30 | 3+40 | 3+50 | 4+00

UMPER
TE THUMPER;
3RD GEOPHONE
FT. INTERVALS ALONG CABLE BACK TO C/S

DEPLOY ASE MORTAR PKG. ON BASE
- DEPLOY M/P ON BASE 58 FT. NNE OF C/S
- LEVEL & ALIGN
- DEPLOY M/P ANTENNA

CORE RECOVERY
- PULL UP ON DRILL AS FAR AS POSSIBLE BY HAND
- REMOVE DRILL
- CARRY ENTIRE STRING TO LRV, INSERT IN VISE
- SEPARATE STRING BETWEEN 3RD & 4TH SECTION
- STOW 2 SEGMENTS IN BAG

CONFIGURE FOR GEOLOGY

TRAVERSE TO GEOLOGY ST
- DRIVE LRV TO GEOLOGY STATION #1

EXPERIMENTS
ACTIVITY WITH CDR THUMPING

DEEP CORE DRILLING
- SELECT DEEP CORE DRILLING SITE
- IMPLANT 6 CORE STEMS AT APPROX. 1 INCH/SEC.

CORE RECOVERY
- ASSIST CDR
- JACK DRILL STRING OUT OF SURFACE IF REQ'D.
- ASSIST CDR
- ASSIST CDR

CONFIGURE FOR GEOLOGY

TRAVERSE TO GEOLOGY ST
- DRIVE LRV TO GEOLOGY STATION #1

10 | 3+20 | 3+30 | 3+40 | 3+50 | 4+00

---

40 | 5+50 | 6+00 | 6+10 | 6+20 | 6+30

TRAVERSE TO STA. #3
- DRIVE TO STATION #3

STATION #3
- LRV GRAN PRIX
- ARM M/P, C/S SW 5 CCW
- RETURN TO LM

EVA CLOSEOUT
- PARK LRV AT MESA
- CONFIGURE LRV COMM.
- PHOTO & RESET FAR UV CAMERA
- REMOVE LMP GEO. EQUIP.
- PACK ETB
  - 2 - 70 MM CAMERAS
  - 70 MM MAGS
  - 16 MM MAGS
  - MAPS
- PACK SAMPLE CONTAINMENT BAGS
- CLEAN L

TRAVERSE TO STA. #3
- DRIVE TO STATION #3

STATION #3
- LRV GRAN PRIX PHOTOS
- PICK UP CORE STEMS
- RETURN TO LM

EVA CLOSEOUT
- READ OUT LRV NAV DISPLAYS
- PLACE CORE STEMS IN BAG
- DEPLOY SWC AT 2:00/60'
- REMOVE CDR GEO. EQUIP
- PACK SRC #1
- CLOSE & SEAL SRC
- CLOSE MESA B
- CLEAN CD

40 | 5+50 | 6+00 | 6+10 | 6+20 | 6+30

APOLLO 16 SUMMARY TIME LINE

LUNAR SURFACE NOMINAL EVA 1

1+40 | 1+50 | 2+00 | 2+10 | 2+20

OWN

ALSEP TRAVERSE
- RESET FAR UV CAMERA
- PULL COSMIC RAY - RED RING
- CLOSE SEQ BAY DOORS
- INITIALIZE LRV NAV
- DRIVE LRV TO ALSEP SITE
- AT C/S HEAD 290° FOR 300 FT.
- PARK LRV 60 FT. SSE OF C/S
- CONFIG. LCRU COMM.

ALSEP INTERCONNECT
- UNSTOW RTG CABLE
- READ AMMETER & REPORT
- CONNECT RTG TO CENTRAL STATION
- REMOVE SUBPALLET FROM EXP. PKG.
- DEPLOY PSE STOOL
- STOW ANTENNA MAST ON SUBPALLET
- ROTATE EXP. PKG. TO SURFACE

PSE DEPLOY
- REMOVE PSE FROM EXP. PKG.
- PLACE PSE ON STOOL
- REMOVE PSE GIRDLE
- DEPLOY THERMAL SHROUD
- LEVEL & REPORT ALIGNMENT

ASE OFFLOAD
- VERIFY C/S SWITCH #5 IS CW
- REMOVE T/G FROM EXP. PKG.
- STOW T/G AGAINST SUBPALLET

ERECT C/S
- REMOVE LSM FROM EXP. PKG.
- LEVEL & ALIGN EXP PKG
- RELEASE C/S BOYD BOLTS
- RAISE C/S
- ATTACH SIDE CURTAINS
- INSTALL ANTENNA MAST
- INSTALL AIMING MECH. ON MAST

EMENT

ELEMENT

ALSEP TRAVERSE
- CARRY ALSEP TO DEPLOYMENT SITE

ALSEP SITE SURVEY
- DISENGAGE PACKAGES
- POSITION EXP. PKG.
- POSITION RTG PKG. 8' WEST OF EXP. PKG.

HFE EQUIP. PREPARATION
- REMOVE MORTAR PKG. BASE
- ROTATE RTG PKG. TO SURFACE
- LIFT HFE SUBPALLET
- CONNECT HFE CABLE TO C/S
- CARRY HFE 30' S OF C/S
- REMOVE PROBE PKG. & SEPARATE
- CARRY PROBE #1 TO BORE HOLE SITE
- CARRY PROBE #2 TO BORE HOLE SITE
- DEPLOY DRILL & CARRY TO HFE BORE HOLE #1 SITE

HFE PROBE # 1
- REMOVE DRILL THERMAL SHROUD
- IMPLANT 3 BORE STEM SECTIONS
- INSERT HFE PROBE #1
- REPORT DEPTH ON EMPLACEMENT TOOL
- EMPLACE 2ND SHIELD
- INSTALL TOP THERMAL SHIELD
- REPORT STEM HEIGHT ABOVE SURFACE

1+40 | 1+50 | 2+00 | 2+10 | 2+20

4+00 | 4+10 | 4+20 | 4+30 | 4+40 | 4+50

IN VISE

D

AG

CONFIGURE FOR GEOLOGY

TRAVERSE TO GEOLOGY STATION #1
- DRIVE LRV TO GEOLOGY STATION #1

GEOLOGY STATION #1
- TV
- RAKE/SOIL
- CRATER SAMPLING

REQ'D.

CONFIGURE FOR GEOLOGY

TRAVERSE TO GEOLOGY STATION #1
- DRIVE LRV TO GEOLOGY STATION #1

GEOLOGY STATION #1
- PHOTO PAN
- RAKE/SOIL
- CRATER SAMPLING

4+00 | 4+10 | 4+20 | 4+30 | 4+40 | 4+50

6+30 | 6+40 | 6+50 | 7+00

CAMERA

EQUIP.

CAMERAS

GS

GS

ONTAINMENT BAGS

- CLEAN LMP'S EMU

EVA TERMINATION
- SWITCH LCRU PWR-OFF
- ADJUST LCRU BLANKETS
- OPEN LRV BATT COVERS
- INGRESS LM CARRY SRC #1; ETB
- RESET FAR UV CAMERA
- CLEAN EMU
- CABIN REPRESS

EQUIP

- PACK SRC #1
- CLOSE & SEAL SRC #1
- CLOSE MESA BLANKETS
- CLEAN CDR'S EMU

EVA TERMINATION
- INGRESS LM; CARRY: SCB ; CORE STEMS
- CLOSE HATCH

6+30 | 6+40 | 6+50 | 7+00

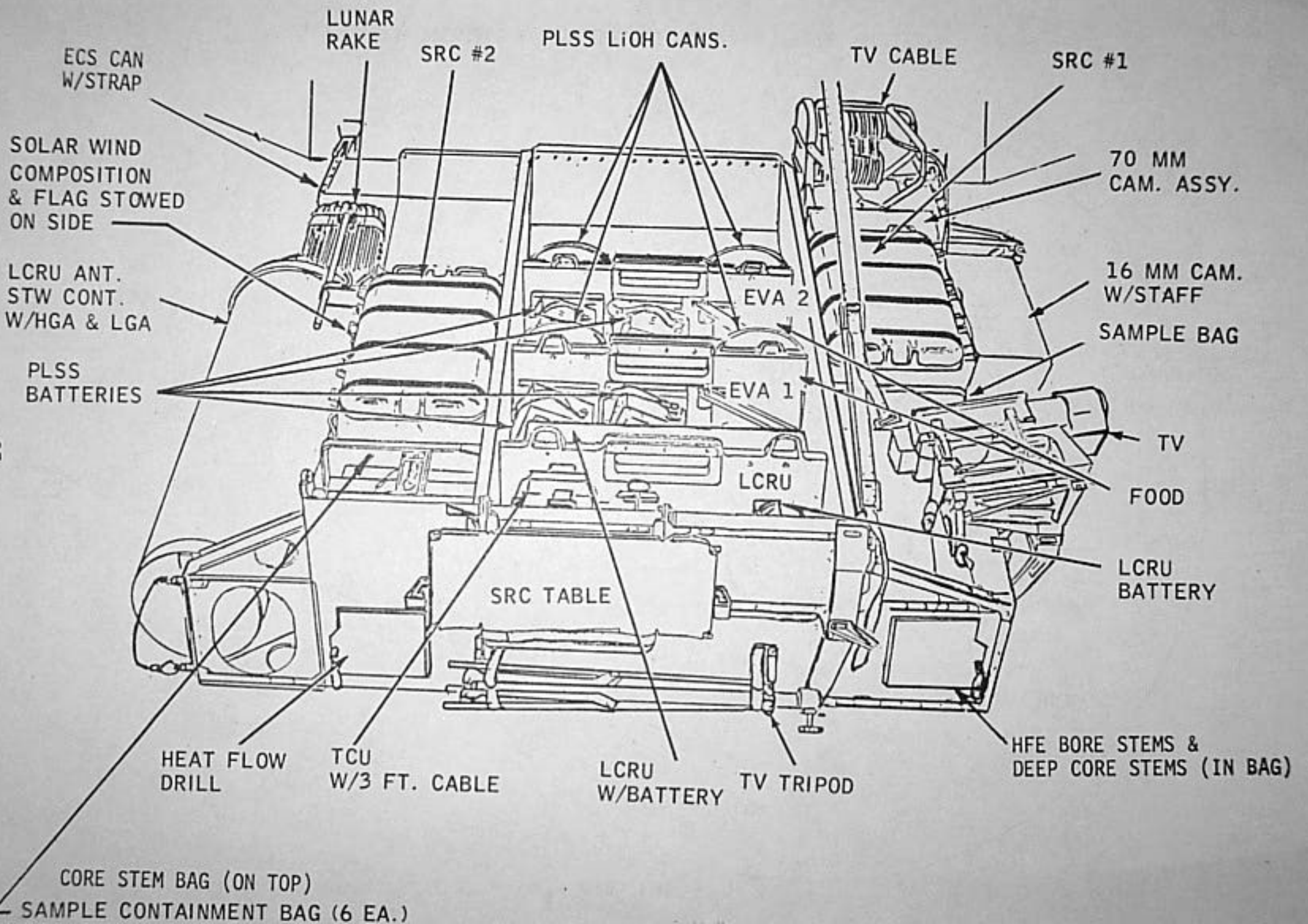
LEGEND

EVENT LINE — SEPARATES MAJOR BLOCKS OF ACTIVITY

COORDINATED TASKS

NOTE:
ACTIVITY TIMES WITHIN AN EVENT NOT FIXED.

NAME	INITIAL	ORIGIN	
R. KOPPA			NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
R.R.KAIN	RRK	NCSA	APOLLO 16 SUMMARY TIMELINE LUNAR SURFACE NOMINAL EVA 1
DR/A. HICKMAN			FIGURE 3.1-1
			BASIC MAR. 1972


LUNAR RAKE
ECS CAN W/STRAP
SRC #2
PLSS LiOH CANS.
TV CABLE
SRC #1
SOLAR WIND COMPOSITION & FLAG STOWED ON SIDE
70 MM CAM. ASSY.
LCRU ANT. STW CONT. W/HGA & LGA
16 MM CAM. W/STAFF
SAMPLE BAG
EVA 2
EVA 1
PLSS BATTERIES
TV
LCRU
FOOD
LCRU BATTERY
SRC TABLE
HFE BORE STEMS & DEEP CORE STEMS (IN BAG)
HEAT FLOW DRILL
TCU W/3 FT. CABLE
LCRU W/BATTERY
TV TRIPOD
CORE STEM BAG (ON TOP)
SAMPLE CONTAINMENT BAG (6 EA.)

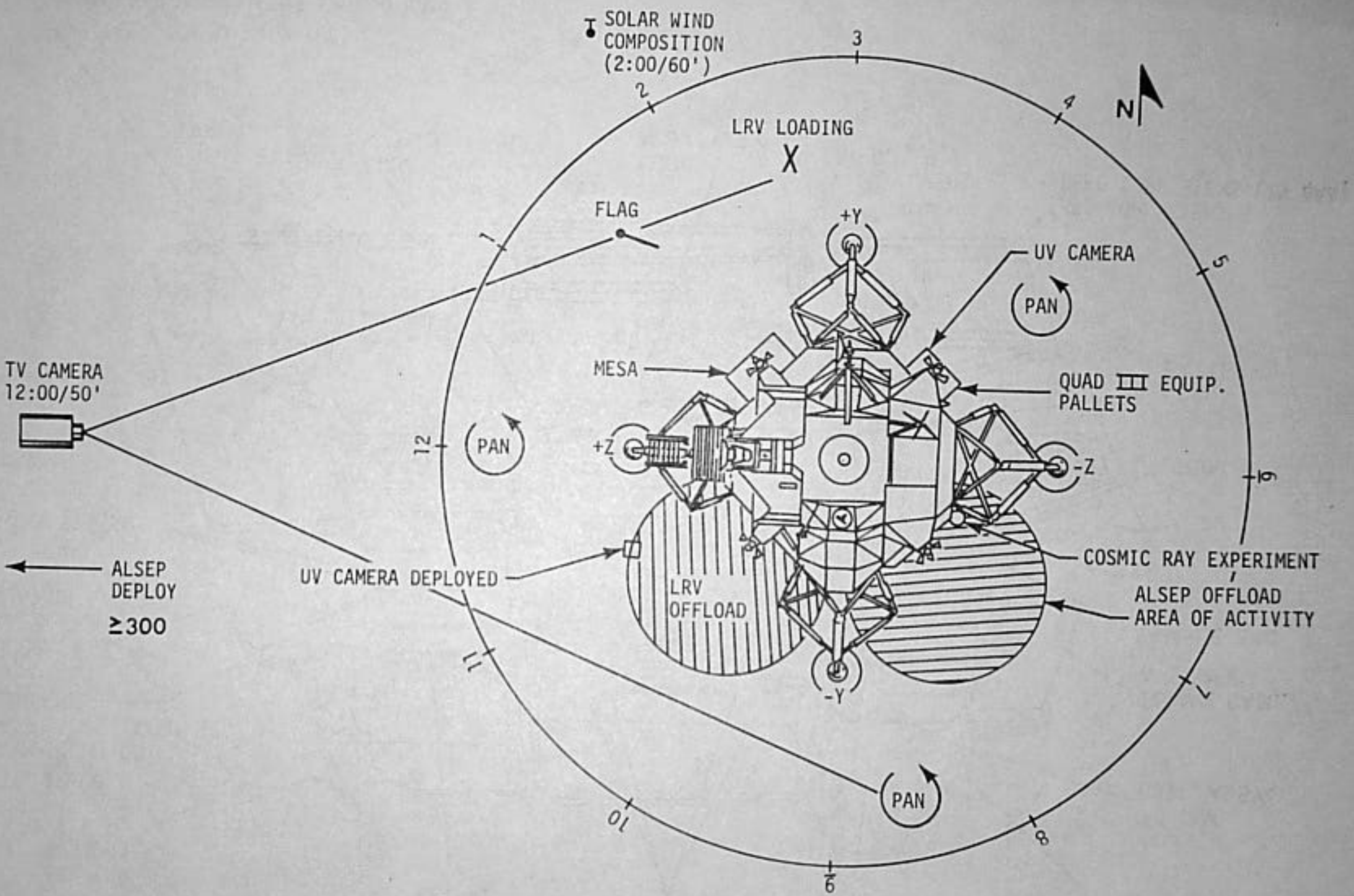


FIGURE 3.1-3 PROBABLE AREAS FOR

The two crewmen then tackle LRV (Lunar Roving Vehicle) unloading and set up. This process is shown in Figure 3.1-2. The LRV comes out of the side (Quad I) of the LM like a folding bed. The two crewmen complete the unfolding and preparation of the LRV, following which the CDR does a system checkout, and takes a short spin around the LM to the vicinity of the MESA. The LMP performs a LM walkaround and photographic documentation of the spacecraft as it is situated.

As soon as the CDR has satisifed himself that all is in order with the LRV, and has parked it by the MESA, he goes to the side of the spacecraft known as Quad III (see figure 3.1-2) and takes out the Far UV (Lyman-Alpha) Camera, a miniature astronomical observatory. See Figure 3.4-4 for a description of this experiment. The camera, essentially a Schmidt camera and spectrograph, is set up on tripod legs in the shadow of the LM not far from where the LRV was deployed. At appropriate times during the next 20 hours of surface EVA time, the CDR will return to this camera to select new pre-designated targets.

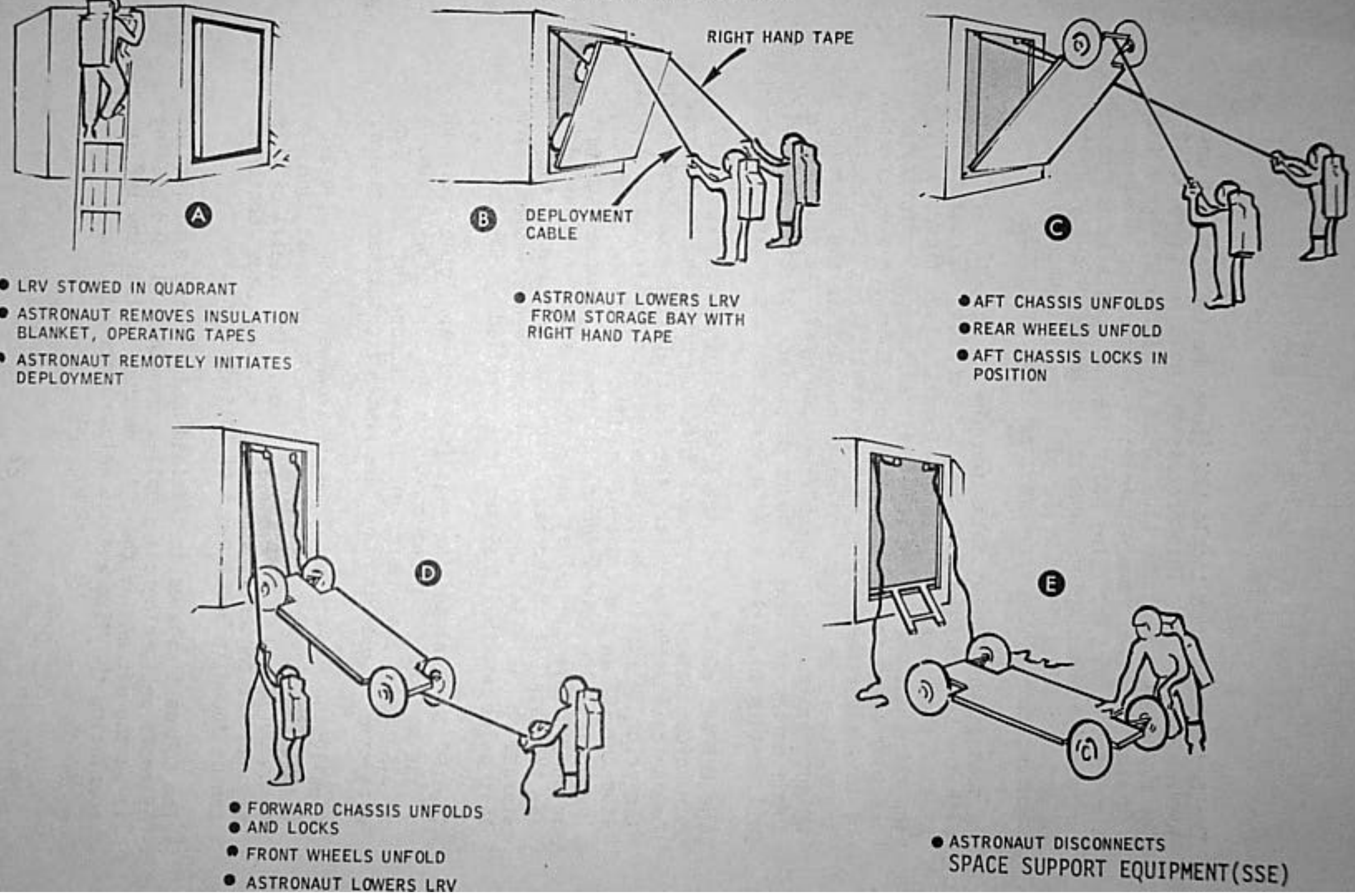
The LMP has been busy during this period setting up the LRV communication and TV system. This comprises the LCRU (Lunar Communications Relay Unit), the TCU (Television Control Unit) the color TV itself, which is moved from its tripod to a post atop the TCU in the front of the LRV, and the two antennas, the helical low gain antenna, and the dish-shaped high gain antenna. This communications array is shown in Figure 3.5-1. The LMP gets all of the requisite components out of their stowage on the MESA, installs and interconnects them. From this point on, the TV system is controlled by MCC.

The LMP then unloads the magazines and maps, other gear out of the bag the CDR brought down to the surface with him. He also takes two cameras off the MESA, one the CDR's 70mm data camera, and the other the 16mm motion picture camera.

Finally, he takes a metal sample stowage container, a SRC (Sample Return Container) from the MESA, opens it, and takes out a bag of sampling supplies. The details of this bag and its contents, as well as the other bags' contents can be found in Section 3.5 of this document.

The CDR participates in LRV load up by taking a pallet full of tools and geological supplies from Quad III and placing it on the aft end of the LRV. He then assists the LMP in completing the MESA and bag unloading chores.

Figure 3.1-4 LRV DEPLOYMENT SEQUENCE



The LMP takes a supply pallet out of the MESA, re-enters the ascent stage to switch the LM communications system to low power (now the LRV system is functional) and regains the surface.

Following a flag deployment ceremony, the crew proceeds around the LM to Quad II and ALSEP offload. The 2 packages are taken out of the quad, and the LMP transfers a radio-active fuel capsule to the Radioisotope Thermoelectric Generator unit on one of the packages that will ultimately power the entire ALSEP.

The LMP picks up the two packages bar-bell fashion, and moves out to the designated ALSEP deployment area, some 100 meters west of the LM. The CDR retargets the Far UV camera and configures the Cosmic Ray Detector experiment for the remaining Lunar Surface stay time. He then mounts the LRV and drives out to the ALSEP site.

On arriving at the site, he receives an MCC advisal on the correct direction in which to lay out the geophone line (part of ALSEP). This line is nominally 290 degrees to facilitate pick up of LM ascent, and avoid the possibility of the grenades' (also part of ALSEP) firing into large craters, since the mortar box is set up to fire parallel to the geophone line of deployment. The CDR drives 100 meters along the required heading using the navigation system (see Section 3.7) to lay out a track to follow in deploying the geophone line.

He returns to the ALSEP site, where the LMP is beginning to set up the ALSEP packages, and parks 60 feet southeast of the central station of ALSEP and on a heading of 195° for good TV coverage.

He aligns the high gain antenna, switches LCRU modes, and joins the LMP to deploy the ALSEP.

In general, the CDR is responsible for deploying all experiments in ALSEP, except the HFE (Heat Flow Experiment). The LMP takes charge of the HFE and the drilling operations that are required to emplace the HFE.

The CDR deploys the PSE (Passive Seismic Experiment), the ASE (Active Seismic Experiment) and the LSM (Lunar Surface Magnetometer). The PSE is a sombrero-shaped package of seismographs which has been carried on all lunar landings to date. Refer to Section 3.4 for more data on these experiments.

The ASE comprises three distinct parts: a mortar package which contains 4 grenades which are planned to be fired long after the crew leaves the surface; a thumper device which has 19 charges (like dynamite caps) to induce artificial local "quakes," and (on the same frame as the thumper) an array of three geophones to be implanted along a 100 meter distance, at spaces of 50 meters. The ASE was flown on Apollo 14. The LSM is an array of magnetometers also flown on Apollo 12 and 15. The deployment layout is given in Figure 3.4-3.

The LMP takes a subpallet containing the HFE south 30 feet from the ALSEP central station, after connecting the experiment to the station. He goes through a preliminary layout and then readies the ALSD (Apollo Lunar Surface Drill) for implantation of the two 2.5 meter bore strings.

The ALSD is an improved version of the system that was used on Apollo 15. Each string consists of 3 sections, an initial 1.37 meter section, and two 0.71 meter sections. These screw together, and the drill is decoupled to add additional sections by using a special wrench.

After each hole is drilled and the bore stems are in the ground, a set of HFE thermocouple heater probes are emplaced using a special long tool.

The CDR, by this time, has completed laying out the PSE, the LSM, readying the ASE, and unfolding as well as activating the Central Station. The ALSEP is on the air. As a team, then, the CDR and LMP deploy the geophones. The CDR walks along the line he previously laid out with the LRV, and carries the spool-laden thumper. He unreels the geophone line, plus a power line back to the central station. The LMP follows along behind, stakes the lines down, and implants two of the three geophones as they unroll out of the thumper. The CDR takes care of the third and last geophone.

The LMP takes a series of documentation photos of ALSEP (see Figure 3.3.1) during the thumping experiment.

The CDR performs the thumping experiment. Every 15 feet he pauses at a white mark on the geophone line, and fires a charge, which is picked up and transmitted by the ALSEP geophones and system to earth. This yields valuable seismologic information to the ASE scientific investigations.

Following this experiment, the CDR deploys the mortar package on a special base nearly 17 meters distant to the NNE. The LMP gets ready to drill a core sample.

The core sample utilizes the same drill system as the HFE, and is very similar to that used on Apollo 15. The chief addition to the system is a jack, or core extractor to save time and energy in removing the core once the sample is taken. The LMP couples titanium fluted core stems together to take a sample 2.5 meters deep.

Both crewmen get the core out of the lunar surface, then unscrew the core making two sections, cap, and stow the sections nearby for later pickup.

With this operation, the ALSEP and related procedures are closed out, and the crew gets ready for geological investigation. They don some tools and sample bags (they have special tool carriers on their life support packs). They then mount the LRV and make for Station 1, "Flag" Crater.

The reader is referred to Section 3.6 for details on crew objectives and activities at all the traverse stations on the three EVA's. The crew procedure upon reaching a given station is repeated at all but a few very short stops. The CDR powers down the LRV, releases his belt and dismounts. He switches the LCRU to mode 2, FM/TV, which enables the TV signal to Houston. He aligns the High Gain Antenna to obtain the best link with ground and, finally, uses a LCRU-mounted dust brush to wipe the accummulated dirt off the TV, the Television Control Unit, and the LCRU thermal radiating surfaces. This cleaning prevents these vital units from over-heating. Meanwhile the LMP reports the LRV navigational and systems data as displayed on the LRV console to MCC, exits the LRV, and (in most cases) takes a preliminary photographic panorama.

When the crew leaves a station, the CDR mode switches the LCRU to 1, or voice-TM only (transmission via the LOW Gain Antenna) and repositions the TV. The LMP verifies all tools and equipment are secured, and both men board the LRV.

Station 1 on EVA 1 is 43 minutes in duration, and is spent near Plum Crater on the SE lip of Flag crater. The crew takes a rake/soil sample and does general documented sampling in this area. They then retrace their path to station 2, near Spook Crater. Here the LMP does geological tasks on his own, while the CDR makes a Lunar Portable Magnetometer reading.

This last device was carried on Apollo 14. It measures local magnetic fluxes, and is described in Section 3.4. The experiment consists of a tripod - mounted sensor, a reel with cable, and an electronics/readout device, all mounted or stowed on the LRV geopallet (see Figure 3.5-1.) Following a period of general sampling, the crew returns to the ALSEP site for a short time. This is dubbed Station 3, and consists of an LRV experiment called the "Gran Prix." The Gran Prix consists of one crewman driving the LRV in a series of stops, starts, and acceleration runs, in road test fashion, while the other man makes a four-minute movie of the proceedings. Then the CDR and LMP arm the mortar package (so it can later be fired after the crew has returned to Earth) and pick up the drill core sample.

The crew returns to the LM at six hours and twenty minutes into the EVA. The LRV is parked in the sun headed 354° (for thermal reasons) and powered down. The communications gear and batteries are dusted, then the CDR resets the Far UV Camera for its next target.

The LMP deploys the Solar Wind Composition Experiment, which has flown on all Apollo missions. This is an aluminum and platinum window shade on a pole.

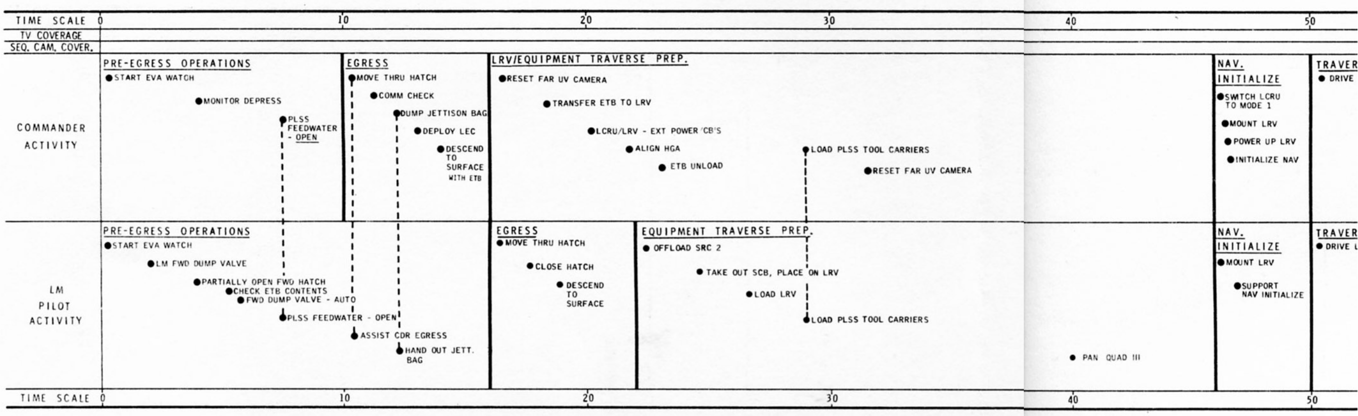
The two men unpack the tools and sample bags from each other's PLSS carriers, then pack up the cameras and film magazines. They leave the telephoto camera and the motion picture camera on the LRV between EVA's. The SRC is packed with the bag that came out of it, now filled with samples and rocks.

The LMP and CDR dust each other off, and the LMP takes a sample bag and the core stems up to the ascent stage. He ingresses the LM. The CDR retargets the Far UV camera for its between-EVA pictures, shuts down the LRV communication system, opens the LRV battery covers, and dusts the battery thermal surfaces if required. He transfers the SRC and the bag of cameras and magazines up to the LM "porch," hands them in to the LMP, and finally ingresses the spacecraft.

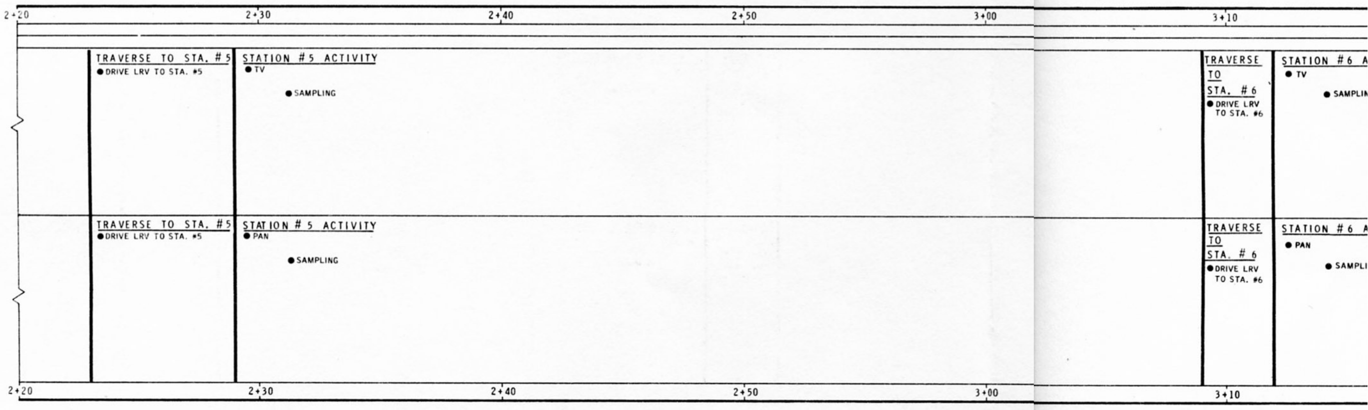
The hatch is closed and repressurization initiated to end the first EVA.

3.1.2 EVA 2

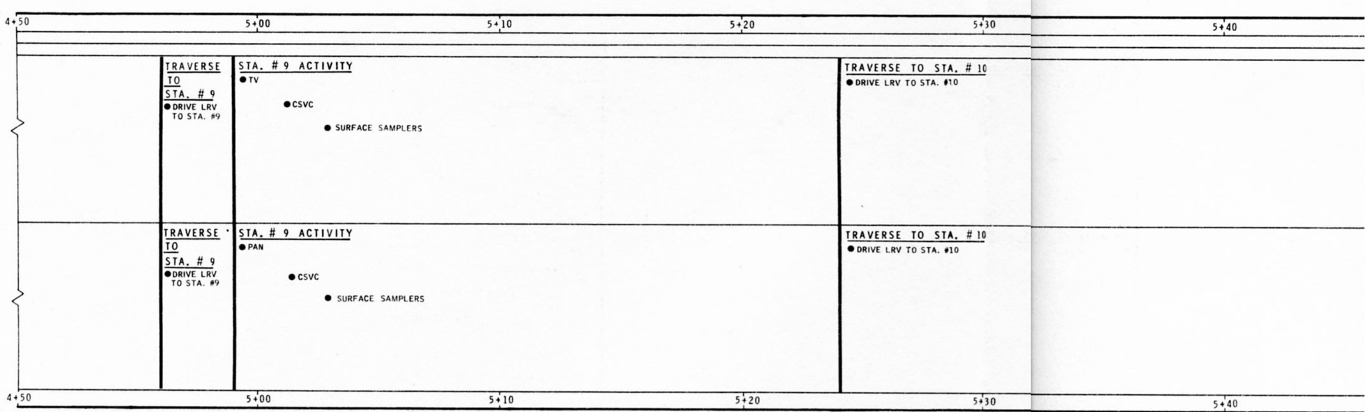
EVA 2 (see Figure 3.1-5) begins with depressurization of the cabin, followed by egress of the CDR, who drops the customary bag of discarded gear to the surface. He descends to the sur-



TIME SCALE 0 10 20 30 40 50
TV COVERAGE
SEQ. CAM. COVER.
COMMANDER ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
MONITOR DEPRESS
PLSS FEEDWATER - OPEN
EGRESS
MOVE THRU HATCH
COMM CHECK
DUMP JETTISON BAG
DEPLOY LEC
DESCEND TO SURFACE WITH ETB
LRV/EQUIPMENT TRAVERSE PREP.
RESET FAR UV CAMERA
TRANSFER ETB TO LRV
LCRU/LRV - EXT POWER CB'S
ALIGN HGA
ETB UNLOAD
LOAD PLSS TOOL CARRIERS
RESET FAR UV CAMERA
NAV. INITIALIZE
SWITCH LCRU TO MODE 1
MOUNT LRV
POWER UP LRV
INITIALIZE NAV
TRAVER
DRIVE
LM PILOT ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
LM FWD DUMP VALVE
PARTIALLY OPEN FWD HATCH
CHECK ETB CONTENTS
FWD DUMP VALVE - AUTO
PLSS FEEDWATER - OPEN
ASSIST CDR EGRESS
HAND OUT JETT. BAG
EGRESS
MOVE THRU HATCH
CLOSE HATCH
DESCEND TO SURFACE
EQUIPMENT TRAVERSE PREP.
OFFLOAD SRC 2
TAKE OUT SCB, PLACE ON LRV
LOAD LRV
LOAD PLSS TOOL CARRIERS
PAN QUAD III
NAV. INITIALIZE
MOUNT LRV
SUPPORT NAV INITIALIZE
TRAVER
DRIVE
TIME SCALE 0 10 20 30 40 50



2+20 2+30 2+40 2+50 3+00 3+10
TRAVERSE TO STA. #5
DRIVE LRV TO STA. #5
STATION #5 ACTIVITY
TV
SAMPLING
TRAVERSE TO STA. #6
DRIVE LRV TO STA. #6
STATION #6 A
TV
TRAVERSE TO STA. #5
DRIVE LRV TO STA. #5
STATION #5 ACTIVITY
PAN
SAMPLING
TRAVERSE TO STA. #6
DRIVE LRV TO STA. #6
STATION #6 A
PAN
2+20 2+30 2+40 2+50 3+00 3+10



4+50 5+00 5+10 5+20 5+30 5+40
TRAVERSE TO STA. #9
DRIVE LRV TO STA. #9
STA. #9 ACTIVITY
TV
CSVC
SURFACE SAMPLERS
TRAVERSE TO STA. #10
DRIVE LRV TO STA. #10
TRAVERSE TO STA. #9
DRIVE LRV TO STA. #9
STA. #9 ACTIVITY
PAN
CSVC
SURFACE SAMPLERS
TRAVERSE TO STA. #10
DRIVE LRV TO STA. #10
4+50 5+00 5+10 5+20 5+30 5+40

Time	50	1+00	1+10	1+20	1+30	1+40

	NAV. INITIALIZE	TRAVERSE TO STA. #4	STA. #4 ACTIVITY
Row 1	● SWITCH LCRU TO MODE 1 ● MOUNT LRV ● POWER UP LRV ● INITIALIZE NAV	● DRIVE LRV TO STA. #4	● TV ● RAKE SOIL ● DOUBLE CORE ● SAMPLING
Row 2	● MOUNT LRV ● SUPPORT NAV INITIALIZE	● DRIVE LRV TO STATION #4	● PAN ● 500 MM PHOTOS ● RAKE SOIL ● PENETROMETER ● DOUBLE CORE ● SAMPLING

Time	3+10	3+20	3+30	3+40	3+50	4+00

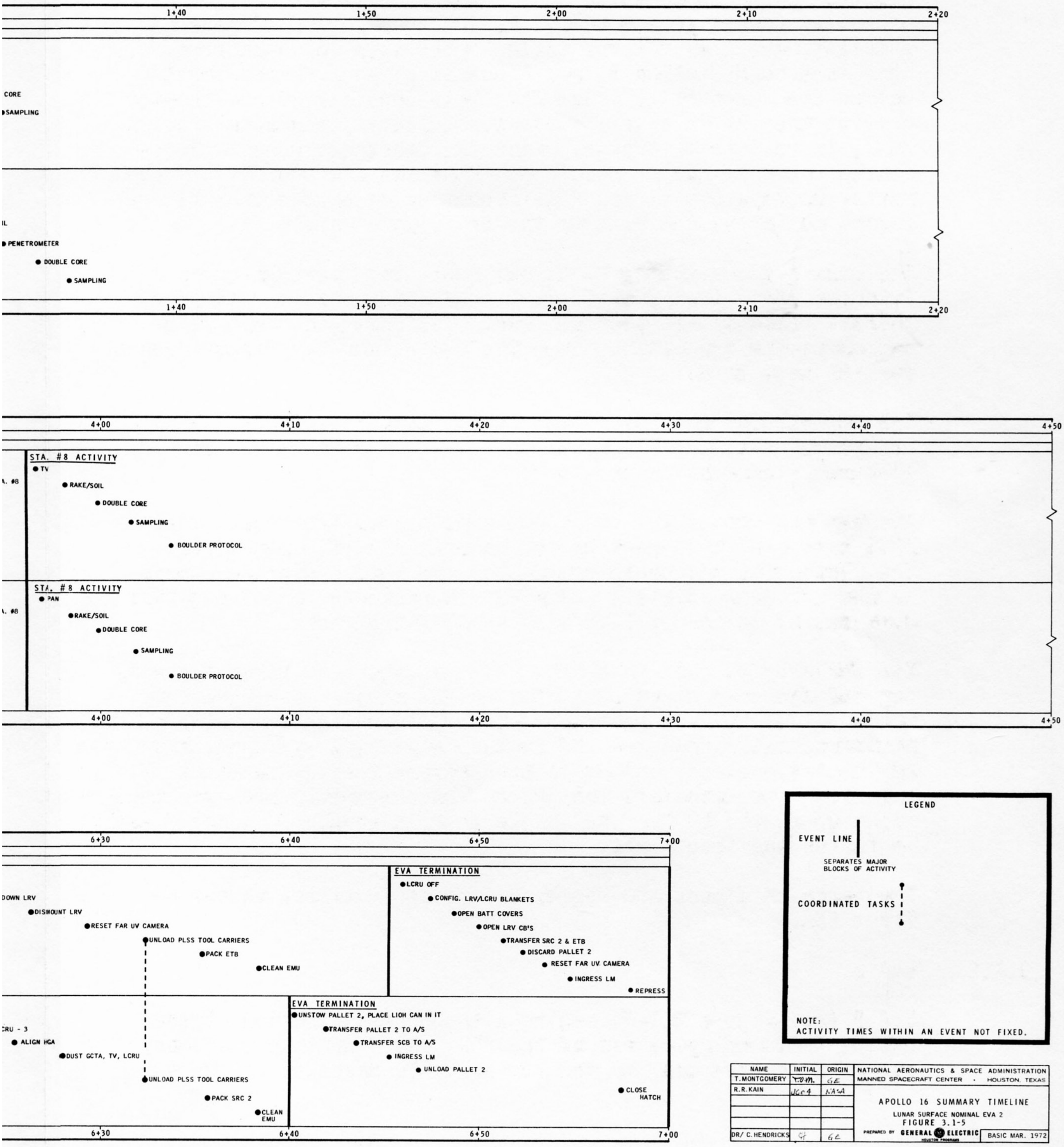
	TRAVERSE TO STA. #6	STATION #6 ACTIVITY	TRAVERSE TO STA. #7	STATION #7 ACTIVITY	TRAVERSE TO STA. #8	STA. #8 ACTIVITY
Row 1	● DRIVE LRV TO STA. #6	● TV ● SAMPLING	● DRIVE LRV TO STA. #7	● TV ● SAMPLING	● DRIVE LRV TO STA. #8	● TV ● RAKE/SOIL ● DOUBLE CORE ● SAMPLING ● BOULDER PROTOCOL
Row 2	● DRIVE LRV TO STA. #6	● PAN ● SAMPLING	● DRIVE LRV TO STA. #7	● PAN ● 500 MM PHOTOS ● SAMPLING	● DRIVE LRV TO STA. #8	● PAN ● RAKE/SOIL ● DOUBLE CORE ● SAMPLING ● BOULDER PROTOCOL

Time	5+40	5+50	6+00	6+10	6+20	6+30

	STA. #10 ACTIVITY	EVA CLOSEOUT
Row 1	● TV ● DOUBLE CORE ● TRENCH ● SAMPLING ● RETURN TO LM	● PARK LRV AT MESA ● POWER DOWN LRV ● DISMOUNT LRV ● RESET FAR UV CAMERA ● UNLOAD PLSS TOOL CARRIERS ● PACK ETB
Row 2	● PAN ● DOUBLE CORE ● PENETROMETER ● TRENCH SAMPLES ● RETURN TO LM	● DISMOUNT LRV ● SWITCH LCRU - 3 ● ALIGN HGA ● DUST GCTA, TV, LCRU ● UNLOAD PLSS TOOL CARRIERS ● PACK SRC 2

APOLLO 16 SUMMARY TIMELINE

LUNAR SURFACE NOMINAL EVA 2



NAME	INITIAL	ORIGIN	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER · HOUSTON, TEXAS
T. MONTGOMERY	T.O.M.	GE	
R.R. KAIN	JGC4	NASA	APOLLO 16 SUMMARY TIMELINE
			LUNAR SURFACE NOMINAL EVA 2
			FIGURE 3.1-5
DR/ C. HENDRICKS	CH	GE	PREPARED BY GENERAL ELECTRIC HOUSTON PROGRAMS — BASIC MAR. 1972

face, bearing the ETB, and activates the television system on the front of the LRV. The LMP follows the CDR soon afterwards, As soon as the TV is up, the CDR resets the FAR UV Camera to a new target for the duration of the pre-traverse activities.

Both crewmen load up for the traverse. The LMP gets out the second SRC (Sample Return Container) while the CDR unpacks the cameras and magazines, together with the map package for EVA 2. The LMP is loaded with the hammer, core tube rammer, core caps, and a sample bag. Some of the contents of the SRC bag are relocated to another, similar bag for use in EVA 3; the latter bag is stowed under the LMP seat. The SRC bag with its remaining gear, which comprises core tubes, a special core tube vacuum container, and a smaller vacuum container is stowed on the CDR's PLSS.

Packs of small teflon sample bags from the SRC bag are affixed to each of the crewmen's data cameras.

After a final check that all supplies and tools are in place on the LRV or on the crewmen's back packs, the Far UV Camera is again retargeted. The crew mounts the LRV and initializes the navigation system. Then they depart, some fifty minutes after depressurization, for the excursion to Stone Mountain, "Stubby" and Wreck" Crater.

For details on the EVA 2 traverse, and Stations 4 through 10, see Section 3.6.

At 20 minutes past the sixth hour of EVA 2, the crew returns to the LM for closeout. The LRV is parked, on a Heading of 351° , cross-sun in the sun facing north, not far from the MESA. As has been done at every stop during the traverse, the communication gear is thoroughly dusted.

The LMP does this chore while the CDR retargets the Far UV Camera, following which the two men unload their PLSS tool carriers. The SRC bag, now filled with samples, core tube samples, and the two filled vacuum containers, is replaced in the SRC and the SRC made ready for transit into the ascent stage. Other bags with samples are off loaded for later transfer. Finally, the hand tools go back on the hand tool carriers on the back of the LRV.

The CDR and LMP clean each other off, and the LMP ingresses the LM with sample bag(s). He also carries in supply pallet no. 2 from the MESA, in which he has installed the spare spacecraft LiOH canister.

The CDR lingers to retarget the Far UV Camera and turn off the LCRU. He then climbs the ladder with the SRC in hand. He receives the stripped pallet 2 in exchange for the SRC when he reaches the platform or "porch" of the LM. The pallet is dropped, then the CDR pulls up the cameras and magazines in their bag by means of a short tether he attached while on the surface. This bag he hands in to the LMP, then he moves through the hatch. Repressurization is initiated to terminate EVA 2.

3.1.3 EVA 3

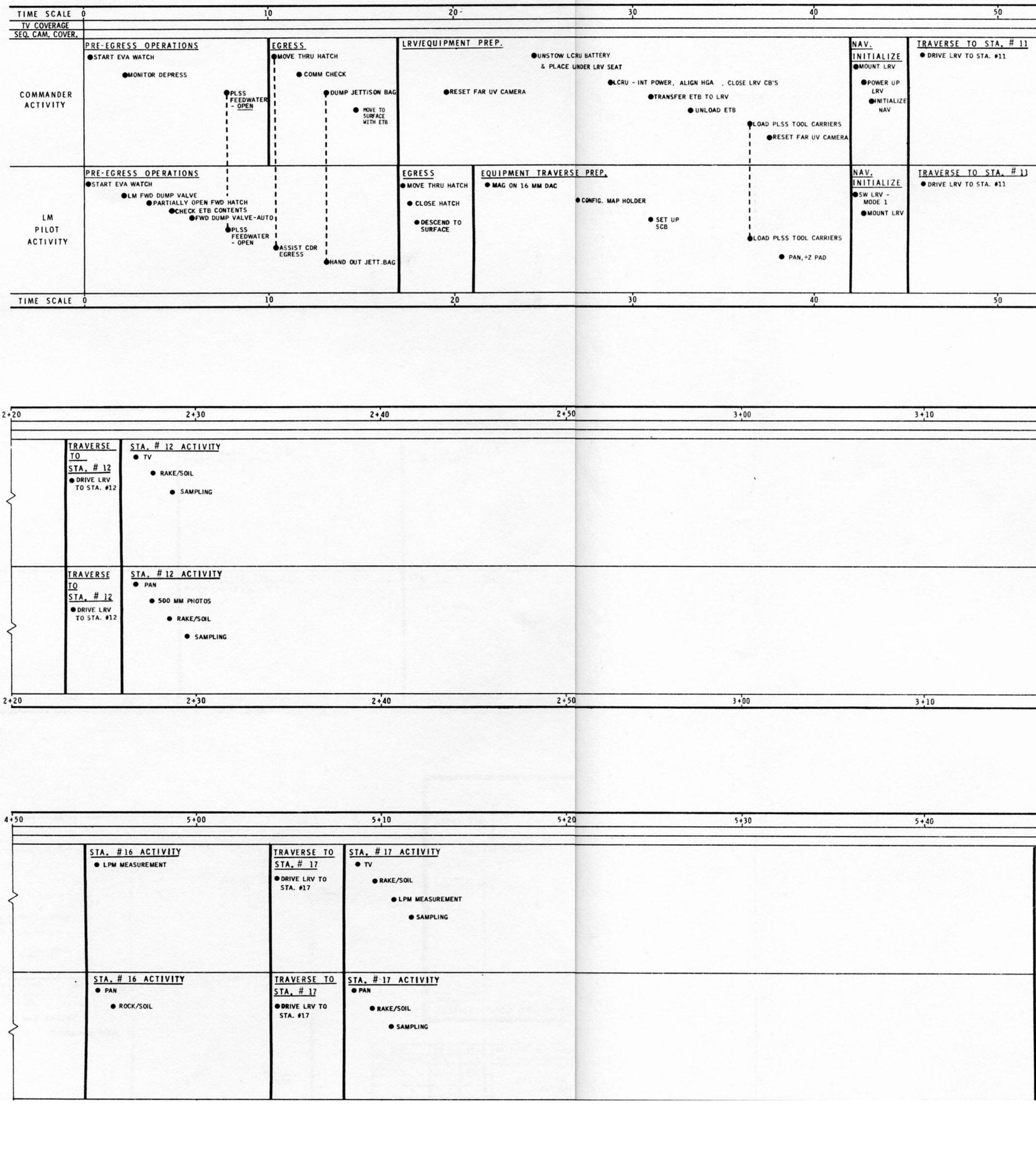
EVA 3 begins with depressurization of the cabin, after which the CDR descends to the surface laden with the camera bag. See Figure 3.5-6 for a general timeline of these activities. He immediately retargets the Far UV Camera, while the LMP egresses and descends to the surface, the LMP unpacks the camera/magazine bag as his next task, as the CDR brings the communications systems to life. Then the crewmen load each other's PLSS tool harnesses. The CDR places the "spare" sample collection bag (stowed with geological supplies under the LMP seat on EVA 2) on the LMP, together with the usual tools from the LRV. The LMP in turn, puts an extra sample collection bag on the CDR.

The LRV is checked to ensure that all the requisite tools and equipment are in place. Then the CDR selects a new target on the Far UV Camera, and both men mount the LRV. The navigational system is initialized, and the crewmen depart at about 45 minutes into the EVA timeline for their northerly sortie to North Ray Crater and Smoky Mountains.

Please refer to Section 3.6 for specific details on the crewmen activities on the EVA 3 traverse at stations 11-17.

The crew returns to the LM to begin final closeout at five minutes after six hours into the timeline.

Once again, the LRV is parked close to the MESA, but in sunlight. The radiating surfaces are dusted by the LMP while the CDR selects the final target of the Far UV Camera. The LMP packs up all the film magazines and clears the LRV of all returnable items and samples. The CDR walks around the spacecraft and retrieves the Cosmic Ray Experiment. He folds the


TIME SCALE 0 10 20 30 40 50
TV COVERAGE
SEQ. CAM. COVER.
COMMANDER ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
MONITOR DEPRESS
PLSS FEEDWATER - OPEN
EGRESS
MOVE THRU HATCH
COMM CHECK
DUMP JETTISON BAG
MOVE TO SURFACE WITH ETB
LRV/EQUIPMENT PREP.
RESET FAR UV CAMERA
UNSTOW LCRU BATTERY & PLACE UNDER LRV SEAT
LCRU - INT POWER, ALIGN HGA , CLOSE LRV CB'S
TRANSFER ETB TO LRV
UNLOAD ETB
LOAD PLSS TOOL CARRIERS
RESET FAR UV CAMERA
NAV. INITIALIZE
MOUNT LRV
POWER UP LRV
INITIALIZE NAV
TRAVERSE TO STA. # 11
DRIVE LRV TO STA. #11
LM PILOT ACTIVITY
PRE-EGRESS OPERATIONS
START EVA WATCH
LM FWD DUMP VALVE
PARTIALLY OPEN FWD HATCH
CHECK ETB CONTENTS
FWD DUMP VALVE-AUTO
PLSS FEEDWATER - OPEN
ASSIST CDR EGRESS
HAND OUT JETT. BAG
EGRESS
MOVE THRU HATCH
CLOSE HATCH
DESCEND TO SURFACE
EQUIPMENT TRAVERSE PREP.
MAG ON 16 MM DAC
CONFIG. MAP HOLDER
SET UP SCB
LOAD PLSS TOOL CARRIERS
PAN, +Z PAD
NAV. INITIALIZE
SW LRV - MODE 1
MOUNT LRV
TRAVERSE TO STA. # 11
DRIVE LRV TO STA. #11
TIME SCALE 0 10 20 30 40 50
2+20 2+30 2+40 2+50 3+00 3+10
TRAVERSE TO STA. # 12
DRIVE LRV TO STA. #12
STA. # 12 ACTIVITY
TV
RAKE/SOIL
SAMPLING
TRAVERSE TO STA. # 12
DRIVE LRV TO STA. #12
STA. # 12 ACTIVITY
PAN
500 MM PHOTOS
RAKE/SOIL
SAMPLING
2+20 2+30 2+40 2+50 3+00 3+10
4+50 5+00 5+10 5+20 5+30 5+40
STA. #16 ACTIVITY
LPM MEASUREMENT
TRAVERSE TO STA. # 17
DRIVE LRV TO STA. #17
STA. # 17 ACTIVITY
TV
RAKE/SOIL
LPM MEASUREMENT
SAMPLING
STA. # 16 ACTIVITY
PAN
ROCK/SOIL
TRAVERSE TO STA. # 17
DRIVE LRV TO STA. #17
STA. # 17 ACTIVITY
PAN
RAKE/SOIL
SAMPLING

APO

1+00 1+10 1+20 1+30 1+40 1+50

STA. # 11 ACTIVITY
- TV
- NEAR FIELD POL SAMPLING
- SAMPLING
- PAN

STA. # 11 ACTIVITY
- PAN
- 500 MM PHOTOS
- FAR FIELD POL NO. 1
- NEAR FIELD POL
- SAMPLING
- FAR FIELD POL NO. 2

1+00 1+10 1+20 1+30 1+40 1+50

3+20 3+30 3+40 3+50 4+00 4+10

TRAVERSE TO STA. # 13
- DRIVE LRV TO STA. #13

STA. # 13 ACTIVITY
- ROCK/SOIL

TRAVERSE TO STA. # 14
- DRIVE LRV TO STA. #14

STA. # 14 ACTIVITY
- TV
- RAKE/SOIL
- DOUBLE CORE
- SAMPLING

TRAVERSE TO STA. # 13
- DRIVE LRV TO STA. #13

STA. # 13 ACTIVITY
- PAN
- ROCK/SOIL

TRAVERSE TO STA. # 14
- DRIVE LRV TO STA. #14

STA. # 14 ACTIVITY
- PAN
- 500 MM PHOTOS
- RAKE/SOIL
- DOUBLE CORE
- SAMPLING

3+20 3+30 3+40 3+50 4+00 4+10

5+50 6+00 6+10 6+20 6+30 6+40

TRAVERSE TO LM
- DRIVE LRV TO LM

EVA CLOSEOUT
- PARK LRV AT MESA
- POWER DOWN LRV
- DISMOUNT LRV
- RESET FAR UV CAMERA
- UNLOAD PLSS TOOL CARRIERS
- RECOVER COSMIC RAY EXP.
- FOLD & BAG COSMIC RAY EXP.
- GET BIG ROCK BAG - PUT ON LADDER HOOK
- SW LCRU - 1
- MOUNT & POWER UP LRV
- LRV GRAN PRIX
- PARK EAST OF LM 300 FT.
- LRV CLOSEOUT PER DECAL
- DISMOUNT LRV
- ALIGN HGA
- DUST GCTA, TV
- OPEN BATT COVERS, DUST IF DIRTY: DUST LCRU
- OPEN LCRU - 100%
- RETURN TV TO LM WITH DUST BRUSH
- PERFORM DAC SHOW
- CLEAN EMU
- RECOVER FAR UV CAM CASSETTE - PUT IN ETB
- READY ETB & SCB'S.
- OBSERVE DOCK LIGHT TEST

TRAVERSE TO LM
- DRIVE LRV TO LM

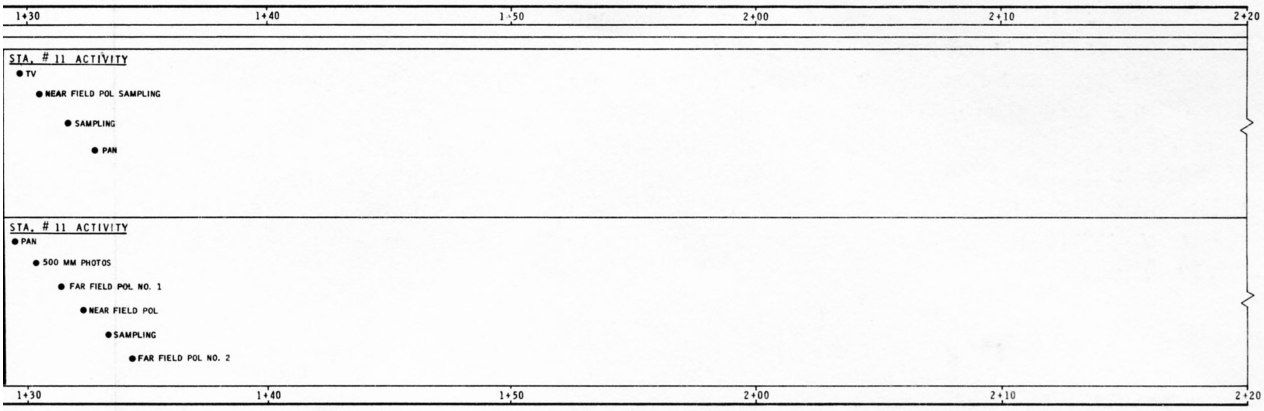
EVA CLOSEOUT
- DISMOUNT LRV
- ALIGN HGA
- SWITCH LCRU - 3
- DUST GCTA, TV, LCRU
- UNLOAD PLSS TOOL CARRIERS
- PACK ETB; MAGS - PENETROMETER DORUM
- BAG COSMIC RAY EXP.
- LRV GRAN PRIX PHOTO
- RETRIEVE SWC, BAG, STOW IN ETB
- POLICE AREA
- CLEAN EMU

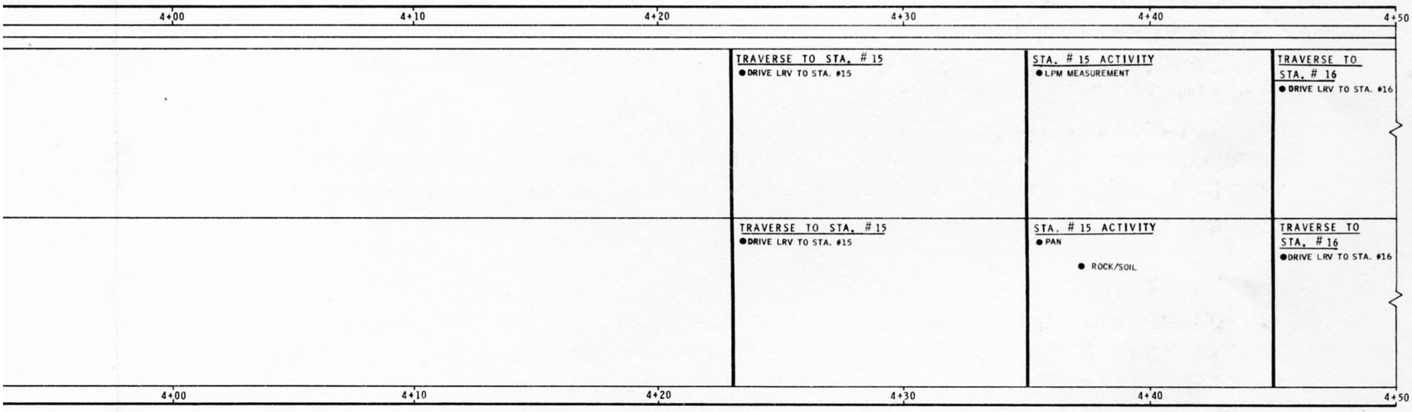
EVA TERMINATION
- ASCEND LADDER WITH BIG ROCK BAG & SCB
- DOCK LIGHT TE
- MOV

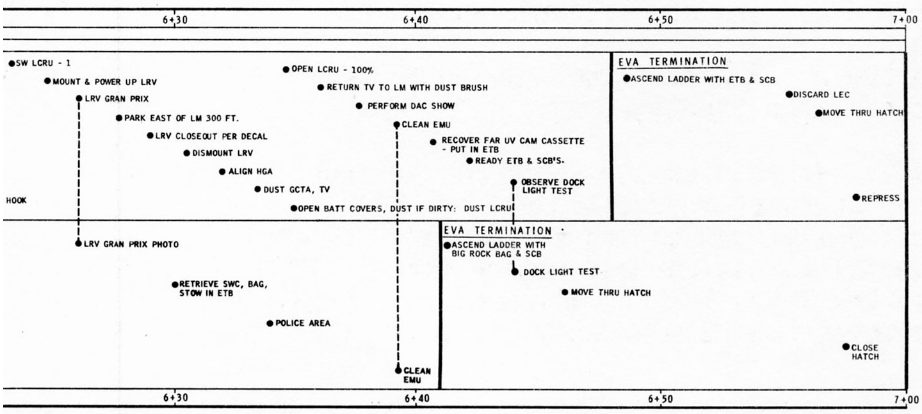
5+50 6+00 6+10 6+20 6+30 6+40

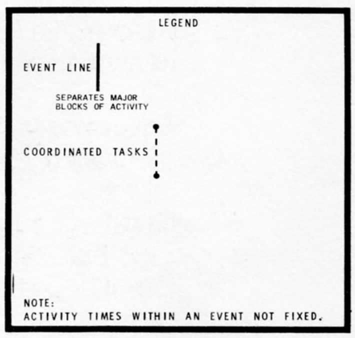
APOLLO 16 SUMMARY TIMELINE

LUNAR SURFACE NOMINAL EVA 3









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T. MONTGOMERY	Tom	GE	APOLLO 16 SUMMARY TIMELINE
R.R. KAIN	JGO A	NASA	LUNAR SURFACE NOMINAL EVA 3
			FIGURE 3.1-6
DR/C. HENDRICKS		GE	PREPARED BY GENERAL ELECTRIC HOUSTON PROGRAMS — BASIC MAR. 1972

experiment up and, with the LMP's help, bags it for return to earth. The LMP takes the motion picture camera off the LRV, while the CDR mounts the vehicle for the final time. The CDR powers up the LRV, and goes through a short "Gran Prix" exercise while the LMP films the procedure, if not achieved on EVA 1.

The CDR resets the navigation system at the LM and heads east 100 meters for the final resting spot for the LRV. He parks it on a heading of 165°, thoroughly cleans all radiation surfaces, and configures the system such that the LRV batteries power the communication system. He then walks back to the LM.

Meanwhile the LMP collects the Solar Wind Composition Experiment foil, bags, and places it in the camera magazine bag. He polices the area around the LM, especially in the direction of the ALSEP, to minimize the possibility that any loose equipment might be blown by the ascent stage engine into the experiments at the LM lift-off.

The crew takes a final DAC movie of general mobility, modes of translation across the surface, and other activities to provide data on human capability in the 1/6 G lunar environment.

The crew then cleans each other off, and makes ready for EVA termination. The final experimental procedure is to remove the film cassette from the Far UV Camera. The cassette joins the other magazines in the equipment bag.

The LMP ingresses first with the Big Rock Bag and a sample bag. The CDR follows soon after with the magazine and equipment bag and several sample bags which he hands in to the LMP. He moves through the hatch, and repressurization is initiated after hatch closure to end the 3rd EVA.

3.2 DETAILED EVA TIMELINE PROCEDURES

3.2.1 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. This data assures that the required information is given by the crew to MCC-H and assists capcom in essential communications with the crew. The crew's cuff checklist does not necessarily correspond to the vertical timeline in content or verbiage as this is a crew preference item and contains those cues the crew feels they need to accomplish the required tasks.

CODE

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

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

NOTE: AT START OF EVA 1

- SUN ANGLE ~ 14°
- LM SHADOW LENGTH ~ 27m (88 ft)
- ASTRONAUT SHADOW LENGTH ~ 7.3m (24 ft)

3/20/72 EVA 1 CDR-3

LRV OFF

PLSS TO LM H20 TRANSFER

PLSS Pump - OFF
Disconnect PLSS H20
Connect LM H20
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H20 TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H20
Connect PLSS H20
PLSS Pump - ON

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

3/20/72 EVA1 LMP-3

LRV OFF

PLSS TO LM H20 TRANSFER

PLSS Pump - OFF
Disconnect PLSS H20
Connect LM H20
CB(16) ECS: LCG Pump - CLOSE

LM TO PLSS H20 TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H20
Connect PLSS H20
PLSS Pump - ON

0+10

NOMINAL TIMELINE

LUNAR SURFACE EVA

MISSION: APOLLO 16
EVA : 1

DATE: 1 Feb, 1972

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

CREW EVA CHECKLIST

PLSS | EVA 1 | CDR-4 | 3/20/72 EVA 1

EVA 1

0+00 <u>CABIN DEPRESS</u> [OPEN
Start watch (call mark) [HATCH

0+10 <u>EGRESS</u>
PLSS ANT (LMP deploy)
Once outside - COMM CHECK
1. Jett bag-discard
2. MESA deploy
3. LEC on rail, lower ETB.

0+18 <u>FAMILIARIZATION</u>
1. Comment on surroundings
2. Jett bag under LM

0+23 <u>TV CAM</u>
1. MESA - adjust height
2. Blanket - loosen around lens

CDR-5 | 3/20/72 EVA 1 | LRV SET

3. MESA blankets - open
4. TV tripod - unstow & deploy (bottom front MESA)
5. TV cam - to tripod (verify handle off mirror)
6. TV sunshade (MESA pallet 1) to TV cam
7. TV - position 12:00, 50'
8. TV lens - (f16, 20MM, PK)
CK HOU reception
<u>DEPLOY LMP ANT</u>

0+30 <u>OFFLOAD LRV</u>
1. Open quad I thermal blkt
2. Unstow L side deployment cable & reel OPS tape & drape over strut
Conting. tool to LM strut

PLSS | LMP-4 | 3/20/72 EVA 1

EVA 1

0+00 <u>CABIN DEPRESS</u>
Open hatch

0+10 <u>CDR EGRESS</u>
Deploy CDR ANT
Jett bag to CDR
LEC & ETB to CDR

0+23 <u>EGRESS</u>
Close hatch

<u>FAMILIARIZATION</u> [TV DEPLOY

<u>MESA WORK</u>
1. Deploy SRC table
2. ALSD (L. MESA) to +Y pad
3. Bore & core stems (R. MESA) to +Y pad
4. ETB to table

VOICE DATA

0+10

(1) LMP - Deploy CDR PLSS antenna

(2) <u>ETB Contents</u>
- LMP HEDC with mag ____(A)
- 500 mm Cam with mag ____(L)
- 2-70 mm mags __(G),__(H)(HBW)
- 2-70 mm mags __(B),__(C)(HCEX)
- 3-DAC mags __(P),__(Q),__(R)
- Maps, LRV Ck. list, sun compass
- Map holder
- BSLSS
- 2-lens brushes
- 2-padded bags
- 20-Dsbd camera shoe

(1) CDR - Stability & mobility discussion

(1) CDR - LM check

0+20

(1) CDR - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(2) LMP - Verify CB config. - O.K.

(1) LMP - Stability & mobility discussion

(1) CDR - Deploy LMP PLSS antenna

(1) CDR - TV position - O.K.
<u>f:16</u>; <u>20 mm</u>; <u>PK</u>

(1) LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

0+30

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Place jettison bag in hatch	0+10	Move through hatch			EGRESS
Deploy CDR PLSS antenna		Deploy PLSS antenna			
		Comm. check			
Attach LEC to ETB		Descend ladder			
Pass ETB/LEC to CDR		Toss Jett Bag into Quad I			
		Deploy MESA			
Verify CB configuration		Deploy LEC/ETB to surface			
		Descend to footpad			
Obtain "GO" for egress		Step to surface			
		<u>CDR FAMILIARIZATION</u>			FAMILIARIZATION
		Check mobility & stability			
		Comment on surroundings			
	0+20				
		Kick Jett bag under LM			
<u>LMP EGRESS</u>		<u>DEPLOY TV CAMERA</u>			
Move through hatch		Adjust MESA height		EGRESS	TV DEPLOY
		Loosen blanket around TV lens			
Close hatch		Open MESA blankets			
Descend to footpad		Unstow & deploy TV tripod			
Step to surface		Unstow TV camera			
		Mount TV camera on tripod			
<u>LMP FAMILIARIZATION</u>		Pull TV cable slack from MESA		FAMILIARIZATION	
Check mobility & stability					
Comment on surface features		Position TV 12:00/50 ft. (f:16; 20mm; PK)			
Deploy SRC table		Check reception with MCC			
Deploy PLSS antenna (CDR)		Deploy LMP antenna			
Offload ALSD from MESA; place on +Y footpad		Remove and discard MESA TV stowage bracket			
	0+30				

CREW EVA CHECKLIST

LRV OFF | CDR-6 | 3/20/72 EVA 1

3. VERIFY walking hinge latches engaged-fwd, aft chassis parallel to center chassis, L&R outrigger cables taut
4. Deploy reel OPS tape, R side & back away from deploy area
5. VERIFY pins release, LRV rotates outboard [PULL D-HANDLE
6. Pull down on R reel tape until out-rigger cables slack [PULL ON DEPLOY CABLE
7. Pull R pin, out-rigger cable [PULL L PIP
8. When fwd wheels on surface, pull pins on deploy cable & fitting [LOWER

CDR-7 | EVA 1 | FAR UV

9. Raise geology pallet post [REL SADDLE
10. Cable & wheel lock struts away from LRV
11. Move LRV from LM

0+37 SET UP LRV

Do RH side - aft 1st [LMP DOES LH SIDE
1. Extend rear fender
2. Verify rear hinge pins & seal
3. Erect seal & unstow seat belt
4. Lower arm rest
5. Pull T-handle [BOTH
6. Lower console, raise handhold, lock T-hndl [CDR & LMP
7. Remove tripod apex (3 pins)
8. Tool to footbar socket

LRV SET | CDR-8 | 3/20/72 EVA 1

9. Erect footrest
10. Verify front hinge pins
11. Extend front fender
12. Verify bat covers CLOSED
13. Conting. tool to L. flrbrd

0+43 LRV CHECKOUT
1. Power up per decal [LM INSPECT
2. Drive to MESA
3. + 15 VDC sw - OFF
4. Aux CB - CLOSED

0+50 OFFLOAD & DEPLOY FAR UV CAMERA
1. Thermal cover - remove
2. Bag - split & fold back
3. Remove pallet from LM (pins)(optional)

LMP-5 | 3/20/72 EVA 1 | LRV SET

PLSS ANT (CDR DEPLOY)

0+33 OFFLOAD LRV
1. Pull D-ring on request
2. Pull deploy cable 20 lbs. (release pull at aft chassis unlock)
3. Pull L pin, outrigger cable
4. Pull L reel tape until 45° cable slack
5. Pull saddle release cable, verify release
6. Move LRV from LM

LRV OFF | LMP-6 | 3/20/72 EVA 1

0+37 SET UP LRV

Do LH Side - Aft 1st [CDR DOES RH SIDE
1. Extend rear fender
2. Verify rear hinge pins
3. Erect seat & unstow seat belt
4. Pull T-handle
5. Lower console. Raise handhold, lock T-handle
6. Pull attitude indicator & C&W flags
7. Drape seat belt
8. Remove tripod apex (3 pins)
9. Tool to footbar socket
10. Erect footrest
11. Verify front hinge pins & seal
12. Extend front fender

LMP-7 | 3/20/72 EVA 1 | ETB

0+43 LM INSPECT & PAN
1. HEDC (ETB), PAN at SEQ Bay
2. Photo CRE 3' [CHECKOUT
3. Comments
   - Soil effects
   - Struts
   - Condition of LM
4. HEDC to L. floorboard

0+50 LOAD LRV [FAR UV CAM
LCRU/TCU/ANT/TV
1. LCRU posts to vertical
2. Remove from stow adapt
   - TCU Conn
   - LCRU Conn
3. Install LCRU, lock posts & conn pwr conn
4. Install TCU (conns inboard)
5. Unstow rake
6. Install LGA (pt. str. up)

VOICE DATA

0+30

(1) Verify during LRV offload & set up
- Walking hinges engaged
- Fwd, aft & center chassis parallel
- Outrigger cables taut
- LRV rotates o/b when D-handle pulled
- Rear hinge pins & steering seal - O.K.
- Front hinge pins & steering seal - O.K.
- Battery covers closed

0+40

(1) CDR - Checkout LRV
- Verify - PWM SEL Sw - BOTH
- Readout displays:

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 - Comment on Soil effects, LM condition
LM strut stroking

(1) LMP - Rpt 70 mm mag/frame ___/___

0+50

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Offload bore/core stems from MESA; place on +Y footpad Hang ETB on SRC table	0+30	<u>OFFLOAD LRV</u> Remove LRV thermal blankets Unstow deploy cable; stow on +Z strut Unstow left side deploy tape Verify: ●Walking hinges engaged ●Chassis parallel alignment ●Outrigger cables taut			LRV OFFLOAD
<u>OFFLOAD LRV</u> Ascend ladder Pull LRV deploy D-handle Descend ladder Apply steady pull on deploy cable Pull pin - left side outrig. cable Pull left side tape until fwd. wheels on surface & cables slack Pull saddle release cable Pick up LRV and turn 90°		Unstow right side deploy tape, back away holding tape Request LMP to pull D-handle Verify LRV rotates outboard Pull right side tape until aft wheels on surface & cables slack Pull pin - rt. side outrig. cable Pull on depoly cable Pull pin & discard deploy cable Raise geopallet post Pickup LRV and turn 90°		LRV OFFLOAD	
<u>SET UP LRV</u> Deploy left rear fender Verify rear hinge pin - o.k. Erect left seat; unstow seat belt Lower & lock console Pull att. indicator, C&W pins Remove tripod & install toehold Erect left footrest Ver. front hinge pin & steering seal - o.k. Deploy left front fender	0+40	<u>SET UP LRV</u> Deploy right rear fender Verify rear hinge pin & steer seal - o.k. Erect right seat; unstow seat belt Lower & lock console Remove tripod & install toehold Erect right footrest Verify front hinge pin - o.k. Deploy right front fender Verify batt. covers closed Place LRV conting. tool on floor		LRV SET UP	LRV SET UP
<u>LM INSPECTION AND PANS</u> Retrieve HEDC from ETB and mount on EMU Take photo pan 20 ft. off SEQ Bay (Quad II) Comment on: ●DPS erosion ●Strut stroking ●Pad penetration ●Soil patterns ●Any LM anomalies Photo Cosmic Ray panels (7 ft.) Remove HEDC; place on LRV floorpan		<u>CHECKOUT LRV</u> Verify parking brake on Mount LRV Close all CB's except AUX, NAV. <u>Report</u>: AMP-HR; AMPS VOLTS; TEMPS Verify: PWM SEL sw - BOTH Position: ●DR EN LF & RF - PWM 1 ●DR EN LR & RR - PWM 2 ●15 V DC - SEC ●STEER FWD - BUS A ●STEER REAR - BUS D ●DR PWR LF & RF - BUS A ●DR PWR LR & RR - BUS D Drive LRV to MESA area		LM INSPECTIONS & PANS	LRV CHECKOUT
	0+50	15 VDC sw - OFF; AUX CB - close			

CREW EVA CHECKLIST

VOICE DATA

FAR UV | 3/20/72 EVA 1 CDR-10

4. Remove cam from pallet (4 pins)
5. Deploy cam:
   Deploy legs (3 pins)
   Point dwn sun
   Remove bat (2 pins) place in sun, read temp
   Remove 2 elev. pins, 1 az. pin & 1 plate pin
   Remove dust cover
   Level cam
   Do target 1
   Power sw - ON

1+05 LOAD LRV
1. Quad III pallet [LOAD LRV to LRV (verify latches engaged)
2. Remove hand rails
3. Pull 2 penetrometer lanyards

SET LRV | 3/20/72 EVA 1 LMP-8

7. Connect LGA to LCRU
8. Install, erect HGA
9. Connect HGA to LCRU (cable velcroed to staff)
10. Deploy & lock dish
11. Align HGA
12. TV cam to TCU (pwr sw-off)
13. TV cable (TCU) to TV cam
14. Y cable conn to TCU
15. Deploy LCRU ant
16. Check LCRU
   • CB - CLOSED
   • Mode sw - PMI/NB
   • Power sw - INT
   • Chk AGC, temp, power
   • LCRU blankets 100% open
   • Power sw - EXT
   • Mode sw - 2
   • Chk - Power & AGC >2

0+50

(1) CDR - Far UV Cam:
- Battery in Sun
- Level ______
- Film advances? (wheels turn)
- CAUTION: Stay away from Cam. front after dust cover removed

(1) CDR - 1st Far UV Cam. setting:

Az 14°

EL 48°

1+00

(1) LMP - Report LCRU

AGC	
VOLTS	
TEMPS	

(1) LMP - LCRU covers open 100 %

1+10

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
LOAD LRV	0+50	OFFLOAD FAR UV CAMERA			
Lift LCRU posts on frt. of LRV		Remove thermal blanket			
Disconnect Y-cable connectors		Pull lanyard to split bag			
Discard cable adapters		Remove pallet from LM (optional)			
Unstow LCRU from MESA and install on LRV		Pull 4 pip pins and remove camera from pallet			
Connect Y-cable conn. to LCRU		Carry camera to deployment site in Quad I (in shadow)			
Unstow TCU from MESA and install on LRV		Deploy Cam. legs & set on surface Point cam. down sun			
Unstow rake, stow on MESA; discard rake bracket		Place cam. battery in sun (Temp Lable up)			
Unstow LGA and install on LRV; point ant. straight up		Pull 2 elev. pins, azimuth pin and plate pin			
Connect LGA cable to LCRU		Remove dust cover			
Unstow HGA and install on LRV		Level camera (Use 3 leveling knobs - and/or dig legs into surface to level)			FAR UV CAMERA OFFLOAD AND DEPLOY
Remove HGA yellow bracket					
Erect ant. mast; lock					
Connect HGA cable to LCRU; velcro cable to ant. mast					
Deploy and lock HGA dish		Caution: Stay away from camera front after protective cover removed		LRV LOADUP	
Point HGA to earth	1+00				
Go to TV camera location		Release azimuth lock, point cam. down sun; lock			
Position TV cam pwr sw - OFF Disconnect TV pwr. cable		Zero azimuth scale if req'd.			
Remove TV cam. from tripod and install on LRV (stow TV pwr. cable conn. on LM)		Set in first target coord. Az. 14° ° El. 48° °			
Connect TCU/TV cable to TV		Position cam. power Sw - ON			
Connect Y-cable conn. to TCU Deploy LCRU VHF antenna		Go to Quad III LOAD LRV			
Configure LCRU: • CB - closed • Mode sw - PM1/NB • Power sw - INT • Report - AGC, TEMP, POWER • LCRU Blkts - 100% open • Power sw - EXT • Mode sw - FM/TV (2) • Verify - AGC & POWER > 2		Remove thermal blanket Pull pip pins; remove pallet Carry pallet to LRV and install; check latches engaged Remove pallet handrails (2) Pull 2 outboard penetro. lanyards			LRV LOADUP
Discard ant. container brackets		Place LPM tripod in bag Remove HTC pip pins Place penetro. in pallet hole			
	1+10				

CREW EVA CHECKLIST

3/20/72 EVA 1 CDR-11

PREPARE PALLET & HTC
1. LPM tripod to bag (R. side pallet)
2. Remove HTC pip pins
3. Penetrometer to pallet hole
4. Tongs to HTC
5. Ext hdl to scoop
6. Remove penet. cones cover
7. Install vise (dust brush bag) on pallet
8. Gnomon to bag on left seat, hammer to L. seat bag & dust brush to LCRU
9. Rake (MESA) to 2nd ext hdl & place on HTC
10. Close HTC

SRC 1 (CDR OR LMP)
1. SRC 1 (R. MESA) to table
2. Seal control sample in SRC SCB to HTC

ETB

3/20/72 EVA 1 CDR-12

CAMERA & ETB UNSTOW (CDR OR LMP)
1. Unstow DAC (R. side MESA) & install mag P (ETB)
2. DAC to R. handhold LRV
3. Unstow HEDC (R. side MESA) to ETB
4. ETB to LRV & empty:
   L. Seat
   - Mag B & sample bag shoe to HEDC
   - 3-HEDC mags
   - 2-DAC mags
   - 500MM
   - 2-lens brushes
   - Sun compass

   R. Seat
   - 2-padded bags

   Install map holder
   BSLSS to back of R. seat
5. ETB to table

3/20/72 EVA 1 CDR-13

ALSEP PREP

STOW LMP ANT

1+15 MESA WORK [INGRESS
1. Discard LCRU pallet (MESA) (optional)
2. LiOH cannister (L. MESA) to middle of MESA

FLAG DEPLOY
1. Unstow flag (2 pins, L. MESA)
2. Deploy flag [EGRESS
3. Photos
4. HEDC to R. seat bag

DEPLOY LMP ANT

CLEAN UP MESA, CLOSE BLANKETS

3/20/72 EVA 1 LMP-9

CAMERA & ETB UNSTOW (CDR OR LMP)
1. Unstow DAC (R side MESA) & install mag P (ETB)
2. DAC to R handhold LRV
3. Unstow HEDC (R side MESA) to ETB
4. ETB to LRV & empty:
   L. Seat
   - Mag B & sample bag shoe to HEDC
   - 3-HEDC mags
   - 2-DAC mags
   - 500MM
   - 2-lens brushes
   - Sun compass

   R. Seat
   - 2-padded bags

   Install map holder
   BSLSS to back of R. seat
5. ETB to table

ALSEP PREP

3/20/72 EVA 1 LMP-10

ETB

SRC 1 (CDR or LMP)
1. SRC 1 (R. MESA) to table
2. Seal control sample in SRC
3. SCB to L. HTC

DRILL, BORE & CORE STEMS
ALSD, bore & core stems (+Y pad) to R. seat

1+15 INGRESS LM (STOW ANT)
1. Pallet 1 (MESA) to A/S (verify 2 cans green)
2. LM sw
   - Power amp sw - OFF
   - Bit rate sw - LOW
   - TV CB - OPEN
   - Modulation sw - PM
3. Strip pallet, discard

1+20 EGRESS
NOTE: Close hatch

ALSEP

3/20/72 EVA 1 CDR-11

FLAG DEPLOY
1. HEDC (L. floorboard) to RCU
2. Photos

PLSS ANT (CDR DEPLOY)

1+27 ALSEP PREP
1. Open door (white)
2. Bat mon sw - ON
3. Remove exp pkg

RTG FUEL UP
1. DRT & FTT from CDR
2. Fuel RTG cask

1+37 BARBELL TO DEPLOYMENT SITE

AT ALSEP SITE

HFE

VOICE DATA

1+10
- (1) LMP - Rpt. DAC mag _____ on DAC
- (1) LMP - Rpt 70 mm mag/frame ____/____
- (1) LMP - ECS LiOH can. pins - Green
- (1) CDR - CLOSE Organic Control Sample in SRC #1
- (1) CDR - Stow LMP PLSS antenna
- (1) LMP - Configure LM switches:
  - Power Amp Sw - OFF
  - Bit Rate Sw - LOW
  - TV CB - OPEN
  - Modulation Sw - PM

1+20
- (1) LMP - Close LM hatch
- (1) CDR - Deploy LMP PLSS antenna
- (1) LMP - BATT TEMP MON - ON
- (1) LMP - Report SEQ Bay doors - OPEN
- (1) CDR - Report Pkg 1 on surface

1+30

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Unstow DAC; install mag; place on LRV Unstow HEDC from MESA, stow in ETB Take ETB to LRV Install Mag B & bag shoe on HEDC; Stow under CDR seat: 500mm Cam HEDC; 3 HEDC mags; 2 DAC mags 2 lens brushes; sun compass Stow padded bags under LMP seat Install maps/holder on LRV Hang BSLSS on back of LMP seat Place ETB on SRC table Place ALSD,bore/core stems-LMP seat	1+10	Place ext. hndle & tongs in HTC Place ext. hndle/scoop in HTC Remove penetro. cone cover Install vise on pallet top Place gnomon in bag on CDR Seat Stow dust brush on LCRU Stow rake in pallet hole Unstow SRC 1; put on SRC table Open SRC; close org. cont. smple Hang SCB 1 on HTC on LRV		LRV LOADUP (CONT'D)	LRV LOADUP (CONT'D)
LMP INGRESS Stow PLSS antenna (CDR) Remove Pallet 1 from MESA (check LiOH can pins - Green) Ingress LM carrying Pallet 1 Position LM switches: • Power Amp Sw - OFF • Bit Rate Sw - LOW • TV CB - OPEN • Modulation Sw - PM Strip pallet and discard Egress LM Close hatch		MESA WORK Stow LMP PLSS antenna Unstow and discard LCRU pallet Place LM ECS LiOH canister in MESA center cavity		INGRESS	MESA WORK
FLAG DEPLOY Mount HEDC from LRV on EMU Photo CDR by flag; hand HEDC to CDR Deploy PLSS antenna (CDR)	1+20	FLAG DEPLOY Unstow flag from MESA Walk to deploy site Push lower shaft into surface Extend flag; insert upper shaft into lower shaft Photo LMP by flag Stow HEDC under LMP seat Tidy MESA; close blankets Deploy LMP PLSS antenna		FLAG DEPLOY	FLAG DEPLOY
ALSEP PREP Remove therm. cover - SEQ Bay door Open SEQ Bay door (white lanyard) Stow lanyard on strut Switch BATT TEMP MON - ON Pull lanyard - unlock PKG 2		ALSEP PREP Pull lanyard - unlock PKG 1 Pull PKG 1 from SEQ Bay, lower to surface Remove hockey stick & lanyard		ALSEP PREP	ALSEP PREP
	1+30				

CREW EVA CHECKLIST

ALSEP

CDR-15 EVA 1 3/20/72

ETB

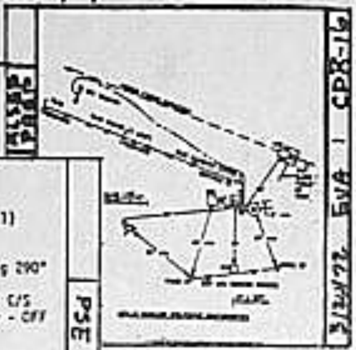
1+27 ALSEP PREP
1. Bat mon sw - ON
2. Remove RTG pkg
3. DRT & FTT to LMP
4. UHTS to pkgs
5. Assy carry bar & attach to exp pkg
6. RTG pkg to gnd & remove RTG dust cover

1+35 RESET FAR UV CAMERA

1+37 SHIFT COSMIC RAY (RED RING)
Report CRE dust, report temp

CLOSED SEQ BAY DOOR

CDR-14 EVA 1 3/20/72

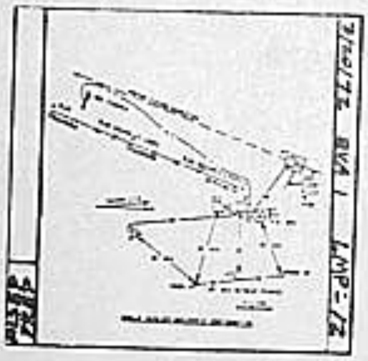


1+38 NAV ALIGNMENT
1. LCRU mode sw - 1
2. Pos TV CCW
3. NAV align (LRV decal)

1+41 LRV TO ALSEP SITE
1. At C/S drive heading 290° for 300 ft
2. Park LRV 60° SSE of C/S H=195° & +15 VDC sw - OFF
3. LCRU mode sw - 3
4. Align HGA

1+45 CONNECT RTG
1. Read temp label
2. 3 BB on RTG cable reel
3. Pull RTG cable from pkg
4. Release connector (1 pin)
5. Verify short sw out
6. Report amp reading

CDR-17 EVA 1 3/20/72 PSE



ALSEP PACKAGE PLACEMENT
1. Place barbell - RTG dwnsun
2. Disengage RTG pkg
3. Pos exp. pkg (UHT north)
4. Pos RTG pkg 8' west (UHT north)

1+49 REMOVE HFE SUBPALLET
1. Release 2 velcroed pull rings, pull 3 pip pins
2. M/P Base; pull pin 1, unwrap tape & pull off cover. Pull pin 2
3. Remove M/P Base
4. Remove subp pull pin
5. RTG pkg to gnd, eyeball align E-W
6. 2 BB (HFE)
7. Remove HFE
8. Remove HFE connector (CCW)
9. HFE to surface

LMP-13 EVA 1 3/20/72 HFE

VOICE DATA

1+30

(1) LMP - Report Pkg 2 on surface

(1) CDR - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(2) LMP - Report Dome Removal Tool Temp Lable reading______

(2) LMP - Report Fuel Transfer Tool Temp Lable reading______

(1) LMP - Report RTG Fueling______

(2) CDR - SEQ Bay doors - CLOSED

(1) CDR - CRE Red ring - PULL
- Report dust condition & temp.

(1) CDR - Reset Far UV cam to Target #2:
Film advances? (wheels turn)
Az 54°
El 77°

1+40

(1) CDR - Align LRV NAV system

SSD		ROLL		PITCH	
COMPUTED NAV HEADING					

(1) CDR - Mark LM departure time_____(1+41)

(1) CDR - On arrival at ALSEP, 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 - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Report RTG cable Temp Lable reading______

1+50

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Pull PKG 2 from SEQ Bay, lower to surface	1+30	Remove tool restraint pins-PKG 1		ALSEP PREP (CONT'D)	ALSEP PREP (CON'T)
Remove hockey stick & lanyard		Remove tool bracket & UHT's; insert UHT'S in ALSEP PKGS.			
Unstow fuel cask lanyard; pull to rotate cask down		Join antenna mast sections to form carry bar; attach to PKG 1			
Receive DRT from CDR		Hand DRT to LMP			
Remove cask dome using DRT, discard under LM		Rotate PKG to surface Remove RTG dust cover			
Receive FTT from CDR		Hand FTT to LMP			
Remove fuel element from cask		Set Far UV Cam to target #2			
Insert fuel element into RTG		• Push reset switch			
Rotate PKG 2 upright and attach to carry bar & PKG 1		• Check film advance			
<u>ALSEP TO DEPLOY SITE</u>		• Set in target: Az <u>54°</u>, El <u>77°</u>			
Carry ALSEP Pkgs to deploy site		Shift CRE plate-pull RED ring <u>Report</u> CRE dust condition Close SEQ Bay door LCRU mode sw - 1 Mount LRV Align LRV NAV system (Ref. LRV Decal page <u>302</u>)		ALSEP TRAVERSE	
	1+40				
		<u>LRV TO ALSEP SITE</u>			ALSEP TRAVERSE
		Drive to ALSEP site approx. 300 ft. West of LM			
		Determine ALSEP C/S location			
		At C/S location drive a heading of <u>290°</u> for 300 ft to scribe geophone line deployment reference			
		Park LRV 60' SSE of C/S Heading = 195°			
<u>ALSEP PACKAGE PLACEMENT</u>					
Place ALSEP Pkgs on surface		LRV ± 15 VDC sw - OFF		SITE SURVEY	
Move Pkg 2 8' West of Pkg 1, orient UHT'S pointing North Tether UHT		Dismount LRV LCRU mode sw - 3 Point HGA to earth			
<u>REMOVE HFE SUBPALLET</u>		<u>CONNECT RTG</u>			
Release pull rings (2); pull pip pins (3)	1+50	Tether UHT Read RTG cable Temp Lable			

CREW EVA CHECKLIST

ALSEP

7. Connect cable to C/S
8. Push down collar to lock

REMOVE ANT AIM MECH & SUBP
1. 2 BB on subp
2. 2 BB on ant aim mech
3. Subp & aim mech to NNE of C/S

DEPLOY PSE STOOL
1. 1 BB
2. Stool to 8 ft ESE of C/S, gouge hole for stool

1+58 TIP & ALIGN EXP PKG
1. Ant mast on stow subp
2. Remove dust cover
3. Rotate EXP pkg
4. Align EXP pkg (eye ball)

3/20/72 EVA 1 CDR-18

1+59 DEPLOY PSE
1. 4 BB
2. PSE to stool, verify BB off of PSE
3. Remove girdle pull pin
4. PSE on stool, rough align
5. Remove girdle
6. Deploy thermal shroud
7. Level PSE
8. Report sun compass align

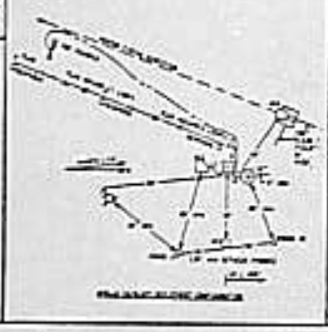
OFFLOAD T/G
1. Verify sw 5 CW
2. 1 BB
3. Deploy T/G
4. Verify T/G Dial "0"
5. T/G to subp

2+08 OFFLOAD M/P
1. NNE of subpallet

C/S

3/20/72 EVA 1 CDR-19

HFE



3/20/72 EVA 1 LMP-14

CONNECT HFE

Connect HFE to C/S & lock (CW)
CAUTION: Don't push on conn while locking

1+53 DEPLOY HFE
1. HFE 30' south
2. Remove probe pkg (4BB)
3. Split box, half with rammer to hole 1
NOTE: Report if cables crossed
4. Other half to hole 2
5. Prepare drill

2+10 BORE HOLE DRILLING
Drill 3 sections of bore stems into surface (last stem 11" off surface)

HFE ELEC.

3/20/72 EVA 1 LMP-15

VOICE DATA

1+50

(1) CDR - Report shorting switch - OUT

(1) CDR - Report shorting switch AMPS

(1) CDR - Report RTG cable connected to C/S _____ (time)

(1) LMP - Report HFE cable connected to C/S _____ (time)

(1) LMP - Report if HFE cables crossed

2+00

(2) CDR - PSE stool 8' ESE of C/S

(1) CDR - Report PSE LEVEL _____
ALIGNMENT _____

(1) CDR - Verify PSE shroud flat on surface

(1) CDR - Verify C/S Sw #5 - CW

(1) CDR - Verify T/G dial = "0"

2+10

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Pull M/P base pin #1; unwrap tape; remove cover; pull pin #2	1+50	Release RTG cable - 3 BB		HFE EQUIPMENT PREP	ALSEP INTERCONNECT
Remove M/P; set on surface Pull subpallet pip pin Rotate Pkg 2 to surface, align		Remove RTG cable and pull pin to release connector			
Remove HFE - 2 BB & connector Place HFE on surface		Verify shorting switch - OUT **Report** amp reading			
Connect HFE to C/S - lock DEPLOY HFE		Connect RTG cable to C/S, push down collar to lock			
Carry HFE pallet 30' S of C/S, place on surface		Remove subpallet & aim mech. from Pkg. 2 - 4 BB			
Remove probe box from pallet - 4 BB		Place subpallet & aim mech. NNE of C/S			
Split probe box (2 velcro straps)		Remove PSE stool from subpallet Position PSE stool on surface 8 ft ESE of C/S; dig out hole			
Carry half with rammer to HFE Hole #1 (~ 18' W)					
Place box half on surface		Stow ant. mast on subpallet Remove Pkg 1 dust cover			
Carry other box half to HFE Hole #2 (~ 18'E), place box on surface		Rotate Pkg 1 to surface and align DEPLOY PSE			
Go to LRV		Remove PSE from Pkg 1 - 4 BB			PSE DEPLOY
	2+00				
		Carry PSE to stool			
Set bore/core stems on surface Configure ALSD hardware:		Remove 4 Boyd Bolts from PSE			
		Remove girdle pull pin			
• Verify motor operates		Place PSE on stool; align			
• Pull pin #2		Remove girdle and discard			
• Rotate rack camloc 90°		Deploy PSE thermal shroud, smooth down edge			
• Rotate batt camloc 90° pull pin lanyard		Level & **Report** compass reading			
• Remove handle and install on battery		Verify C/S sw #5 - CW			
• Rotate rack bracket up		Remove T/G from C/S - 1 BB Deploy T/G			
• Lift rack off treadle, extend legs and set on surface		Verify T/G dial at "0"			
		Lean T/G against subpallet			
• Pull pin #5, move bracket & lift drill		OFFLOAD MORTAR PACKAGE Remove M/P from C/S			
Carry drill, rack and bore/core stem bag to HFE Hole #1 site		Pull socket pin ring; deploy 1st leg			
	2+10	Rotate M/P on swivel socket			

VOICE DATA

PSE — 3/20/72 EVA 1 CDR-20

2. Pull ring to remove socket pin & deploy 1st leg
3. Rotate M/P on UHT swivel socket
4. Deploy 2nd leg, position footpads
5. M/P to surface pointing NW

2+11 REMOVE LSM
1. 2 BB
2. Pull handle of upper support brkt up then forward
3. Remove LSM to surface

2+13 ERECT C/S
1. Level & align EXP pkg
2. 5 BB S side
3. 4 BB + ant BB E side

3/20/72 EVA 1 CDR-21 — LSM

4. Engage UHT rear thermal socket & pull lanyard to remove cover & lower rear curtain to surface by velcro patch
5. Using UHT remove ant cable
6. 3 BB N side
7. 4 BB + ant BB W side
8. Verify sunshield released
9. 2 BB N side inter
10. Center BB
11. Control deployment
12. Remove 3 curtain covers
13. Attach side curtains to C/S
14. Attach rear to side curtains

HFE — 3/20/72 EVA 1 LMP-16

2+26 EMPLACE PROBE 1
1. Emplace probe + therm shld
2. Report depth of probe & stem ht. above surf
3. Emplace 2nd therm shld (30' dwn)
4. External sunshld to top of stem
5. Verify cable N.

2+10

(1) CDR - Report C/S: LEVEL ____ ALIGNMENT ____

(1) LMP - Report start of HFE bore hole #1 drilling

(2) LMP - Report 54" bore stem in surface

(2) LMP - Report 1st 28" bore stem in surface

2+20

(2) LMP - Report HFE bore hole #1 drilling finished

(1) LMP - Report probe depth ____

(1) LMP - Report stem height above surface ____

(1) LMP - Report 2nd thermal shield depth ____

2+30

MISSION: APOLLO 16
EVA: 1

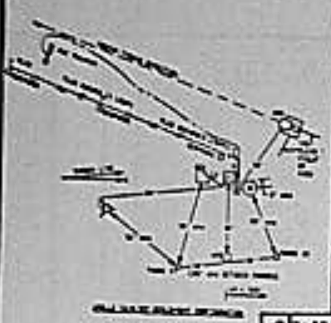
DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
BORE HOLE 1 DRILLING Set drill on surface	2+10	Deploy 2nd leg, position legs Place M/P NNE C/S; point NW
Lean bore/core stem bag against rack; open bag		REMOVE LSM Release LSM from C/S - 2 BB
Insert 54" bore stem into drill		Lift LSM off C/S, ck. cable
Pick up drill & push bit into surface as far as possible		Set LSM on surface clear of C/S
Remove batt. thermal shield		ERECT CENTRAL STATION Level and align Pkg 1
Energize drill until stem top approx. 16" above surface		Release C/S So. side - 5 BB
		Release E side & ant. - 4 BB
Attach wrench to bore stem Remove drill from stem		Remove rear curtain cover; use UHT socket, pull pins, velcro
Screw 28" bore section to section in surface		Release ant. cable bracket
Screw drill onto bore section Energize drill until stem top approx. 16" above surface		Release C/S N side - 3 BB
	2+20	
Attach wrench to bore stem Remove drill from stem		Release W side & ant. 4 BB
Screw 28" bore section to section in surface		Verify sunshield released
Screw drill onto bore section Energize drill until stem top approx 11" above surface		Release 2 N interior BB
		Release center BB and control sunshield erection
Attach wrench to bore stem Remove drill from stem, set on surface		Check side curtains deployed, discard covers
EMPLACE HFE PROBE 1		Attach rear and front of side curtains
Remove HFE probe from box Deploy rammer, lean on rack		
Insert probe and first thermal shield into bore hole, using rammer		Attach rear thermal curtain to side thermal curtain
Report probe depth & stem height above surface		
Emplace second thermal shield to 21" depth	2+30	

SEQ CAM	TASK FUNCTION: LMP	TASK FUNCTION: CDR
	HFE BORE HOLE #1 AND PROBE #1 EMPLACEMENT	EQ. OFFLOAD
		CENTRAL STATION ERECTION

CREW EVA CHECKLIST

C/S



3/20/72 EVA 1 CDR-22

3/20/72 EVA 1 CDR-23

LSM

2+40 ASSEMBLE & ALIGN ANT
1. Ant mast to C/S
2. Remove aiming mech dust cover
3. Aim mech to mast
4. Remove aim mech housing & packing
5. Ant to aim mech
6. Level & align
7. Set AZ-24.68 EL-16.59

ACTIVATE C/S
1. Push in short sw, verify amps
2. Turn sw 1 CW, sw 5 CCW
Report to HOU

2+41 DEPLOY LSM
1. LSM to deploy site (50'WSW)
2. Remove stowage bracket

LSM

3. Deploy legs
4. LSM to surface, colored leg east
5. Remove foam packaging
6. Deploy sensor arms (center 1st)
7. Remove sensor dust covers
8. Clean off top
9. Raise legs
10. Remove PRA (striped ring) (verify PRA deployed)
11. Level & align LSM

3/20/72 EVA 1 CDR-24

3/20/72 EVA 1 LMP-17

2+30 DRILL BORE HOLE 2 & EMPLACE PROBE
Same as for hole 1 & probe
NOTE: Remove all debris from area (16 ft away or more

DEPLOY HFE ELECT
1. Remove elect (4 BB)
2. Remove cover
3. Level & align
4. Verify cables N.
5. UHT to L. floorboard

2+53 ASSIST IN GEOPHONE DEPLOY
1. Get HEDC & hammer (LRV)
2. Stake cables near C/S
3. Emplace geophone 1
4. Emplace geophone 2, stake cable
5. Photo CDR at geophone 3

PHOTOS

VOICE DATA

2+30

(1) LMP - Report sun shield over top of HFE #1 stem

(1) LMP - Verify cable pointing North

(1) CDR - Verify ALSEP antenna fully seated

(1) CDR - Report ant. base ALIGN ____ LEVEL ____

(1) CDR - Report antenna offsets:
Az 24.68
El 16.59

(1) CDR - Push shorting switch, report AMPS

(1) CDR - Turn Sw #1 - CW
Sw #5 - CCW

2+40

(1) LMP - Report start of HFE bore hole #2 drilling

(2) LMP - Report 54" stem in surface

(2) LMP - Report 1st 28" stem in surf

(2) LMP - Report HFE bore hole #2 drilling finished

(1) LMP - Report probe depth ____

(1) LMP - Report stem height above surface ____

(1) LMP - Report 2nd thermal shield depth ____

(1) CDR - Verify LSM PRA deployed

2+50 (1) CDR - Report LSM LEVEL ____
ALIGNMENT ____

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

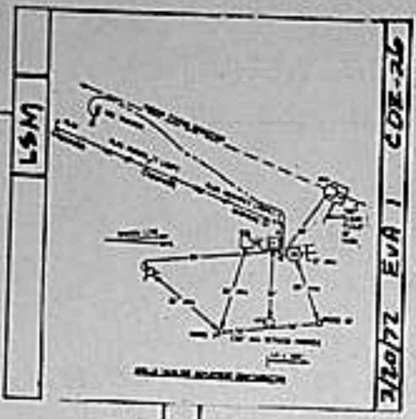
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Place sunshield over top of stem	2+30	
DRILL BORE HOLE 2		ASSEMBLE & ALIGN ANTENNA
Carry drill, rack, rammer and bore/core stems to hole 2		Retrieve ant. mast from subpallet; install on C/S
Set drill on surface Lean bore/core stem bag and rammer against rack Insert 54" bore stem into drill		Retrieve aiming mech. from subpallet, remove dust cover Install aiming mech. on mast Remove aiming mech. housing and packing
Pick up drill & push bit into surface as far as possible		Install antenna on aiming mech.
Energize drill until stem top is approx. 16" above surface		Level and align aiming mech.
		Set antenna offsets: Az - 24.68 El - 16.59
Attach wrench to bore stem Remove drill from stem Screw 28" bore section to section in surface		Push in shorting switch, report amps Turn Sw #1 CW; Sw #5 CCW, report to Hou.
Screw drill onto bore section	2+40	
Energize drill until stem top is approx. 16" above surface		DEPLOY LSM
		Carry LSM to deploy site (50'WSW)
Attach wrench to bore stem Remove drill from stem Screw 28" bore section Screw drill onto bore stem Energize drill until stem top is approx. 11" above surface		Remove stowage bracket Deploy legs & verify locked Set LSM on surface(striped leg E) Remove foam packing
		Deploy sensor arms (center one first)
Attach wrench to bore stem Remove drill from stem, set on surface		Remove sensor dust covers Clean debris from top of LSM
EMPLACE HFE PROBE 2		Raise legs so that PRA cover will clear bottom
Remove HFE probe from box Insert probe and first thermal shield into bore hole, using rammer		Pull striped ring to remove PRA cover; verify PRA deployed
Report probe depth & stem height above surface Emplace second thermal shield to 21" depth	2+50	Level & align LSM

SEQ CAM

TASK FUNCTION

LMP	CDR
HFE BORE HOLE #2 AND PROBE #2 EMPLACEMENT	CENTRAL STATION ACTIVATION
	LSM DEPLOY

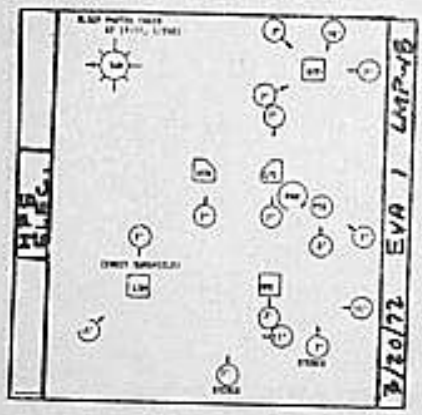
3/20/72 EVA 1 CDR-25



3/20/72 EVA 1 CDR-27

2+50 DEPLOY GEOPHONES
1. Pick up T/G & walk 8' N
2. Push stake through power cable & geophone cable loops (LMP may do) (make sure loops take the strain)
3. Walk out LRV tracks (290°) & emplace #1 geophone (LMP may do)
4. Walk 150 ft. LMP emplaces #2 geophone & stakes cable
5. Walk 150 ft. emplace #3 geophone. Place flag by 3rd geophone. Pose for photo by LMP (alert him to take)
6. Verify Go from MCC for thumper

M/D



3/20/72 EVA 1 LMP-19

3+05 TAKE ALSEP PHOTOS
Coordinate with thumping activities
HEDC to C/S

3+33 DRILL CORE SAMPLE
1. Insert bit string in drill
2. Drill 3 sections into surface (steady drill, don't push)
3. Last section 8" off. surface. Run drill 15 sec without fruther penetration

CONFIG

2+50

(1) LMP - Report sun shield over top of HFE hole #2 stem

(1) LMP - Verify cable pointing North

(1) LMP - Report HFE elec. box:
LEVEL ______
ALIGNMENT ______

(1) LMP - Remove all debris > 16 ft. away from HFE

(1) LMP - Rpt. 70 mm mag/frame
___/______

(1) CDR - Verify FLAG on cable before 2nd geophone is reached

3+00 (1) CDR - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Verify FLAG on cable before 3rd geophone is reached

(1) CDR - Verify T/G dial = "0"

(1) CDR - Wait for MCC "GO" for thumping

3+10

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Place sunshield over top of stem Remove HFE elec. box from pallet Remove dust cover (4BB)	2+50	DEPLOY GEOPHONES		HFE (CONT'D)	
Level & align HFE elec box		Pick up T/G from pallet			
Remove all debris at least 16' away from HFE area Place UHT on LRV left floorboard		Walk approx. 8' N with T/G			
ASSIST IN GEOPHONE DEPLOY Retrieve HEDC from LRV; mount on EMU Retrieve hammer from HTC; place in leg pocket Remove T/G cable stakes from M/P pallet				ASE GEOPHONE DEPLOY	ASE GEOPHONE DEPLOY
Coordinate with CDR; stake power and geophone cable loops just N of C/S		Coordinate with LMP; LMP stake power and geophone cable loops just N of C/S			
		Walk out LRV track (290°) until 1st geophone is reached			
		Remove geophone clip end geophone #1			
Emplace geophone #1 into surface (within 7° of vertical)	3+00	Walk out 150' until 2nd geophone is reached			
Stake geophone cable at geophone #2		Remove geophone clip and geophone #2			
Emplace geophone #2 into surface (within 7° of vertical)		Walk out 150' until 3rd geophone is reached			
Photo CDR when he reaches end of geophone cable		Remove geophone clip and geophone #3			
TAKE ALSEP PHOTOS Coordinate photo activity with CDR thumping		Emplace geophone #3 into surface (within 7° of vertical)		ALSEP PHOTOS	
Photo:		Remove flag and emplant by geophone #3			
• HFE Bore stems - Down sun, 11 ft (ea.) - Stereo pair, X Sun, 7 ft (ea)		Unreel remaining power cable THUMPER GEOPHONE EXP. Verify "GO" for thumping from MCC			
• HFE Electronics Box - X Sun, 7 ft.	3+10				

CREW EVA CHECKLIST

3+08 CONDUCT THUMPER EXP
Movement cease for 10 sec. before & 10 sec. after shot
To fire: select ASI, rotate arm SW, wait 4 sec., depress to fire

3+33 SET UP M/P
1. Sw 5 - CW
2. Deploy base (ring 3), pull hinge lanyard. Indert UHT. EST Geo line
9. M/P & base to deploy site, NNE of C/S
4. Deploy legs (ring 4)
5. Align to geo line ($\pm$ 5°)
6. Base into surface
7. M/P to pallet

CDR - EVA 1

VOICE DATA

3+10

(1) CDR - Call out 10 sec. before and 10 sec. after firing T/G

ASI#	LOCATION	GOOD FIRE?
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		

3+20

(1) LMP - Report LSM sunshade deployed

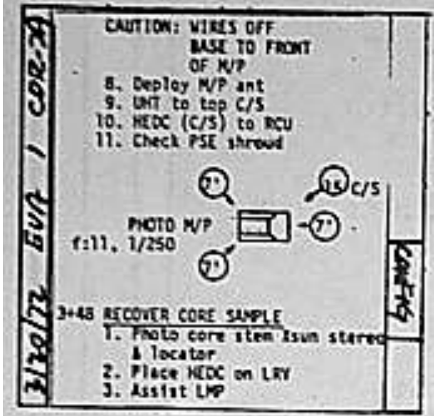
(1) LMP - Rpt. 70 mm mag/frame after ALSEP photos ___/___

3+30

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
•LSM - Sun compass; X Sun, 3 ft. - Deploy sunshade - LSM with C/S in bkgnd, 7 ft. •RTG - With C/S in bkgnd; 7 ft. CENTRAL STATION - X Sun, looking So., 7 ft. - X Sun, viewing switches, 7 ft. •PSE - X Sun; Viewing bubble and suncompass; 3 ft. - With C/S in bkgnd.; 7 ft.	3+10	To fire thumper: - Select ASI - Rotate arm switch - Wait 4 sec. - Depress switch to fire Note: Each crewman must remain motionless 10 sec. before and 10 sec. after each thumper firing. CDR will alert LMP preceeding each firing.		ALSEP PHOTOS	ASE THUMPER FIRING
•Panorama - 10 ft. So. of C/S Place HEDC on C/S	3+20	The first thumper firing will be at geophone #3; subsequent firing will be at each white mark on the geophone line. A total of 19 thumper firings will be performed.			
	3+30				



3/20/72 EVA 1 CDR-24

CAUTION: WIRES OFF BASE TO FRONT OF M/P

8. Deploy M/P ant
9. UHT to top C/S
10. HEDC (C/S) to RCU
11. Check PSE shroud

PHOTO M/P
f:11, 1/250

3+48 RECOVER CORE SAMPLE

1. Photo core stem Xsun stereo & locator
2. Place HEDC on LRV
3. Assist LMP

3+30

(1) LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Turn C/S Sw #5 - CW

(1) CDR - Report estimate of geophone line heading _____°

(1) CDR - Verify wires in front, off base

(1) CDR - Report M/P base heading _____
- M/P base LEVEL _____

(1) CDR - Check base bubble level

3+40

(1) LMP - Report start of core drilling

(2) LMP - Report 1st core section in surface

(2) LMP - Report 2nd core section in surface

(1) LMP - Report core drilling finished

(1) LMP - Run drill 15 seconds to clear flutes

(2) CDR - Rpt. 70 mm mag/frame ___/___

3+50

MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+30				
DRILL CORE SAMPLE		SET UP MORTAR PACKAGE		DEEP CORE DRILLING	ASE MORTAR PACKAGE DEPLOY
Take drill, rack and core stems to deep core site So. of C/S		Return to C/S			
		Turn astro sw #5 - CW			
Set drill on surface		Deploy M/P base (pull pin #3)			
Lean core stem bag against rack		Insert UHT in M/P base			
Insert core stem with adapter into drill		Using UHT & M/P base as sun compass, estimate geophone line heading			
Pick up drill and push stem into surface as far as possible					
Energize drill until stem top is approx. 12" above surface		Carry M/P and base ~ 50 ft NNE of C/S			
Attach wrench to core stem		Place M/P on surface			
Remove drill from stem		Deploy M/P base legs(pull pin #4)			
Screw another core stem section to section in surface	3+40	Using UHT, orient base to same heading as geophone line			
Screw drill onto core section					
Energize drill until stem top is approx. 12" above surface		Place base on surface and emplant legs. Verify base is flat on surface			
Attach wrench to core stem		Place M/P on base; front pins 1st, then lock on rear posts			
Remove drill from stem					
Screw last core stem section to section in surface		Verify wires in front off base			
Screw drill onto core section		Check M/P bubble level reading			
Energize drill until stem top is approx. 8" above surface		Deploy M/P antenna			
		Return to C/S			
		Mount HEDC on EMU; leave UHT			
		Check PSE shroud			
Keep drill energized for 15 sec. to clear flutes		Photo M/P - Down sun; 7 ft. - Viewing NE; 7 ft. - Viewing SE, 7 ft. - With C/S in bkgnd, 15 ft.			
DRILL CORE RECOVERY		ASSIST CORE RECOVERY			
Pull drill string up as far as possible		Take pan at deep core site			
Attach wrench to core stem	3+50				

3+50

(2) LMP - Report core cap letters:

Bottom section: Bit ____
Top ____

Top Section: Bottom ____
Top ____

M/P

CONFIGURE FOR GEOLOGY
1. 3 bag disp (SCB) to
   e1 R. seat bag
   e1 on each seat
2. 2 cap disp. (SCB) to
   e1 HTC
   e1 R. seat bag
3. 2 core tubes (SCB) to R. seat bag
4. SCB (5,6,7,8)(pallet) to LMP PLSS
5. Hammer (L. seat bag) to pocket
6. Tongs (HTC) to Yoyo
7. LMP load CDR
8. Bag disp & HEDC (L. seat) to RCU
9. LCRU mode sw - 1
10. Report heading
11. LRV start (decal)

3/20/72 EVA 1 CDR-30

(1) LMP - Rpt. 70 mm mag/frame
___/___

(1) CDR - Rpt. 70 mm mag/frame
___/___

4+00

SCB #1 Contents:

- Core tubes - 27U, 32L
- 20-DSBD Number Series (3 sets)
  - 2;4-11;13-15;17-24
  - 331-350
  - 351-359;362-365;367-373
- 2-Core tube cap dispensers

PHOTOS

3+48 RECOVER CORE SAMPLE
1. Pull up drill as high as possible
2. Remove drill, cap top
3. Remove core by hand or jack
4. Cap bit
5. Core to LRV, break between 3rd & 4th stem
6. Cap ends
7. Core stems to rack

CONFIGURE FOR GEOLOGY
1. Mag G (L. seat bag) to HEDC (R. seat)
2. Mag A (LMP HEDC) to L. seat bag
3. CDR load LMP
4. SCB (HTC) to CDR PLSS
5. HEDC & bag disp (R. seat) to RCU
6. Report heading

3/20/72 EVA 1 LMP-20

(1) CDR - Attach SCB #____ to LMP

(2) CDR - Readout LRV systems data:

Amp-Hr Bat 1	
Amp-HR Bat 2	

Temp Bat 1	
Temp Bat 2	
Temp LF mtr	
Temp RF mtr	
Temp LR mtr	
Temp RR mtr	

(1) CDR - Report LRV Heading____ °

(1) CDR - Mark LRV departure time from ALSEP______ (4+02)

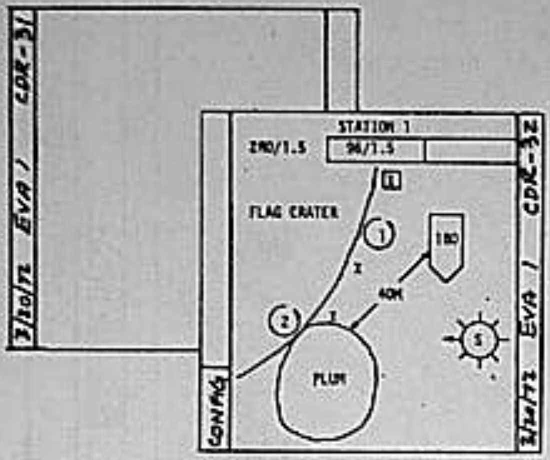
4+10

MISSION: APOLLO 16
EVA: 1

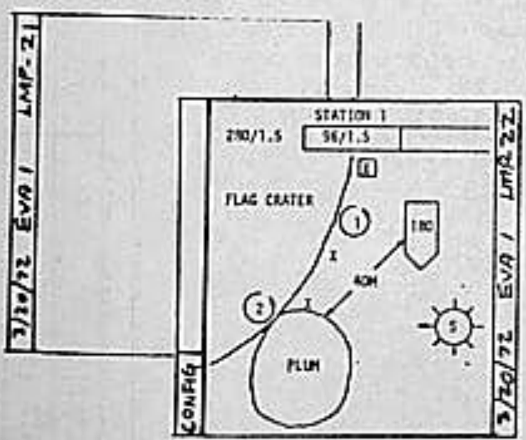
DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQUENCE	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove drill from stem	3+50	Place HEDC on LRV		CORE RECOVERY	CORE RECOVERY
Retrieve stem caps from rack; cap top of core stem		Assist LM in deep core recovery			
Pull core string out of surface by hand, or if difficult:					
- Assemble jack to treadle					
- Position jack/treadle over core stem in surface					
- Jack core out of surface					
Cap bit end of core					
Take core string to LRV; install string in vise on pallet		CONFIGURE FOR GEOLOGY TRAV			GEOLOGY TRAVERSE PREP
Using wrench, break core string between 3rd & 4th section		Remove from SCB #1 (on HTC): • 3 20-Bag Disp; place one on each seat, one in rt. seat bag			
Cap ends of core sections					
Lean core sections against rack		• 2 Core cap disp; place one on HTC, one in rt seat bag			
CONFIGURE FOR GEOLOGY TRAV		• 2 Core tubes; place in rt seat bag			
Install Mag G on HEDC; stow Mag A CDR attach SCB to LMP		Attach SCB #5,6,7 or 8 to LMP		GEO. TRAV. PREP.	
	4+00	Place hammer in leg pocket, and tongs on tether			
Attach SCB #1 (from HTC) to CDR		LMP attach SCB to CDR			
Mount HEDC & bags on EMU		Mount HEDC & bags on EMU LCRU mode sw-1; pos. TV horiz, CCW			
Mount LRV		Mount LRV - Report heading Configure LRV per decal			
TRAVERSE TO STATION 1		TRAVERSE TO STATION 1		TRAVERSE TO STATION #1	TRAVERSE TO STATION #1
Drive to Station 1		Drive to Station 1			
	4+10				

CREW EVA CHECKLIST




LOOK FOR:
●Rays from south ray 99/0.8
●NE scarp on Spook rim
●Boulders at Buster
●NE scarp 95/1.4
STATION 1
FLAG CRATER (PLUM) :43
CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN 1
3: DESCRIPT
8:PAN 2 RAKE/SOIL
27: SAMPLING
(Flag ejecta-PLUM)
FRAME COUNT
MODE.SW-1
POS TV HORIZ, CCW
3/20/72 EVA 1 CDR-33
STA 2




LOOK FOR:
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CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN 1
3: DESCRIPT
8:PAN 2 RAKE/SOIL
27: SAMPLING
(Flag ejecta-PLUM)
FRAME COUNT
MODE.SW-1
POS TV HORIZ, CCW
3/20/72 EVA 1 LMP-23
STA 2

VOICE DATA

4+10

(2) LMP - Report LRV:
- Speed ______
- AMPS ______

(1) CDR - Mark station arrival time _____ (4+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	

4+20

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

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

4+30

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+10			TRAVERSE (CONT'D)	TRAVERSE (CONT'D)
FLAG CRATER		FLAG CRATER			
GEOLOGY STATION 1		GEOLOGY STATION 1		GEOLOGY STATION 1	GEOLOGY STATION 1
Read LRV displays		Park LRV; Heading = 180° Set brake + 15 VDC Sw - OFF			
Dismount LRV		Dismount LRV			
Take photo pan		LCRU mode Sw - 2 Align HGA to earth Dust GCTA, LCRU & TV lens			
Describe surrounding area		Describe surrounding area			
	4+20				
Take rake/soil sample		Take rake/soil sample			
	4+30				

4+30

(1) CDR - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

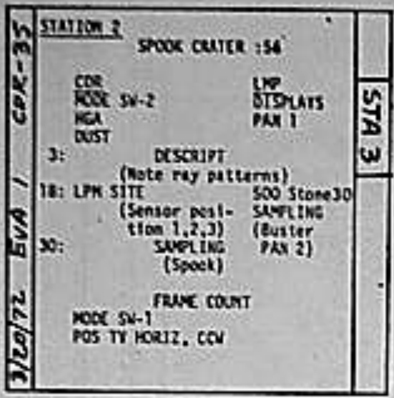
4+40

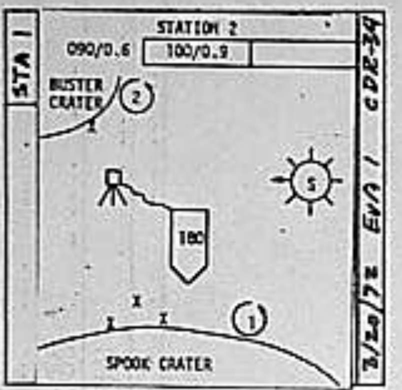
4+50

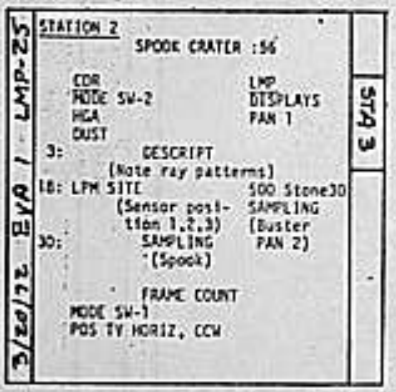
MISSION: APOLLO 16
EVA: 1

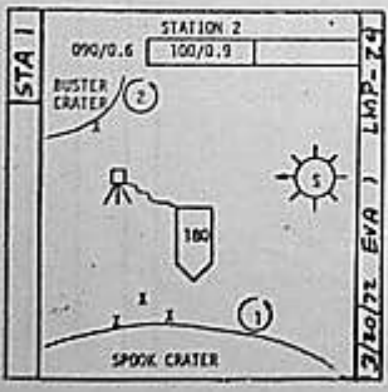
DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Collect documented samples	4+30	Collect documented samples - Look for S. Ray ray contact & ejecta material from Flag crater		GEOLOGY STATION 1 (CONT'D)	GEOLOGY STATION 1 (CONT'D)
	4+40				
	4+50				









4+50

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

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

(1) CDR - Mark station departure time _____ (4+57)

5+00 (1) LMP - EMU check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Mark station arrival time _____ (5 + 02)

(1) LMP - Readout LRV displays

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

5+10

MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+50			GEOLOGY STATION 1 (CONT'D)	GEOLOGY STATION 1 (CONT'D)
Stow ext. handle/scoop on HTC		Stow gnomon in LRV bag			
Verify HTC is secure		LCRU mode sw-1; pos. TV horiz, CCW Mount LRV			
Mount LRV		Configure LRV per decal			
TRAVERSE TO STATION 2		TRAVERSE TO STATION 2		TRAV. TO GEO. STAT. 2	TRAV. TO GEO. STAT. 2
Drive to Station 2		Drive to Station 2			
	5+00				
SPOOK CRATER GEOLOGY STATION 2		SPOOK CRATER GEOLOGY STATION 2		GEOLOGY STATION 2	GEOLOGY STATION 2
Read LRV displays		Park LRV; Heading = 180° Set brake			
Dismount LRV		± 15 VDC Sw - OFF			
Take photo pan		Dismount LRV LCRU mode Sw - 2 Align HGA to earth Dust GCTA, LCRU & TV lens			
Describe surrounding area		Describe surrounding area			
Take 500 mm cam. photos		Perform LPM site measurement • Sensor position #1,#2,#3			
	5+10				

5+10

3/20/72 EVA 1 CDR-34

LPM SITE MEASUREMENT

1. Pull 2 pins, unsnap sensor strap
2. Sensor to tripod, pos. 1
3. Elect pwr sw - ON
4. Read temp label
5. Deploy sensor/tripod 48" R of LRV
6. Align & level sensor/tripod
7. Ret to LRV, call "Mark" to MCC
8. Photo sensor/tripod WRT LRV
9. MCC 60 sec "Mark" READ sw - ON
10. Read XYZ 3 times (cycle read sw)
11. Read sw - OFF
12. Sensor to pos. 2, align & level
13. Do 7 - 10
14. Sensor to pos. 3, align & level
15. Do 7 - 10, then pwr sw - OFF
16. Retrieve & stow sensor/tripod
17. Wind up cable, stow reel

CLOSEOUT

(1) CDR - LPM measurement:
- Level_____
- Align_____
- Temp Lable_____(on elec. box)
- Report position relative to LRV

	X	Y	Z
•(1)	____	____	____
•(2)	____	____	____
•(3)	____	____	____

5+20

(1) CDR - Verify LPM Pwr - OFF after measurements complete

5+30

MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10				
Collect documented samples - Look for: ray patterns route up Stone mtn.				GEOLOGY STATION 2 (CONT'D)	GEOLOGY STATION 2 (CONT'D)
	5+20				
		Collect documented samples - Look for: ray patterns route up Stone Mtn.			
	5+30				

5+30

(1) CDR - Rpt. 70 mm mag/frame ___/_____

(1) LMP - Rpt. 70 mm mag/frame ___/_____

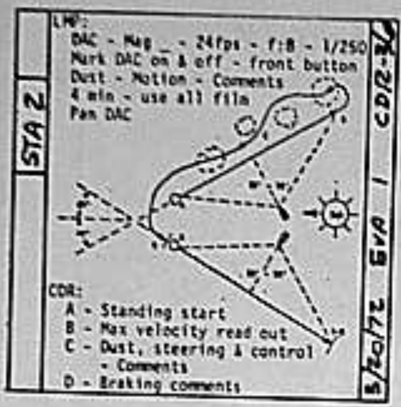
5+40

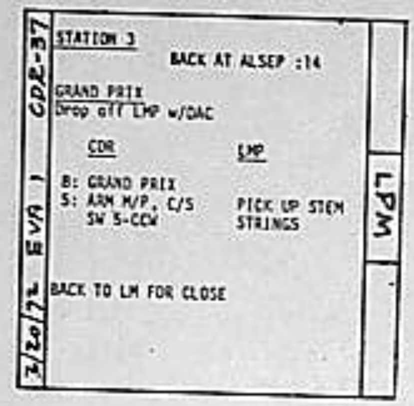
5+50

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+30				
	5+40			GEOLOGY STATION 2 (CONT'D)	GEOLOGY STATION 2 (CONT'D)
	5+50				





5+50

(1) CDR - Rpt. 70 mm mag/frame ___/___

(1) LMP - Rpt. 70 mm mag/frame ___/___

(1) CDR - EMU Check

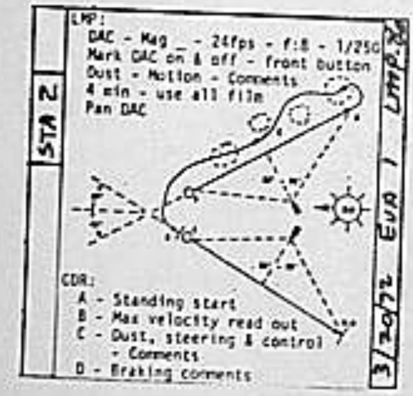
	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

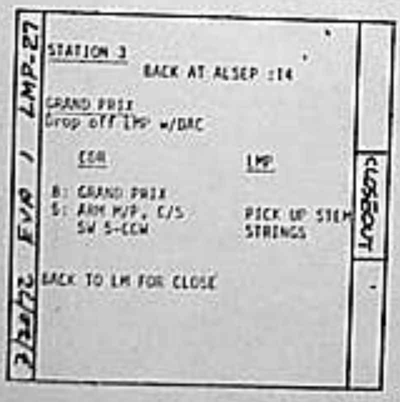
(1) CDR - Mark station departure time _____ (5 + 58)

6+00

(2) LMP - Report LRV :

- Speed ______
- AMPS ______





(1) CDR - Mark arrival at ALSEP area _____ (6+05)

(1) LMP - Report DAC mag _____ (mag P)

(1) LMP Mark DAC Time:
ON: ___,___,___
OFF: ___,___,___

6+10

MISSION: APOLLO 16 DATE: MARCH 1972

EVA: 1

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+50			GEOLOGY STATION 2 (CONT'D)	GEOLOGY STATION 2 (CONT'D)
Stow ext. handle/scoop on HTC		Stow gnomon in LRV bag			
Verify HTC is secure		LCRU mode sw-1; pos. TV horiz, CCW			
Mount LRV		Mount LRV			
		Configure LRV per decal			
<u>TRAVERSE TO STATION 3</u>		<u>TRAVERSE TO STATION 3</u>		TRAVERSE TO STATION 3	TRAVERSE TO STATION 3
Drive to Station 3		Drive to Station 3			
	6+00				
<u>STATION 3 (Back at ALSEP area)</u>		<u>STATION 3 (Back at ALSEP area)</u>		STATION 3	STATION 3
Remove DAC		Drop LMP off			
Dismount LRV		Drive Gran Prix			
Photo CDR driving Gran Prix					
	6+10				

STA 3

3/20/72 EVA 1 CDR-[illegible]

LPM

3/20/72 EVA 1 CDR-40

6+20 CLOSEOUT
1. LRV at MESA: in sun; H=354°
2. + 15 VDC sw - OFF
3. [LCRU mode sw - 3]
4. Align HGA
5. Dust LCRU & GCTA
6. Reset Far UV [SWC
Photo
X-sun 20' f 5.6/60
Dwn sun 3' f 5.6/60
7. HEDC to L. seat
8. From LMP PLSS
SCB to HTC
9. LMP unload CDR
10. Tongs to HTC, hammer to L. seat

STA 3

3/20/72 EVA 1 LMP-28

3/20/72 EVA 1 LMP-29

6+20 CLOSEOUT
1. Readout NAV & LRV displays
2. Place core stems in bag (L. MESA)
3. Deploy SWC at [FAR UV CAM
Z:00/LO ft. photo SWC X-sun
Stereo; foil & staff 7',
upper part
4. HEDC to L. seat
5. CDR unload LMP
6. SCB (CDR PLSS) into SRC
7. Close SRC 1
8. Tidy MESA blankets
9. Big rocks (LRV) to SCB (pallet) to +Z pad
10. Clean EMUs & stow ants
11. SCB (HTC), SCB (+Z pad) & core stems (+Z pad) to A/S
12. INGRESS
13. SRC 1 from CDR

REPRESS

6+10

(1) CDR Driving Comments:
START: _____
DUST: _____
CONTROL: _____

(1) CDR - Mark LRV park _____

(1) CDR - Report M/P armed _____
- Verify M/P level _____
Alignment _____

(1) CDR - Report C/S Sw #5 - CCW

(1) CDR - Mark LRV departure time _____

6+20

(1) CDR - Mark arrival at LM time _____ (6 + 20)

(1) CDR - Report LRV Heading _____ (354°)

(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	
Amps Bat 1			
Amps Bat 2			
Volts Bat 1			
Volts Bat 2			

(1) CDR - Reset Far UV cam to Target #3
•Film advances? (wheels turn)
•Az 126°
•El 33°

(2) CDR - Rpt 70 mm mag/frame after Far UV cam photos ___/_____

6+30

(2) LMP - Rpt 70 mm mag/frame after SWC photos ___/_____

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+10	Park LRV ~ 25 ft E of M/P Set brake + 15 VDC Sw - OFF Dismount LRV		STATION 3 (CONT'D)	STATION 3 (CONT'D)
Mount DAC on LRV		Pick up UHT from C/S			
Pick up core stems		Arm Mortar package: ●Rotate latch with UHT ●Remove safety pin (lanyard) ●Rotate 2 Safe/Arm switches with UHT ●Verify alignment and level			
Place core stems on LRV					
Mount LRV		Position C/S Sw #5 - CCW			
		Mount LRV + 15 VDC Sw - ON			
Return to LM		Return to LM			
EVA CLOSEOUT		EVA CLOSEOUT		EVA CLOSEOUT	EVA CLOSEOUT
Readout NAV & LRV displays	6+20	Park LRV at MESA; in sun; Heading = 354°			
Dismount LRV		+ 15 VDC Sw - OFF Dismount LRV			
Unstow core stem bag from MESA		LCRU mode Sw - 3			
Place core stem sections in bag		Align HGA			
Lean bag on +Z strut		Dust LCRU & GCTA			
Unstow SWC from MESA		Reset Far UV cam. target: Az 126° El 33°			
Deploy SWC 60' at 2:00					
Extend SWC staff sections					
Press staff into surface		Photo Far UV Camera - X Sun; 20 ft; f5.6/60 - Dn Sun; 3 ft; f5.6/60			
Deploy foil; hook on staff					
Photo SWC: - X Sun; stereo pair of foil and staff; 7 ft. - X Sun; upper foil; 7 ft.					
	6+30				

3/20/72 EVA / CDR-41

11. ETB (table) to L. floorbrd & load [SRC 1]
    - 2 HEDC w/mags
    - 3 HEDC mags
    - 500MM mag (500MM back in L. seat bag)
    - 2 DAC mags
    - Mag from DAC (orient DAC bat to sun)
    - Maps
12. ETB to table
13. 6 containment bags (L. MESA to ETB
14. Clean EMUs & stow ants
15. Brush to LCRU
16. LCRU power sw - OFF
17. LCRU covers 65% open
18. Open LRV bat covers & dust if dirty, dust LCRU

6+30

SRC #1 Contents:

- SCB #1
  - Doc. samples
- Organic Control Sample

ETB Contents:

- 2 HEDC with mags ___(B), ___(G)
- 3 HEDC mags ___(A), ___(C), ___(H)
- 500 mm Cam. mag ___(L)
- 3 DAC mags ___(P), ___(Q), ___(R)
- Maps
- 6-sample cont. bags (from MESA)

LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

6+40

(1) CDR - Stow LMP PLSS antenna
(1) LMP - Stow CDR PLSS antenna

ITEMS TRANSFERED TO A/S

- SCB#_____ (LMP)
- Core stems (LMP)
- SRC #1 (CDR)
- ETB (CDR)

CLOSEOUT

14. ETB from CDR
15. Close hatch
16. REPRESS

3/20/72 EVA / LMP-30

(1) CDR - LCRU Dust Cover___(65%)OPEN
(1) CDR - LRV Batt Covers OPEN
(1) CDR - LRV Batt Mirrors (Clean)/(Dirty)
(1) CDR - Dust LCRU
(1) CDR - Config. LRV C/B's:
- Bus A, B, C, D OPEN

6+50

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

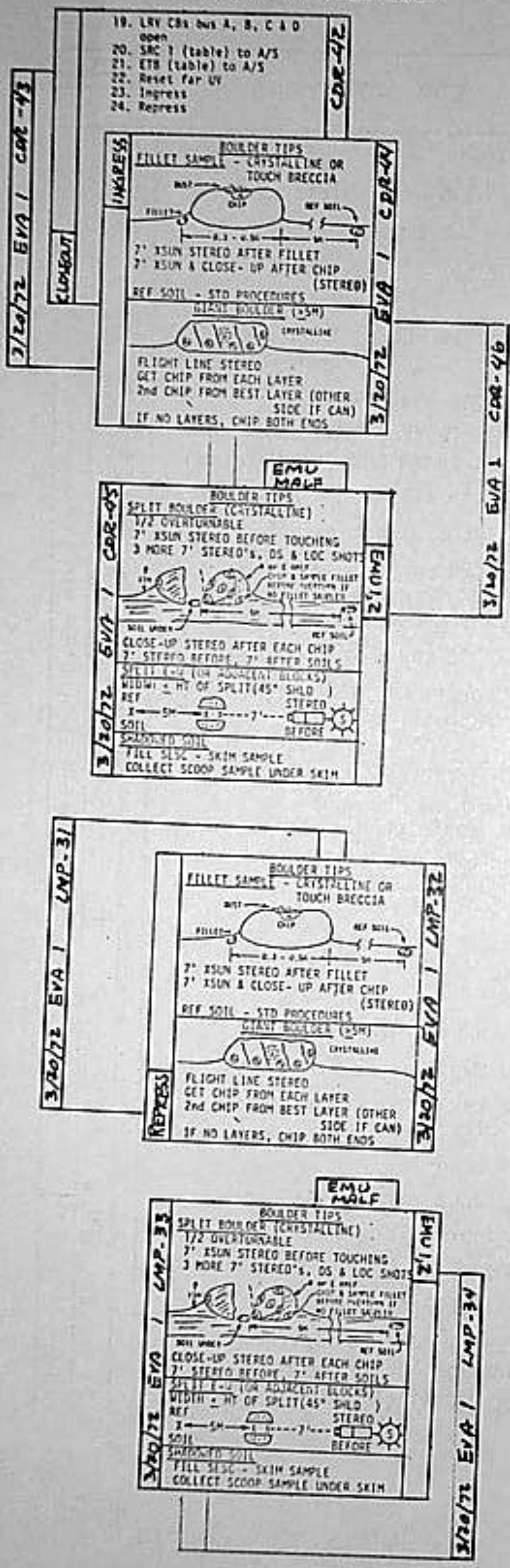
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	6+30	
Place HEDC on LRV left seat		Place HEDC on LRV left seat
CDR remove SCB from LMP		Remove SCB from LMP and stow on HTC
Remove SCB #1 from CDR		LMP remove SCB #1 from CDR
Place SCB #1 in SRC #1 on MESA table		Stow tong and hammer on HTC
		Remove ETB from MESA table and place on LRV lf. floorboard
Remove seal protectors (2)		Load into ETB:
Verify bag material is free of seal area		● 2 HEDC with mags
		● 3 HEDC mags
Close and seal SRC #1		● 500 mm mag (stow 500 mm. cam. under flap in seat bag)
Tidy MESA blankets		● 2 DAC mags
		● Mag off of DAC (orient DAC batt to Sun)
		● Maps
Place any large rocks on +Z footpad	6+40	Stow ETB on MESA table
		Stow sample cont. bags (6) in ETB
Clean LMP and CDR EMUS		Clean LMP and CDR EMU's
LMP INGRESS		
Stow LMP and CDR PLSS antennas		Stow LMP and CDR PLSS antennas
Remove SCB from HTC and ascend ladder		Stow dust brush on LCRU
		LCRU pwr. Sw - OFF
Place SCB on platform		Open LRV Batt. covers; dust if dirty
Descend ladder		
Obtain core stem bag and ascend ladder		Dust LCRU
		LCRU dust covers - 65% open
Place core stem bag on platform		Configure LRV C/B's:
Open hatch		● Bus A,B,C,D - OPEN
Place SCB and core stem bag in A/S		Attach ETB to LEC
Ingress LM		Ascend ladder to platform carrying SRC #1
Obtain SRC #1 from CDR		Pass SRC #1 to LMP
	6+50	

SEQ CAM | TASK FUNCTION: LMP | CDR

LMP: EVA CLOSEOUT (CONT'D); EVA TERMINATION

CDR: EVA CLOSEOUT (CONT'D)

CREW EVA CHECKLIST



VOICE DATA

6+50

(1) CDR - Reset Far UV cam to Tar
•Film advances? (wheels
•Az 230°
•El 53°

(1) LMP - Report hatch closed

7+00 (1) CDR - Report cabin repress.
(END EVA 1)

MISSION: APOLLO 16
EVA: 1

DATE: MARCH 1972

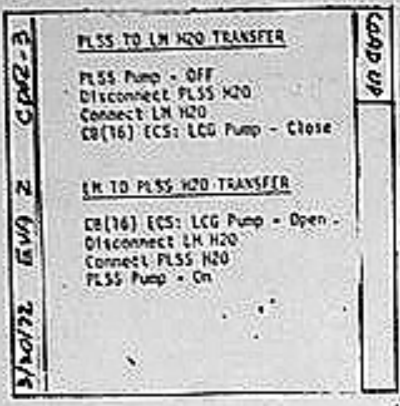
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	6+50			EVA TERMINATION (CONT'D)	EVA TERMINATION (CONT'D)
Obtain ETB from CDR		Pull up ETB Pass ETB to LMP Descend ladder to surface Reset Far UV cam. target: Az 230° El 53°			
		CDR INGRESS			
Assist CDR ingress		Ingress LM			
Close hatch					
NOTE: DETAILED PROCEDURES FOR FINAL EVA CLOSEOUT ARE PRESENTED IN THE LUNAR SURFACE CHECKLIST					
	7+00				

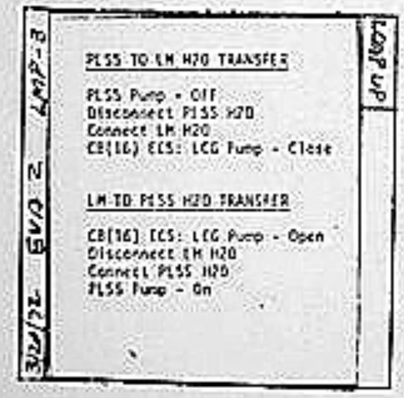
3.2.2 EVA 2

The detailed timeline procedures for EVA-2 are shown on the following vertical format pages.

The detailed sampling and related procedures during the traverse are given in Sections 3.2.4 and 3.2.5 .

CREW EVA CHECKLIST





VOICE DATA

<u>CODE</u>

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

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

<u>NOTE</u>: AT START OF EVA 2

- SUN ANGLE ~ 25°
- LM SHADOW LENGTH ~ 12.5m (40ft.)
- ASTRONAUT SHADOW LENGTH ~ 3.3m (10ft.)

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

0+10

APOLLO 16

NOMINAL TIMELINE

LUNAR SURFACE EVA 2

MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Start EVA watch	0	Start EVA watch (Call "MARK")		PRE-EGRESS OPERATIONS	PRE-EGRESS OPERATIONS
		NOTE: detailed procedures are presented in "Lunar Surface Checklist" Equipment Prep - EVA 2 Section.			
Open hatch	0+10	EGRESS			

CREW EVA CHECKLIST

PLSS

EVA 2

0+00 CABIN DEPRESS
Start watch (call mark)

0+10 EGRESS
1. PLSS ANT (LMP deploy)
2. Jett bag discard
3. Lower ETB

0+17 RESET FAR UV CAMERA [EGRESS

ETB TO LRV L. FLOORBOARD

0+20 TV
1. LRV CB's bus A, B, C, D & NAV - close
2. Verify dust brush on LCRU
3. Close LRV bat covers & pres tight
4. LCRU switch - EXT

CDR-4 EVA 2 3/10/72

PLSS

EVA 2

0+00 CABIN DEPRESS
Start watch
Open hatch

0+10 PREP
1. Deploy CDR ant
2. Jett bag to CDR
3. ETB to CDR
4. Verify
Recorder - OFF
Vox sens (2) - max
CB config
Utility, floodlights - OFF

0+17 EGRESS [FAR UV
NOTE: Close hatch

0+22 SRC 2
1. SRC 2 (L. MESA) to table

LMP-4 EVA 2 3/10/72

VOICE DATA

0+10

(1) LMP - Deploy CDR PLSS Antenna

(2) LMP - ETB CONTENTS

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

(1) LMP - Verify CB Config - ok

(1) CDR - FAR UV CAMERA Reset

MARK _____

Film Advance _____

AZ _____(91) EL _____(79)

0+20

(1) CDR - EMU Check

02	
FLAGS	
PRESS	
COOL	

(1) CDR - DUST Brush on LCRU

(1) CDR - LRV BATT covers closed & PRESS TIGHT

(1) LMP - EMU Check

02	
FLAGS	
PRESS	
COOL	

(1) CDR - Deploy LMP PLSS Antenna

0+30

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
Hand jettison bag to CDR	0+10	Move thru hatch		EGRESS
Erect CDR antenna		Toss jettison bag to surface (-y strut)		
Hook up LEC to ETB		Pass in LEC hook		
Hand ETB to CDR				
Recorder - OFF		Lower ETB to surface		
Verify - VOX Sens - MAX - CB config - Utility, floodlights - OFF		Descend to surface		
		Gain surface		
EGRESS				
Move thru hatch		RESET FAR UV CAMERA	EGRESS	LRV/EQUIPMENT TRAVERSE PREP
Close hatch		Punch "reset", verify target(5) with MCC		
Descend to surface		Enter new azimuth, elevation Get ETB and place on LRV Floor pan (Left)		
	0+20	TV		
Gain Surface		Close LRV CB's A,B,C,D & NAV Place brush on LCRU Close battery covers (verify closure mated)		
Get out SRC 2, clamp on SRC table		LCRU SW - EXT Align HGA	EQUIPMENT TRAVERSE PREP	
Open SRC 2, take out SCB 2. Interim stow on MESA, close control sample.		LCRU Covers 100% OPEN TRAVERSE LOADUP		
Take SCB 2 to LRV, place on HTC (left side)		Place LMP HEDC on LMP seat Erect LMP Antenna Place 1-16mm mag Q & maps on LMP seat		
Take out SCB (3 or 4) place on HTC (right side)		Install mag L on 500mm cam		
Take 2-20 bag dispensers from SCB 2 & place on seats				
Transfer equipment from SCB 2 to SCB 3 or 4	0+30			

5. Align HGA
6. LCRU covers - open 100%

DEPLOY LMP ANT

0+23 TRAVERSE LOADUP
1. Unload ETB;
   R. Seat
      LMP HEDC
      Mag Q
      Maps
   L. Seat
      Mag L to 500MM (500MM in L. seat bag)
      2 mags (D,I)
      2 mags (R,S)
2. ETB to table
3. Tidy MESA blankets

0+40 PLSS LOADUP
1. SCB (5,6,7,8)(pallet) to LMP PLSS

2. Cap disp (SCB 2) to LMP PLSS
3. Hammer (L. seat) to pocket
4. LMP loadup CDR
5. Close HTC

0+43 RESET FAR UV CAMERA

0+46 LRV PREP
1. LCRU mode sw - 1
2. Pos TV CCW
3. HEDC & bag disp (L. seat) to RCU
4. LRV start (decal)
5. Initialize NAV

2. Seal control sample in SRC
3. SCB to L. HTC

PLSS ANT (CDR DEPLOY)

0+28 TRAVERSE LOADUP
1. SCB (3,4)(pallet)to R. HTC
2. 2-bag disp. (L. SCB) to one on each seat
3. From L. SCB to R. SCB
   1U & 1L core tube
   2-bag disp
   1-cap assy
4. R. SCB to R. flrbrd.[FAR UV
5. Mag Q (R. seat) to DAC
6. Maps (R. seat) to holder

0+40 PLSS LOADUP
1. CDR loadup LMP
2. SCB (HTC) to CDR PLSS
3. Close HTC

0+43 PAN
1. HEDC (L. seat) to RCU
2. Pan, quad III: CRE 7' report temp
3. HEDC (RCU) to L. seat

0+46 LRV PREP
1. HEDC & bag disp (R. seat) to RCU
2. SCB (R. floorboard) to R. seat bag
3. Support NAV INT

TURN ON DAC f4/250/1fps

0+30

(1) CDR - 70mm Mags _____ (D) & _____ (I) under seat

(1) CDR - 16mm Mags _____ (R) & _____ (S) under seat

(1) LMP - 16mm Mag _____ (Q) on DAC

(2) LMP - SCB # ON HTC (goes under seat for EVA 3)

0+40

(1) CDR - FAR UV Reset _____ MARK
Film Advance _____
AZ _____ (274) EL _____ (14)

(1) LMP - DAC "ON" _____ MARK
f4,1/250,1fps

(1) CDR - ALIGN NAV SYSTEM

0+50

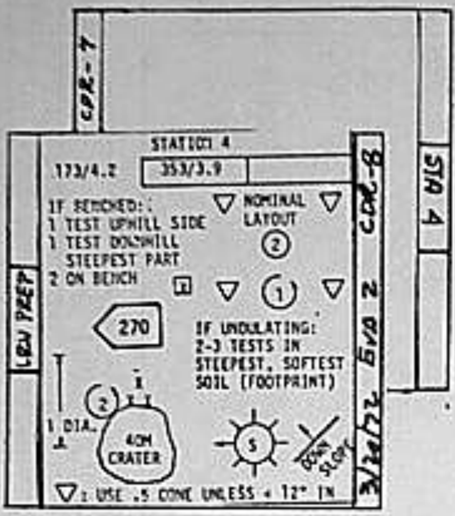
(1) LMP - LRV READ OUTS

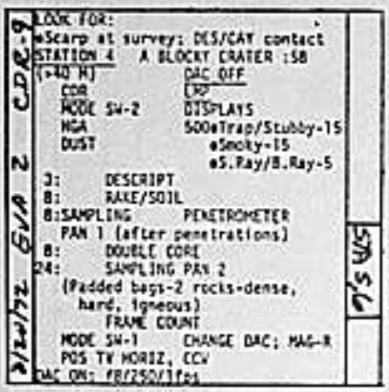
MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 2

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
∘ Core tubes - 1U, 1L ∘ 2-20 bag dispensers ∘ 1-core tube cap assy	0+30	Place 2-70mm mags D & I under seat Place 2-16mm mags R & S under seat	EQUIPMENT PREP (CONT'D)	EQUIPMENT PREP (CONT'D)
Put SCB 3(or 4) on R floor board		Return ETB to table on MESA		
Put 16mm mag Q on DAC - check DAC out (ensure green light)		Tidy MESA blankets		
Place maps in holder				
PLSS LOADUP	0+40	PLSS LOADUP	PLSS LOAD UP/PAN	PLSS LOAD UP/UV CAM
Hold still		Get extra SCB (No's 5-8) from pallet, place on LMP		
Put SCB 2 on CDR		Get Core tube cap assy & place on LMP Put hammer in pocket - hold still		
PAN Don CDR HEDC, move to Quad III Pan 20' off Quad III, 7' vertical pan Cosmic Ray Experiment		RESET FAR UV CAMERA Punch "reset" verify new target (6) with MCC		
Replace CDR HEDC on L seat		Enter new azimuth, elevation		
LRV PREP Don LMP HEDC & 20 DSBD		LRV PREP Switch LCRU Mode - 1	LRV PREP	LRV PREP
Put SCB 3(or 4) under R seat		Position TV horizontal and CCW to stop		
Mount LRV		Don HEDC & 20 DSBD Mount LRV		
As move out, turn on DAC f4/250/1 fps		Power up		
	0+50	Initialize NAV System		

CREW EVA CHECKLIST

VOICE DATA





0+50				
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+50)

(1) CDR/LMP - AT SIGNIFICANT FEATURES

BEARING _____, _____, _____, _____

RANGE _____, _____, _____, _____

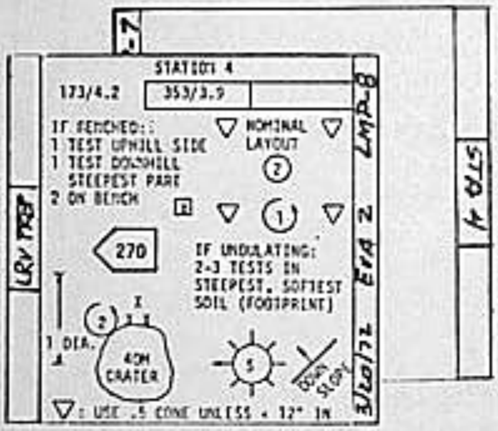
(2) CDR/LMP - Slope (ESTIMATE) _____ °

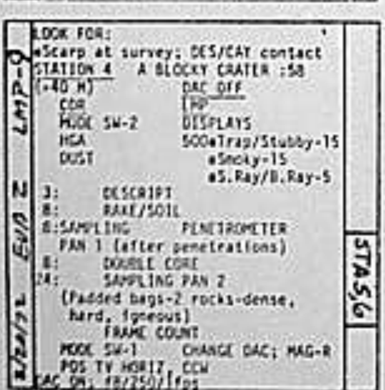
AMPS _____, SPEED _____

(2) CDR/LMP - Slope (EST.) _____ °

AMPS _____, SPEED _____

(1) Cap Com-- If Slope OK, Park Down Sun for Nav up-date at station 4





(1) CDR - MARK STOP TIME _____ (1+25)

1+25

(1) LMP - LRV READ OUT

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				

(1) CDR - Rpt 70mm Mag/Frame ___/_____

1+30 (1) LMP - Rpt 70mm Mag/Frame ___/_____

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU	TASK FUNCTION LMP	TASK FUNCTION CDR
Depart for Sta 4 Ride time: 35 min @ 7.3 kph distance: 4.2 km	0+50	Depart for Sta 4		TRAVERSE TO GEOLOGY STATION 4	TRAVERSE TO GEOLOGY STATION 4
Climb Stone Mountain to highest negotiable point					
	1+20				
GEOLOGY STATION 4 Readout NAV displays Read Amp Hrs and Temps Dismount LRV Get 500mm cam 15 photos Trap/Stubby 15 photos Smoky 5 photos S. Ray/Baby Ray		GEOLOGY STATION 4 Powerdown LRV Dismount LRV Sw LCRU Mode - 2 Align HGA Dust off TV, TCU, LCRU		GEOLOGY STATION 4	GEOLOGY STATION 4
	1+30				

1+30 (1) LMP - Rpt 500mm Mag/Frame ___/_____

(1) CDR/LMP - ROCK BAG NO. _____

Soil Bag NO. _____

in SCB _____

1+40

(1) LMP - Rpt Penetrometer

INDEX _____, _____, _____, _____

Cone _____, _____

Depth _____, _____, _____, _____

1+50

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES		TASK FUNCTION LMP	TASK FUNCTION CDR
	1+30			GEOLOGY STATION 4 (CONT'D)	GEOLOGY STATION 4 (CONT'D)
Description of Site		Description of Site			
Rake/Soil Sample		Rake/Soil Sample			
	1+40				
Penetrometer Tests - Use 0.5 in^2 cone unless penetration $\leq$ 12 inches. Then change to 0.2 in^2 cone.		Solo Sampling			
	1+50				

1+50

(1) CDR/LMP - Core Tubes

upper _____

lower _____

2+00

2+10

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	CRUTY	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+50	Panorama 1 (of penetrometer area)		GEOLOGY STATION 4 (CONT'D)	GEOLOGY STATION 4 (CONT'D)
Double Core		Double Core			
Panorama 2 (at rim of 40 M Crater) General Samples		General Samples			
	2+00				
NOTE: Collect Padded Bag samples at this stop if possible. 1 crystalline rock in each bag, stow under L Seat next to 500mm Camera.					
	2+10				

2+10

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(2) LMP - DAC Mag change _____

(1) CDR - Rpt 70mm Mag/Frame
___/_____

2+20 (1) LMP - Rpt 70mm Mag/Frame
___/_____

(1) LMP - MARK DAC ON _____

(1) CDR - LRV Heading _____
- Torque Gyro

(1) CDR - MARK DEPART TIME _____ (2+23)

(1) CDR - MARK STOP TIME _____ (2+29)

(1) LMP - MARK DAC OFF

2+30 (1) LMP - LRV Readout

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+10		GEOLOGY STATION 4 (CONT'D)	GEOLOGY STATION 4 (CONT'D)
Change DAC mag - Mag R				
Verify all tools stowed	2+20			
Mount LRV		LCRU Mode Sw - 1 Position TV Horizontal, CCW against stop Mount & power up LRV		
Turn on DAC - f8/250/1 fps				
Go to Station 5 distance: 0.8 km		Go to Station 5	TRAVERSE TO STATION 5	TRAVERSE TO STATION 5
GEOLOGY STATION 5		GEOLOGY STATION 5		
DAC OFF Readout NAV displays	2+30	Power down LRV		

CREW EVA CHECKLIST

VOICE DATA

2+30

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	

STATION 5
STONE MOUNTAIN :40
331/0.8 | 358/3.3 |
LRV=180°
DAC OFF
CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN
35: SAMPLING
Observe terraces & bedrock/regolith changes at contact
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
DAC ON
f8/250/1fps
STA 4
CDR-10
EVA 2
3/20/72

2+40

STATION 5
STONE MOUNTAIN :40
331/0.8 | 358/3.3 |
LRV=180°
DAC OFF
CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN
35: SAMPLING
Observe terraces & bedrock/regolith changes at contact
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
DAC ON
f8/250/1fps
STA 4
LMP-10
EVA 2
3/20/72

2+50

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU/TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Read Amp Hrs and Temps Dismount LRV	2+30	Dismount LRV		GEOLOGY STATION 5	GEOLOGY STATION 5
Panorama		Sw LCRU Mode - 2			
		Align HGA			
		Dust off TV, TCU, LCRU			
General Sampling		General Sampling			
	2+40				
	2+50				

2+50

3+00

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Rpt 70mm Mag/Frame ___/_____

(1) LMP - Rpt 70mm Mag/Frame ___/____

(1) LMP - MARK DAC ON

(1) CDR - MARK DEPART TIME _____ (3+09)

3+10

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	ACTIVITY	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+50			GEOLOGY STATION 5 (CONT'D)	GEOLOGY STATION 5 (CONT'D)
	3+00				
Verify all tools stowed					
Mount LRV		Sw LCRU Mode - 1			
		Position TV horizontal & CCW			
DAC on - f8/250/1 fps		Mount & power up LRV			
Go to Sta. 6	3+10	Go to Sta. 6			

3/20/72 EVA 2 CDR-11

STATION 6
FOOT OF STONE MT. :20
341/0.4 | 360/2.9 |

LRV-180°
DAC OFF

CDR
MODE SW-2
HGA
DUST

LMP
DISPLAYS
PAN

15: SAMPLING
FRAME COUNT

MODE SW-1
POS 1Y HORIZ, CCW

DAC ON
f8/250/1fps

STA 7

3+10

(1) CDR - MARK STOP TIME _____ (3+12)
(1) LMP - MARK DAC OFF
(1) LMP - LRV READOUT

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+20

3/20/72 EVA 2 LMP-11

STATION 6
FOOT OF STONE MT. :20
341/0.4 | 360/2.9 |

LRV-180°
DAC OFF

CDR
MODE SW-2
HGA
DUST

LMP
DISPLAYS
PAN

15: SAMPLING
FRAME COUNT
MODE SW-1
POS 1Y HORIZ, CCW

DAC ON
f8/250/1fps

STA 7

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

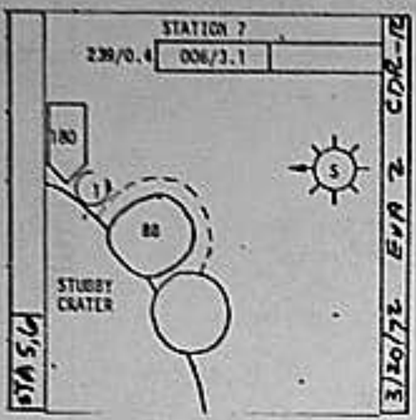
(1) CDR/LMP - EMU Check

3+30

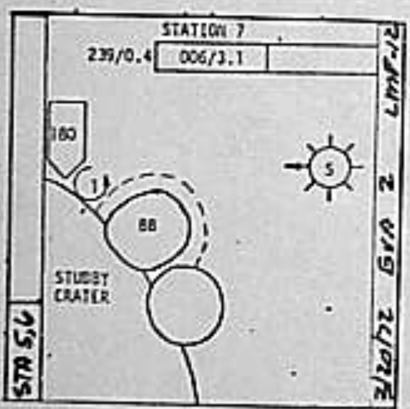
MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+10		TR.TO ST.6	TR.TO ST.6
	Distance - 0.4 km			
GEOLOGY STATION 6		GEOLOGY STATION 6	GEOLOGY STATION 6	GEOLOGY STATION 6
DAC OFF Readout LRV Displays Dismount LRV		Power down LRV Dismount LRV Sw LCRU - Mode 2		
Panorama		Align HGA Dust TV, TCU, LCRU		
General Sampling		General Sampling		
	3+20			
	3+30			




LOOK FOR:
•N scarp 001/2.9
STATION 7
NEAR STUBBY :15
DAC OFF
LMP
DISPLAYS
PAN
CDR
MODE SW-2
HGA
DUST
3: DESCRIPT
500•Stubby-20
•Smoky-15
7: SAMPLING (88)
Note any differences between Cayley & Descartes and any flow on E. side of Stubby
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
DAC ON
f8/250/1fps
CDR-13 EVA 2 3/20/72
STA 8




LOOK FOR:
•N scarp 001/2.9
STATION 7
NEAR STUBBY :15
DAC OFF
LMP
DISPLAYS
PAN
CDR
MODE SW-2
HGA
DUST
3: DESCRIPT
500•Stubby-20
•Smoky-5
7: SAMPLING (88)
Note any differences between Cayley & Descartes and any flow on E. side of Stubby
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
DAC ON
f8/250/1fps
LMP-13 EVA 2 3/20/72
STA 8

3+30

(1) CDR - Rpt 70mm Mag/Frame ___/____

(1) LMP - Rpt 70mm Mag/Frame ___/____

(1) LMP - Rpt DAC ON

(1) CDR - MARK DEPART TIME _____ (3+32)

(1) CDR - MARK STOP TIME _____ (3+36)

(1) LMP - Rpt DAC OFF

(1) LMP - LRV Readout

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+40

(1) CDR - Rpt 70mm Mag/Frame ___/____

(1) LMP - Rpt 70mm Mag/Frame ___/____

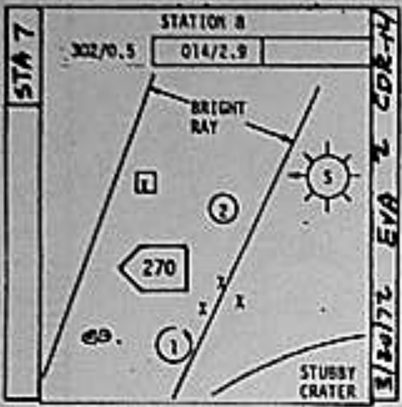
3+50

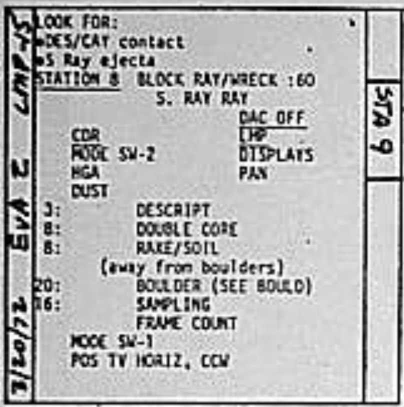
MISSION: APOLLO 16
EVA: 2

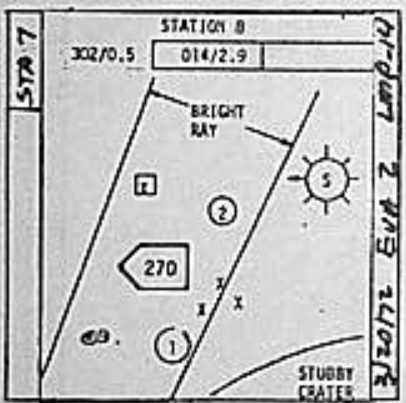
DATE: MARCH 1972

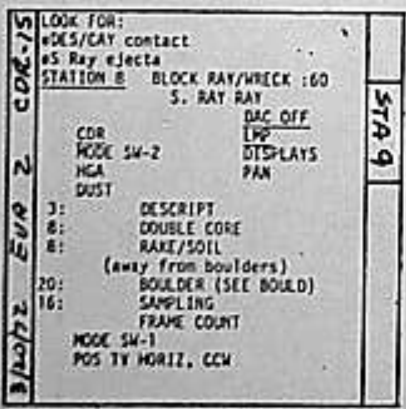
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	TASK FUNCTION CDR
Verify tools stowed	3+30	Sw LCRU Mode - 1			
Mount LRV		Position TV horizontal and CCW			
DAC ON - f8/250/1 fps		Mount & power up LRV			
Go to Station 7		Go to Station 7		TRAV. TO STAT. 7	TRAV. TO STAT. 7
	Distance - 0.4 km				
GEOLOGY STATION 7		GEOLOGY STATION 7		GEOLOGY STATION 7	GEOLOGY STATION 7
DAC OFF Readout LRV Displays (NAV, Amp Hr and Temps) Dismount LRV		Power down LRV Dismount LRV Sw LCRU Mode - 2			
		Align HGA			
Panorama		Dust TV, TCU, LCRU			
Get 500mm camera -		Description			
20 photos - Stubby 15 photos - Smoky	3+40				
General Sampling (from BB Crater)		General Sampling			
Verify all tools stowed					
Mount LRV		Sw LCRU Mode - 1			
	3+50				

CREW EVA CHECKLIST









VOICE DATA

3+50

(1) LMP - Rpt DAC ON

(1) CDR - MARK DEPART TIME _____ (3+52)

(1) Cap Com-- Park LRV Heading Down Sun for Nav up-date at station 8

(1) CDR - MARK STOP TIME _____ (3+56)

(1) LMP - Rpt - DAC OFF

(1) LMP - LRV Readout

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					

4+00

(1) CDR/LMP - Core tubes

upper _____

lower _____

4+10

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+50	Position TV horizontal & CCW		
DAC ON - f8/250/1 fps		Mount & power up LRV	TRAV. TO STAT. 8	TRAV. TO STAT. 8
Go to STATION 8		Go to STATION 8		
Distance - 0.6 km				
GEOLOGY STATION 8		GEOLOGY STATION 8	GEOLOGY STATION 8	GEOLOGY STATION 8
DAC off Readout LRV Displays		Power down LRV Dismount LRV		
Dismount LRV		Sw LCRU Mode - 2		
Panorama		Dust TV, TCU, LCRU		
Description of Site		Description of Site		
	4+00			
Double Core		Double Core		
	4+10			

4+10

(1) CDR/LMP - Rake/Soil

Rock Bag NO. _____

Soil Bag NO. _____

in SCB _____

4+20

4+30

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Rake/Soil (away from boulders)	4+10	Rake/Soil
Boulder Protocol		Boulder Protocol
	4+20	
	4+30	

GEOLOGY STATION 8 (CONT'D)

GEOLOGY STATION 8 (CONT'D)

4+30

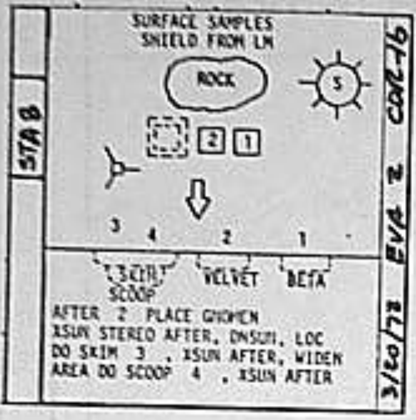
4+40

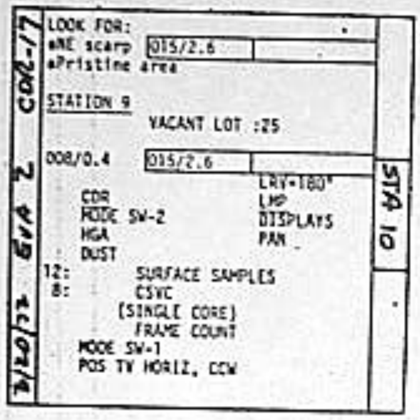
4+50

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	CRUTV	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+30				
Sampling		Sampling		GEOLOGY STATION 8 (CONT'D)	GEOLOGY STATION 8 (CONT'D)
	4+40				
	4+50				





4+50

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

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

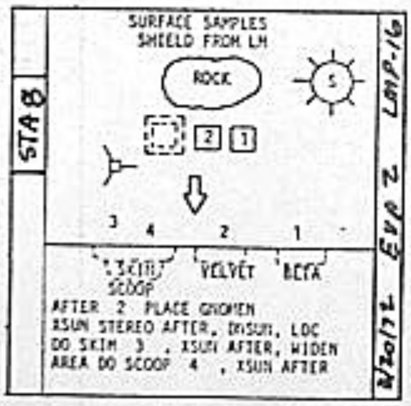
(1) LMP - Rpt 70mm mag/frame ____/____

(1) CDR - LRV Heading ____
- Torque Gyro

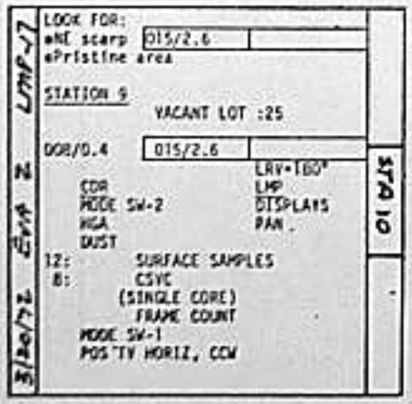
(1) CDR - MARK DEPART TIME ____ (4+56)

(1) CDR - MARK STOP TIME ____ (4+59)

5+00 (1) LMP - LRV Readout



(1) CDR/LMP - Core tube ____



(1) LMP - Rpt CSVC IN (CDR) ____ Bag

5+10

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+50		GEO. STATION 8 (CONT'D)	GEO. STATION 8 (CONT'D)
Verify tools secured				
Mount LRV		Sw LCRU Mode - 1		
		Pos TV horiz., CCW		
		Mount LRV & power up		
Go to STATION 9		Go to STATION 9	TR. TO ST. 9	TR. TO ST. 9
	Distance - 0.45 km			
GEOLOGY STATION 9		GEOLOGY STATION 9	GEOLOGY STATION 9	GEOLOGY STATION 9
Readout LRV Displays Dismount LRV Panorama	5+00	Powerdown LRV Dismount LRV Sw LCRU Mode - 2		
		Align HGA		
Ready single core		Dust TV, TCU, LCRU		
Single Core		Single Core		
Put core in CSVC		Put core in CSVC		
CSVC in CDR SCB				
	5+10			

5+10

(2) CDR/LMP - Surface samplers in SCB ____

Bag NO'S

Skim Sample ____

Scoop Sample ____

5+20

(1) CDR - Rpt 70mm Mag/Frame ___/____

(1) LMP - Rpt 70mm Mag/Frame ___/____

(1) CDR - MARK DEPART TIME ____ (5+24)

(1) CDR/LMP - AT Significant Features

Bearing ____, ____, ____, ____

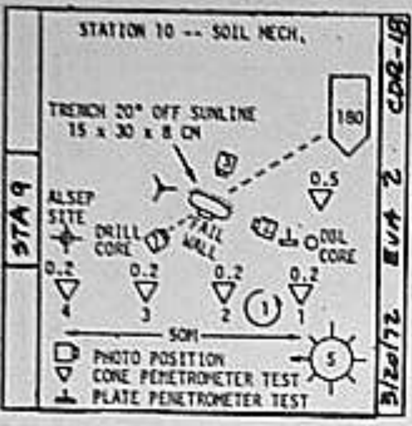
Range ____, ____, ____, ____

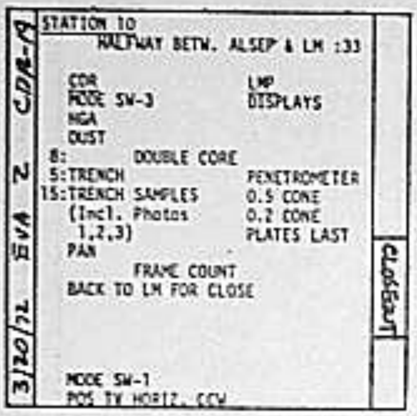
5+40

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION	
Surface Samplers	5+10	Surface Samplers	GEOLOGY STATION 9 (CONT'D)	GEOLOGY STATION 9 (CONT'D)
#1 - Beta cloth				
# 2 - Velvet				
Skim Sample				
	5+20			
Scoop Sample				
Verify tools stowed				
Mount LRV		Sw LCRU Mode - 1		
		Pos TV horiz., CCW		
		Mount LRV & power up		
GO TO STATION 10 (near ALSEP)		GO TO STATION 10 (near ALSEP)	TRAVERSE TO STATION 10	TRAVERSE TO STATION 10
2.6 Km				
	5+40			




STATION 10
HALFWAY BETW. ALSEP & LM :33
CDR
MODE SW-3
HGA
DUST
8: DOUBLE CORE
5: TRENCH
15: TRENCH SAMPLES
(Incl. Photos 1,2,3)
PAN
FRAME COUNT
BACK TO LM FOR CLOSE
MODE SW-1
POS TV HORIZ. CCW
LMP
DISPLAYS
PENETROMETER
0.5 CONE
0.2 CONE
PLATES LAST
CDR-A
EVA 2
3/20/72
CLOSEOUT

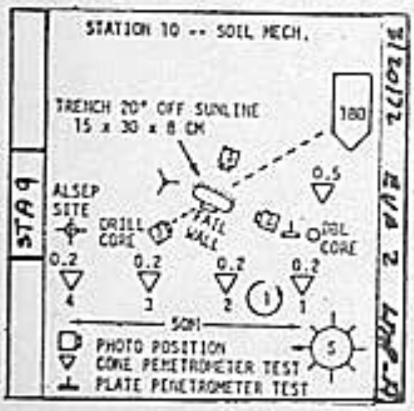
5+40

(1) CDR - MARK STOP TIME ______ (5+46)

(1) LMP - LRV Readout

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

5+50




STATION 10
HALFWAY BETW. ALSEP & LM :33
CDR
MODE SW-3
HGA
DUST
8: DOUBLE CORE
5: TRENCH
15: TRENCH SAMPLES
(Incl. Photos 1,2,3)
PAN
FRAME COUNT
BACK TO LM FOR CLOSE
MODE SW-1
POS TV HORIZ. CCW
LMP
DISPLAYS
PENETROMETER
0.5 CONE
0.2 CONE
PLATES LAST
EVA 2
3/20/72
CLOSEOUT

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR/LMP - Core tubes

Upper ______

lower ______

(1) LMP - Rpt Penetrometer TEST 1

INDEX ______, ______

Cones ______, ______

Depth ______, ______

6+00

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION
	5+40		TRAVERSE TO STATION 10 (CONT'D)
<u>GEOLOGY STATION 10</u>		<u>GEOLOGY STATION 10</u>	
Readout LRV Displays		Power down LRV	GEOLOGY STATION 10
Dismount LRV		Dismount LRV Sw LCRU Mode - <u>3</u> Align HGA Dust TV, TCU, LCRU	
Get double core ready			
Double Core		Double Core	
	5+50		
Penetrometer Tests Use 0.5 in^2 cone* Do test around core hole		Dig Soil Mechanics Trench	
	6+00		

* If penetration less than 12 in, change to 0.2 in^2 cone for further tests.

6+00

(1) LMP - TEST 2

INDEX _____, _____

Depth _____, _____

(1) LMP - TEST 3

INDEX _____, _____

Depth _____, _____

(1) LMP - TEST 4

INDEX _____, _____

Depth _____, _____

6+10

(1) LMP - Plate Test 1 & 2

Index _____, _____

Depth _____, _____

Index _____, _____

Depth _____, _____

(1) CDR/LMP EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

(1) CDR - Rpt 70mm Mag/Frame

___/_____

(1) LMP - Rpt 70mm Mag/Frame

___/_____

(1) CDR - MARK DEPART TIME _____ (6+19)

6+20

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	ACTIVITY	TASK FUNCTION LMP	TASK FUNCTION CDR
(change to 0.2 in^2 cone if required)	6+00			GEOLOGY STATION 10 (CONT'D)	GEOLOGY STATION 10 (CONT'D)
Perform second test near core hole					
Perform 3rd test 50 ft. away toward ALSEP site					
Perform 4th test 50 ft. closer to ALSEP		Take samples from soil mechanics trench - from bottom, sides, discontinuities			
Perform final cone test near drill core site					
Return to LRV					
Change to plate	6+10				
"Fail Wall" plate test at trench					
Plate test at core site		Panorama			
Secure penetrometer					
Verify all tools recured					
Mount LRV		Sw LCRU Mode - 1 Position TV horiz., CCW Mount & power up LRV			
	6+20				

CDR-20 EVA 2 3/20/72

3/20/72 EVA 2 CDR-21

EVA 2

6+20 LRV PWR DWN
1. LRV at MESA; H=351° in sun
2. ± 15 VDC sw - OFF

6+23 RESET FAR UV CAMERA

6+26 UNLOAD PLSS
1. LMP SCB to +Z footpad
2. Discard core cap disp
3. Tongs to HTC
4. Hammer to L. seat
5. Stow LMP ANT
6. LMP unload CDR

6+29 PACK ETB (CDR OR LMP)
1. ETB (SRC table) to floor-board

CLOSEOUT

CDR-22 EVA 2 3/20/72

2. Place in ETB
2-HEDC W/mags
2-HEDC mags
2-DAC mags
1-mag from 500MM (restow 500MM under seat)
1-mag from DAC
1-set maps
2-padded bags (HTC)
DAC bat to sun

5+38 EMU CLEANUP
1. Clean EMU's & stow ants
2. Brush to LCRU

5+41 LRV, LCRU CONFIGURE
1. LCRU power - OFF
2. LCRU blankets 100% open
3. Open LRV bat covers (dust if dirty), dust LCRU

CLOSEOUT

LMP-20 EVA 2 3/20/72

3/20/72 EVA 2 LMP-21

EVA 2

6+20 LRV PWR DWN
1. Readout LRV displays

6+22 TV
1. Switch LCRU - 3 [FAR UV
2. Align HGA
3. Dust GCTA & LCRU

PLACE HEDC & BAG DISP ON L. SEAT

6+26 UNLOAD PLSS
1. CDR unload LMP
2. SCB (CDR) to L. HTC
3. Tongs to HTC
4. Stow CDR ANT

6+29 PACK SRC 2
1. SCB from LHTC to SRC 2

ETB

LMP-22 EVA 2 3/20/72

2. Seal SRC 2

6+34 PACK ETB (CDR OR LMP)
1. ETB (table) to L. flrbrd
2. Place in ETB
2-HEDC W/mags
2-HEDC mags
2-DAC mags
1-mag from 500MM (restow 500MM under seat)
1-mag from DAC
1-set maps
2-padded bags (L. seat bag)
DAC bat to sun
LARGE ROCKS (LRV) TO SCB (PALLET) TO +Z PAD

6+38 EMU CLEANUP
Clean EMU's & stow ants

CLOSEOUT

6+20

(1) CDR - MARK STOP TIME _____ (6+21)

(1) LMP - LRV Readout

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	
Amps Bat 1		Volts Bat 1	
Amps Bat 2		Volts Bat 2	

(1) CDR - MARK UV CAM Reset _____

Film Advance _____

AZ _____ (310), EL _____ (56)

6+30

ETB CONTENTS

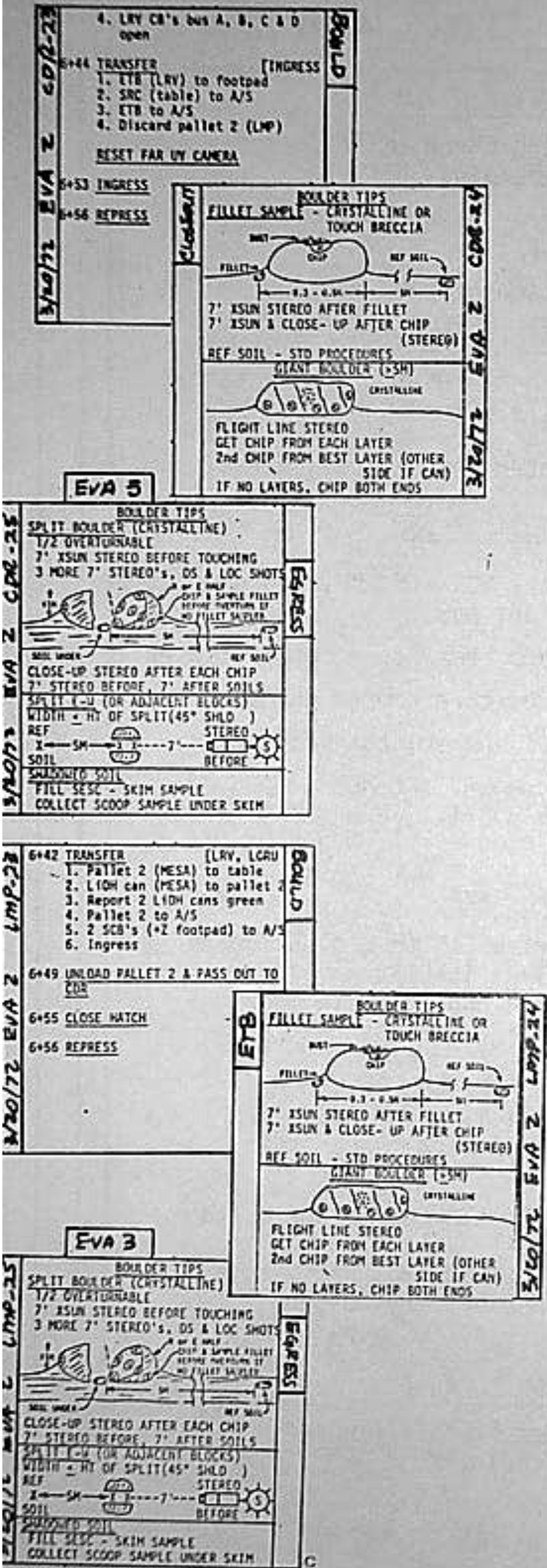
- 2 - 70mm CAM w/mag _____ (D), _____ (I
- 2 - 70mm mags _____ (C), _____ (H
- 2 - 16mm mags _____ (Q), _____ (S
- 500mm cam mag _____ (L)
- 16mm cam mag _____ (R)
- Maps

6+40

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION LMP	TASK FUNCTION CDR
ARRIVE AT LM	6+20	ARRIVE AT LM	EVA CLOSEOUT	EVA CLOSEOUT
Readout all LRV Displays		Park LRV at MESA in sun x sun (heading 351°)		
Dismount LRV		Power down LRV (± 15 VDC Sw - OFF)		
TV				
Switch LCRU Mode - 3		Dismount LRV		
Align HGA		RESET FAR UV CAMERA		
Dust TV, TCU, LCRU		Punch "reset", verify target (7) with MCC		
Put HEDC on L seat		Enter new azimuth, elevation		
UNLOAD PLSS		UNLOAD PLSS		
Hold Still		Take SCB off LMP, place on +Z foot pad		
		Throw away core cap dispenser		
		Stow core rammer on HTC		
		Put hammer, tongs on HTC		
Take SCB 2 off CDR, put on HTC		Stow LMP antenna		
Put tongs on HTC	6+30	Hold Still		
Stow CDR antenna				
PACK SRC 2		PACK ETB		
Get SCB 2 from HTC Place SCB pouches up in SRC 2		Bring ETB to L floor board Place in ETB:		
Remove skirt & seal protector		2 - HEDC's (with mags) 2 - 70mm mags		
Close & seal SRC 2		2 - 16mm mags 2 - Padded Bags		
Place SRC 2 by ladder on pad		1 - mag from 500mm cam restow cam under seat		
		Take ETB to R floor board Pack:		
Put any large rocks collected during EVA 2 on +Z pad		1 - mag from DAC - turn DAC battery to sun 1 - set of maps		
EMU CLEANUP		EMU CLEANUP		
Clean EMU's		Get brush off LCRU - clean EMU's		
	6+40			



6+40

(1) LMP - Rpt PLSS LiOH CANS
PINS _____ (Green)

(2) CDR - Batt Covers - Open

(1) CDR - Rpt LRV CB's A,B,C&D - OPE

ITEMS Transferred to A/S

- SCB _____ (6)
- Pallet No. 2 W/ECS LiOH CAN
- ETB
- SRC

6+50

(2) CDR - Rpt Pallet № 2 Jettison

(1) CDR - Mart UV CAM Reset
Film Advance _____
AZ _____ (137), EL _____ (39)

(1) LMP - Report hatch closed

(1) CDR - Report cabin repress

7+00

(END EVA 2)

MISSION: APOLLO 16
EVA: 2

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	6+40	
TRANSFER Unstow Pallet 2 from MESA to table		LRV, LCRU CONFIGURE
		Turn off LCRU
LiOH can (in MESA) - place in Pallet 2		Verify LCRU blankets open 100%
Report status of green pressure indicators on PLSS LiOH Cans		Open LRV battery covers (dust off mirrors if dirty). Redust LCRU
Take Pallet 2 up ladder		LRV CB's A,B,C,D - OPEN
Open Hatch -		TRANSFER
Put Pallet 2 inside		Take ETB to foot pad, or attach to LEC
Return to surface		
Get SCB from foot pad (+Z)		
Take SCB to ascent stage		Take SRC to ascent stage, pass into cabin
INGRESS		
Receive & stow SRC Strip Pallet 2 - LiOH cans (3) Food parcels PLSS batteries	6+50	Return to surface, (or hand up ETB) Get ETB. Climb ladder
		Pass in ETB
Receive & stow ETB		Receive Pallet 2, return to surface. Discard Pallet 2
Pass out Pallet 2		
		RESET FAR UV CAMERA
		Punch "reset", verify target (8) with MCC
		Enter new azimuth, elevation
		Climb ladder
		INGRESS
Close hatch		REPRESS
	7+00	

CREW DUTY	TASK FUNCTION LMP	TASK FUNCTION CDR
	EVA TERMINATION	EVA CLOSEOUT (CONT'D)
		EVA TERMINATION

3.2.3 EVA-3

The detailed timeline procedures for EVA-3 are shown in the following vertical format pages.

The detailed sampling and related procedures during the traverse are given in Sections 3.2.4 and 3.2.5 .

BOULD

PLSS TO LM H2O TRANSFER

PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - Close

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - Open
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - On

3/20/72 EVA 3 CDR-26

CODE

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

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

NOTE: AT START OF EVA 3

- SUN ANGLE ~ 37°
- LM SHADOW ~ 7.9m (25 ft.)
- ASTRONAUT SHADOW LENGTH ~ 2m (6.5 ft.)

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

BOULD

PLSS TO LM H2O TRANSFER

PLSS Pump - OFF
Disconnect PLSS H2O
Connect LM H2O
CB(16) ECS: LCG Pump - Close

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - Open
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - On

3/20/72 EVA 3 LMP-26

0+10

APOLLO 16

NOMINAL TIMELINE

LUNAR SURFACE EVA 3

MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	LCRU TV	TASK FUNCTION LMP	
Start EVA Watch	0+00	Start EVA Watch (Call "MARK")		PRE-EGRESS OPERATIONS	PRE-EGRESS OPERATIONS
		NOTE: detailed procedures are presented in "Lunar Surface Checklist" Equipment Prep-EVA 3 Section			
Open hatch	0+10	EGRESS			

CDR-27 EVA 3

EVA 3

0+00 CABIN DEPRESS
Start watch (call mark)

0+10 EGRESS
1. PLSS ANT (LMP deploy)
2. Jett bag - discard
3. Lower ETB

0+17 RESET FAR UV CAMERA [EGRESS
Read bat temp

0+20 ETB TO L. FLOORBOARD
DEPLOY LMP ANT

0+21 LCRU POWER UP & BAT
1. Unstow LCRU bat (MESA)
2. Tidy up MESA blankets
3. Stow bat in L. seat bag
4. LCRU pwr sw - INT

LOAD UP

CDR-28 EVA 3

EGRESS

0+26 TV
1. Close LRV bat covers & pres tight
2. Align HGA
3. LCRU covers - open 100%
4. LRV CB's - bus A, B, C, D & NAV - close

0+29 TRAVERSE LOADUP (CDR OR LMP)
1. Unload ETB
R. Seat
LMP HEDC (filter on)
Mag R
Maps
L. Seat
Mag L to 500MM (500MM in L. seat bag)
3-mags (F,K,M)
3-mags (S,T,U)
CDR HEDC

LMP-27 EVA 3

EVA 3

0+00 CABIN DEPRESS
Start watch
Open hatch

0+10 PREP
1. Deploy CDR ANT
2. Jett bag to CDR
3. ETB to CDR
4. Verify [TV
Recorder - OFF
Vox sens (2) - max
CB config
Utility, floodlight - OFF

0+17 EGRESS
NOTE: Close Hatch

PLSS ANT (CDR DEPLOY)

LOAD UP

LMP-28 EVA 3

EGRESS

0+21 TRAVERSE LOADUP (CDR OR LMP)
1. Unload ETB
R. Seat
LMP HEDC (filter on)
Mag R
Maps
L. Seat
Mag L to 500MM (500MM in L. seat bag)
3-mags (F,K,M)
3-mags (S,T,U)
CDR HEDC
2. Mag R (R. seat) to DAC
3. Maps to holder
4. SCB (R. seat bag) to L. HTC
5. ETB to table
6. Unstow big rock bag (R.MESA)
7. Tidy MESA blankets
8. Big rock bag to HTC

0+10

(1) LMP - Deploy CDR PLSS Antenna

(2) LMP - ETB Contents

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

(1) CDR - EMU Check

O2	
FLAGS	
PRESS	
COOL	

(2) LMP - EMU Check

O2	
FLAGS	
PRESS	
COOL	

(1) CDR - Far UV Cam Reset

MARK _____

FILM ADVANCE _____

AZ _____(198), EL. _____(38)

BATT TEMP _____

0+20

(1) CDR - LCRU BATT (FROM MESA) UNDER LEFT SEAT

(1) CDR - LRV BATT COVERS CLOSED & PRESS TIGHT

(1) LMP - MAG _____(L) ON 500MM

(1) LMP - 70MM MAGS _____(F), _____(K), _____(M) UNDER SEAT

(1) LMP - 16MM MAGS _____(S), _____(T), _____(U) UNDER SEAT

(1) CDR - 16MM MAG _____(R) ON DAC

0+30

MISSION: APOLLO 16 DATE: MARCH 1972

EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
Deploy CDR antenna	0+10	Move thru hatch
Hand jettison bag to CDR		Toss jettison bag to surface (-y strut)
Hook up LEC to ETB		Pass in LEC hooks
Hand ETB to CDR		Lower ETB to surface
Recorder - OFF		Descend to surface
Verify - VOX Sens - MAX - CB Config - Utility, flood lights-OFF		Gain Surface
EGRESS		RESET FAR UV CAMERA
Move thru hatch Close hatch		Punch "reset", verify target with MCC Enter new azimuth, elevation
Descend to surface		Read battery temp labels
		TV
	0+20	Get new battery from MESA for LCRU
Gain Surface		
ETB UNPACK		
Get ETB and place on L floor pan LRV		Place LCRU Batt under L Seat
		LCRU Mode sw - INT
Place LMP HEDC, 1-16 mm mag (R), maps on R seat		Close LRV battery covers - press tight Open LCRU covers - 100% Push in LRV CB's - bus A,B,C,D (Verify NAV closed)
Install mag L on 500 mm cam, restow		
Place 3-70 mm mags (F,K,M) & 3-16 mm mags (S,T,U) under seat		Verify Dust Brush on LCRU
		Place 16 mm mag (R) on DAC
Place CDR HEDC on seat		Put maps in holder
Return ETB to SRC table		Get SCB out from under seat - lay out 2-20 bag dispensers & core tube cap assy.
Unstow Big Rock Bag		
	0+30	

TASK FUNCTION (SEQ CAM / LMP / CDR):
- CDR: EGRESS
- LMP: EGRESS
- LMP: EQUIPMENT TRAVERSE PREP
- CDR: LRV/EQUIPMENT PREP

CREW EVA CHECKLIST

VOICE DATA

0+30

3/20/72 EVA 3 CDR-29

2. Mag R (R. seat) to DAC
3. Maps to holder
4. SCB (R. seat bag) to L. HTC
5. ETB to table
6. Unstow big rock bag (R.MESA
7. Tidy MESA blankets
8. Big rock bag to pallet

0+35 PLSS LOADUP
1. SCB (5,6,7,8) (pallet) to LMP PLSS
2. Cap disp (SCB HTC) to LMP PLSS
3. 2 bag disp (SCB HTC), one to each seat
4. Hammer (L. seat) to pocket
5. LMP loadup CDR
6. Close HTC

LRV Prep

3/20/72 EVA 3 CDR-30

0+38 RESET FAR UV CAM

REPORT BAT TEMP

0+41 LRV PREP
1. HEDC & bag disp (L. seat) to RCU
2. + 15 VDC - prim
3. Initialize NAV

LOAD UP

(1) CDR - FAR UV CAM RESET _____ MARK
FILM ADVANCE
AZ _____ (237), EL. _____ (28)

0+40

3/20/72 EVA 3 LMP-29

0+35 PLSS LOADUP
1. CDR load LMP
2. SCB (HTC) to CDR PLSS

0+38 PAN
1. HEDC (L. seat) to RCU
2. Pan +Z footpad
3. HEDC (RCU) to L. seat

0+40 LRV PREP
1. HEDC & bag disp (R. seat to RCU (filter R. pos)
2. LCRU mode sw - 1
3. Pos TV CCW
4. Support NAV INT

Turn on DAC [LM + 19 min]
f4/250/1fps

11, 6115

(1) CDR - ALIGN NAV SYSTEM
(1) LMP - LRV READ OUT

SSD		ROLL		PITCH	
COMPUTED NAV HEADING					

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	

0+50 (1) CDR - MARK DEPART TIME _____ (0+46)

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Place Big Rock Bag on HTC	0+30	Place SCB (3 or 4) on HTC			
PLSS LOADUP Hold Still		PLSS LOADUP		PLSS LOADUP/PAN	PLSS LOADUP/FAR UV CAM.
		Get SCB (5,6,7,8) from pallet, place on LMP			
		Put cap dispenser on LMP			
		Put core rammer on LMP			
		Place hammer in pocket or on LMP			
Put SCB (3 or 4) on CDR		Hold Still			
PAN Get CDR HEDC					
Go to 20 ft. off +Z pad panorama		RESET FAR UV CAMERA			
		Punch "reset", verify Target (10) with MCC			
		Enter azimuth and elevation			
Replace HEDC on L Seat					
LRV PREP	0+40				
Put on HEDC (from R Seat) with 20 DSBD filter - Right position		LRV PREP		LRV PREP	LRV PREP
Sw LCRU Mode - 1		Don HEDC (from L Seat) with 20 DSBD			
Position TV horizontal - turn CCW to stop		Mount LRV			
Mount LRV		Power up LRV - $\underline{+}$15 VDC - prim			
Read out LRV displays		Initialize NAV system			
Go to Station 11		Go to Station 11		TRAV. TO STAT. 11	TRAV. TO STAT. 11
Distance: 5.5 Km					
	0+50				

0+50

(1) LMP - MARK DAC ON _____
F4,1/250,1fps

(19 min after leaving LM)

(1) CDR/LMP - AT SIGNIFICANT FEATURES
BEARING _____,_____,_____,_____
RANGE _____,_____,_____,_____

1+00

(2) CDR/LMP - Slope (EST) _____°
Amps _____, Speed _____

1+10

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0+50			TRAVERSE TO GEOLOGY STATION 11 (CONT'D)	TRAVERSE TO GEOLOGY STATION 11 (CONT'D)
	1+00				
TURN ON DAC - f4/250/1fps					
	1+10				

1+10

1+20 (1) LMP - DAC SPEED 12 fps
(16 Min after DAC ON)

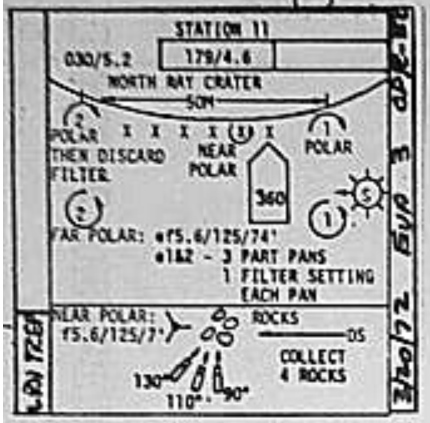
(1) CDR/LMP - AT SIGNIFICANT FEATURES
BEARING ______,______,______,______
RANGE ______,______,______,______

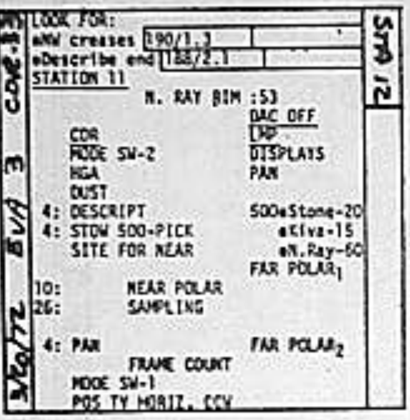
(1) LMP - MARK DAC OFF ______
1+30

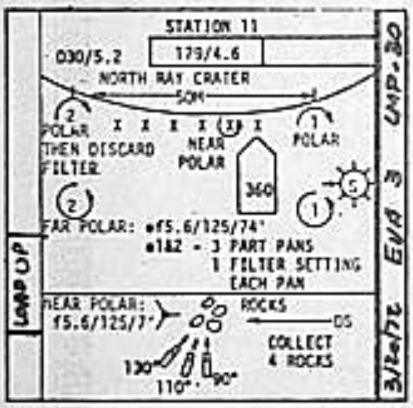
MISSION: APOLLO 16
EVA: 3

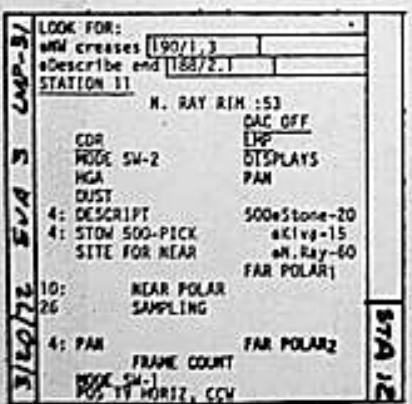
DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+10			TRAVERSE TO GEOLOGY STATION 11 (CONT'D)	TRAVERSE TO GEOLOGY STATION 11 (CONT'D)
CHANGE DAC SPEED to 12 fps	1+20				
	1+30				









1+30

(1) CDR - MARK STOP TIME _____ (1+30)

(1) LMP - LRV READOUT

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

(1) CDR - RPT 70MM MAG/FRAME

___/_____

(1) LMP - RPT 70MM MAG/FRAME

___/_____

(1) LMP - RPT 500MM MAG/FRAME

___/_____

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

1+40

(1) LMP - Far Polar 1 (f5.6/1/125/74')

Part Pan 1 _____ _____ _____

Part Pan 2 _____ _____ _____

Part Pan 3 _____ _____ _____

(1) LMP - Near Polar (f5.6/1/125/7')

90° _____ _____ _____

110° _____ _____ _____

130° _____ _____ _____

Rocks bagged in _____

_____

_____

_____

_____

1+50

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
GEOLOGY STATION 11	1+30	GEOLOGY STATION 11		GEOLOGY STATION 11	GEOLOGY STATION 11
Turn DAC off Read out LRV Displays		Power down LRV Dismount LRV Sw LCRU Mode - 2			
Dismount LRV		Align HGA			
Panorama 1		Dust TV, TCU, LCRU Description of site			
Get 500 mm Camera - · Stone Mt. - 20 photos · Kiva Crater - 15 photos · N. Ray - 60 photos					
Give 500 to CDR		Stow 500 mm Camera			
Take Far Polarimetric Photos - 3 part pans of N. Ray at each filter setting (Left, Center, Right) f:5.6/125/74		Pick out site for near Polarimetric photos and sampling - place gnomon			
		Take dn sun & locator shots			
	1+40				
Near Polarimetric Photos		Near Polarimetric Photos			
Photo rocks at phase angles of 90, 110, 130 degrees at 7 ft. distance					
f:5.6/125/7'					
Bag rocks		Collect rocks (at least 4)			
Take x sun after photo(s)					
	1+50				

1+50

2+00

2+10

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	1+50				
General Sampling		General Sampling		GEOLOGY STATION 11 (CONT'D)	GEOLOGY STATION 11 (CONT'D)
	2+00				
	2+10				

2+10

(1) LMP - Far Polar 2 (f5.6/1/125/74')

Part Pan 1 ____ ____ ____

Part Pan 2 ____ ____ ____

Part Pan 3 ____ ____ ____

2+20 (1) LMP - Verify 70MM cam 1/250 sec
filter discarded

(1) CDR - Rpt 70MM MAG/FRAME
___/____

(1) LMP - Rpt 70MM MAG/FRAME
___/____

(1) CDR - MARK DEPART TIME ____ (2+23)

(1) CDR - MARK STOP TIME ____ (2+26)

(1) LMP - LRV READ OUT

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	

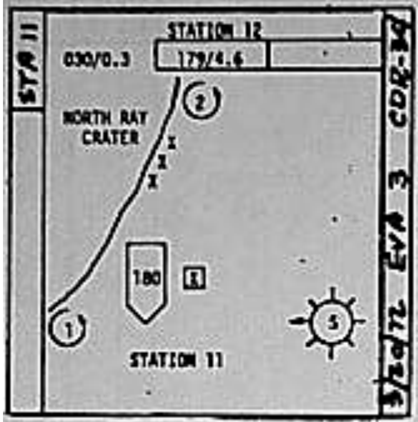
2+30

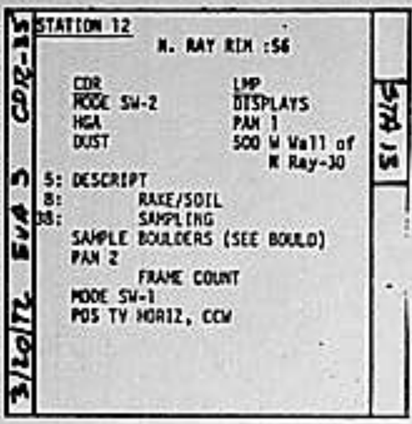
MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	2+10			GEOLOGY STATION 11 (CONT'D)	GEOLOGY STATION 11 (CONT'D)
Take Far polarimetric photos - 3 part pans 50 meters down sun of 1st set, of N. Ray at each filter setting f:5.6/125/74'		Panorama 2			
	2+20	Sw LCRU Mode - 1 Position TV horizontal, CCW to stop			
Discard polarimetric filter Return HEDC to 250 Mount LRV					
LEAVE for STA 12		Mount & power up LRV LEAVE FOR STA 12		TR. TO ST. 12	TR. TO ST. 12
Distance:		.4 Km			
GEOLOGY STATION 12 Read out LRV Displays		GEOLOGY STATION 12 Power down LRV		GEO. STATION 12	GEO. STATION 12
Dismount LRV		Dismount LRV Sw LCRU Mode - 2			
Panorama 1		Align HGA			
		Dust TV, TCU, LCRU			
	2+30				

CREW EVA CHECKLIST

VOICE DATA




STATION 12
N. RAY RIM :56
CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN 1
500 W Wall of
N Ray-30
5: DESCRIPT
8: RAKE/SOIL
38: SAMPLING
SAMPLE BOULDERS (SEE BOULD)
PAN 2
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
CDR-35
STA 13
3/20/72 EVA 3

2+30

(1) CDR/LMP - EMU Check

	CDR	LMP
O2		
FLAGS		
PRESS		
COOL		

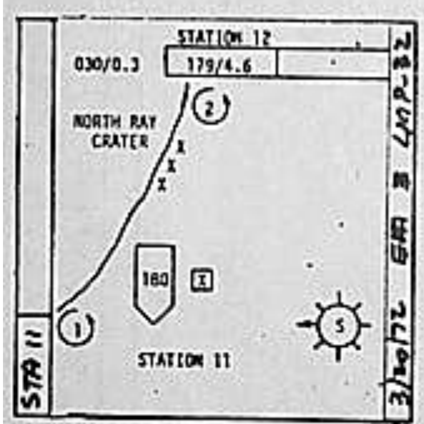
(1) CDR/LMP - Rake/Soil

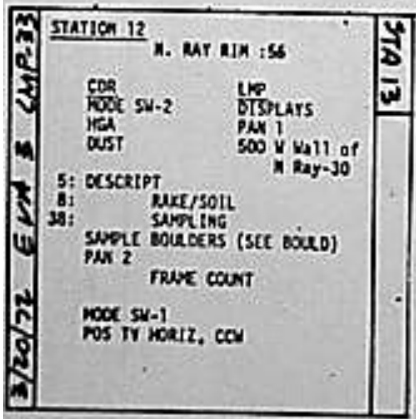
Rocks in Bag ________

1 kg Soil in Bag ________

Stowed in SCB ________

2+40




STATION 12
N. RAY RIM :56
CDR
MODE SW-2
HGA
DUST
LMP
DISPLAYS
PAN 1
500 W Wall of
N Ray-30
5: DESCRIPT
8: RAKE/SOIL
38: SAMPLING
SAMPLE BOULDERS (SEE BOULD)
PAN 2
FRAME COUNT
MODE SW-1
POS TV HORIZ, CCW
LMP-33
STA 13
3/20/72 EVA 3

2+50

MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES		
Get 500 mm Cam - · W. Wall N. Ray Crater - 30 photos	2+30	Description of Site	GEOLOGY STATION 12 (CONT'D)	GEOLOGY STATION 12 (CONT'D)
Stow 500 mm Cam				
Rake/Soil Sample		Rake/Soil Sample		
	2+40			
General Sampling		General Sampling		
	2+50			

CREW EVA CHECKLIST

VOICE DATA

2+50

3+00

3+10

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
General Sampling (Cont'd)	2+50	General Sampling (Cont'd)			
	3+00		GEOLOGY STATION 12 (CONT'D)	GEOLOGY STATION 12 (CONT'D)	
	3+10				

STA 12 | 3/20/72 EVA 3 CDR-36

STATION 13
NORTH RAY EJECTA BLANKET :10

130/.7 | 186/4.3

LRV - 270°

NO TV OR DUST

CDR
LMP PAN

B: ROCK
SOIL (1 KG)
FRAME COUNT

3/20/72 EVA 3 CDR-37 | STA 14

3+10

(1) CDR - Rpt 70MM MAG/FRAME ___/_____

(1) LMP - Rpt 70MM MAG/FRAME ___/_____

3+20

(1) CDR - MARK DEPART TIME _____(3+20)

(1) Cap Com-- Park LRV Heading Down Sun for Nav up-date at station 13

STA 12 | 3/20/72 EVA 3 LMP-36

STATION 13
NORTH RAY EJECTA BLANKET :10

130/0.7 | 186/4.3

NO TV OR DUST

LRV - 270°

CDR
LMP PAN

B: ROCK
SOIL (1 KG)
FRAME COUNT

3/20/72 EVA 3 LMP-37 | STA 14

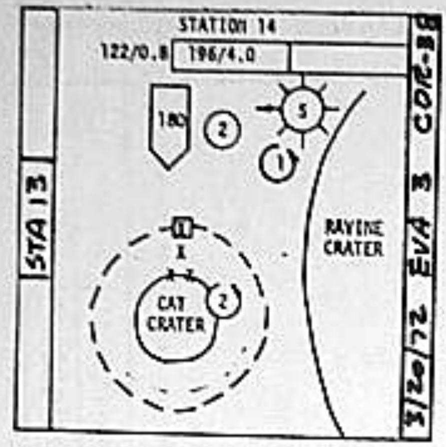
(1) CDR - MARK STOP TIME _____(3+26)

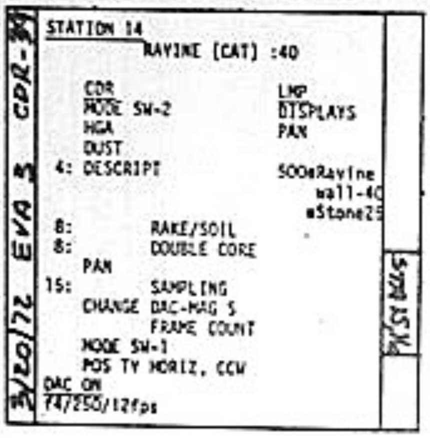
(1) LMP - LRV READ OUT

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

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	TASK FUNCTION (CDR)	TASK FUNCTION (LMP)
General Sampling (Cont'd)	3+10	General Sampling (Cont'd)	GEOLOGY STATION 12 (CONT'D)	GEOLOGY STATION 12 (CONT'D)
Verify tools secured		Sw LCRU Mode - 1		
Mount LRV		Position TV horizontal, CCW		
		Mount & power up LRV		
	3+20			
Go to Sta 13		Go to Sta 13	TRAV. TO STATION 13	TRAV. TO STATION 13
Distance -		0.7 Km		
GEOLOGY STATION 13		GEOLOGY STATION 13	GEO. STATION 13	GEO. STATION 13
Read out LRV Displays		Power Down LRV		
Dismount		Dismount		
Rock/Soil (1 Kg) Sampling		Rock/Soil (1 Kg) Sampling		
	3+30			





3+30

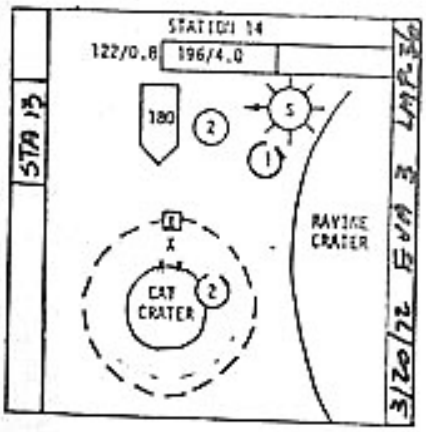
(1) LMP - Rpt 70mm mag/frame ___/____

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

(1) CDR - LRV Heading _____
- Torque Gyro

(1) CDR - MARK DEPART TIME _____ (3+36)

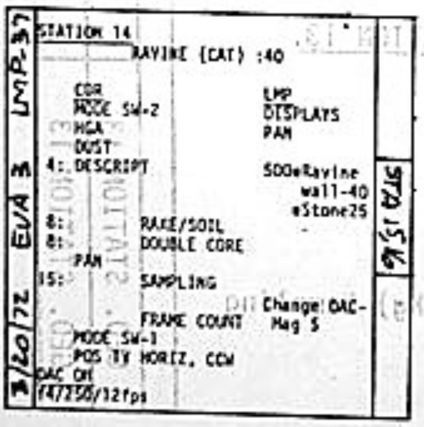
3+40



(1) CDR - MARK STOP TIME _____ (3+43)

(1) LMP - LRV READ OUT

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		

3+50

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	3+30			GEOLOGY STATION 13 (CONT'D)	GEOLOGY STATION 13 (CONT'D)
Verify tools secured					
Mount LRV		Mount LRV			
		Power up LRV		TRAVERSE TO GEO. STATION 14	TRAVERSE TO GEO. STATION 14
Go to STA 14		Go to STA 14			
Distance - 0.9 Km					
	3+40				
GEOLOGY STATION 14		GEOLOGY STATION 14		GEOLOGY STATION 14	GEOLOGY STATION 14
Read out LRV Displays		Power down LRV			
Dismount LRV		Dismount LRV			
		Sw LCRU Mode 2			
		Align HGA			
Panorama					
Get 500 mm Cam - · Ravine wall - 40 photos · Stone Mt. - 25 photos		Dust TV, TCU, LCRU			
		Description			
	3+50				

3+50

(1) LMP - Rpt 500 Mag/Frame
____/______

(1) CDR/LMP - Rake/Soil
Rocks in Bag ____________
1 Kg Soil in Bag ________
Stowed in SCB ___________

(1) LMP - Core Tube No's
upper __________
lower __________

4+00

4+10

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Rake/Soil Sample	3+50	Rake/Soil Sample		GEOLOGY STATION 14 (CONT'D)	GEOLOGY STATION 14 (CONT'D)
Double Core		Double Core			
	4+00				
		Panorama			
General Sampling		General Sampling			
	4+10				

4+10

4+20

(1) LMP - DAC Mag Change to _____(s)

(1) CDR - Rpt 70mm Mag/Frame ___/_____

(1) LMP - Rpt 70mm Mag/Frame ___/_____

(1) CDR - MARK DEPART TIME _____(4+2

(1) LMP - MARK DAC ON _____

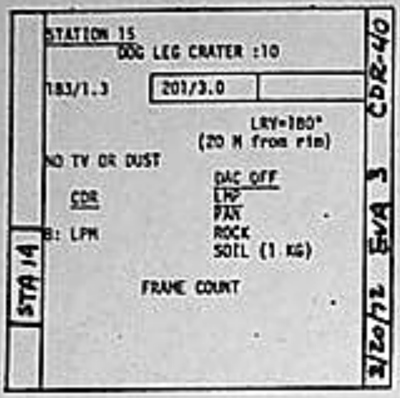
4+30

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+10			GEOLOGY STATION 14 (CONT'D)	GEOLOGY STATION 14 (CONT'D)
Verify tools secured	4+20				
Change DAC Mag to "S"		Sw LCRU Mode - 1			
Mount LRV		Position TV horizontal, CCW			
		Mount & power up LRV			
DAC on - f:4/250/12fps					
GO TO STA 15		GO TO STA 15		TRAVERSE TO STATION 15	TRAVERSE TO STATION 15
Distance -		1.4 Km			
	4+30				

4+30



STA 14

STATION 15
DOG LEG CRATER :10
183/1.3
201/3.0
LRV-180°
(20 M from rim)
NO TV OR DUST
CDR
B: LPM
DAC OFF
LMP
PAN
ROCK
SOIL (1 KG)
FRAME COUNT

CDR-40
EVA 3
3/20/72

(1) LMP - MARK DAC OFF

(1) CDR - MARK STOP TIME ____(4+34)

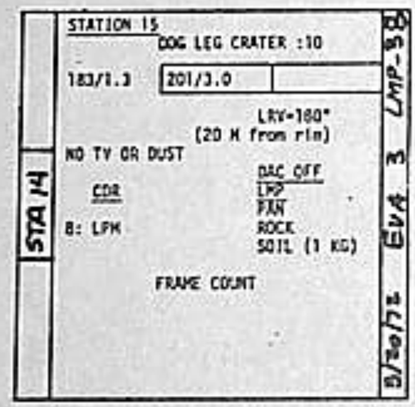
(1) LMP - LRV READOUT

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 Readings -

	X	Y	Z
(1)	____	____	____
(2)	____	____	____
(3)	____	____	____

4+40



STA 14

STATION 15
DOG LEG CRATER :10
183/1.3
201/3.0
LRV-180°
(20 M from rim)
NO TV OR DUST
CDR
B: LPM
DAC OFF
LMP
PAN
ROCK
SOIL (1 KG)
FRAME COUNT

LMP-59
EVA 3
3/20/72

(1) CDR - Confirm power - OFF

(1) CDR - Rpt 70mm Mag/Frame
___/____

(1) LMP - Rpt 70mm Mag/Frame
___/____

(1) CDR - MARK DEPART TIME ____(4+45)

4+50

MISSION: APOLLO 16

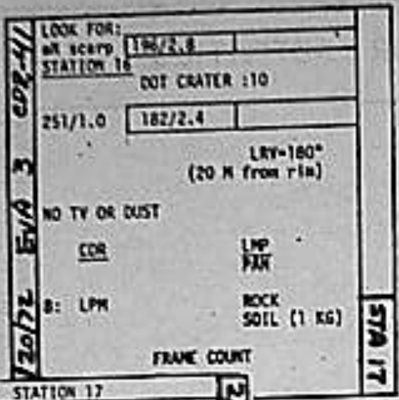
EVA: 3

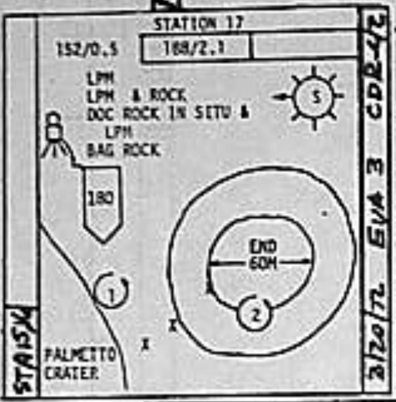
DATE: MARCH 1972

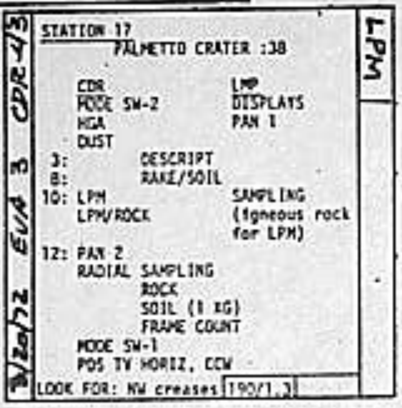
LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+30			TRAV. TO STAT. 15	TRAV. TO STAT. 15
GEOLOGY STATION 15		**GEOLOGY STATION 15**		GEOLOGY STATION 15	GEOLOGY STATION 15
Turn DAC off		Power Down LRV			
Read out LRV Displays		Dismount LRV			
Dismount LRV		Make LPM measurement			
Panorama					
Collect rock/soil sample (1 Kg)					
	4+40				
Verify tools secure		Stow LPM Sensor/Tripod			
Mount LRV		Mount LRV & power up			
Go to Sta 16		Go to Sta 16		TRAV. TO STATION 16	TRAV. TO STATION 16
Distance -		1.1 Km			
	4+50				

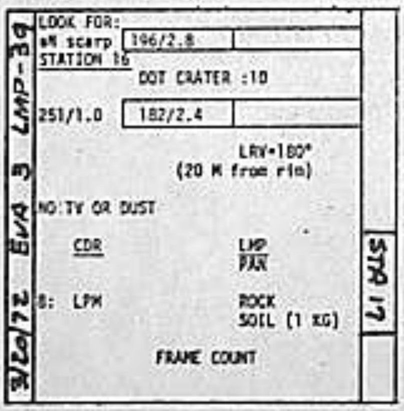
CREW EVA CHECKLIST

VOICE DATA









4+50

(1) CDR - MARK STOP TIME ____(4+51)

(1) LMP - LRV Readout

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 Readings -

	X	Y	Z
(1)	____	____	____
(2)	____	____	____
(3)	____	____	____

5+00

(1) CDR - Confirm Power - OFF

(1) CDR - Rpt 70mm Mag/Frame
___/____

(1) LMP - Rpt 70mm Mag/Frame
___/____

(1) CDR - MARK DEPART TIME ____(5+04)

(1) CDR MARK STOP TIME ____(5+08)
(1) CMP - LRV Readout

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

5+10

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	4+50			TRAV. TO STAT. 16	TRAV. TO STAT. 16
GEOLOGY STATION 16		GEOLOGY STATION 16		GEOLOGY STATION 16	GEOLOGY STATION 16
Read out LRV Displays		Power down LRV			
Dismount LRV		Dismount LRV			
Panorama		Make LPM measurement			
Collect rock/soil sample (1 Kg)					
	5+00				
Verify tools secured		Stow LPM Sensor/Tripod			
Mount LRV		Mount & power up LRV			
Go to Sta 17		Go to Sta 17		TRAV. TO STAT. 17	TRAV. TO STAT. 17
	Distance - 0.6 Km				
GEOLOGY STATION 17		GEOLOGY STATION 17		STAT. 17	STAT. 17
Read out LRV Displays		Power down LRV			
Dismount LRV		Dismount LRV			
		SW LCRU Mode - 2			
	5+10				

STA 17 — 3/20/72 EVA 3 CDR-44

3/20/72 EVA 3 CDR-45 — GP

LPM MEASUREMENT

1. Elect pwr sw - on
2. Deploy sensor/tripod 48' R of LRV
3. Align & level sensor/tripod
4. Ret to LRV, call "Mark" to MCC
5. Photo sensor/tripod WRT LRV
6. MCC 60 sec "Mark" read sw - on
7. Read XYZ 3 times (cycle read sw)
8. Read & pwr sw - off
9. Retrieve & stow sensor/tripod
10. Wind up cable, stow reel

LAST MEAS., STA 17
2 measurements, 2nd with a documented rock on sensor
Photo 7" & bag rock
Report elect box temp prior to pwr sw - off

5+10

(1) CDR/LMP - EMU Check

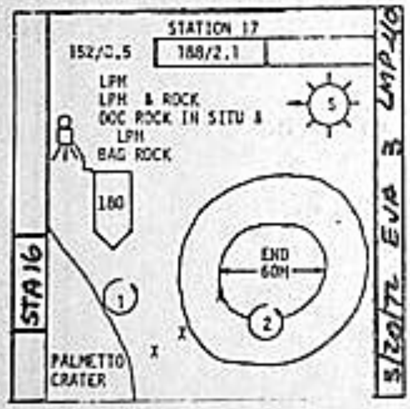
	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

(1) CDR/LMP - Rake/Soil

Rocks in Bag ____________

1 Kg Soil in Bag ________

Stowed in SCB __________



5+20

(1) CDR - LMP Reading -

	X	Y	Z
(1)	_____	_____	_____
(2)	_____	_____	_____
(3)	_____	_____	_____

3/20/72 EVA 3 LMP-41 — 8-3

STATION 17
PALMETTO CRATER :38

CDR
MODE SW-2
HGA
DUST

LMP
DISPLAYS
PAN 1

3: DESCRIPT
8: RAKE/SOIL
10: LPM / LPM/ROCK — SAMPLING (igneous rock for LPM)
12: PAN 2
RADIAL SAMPLING
ROCK
SOIL (1 KG)
FRAME COUNT
MODE SW-1
POS TV HORIZ. CCW

LOOK FOR: NW creases 190/1.3

(1) CDR - LMP Reading - (Rock)

	X	Y	Z
(1)	_____	_____	_____
(2)	_____	_____	_____
(3)	_____	_____	_____

5+30

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	GEO CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+10	Align HGA		GEOLOGY STATION 17 (CONT'D)	GEOLOGY STATION 17 (CONT'D)
Panorama 1		Dust TV, TCU, LCRU			
		Description			
Rake/Soil Sample		Rake/Soil Sample			
	5+20				
Locate a suitable rock for LPM/rock meas. - (igneous rock $\geq$ 5 cm)		Make LPM measurement			
Document in situ					
Photo rock on sensor		Place rock on sensor			
X sun stereo pr.		Take LPM Measurement			
	5+30				

5+30

(1) LMP - LPM Rock in Bag _____

5+40

(1) CDR - Rpt 70mm Mag/Frame ___/_____

(1) LMP - Rpt 70mm Mag/Frame ___/_____

(1) CDR - MARK DEPART TIME _____(5+46)

5+50

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	GEO CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+30			GEOLOGY STATION 17 (CONT'D)	GEOLOGY STATION 17 (CONT'D)
		Stow Sensor/Tripod			
Bag rock		Panorama 2			
General Sampling		General Sampling			
	5+40				
Verify tools secured		Sw LCRU Mode 1			
		Position TV horizontal, CCW			
Mount LRV		Mount & power up LRV		RETURN TO LM	RETURN TO LM
Distance -		2.3 Km			
	5+50				

5+50

LPM

EVA 3

6+10 LRV CONFIGURE
1. LRV to MESA
2. + 15 VDC sw - OFF
3. HEDC to L. seat

6+12 RESET FAR UV CAMERA [TV

6+15 UNLOAD PLSS
1. LMP SCB to footpad
2. Quick remove PLSS tool carrier (optional)
3. LMP unload CDR

6+18 COSMIC RAY [ETB
1. CRE (Quad II, white ring) to table

CDR-46 EVA 3 3/20/72

6+00

EVA 3

6+10 LRV CONFIGURE
1. Readout LRV displays
2. HEDC to R. seat

6+12 CONFIG FRONT OF LRV [FAR UV
1. Switch LCRU - 3
2. Align HGA
3. Dust GCTA & LCRU

6+15 UNLOAD PLSS
1. CDR unload LMP
2. CDR SCB to footpad
3. Quick remove PLSS tool carrier (optional)

6+18 PACK ETB
1. ETB (table) to L. floorboard

STA 17

LMP-47Z EVA 3 3/20/72

(1) CDR - MARK STOP TIME _____ (6+05)
(1) LMP - LRV Readout

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	

(1) CDR - MARK UV CAM RESET _____
Film Advance _____
AZ _____ (84), EL _____ (27)

6+10

MISSION: APOLLO 16
EVA: 3

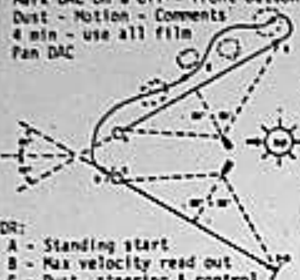
DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	5+50			RETURN TO LM	RETURN TO LM
	6+00				
ARRIVE AT LM LRV CONFIGURE Read out LRV displays Dismount LRV Put HEDC on Seat CONFIG FRONT OF LRV Switch LCRU - 3 Align HGA Dust TV, TCU, LCRU		ARRIVE AT LM LRV CONFIGURE Power down LRV ± 15 VDC sw - OFF Dismount LRV Place HEDC on Seat RESET FAR UV CAMERA Punch "reset" verify target (11) with MCC Enter new azimuth & elevation		EVA CLOSEOUT	EVA CLOSEOUT
	6+10				

CREW EVA CHECKLIST

3/20/72 EVA 3 CDR-47 | LRV RIP

LMP:
DAC - Mag _ - 24fps - f:8 - 1/250
Mark DAC on & off - front button
Dust - Motion - Comments
4 min - use all film
Pan DAC



CDR:
A - Standing start
B - Max velocity read out
C - Dust, steering & control - Comments
D - Braking comments

GP | 3/20/72 EVA 3 CDR-48

2. Remove panels (blue ring) & fold. Report temp labels: 1 in bag, 2 panel 4 & 1 panel 1
3. Panels to bag (R. MESA), leave on table

6+23 BIG ROCK BAG (HTC) TO LADDER HOOK

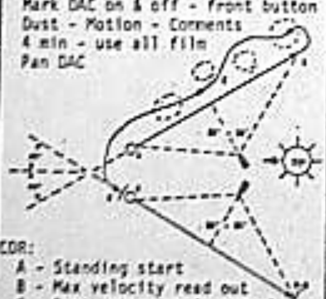
6+24 LRV PLACEMENT & GRAN PRIX [SWC
1. LCRU sw - 1
2. + 15 VDC - prim
3. Perform gran prix
4. Reset NAV
5. Place LRV as follows
   Head - 085°
   Distance - .1 KM
   Bearing - 285°
   Park Heading - 165°

3/20/72 EVA 3 LMP-43 | GP

2. Load ETB, L. side
   Mag from 500MM (500mm in L. seat bag)
   Mag R
   3-HEDC mags
3. Mags T,U (L. seat bag) to R seat
4. ETB to R. side
5. DAC mag to ETB
6. Mag T to DAC
7. DAC & mag U to table
8. Maps to ETB [COSMIC RAY
9. Place penetrometer recording drum in sample bag; place in ETB
10. ETB to table (hang)
11. CRE bag (table) to ETB
12. HEDC (R. seat) to MESA

ETB | 3/20/72 EVA 3 LMP-49

LMP:
DAC - Mag _ - 24fps - f:8 - 1/250
Mark DAC on & off - front button
Dust - Motion - Comments
4 min - use all film
Pan DAC



CDR:
A - Standing start
B - Max velocity read out
C - Dust, steering & control - Comments
D - Braking comments

VOICE DATA

(1) CDR/LMP - EMU Check

	CDR	LMP
02		
FLAGS		
PRESS		
COOL		

6+10

(1) CDR/LMP ETB Pack:

500mm Mag _____ (M)

3 Add'l 70mm Mags _____ (E), (J), (L)

16mm Mag R _____

16mm Mag S (off DAC) _____

Maps _____

Penetrometer drum _____

Cosmic Ray _____

(1) CDR - Temp labels CRE _____

_____

_____

_____

6+20

(2) LMP - Mag T on DAC

(2) LMP - Mag U on DAC

6+30

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES
	6+10	
<u>UNLOAD PLSS</u> Hold still		<u>UNLOAD PLSS</u> Put LMP SCB on footpad (+Z) Quick release PLSS tool carrier (optional)
Put CDR SCB on foot pad (+Z) Quick release PLSS tool carrier		Hold still
<u>PACK ETB</u> Get ETB, place on L floor board Pack in ETB: 500 mm cam mag 3 HEDC mags Mag R (16 mm)		<u>COSMIC RAY</u> Pull white ring & pin, take Cosmic Ray experiment & Case to SRC Table Pull blue ring & slide cosmic ray panels out of CRE case
Put 16 mm mags T, U on R Seat Transfer ETB to R Side Put DAC mag in ETB Put Mag T on DAC Take mag U & DAC to SRC table		Report Temp labels as they come up Fold panels and place in bag - leave bag on table
Assist CDR with CRE if req'd Return to LRV	6+20	
Place maps in ETB Remove drum from penetrometer Bag (DSB) and place drum in ETB		Get Big Rock Bag off HTC, take it to footpad, load up other rocks stowed there Hang BRB on Ladder Hook
Take ETB to SRC table - hang it up		<u>LRV PLACEMENT & GP</u> Sw LCRU Mode - 1 Mount LRV
Put CRE bag in ETB Get HEDC (R Seat) place on MESA		
Ready DAC for Gran Prix Photo Gran Prix		Perform Gran Prix
	6+30	End Gran Prix

SEQ CAM

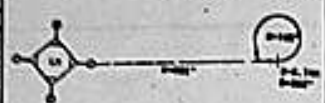
TASK FUNCTION

LMP: EVA CLOSEOUT (CONT'D)

CDR: EVA CLOSEOUT (CONT'D)

EMU MALF

3/20/72 EVA 3 CDR-49



6. LRV closeout EVA 3 (decal)
7. Align HGA
8. Dust GCTA & TV lens
9. Open LRV bat covers, dust bats if dirty, dust LCRU
10. Verify LCRU covers 100% open; 65% cover to control panel
11. Return to LM, take dust brush & HEDC

PERFORM DAC SHOW
3sun, f8/250/24fps

EMU MALF 1.1

3/20/72 EVA 3 CDR-50

LRV RiP

6+38 CLEAN EMUs
Clean EMUs & stow ants

6+41 FAR UV CAMERA
1. Reset 3 times
2. Turn cam off
3. Pull pin on cassette
4. Remove cassette & place in ETB

OBSERVE DOCK LIGHT TEST

6+46 TRANSFER
1. Place HEDC mag in ETB
2. ETB & SCB (footpad) to A/S
3. Discard LEC

6+55 INGRESS

6+56 REPRESS

EMU MALF

3/20/72 EVA 3 LMP-45

6+24 TAKE PICTURES OF GRAN PRIX
DAC - DAC mag to ETB
Mag U to DAC
DAC to table

6+29 SWC [LRV PLACEMENT]
1. HEDC (MESA) to RCU
2. Photo 7" (top part)
3. Retrieve SWC
4. Bag (L. MESA) SWC, to ETB

6+33 CLEAN UP AREA, MAKE SURE EVERYTHING IS WELL UNDER THE LM

DAC SHOW 3sun, f8/250/24fps
1. Get DAC (table), shoot Astro actions
2. DAC mag to ETB
3. HEDC mag to ETB

EMU MALF 1.2

3/20/72 EVA 3 LMP-46

GP

6+38 CLEAN EMUs
Clean EMUs & stow ants

6+44 INGRESS WITH SCB & BIG ROCK BAG

TRACK LITE TEST
CB (16) LTG Track - CLOSE
EXT LTG SW - Track
(CDR observes)
EXT LTG SW - OFF
CB 16 LTG Track - OPEN

6+56 REPRESS

6+30

(1) CDR - NAV SYS Reset

(1) CDR - Report
Heading out _____(085°)
DISTANCE _____(0.1 Km)
Bearing _____(265°)
Heading Final _____(165°)

(2) CDR - Batt Covers - Open

(1) CDR - Rpt Aux CB By PASS SW - ON

(2) CDR - Confirm LCRU panel covered

(1) CDR - Brush returned to LM

(1) LMP - ETB Pack:

6+40

SWC in bag _____
2 HEDC Mags _____ (F), (K)
Far UV Cassette _____
2 16mm Mags_____ (U), (T)

(1) CDR/LMP - Antennas Stowed

(1) LMP - Transfer Check =
SCB from +Z footpad _____
Big Rock Bag from ladder hook _____

6+50

MISSION: APOLLO 16
EVA: 3

DATE: MARCH 1972

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Take mag T of DAC and replace with mag U	6+30	Reset Nav System (at LM)		EVA CLOSEOUT (CONT'D)	EVA CLOSEOUT (CONT'D)
Put T in ETB Put on HEDC		Drive LRV .1 Km on a heading of 085° (Bearing - 265°)			
Retrieve SWC		Final Parking heading - 165°			
Return to MESA		Open CB's - B&D, NAV			
Get SWC bag out of MESA, bag SWC, place in ETB		Dismount LRV AUX CB By Pass Sw - ON			
Walk around LM, kick all discards underneath		Set LCRU power - EXT Sw LCRU Mode - 3			
		Align HGA			
Place HEDC mag in ETB		Dust TV, TCU, LCRU Tear off 65% blanket, Cover LCRU panel			
Pick up DAC		Open LRV batt covers, dust batteries if required			
Film CDR return to LM f8/250/24fps	6+40	Redust LCRU if required Return to LM with brush & HEDC			
DAC Show		DAC Show			
CLEAN EMU's		CLEAN EMU's			
Brush off CDR Stow CDR antenna		Brush off LMP Stow LMP antenna			
		FAR UV CAMERA			
INGRESS (take SCB and Big Rock Bag)		Reset 3 times, cam off Pull pin & remove cassette		EVA TERM.	EVA TERM.
Open hatch Move thru hatch		Place cassette in ETB			
	6+50	Place HEDC mag in ETB			

6+50

(1) CDR - Track Light on ______

(1) CDR - Transfer check:
SCB from +Z footpad ______
ETB ______

(1) LMP - Report hatch closed

(1) CDR Report cabin repress

7+00 (END EVA 3)

MISSION: APOLLO 16 DATE: MARCH 1972
EVA: 3

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
TRACK LITE TEST	6+50	TRANSFER		EVA TERMINATION	EVA TERMINATION
Close CB & pos. SW		Hang ETB on LEC (option)			
Open CB & SW		Observe & report track light			
Receive SCB & stow		Climb ladder with SCB			
		Pass SCB thru hatch			
		Pull up ETB			
Receive ETB, detach LEC hook		Pass ETB thru hatch			
Pass LEC back to CDR		Drop LEC to surface			
Stow ETB		INGRESS			
		Move thru hatch			
Close hatch					
REPRESS		REPRESS			
	7+00				

3.2.4 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 16 DATE: MARCH 1972

EVA:

CORE TUBE SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove core tube from CDR's sample bag	0	Place gnomon nearby			
Assemble core tube/ext handle - report number		Remove hammer from LMP PLSS tool carrier			
Hold core tube upright on surface and press into surface by hand		Take stereo pair X-sun f8,1/250,7 ft			
Drive tube into surface (comment on difficulty)					
Remove core from surface		Photo tube & LRV f8,1/250,15 ft			
		Obtain core tube cap from LMP PLSS & cap tube			
Assist CDR		Remove core tube from ext hndl			
Get extension handle from CDR & install scoop		Get core tube tool & seat core follower against core			
		Stow core in collection bag stow core tube tool & hammer			
Proceed to next sample	5	Pick up gnomon			
		Proceed to next sample			

NOTE: Double 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 and the follower on each tube is seated with tool. The double core is rammed as a unit before the tubes are disassembled. A double core requires an additional three minutes.

MISSION: APOLLO 16

DATE: MARCH 1972

EVA:

SINGLE SAMPLE DOCUMENTATION

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Describe sample	0	Describe sample & place gnomon down-sun with pointer leg at sample & color chart at 45° to sun			
Take down-sun photo at f11,1/250,11 ft		Take stereo pair X-sun at f8,1/250,7 ft			
Prepare sample bag (if reqd) & report bag number		Collect sample			
Add soil to sample (scoop) if desired.					
Seal sample bag and place in collection bag		Take X-sun after photo f8,1/250,7 ft			
*Take locator photo using LRV in background X-sun at f8,1/250,15 ft		Describe area of sample			
NOTE: Locator photo may be taken before sampling		Pick up gnomon			
Proceed to next sample	5	Proceed to next sample			
*This locator photo procedure assumes that a panorama is taken at each sampling site, showing the position of the LRV.					

MISSION: APOLLO 16

DATE: MARCH 1972

EVA:

RAKE/SOIL SAMPLE

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	GEO CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Remove rake from LRV	1	Select area for optimum rock distribution & place gnomon			
Describe sample area		Describe area, relate to surrounding terrain.			
		Mark off area to be sampled			
Take before photo down-sun f11,1/250,11 ft		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 LRV in background X-sun f8,1/250, 15 ft		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 16

DATE: MARCH 1972

EVA: PHOTO POLARIMETRIC SURVEY (Far & Near)

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
Install polar filter on camera (Verify on camera) Assume a position X-sun from distant feature to be photographed (approx 1 Km away)	0	Nominal procedure - far & near segments can be done in any order			
Reset camera f5.6,1/125,74 ft					
Take 3 4-photo partial pans: f5.6,1/125,74 ft, Filter L* f5.6,1/125,74 ft, Filter C f5.6,1/125,74 ft, Filter R					
Move down-sun ~ 50 meters from first position Take 3 4-photo partial pans: f5.6,1/125,74 ft, Filter R* f5.6,1/125,74 ft, Filter C f5.6,1/125,74 ft, Filter L		Locate & describe near - photo polarimetric area -- (should have at least 4 collectable rocks in close proximity) Place gnomon			
		Take before photo down-sun f11,1/250,11 ft			
Assume position 7 ft from area	10				
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 LRV in background feature X-sun f8,1/250,15 ft			
Collect minimum of 4 rock samples from area in documented sample bags		Get sample bags, report number & hold for CDR. Close bags, seal & stow in collection bags			
Retrieve gnomon		* L=left, C=center, R=right for filter position which can be used in any order but must be reported to MCC			
Proceed to next sample	20				

MISSION: APOLLO 16

DATE: MARCH 1972

EVA:

SMALL TRENCH SAMPLE (EXPLORATORY)

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM.	TASK FUNCTION LMP	TASK FUNCTION CDR
Take locator photo using LRV in background feature X-sun f8,1/250,15 ft	0	Select area to be sampled & place gnomon			
Use scoop, dig trench 3-8 inches deep 20° off sunline					
Take after photo down-sun f11,1/250,11 ft		Take after photos, stereo pair X-sun f8,1/250,7 ft			
If samples taken, using scoop collect soil samples from inside trench and surface *		If samples taken, get sample bags, report number & hold for LMP to fill			
		Close bags, seal & stow in collection bag			
		Retrieve gnomon			
Proceed to next sample	5	Proceed to next sample			
*If buried rock found in trench and shadowed soil not found, consider collecting rock & some soil into SESC					

MISSION: APOLLO 16

DATE: MARCH 1972

EVA: LUNAR PORTABLE MAGNETOMETER(LPM)-"SITE"

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

0 - Unstow tripod, spread & place on surface

Pull pins, unstow sensor and reel

Discard stowage bracketry

Unreel 5 ft of cable

install sensor on tripod, "sun" to "sun", position 1

Sw elect power ON

Walk 45 feet to R of LRV carrying sensor/tripod(relieve strain on cbl)

Watch for white indicator mark on cable when 47 ft extension reached

Place tripod, "sun" arrow to sun

Align and bubble level sensor/tripod

Return to LRV (MARK 60 sec)

Take photo of deployed sensor/tripod

Report tempilabel reading on elect.

5 - READ Sw-ON--Report reading

READ Sw-OFF

READ Sw-ON--Report reading

READ Sw-OFF

READ Sw-ON--Report reading

READ Sw-OFF

Return to Sensor/tripod

Turn sensor to Position 2 and reclamp

Relevel and re-align tripod

Return to LRV (MARK 60 sec)

READ Sw-ON--Report reading

READ Sw-OFF

(Repeat 2 times)

Return to sensor/tripod

Turn sensor to Position 3 and reclamp

Relevel and re-align tripod

10 -

10 Return to LRV (MARK 60 sec)

READ Sw-ON--Report reading

READ Sw-OFF

(Repeat 2 times)

Power Sw- OFF

Return to sensor/tripod

Pick up sensor/tripod, carry back to LRV

Stow sensor/tripod in bag

Reel up cable

Stow reel in bag and secure

CAUTION: ensure cable does not foul LRV suspension or running gear

15

MISSION: APOLLO 16 DATE: MARCH 1972

EVA: LUNAR PORTABLE MAGNETOMETER (LPM) "TRAVERSE"

LMP ACTIVITIES	EVA TIME	CDR ACTIVITIES	SEQ CAM	TASK FUNCTION LMP	TASK FUNCTION CDR
	0	Unstow tripod with sensor			
		Unbag reel, pull out sufficient cable to clear LRV			
		Sw power -ON			
		Let reel fall, walk 45 feet to R of LRV carrying sensor/tripod (relieve strain on cable)			
		Watch for white indicator mark on cable when 47 ft extension reached			
		Place tripod, sun arrow to sun			
		Align and bubble level tripod			
		Return to LRV (MARK 60 sec)			
		Take photo of sensor/tripod			
		READ Sw-ON--Report reading			
		READ Sw OFF			
		(Repeat twice)			
		Power Sw-OFF*			
		Report tempilabel(last time used)			
		Return to sensor/tripod			
		Pick up sensor/tripod, carry back to LRV			
	5	Stow sensor/tripod in bag			
		Reel up cable			
		*IF LAST TEST, DO FOLLOWING			
		RESIDUAL MAGNETISM			
		Document crystalline rock in situ (Standard doc.)			
		Place rock on LPM sensor			
		Take X-sun stereo of rock on sensor			
		Return to LRV (MARK 60 sec)			
		READ Sw-ON--Report reading			
		READ Sw-OFF			
		(Repeat 2 times)			
		Bag rock, place in SCB			
		Stow reel in bag and secure			
		CAUTION-Ensure cable does not foul LRV suspension or running gear			
	10				

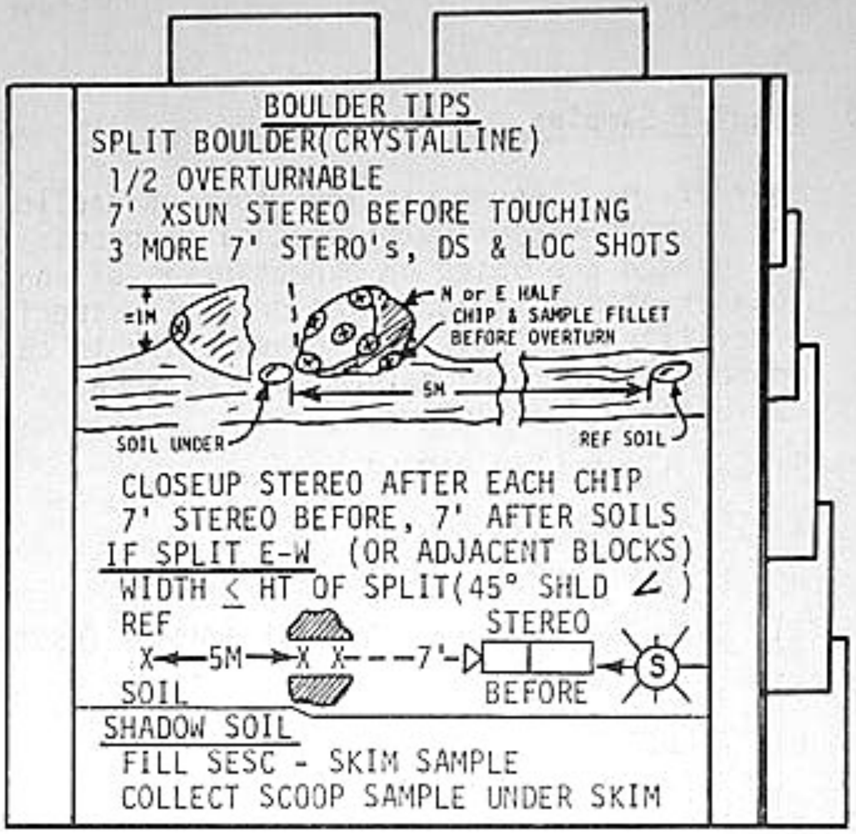
3.2.5 Special Samples

Many of the planned station stops on Apollo 16 involve collecting one or more varieties of special samples. The kind of samples designated are based on expectancies of what the crew may encounter at the various stations. The special samples are also prioritized as targets of opportunity in case the EVA's are changed or certain stations are bypassed. The order of priority is followed in this section:

1) SPLIT BOULDER SAMPLE
2) GIANT IGNEOUS ROCK
3) RADIAL SAMPLING OF A FRESH CRATER
4) CHEMICALLY ULTRACLEAN SOIL SAMPLE (CSVC)
5) SOIL SURFACE MATERIALS
6) FILLET SAMPLE
7) PERMANENTLY SHADOWED SOIL
8) E-W SPLIT

This material was drafted in part by Dr. Friedrich Horz, of the Science and Applications Directorate.

Figure 3.2.5-1 shows the cuff checklist pages which the crew has available during lunar surface operations relative to the "Special" samples.



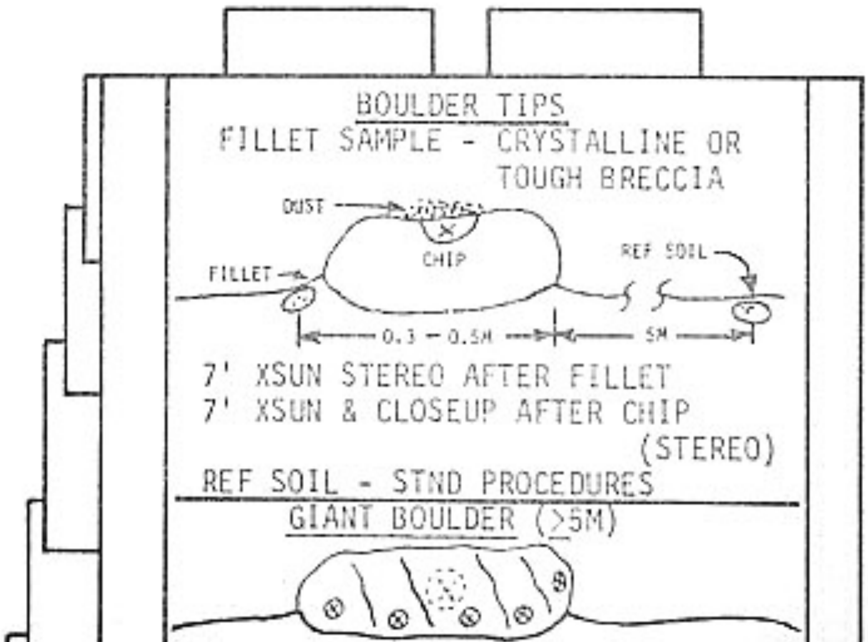


Figure 3.2-1 Boulder TIPS

(1) SPLIT BOULDER SAMPLE:

PRIME OBJECTIVE: Dating of specific cratering event

ADDITIONAL OBJECTIVES: Small scale lunar surface processes of all kinds (micrometeoroids, isotope studies, tracks, noble gases, thermoluminescence, etc.). The combination of these studies lead to a better understanding of such surface processes as erosion rates, gardening of the regolith, etc.

REQUIREMENTS:

A) Roughly equidimensional (1m) boulder, crystalline rock having a nearly vertical split to no more than 5 cm apart running roughly through its center.

B) Unambiguous association with catering event.

C) One half of boulder has to be overturnable.

D) If no crystalline boulder of that size is encountered the experiment may be performed on a very hard breccia.

PRIORITIES:

A) Chip "top"

B) Chip "bottom" — Chip weight: ~100 gr or larger

C) Chip "center"

D) Chips "E" or "W"

E) Chips "S" or "N"

F) Soil underneath

G) Reference soil

MINIMUM RETURN:

A) Chip "top"

B) Chip "bottom"

SPLIT BOULDER PROCEDURE

SAMPLE	CDR	LMP	PHOTOS
	7', XS, stereo "before" Assessment of tasks: 1) Can boulder be turned over? 2) Is dust present on boulder top?[1] 3) Does boulder qualify for fillet sample?[2] 4) Does split strike EW or NS?[3]		2
	3 additional 7', XS stereo pairs	DS, locator See notes 1 & 2	8
"N" chip	Chip face to be turned over "N"-face	Same + Close up, stereo	
	Turn over rock	Same	
soil	7', XS (stereopair) "before" 7', XS, "after"	Collect soil from underneath See note 3	3
6 chips	Chip in the following order: 1) Top chip 2) Bottom chip 3) Center 4) "W" chip 5) "E" chip 6) "S" chip	Same + document each chip with close up (stereopair)	
soil	Reference soil, standard procedure Collection of other rocks is encouraged		5

1) If yes: brush dust off boulder top (no special photography)
2) If yes: collect fillet soil (7' stereo "after").
3) If EW: collect E-W split sample; soil from "underneath" is still to be collected in addition (7', "after").
   If NS: collect permanent shadow sample; soil from "underneath" is to be collected in addition (7', "after").

(2) GIANT BOULDER SAMPLE:

OBJECTIVE: 1) Variation of igneous units

2) Erosion rate, exposure history, etc.

REQUIREMENTS: Crystalline Rock, larger than 5m (no breccias)

PROCEDURE[1]: 1) If heterogeneities are recognizable with the naked eye, sample and document representative materials.

2) Each chip should be documented with a close up stereopair.

3) If no heterogeneities can be detected, sample 2 chips from opposite boulder ends.

4) Photo documentation:

a) Entire boulder: 1 flightline pan (3-5 frames) or other best possible way

b) Chipped areas: close up, stereopair

MINIMUM RETURN: At least 2 chips

1) A more detailed procedure cannot be established, because it is up to the crew's evaluation how to best sample these materials.

ADIAL SAMPLING OF FRESH, 20-50m SIZE CRATER:

OBJECTIVES: 1) To reconstruct three dimensional target stratigraphy.

2) To possibly date cratering event.

3) To reveal dynamics of small scale surface processes like horizontal transport of regolith and erosion of small craters.

REQUIREMENTS:

1) Fresh crater (20-50m diameter)

2) Crater should barely penetrate bedrock, i.e. have blocky rim

3) Best statistical sample reflecting changes in ejecta lithologies.

PROCEDURE A (IDEAL CASE): Changes in lithologies in ejecta blanket are obvious to the naked eye.

1) Collected rock specimens representative of various lithologies.

2) Collect soils together with rocks.

3) Assess the original target position of the samples collected and/or document position of samples with respect to overall crater by taking Part. Pan. "after" radial sampling.

4) If time permits and operational feasible, collect specimens from crater center.

PROCEDURE B: Changes in lithologies of ejecta blanket cannot be recognized.

1) Plan at least 3 sampling locations:

a) on crater rim

b) 1/2 crater diameter

c) 1 crater diameter

2) Take rake/soil sample at all 3 locations and rock grab samples.

3) Take Part. Pan. after radial sampling.

4) Collect specimen (grab sample/soil sample from center of crater) if feasible.

STATION PRIORITIES:

1) rim

2) 1 radius

3) 1/2 radius

4) inside crater

SHORT CUT PROCEDURE:

If not sufficient time, the rake/soil samples may be replaced by large soil samples (1000 gram).

(4) CHEMICALLY ULTRACLEAN SOIL SAMPLE (CSVC):

OBJECTIVE: Sample devoid of potential sources of contamination.

REQUIREMENTS:

1) Single drive tube on "typical" Caley

2) CSVC container

3) Distance to LM: at least 1 km

PROCEDURE:

1) Standard single drive tube and standard photo documentation

2) Store in CSVC

SOIL SURFACE MATERIALS ("SURFACE SAMPLER"):

OBJECTIVE: Interaction of solar wind and cosmic radiation with lunar surface yielding a better understanding of:

A) Solar and galactic radiation

B) Small scale lunar surface processes

C) Implications for remote sensing

REQUIREMENTS:

A) Flat, "typical" soil surface

B) Approach area with utmost caution to keep soil contamination at a minimum or collect "behind" a boulder

C) Distance to LM: larger than 1 km

PRIORITIES:

A) Velvet cloth sampler

B) Beta cloth sampler

C) Skim sample

D) Scoop sample

MINIMUM RETURN:

A) Velvet cloth sampler

B) Beta cloth sampler

SURFACE SAMPLER PROCEDURE

SAMPLE	CDR	LMP	PHOTOS
	Assessment of Tasks Prepare Surface Sampler Approach area with utmost caution or select suitable boulder for shielding		
surface sampler 1	Put "beta cloth" sampler down, don't push Retrieve beta cloth sampler		
surface sampler 2	Push "velvet" sampler down Retrieve "velvet" sampler		
	Put gnomon over sampling area 7', XS, stereo-pair "after"	DS, locator	4
skim sample	Take skim sample 7', XS stereopair, "after"	Widen skimmed area	2
scoop sample	Take scoop sample underneath skimmed area 7', XS, "after"		1

6) FILLET-SAMPLE:

OBJECTIVE: A) Erosion mechanism and rate

B) Regolith transport mechanism

C) Surface history of rock

REQUIREMENTS:

A) Boulder larger than 30 cm.

B) Crystalline rock or very tough breccia

C) Must have fillet which is equally developed around entire rock; markedly assymetric fillets are undesirable. Best opportunity: on flat terrain.

D) Distance to LM: larger than 1 km

PRIORITIES:

A) Fillet-soil

B) Rock-chip

C) Dust from top of boulder

D) Reference soil

MINIMUM RETURN:

Samples: A) Fillet-soil

B) Rock-chip

C) Reference soil

POSSIBLE COMBINATION: "Split Boulder" Sample

This combination is actually highly desirable, because boulder dust and "fillet-soil" only has to be added to the split boulder procedure.

FILLET-SAMPLE

PROTOCOL AND TIMELINE

SAMPLE	CDR	LMP	PHOTOS
	Assessment of Tasks Approach Area with Caution	DS, loc.	6
	7', XS-stereo, "before", of fillet to be collected; 2 other 7' shots, illustrating extent of fillet around rock		
soil	Collect dust on boulder surface (if present) by brushing		
soil	Collect fillet soil 7', XS, stereo "after"	Close up,	2
chip	Chip surface of boulder 7', XS, "after"	Close up, stereo "after"	
soil	Collect Reference Soil, 5-10 ft. away Standard Procedure		

) PERMANENTLY SHADOWED SOIL:

OBJECTIVE: To investigate the migration and redistribution of volatiles and semi-volatiles in permanently shadowed areas which act as "cool-traps".

REQUIREMENTS:

1) Overhang on boulder or pile of boulders which generate permanently shielded cavity partly filled with regolith. This implies that the overhang, etc., should be facing roughly S for the Descartes landing site.

2) Distance to LM: larger than 1 km

PROCEDURE:

1) If "permanently shadowed" area has been identified, photodocument sampling area and procedure by standard photo documentation as best as possible.

2) Take skim sample of soil surface and place sample in normal SESC container (7' "after")

3) Collect reference soil underneath skimmed area (7' "after")

PRIORITIES:

1) Permanently shadowed soil

2) Reference soil

MINIMUM RETURN:

1) Permanently shadowed soil

2) Reference soil

POSSIBLE COMBINATION:

Split boulder protocol if "split" strikes NS.

) E-W SPLIT:

OBJECTIVE: To investigate the implantation of rare gases that are accelerated and redistributed by the solar wind electric field.

REQUIREMENTS:

A block of any lithology which is broken in half or 2 adjacent blocks which satisfy the following geometrical situation.

1) The "split" trends EW

2) The width of the split is no more than the height of the "walls", i.e. a "shielding angle" of 45° is required.

3) Soil contamination should be kept at a minimum.

4) Distance to LM: More than 1 km

PROCEDURE

1) Approach area with caution.

2) 7', stereopair, "before", along EW split.

3) Skim sample in EW split (~150 gr)

4) 7', "after"

5) Reference soil, standard procedure. However taken along E-W line, about 10-20' away from split boulder on level, i.e., "unshielded" ground.

PRIORITIES: 1) Soil in E-W split.

2) Reference soil.

MINIMUM RETURN:

1) Soil in E-W split

2) Reference soil.

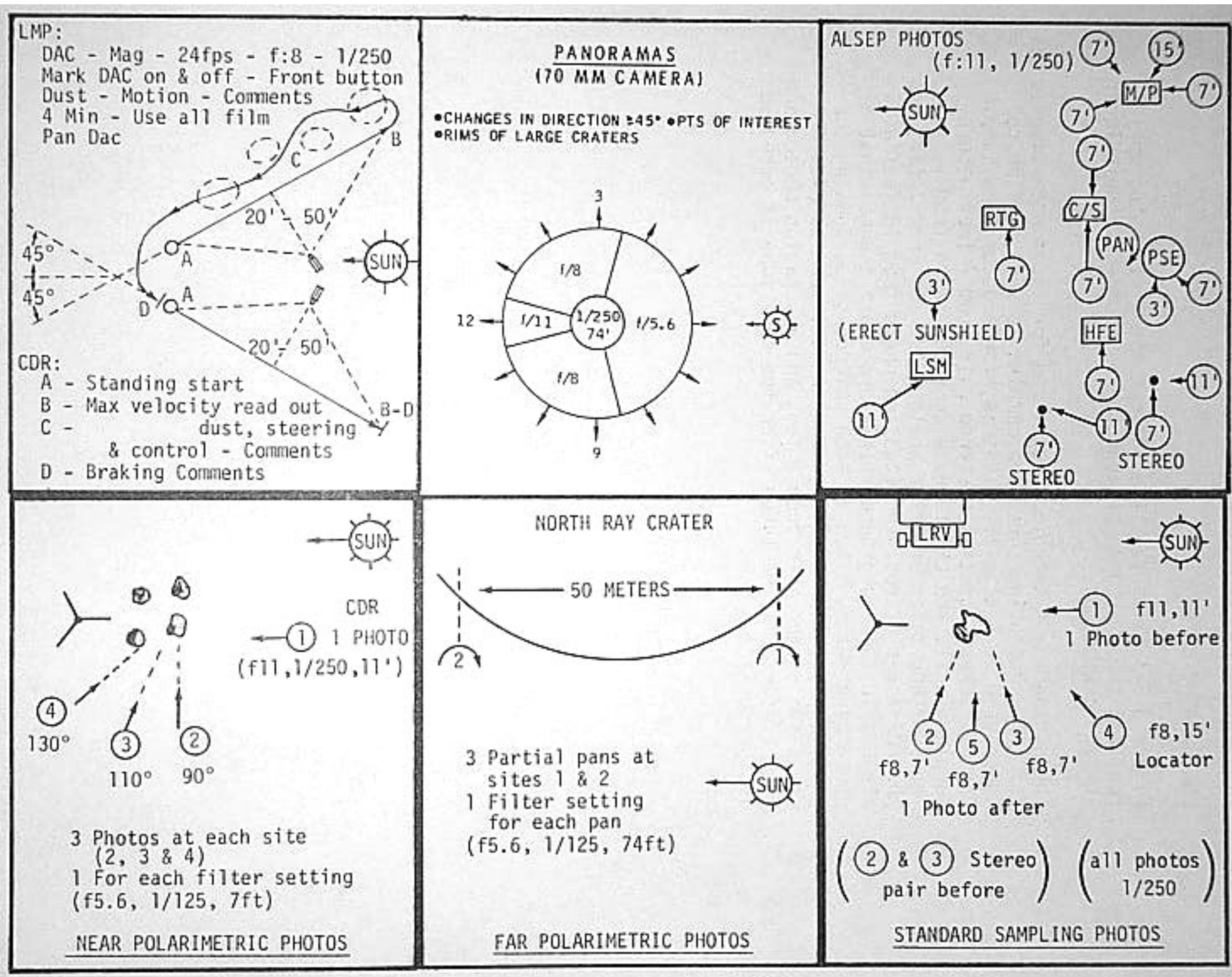
POSSIBLE CONTAMINATION:

This sample may be combined with the "split boulder" procedure, if "split" strikes EW.

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.

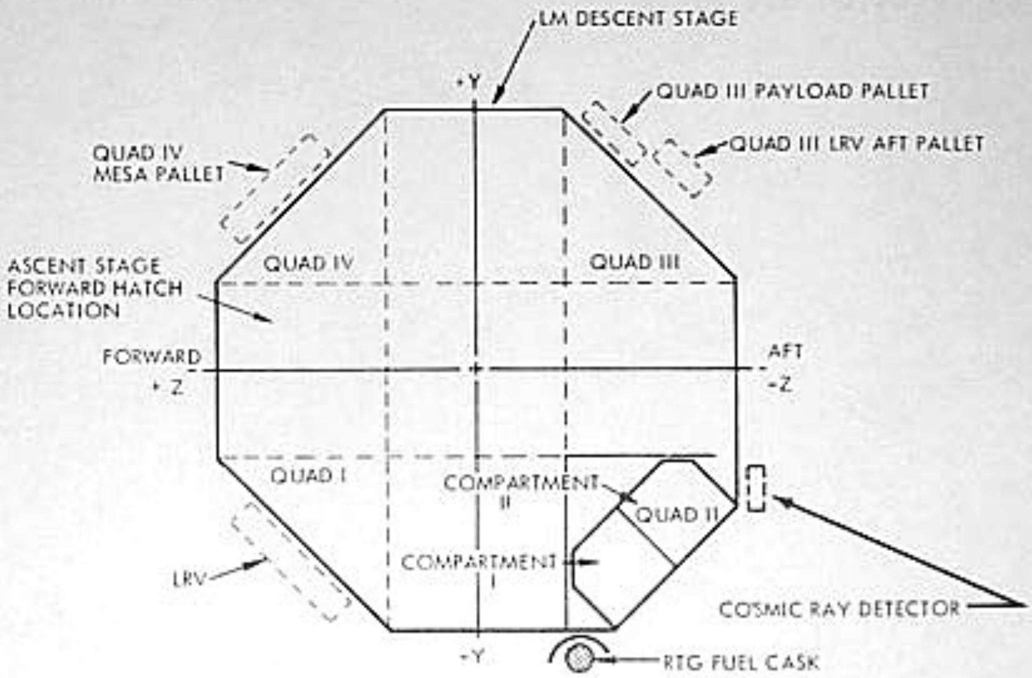
The photographic techniques utilized for documented samples and for documenting core tube samples is very similar to those used in Apollo 15. That is, for a documented sample, the CDR takes a cross-sun stereo pair from 7 feet before sampling while the LMP takes a down-sun photo from 11 feet. The CDR then takes an after photo cross-sun from 7 feet and the LMP takes a cross-sun location photo from 15 feet with the LRV in the background. This procedure assumes that a photo panorama is taken at each science site, showing the position of the LRV. To document a core tube sample, a cross-sun stereo pair from 7 feet and a location photograph from 15 feet will be taken after the core tube is embedded in the surface.



Lunar Surface Photo Data

3.4 LUNAR SURFACE EXPERIMENTS - DEPLOYMENT & EQUIPMENT DATA

Figure 3.4-1 illustrates the LM Descent Stage stowage locations for the lunar surface scientific equipment. Detailed data on ALSEP experiments is contained in Section 3.4.1. The astrophysical experiments (UV Camera, Cosmic Ray and Solar Wind) and the geophysical experiments (Portable Magnetometer and Soil Mechanics) are contained in section 3.4.2.



QUAD I
- LUNAR ROVING VEHICLE

QUAD II SEQ BAG
- APOLLO 16 ALSEP
  - SUBPACKAGE NO. 1
  - SUBPACKAGE NO. 2

QUAD III PAYLOAD PALLET
- FAR UV CAMERA/SPECTROSCOPE

QUAD III NO. 3 PALLET
- UNUSED

QUAD IV MESA PALLET
- LUNAR SURFACE DRILL ASSEMBLY
- 16-MM DATA ACQUISITION CAMERA AND STAFF
- LUNAR SURFACE ELECTRIC HASSELBLAD CAMERA
- CAMERA ACCESSORIES
- GROUND-COMMANDED TV CAMERA, CONTROL
- UNIT, AND ACCESSORIES
- SAMPLE RETURN CONTAINERS (2)
- SAMPLE RETURN BAG
- LUNAR SURFACE RAKE
- RETURN BAG FOR COSMIC RAY DETECTOR
- SOLAR WIND COMPOSITION
- SAMPLE CONTAINMENT BAGS (6)

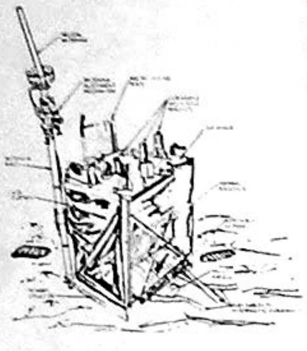
QUAD III LRV AFT PALLET
- ADJUSTABLE SAMPLING SCOOP
- APOLLO LUNAR HAND TOOL CARRIER
- GNOMON/COLOR PATCH
- SELF-RECORDING PENETROMETER
- HAMMER
- 32-INCH TONGS (2)
- TOOL EXTENSION HANDLE (2)
- LUNAR PORTABLE MAGNETOMETER
- SAMPLE COLLECTION BAGS (2)
- EXTRA SAMPLE COLLECTION BAGS (4)
- SURFACE SAMPLERS (2)

FIGURE 3.4-1 LM DESCENT STAGE STOWAGE OF SURFACE SCIENCE EQUIPMENT

3.4.1 ALSEP Deployment And Equipment Data

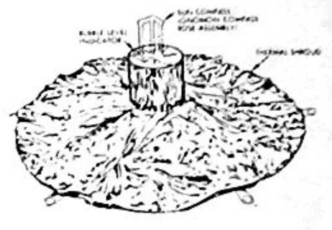
The ALSEP deployment site is selected in a location not less than 100 meters due West of the LM such that the LM ascent engine blast will not create a dust cloud or otherwise disturb the deployed experiments. The ALSEP site should be fairly level and relatively free of boulders and craters which may 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 3.4-2.

CENTRAL STATION (C/S)



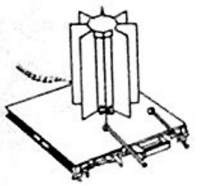
The Central Station is deployed East of the RTG, leveled within 5° of vertical using bubble level and aligned within ±5° of East-West using a gnomon and partial compass rose on the C/S. When sunshield is deployed the sides face East, West.
The ALSEP Antenna is attached to C/S and must be leveled to within 0.5° of vertical using the bubble level and aligned within ±.5° of the sun line as determined by the sun shadow reference line. The crewman then sets the Azimuth and Elevation dials to the predetermined settings in his cuff checklist.

PASSIVE SEISMIC EXPERIMENT (PSE)



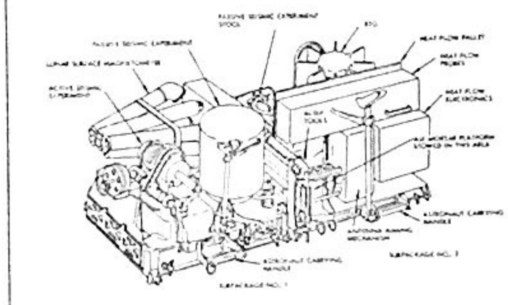
The PSE is deployed approximately 3 meters East of C/S on a stool designed to provide good mechanical contact and thermal insulation with the lunar surface. The PSE must be out of the field-of-view of the C/S radiator (South) and leveled within 5° of vertical on the bubble level. Initial alignment is within ±20° of East before removing PSE girdle. Fine alignment is reported within ±5° using the compass rose after the thermal shroud deployment.

RADIOISOTOPE THERMOELECTRIC GENERATOR (RTG)



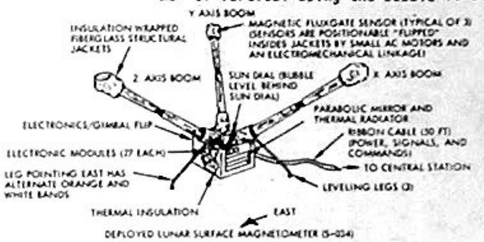
The RTG is located approximately 3 to 3.5 meters away from and within ±20° West of C/S. The RTG should be approximately level and not located in a depression as a maximum view of space is required for heat radiation

The astronaut will read the shorting switch ammeter, connect it to C/S and actuate the switch at the proper time.

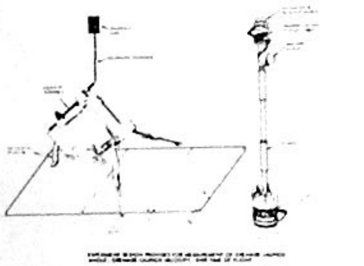


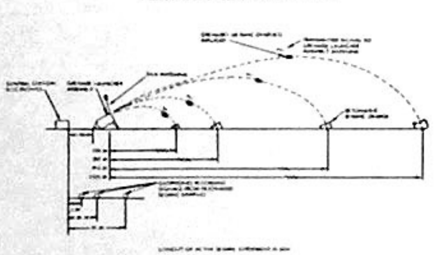
LUNAR SURFACE MAGNETOMETER (LSM)

The LSM is deployed approximately 14 meters WSW of C/S and aligned within ±3° of the sun line using the sun shadow device provided. The crewman will report final alignment to within ±1° by reading the shadowgraph. The LSM is leveled within ±3° of vertical using the bubble level.



ACTIVE SEISMIC EXPERIMENT (ASE)



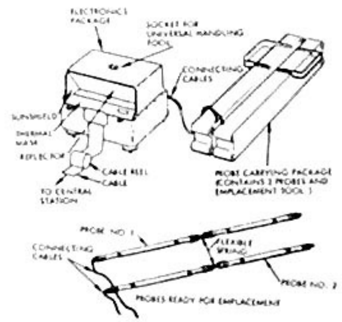


The ASE consists of two major subsystems:

MORTAR BOX ASSEMBLY Deployed on a base and bubble leveled to (5°) and aligned by the astronaut as shown North of Central Station 58 ft. away. Contains 4 grenades remotely fired by ground control 1 year after crew returns to earth. Astronaut readies by removing safety rod and actuating safety switches to remove short across arm/fire circuits.

THUMPER/GEOPHONE ASSEMBLY - Astronaut unfolds thumper and walks WSW unreeling geophone line. Geophones emplaced at 12, 162, and 312 ft. from Central Station. Alignment of phones along line ±3° ref. to Mortar Box and Flag at 162' geophone, each leveled to 7°. Astronaut returns to Central Station along geophone line firing thumper charge every 15 ft. to excite geophones (21 charges in all).

HEAT FLOW EXPERIMENT (HFE)



The HFE is deployed 8 to 10 meters South of C/S, aligned within ±5° of the plane of the ecliptic using the UHT as a gnomon and leveled within 5° using a bubble level. The HFE probes are deployed 5 to 6 meters from the electronics package and a minimum of 12 meters from the RTG. The HFE probe holes are drilled with the ALSD within 15° of vertical and should be located 60 meters from fresh craters and at least 5 diameters away from boulders greater than 2/3 meter across at the surface.

FIGURE 3.4-2 ALSEP DEPLOYMENT AND EQUIPMENT DATA

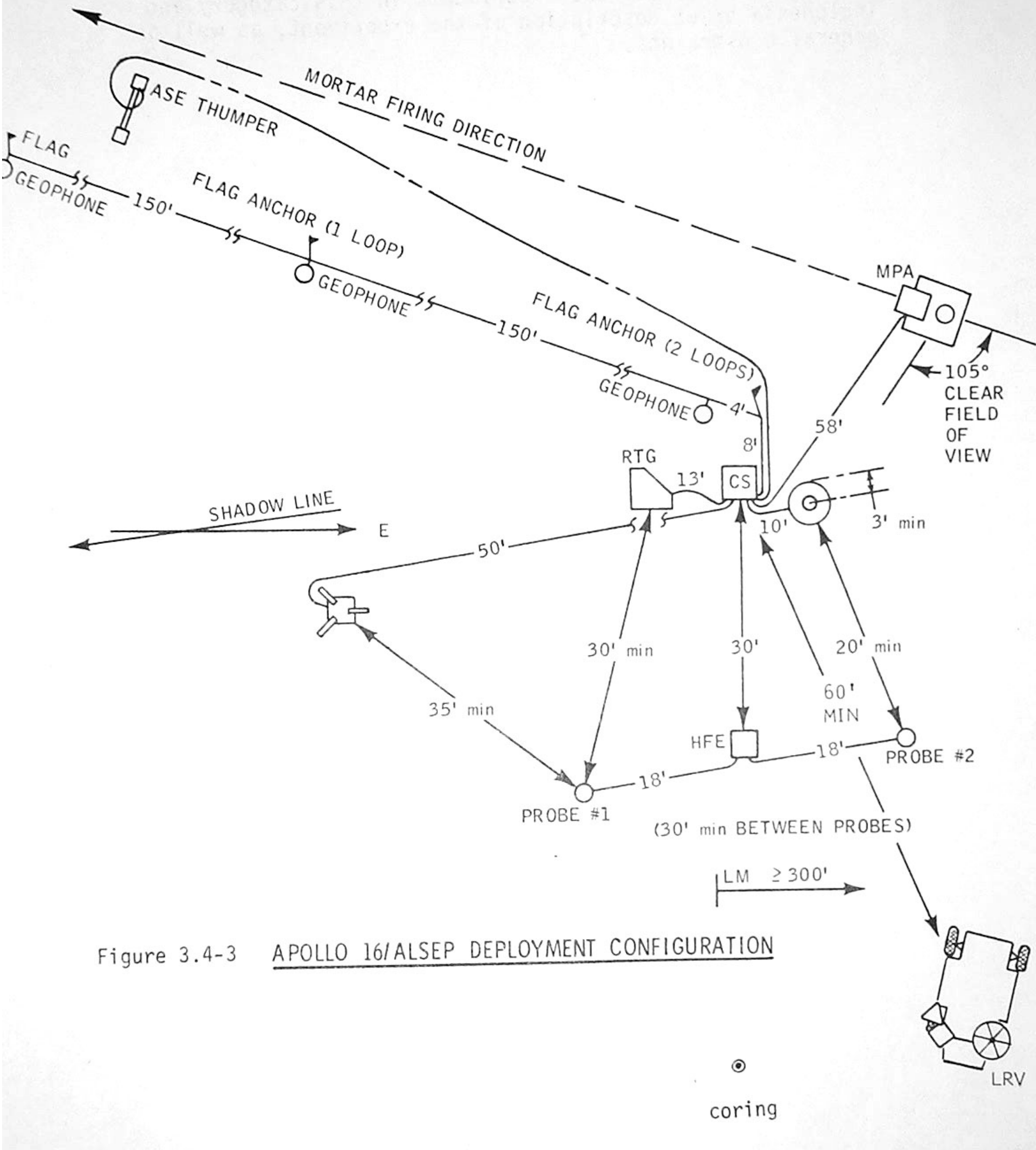


Figure 3.4-3 APOLLO 16/ALSEP DEPLOYMENT CONFIGURATION

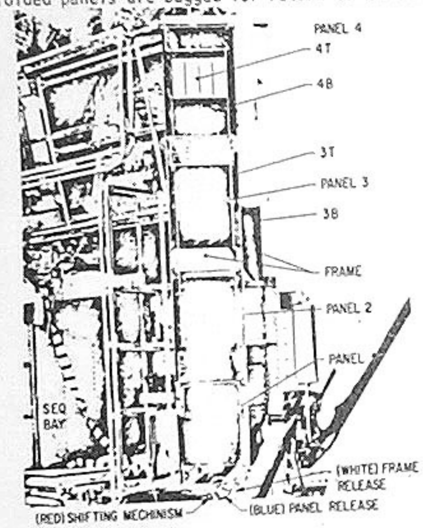
3.4.2 Astrophysical and Geophysical Equipment Data

Figure 3.4-4 depicts the experiments in this category and includes a brief description of the experiment, as well as general constraints.

COSMIC RAY DETECTOR (SHEETS) EXPERIMENT

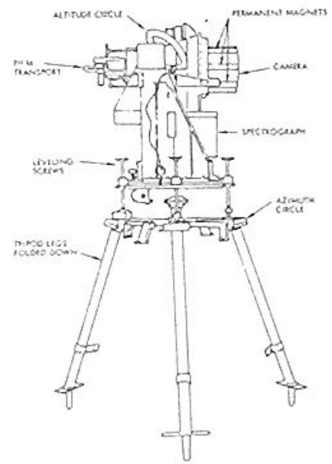
The Cosmic Ray Experiment comprises three separate but related investigations. Data will be obtained from analyses of the various sheets of materials (plastics and metals) which make up the four-panel array. The Cosmic Ray Experiment collects data on the outbound trip as well as on the lunar surface. To provide a discrete "mark" for the transition from orbital to lunar surface data, the crew, near the beginning of EVA 1, pulls a lanyard to shift some sheets which respect to others in the array. The crew also documents the amount of dust on the experiment in this EVA. The shift must be accomplished after the RTG for ALSEP is out of sight, since the radiation from the RTG capsule affects the data.

At the close of EVA 3, the Cosmic Ray Experiment is taken down from the spacecraft (SEQ Bay), removed from its frame, and folded. The crew must report the readings on tempilabels as they appear during the folding process. The folded panels are bagged for return to earth.



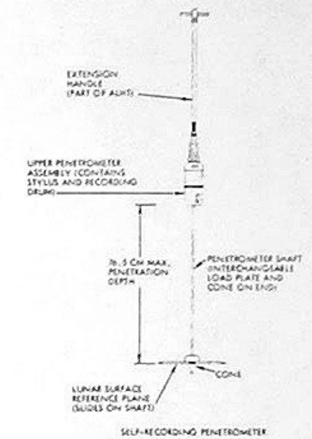
LUNAR SURFACE ULTRAVIOLET CAMERA (LSUC)

The LSUC is a miniature observatory which provides imagery and spectroscopy in the far ultraviolet range (Lyman-alpha). The LSUC is a modified Scmidt camera with a field of 20 degrees, and a spectral resolution of 4 angstroms. The crew deploys the LSUC on its own tripod to within 5 degrees of vertical. The camera is set up in the shade of the LM off the Quad I side near the ladder. The camera mounting is of the alt-azimuth type, with a setting accuracy of 1 degree. Crew operation consists of initial setup, turnon, and periodic retargeting. A crewman removes the film cassette at the top of the camera for return to earth.



SELF-RECORDING PENETROMETER

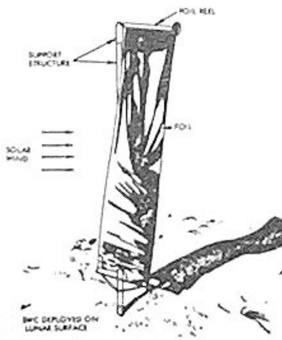
The Penetrometer is the principal Soil Mechanics instrument used on Apollo 16. It is used to obtain penetration and plate-load-sinkage characteristics of the lunar soil, through the use of three different cross-section penetration tips (cones), and a plate attachment. The crewman must push down on the penetrometer top handle (which is the Extension handle) with a smooth, even downstroke until full penetration is achieved, or no further travek is possible. Photographic documentation is TBD. Plate load measurements are accomplished in the same manner, except loading is exerted until the handle seats on the top of the drum housing, which requires 40 lbs pressure. Each measurement is indexed by turning the recording drum, the only part of the penetrometer which is returned to earth.



SOLAR WIND COMPOSITION (SWC) EXPERIMENT

The SWC is an aluminum-platinum foil collector of particles from the Solar Wind which provides data on the elemental and isotopic composition of the noble gasses and other selected elements that comprise the Solar Wind. The SWC is deployed 60 to 100 feet away from the LM in direct sun, with the surface of the foil within 30 degrees of the sun line. The SWC foil deployment is photographed to localize its position with respect to the LM as well as its orientation.

The SWC foil is removed from its pole, rolled, and bagged for return to earth at the end of the 3ed EVA.



LUNAR PORTABLE MAGNETOMETER (LPM)

Instrument measures local magnetic flux. Sensor head (on tripod) must be deployed 47 feet from LRV and from electronics/readout device mounted on the LRV geopallet. Sensor must be leveled (by bubble) to within 5 degrees of vertical, and aligned by sun shadow to within 3 degrees. Sixty seconds must elapse between sensor placement and reading. The readout on the LPM is digital via solid-state devices. Since the magnetic flux varies as a function of time, the crewman takes three readings in sequence for each measurement. The cable is then reeled up and the tripod/sensor restowed on the LRV.

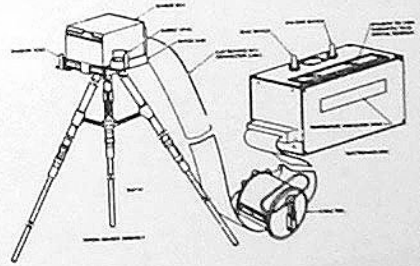


FIGURE 3.4-4 ASTROPHYSICAL AND GEOPHYSICAL EXPERIMENTS DATA

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 3.5-7, 3.5-8, and 3.5-9 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.

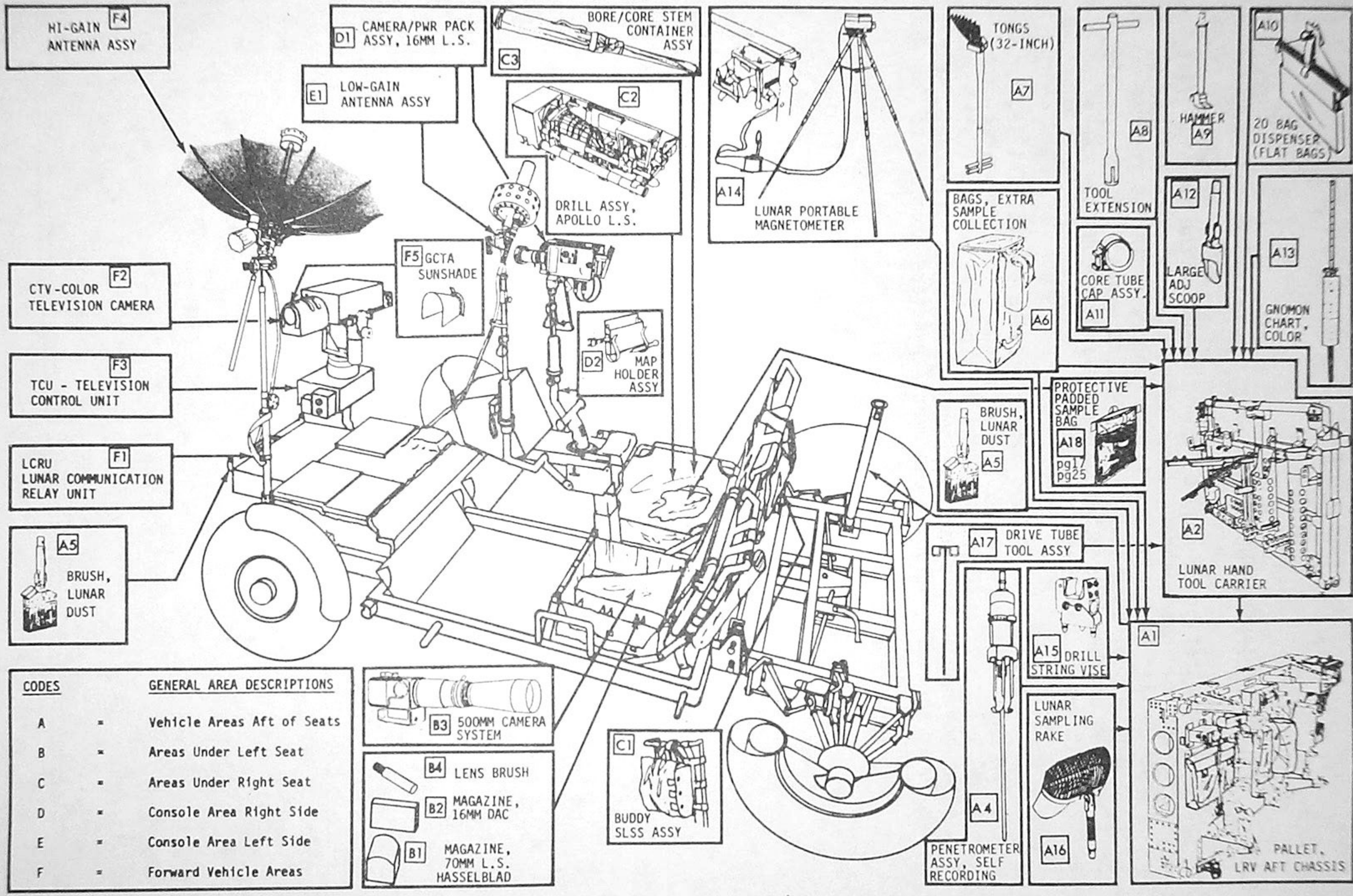
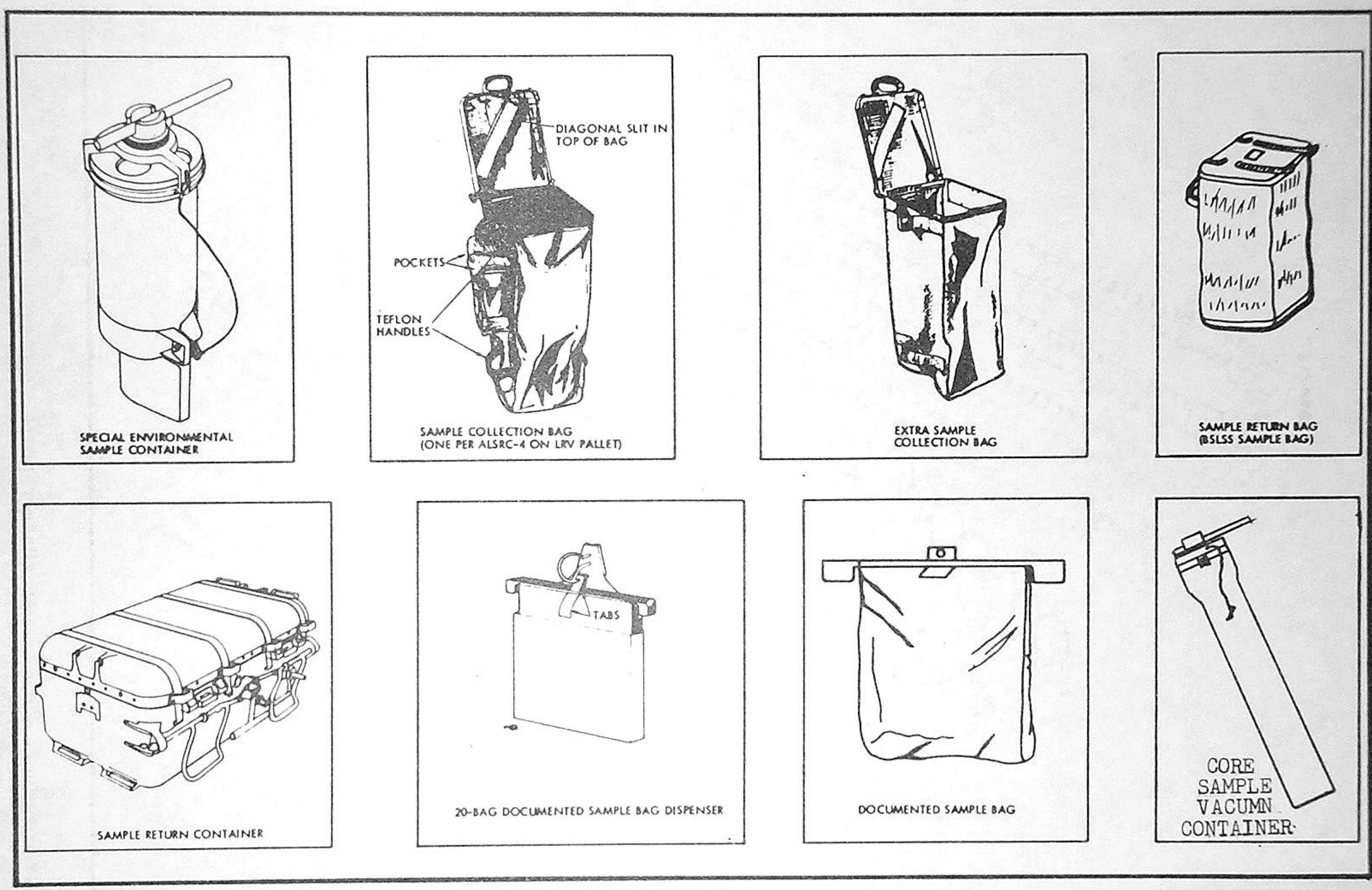


Figure 3.5-1 Lunar Field Geology Equipment Stowage on LRV



NOTE: 3 "PADDED" DOCUMENTED SAMPLE BAGS WILL ALSO BE USED.

FIGURE 3.5-2 LUNAR GEOLOGY SAMPLE CONTAINERS

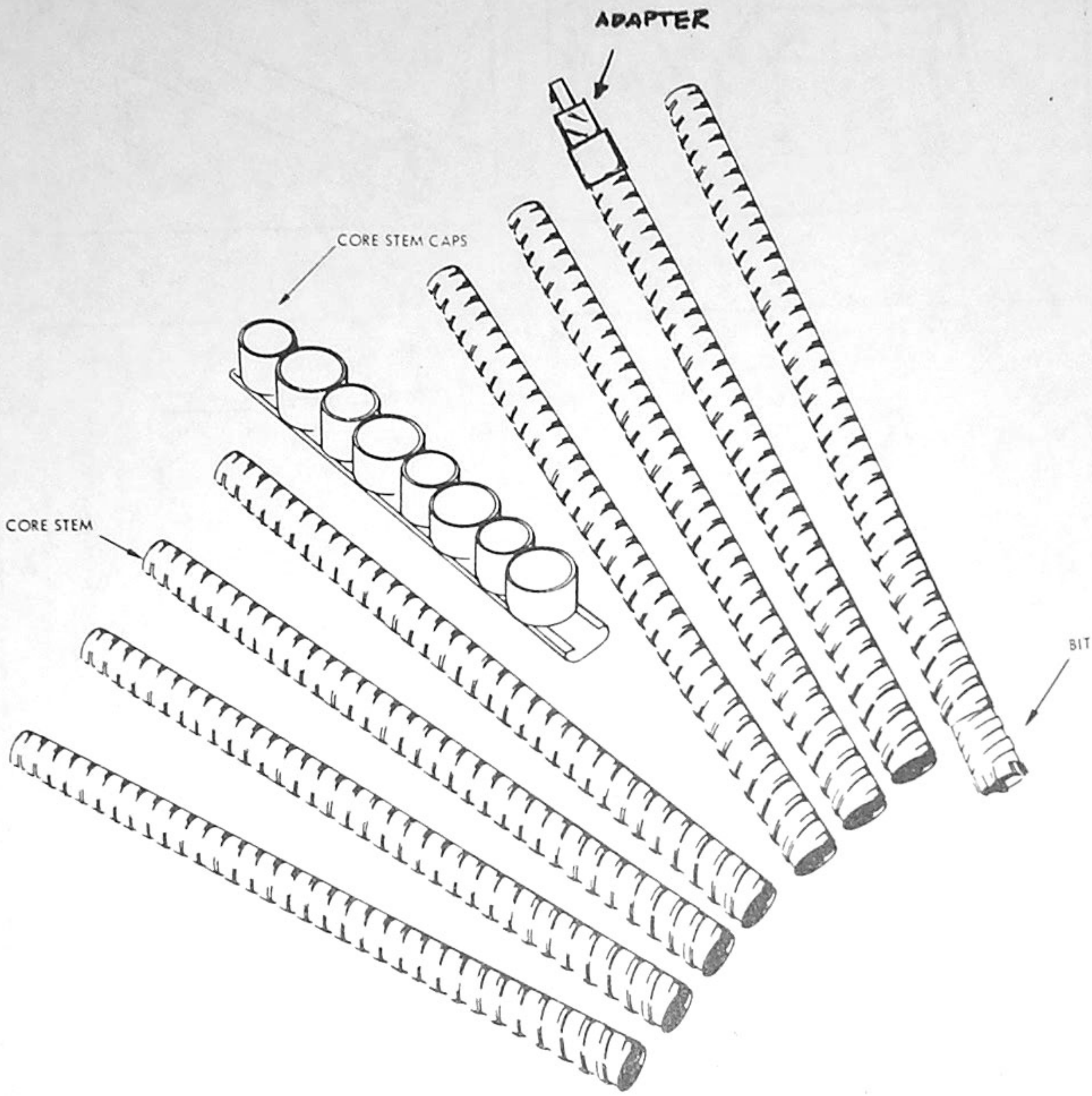


FIGURE 3.5-3 LUNAR SURFACE DRILL CORE STEMS & CAPS

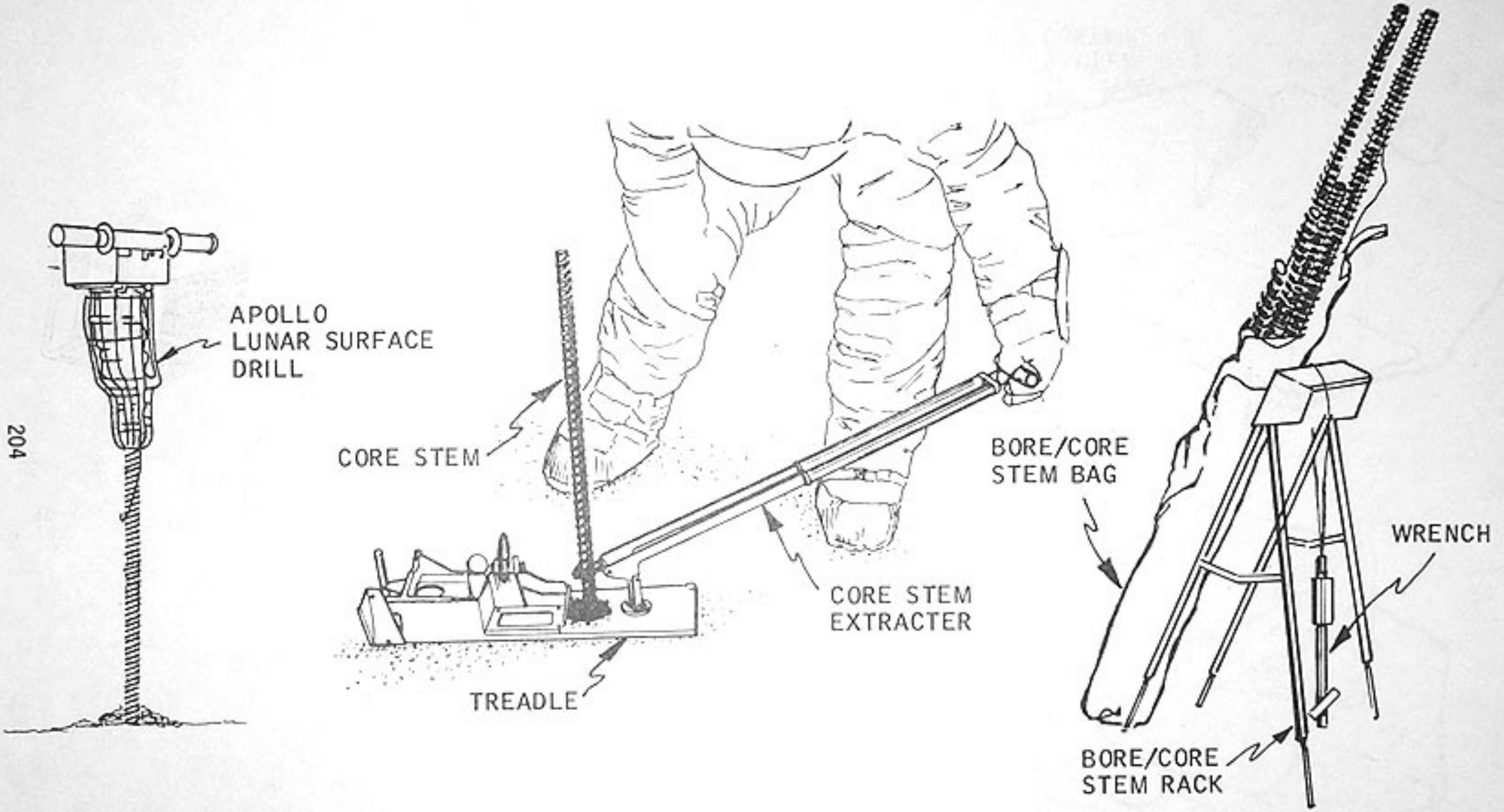


Figure 3.5-4 LUNAR SURFACE BORING & CORING HARDWARE

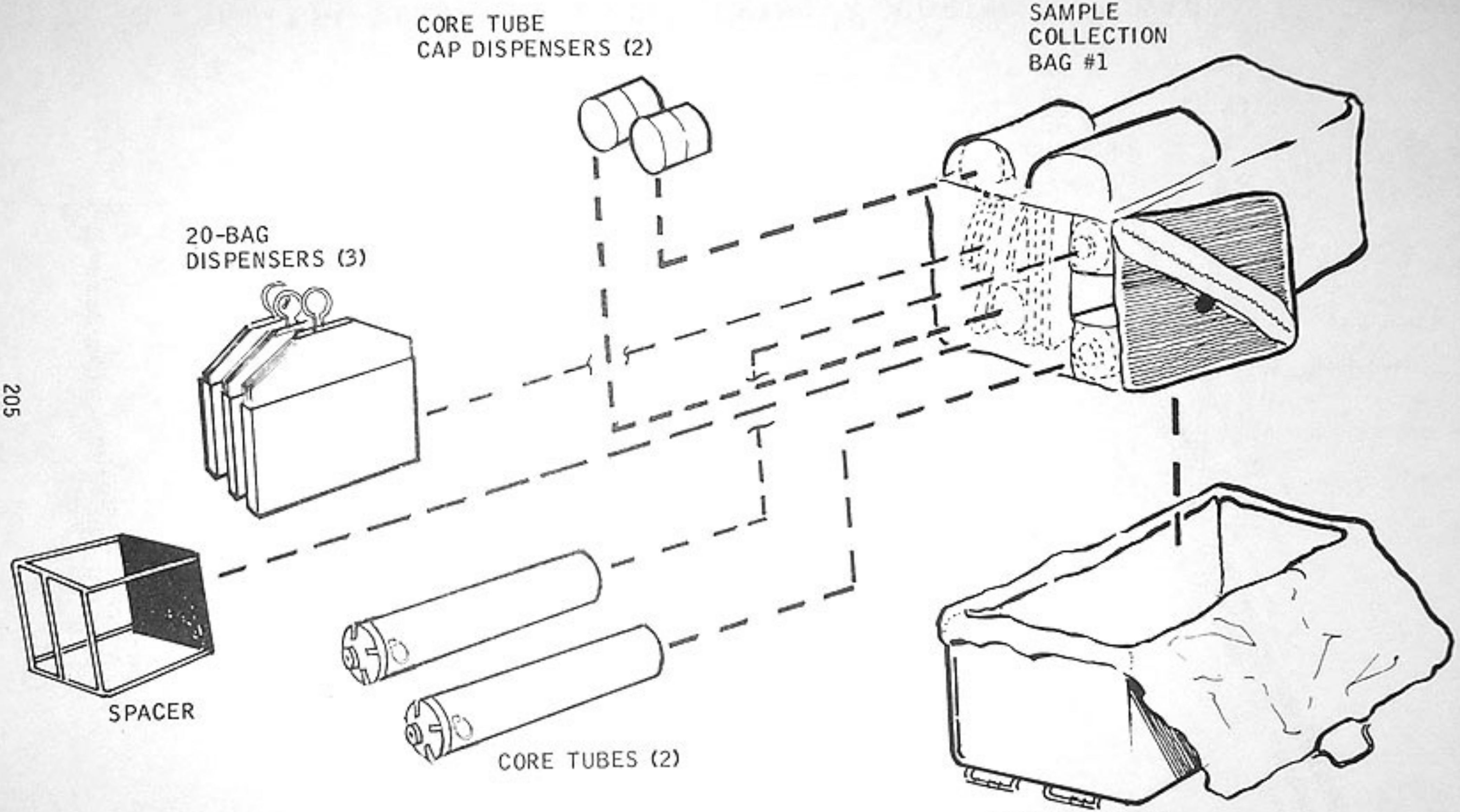


Figure 3.5-5a GEOLOGY SAMPLING ITEMS STOWED IN SRC # 1

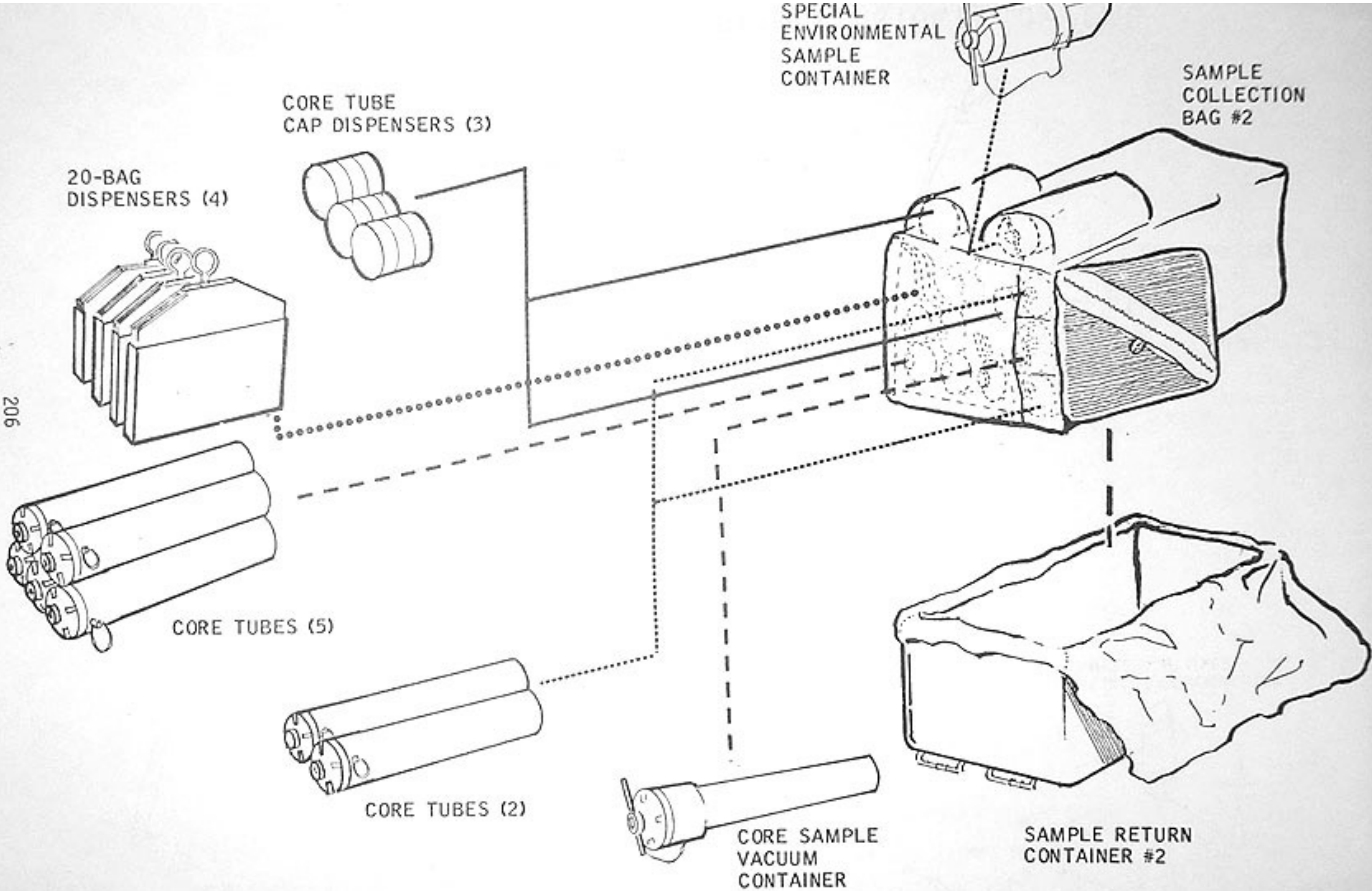


Figure 3.5-5b GEOLOGY SAMPLING ITEMS STOWED IN SRC # 2

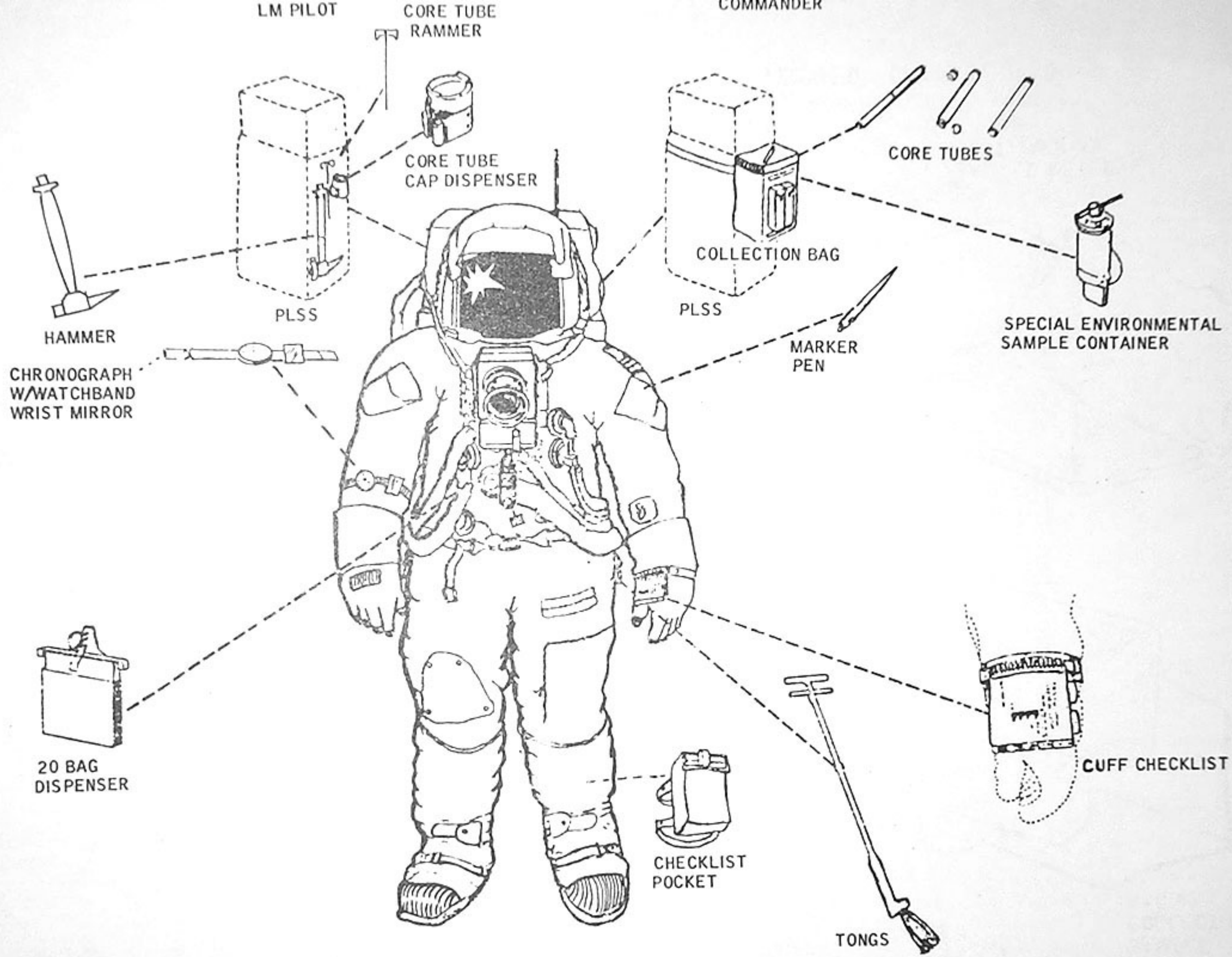
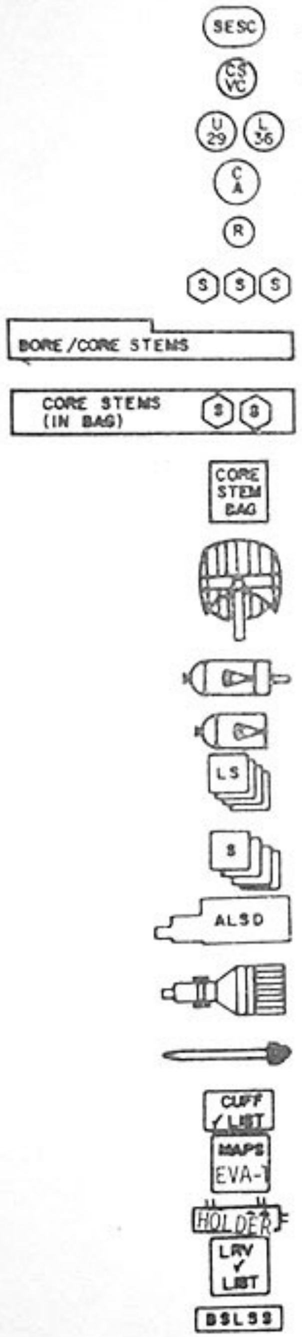
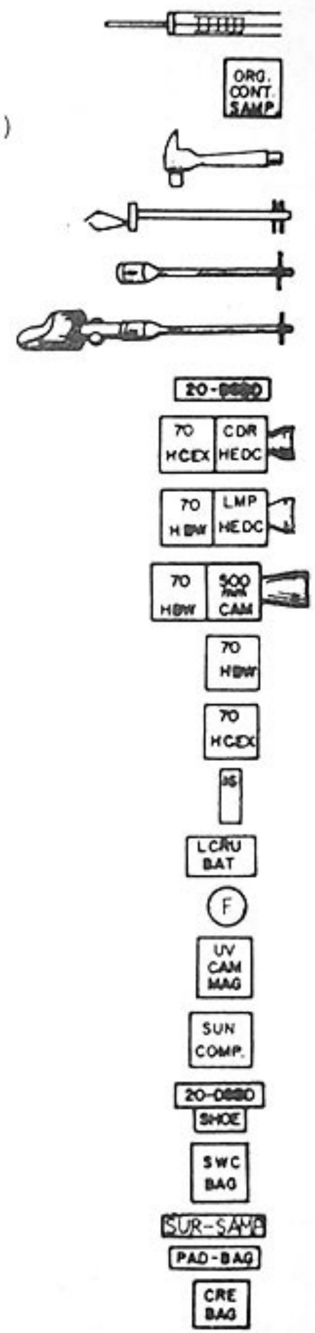


Figure 3.5-6 LUNAR SURFACE EQUIPMENT STOWED ON EMU

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



- Special Environmental Sample Container
- Core Sample Vacuum Container
- Core tubes (ex. Upper tube #29, Lower tube #36)
- Core tube cap assy (w/3 caps)
- Core tube tool assy
- Core stems
- Bore (6) & Core (6) stems in MESA Container
- Core stems (2 sections) in return bag
- Core stem return bag as stowed on MESA
- Lunar surface rake
- Penetrometer
- Penetrometer (Data recording section only)
- Large Samples
- Small Samples
- Apollo Lunar Surface Drill
- Dust brush
- Camera Lens 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
- CDR Hasselblad Elec. Data Cam. & Mag
- LMP Hasselblad Elec. Data Cam. & Mag.
- 500 MM Lens HEDC & Mag.
- 70mm Magazine w/HBW film
- 70mm Magazine w/HCEX film
- 16mm Magazine w/CEX film
- LCRU Battery
- Polarizing Filter
- Far UV Cam. Magazine return bag
- Sun Compass
- 20-Documented Sample Bag Dispenser Bracket
- Solar Wind Comp. foil return bag
- Surface Sampler
- Protective Sample Bag
- Cosmic Ray Exp. return bag

FIGURE 3.5-7A EVA 1 PRE-ALSEP DEPLOYMENT

(MESA AND ETB TRANSFERS TO LRV)

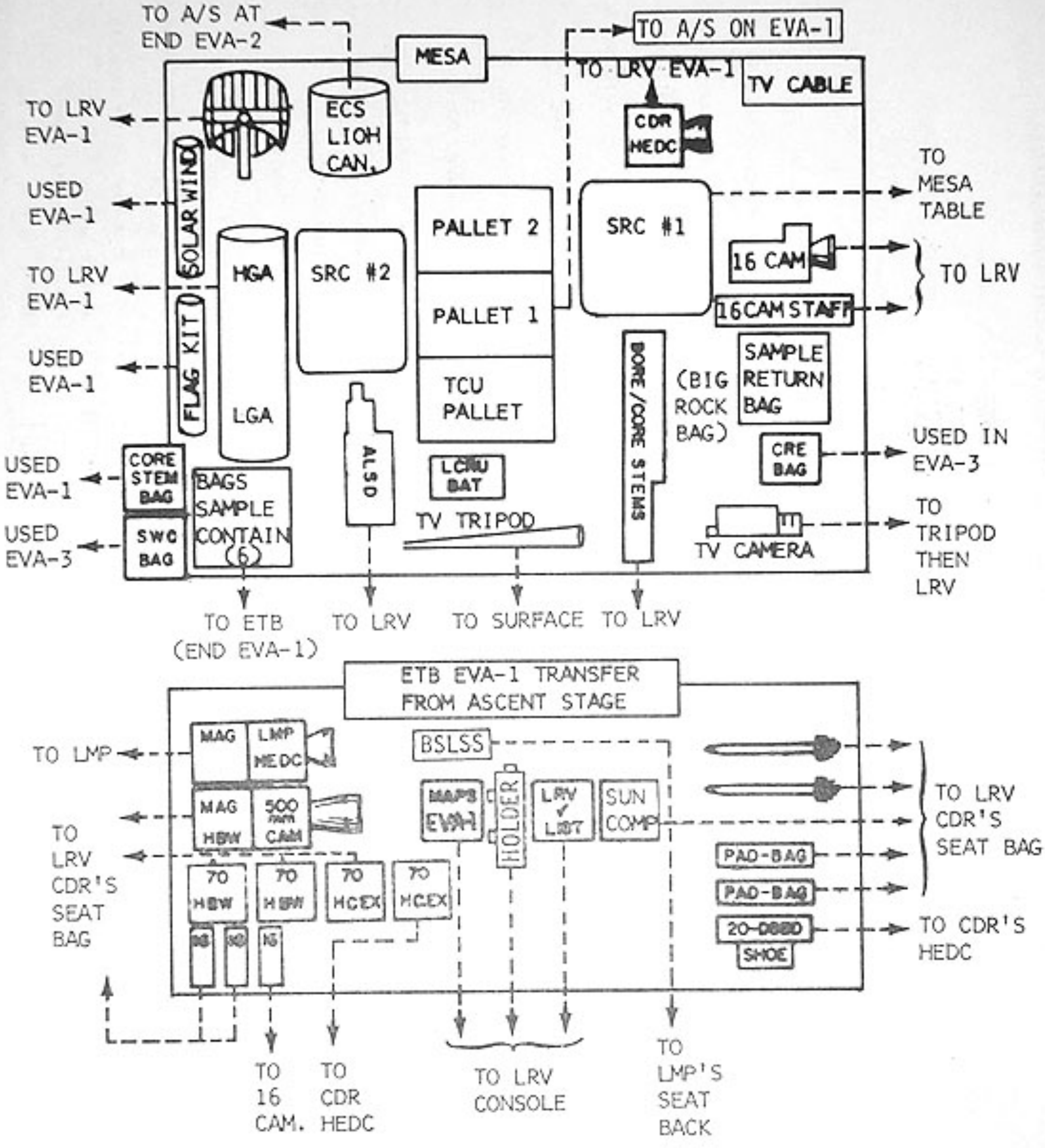
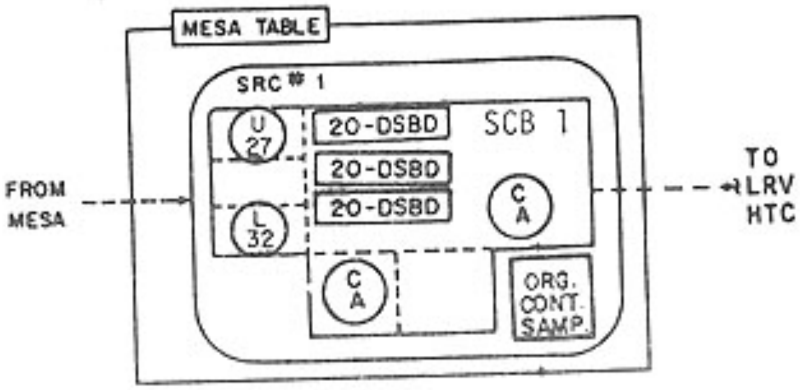


FIGURE 3.5-7b EVA 1 PRE ALSEP DEPLOYMENT
(MESA TABLE LOADING AND TRANSFER TO LRV)



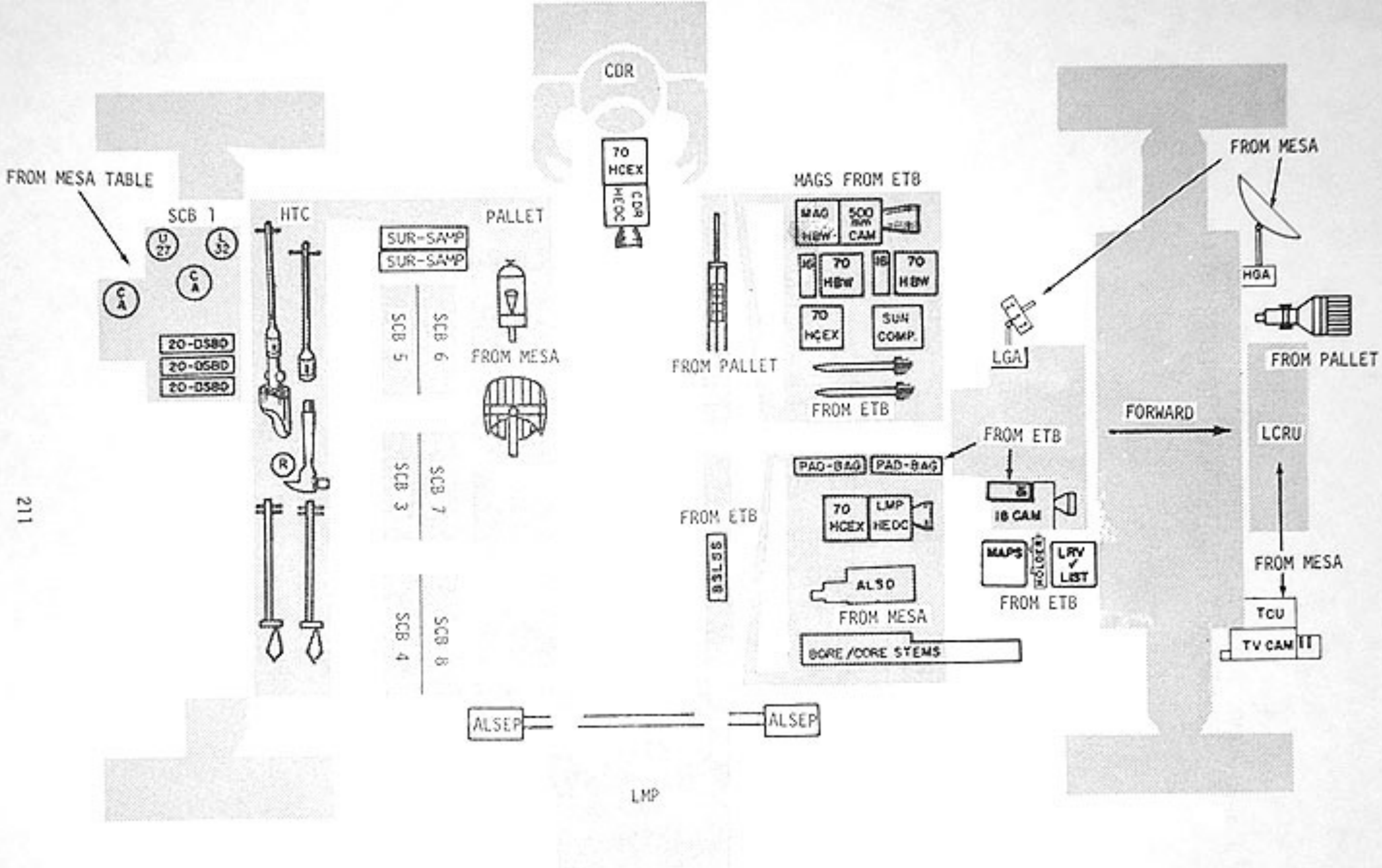


Figure 3.5-7c EVA 1 Pre-ALSEP

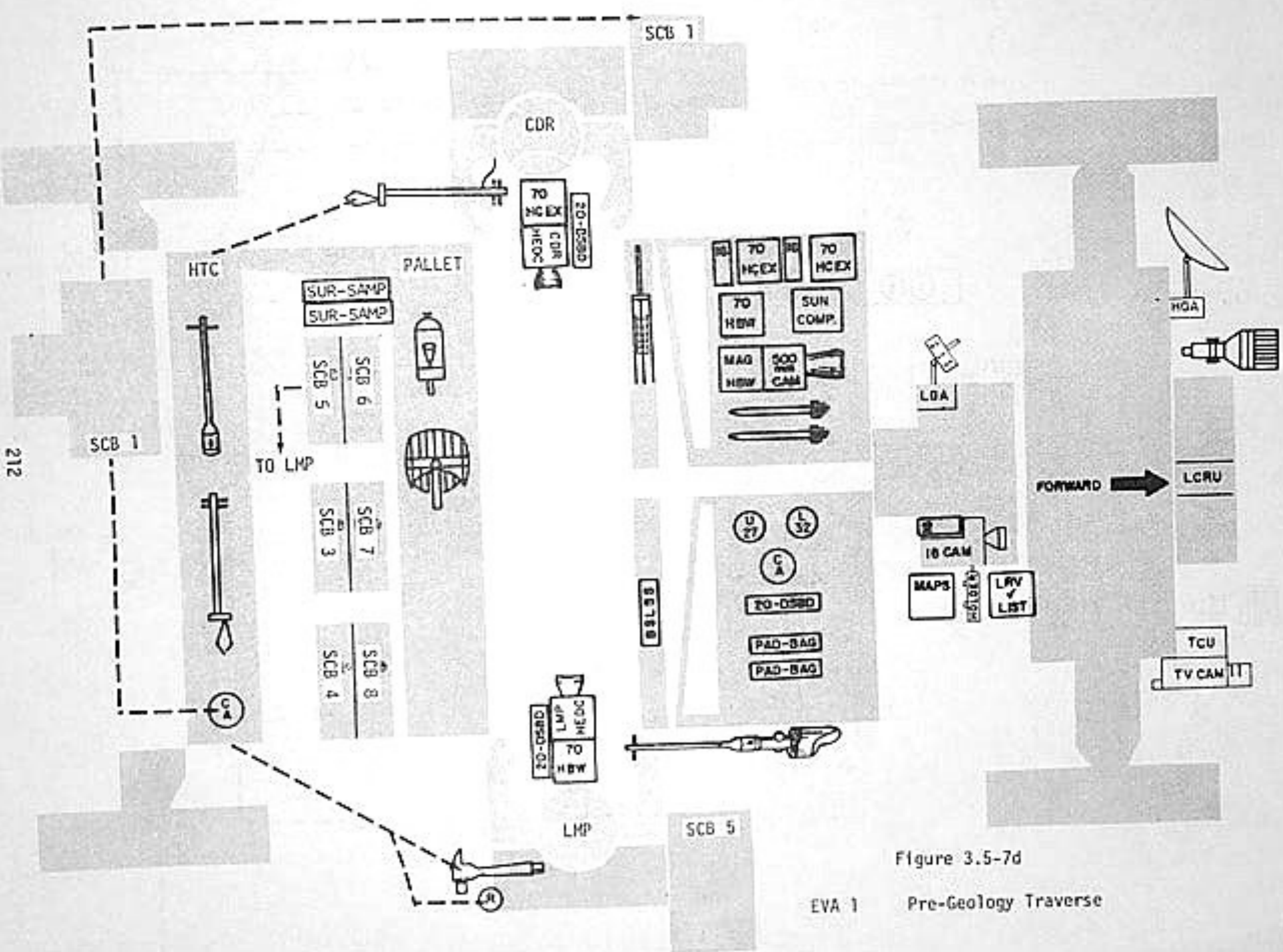


Figure 3.5-7d

EVA 1 Pre-Geology Traverse

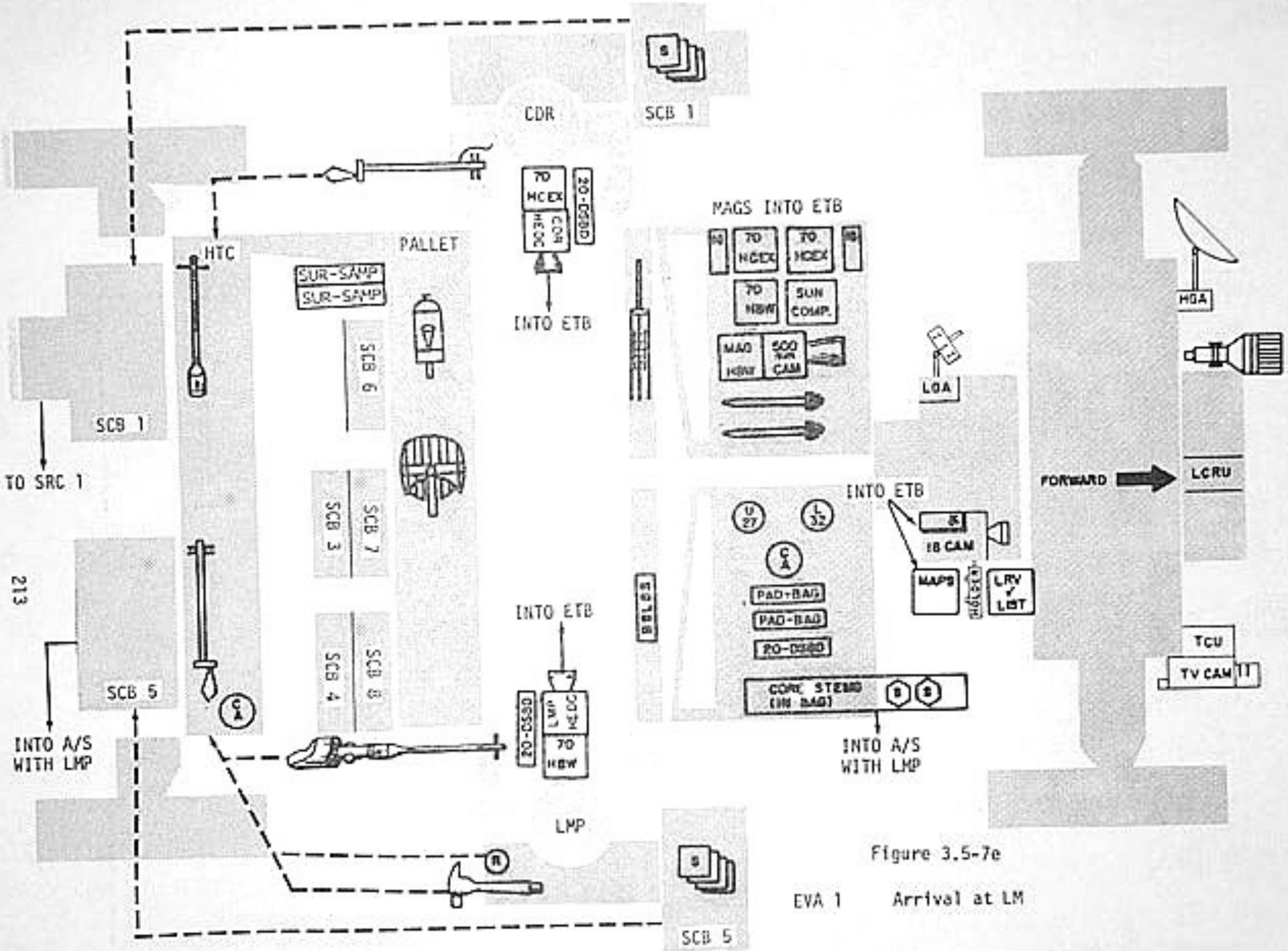


Figure 3.5-7e

EVA 1 Arrival at LM

FIGURE 3.5-7f **EVA-1 LRV TRANSFERS TO MESA AND LM**

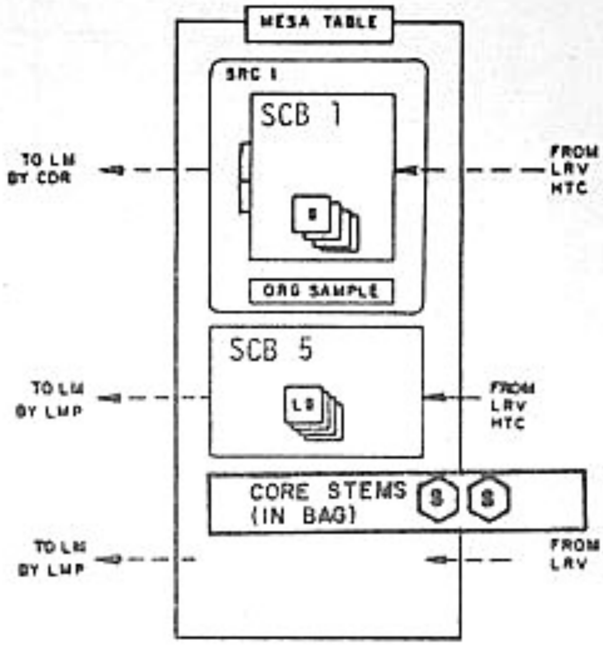
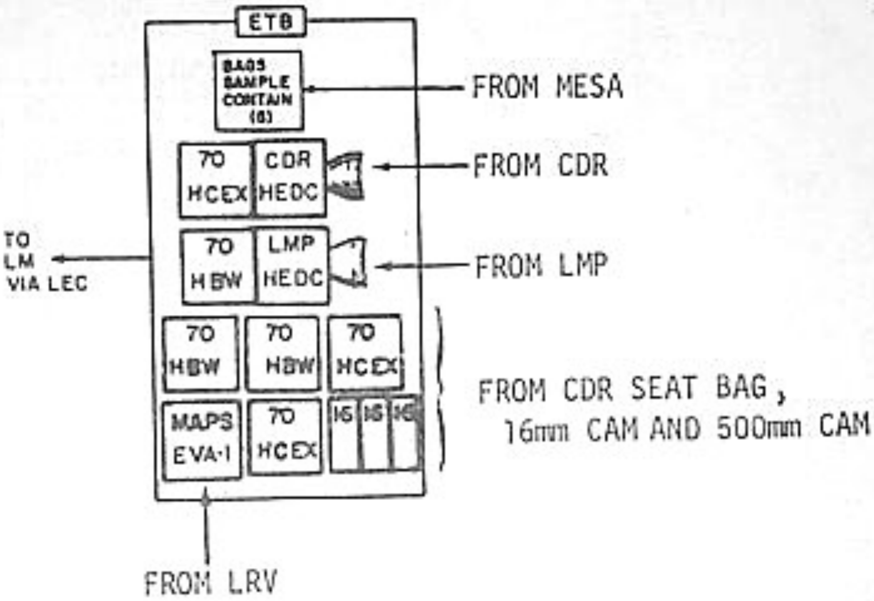


FIGURE 3.5-7g <u>EVA-1 ON LMP INGRESS</u>
(ETB TRANSFER TO LM)



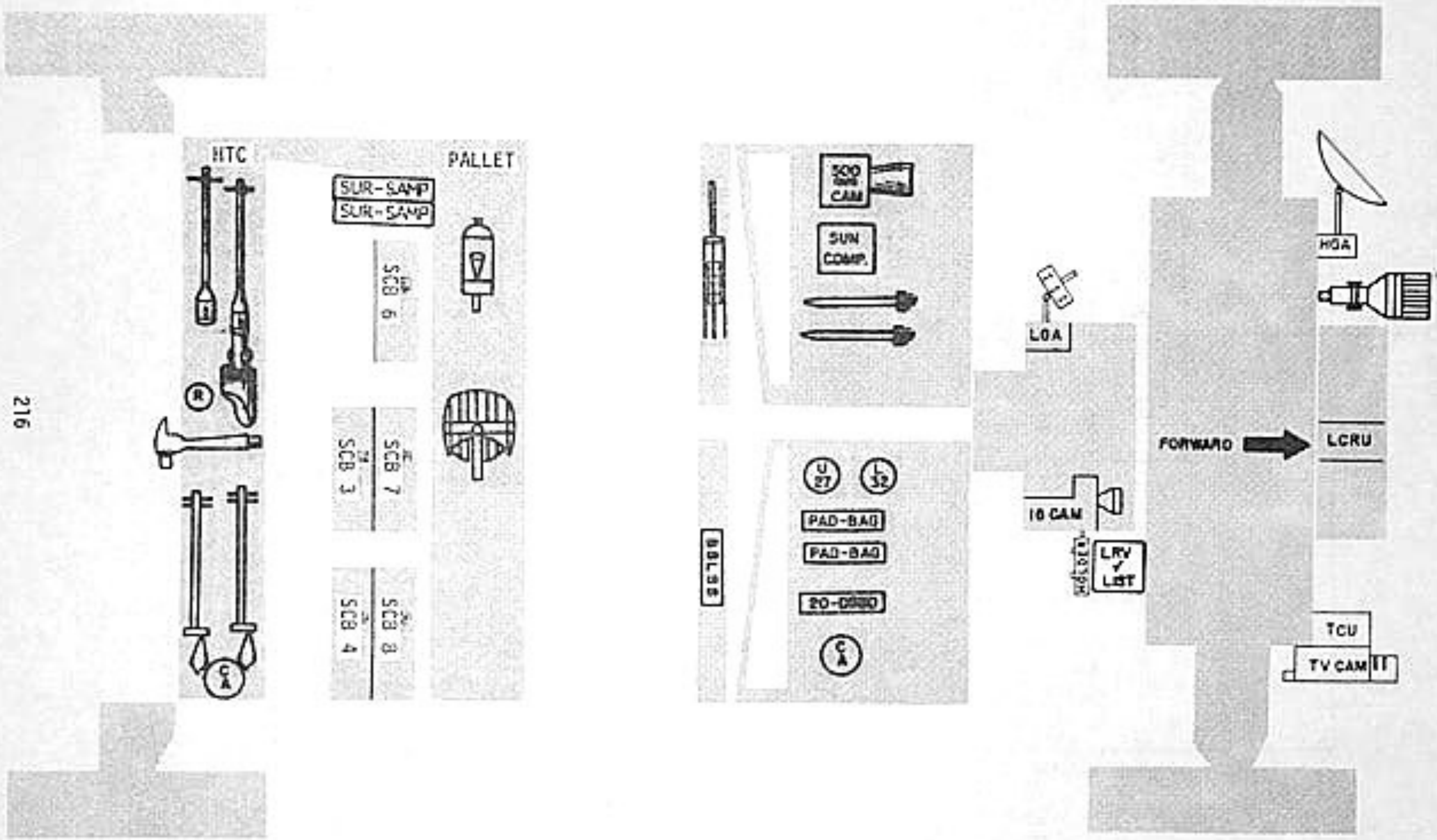


Figure 3.5-7h EVA 1 Final LRV Configuration

FIGURE 3.5-8a : **EVA-2 PRE-GEOLOGY TRAVERSE**

(MESA AND ETB TRANSFERS TO LRV)

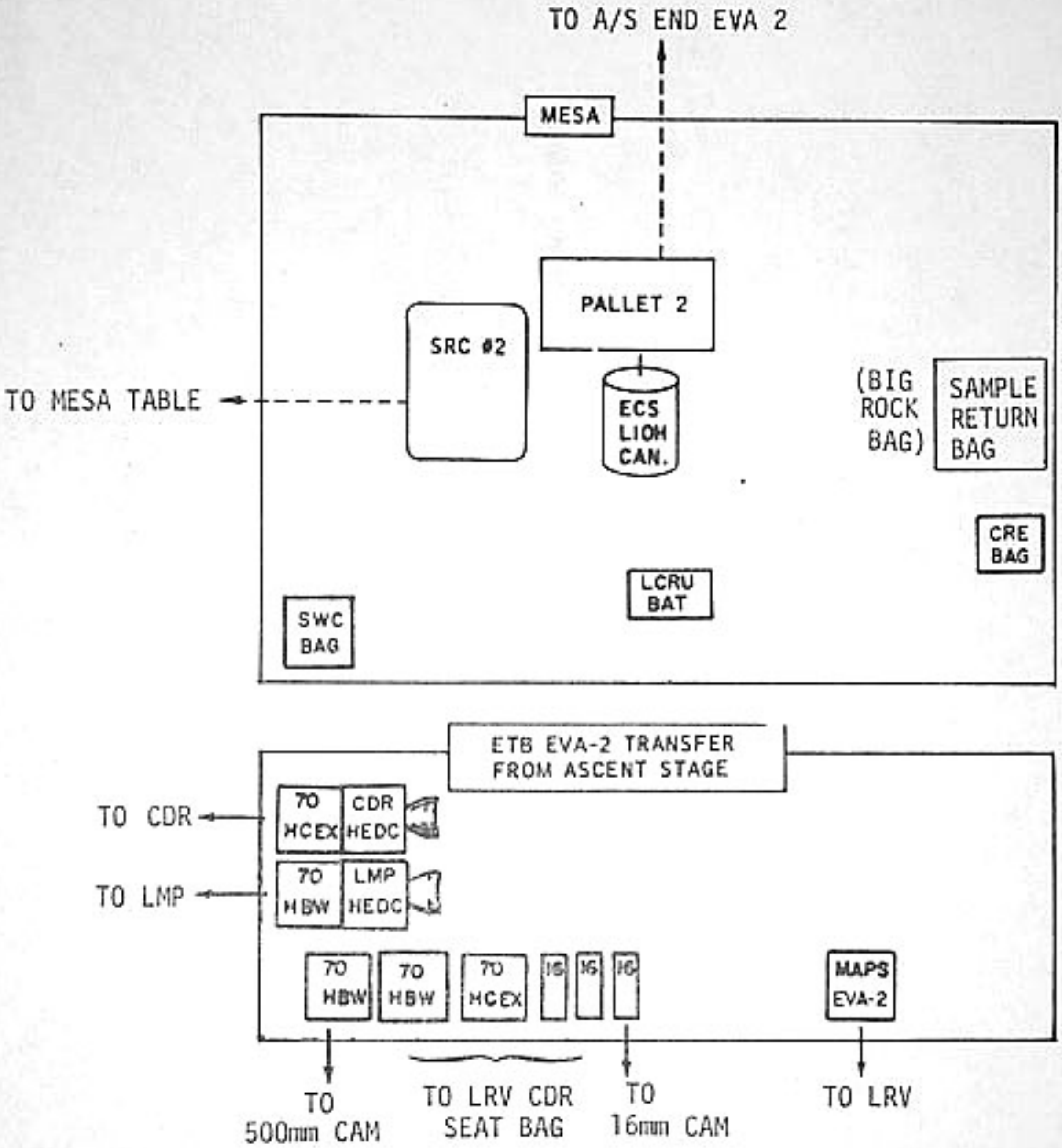
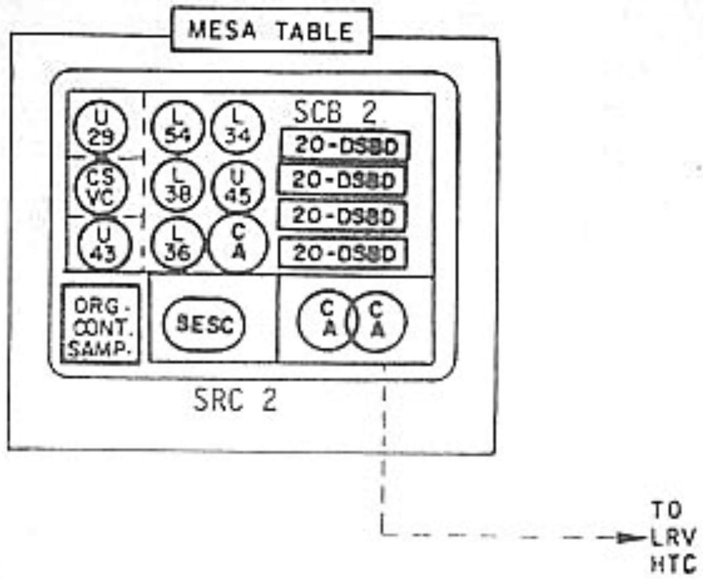
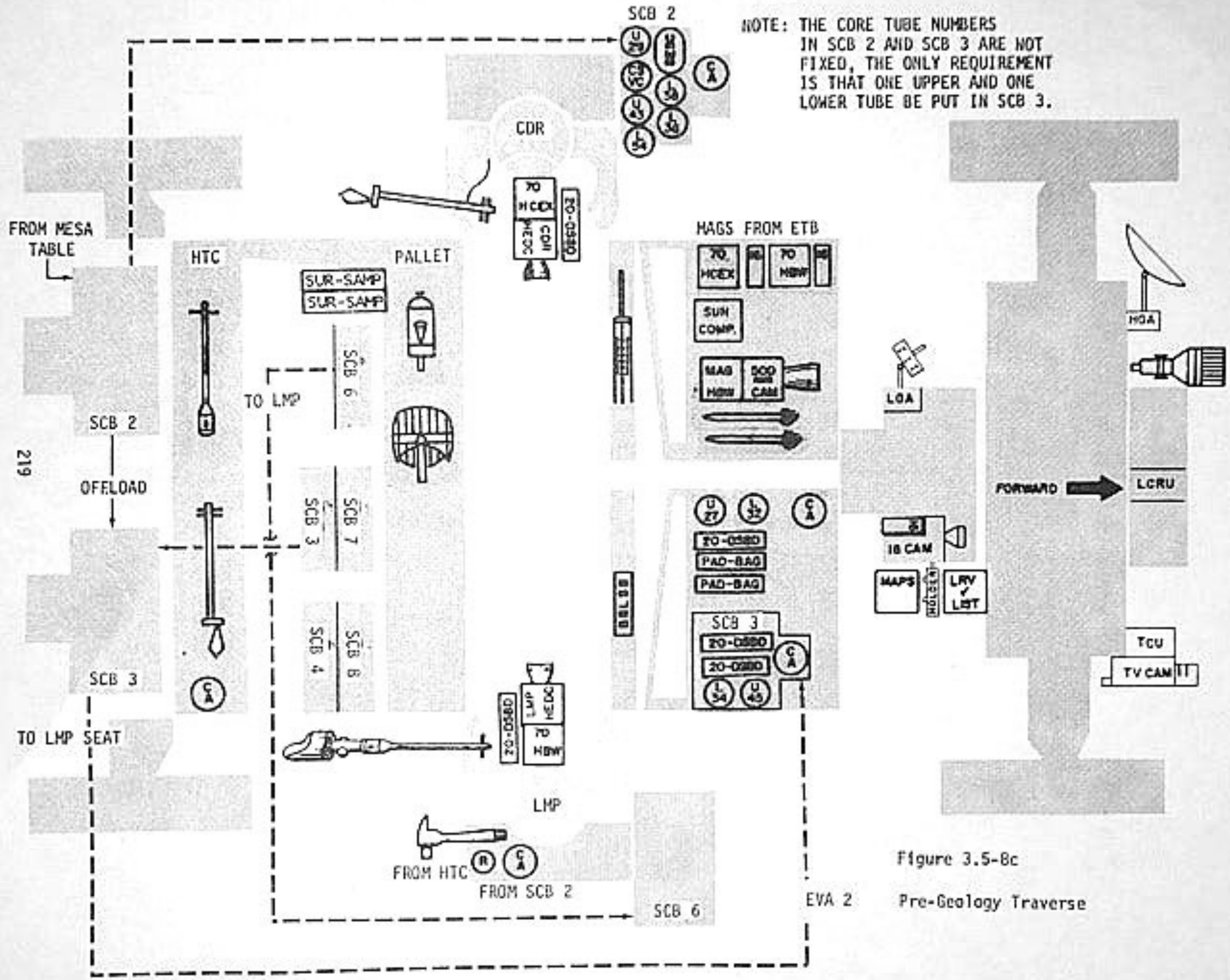


FIGURE 3.5-8b EVA-2 PRE-GEOLOGY TRAVERSE
(MESA TABLE LOADING AND TRANSFER TO LRV)



NOTE: THE CORE TUBE NUMBERS IN SCB 2 AND SCB 3 ARE NOT FIXED, THE ONLY REQUIREMENT IS THAT ONE UPPER AND ONE LOWER TUBE BE PUT IN SCB 3.



EVA 2

Figure 3.5-8c

Pre-Geology Traverse

NOTE: ONE LOWER CORE TUBE
IS RETURNED IN THE CSVC

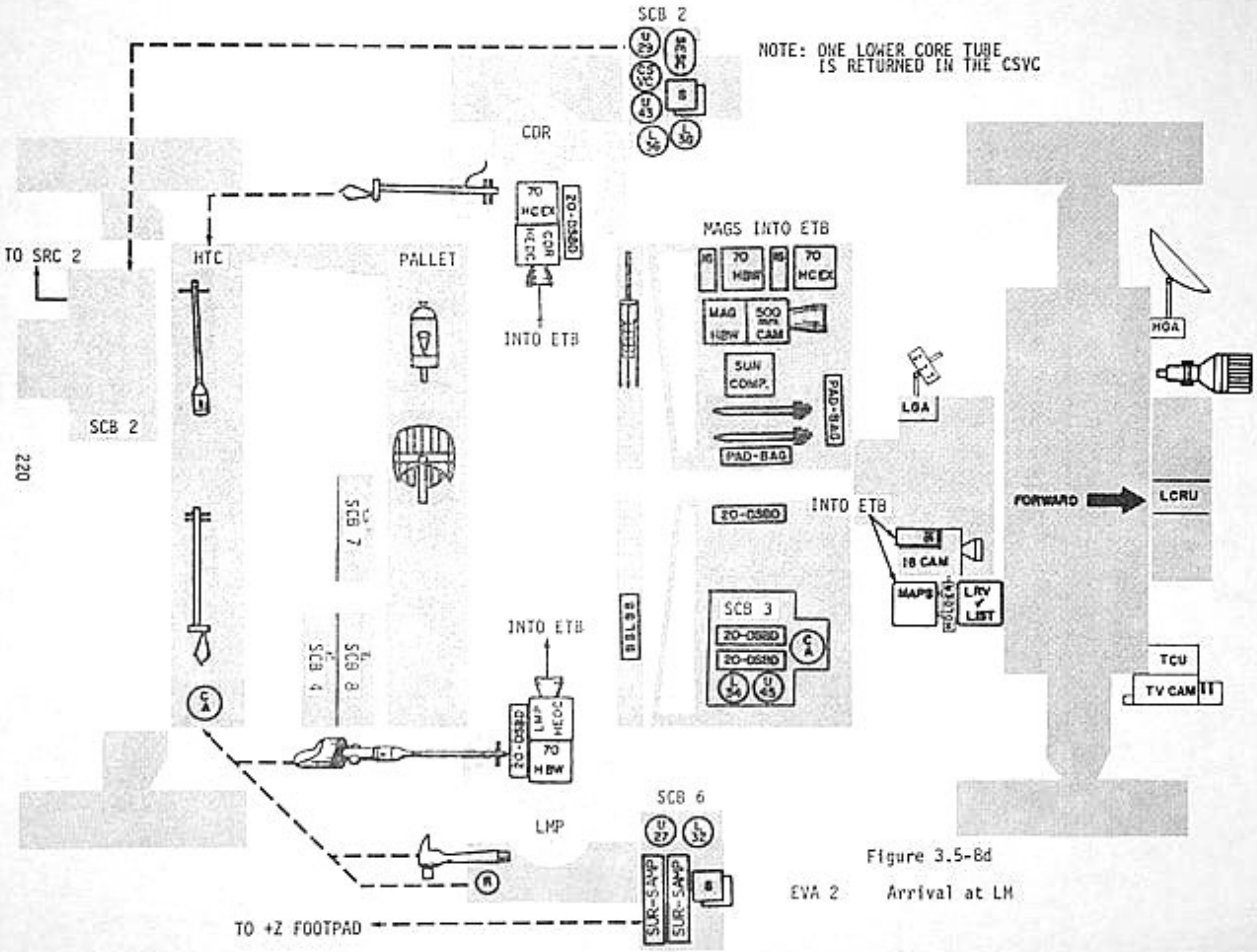


Figure 3.5-8d

EVA 2 Arrival at LM

FIGURE 3.5-8e : EVA-2 ON ARRIVAL BACK AT LM

(LRV TRANSFERS TO MESA AND LM)

NOTE: ONE LOWER CORE TUBE
IS RETURNED IN THE CSVC

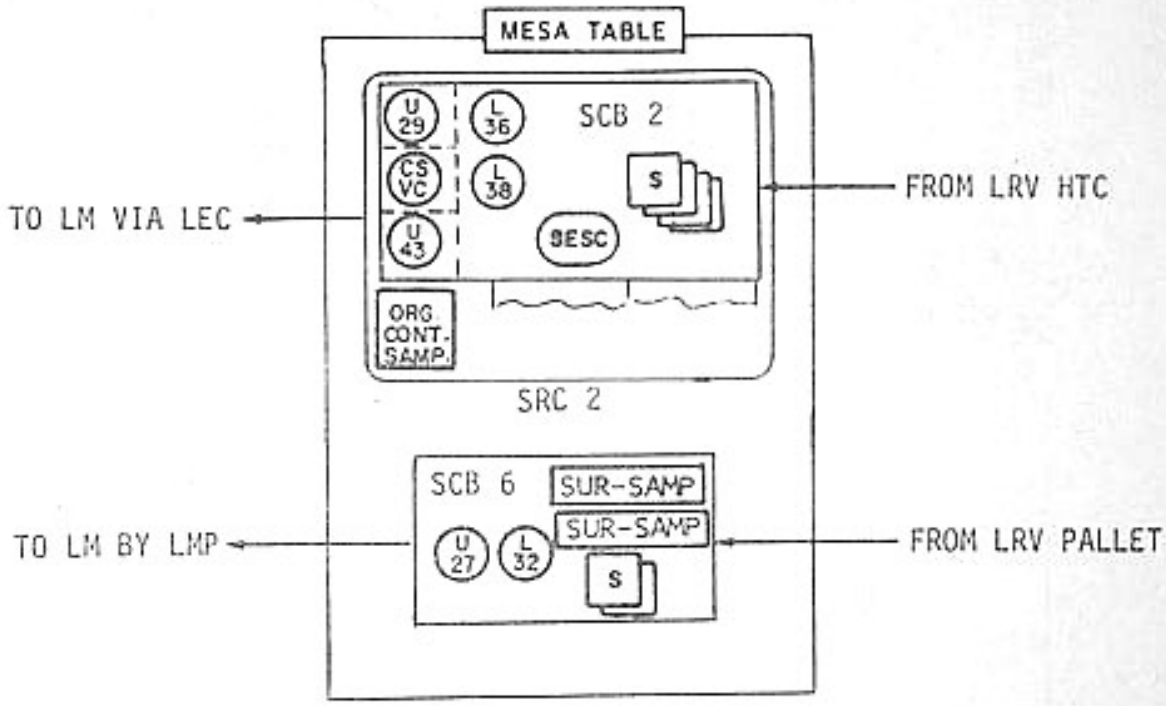
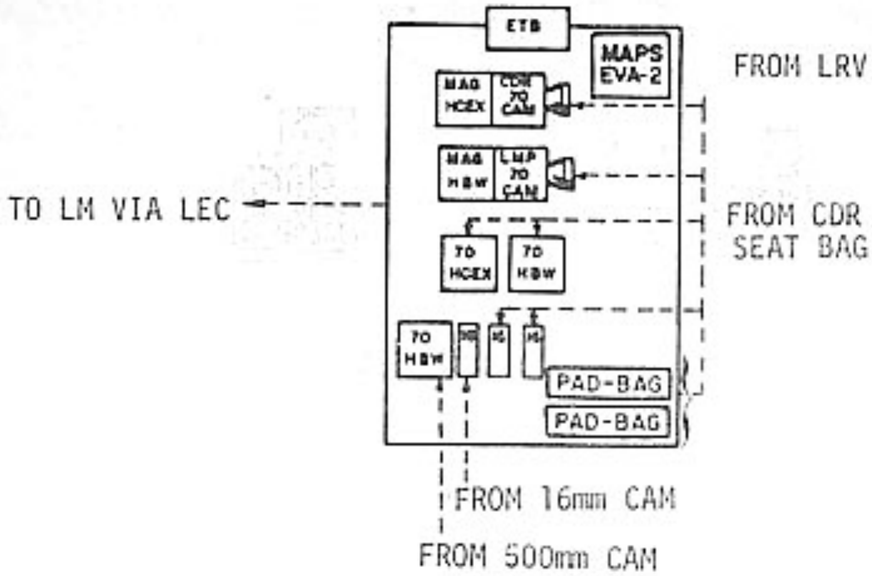


FIGURE 3.5-8f **EVA-2 ON LMP INGRESS**

(ETB TRANSFER TO LM)



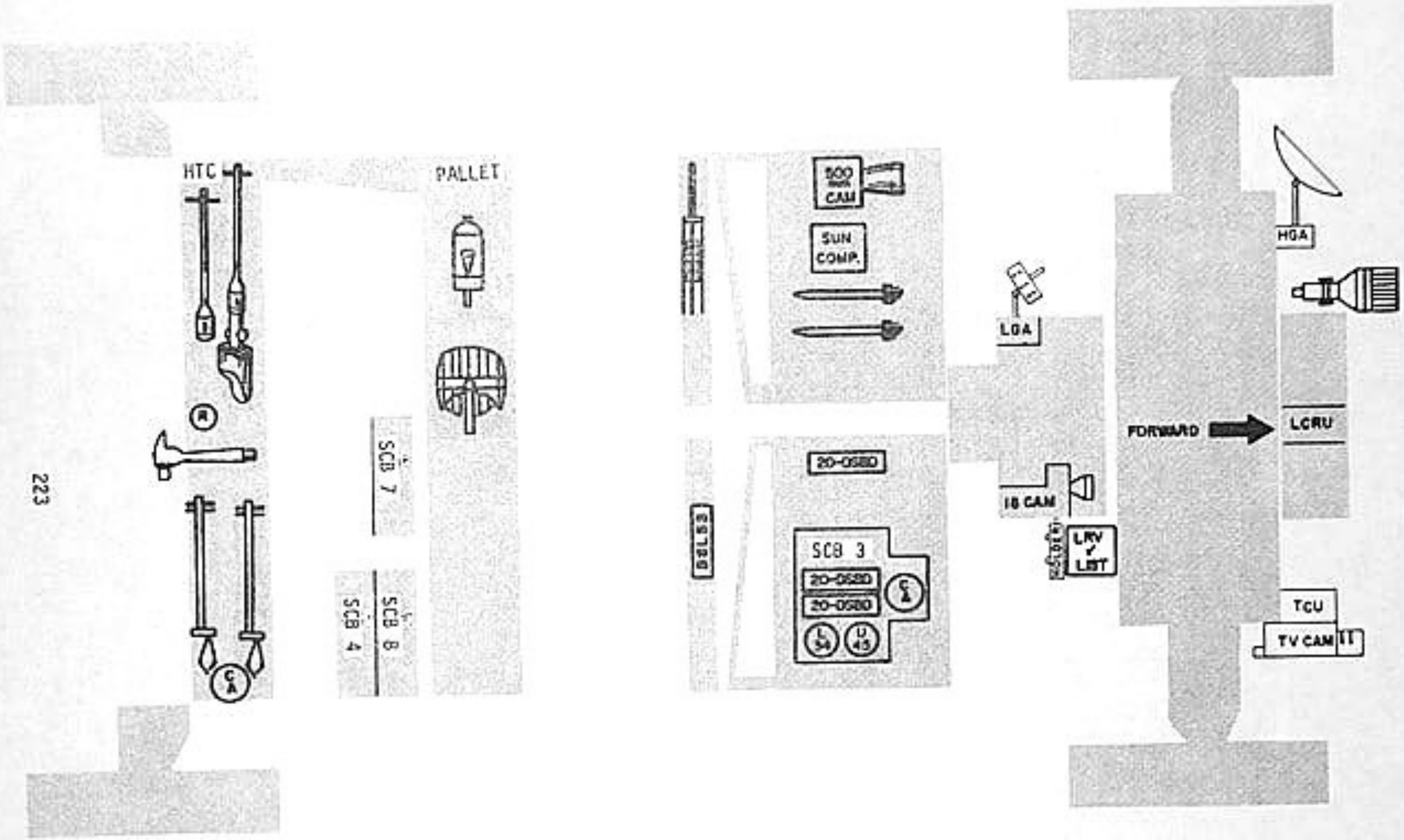
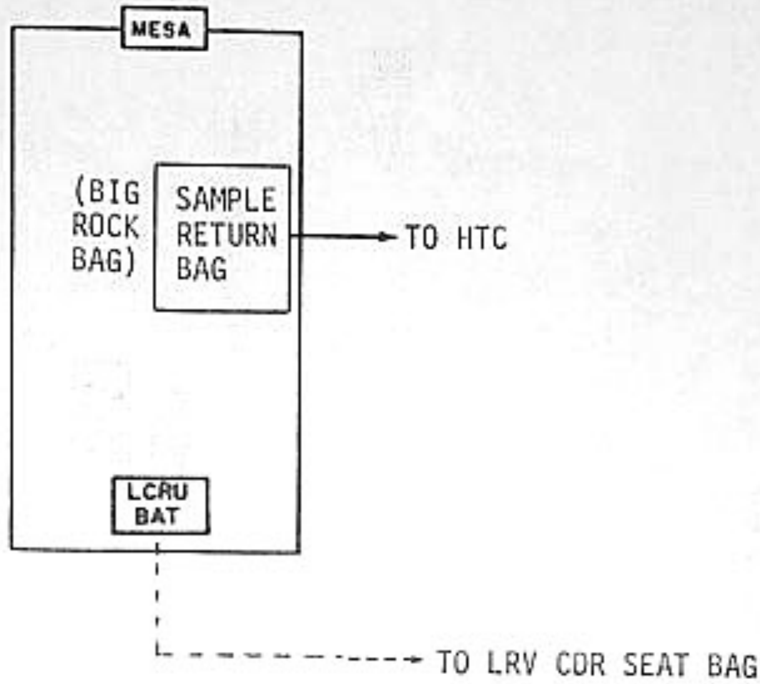
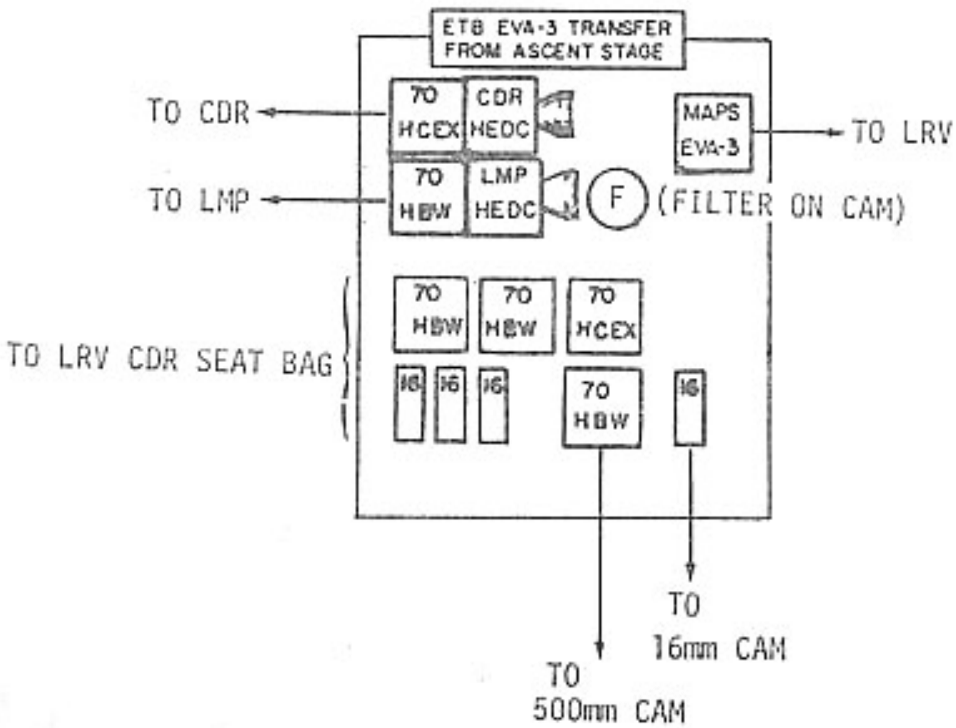


Figure 3.5-8g EVA 2 Final LRV Configuration

FIGURE 3.5-9a : **EVA-3 PRE-GEOLOGY TRAVERSE**

(MESA AND ETB TRANSFERS TO LRV)





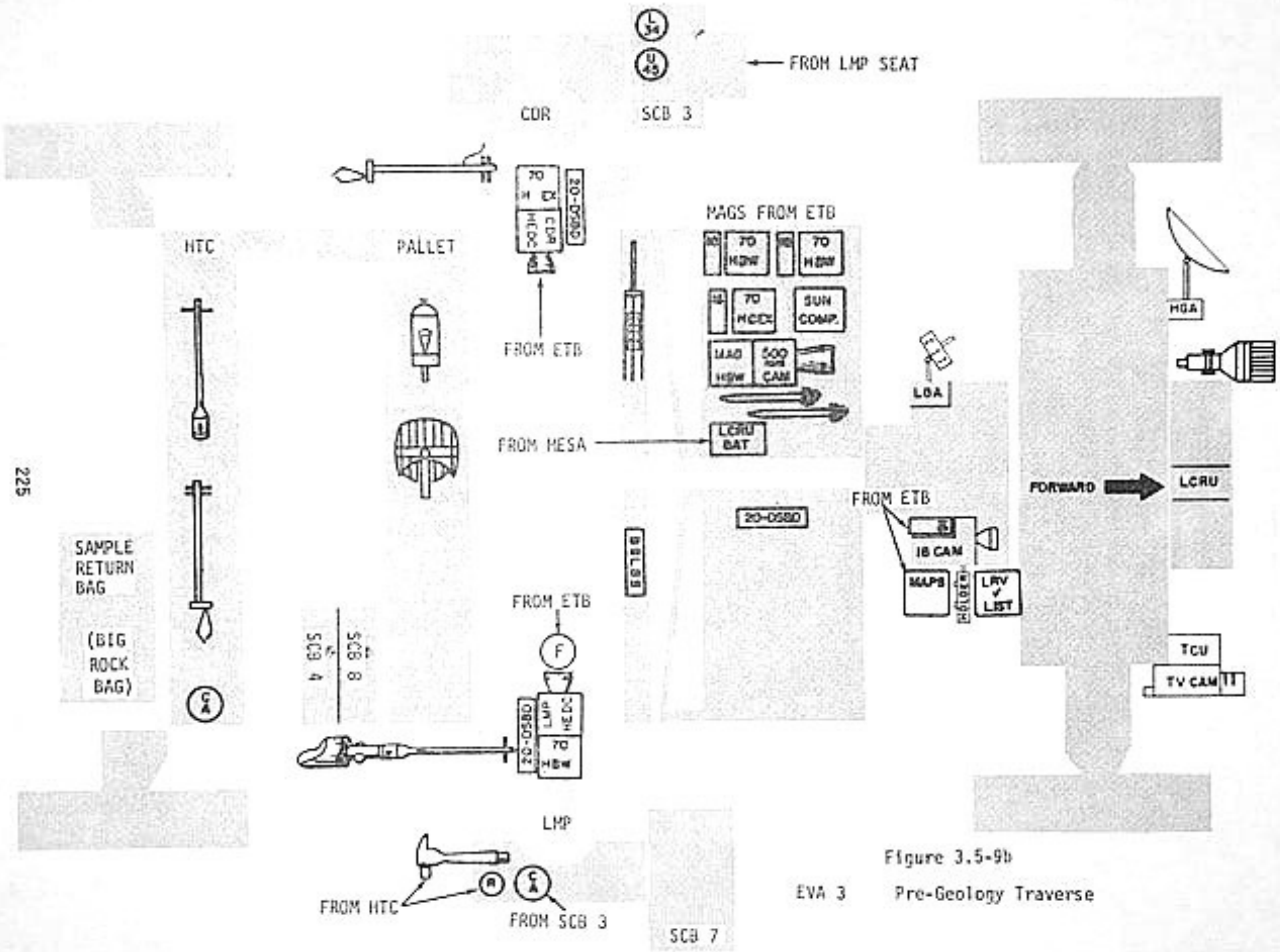


Figure 3.5-9b

EVA 3 Pre-Geology Traverse

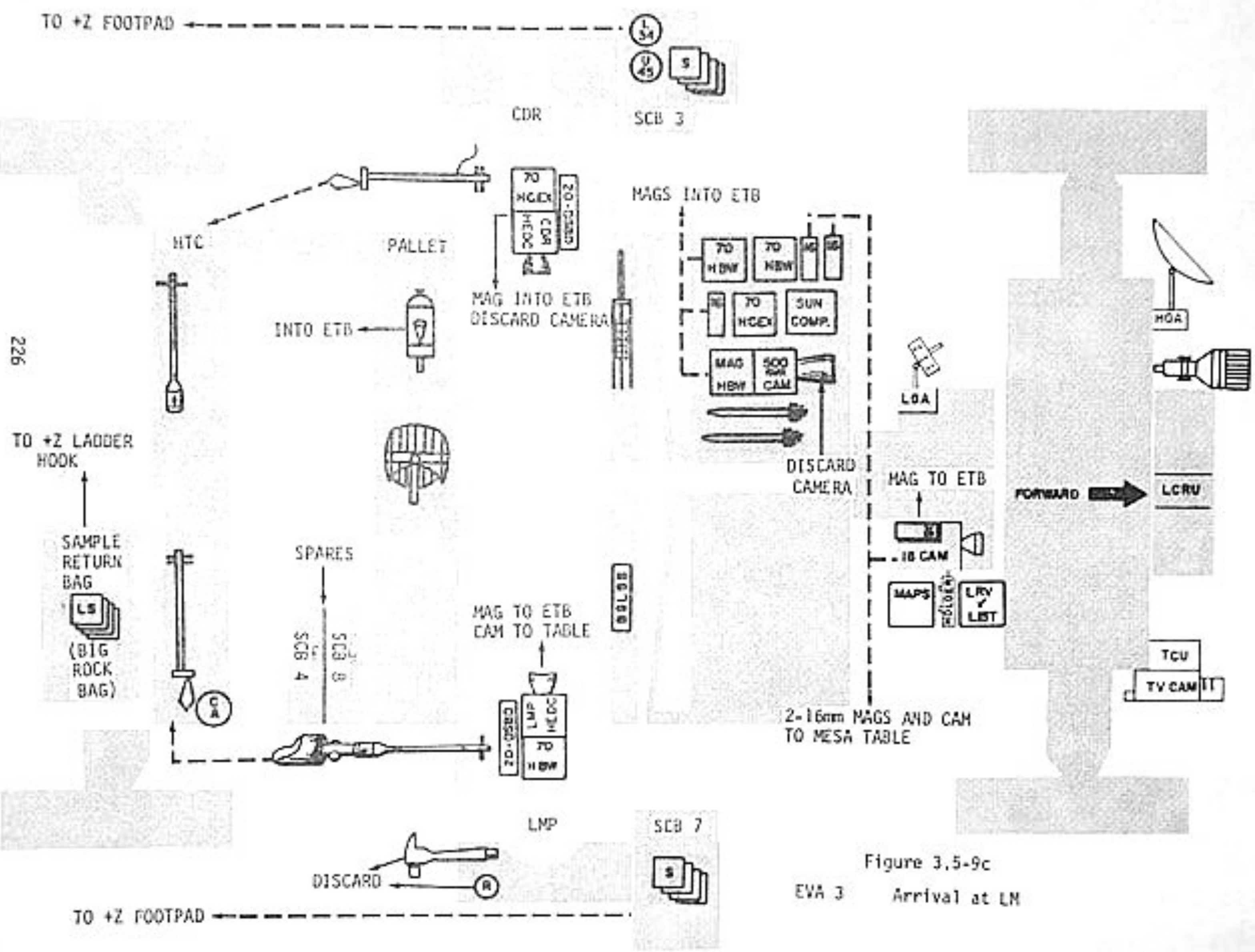
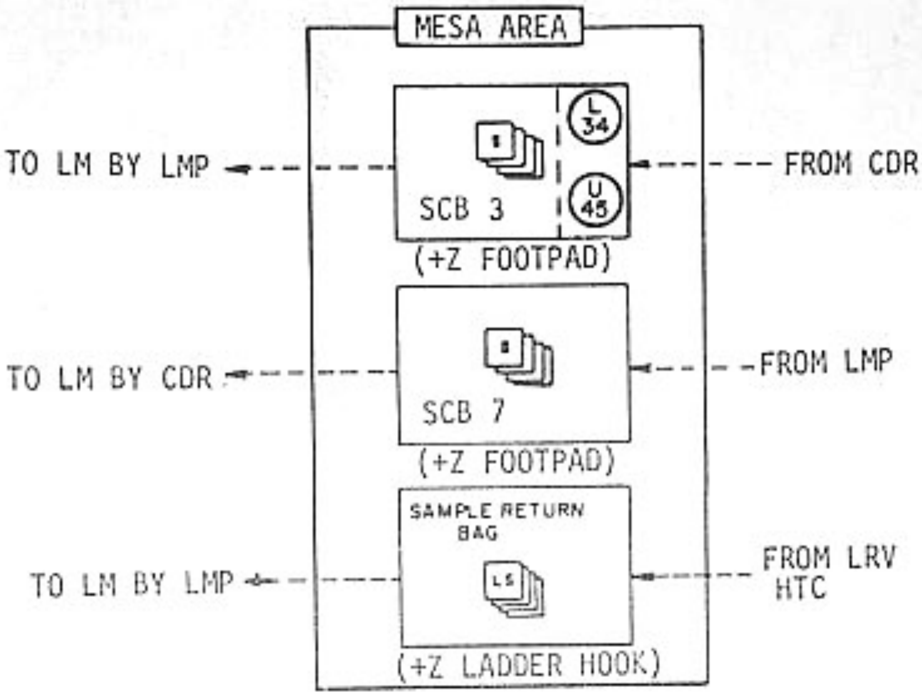


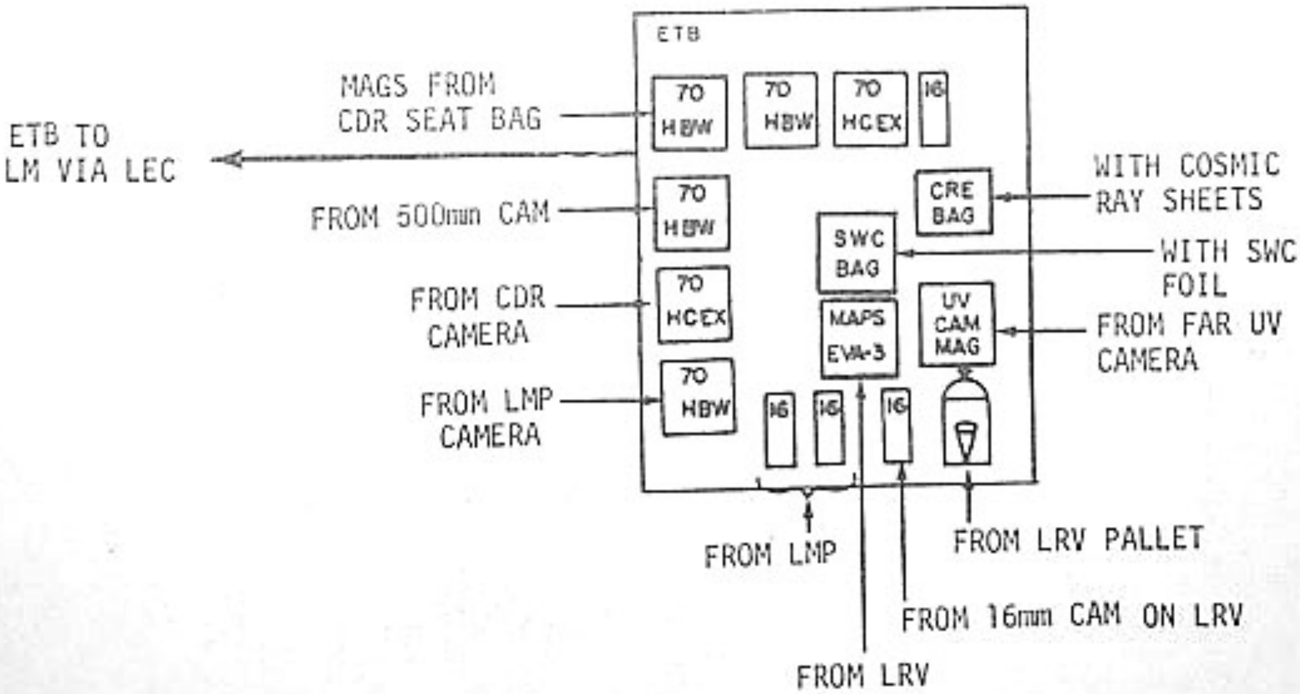
Figure 3.5-9c

EVA 3 Arrival at LM

FIGURE 3.5-9d **EVA-3 ON ARRIVAL BACK AT LM**

(LRV TRANSFER TO MESA AREA AND LM)





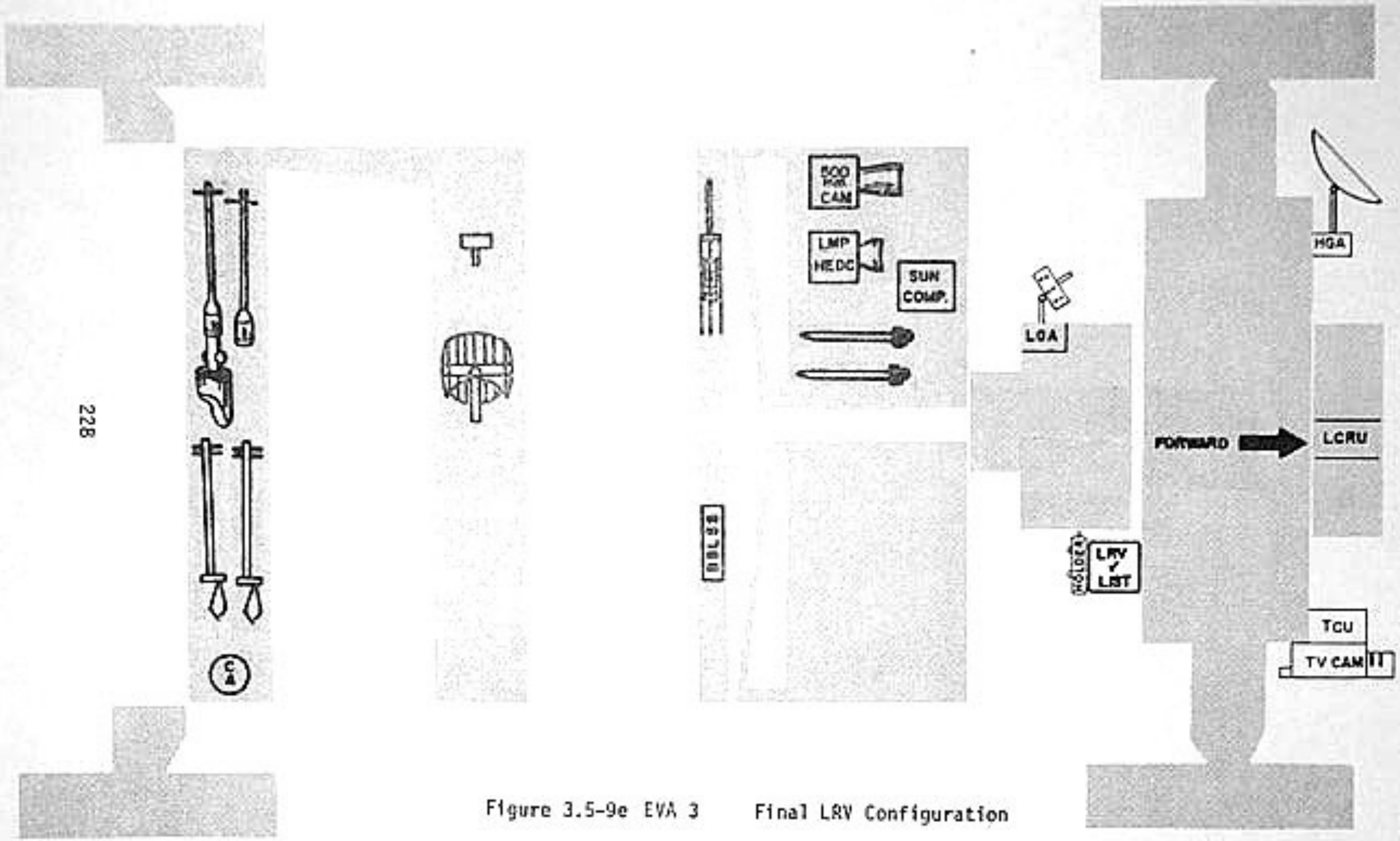


Figure 3.5-9e EVA 3 Final LRV Configuration

3.6 EVA TRAVERSES

Section 3.6 was prepared with the cooperation of the Lunar Surface Procedures Section, Crew Procedures Division by the Operations Analysis Branch of Systems Engineering Division, Apollo Spacecraft Program Office, for inclusion in this document.

6 LUNAR SURFACE TRAVERSES

Descartes Landing Site

The regional setting of the Descartes landing site is shown in Figure 3.6-1. The arrow points to the landing area, the coordinates of which are 9°00'01"S and 15°30'59"E. The names of major craters are indicated on the figure for purposes of orientation.

Figure 3.6-2 is a detailed view of that portion of the Descartes area which will be under investigation during the Apollo 16 LRV traverses. The photo covers about 13 kilometers north to south and 15 kilometers east to west. The landing point is marked by an X and the bright-rayed crater in the center of the southern margin is South Ray. On the previous figure (3.6-1), South Ray is the bright dot just under the arrow.

Crater names and names of other topographic features in the area of interest to the traverses are shown in Figure 3.6-3 superimposed on the photograph of the landing area.

EMU Consumables Data for Traverse Planning

The initial quantities of PLSS consumables (water, oxygen, and electrical power) and the rate at which they are depleted (metabolic rate, heat leak, suit leak, etc.) have a direct influence on the nominal traverse design. In addition, the traverse must always accommodate two contingencies: walkback from any point in the traverse after an LRV failure and driveback from any point in the traverse after one crewman's PLSS failure (using the Buddy-SLSS mode). Tables 3.6-1 through 3.6-4 present the basic EMU data used in Apollo 16 traverse planning. Details of the particular traverse evaluation relative to the consumables margin for the nominal and contingency cases are shown in a later section.

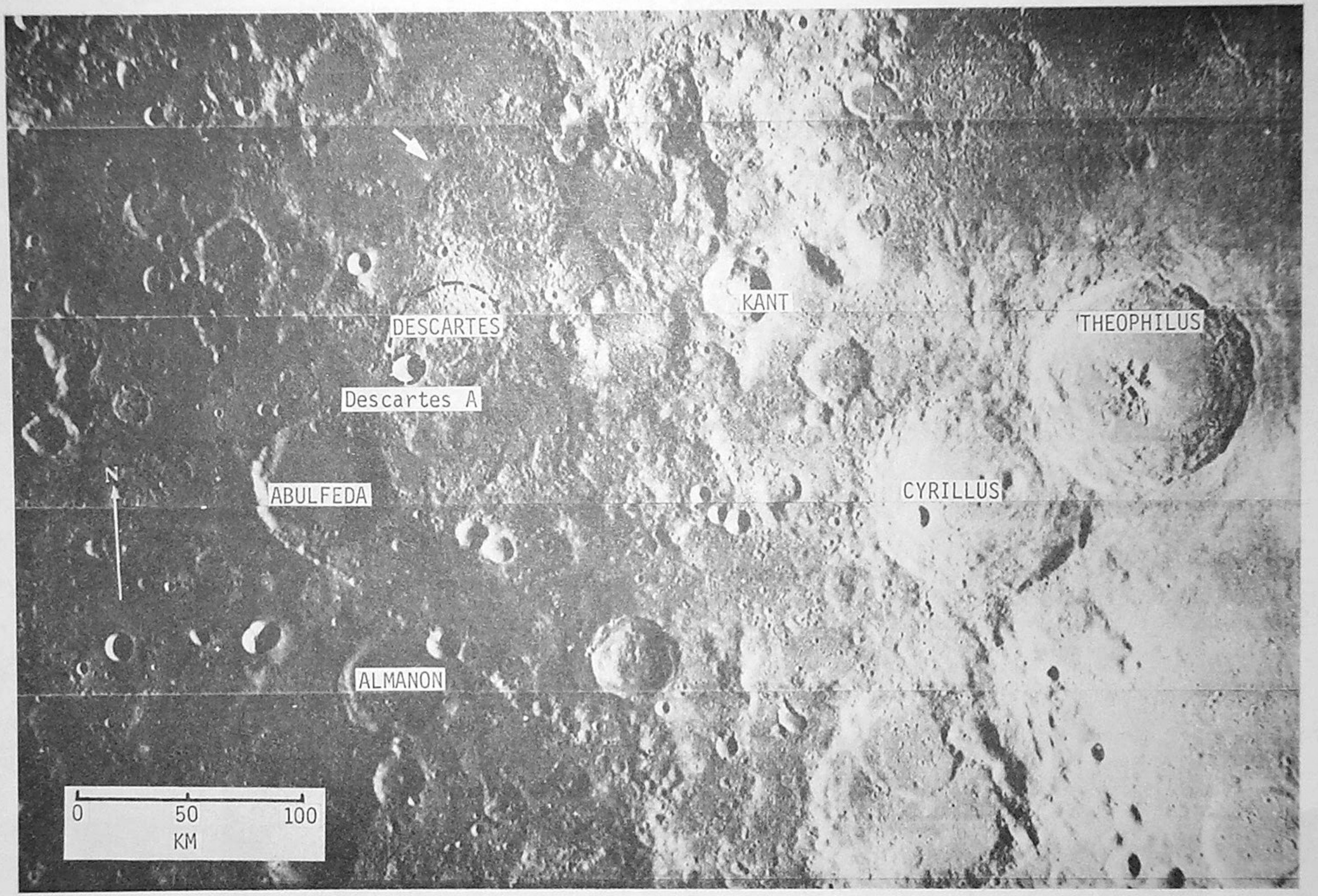


Figure 3.6-1. - Regional setting of the Descartes area.
Arrow points to the landing site.

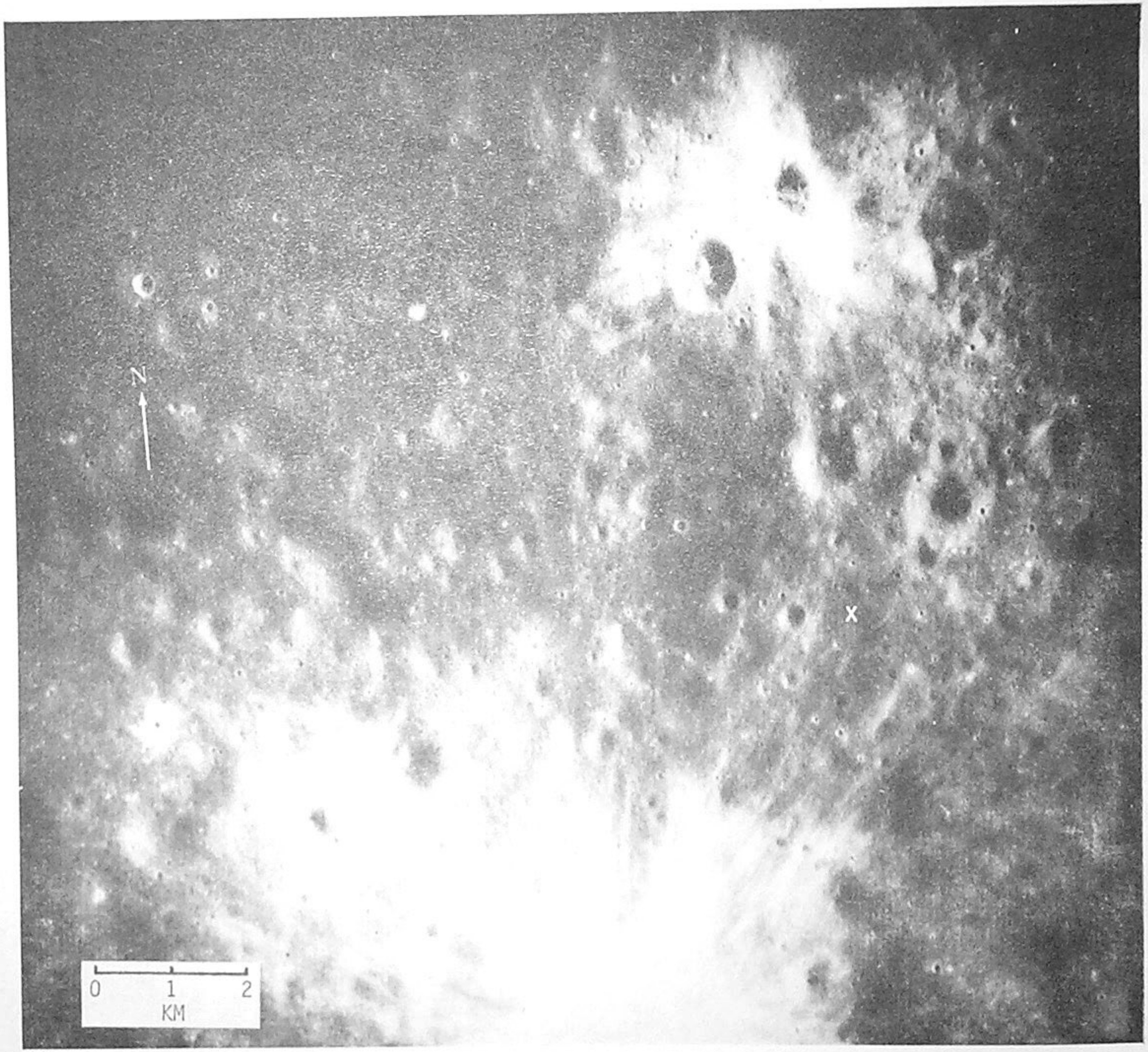


Figure 3.6-2. - Detailed view of the Descartes area.

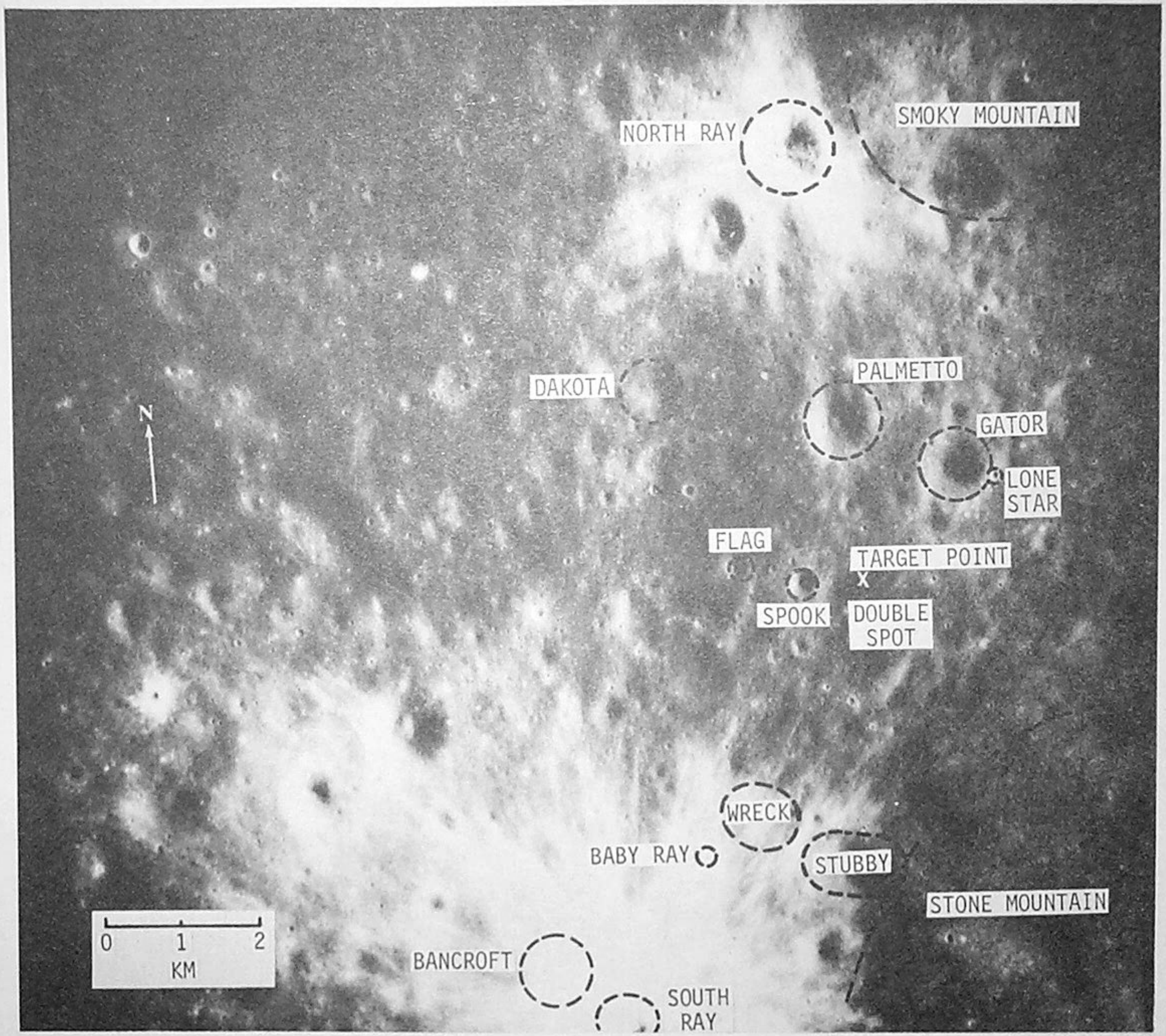


Figure 3.6-3. - Photograph of Descartes area with major feature names.

TABLE 3.6-1 PLSS CONSUMABLES

Primary Oxygen

Total usable: EVA I 1.403 lb

EVA II & III 1.353 lb

$$O_2 \text{ usage rate (lb/hr)} = 1.627 \times 10^{-4} \times \text{metabolic rate (BTU/hr)} + \text{EMU leak rate (lb/hr)}$$

Feedwater

Total usable: EVA I 11.21 lb

EVA II & III 11.64 lb

$$\text{Feedwater usage rate (lb/hr)} = \frac{1.26}{1038} \times \text{metabolic rate (BTU/hr)} + \frac{\text{EMU heat leak (BTU/hr)}}{1038} + \frac{153}{1038}$$

Electrical Power

Total usable: 21.37 amp/hr

Usage rate: 2.6 amp

TABLE 3.6-2 OXYGEN PURGE SYSTEM CAPABILITY

Usable:	High flow purge	5.07 lb
	Low flow purge	5.37 lb
	Make-up mode	5.67 lb
Lifetime:	High flow purge	39 min
	Low flow purge	80.5 min
Operational Allowances:		
	Buddy-SLSS hook-up time	5 min
	LM ingress time	13 min
	Time limit for walkback to LRV (OPS low purge) for B-SLSS hook-up	10 min

TABLE 3.6-3 CONSUMABLES LEAK RATES

EMU O_2 Leak	
EVA I	0.020 lb/hr
EVA II	0.028 lb/hr
EVA III	0.035 lb/hr
EMU Heat Leak	
EVA I	-75 BTU/hr
EVA II	+125 BTU/hr
EVA III	+180 BTU/hr

TABLE 3.6-4 METABOLIC RATES

Activity

LRV riding: 550 BTU/hr

LM overhead and ALSEP activity: 1050 BTU/hr

Traverse station activity: 950 BTU/hr

Contingency walkback:

(a) Up to 1 hr return time: 1560* BTU/hr

(3.6 km/hr walking rate)

(b) Over 1 hr return time: 1290* BTU/hr

(2.7 km/hr walking rate)

*Includes 20 percent uncertainty over estimated metabolic rate.

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3.6.1 LRV Traverses

The LRV traverses are designed to concentrate on two major geologic objectives: the Cayley formation typified by the landing area itself and the Descartes Mountains typified by Stone Mountain to the south of the landing area and Smoky Mountain to the north. Figure 3.6.1-1 shows the planned LRV traverses superimposed on a photograph of the Descartes site. A topographic map of the area is shown in Figure 3.6.1-2. The EVA I traverse is relatively short since a significant portion of the EVA is spent in performing tasks in the LM vicinity including ALSEP deployment. It is devoted entirely to sampling the Cayley Formation. The traverses on EVA II and III divide the time between the Cayley Formation and the Descartes Mountains.

Details of the station time allotments, the station activities, PLSS consumables margins (for both the nominal and contingency walk-back cases) appear in the following sections. It should be understood that the station times available and the list of activities at each station represent a highly success-oriented estimate of achievement. This approach is taken consciously in order that training of the crew and ground support elements will encompass the most optimistic estimate of accomplishment. Achieving the pre-planned EVA durations will depend to a large extent on accurately estimating PLSS consumables usage rates; achieving the preplanned times for the traverse will depend upon the other EVA activities such as LRV deployment and ALSEP deployment going precisely as planned; achieving the preplanned station times will depend directly on making good the premission estimates of LRV speed; and finally, achieving the many preplanned station tasks will depend on a rather complex set of interrelated activities meshing exactly as planned; moreover, on-the-scene observations by the crew (in consultation with the science support team on the ground) will probably result in reordering of scientific tasks and reapportionment of times. In order to be able to respond to the various non-nominal situations, priorities of traverse stations and priorities of station tasks are established beforehand to serve as guidelines when the situations occur during the mission. These guidelines appear in Section 4.0

Details of the three LRV traverses appear in Sections 3.6.1.1, 3.6.1.2, and 3.6.1.3. For each EVA, a narrative description is presented followed by a station timeline in which the individual activities of the two crewmen are presented in a simplified bar chart form. The actual division and interrelationship of the crew's activities will be more complex than it is practical to show in this type format. Finally, details relative to EMU consumables are presented for both the nominal case and for the traverse contingency.

cases (walkback from failed LRV and driveback using Buddy-SLSS). The calculated data for each traverse are presented and are followed by the input data on which the calculations were based. The figure at the end of each section shows graphically the walkback distance as a function of EVA time relative to the PLSS consumable margins.

FIG. 3.6.1-1. - LRV TRAVERSES

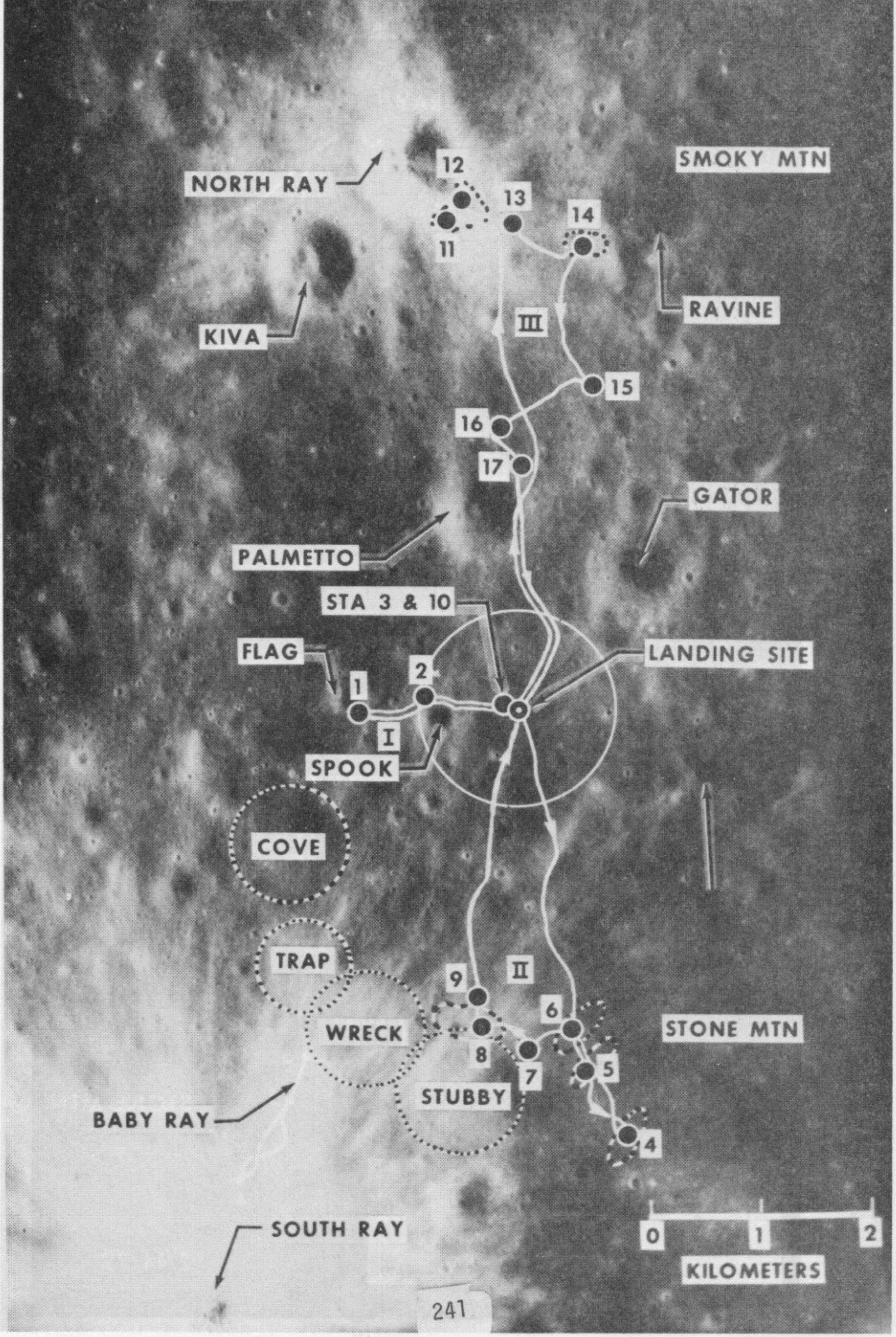
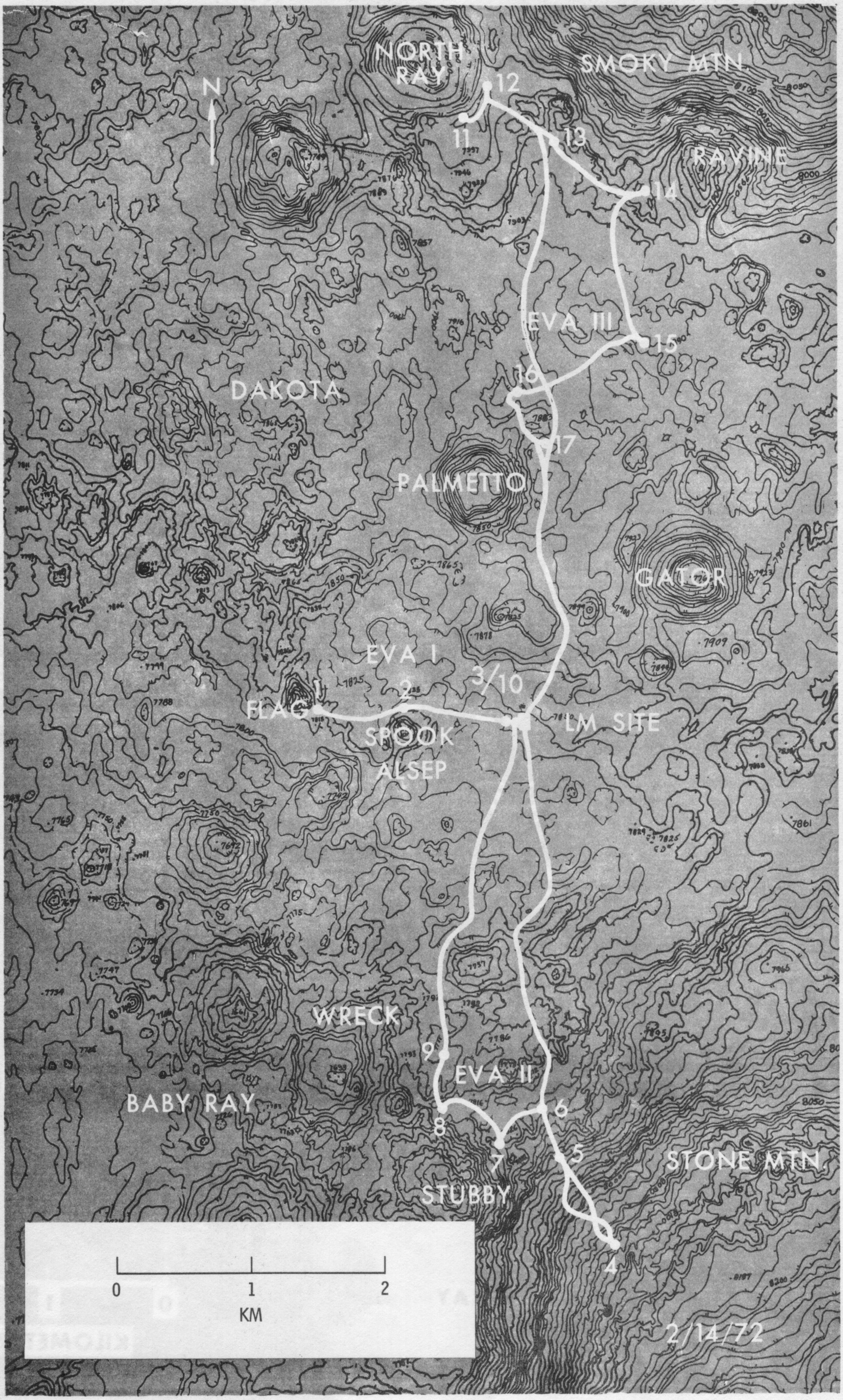


FIG. 3.6.1-2. - TOPOGRAPHIC MAP OF THE DESCARTES AREA WITH LRV TRAVERSES SUPERIMPOSED. CONTOUR INTERVAL IS 10 METERS



.1.1 EVA I

Traverse Description

On EVA I, the initial period of activity in the LM vicinity occupies about 1-1/2 hours, during which time the LRV is deployed and equipment is loaded on the LRV in preparation for the traverse. In addition, the far UV camera is set up near the LM and the first of several exposures of various astronomical targets is accomplished. Near the end of this period, the ALSEP is off-loaded and transported to its deployment site about 100 meters west of the LM. For approximately the next 2-1/2 hours, the crewmen are occupied at the ALSEP site setting up and activating the various ALSEP experiments. Activity at the ALSEP site is concluded with the drilling of the 2.6-meter core and its recovery. The drill stems from the core are separated into their two sections and are left at the site for retrieval later in the EVA. The LRV navigation system is initialized, and the geology traverse begins at 4 hours 02 minutes into the EVA.

Approximately 2-1/2 hours is available on EVA I for the geology traverse. This time is spent in investigating and sampling the Cayley Plains in the area west of the landing site. Three stations are planned: the first at Flag crater about 1.6 kilometers west of the landing site; the second near Spook crater about 0.9 kilometer west of the landing site; and the third back in the LM/ALSEP area. Details of the station activities appear in the following section. Activities at and in the vicinity of Spook and Flag craters are designed to gain a better understanding of the Cayley areally, as well as with depth. Material ejected from these craters may have been derived from depths as great as 60 meters. Observations of any stratigraphy in the crater walls coupled with samples from the excavated materials will also be important in the interpretation of the Active Seismic, Magnetometer, and Heat Flow Experiment data.

At the completion of Station 2 activities, the crewmen return to the vicinity of the LM, 6 hours into the EVA. Activities at Station 3, located in the LM/ALSEP vicinity, include taking motion pictures of the LRV driving operations (Grand Prix), arming the previously deployed mortar package, and retrieval of the 2.6-meter core.

The EVA I closeout begins at 6 hours 20 minutes, and cabin repressurization occurs 40 minutes later, ending the 7-hour EVA.

TRAVERSE STATION TIMELINES - EVA I

STATION 1 - FLAG CRATER (:43)

CDR	OVER-HEAD		DESCRIP-TION	RAKE/SOIL SAMPLE	SAMPLING*	O/H
	:03		:03	:08	:27	:02
LMP	O/H	PAN	DESCRIP-TION	RAKE/SOIL SAMPLE	SAMPLING	O/H

STATION 2 - SPOOK CRATER (:56)

CDR	O/H		DESC	LPM SITE MEAS.			SAMPLING*	O/H
	:03		:03	:05	:11	:02	:30	:02
LMP	O/H	PAN	DESC	500mm PHOTOS	SAMPLING	PAN	SAMPLING	O/H

STATION 3 - ALSEP/LM AREA (:14)

CDR	O/H	GRAND PRIX	ARM MP RETRIEVE 2.6m CORE
	:01	:08	:05
LMP	O/H	GRAND PRIX	ARM MP RETRIEVE 2.6m CORE

NOTES:

O/H = OVERHEAD

* = CONSIDER 2nd PAN NEAR END OF STATION IF TIME PERMITS.

3/6/72

APOLLO 16 DESCARTES TRAVERSES

EVA I CALCULATED DATA MAR 7 1972

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	1+37	1+37
RIDE	0.10	7.30	1				
ALSEP				0.10	1+38	2+24	4+ 2
RIDE	1.50	7.30	12				
1				1.60	4+14	0+43	4+57
RIDE	0.65	7.30	5				
2				2.25	5+ 2	0+56	5+58
RIDE	0.85	7.30	7				
3				3.10	6+ 5	0+14	6+19
RIDE	0.05	7.30	0				
LM				3.15	6+20	0+40	7+ 0
TOTALS			25			6+34	7+ 0

		---------------- TRAVERSE CONTINGENCIES						
		----------LRV FAILURE----------				--PLSS FAILURE--		
STAT NO	RETURN DISTANCE TO LM (KM)	WALKBACK TIME TO LM (HR+MIN)	STATION MARGIN ABOVE WALKBACK REQUIREMENTS FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	MIN LRV RIDEBACK SPEED REQUIRED 0 MIN (KM/HR)	10 MIN (KM/HR)	AVG EVA MET RATE (BTU/HR)
LM	0.00	0+ 0	****	****	****	0.00	0.00	1050.00
ALSEP	0.10	0+ 2	4+17	3+13	3+46	0.10	0.11	1048.30
1	1.60	0+27	2+46	1+43	2+25	1.54	1.83	1013.40
2	0.90	0+15	2+ 6	1+ 2	1+36	0.86	1.03	996.59
3	0.05	0+ 1	2+10	1+ 6	1+29	0.05	0.06	986.65
LM	0.00	0+ 0	1+50	0+46	1+12	0.00	0.00	992.26

APOLLO 16 DESCARTES TRAVERSES

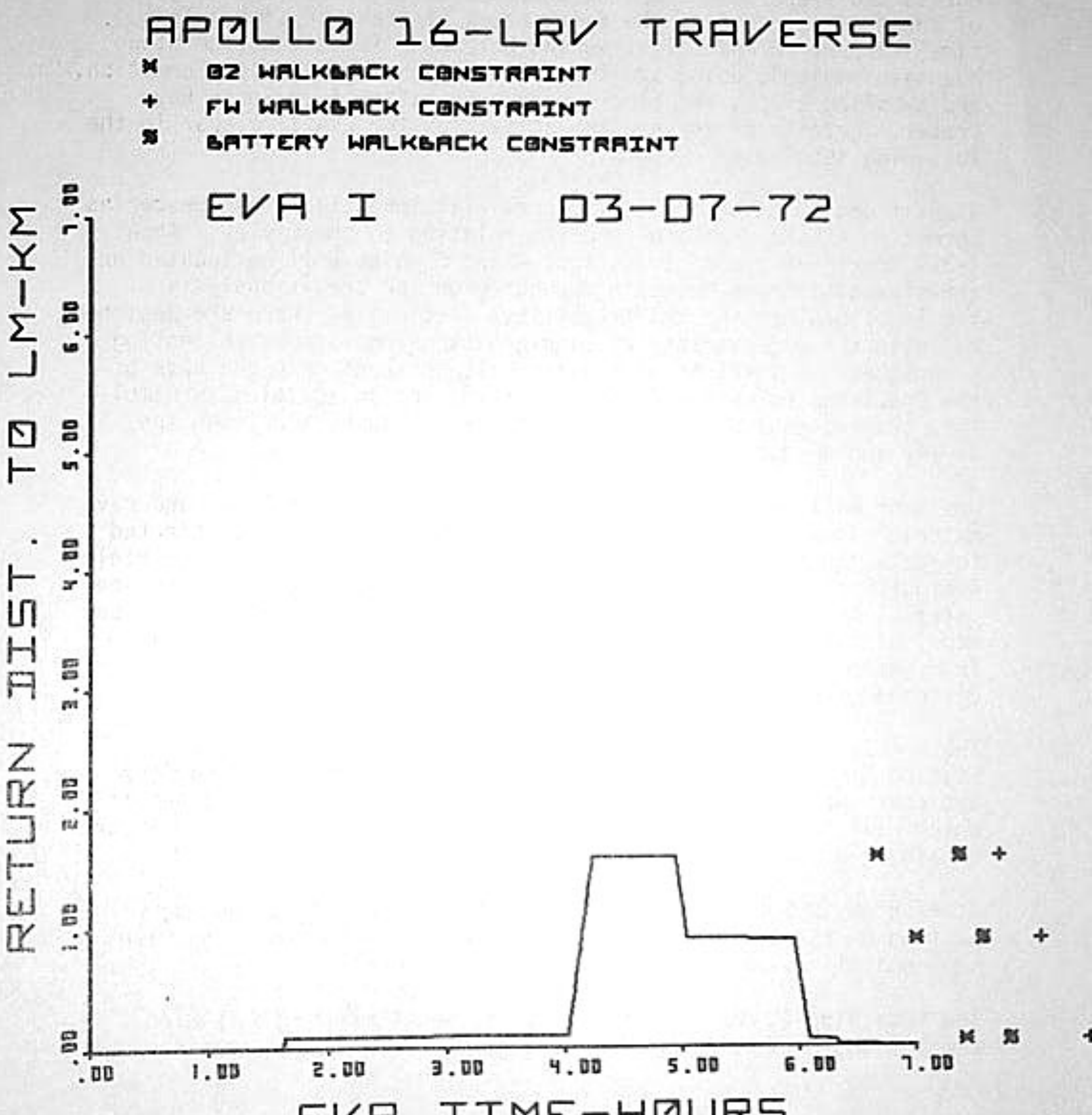
EVA I

INPUT DATA

MAR 7 1972

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	1+37	0.00	0.00	-75.00	3.60	7.30	1560.0
ALSEP	2+24	0.10	0.10	-75.00	3.60	7.30	1560.0
1	0+43	1.50	1.60	-75.00	3.60	7.30	1560.0
2	0+56	0.65	0.90	-75.00	3.60	7.30	1560.0
3	0+14	0.85	0.05	-75.00	3.60	7.30	1560.0
LM	0+40	0.05	0.00	-75.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE 02 (LB/HR)	EVA START (F/W-LB)	EVA START (02-LB)
1050.00	550.00	950.00	1050.00	0.020	11.21	1.403


APOLLO 16-LRV TRAVERSE
O2 WALKBACK CONSTRAINT
FW WALKBACK CONSTRAINT
BATTERY WALKBACK CONSTRAINT
EVA I
03-07-72
RETURN DIST. TO LM-KM
.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
EVA TIME-HOURS

.1.2 EVA II

Traverse Description

On EVA II, approximately the initial 50-minute period involves egress and preparation for the traverse activities. Investigation of three areas occupies the 5-1/2 hours of traverse time. This time is spent in investigating the Descartes Formation (the Stone Mountain region), doing additional sampling of the Cayley Formation, and sampling blocks and blocky rays originating from South Ray Crater. Details of the station activities for EVA II appear in the following section.

At Stations 4, 5, 6, and 7, the crew will investigate the Descartes Formation (Stone Mountain) and its relation to the Cayley. About 1-3/4 hours are spent at Stations 4 and 5 which will be located on the slopes of Stone Mountain depending on the crew's analysis of the local geology and trafficability. Activities there are designed to collect a wide variety of sample data using various collecting techniques. A total of 35 minutes will be spent near the base of the Descartes Formation (Stone Mountain) and in addition to sampling, observations will be made on the relationships between the Cayley and Descartes formations.

One hour will be spent at Station 8 investigating boulders and ray material from South Ray Crater. A large boulder will be selected for detailed sampling according to procedures outlined in the Field Geology Experiment. Sampling of this region will not only provide material derived from below the surface several kilometers away but study of the length of exposure of these materials and materials from North Ray Crater will help to establish the rate of ray disappearance.

Two special sampling techniques (and tools) are employed at Station 9: one designed to obtain soil samples from the surface and near subsurface, and the other to obtain a single core sample which will be placed in a special vacuum container (CSVC) to insure retaining a chemically ultra-clean state.

Station 10 is located back at the LM/ALSEP area where the major portion of the Soil Mechanics Experiment is performed along with some additional sampling.

The remaining 40 minutes of the EVA is spent at the LM stowing samples and equipment and ingressing.

TRAVERSE STATION TIMELINES - EVA II

STATION 4 - STONE MOUNTAIN (:58)

CDR	O/H	DESC	RAKE/SOIL SAMPLE	SAMPLING	PAN	DOUBLE CORE	SAMPLING		O/H
	:03	:05	:08	:06	:02	:08	:22	:02	:02
LMP	O/H & DESC	500 mm	RAKE/SOIL SAMPLE	PENETROMETER MEASUREMENTS		DOUBLE CORE	SAMPLING	PAN	O/H

STATION 5 - STONE MOUNTAIN (:40)

CDR	O/H		DESCRIPTION AND SAMPLING *	O/H
	:03		:35	:02
LMP	O/H	PAN	DESCRIPTION AND SAMPLING	O/H

STATION 6 - BASE OF STONE MOUNTAIN (:20)

CDR	O/H		DESCRIPTION AND SAMPLING	O/H
	:03		:15	:02
LMP	O/H	PAN	DESCRIPTION AND SAMPLING	O/H

NOTES:

O/H = OVERHEAD

* = CONSIDER 2nd PAN NEAR END OF STATION IF TIME PERMITS.

TRAVERSE STATION TIMELINES - EVA II (CONT)

STATION 7 - STUBBY CRATER (:15)

CDR	O/H	DESCRIP-TION	SAMPLING	O/H
	:03	:03	:07	:02
LMP	O/H, PAN	500mm PHOTOS	SAMPLING	O/H

NOTES:

O/H = OVERHEAD

* = CONSIDER 2nd PAN NEAR END OF STATION IF TIME PERMITS.

STATION 8 - SOUTH RAY RAY (:60)

CDR	O/H	DESC.	RAKE/SOIL SAMPLE	DOUBLE CORE	SAMPLING (INCLUDING BOULDER OPERATIONS)*	O/H
	:03	:03	:08	:08	:36	:02
LMP	O/H, PAN	DESC	RAKE/SOIL SAMPLE	DOUBLE CORE	SAMPLING (INCLUDING BOULDER OPERATIONS)	O/H

STATION 9 - CAYLEY PLAINS (:25)

CDR	O/H	SURFACE SAMPLER	CSVC	O/H
	:03	:12	:08	:02
LMP	O/H, PAN	SURFACE SAMPLER	CSVC	

STATION 10 - LM/ALSEP AREA (:33)

CDR	O/H	DOUBLE CORE	TRENCH	SAMPLING	PAN	TRENCH SAMPLES	O/H
	:03	:08	:05	:08	:02	:05	:02
LMP	O/H	DOUBLE CORE	PENETROMETER READINGS			TRENCH SAMPLES	O/H

3/5/72

APOLLO 16 DESCARTES TRAVERSES

EVA II | CALCULATED DATA | MAR 7 1972

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	0+50	0+50
RIDE	4.20	7.30	35				
4				4.20	1+25	0+58	2+23
RIDE	0.80	7.30	7				
5				5.00	2+29	0+40	3+ 9
RIDE	0.40	7.30	3				
6				5.40	3+12	0+20	3+32
RIDE	0.40	7.30	3				
7				5.80	3+36	0+15	3+51
RIDE	0.60	7.30	5				
8				6.40	3+56	1+ 0	4+56
RIDE	0.45	7.30	4				
9				6.85	4+59	0+25	5+24
RIDE	2.60	7.30	21				
10				9.45	5+46	0+33	6+19
RIDE	0.05	7.30	0				
LM				9.50	6+19	0+40	6+59
TOTALS			78			5+41	6+59

--------------- TRAVERSE CONTINGENCIES ---------------

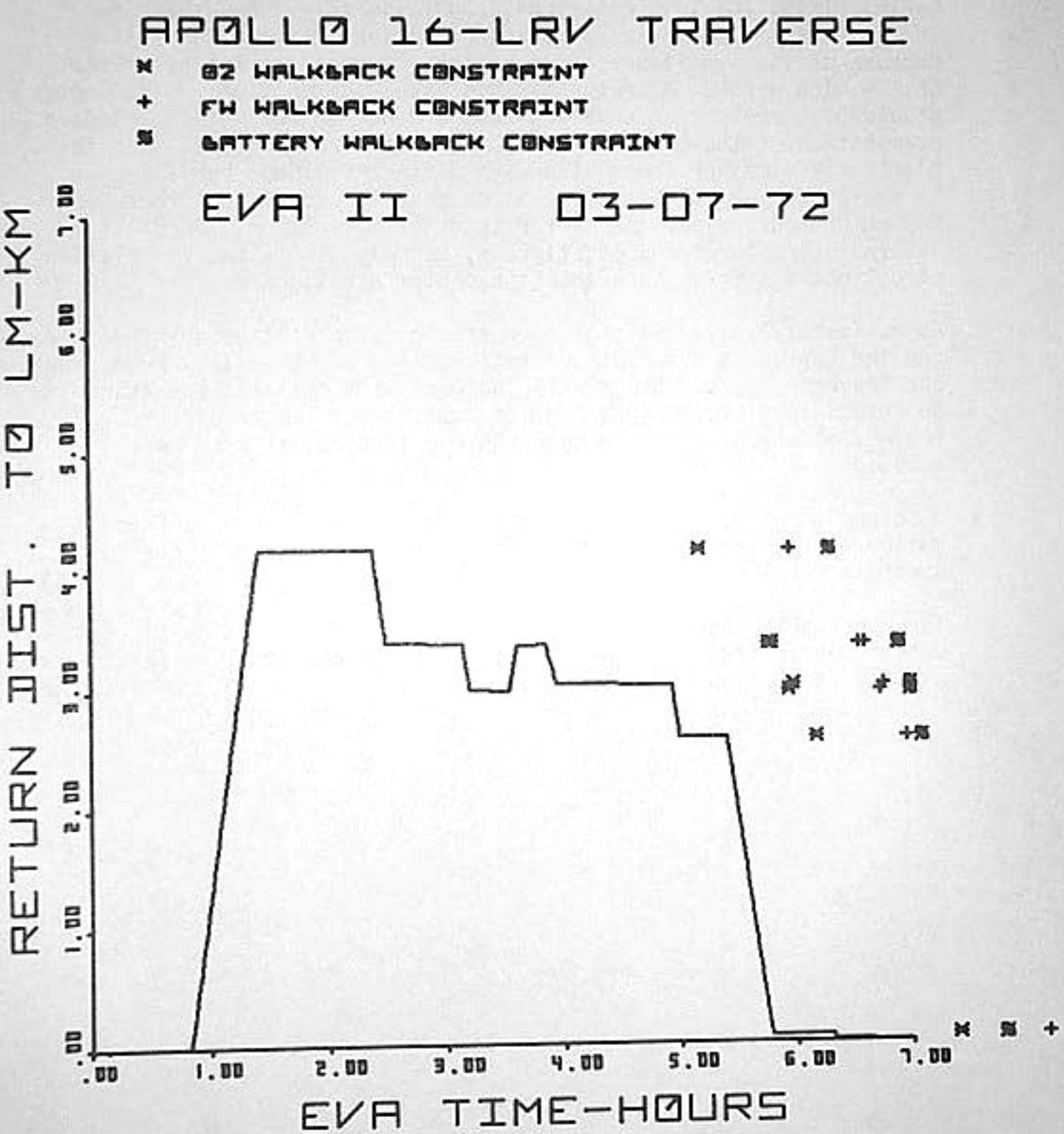
		----------LRV FAILURE----------				--PLSS FAILURE--		
STAT NO	RETURN DISTANCE TO LM (KM)	WALKBACK TIME TO LM (HR+MIN)	STATION MARGIN ABOVE WALKBACK REQUIREMENTS FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	MIN LRV RIDEBACK SPEED REQUIRED 0 MIN (KM/HR)	10 MIN (KM/HR)	AVG EVA MET RATE (BTU/HR)
LM	0.00	0+ 0	****	****	****	0.00	0.00	1050.00
4	4.20	1+33	3+33	2+46	3+53	4.03	4.80	888.20
5	3.40	0+57	3+23	2+36	3+43	3.26	3.89	889.51
6	3.00	0+50	3+11	2+24	3+27	2.88	3.43	889.95
7	3.40	0+57	2+44	1+56	3+ 2	3.26	3.89	889.01
8	3.05	0+51	1+49	1+ 2	2+ 3	2.93	3.49	895.73
9	2.60	0+43	1+33	0+46	1+41	2.50	2.97	895.97
10	0.05	0+ 1	1+51	1+ 5	1+29	0.05	0.06	881.16
LM	0.00	0+ 0	1+31	0+46	1+13	0.00	0.00	896.95

APOLLO 16 DESCARTES TRAVERSES

EVA II INPUT DATA MAR 7 1972

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	0+50	0.00	0.00	125.00	3.60	7.30	1560.0
4	0+58	4.20	4.20	125.00	2.70	7.30	1290.0
5	0+40	0.80	3.40	125.00	3.60	7.30	1560.0
6	0+20	0.40	3.00	125.00	3.60	7.30	1560.0
7	0+15	0.40	3.40	125.00	3.60	7.30	1560.0
8	1+ 0	0.60	3.05	125.00	3.60	7.30	1560.0
9	0+25	0.45	2.60	125.00	3.60	7.30	1560.0
10	0+33	2.60	0.05	125.00	3.60	7.30	1560.0
LM	0+40	0.05	0.00	125.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE 02 (LB/HR)	EVA START (F/W-LB)	EVA START (02-LB)
1050.00	550.00	950.00	1050.00	0.028	11.64	1.353


APOLLO 16-LRV TRAVERSE
✱ O2 WALKBACK CONSTRAINT
+ FW WALKBACK CONSTRAINT
% BATTERY WALKBACK CONSTRAINT
EVA II 03-07-72
RETURN DIST. TO LM-KM
.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
EVA TIME-HOURS

3.6.1.3 EVA III

Traverse Description

Egress and preparation for the traverse will consume the first 3/4 hour of EVA III. The 5-1/4 hour traverse time will be used to investigate three broad points of interest: Smoky Mountain (Descartes Formation), and North Ray Crater, and other areas in the Cayley Plains (Cayley Formation). Approximately 2 hours are spent in the vicinity of North Ray Crater (Stations 11, 12, and 13) because of its importance in revealing the characteristics of the Cayley with depth. A crater of this size (approximately 1 kilometer) should have brought material up from a depth of 200 meters. Indeed, examination of the photography of the crater rim suggests that large blocks there may be correlated with different albedo banding seen in the crater wall. Extensive block sampling is planned there and 500 mm photography of the crater interior may not only document internal structures and stratigraphy but may also allow correlation of collected samples back into the crater stratigraphy.

Approximately one additional hour station time will be spent sampling the Cayley at three other stations (15, 16, and 17) spread over the traverse route. Stops will include small craters less than 50 meters in diameter (Dog Leg and Dot), and a larger crater (Palmetto) which, approaching North Ray in size, is much more subdued.

A second sampling of the Descartes Formation will involve investigation of the Smoky Mountain region. Approximately 3/4 hour is spent in sampling that feature at station 14.

Three portable magnetometer measurements will be taken on the traverse. After return to the LM, the last 3/4 hour will be spent stowing samples and equipment and ingressing.

TRAVERSE STATION TIMELINE - EVA III

STATION 11 - NORTH RAY RIM (:53)

CDR	O/H	DESCRIP-TION	SET UP FOR NEAR FIELD POL.	SAMPLING FOR NEAR FIELD POL.	SAMPLING	PAN	O/H
	:03	:04	:04	:10	:26	:04	:02
LMP	O/H PAN	500mm	FAR FIELD POLAR NO. 1	NEAR FIELD POLAR.	SAMPLING	FAR FIELD POL. NO. 2	O/H

STATION 12 - NORTH RAY RIM (:56)

CDR	O/H	DESCRIP-TION	RAKE/SOIL SAMPLE	SAMPLING *	O/H
	:03	:05	:08	:38	:02
LMP	O/H PAN	500mm PHOTOS	RAKE/SOIL SAMPLE	SAMPLING	O/H

STATION 13 - NORTH RAY EJECTA BLANKET (:10)

CDR	O/H	ROCK/SOIL SAMPLE		O/H
	:01	:02	:06	:01
LMP	O/H	PAN	ROCK/SOIL SAMPLE	O/H

NOTES:

O/H = OVERHEAD

* = CONSIDER 2nd PAN NEAR END OF STATION IF TIME PERMITS.

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TRAVERSE STATION TIMELINE - EVA III (CONT)

STATION 14 - SMOKY MOUNTAIN (:40)

CDR	O/H		DESCRIPTION	RAKE/SOIL SAMPLE	DOUBLE CORE	PAN	SAMPLING		O/H
	:03		:04	:08	:08	:02	:13		:02
LMP	O/H	PAN	500mm PHOTOS	RAKE/SOIL SAMPLE	DOUBLE CORE		SAMPLING		O/H

STATION 15 - DOG LEG CRATER (:10)

CDR	O/H		LPM MEAS.		O/H
	:01	:02	:06		:01
LMP	O/H	PAN	ROCK/SOIL SAMPLE		O/H

STATION 16 - DOT CRATER (:10)

CDR	O/H		LPM MEAS.	O/H
	:01	:02	:06	:01
LMP	O/H	PAN	ROCK/SOIL SAMPLE	O/H

NOTES:

O/H = OVERHEAD

* = CONSIDER 2nd PAN NEAR END OF STATION IF TIME PERMITS.

STATION 17 - PALMETTO CRATER (:38)

CDR	O/H		DESC	RAKE/SOIL SAMPLE	LPM MEAS. (2)	SAMPLING*		O/H
	:03		:03	:08	:10	:12		:02
LMP	O/H	PAN	DESC	RAKE/SOIL SAMPLE	SAMPLING			O/H

3/6/72

APOLLO 16 DESCARTES TRAVERSES

EVA III | CALCULATED DATA | MAR 7 1972

SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
			0.00	0+ 0	0+45	0+45
5.30	7.30	44				
			5.30	1+29	0+55	2+24
0.35	7.30	3				
			5.65	2+26	0+55	3+21
0.65	7.30	5				
			6.30	3+27	0+10	3+37
0.85	7.30	7				
			7.15	3+44	0+40	4+24
1.35	7.30	11				
			8.50	4+35	0+10	4+45
1.10	7.30	9				
			9.60	4+54	0+10	5+ 4
0.55	7.30	5				
			10.15	5+ 8	0+38	5+46
2.25	7.30	18				
			12.40	6+ 5	0+55	7+ 0
		102			5+18	7+ 0

TRAVERSE CONTINGENCIES

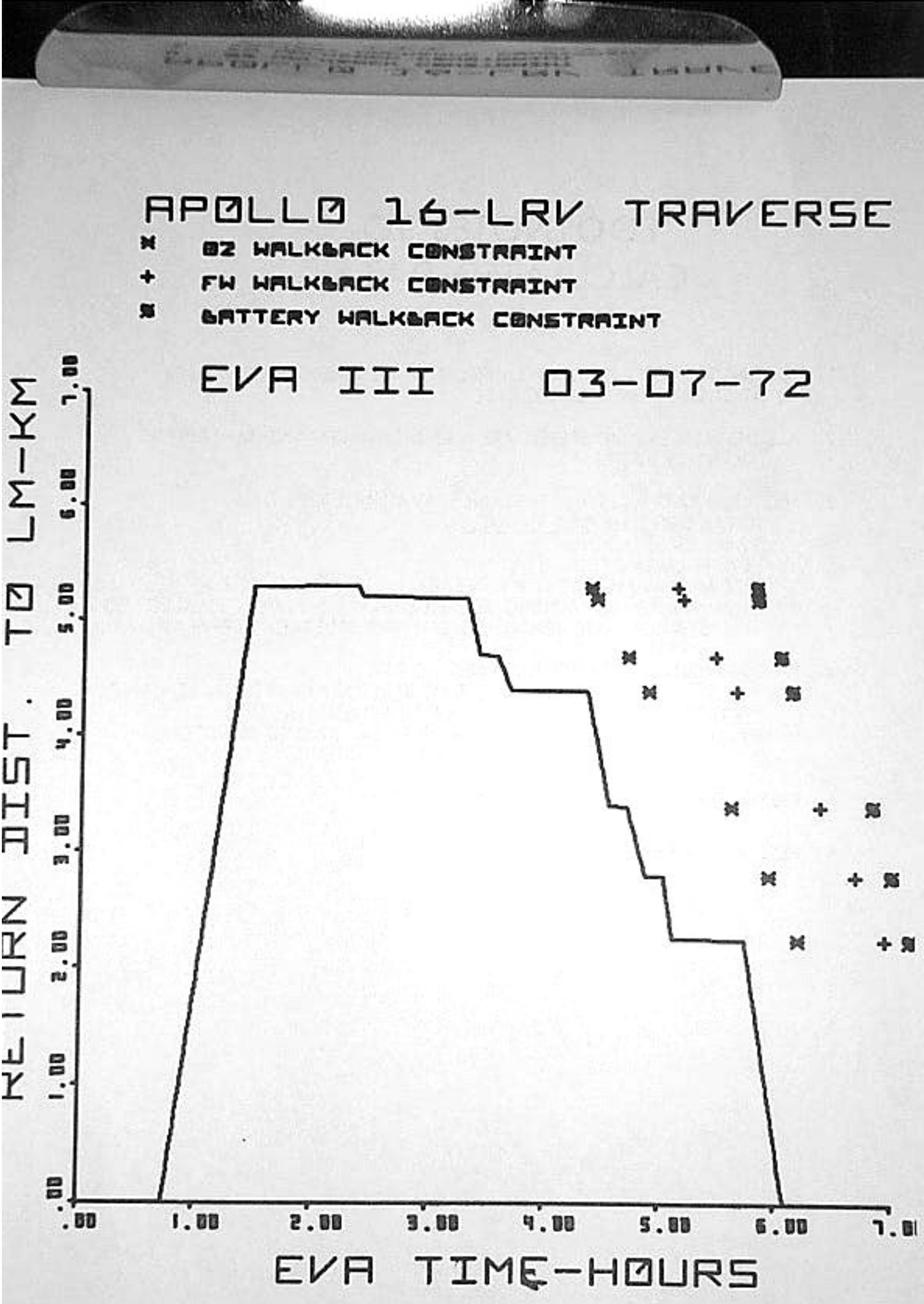
	LRV FAILURE				PLSS FAILURE		
		STATION MARGIN ABOVE WALKBACK REQUIREMENTS			MIN LRV RIDEBACK SPEED REQUIRED		
RETURN DISTANCE TO LM (KM)	WALKBACK TIME TO LM (HR+MIN)	FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	0 MIN (KM/HR)	10 MIN (KM/HR)	AVG EVA MET RATE (BTU/HR)
0.00	0+ 0	****	****	****	0.00	0.00	1050.00
5.30	1+58	2+47	2+ 1	3+28	5.09	6.06	859.97
5.20	1+56	1+53	1+ 7	2+32	4.99	5.94	880.13
4.70	1+44	1+54	1+ 8	2+28	4.51	5.37	875.21
4.40	1+38	1+18	0+32	1+47	4.22	5.03	877.94
3.40	0+57	1+40	0+54	2+ 7	3.26	3.89	867.70
2.80	0+47	1+39	0+54	1+58	2.69	3.20	860.95
2.25	0+37	1+12	0+27	1+25	2.16	2.57	866.66
0.00	0+ 0	1+19	0+35	1+12	0.00	0.00	876.73

APOLLO 16 DESCARTES TRAVERSES

EVA III INPUT DATA MAR 7 1972

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	0+45	0.00	0.00	180.00	3.60	7.30	1560.0
11	0+55	5.30	5.30	180.00	2.70	7.30	1290.0
12	0+55	0.35	5.20	180.00	2.70	7.30	1290.0
13	0+10	0.65	4.70	180.00	2.70	7.30	1290.0
14	0+40	0.85	4.40	180.00	2.70	7.30	1290.0
15	0+10	1.35	3.40	180.00	3.60	7.30	1560.0
16	0+10	1.10	2.80	180.00	3.60	7.30	1560.0
17	0+38	0.55	2.25	180.00	3.60	7.30	1560.0
LM	0+55	2.25	0.00	180.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE O2 (LB/HR)	EVA START (F/W-LB)	EVA START (O2-LB)
1050.00	550.00	950.00	1050.00	0.035	11.64	1.353


APOLLO 16-LRV TRAVERSE
O2 WALKBACK CONSTRAINT
FW WALKBACK CONSTRAINT
BATTERY WALKBACK CONSTRAINT
EVA III 03-07-72
RETURN DIST. TO LM-KM
EVA TIME-HOURS

FOOTNOTES TO 'CALCULATED DATA'

1. 30 MINUTES RESERVES MAINTAINED ON ALL PLSS CONSUMABLES AT STATION METABOLIC RATE

2. ALL DISTANCES AND SPEEDS ARE MAP DISTANCES AND MAP SPEEDS (MOBILITY RATES)

3. REQUIRED RATE = RETURN DISTANCE/AVAILABLE OPS TIME
   TOTAL OPS TIME <u>80.5 MINUTES</u>
   5 MIN BSLSS HOOKUP
   13 MIN LM INGRESS
   62.5 MIN AVAILABLE FOR RIDEBACK
   52.5 MINUTES REMAINING FOR RIDEBACK (10 MINUTES ALLOWED AT STATION FOR RETURN TO LRV AND RIDEBACK PREPARATION)

4. TIME MARGIN AT STATION METABOLIC RATE

$$\left.\begin{array}{l}\text{STATION}\\ \text{FINAL LM O/H}\end{array}\right\}\ \text{MARGIN} = \begin{array}{l}\text{TIME REMAINING AFTER ALLOWANCE}\\ \text{FOR 10 MINUTES AT LRV,}\\ \text{WALKBACK, AND 13 MINUTES}\\ \text{INGRESS}\end{array}$$

5. RESPIRATORY EXCHANGE QUOTIENT = .90

6 FEED WATER HEAT OF VAPORIZATION 1038 $\frac{\text{BTU}}{\text{LB.}}$

3.6.2 Traverse Maps

This section provides a set of maps similar to those to be used by the crew on the lunar surface. They are preceded by a key to the symbols on the map. First, two 1:25,000 scale maps depicting the three traverses are given, then a series of 1:12,500 maps follow.

Figure 3.6.2-1

EXPLANATION FOR GEOLOGIC MAPS (1:12,500 and 1:25,000 SCALES) APOLLO 16 (DESCARTES) LANDING SITE AREA

STRATIGRAPHY

Ici

CAYLEY FORMATION

Stratified materials, with layers about 10-40 m thick. Underlying rolling, irregular surface; interpreted to be mafic to intermediate volcanics.

Idd	Idd_1
	Idd_2

MATERIALS OF THE DESCARTES MOUNTAINS

Stratified, with layers about 10-40 m thick; forms domes. Divided on Stone Mountain into a light medium-gray lower unit (Idd_1) and a dark medium-gray upper unit (Idd_2). Interpreted to be intermediate volcanics with lower part gradational into Ici.

IMBRIAN

GEOLOGIC AND TOPOGRAPHIC SYMBOLS (WHITE)

GEOLOGIC CONTACT
Dashed where approximately located

Convex — Concave

ESCARPMENT

CREASE

TRAVERSE SYMBOLS (BLACK)

NOMINAL LM SITE

LINE OF TRAVERSE

12• LRV — •A WALKING

STATIONS

16• $\frac{251°}{1.0}$ •15

AZIMUTH (251°) AND APPROXIMATE DISTANCE (1.0) BETWEEN STATIONS: AVERAGE AZIMUTHS GIVEN ON CURVING TRAVERSE SEGMENTS.

$\boxed{\frac{179°}{4.6}}$ •12

BEARING (179°) AND RANGE (4.6) OF SHORTEST DISTANCE TO LM FROM STATION OR FROM MAJOR CHANGE IN TRAVERSE DIRECTION.

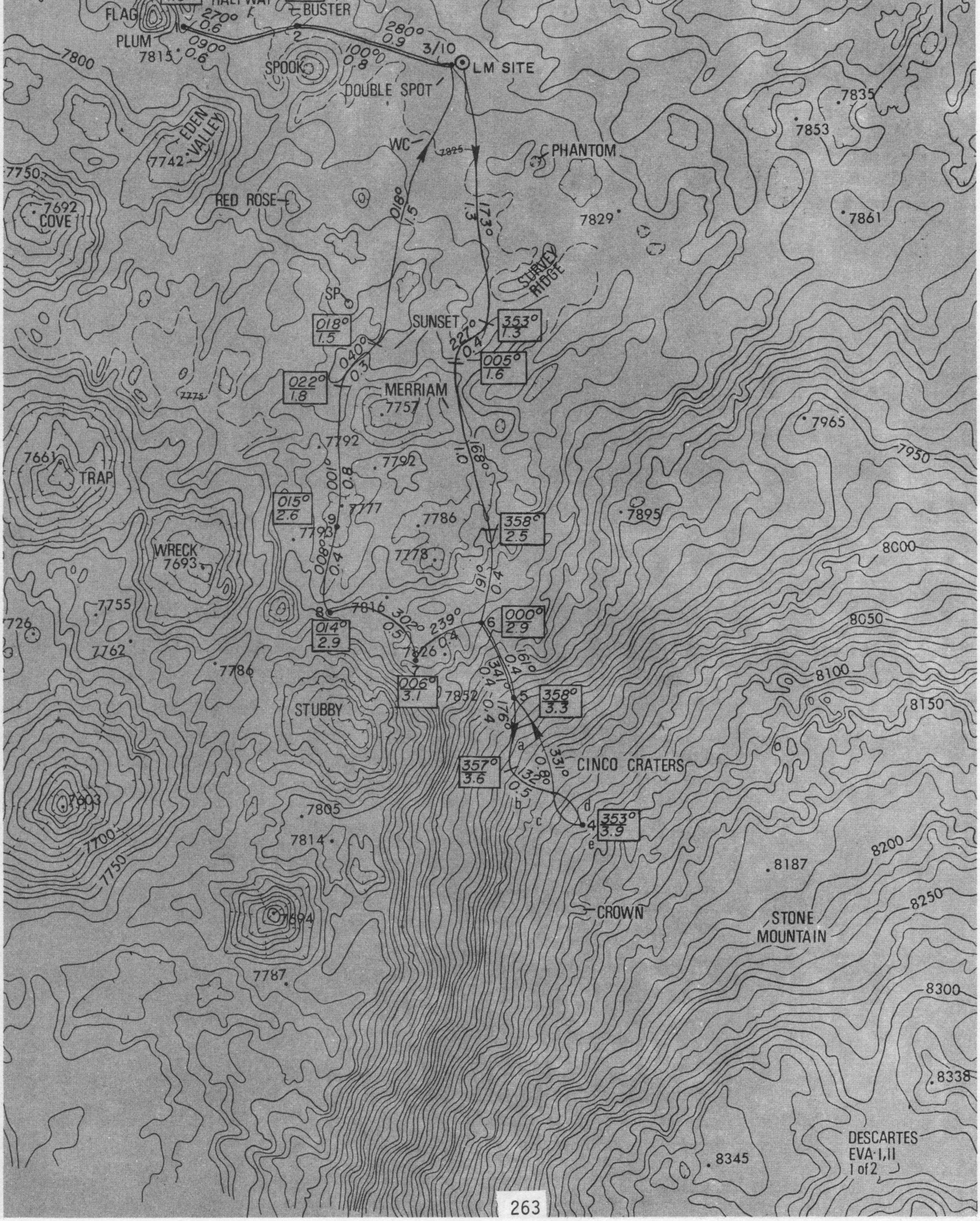


Figure 3.6.2-2 EVA-1&2 1:25,000 Contour Map

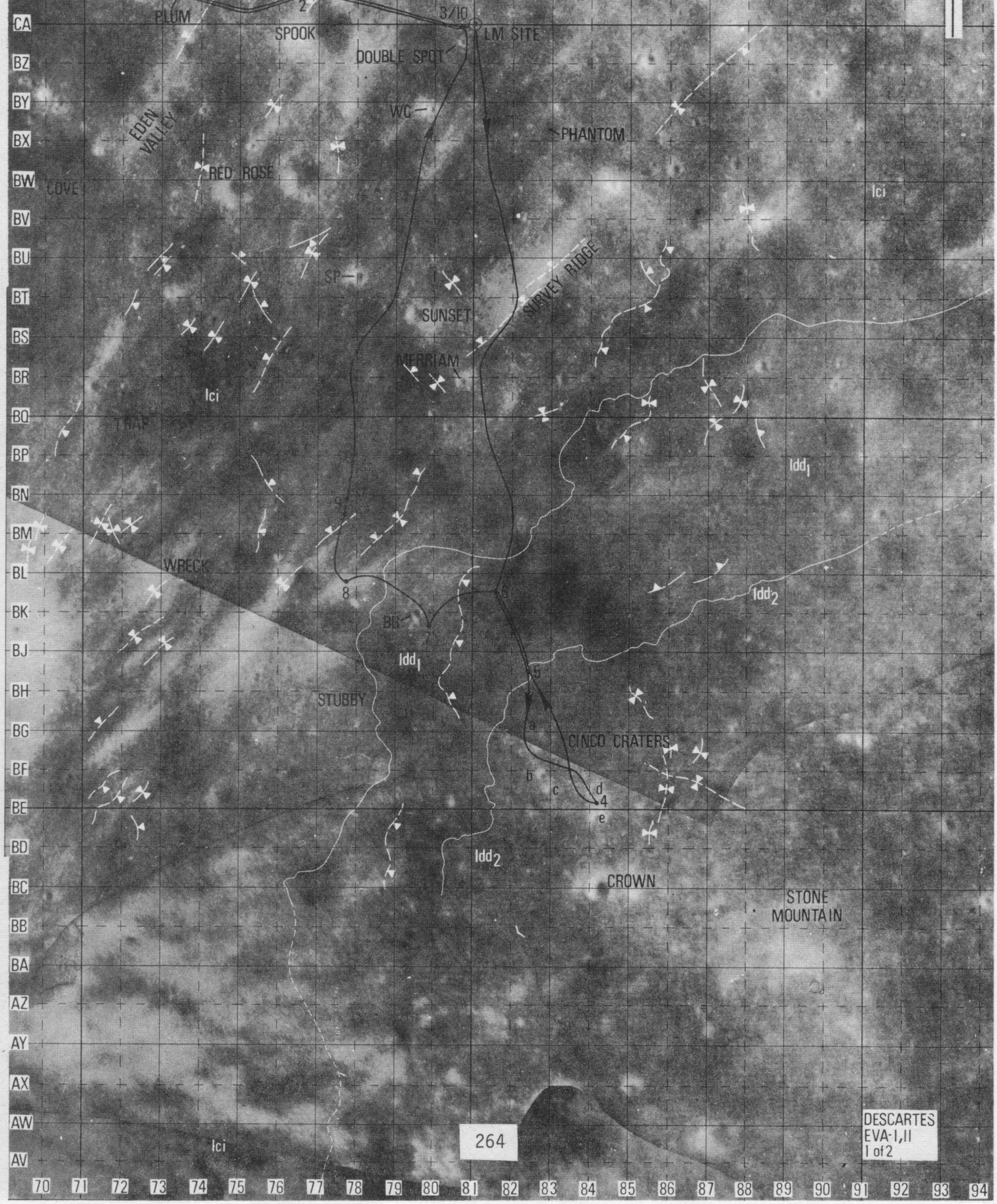
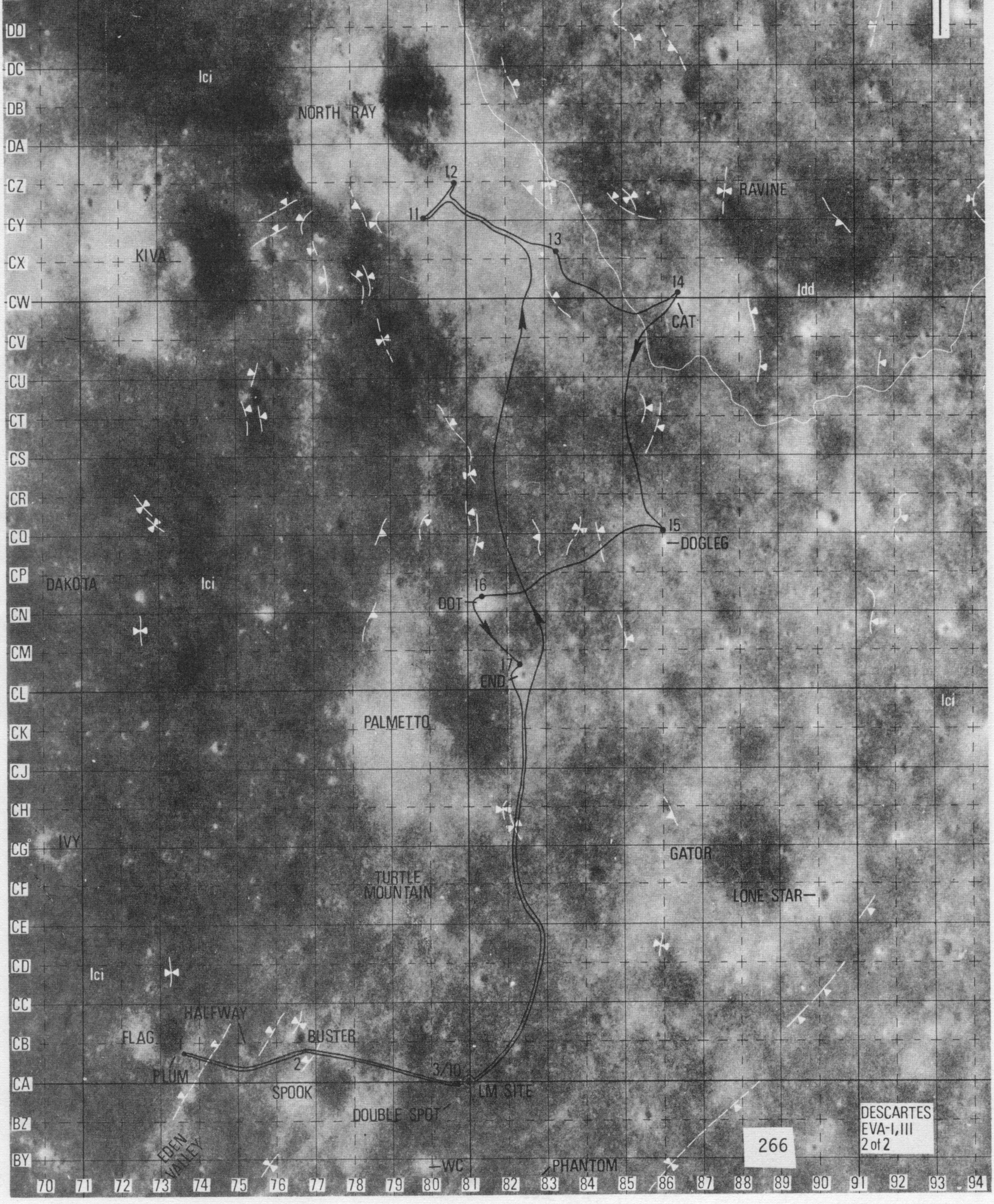


Figure 3.6.2-3 EVA-1&2 1:25,000 Traverse Map

Figure 3.6.2-4 EVA-1&3 1:25,000 Contour Map



NORTH RAY
KIVA
RAVINE
Idd
CAT
DOGLEG
DAKOTA
Ici
DOT
END
PALMETTO
IVY
GATOR
TURTLE MOUNTAIN
LONE STAR
HALFWAY
FLAG
BUSTER
PLUM
SPOOK
DOUBLE SPOT
LM SITE
3/10
EDEN VALLEY
WC
PHANTOM
11
12
13
14
15
16
17
2
DD
DC
DB
DA
CZ
CY
CX
CW
CV
CU
CT
CS
CR
CQ
CP
CN
CM
CL
CK
CJ
CH
CG
CF
CE
CD
CC
CB
CA
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94
DESCARTES
EVA-I,III
2 of 2

Figure 3.6.2-6 EVA 1 1:12,500 Traverse Map

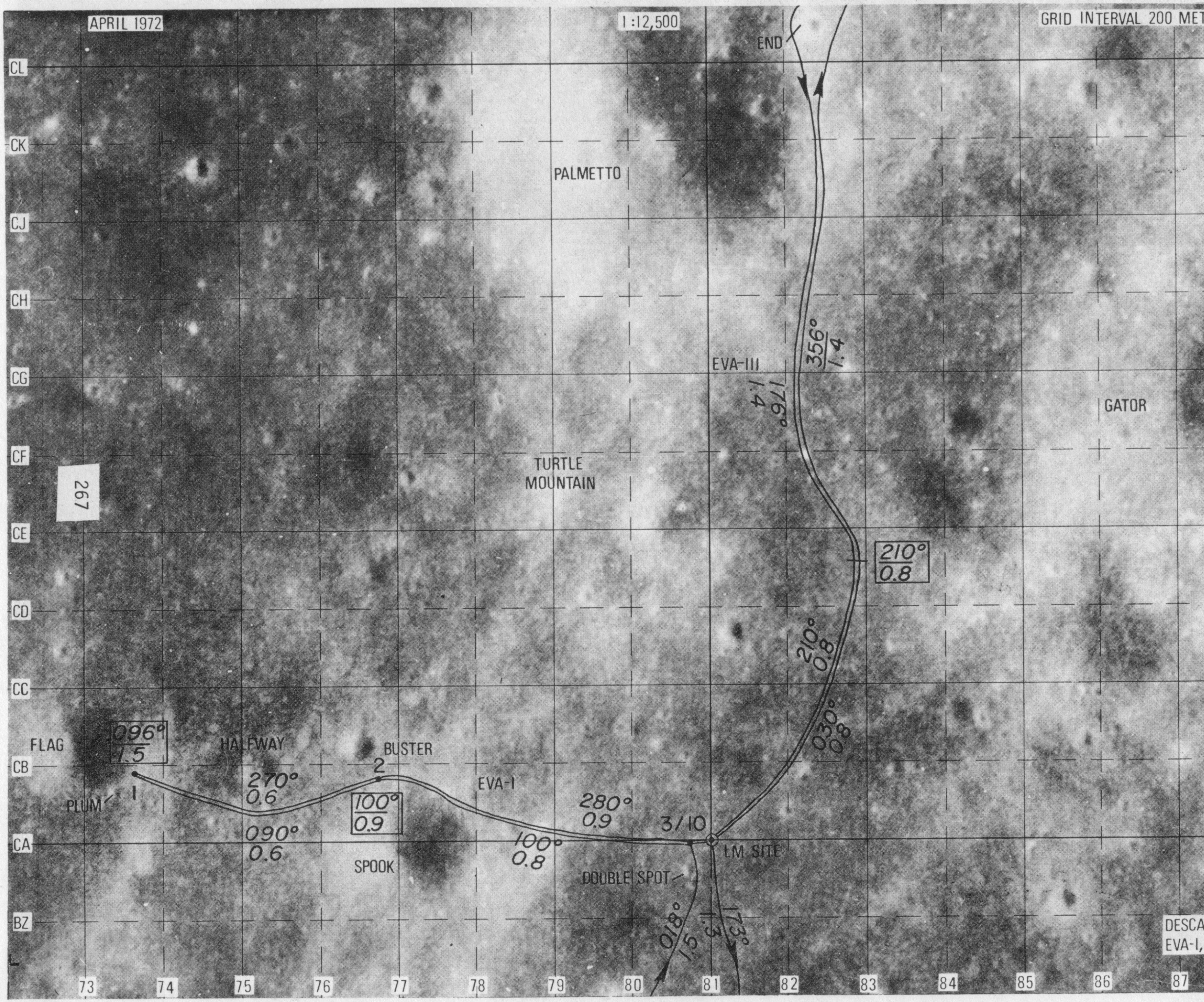
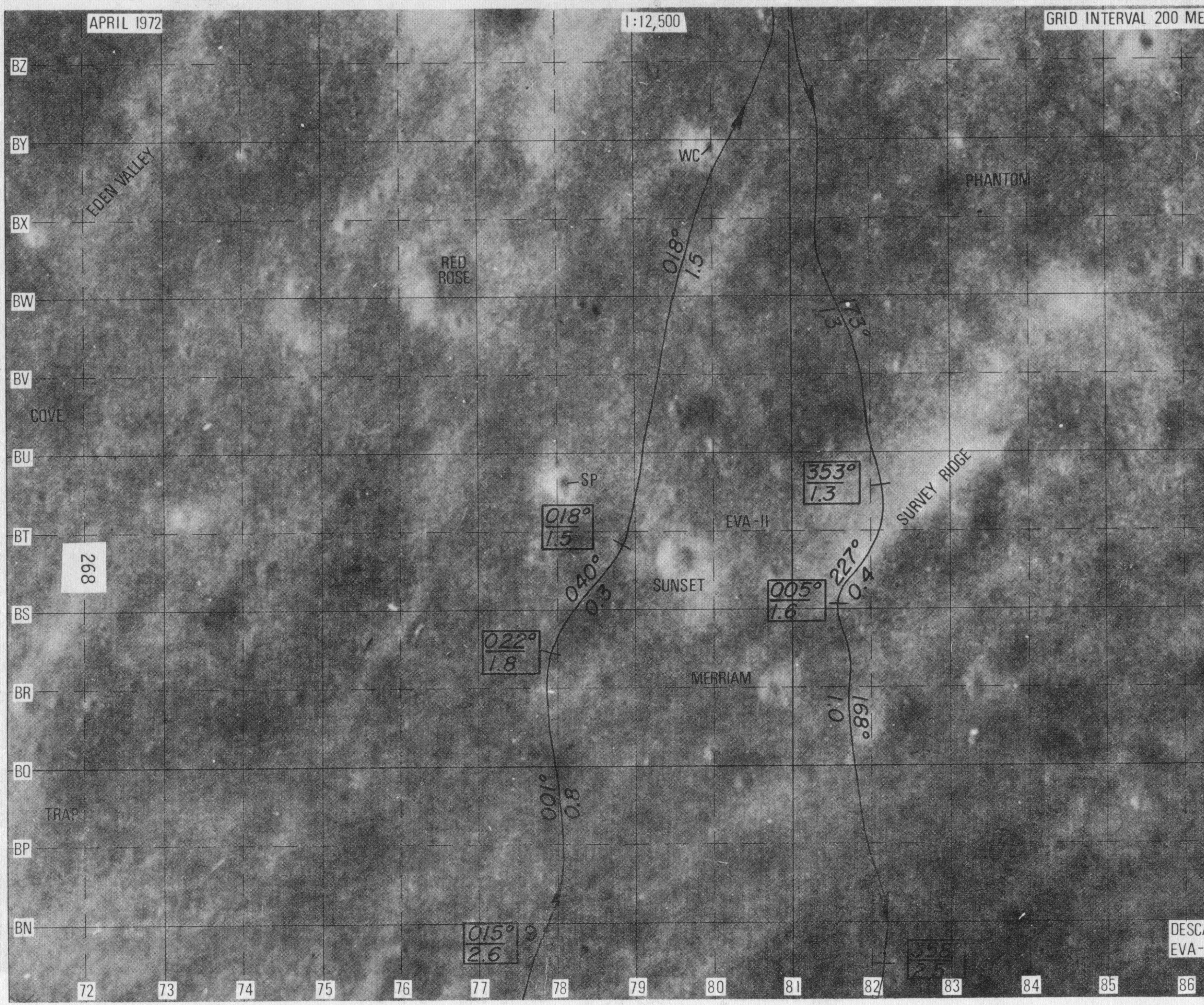


Figure 3.6.2-7a EVA 2 1:12,500 Traverse Map



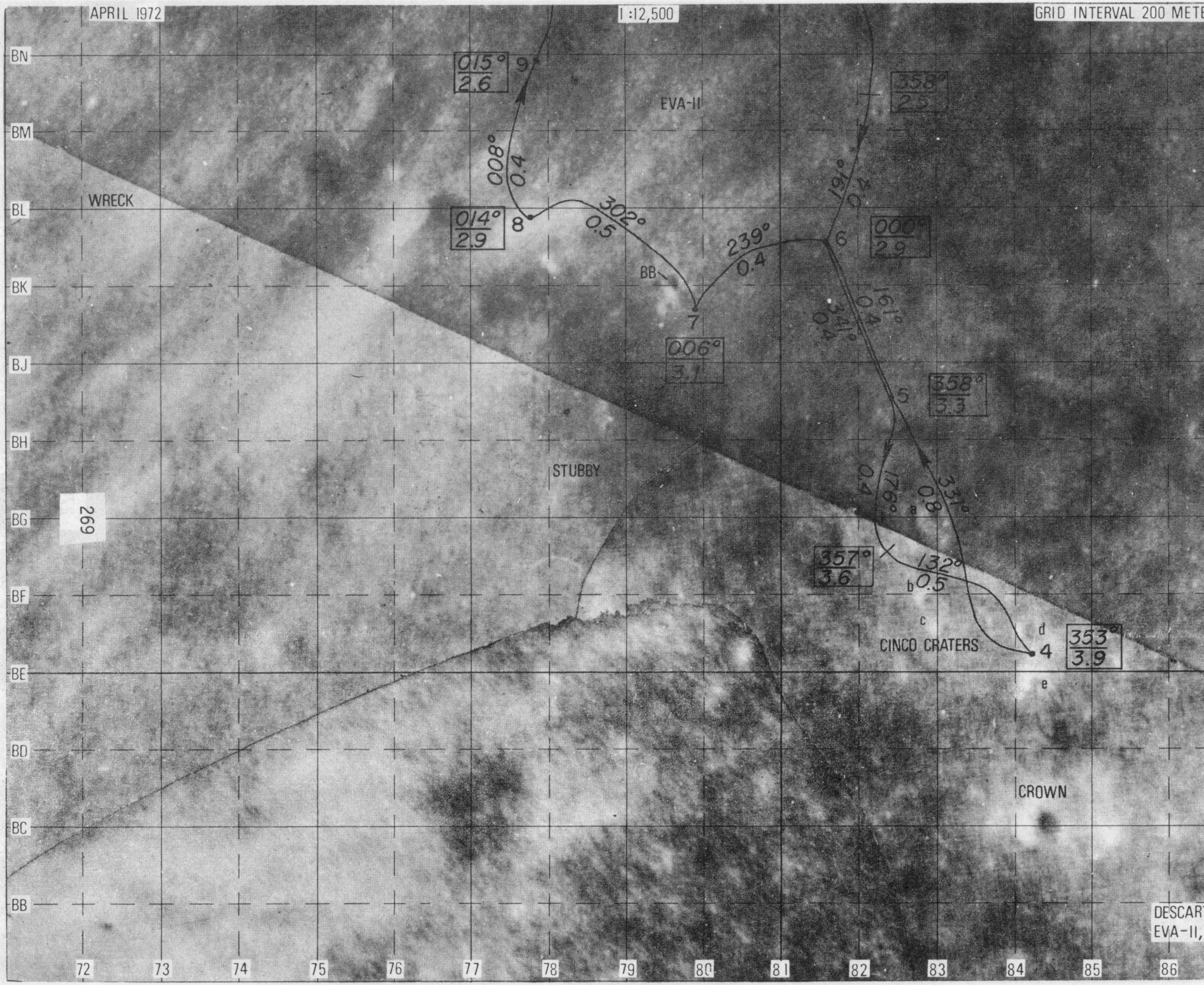


Figure 3.6.2-7b EVA 2 1:12,500 Traverse Map

Figure 3.6.2-8a EVA 3 1:12,500 Traverse Map

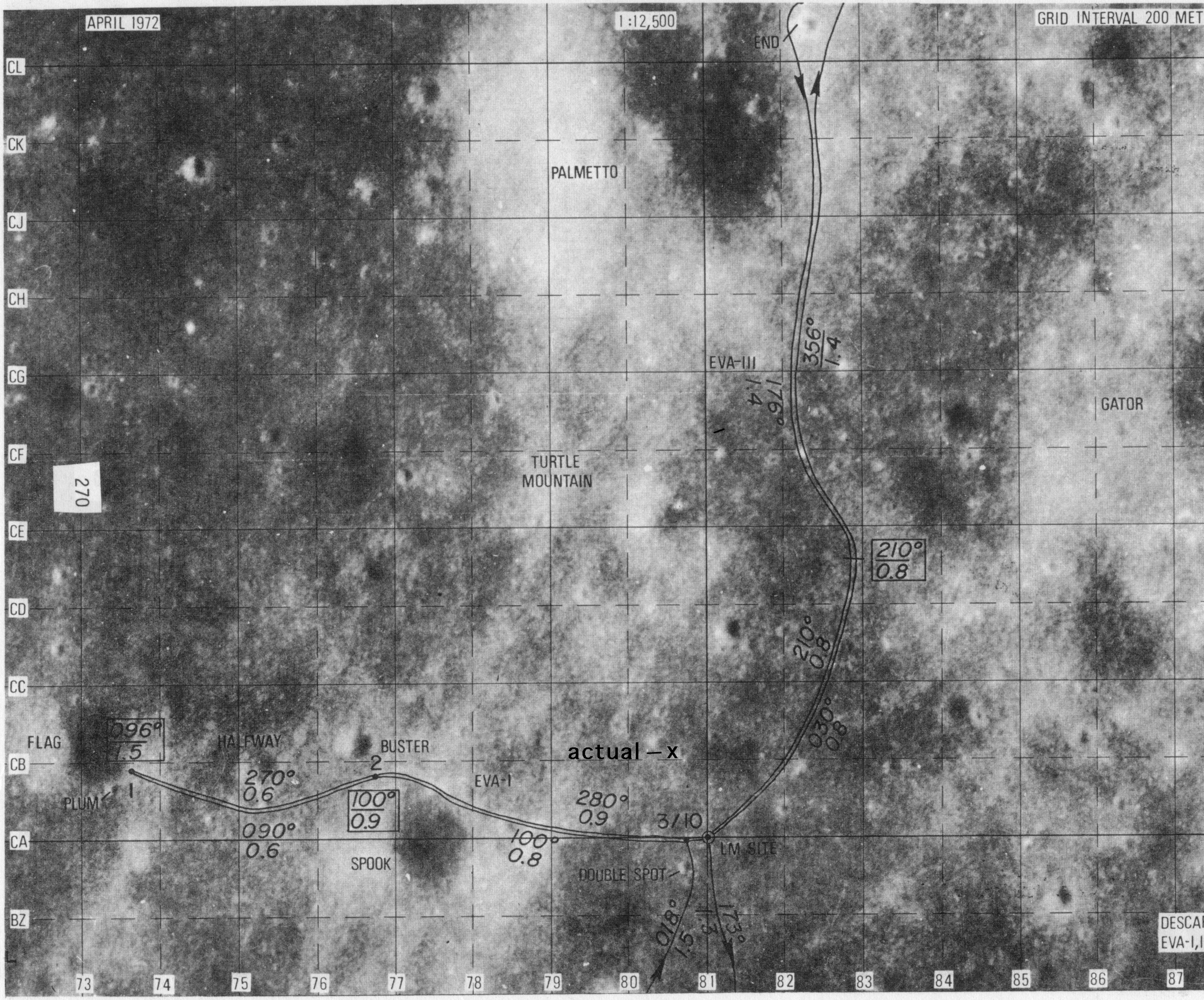
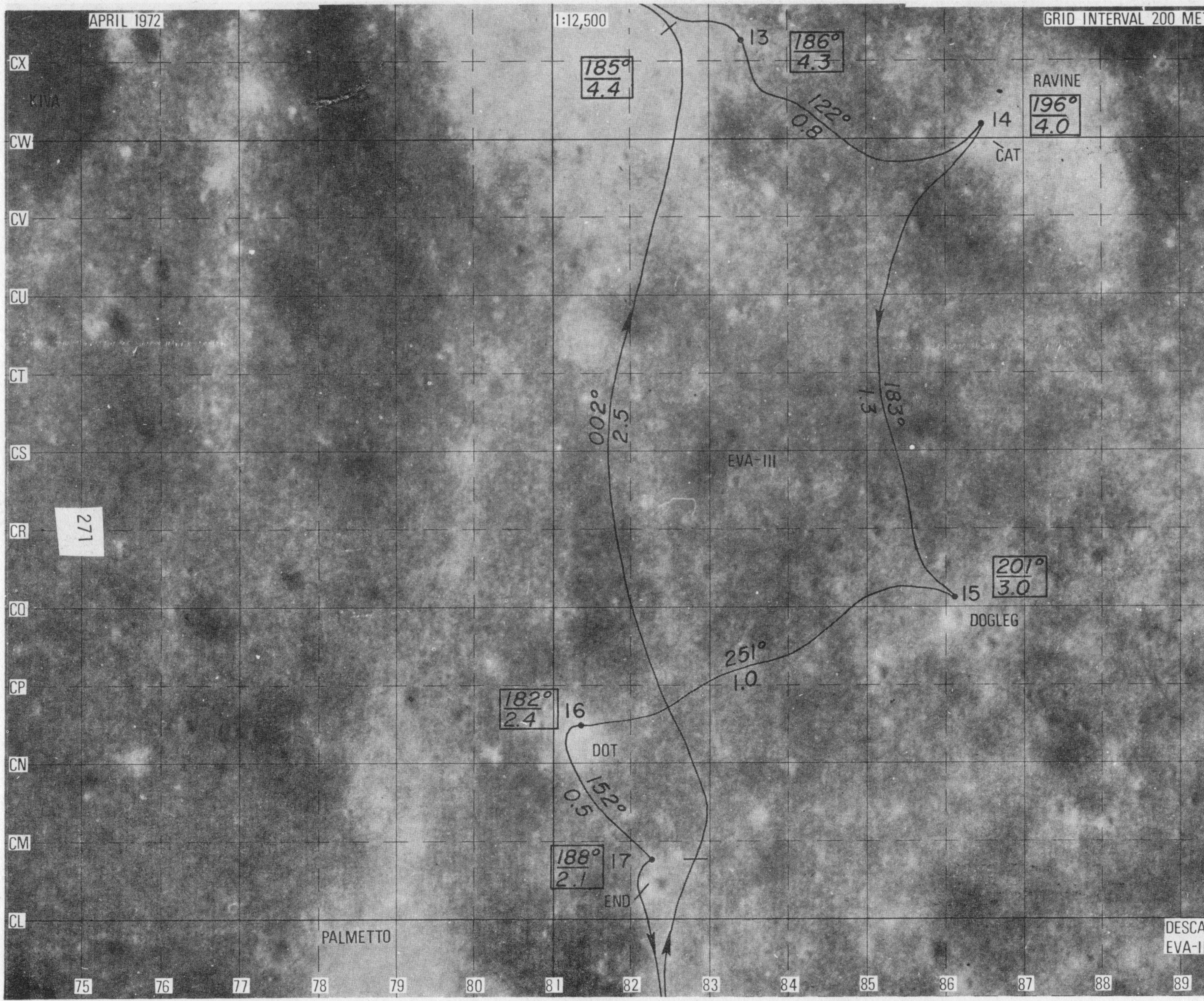


Figure 3.6.2-8b EVA 3 1:12,500 Traverse Map



271

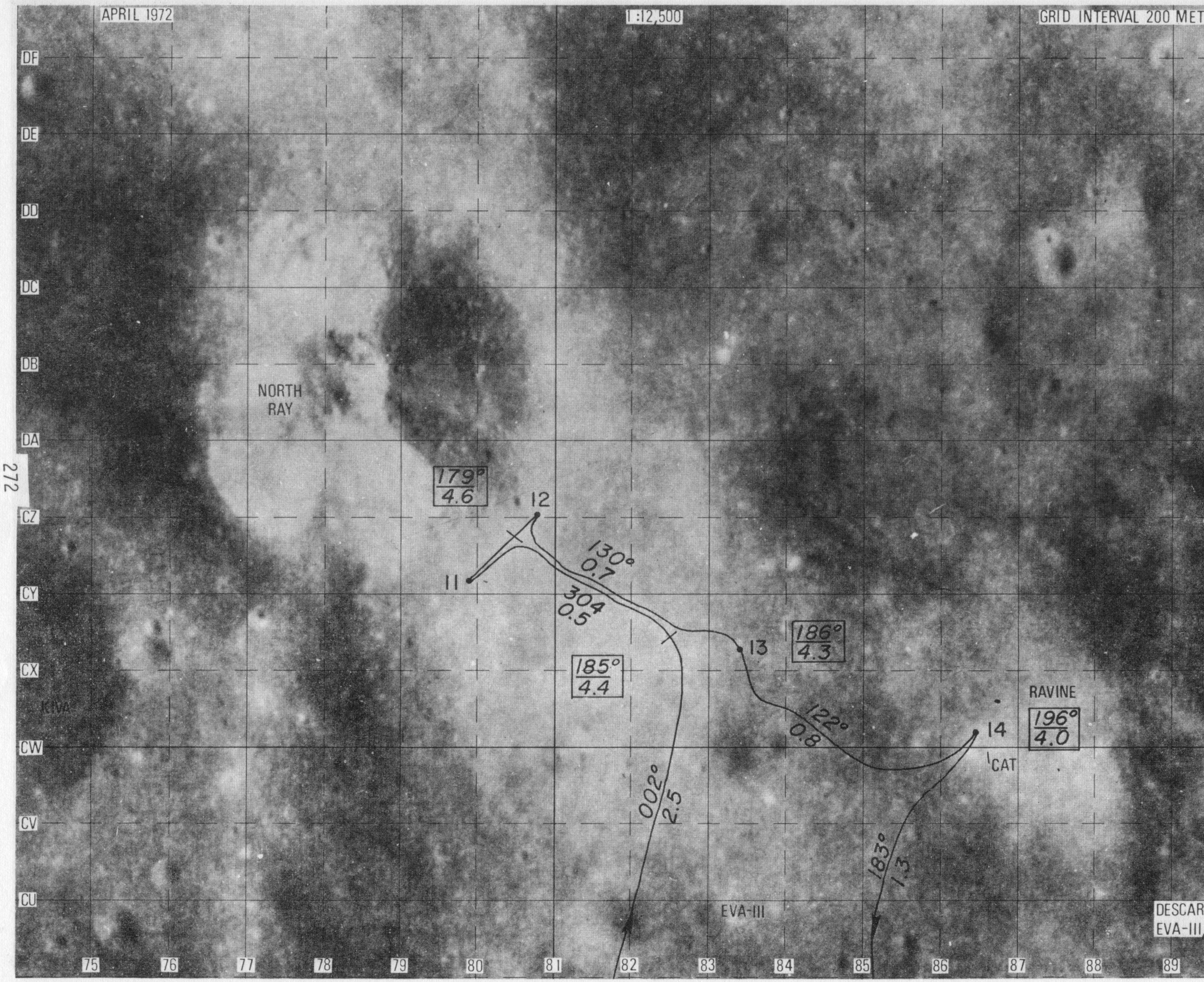


Figure 3.6.2-8c EVA 3 1:12,500 Traverse Map

3.7 LUNAR ROVER VEHICLE

The Apollo 16, J-2, mission is the second 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,
3) Increased communications capability, and
4) Increased equipment transportation 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 3.5-1 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 3.7-3. 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 3.7-4. For a complete description of the LRV systems refer to the Lunar Roving Vehicle Operations Handbook.

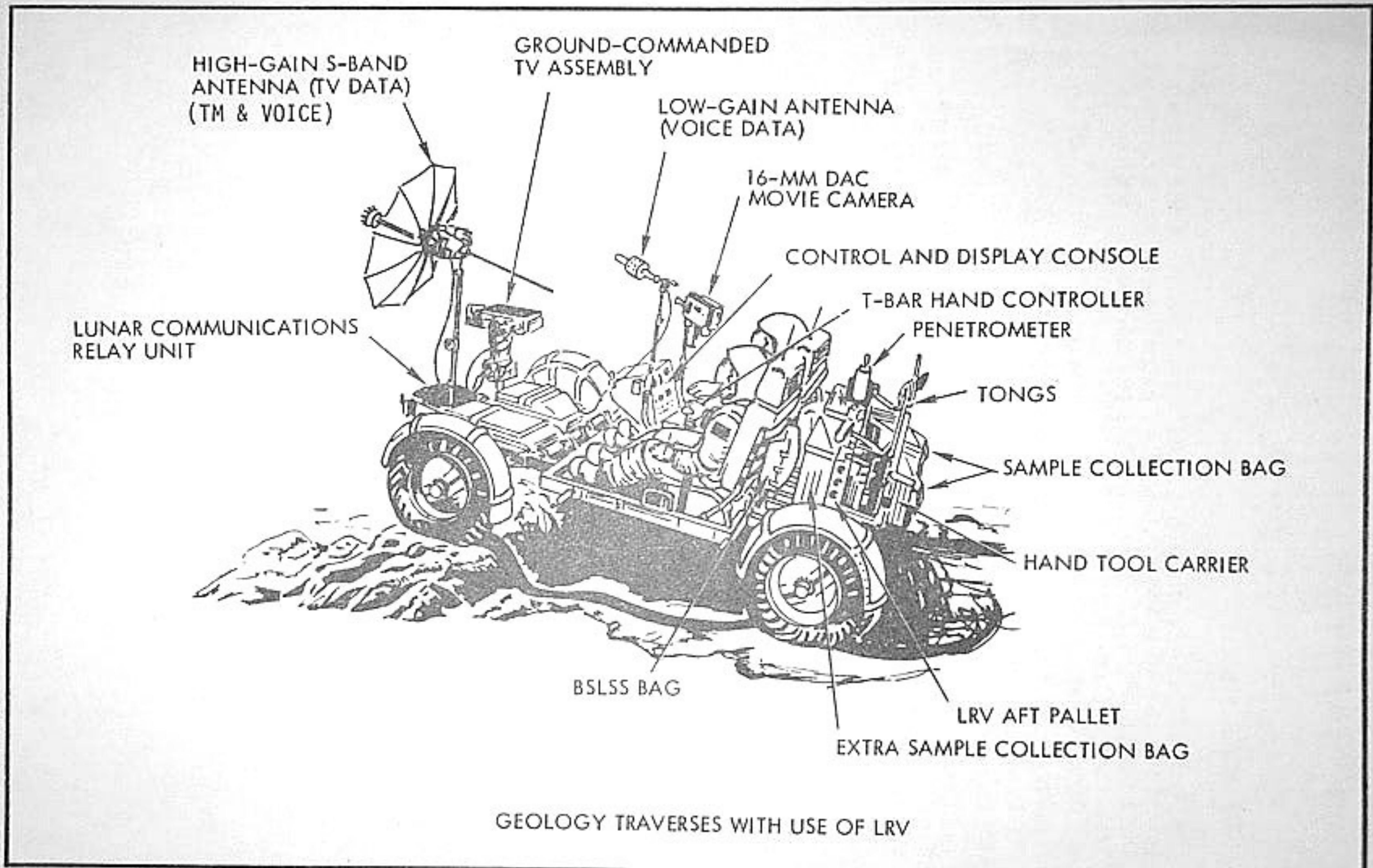


FIGURE 3.7-1 LUNAR ROVING VEHICLE (LRV)

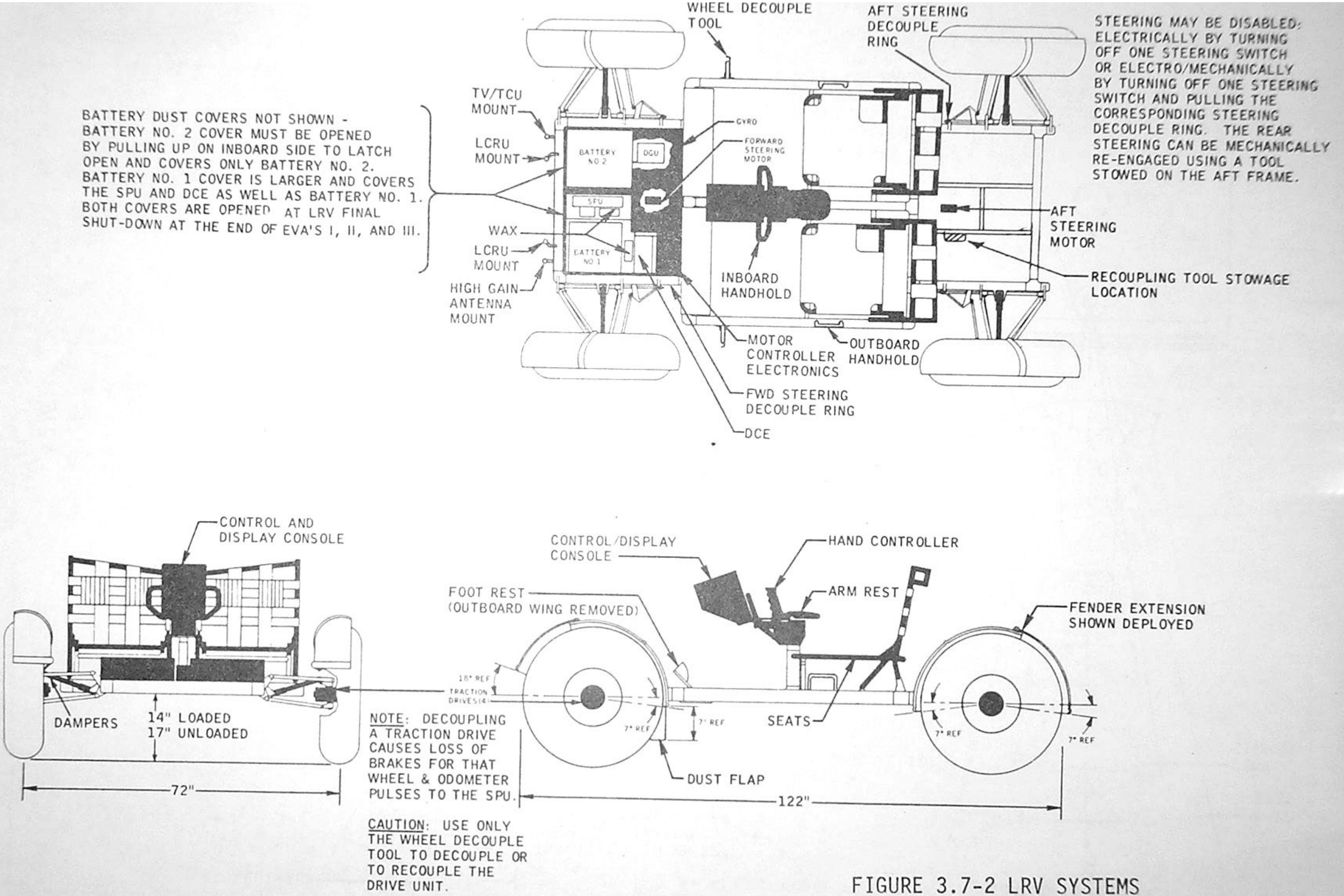


FIGURE 3.7-2 LRV SYSTEMS

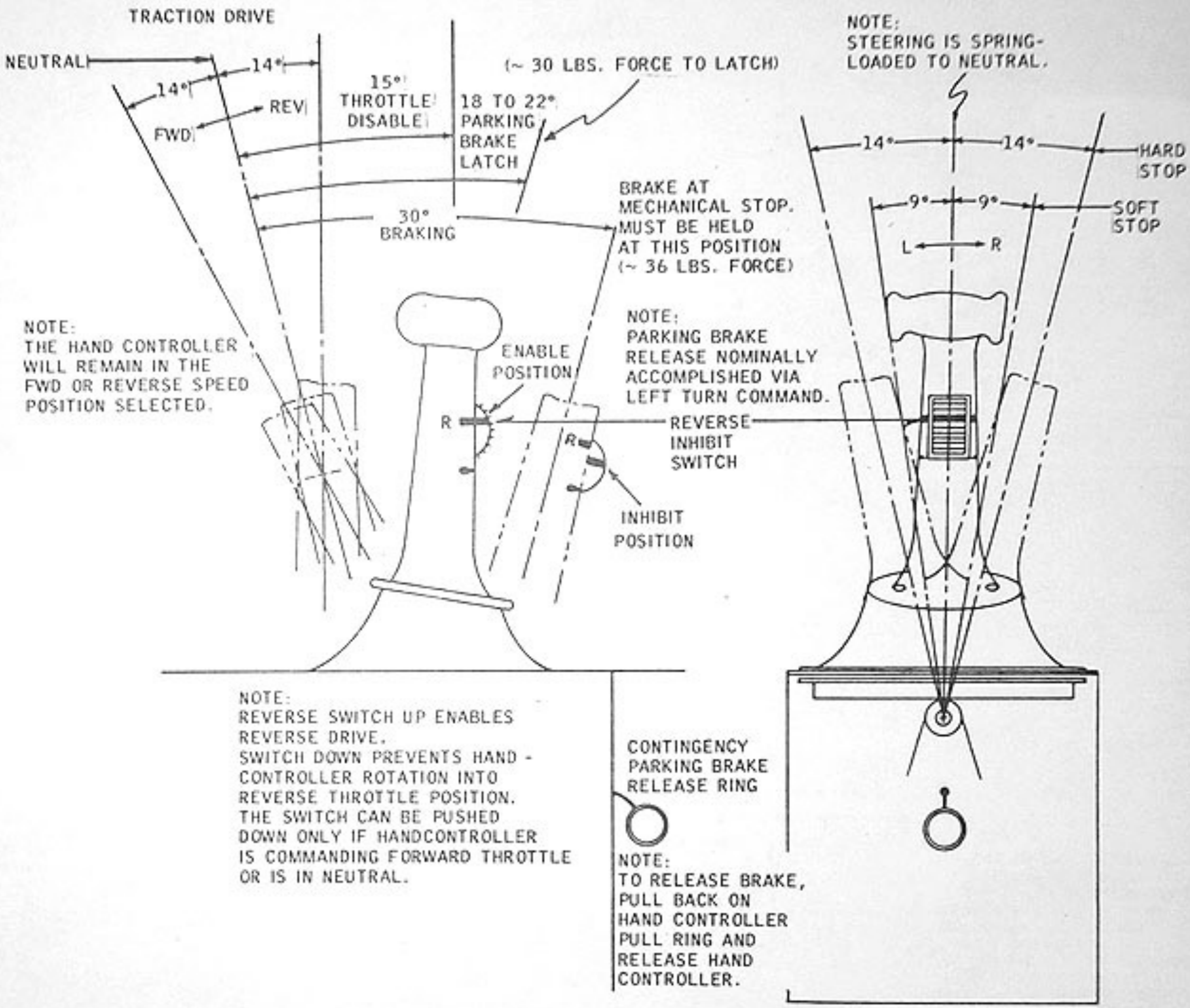
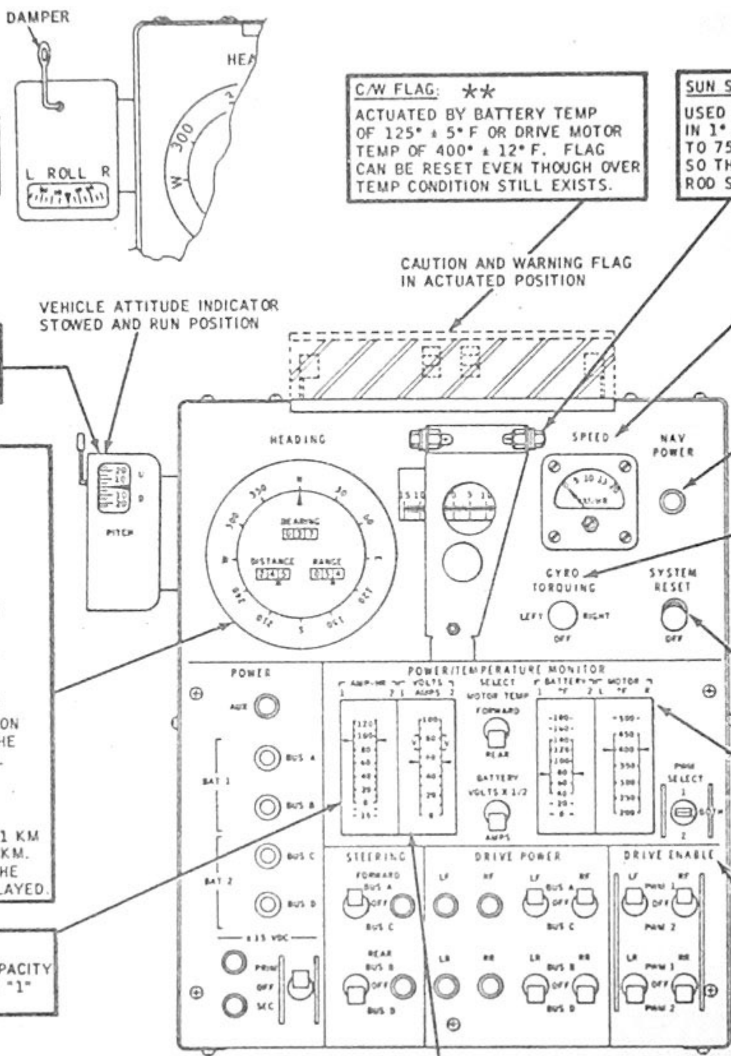


FIGURE 3.7-3 LRV HANDCONTROLLER FUNCTIONS

FIGURE 3.7-4 LRV CONTROL AND DISPLAY FUNCTIONS



ATTITUDE INDICATOR (PITCH & ROLL):
USED FOR NAV. ALIGNMENT AND UPDATE. THE LRV IS PARKED WITHIN ± 6° PITCH AND ROLL.

ROLL
± 25° IN 1° INCREMENTS

PITCH
± 25° IN 5° INCREMENTS

C/W FLAG: **
ACTUATED BY BATTERY TEMP OF 125° ± 5° F OR DRIVE MOTOR TEMP OF 400° ± 12° F. FLAG CAN BE RESET EVEN THOUGH OVER TEMP CONDITION STILL EXISTS.

SUN SHADOW DEVICE (SSD):
USED TO INITIALIZE THE NAVIGATION SYSTEM. 15° EITHER SIDE OF ZERO IN 1° DIVISIONS. THE SSD IS EFFECTIVE FOR SUN ELEVATION ANGLES UP TO 75°. READING THE SHADOW FOR NAV. ALIGNMENT - THE LRV IS PLACED SO THAT A SHADOW IS CAST WITHIN ± 3° OF ZERO. THE CENTER OF THE ROD SHOULD BE USED IN CASTING THE SHADOW.

SPEED INDICATOR:
SHOWS LRV VELOCITY FROM 0 TO 20 KM/HR AND IS DRIVEN BY ODOMETER PULSES FROM THE RIGHT REAR WHEEL. THE NAV POWER C/B MUST BE IN TO OPERATE THE INDICATOR.

NAV POWER CIRCUIT BREAKER: *
PROVIDES POWER FROM BATTERY 1 & 2 TO NAV SYSTEM. NAV SYSTEM GYRO MUST STABILIZE FOR 3 MIN. BEFORE MOVING THE VEHICLE OR TORQUING THE GYRO.

GYRO TORQUING SWITCH:
USED TO TORQUE THE GYRO UNTIL THE HEADING CORRESPONDS TO THE CALCULATED LRV HEADING. THE SWITCH IS USED TO INITIALIZE THE NAV SYSTEM AT THE START OF THE EVA AND TO UPDATE THE SYSTEM DURING THE TRAVERSE. LEFT (RIGHT) SWITCH POSITION CAUSES HEADING ROSE TO ROTATE CLOCKWISE (COUNTERCLOCKWISE) AT 1.5 °/SEC. SWITCH ACTUATION LIMITED TO 2 MINUTES.

SYSTEM RESET SWITCH:
USED TO RESET BEARING, DISTANCE, AND RANGE TO ZERO AT THE START OF EACH EVA.

HEADING INDICATOR:
DISPLAYS THE LRV HEADING WITH RESPECT TO LUNAR NORTH. THE INITIAL SETTING AND UPDATING OF THIS INSTRUMENT IS ACCOMPLISHED BY OPERATING THE GYRO TORQUING SWITCH LEFT OR RIGHT.

BEARING INDICATOR:
DISPLAYS BEARING TO THE LM IN ONE DEGREE DIGITS. IN THE EVENT OF POWER LOSS TO THE NAVIGATION SYSTEM, THE BEARING INDICATION WILL REMAIN DISPLAYED.

DISTANCE INDICATOR:
DISPLAYS DISTANCE TRAVELED BY THE LRV IN INCREMENTS OF 0.1 KILOMETER. THIS DISPLAY IS DRIVEN FROM THE NAVIGATION SIGNAL PROCESSING UNIT WHICH RECEIVES ITS INPUTS FROM THE THIRD FROM THE FASTEST TRACTION DRIVE ODOMETER. TOTAL DIGITAL SCALE CAPACITY IS 99.9 KM.

RANGE INDICATOR:
DISPLAYS THE DISTANCE TO THE LM, AND IS GRADUATED IN 0.1 KM INCREMENTS WITH A TOTAL DIGITAL SCALE CAPACITY OF 99.9 KM. IN THE EVENT OF POWER LOSS TO THE NAVIGATION SYSTEM, THE RANGE INDICATED AT TIME OF POWER LOSS WILL REMAIN DISPLAYED.

AMP-HR METER: *
THIS INDICATOR IS USED TO MONITOR REMAINING BATTERY CAPACITY IN BATTERY 1 AND BATTERY 2. AT FULL CHARGE, BOTH THE "1" AND "2" READ 121 AMP-HRS.

MOTOR °F METER: *
THIS INDICATOR IS USED TO MONITOR THE TEMPERATURE OF EACH DRIVE MOTOR. SELECTION OF WHICH SET OF WHEELS TO MONITOR IS MADE BY PLACING THE MOTOR TEMP SELECT SWITCH TO EITHER FORWARD OR REAR POSITION. EXPECTED TEMP READING IS 200° F. ALLOWABLE TEMP BRACKET ON METER IS 200 TO 450° F.

BATTERY °F METER: *
THIS INDICATOR IS USED TO MONITOR THE INTERNAL TEMPERATURE OF EACH BATTERY. THE ALLOWABLE BATTERY TEMPERATURE AS BRACKETED ON THE METER IS 40 TO 140° F. EXPECTED TEMP RANGE IS 45 TO 120° F.

VOLTS AMPS METER:
THIS INDICATOR IS USED TO MONITOR THE VOLTAGE OR CURRENT BEING SUPPLIED FROM BATTERY 1 AND BATTERY 2. SELECTION OF THE PARAMETER TO MONITOR IS CONTROLLED BY THE BATTERY SELECT SWITCH.
THE METER INDICATION
WILL BE TWICE THE ACTUAL VALUE
THE NOMINAL METER READING FOR VOLTAGE IS BRACKETED FROM 66 TO 82.

* POWER VIA CB'S BUS B&D
** POWER VIA CB'S BUS A&C

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.

TABLE 3.7-1

LRV OPERATIONAL FUNCTIONS

	FUNCTION	PROCEDURE
EVA-1		
	Deploy and set-up	Table 3.7-2
	LRV Power-up	Table 3.7-3.A
	Navigation Alignment	Table 3.7-4
	Geology/Science Sites	
	A) Nominal	Table 3.7-5.A
	B) Nav update	Table 3.7-5.B
	LRV close-out	Table 3.7-5.A
EVA-2		
	LRV power-up	Table 3.7-3.B
	Navigation Alignment	Table 3.7-4
	Geology/Science Sites	
	A) Nominal	Table 3.7-5.A
	B) Nav Update	Table 3.7-5.B
	LRV close-out	Table 3.7-6.B
EVA-3		
	Navigation Alignment	Table 3.7-4
	Geology/Science Sites	
	A) Nominal	Table 3.7-5.A
	B) Nav Update	Table 3.7-5.B
	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, verify outrigger cables taut and chassis parallel.

2. Inspect right and left walking hinge latches to verify indicator marks aligned.

2A. Release contingency deployment tool velcro. Remove and stow tool.

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.

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) Tension on aft deployment cable is released.
    (b) Aft chassis unfolds and locks in position.
    (c) Rear wheels unfold and tethered rear wheel struts fall free.
    (d) Forward chassis is released from console post and returns to 35 degree position. (Rotates in toward LM)

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.
    (d) Slack in outrigger cables (outer braked reel cables).

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 (right).

17. Pull saddle release cable verify telescoping rods drop free (left).

18. Erect LRV geology pallet mounting post (right).
    -(SEE NOTE 1)-

19. Deploy rear fender extension (right and left).

20. Check rear hinge pins engaged (right and left).

21. Check aft steering seal intact (right).

22. Check rear steering decouple ring sealed (right).

23. Release inboard hand hold tie down (left).

24. Erect seats (release seat tie down straps) (right and left).

25. Attach seat support leg velcro strap to outboard handhold (right and left).

26. Lower arm rest (right).

27. Pull console "T" handle and rotate 90°; lower console while raising inboard handhold (right and left).

28. Lock console/handhold in place, T handle 90°, velcro T handle strap (right and left).

29. Remove tripod and stow toehold (wheel decouple tool) (right and left).

30. Release velcro tiedowns and erect footrest and velcro in place (right and left).

31. Check front hinge pins engaged (right and left).

32. Check fwd steering seal intact (left).

33. Deploy front fender extension (right and left).

34. Verify battery covers closed (right and left).

35. Pull attitude indicator and C&W pins and discard (left).

    NOTE 1: The vehicle may be picked up by both crewmen and turned away from the LM prior to vehicle set-up (i.e., prior to step 19).

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. Report BAT 1 and BAT 2 AMP-HR indications.
5. Report BAT 1 and BAT 2 AMPS indications.
6. BATTERY Switch - VOLTS x 1/2.
7. Report BAT 1 and BAT 2 VOLTS indications.
8. BATTERY Switch - AMPS.
9. Report BAT 1 and BAT 2 temp (°F) indications.
10. Report motor temps (LF, RF, LR, RR).
11. ± 15 VDC PRIM and SEC Circuit Breakers - CLOSE.
12. STEERING FORWARD AND REAR Circuit Breakers - CLOSE.
13. DRIVE POWER LF, RF, LR, RR Circuit Breakers - CLOSE.
14. PWM SELECT Switch - BOTH. (Verify)
15. DRIVE ENABLE LF and RF Switches - PWM 1.
16. DRIVE ENABLE LR and RR Switches - PWM 2.
17. ± 15 VDC Switch - SEC.
18. STEERING FORWARD Switch - BUS A.
19. 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 <u>active</u> PWM prior to setting any drive power switch to an energized bus. If the drive power switch is turned on and the corresponding drive enable switch is not selected to an active PWM, then full power will be applied to the corresponding drive motor when the hand controller is released from brake position. Should this condition occur, the hand controller should be immediately returned to park brake position.

20. DRIVE POWER LF AND RF Switches - BUS A.

21. DRIVE POWER LR AND RR Switches - BUS D.

*22. 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.

*23. Stop LRV and set parking brake. Reset Reverse INHIBIT Switch (push switch DOWN).

24. Release parking brake and drive to MESA area for equipment loading.

25. Stop LRV and set brake.

26. $\pm$ 15 VDC SW - OFF

27. AUX CB - CLOSE.

*Omit Steps 21 & 22 if the LRV has been picked up and turn facing away from the LM.

TABLE 3.7-3.B

POWER-UP (EVA-2&3)

1. Close LRV battery covers as required and press on covers to mate velcro.

2. Check hand controller set parking brake and Verify Reverse INHIBIT Switch - DOWN.

3. BUS A, BUS B, BUS C, BUS D Circuit Breakers - CLOSE.

4. NAV POWER CB - CLOSE (Verify) (Do not Torque gyro or move LRV for 1-1/2 min.).

5. AUX CB - CLOSE (Verify).

6. Report BAT 1 and BAT 2 AMP-HR indications.

7. Report BAT 1 and BAT 2 VOLTS indications.

8. Report BAT 1 and BAT 2 AMPS indications.

9. Report BAT 1 and BAT 2 temp (°F) indications.

10. Report drive motor temps (LF, RF, LR, RR).

11. Verify PWM SELECT Switch - BOTH.

12. Verify DRIVE ENABLE LF and RF Switches - PWM 1.

13. Verify DRIVE ENABLE LR and RR Switches - PWM 2.

14. ± 15 VDC Switch - PRIM

15. Release parking brake and Drive to nav alignment site.

TABLE 3.7-4
NAVIGATION ALIGNMENT

1. Drive LRV to area level within ± 6° of zero for pitch and roll.

2. Deploy Sun Shadow Device (SSD).

3. Park heading down sun within ± 3° SSD.

   Hand controller to parking brake position
   Power down (± 15 VDC SW - OFF)

4. Report SSD, pitch and roll readings.

5. Stow SSD and attitude indicator.

6. Move SYSTEM RESET switch momentarily to RESET and return to OFF position.

7. Verify bearing, distance & range indicators zero.

8. Operate GYRO TORQUING switch to LEFT or RIGHT position to correct HEADING indicator as required.

9. Power-up LRV. (± 15 VDC SW - PRIM).

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) ± 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. LCRU mode switch:

   (a) 3 (TV RMT) (near the LM) or,
   (b) 2 (FM/TV) (on the traverse)

5. Align HGA via AGC meter and sight.

6. Dust CTV, TCU and LCRU.

7. Perform science requirements.

8. Return to LRV.

9. Stow Gnomon.

10. LCRU mode switch to 1 (PM1/WB).

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. Release parking brake.

*These four readings may be given as "all low" if the temps do not drive the needle off the peg.

TABLE 3.7-5.B

GEOLOGY/SCIENCE SITE-NAV UPDATE

1. Drive to area level within ± 6° of zero for pitch and roll.

2. Deploy SSD and head down sun within ± 3° SSD.

3. Stop LRV and set hand controller in parking brake position. Reverse inhibit switch - down.

4. Report SSD, pitch and roll readings.

5. Stow SSD and attitude indicator.

6. Power down as follows:

   (a) ± 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. LCRU mode Switch:

   (a) 3 (TV RMT) (near the LM)
   (b) 2 (FM/TV) (on the traverse)

9. Align HGA via AGC meter and SIGHT.

10. Dust CTV, TCU and LCRU.

11. Perform stop science requirements.

12. Return to LRV.

13. Stow Gnomon.

14. LCRU mode switch to 1 (PM1/WB).

15. Mount LRV and fasten seat belt.

16. Verify hand controller in parking brake position and reverse inhibit switch down.

17. Report heading and Torque Gyro to Houston update as required.

18. $\pm$ 15 VDC switch - PRIM.

19. Release parking brake.

*These temps may be reported as "all low" if temps do not drive needle off the peg

TABLE 3.7-6.A

EVA-1 Closeout

1. Position LRV near MESA - Cross sun, Heading = 354° set parking brake and verify REVERSE INHIBIT switch - DOWN.

2. Report BEARING, DISTANCE, & RANGE.

3. ± 15 VDC switch - OFF.

4. 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

5. LCRU mode sw - 3 (TV RMT).

6. Align Hi-gain Ant.

7. Dust CTV, TCU & LCRU.

8. Prior to LM ingress.

   (a) LCRU power switch - OFF
   (b) LCRU thermal blanket - place __35%__, blanket over mirrors (i.e., 65% of mirrors showing).
   (c) LRV battery covers - OPEN & dust LRV mirrors as required. (Dust LCRU mirrors).
   (d) BUS A, BUS B, BUS C, & BUS D CB's - OPEN.

TABLE 3.7-6.B

EVA-2 Closeout

1. Position LRV near MESA - Cross sun, Heading - 351°, set parking brake and verify REVERSE INHIBIT switch - DOWN.

2. Report BEARING, DISTANCE and RANGE.

3. $\pm$ 15 VDC switch - OFF

4. 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

5. LCRU mode sw - 3 (TV RMT).

6. Align Hi-gain Ant.

7. Dust CTV, TCU, & LCRU.

8. Prior to LM ingress:

   (a) LCRU power switch - OFF
   (b) LCRU thermal blanket - 100% open. (verify)
   (c) LRV covers open and LRV mirrors dusted as required (Dust LCRU mirrors).
   (d) BUS A, BUS B, BUS C, & BUS D CB's - OPEN.

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. $\pm$ 15 VDC switch - OFF.

4. 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

5. LCRU mode switch - 3 (TV RMT).

6. Align Hi-gain Ant.

   NOTE: Off-load equipment and then drive to final LRV parking site.

7. LCRU mode switch - 1 (PM/WB).

8. Ingress LRV verify parking brake, reverse inhibit switch - DOWN.

9. $\pm$ 15 VDC switch - PRIM.

10. Gran Prix.

11. NAV RESET switch to RESET momentarily then to - OFF.

12. Verify BEARING, DISTANCE and RANGE - ZERO.

13. Drive on a HEADING of 085° until the DISTANCE indicator reads 0.1 km; BEARING indicator should read 265°. Turn left to a HEADING OF 165° and stop at outbound tracks.

14. Set parking brake.

15. ± 15 VDC switch - OFF.

16. NAV POWER CB - OPEN.

17. BUS B and BUS D CB's - OPEN (Note BUS A & BUS C CB's remain closed).

18. AUX power CB - CLOSED (Verify).

19. AUX power by pass sw - ON.

20. LCRU mode sw - 3 (TV RMT).

21. Align Hi-gain Ant.

22. Peel 65% LCRU blanket - and install over control panel.

23. Dust CTV & TCU.

24. LRV battery covers - OPEN.

25. Dust LRV mirrors as required.

26. Dust LCRU mirrors

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 3.7-5 , 3.7-6 and 3.7-7 , 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 3.7-8 is intended to further refine the data provided in figure 3.7-7 to include the effects of various hand controller braking positions on stopping distance vs slopes for 8 km/hour.

Table 3.7-7 is compendium of LRV operating limits, constraints, and requirements of crew operation. These are generally presented without comment.

CONSTRAINTS (KPH)

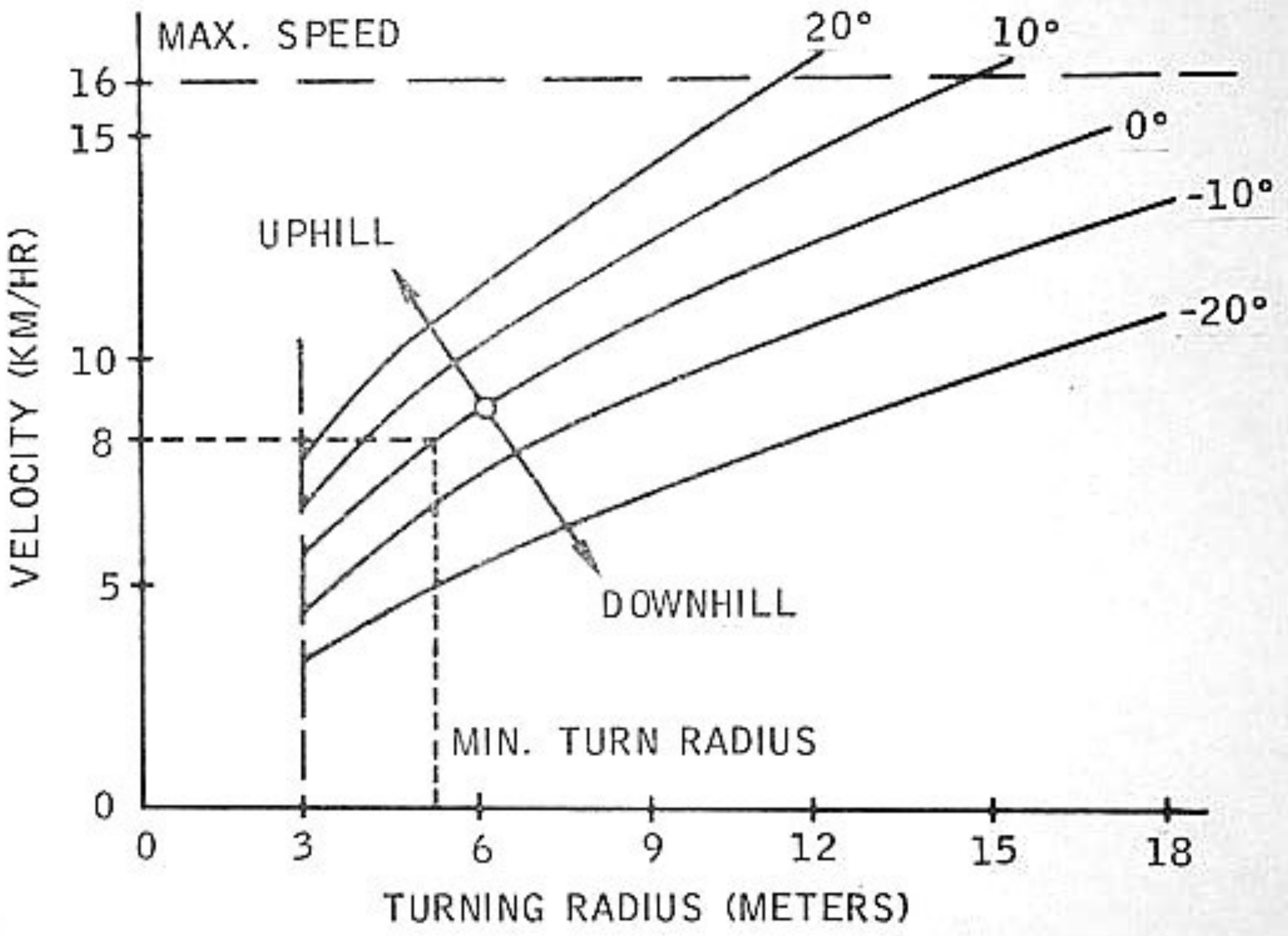
CONSTRAINTS	SLOPE	SMOOTH MARE	ROUGH MARE
SPEED CAPABILITY TORQUE LIMITED	0° 5° 10°	11.2 9.2 8.0	10.5 8.8 7.6
SUSPENSION		16	10
LIMIT LOADS		12" BUMP AT 14 KPH	
CONTROLLABILITY 13° SIDE SLIP ANGLE		6m TURN AT 5.5 KPH	
		12m TURN AT 10 KPH	

NOTE: LOW RANGE P.S.D.
1.5 FACTOR OF SAFETY ON SUSPENSION LOAD

Figure 3.7 - 5

FIGURE 3.7-6

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 3.7-7
STOPPING DISTANCE VERSUS INITIAL VELOCITY FOR VARIOUS SLOPES

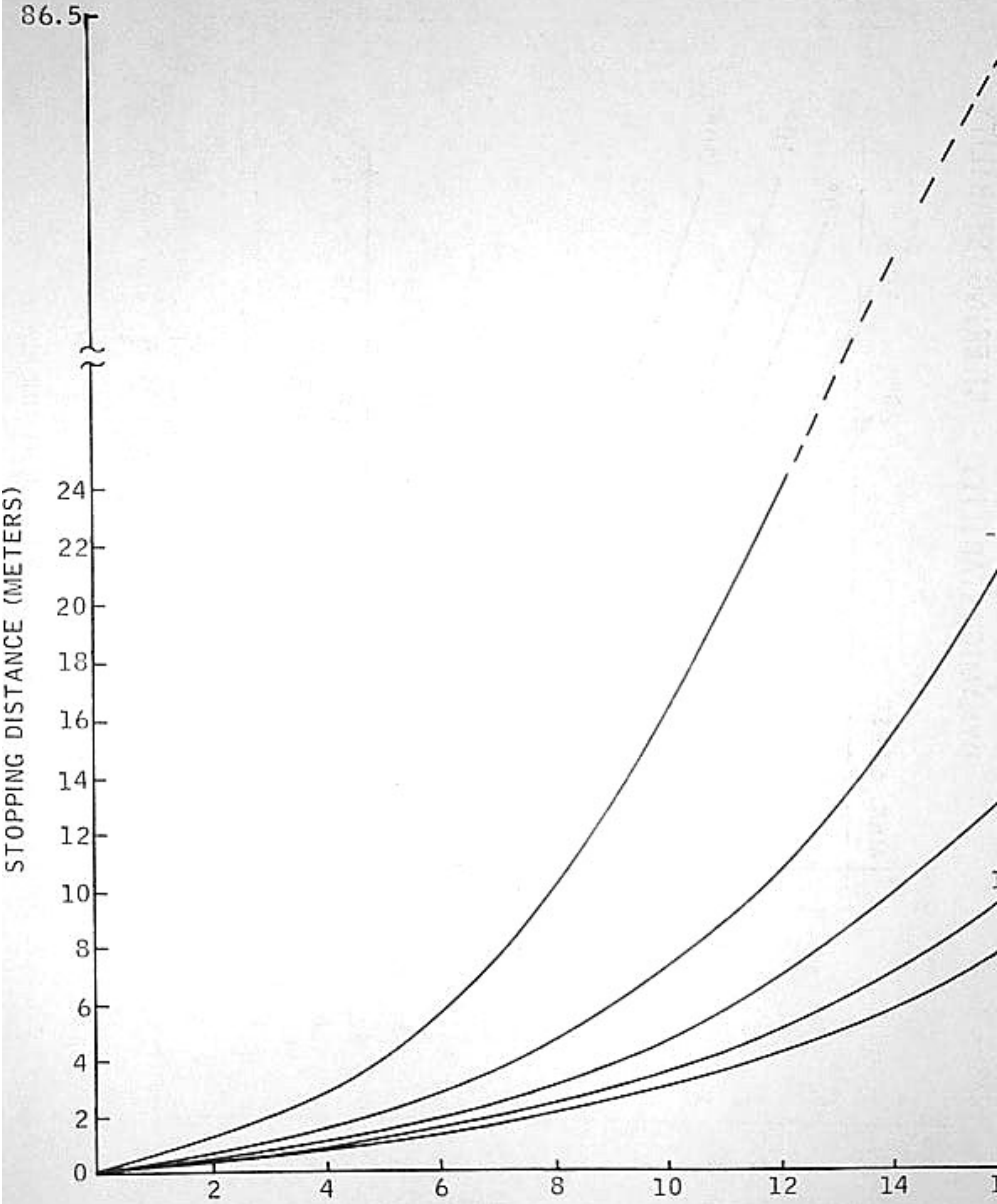


FIGURE 3.7-8

LRV STOPPING DISTANCE VS. HANDCONTROLLER PULL FORCE FOR 8 KM/HR

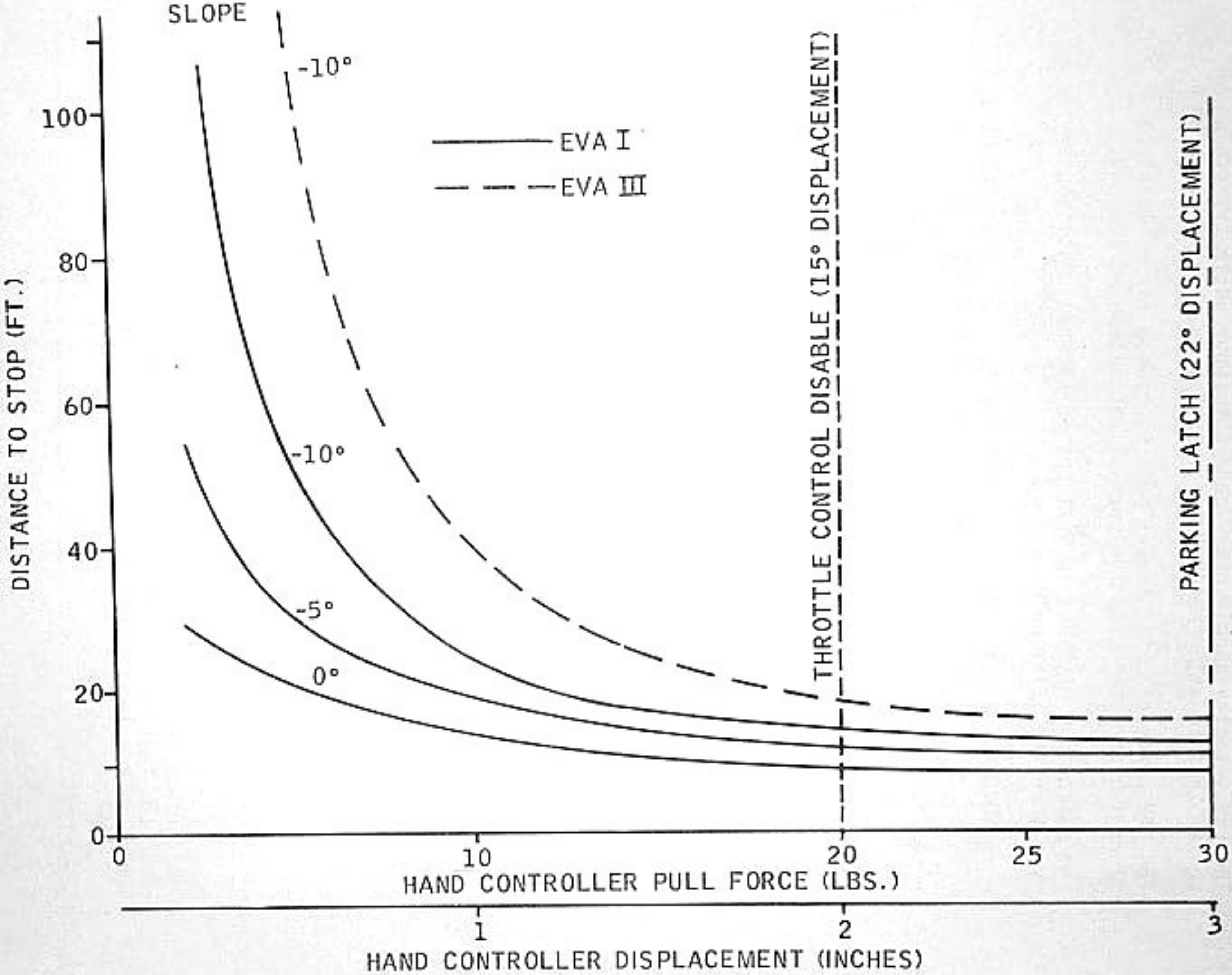


TABLE 3.7-7

LRV Operating Limits, Constraints & Requirements

1. The LRV velocity should not exceed 5 km/hour while traversing to the ALSEP site with the ALSD on the LMP seat.

2. The NAV power circuit breaker must be closed for at least 1-1/2 minutes before torquing the gyro or repositioning the LRV.

3. The navigation system gyro must not be torqued continuously for more than two (2) minutes.

   NOTE: Since the heading indicator torques at a rate of 1.5°/sec the heading could be torqued 180° in 2 minutes.

4. To minimize heading errors for navigation system initial alignment and updates, the LRV should be parked such that the pitch and roll is within ± 6° of zero, (roll being the most critical) and the Sun Shadow Devices (SSD) within ± 3°.

5. The attitude indicator and the SSD should be read to MCC within the tolerances noted below to minimize heading errors:
   Pitch within 2-1/2°, Roll within 1° and SSD within 1°.
   Further the shadow cast on the SSD scale should be read from the center of the rod.

6. Park the LRV cross sun heading North between EVA's in the sun light:

   (a) END of EVA-1 - HEADING = 354°
   (b) END of EVA-2 - HEADING = 351°

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 - 65%
   (c) Between EVA's 2&3 - 100%
   (d) Subsequent to EVA-3 - 100%

9. The LRV will be parked at the conclusion of EVA 3 as per the following parameters:

   (a) Distance 300 ft ± 25 ft
   (b) LRV to LM Bearing 265°
   (c) LRV Heading 165°

10. Caution: While driving, an open-operating corridor shall be maintained on either side of the LRV. For a velocity of 8 km/hour the driving corridor should be 17 feet. Possible condition: 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 realeased 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.

14. Hi-gain antenna sighting/LRV Heading: Coarse alignment (6°) of LCRU Hi-gain antenna may be made at any LRV parking heading by use of the AGC meter. Fine alignment (2.5°) via the optical sight is dependent upon the LRV heading as follows:

	LRV Heading	Optical Sighting
1)	0° - 195°	good - not more than 30 secs of crew time
2)	195° - 270° and 350° - 360°	marginal - more than 30 secs of crew time
3)	270° - 350°	not possible

15. The LRV mirrors (eg Battery 1, Battery 2, SPU and DCE) shall be dusted at the end of each EVA if there is dust visible or if 10% of the mirrore surface is covered with dust clumps.

16. The TV camera will be manually positioned horizontal and CCW by the crew at the end of each science site.

17. The maximum down slope velocity for slopes greater than 12° shall be 4 Km per hour. This may require braking for extend driving times. The brakes should be applied as required to slow the vehicle and then relaxed (i.e., do not drag the brakes nor panic stop the LRV).

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 3.7-9. The LRV/LCRU Malfunction Procedures Checklist shown in figure 3.7-10 is included as part of the onboard Flight Data File and is stowed in the LRV mapholder.

POWER-UP

Check Hand Controller

Brake - On, Rev - Down

CB: All Closed
(Ex. Aux + Nav)

Hou: Amp Hr, Amps,
Volts, Temps

PWM Select - Both

Drive Enable:
Fwd - PWM 1
Aft - PWM 2

±15 VDC - SEC

Steering: Fwd - BUS A
Aft - BUS D

Drive Power:
Fwd - BUS A
Aft - BUS D

STOP

Brake - On, Rev - Down

±15 VDC - OFF

Hou: Nav, Amp Hrs,
Temps

LCRU: LM - 3 (TV RMT)
TRAV - 2 (FM/TV)

NAV ALIGN

* STOP, 3° SSD, 6° R & P

CB: Nav - Close (1-1/2 min)

Sys Reset - Reset & Off

Brng, Dist, Rng - Zero

* Hou: Roll, Pitch, SSD,
Heading

* Gyro Torq To Hou Update

* SSD - Stow

* = NAV UPDATE

START

GNOMON - GNOMON

LCRU - 1 (PM1/WB)

±15 VDC - PRIM

CLOSE OUT

STOP At LM, Hou Heading

CB: Bus A, B, C, D, &
Nav - Open

Hou: LCRU Covers

LCRU Power - Off

Batt Covers Open

EVA 3 - CB: All Open Ex
Aux, Bus A & C - Closed

Aux CB By Pass - On

LCRU: Power - Ext
Mode - 3 (TV RMT)

Figuure 3.7-9 LRV Operations Decal

Figure 3.7-10

LRV MALF. PROCEDURE

LOW ACCELERATION OR LOW SPEED

1. Cycle hand controller (fwd/rev/fwd) - - - - - - - - - - -	Intermittent Contacts
2. Check motor temps. if any motor temp. unbalanced high (> 50°): Affected wheel - DRIVE POWER Sw — OFF - - - - - - -	Motor Short
If motor continues to heat: While driving - decouple wheel - - - - - - - - - - - -	Traction Drive Binding
3. Set parking brake DRIVE ENABLE Sw (4) - PWM 1 - - - - - - - - - - - - - - - -	PWM 2 Failure PWM SELECT Sw - PWM 1
4. Set parking brake DRIVE ENABLE Sw (4) - PWM 2 - - - - - - - - - - - - - - - -	PWM 1 Failure PWM SELECT Sw - PWM 2
5. DRIVE POWER Sw (4) - alt. pos. - - - - - - - - - - - - -	Bus A (D) Failure STEERING Sw (2) - alt. pos.
6. LF,RF DR PWR Sw - BUS A LR,RR DR PWR Sw - BUS B - - - - - - - - - - - - - - - - -	Batt 2 Failure REAR STEERING Sw - BUS B
7. LF,RF DR PWR Sw - BUS C LR,RR DR PWR Sw - BUS D - - - - - - - - - - - - - - - - -	Batt 1 Failure FWD STEERING Sw - BUS C

8. Restore normal configuration per power-up decal. Monitor motor temps. frequently. Perform step 2 if motor temp. unbalance occurs.

LOSS OF STEERING AND 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 3.7-10

LOSS OF VOICE COMM with MSFN (LCRU)

LCRU:

LGA: AGC <2

MODE - FM/TV (HGA)	LGA or Rcvr 1
CB LRV AUX - Close POWER - alt. pos. (INT/EXT)	16.8V Batt Power or DC - DC Converter

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
CB LRV AUX - Close POWER - EXT	CB/Switch Short

Traverse Mode: Swap Ant Connectors
MODE-PM2/NB (LGA)

CB LRV AUX - Close POWER - alt. pos. (INT/EXT)	28V Batt Power or DC - DC Converter

HGA: AGC <2.5

MODE-PM1/WB (LGA)	HGA or Rcvr 2
CB LRV AUX - Close POWER - alt. pos. (INT/EXT)	16.8V Batt Power or DC - DC Converter

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 - alt. pos. (INT/EXT)	28V Batt Power or DC - DC Converter

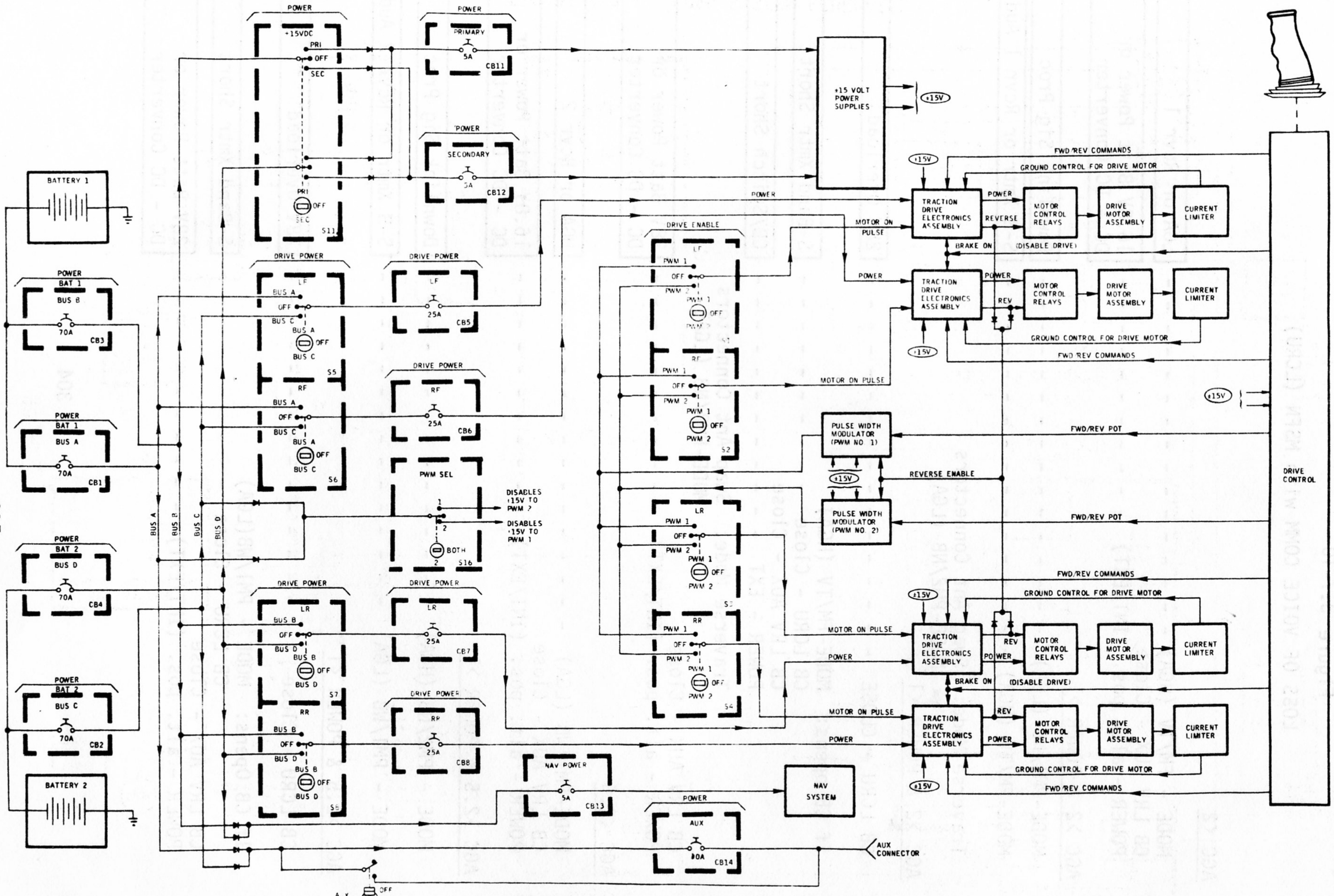


FIGURE 3.7-11 LRV SYSTEMS SCHEMATIC

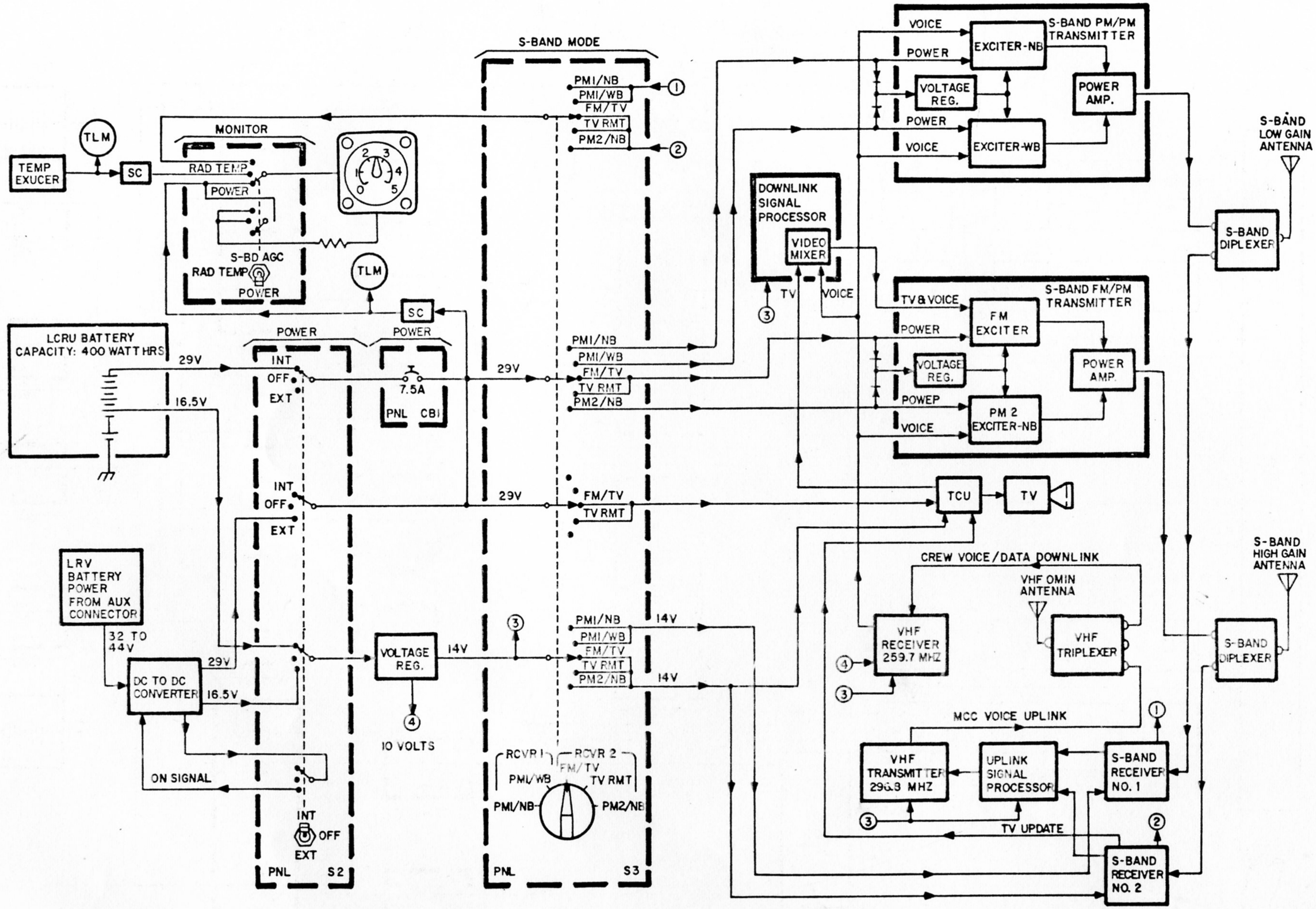


FIGURE 3.7-12 LCRU SYSTEM SCHEMATIC

Section 4.0 Contingent Plans

This section will be provided as an errata to the document when it becomes available.

5.0 APPENDIX

5.1 ABBREVIATIONS

ALSD - Apollo Lunar Surface Drill
ALSEP - Apollo Lunar Surface Experiments Package
A/S - Ascent Stage
ASE - Active Seismic Experiment

BB - Boyd Bolt
BRB - Big Rock Bag
BSLSS - Buddy Secondary Life Support System

CDR - Commander
CRE - Cosmic Ray Experiment
C/S - Central Station
CSVC - Core Sample Vacuum Container
CTV - Color Television Camera

DAC - Data Acquisition Camera
D/S - Descent Stage
DSBD - Documented Sample Bag Dispenser

ECS - Environmental Control System
EMU - Extravehicular Mobility Unit
ETB - Equipment Transfer Bag
EVA - Extra Vehicular Activity

GCTA - Ground Controlled Television Assembly

HBW - Hi-Speed Black & White
HCEX - Hi-Speed Colar Exterior
HEDC - Hasselblad Electric Data Camera
HFE - Heat Flow Experiment
HGA - High Gain Antenna
HTC - Hand Tool Carrier

ICG - Internal Cover Garment
ISS - Interim Stowage Shelf

LCG - Liquid Cooled Garment
LCRU - Lunar Communication Relay Unit
LEC - Lunar Equipment Conveyor
LGA - Low Gain Antenna
LiOH - Lithium Hydroxide

LM	-	Lunar Module
LMP	-	Lunar Module Pilot
LPM	-	Lunar Portable Magnetometer
LRV	-	Lunar Roving Vehicle
LSM	-	Lunar Surface Magnetometer
LSUC	-	Lunar Surface Ultra-Violet Camera
MCC-HOU	-	Mission Control Center - Houston
MESA	-	Modularized Equipment Stowage Assembly
MSFN	-	Manned Space Flight Network
OPS	-	Oxygen Purge System
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
SCB	-	Sample Collection Bag
SEQ	-	Scientific Equipment
SESC	-	Special Environmental Sample Container
SRC	-	Sample Return Container
SSD	-	Sun Shadow Device
SWC	-	Solar Wind Composition
TCU	-	Television Control Unit
TD	-	Touchdown
UHT	-	Universal Handling Tool
UV	-	Ultra-Violet

5.2 Lunar Surface Operational Constraints

5.2.1 Introduction

The data presented in this section are restricted to flight crew operational constraints relative to lunar surface extra-vehicular activity. Excluded are spacecraft constraints except where they have a direct bearing on 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 according to the impact on the mission if the constraint is violated. The 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

Spececraft Attitude:

Lunar surface EVA operations will not be conducted when the angle of the LM X-axis with the local gravity vector exceeds 15°. This attitude may arise from the combination of all factors such as asymetric compression of the landing gear struts and terrain conditions. (CRITICAL) (Provisional, documentation to substantiate is unavailable)

Landing Site Slope:

The maximum topographical slope on which lunar surface EVA operations will be conducted will be that which the astronaut can safely negotiate unassisted. This is presently established as 15°. (CRITICAL) (Reference: Unpublished report of test "Crewman Capability Investigation", by Dr. D. L. Lind, Astronaut, Partial Gravity Simulator, Building 5, MSC, November 8, 1968).

LM Forward (+Z) Hatch Operations:

The forward hatch may be left fully open during the EVA (up to 3 hours) provided: (CRITICAL) (GAEC LM Engineering Memorandum LMO-510-1201, April 24, 1969)

1) The cabin temperature, GF 1641T, must be between 60°F and 90°F at the beginning of the EVA, and

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.

Foward 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 Communications 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 8 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 is 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 10° 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 $\leq$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.)

Sample Return Container

1. Remove flaps from the small pockets and press the pockets flat prior to closing SRC lid.

2. Flatten the strap on top of lid to aid in engagement of the latch and apply a slow even force to handle to lock lid.

3. Assure that seal area is clean of foreign objects prior to closing lid.

Penetrometer

The Penetrometer should be held as nearly vertical as possible and pressure applied with a smooth, steady force when taking a measurement.

The Lunar Reference plane must be returned to its full up position after each penetration and prior to indexing, and the Penetrometer should be indexed after each penetration measurement.

In addition the Lunar Reference plane should be in its full up position when changing cones and pressure plate.

Apollo Lunar Surface Experiments Package (ALSEP)

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, carry ALSEP to deployment site; remove HFE subpallet from Package no. 2; carry Package no. 1 to emplace site (do not deploy); inter-connect RTG cable (do not actuate shorting switch); inter-connect HFE.

   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: (MAJOR)

2a) RTG (Radioisotope Thermoelectric Generator)

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	±20° West of Central Station as visually determined by astronaut to minimize thermal load on Central Station.
RTG Deployment Site	Horizontal site. Pallet must be horizontal ±10°, as visually determined by astronaut. No mechanical provisions for astronaut to level RTG. Astronaut will avoid craters and slopes which impede dissipation of heat from RTG.
RTG Alignment	No critical constraints. Astronaut will align so as to favor RTG cable exit toward Central Station.
Interrelation	Nominal Current Readings:

Time after fueling	Short Circuit Current
10 min.	4-6 amps
20 min.	5-7 amps
30 min.	6-8 amps
>35 min.	7-8 amps

After the connection is made and the shorting switch is depressed, the ammeter reading goes to zero.

2b) ALSEP Central Station

PARAMETER	CONSTRAINT
Central Station-to-LM Separation	300 to 1000 ft. This distance is required to keep ALSEP out of the LM ascent debris blast area.
Central Station Orientation from LM	Due West or East of LM, preferably West. Must not be deployed in shadow of 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	$\pm 5°$ of East-West as aligned by astronaut using partial compass rose. Alighment affects thermmal 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 when bottom of SEQ Bay is 18 to 60 in. from lunar surface and with a 15 degree tilt in any direction.

2c) Central Station Antenna

PARAMETER	CONSTRAINT
Site Selection	Attach to Central Station
Antenna Leveling	$\pm 0.5°$ of vertical. Astronaut will use bubble level to adjust. Level adjustment interacts with alignment.
Antenna Alignment	± 0.5 of East-West line as determined by sundial. When shadow coincides with shadow reference line, alignment is within $\pm 0.5°$.
Antenna Azimuth Setting	Astronaut will set dial to value indicated on Cuff Checklist for landing site chosen to assure adequate signal strength for life of ALSEP.
Antenna Elevation Setting	Astronaut will set dial to value indicated on Cuff Checklist for landing site chosen to assure adequate signal strength for life of ALSEP.

2d) ASE (Active Seismic Experiment)

PARAMETER	CONTRAINT
Geophone Deployment	Deploy geophone cable anchor/flag 8 feet north of Central Station and Geophone #1 four feet West from anchor/flag. Deploy Geophone #2 and #3 at 150 feet increments.
Geophone Alignment	Geophone cable line should run 290° of the Central Station. Geophones should be in a straight line within 3 degrees as visually determined, utilizing marker flags.
Geophone Emplacement	Plumb geophones to within 7 degrees of vertical.
Thumper Operations	During the firing of the ASI's, both crewmen should remain still when within 300 feet of the nearest geophone, 10 seconds before firing and 10 seconds after firing.
Separation between ASE Mortar Package Assembly (MPA) and Central Station	Deploy the Mortar Package 55 feet north of the Central Station and RTG. Limited by 58 foot cable.
MPA Leveling	After mounting the MPA to the pallet, coarse level the MPA within 5 degrees using bubble level.
MPA Alignment	Align the MPA within 5 degrees from assumed Geophones deployment lines.

Caution: Alignment must assure that Mortar Package fires parallel to geophone line (to within 5 degrees) but in opposite direction from Central Station and LM.

Caution: Do not remove the safety rods and arm the Mortar Package until after the EVA 1 geology traverse.

2e) PSE (Passive Seismic Experiment)

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	Southeast of Central Station, on opposite side from the RTG, visually determined by astronaut.
PSE Deployment Site	Approximately level spot.
PSE Leveling	Must be coarse leveled by astronaut within ±5 degrees of vertical. Five degrees is the limit of the automatic, fine-leveling gimbal system.
PSE Alignment	Astronaut must rough align within ±20 degrees of lunar East, before opening PSE shroud, by pointing arrow on the sensor girdle towards the sun.
	Fine alignment will be performed by the astronaut after removing girdle and spreading the thermal shroud. Astronaut will read and report, to the nearest degree.
Interrelation	PSE must be no less than 10 ft from other units to minimize pickup of stray vibrations.
PSE Thermal Shroud	Outer edge of thermal shroud must lay flat on the surface.

2f) LSM (Lunar Surface Magnetometer)

PARAMETER	CONSTRAINT
Site Selection	Deploy LSM 40 to 48 feet down sun 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 ±3° of East-West sun line. Astronaut should read the shadowgraph within ±1°. Alignment is critical because thermal control is critical and exact alignment is required to interpret LSM scientific data.
Leveling	LSM should be placed in an approximately level spot, free from loose material. Level the LSM to within ±3° of vertical using bubble level. Recheck level after deploying sunshade.

2g) HFE (Heat Flow Experiment)

PARAMETER	CONSTRAINTS
Site Selection	Deploy the HFE Electronics Package 25 to 30 feet south of the Central Station. HFE Electronics Pacakge should be placed in an approximately level area, removed from any surface irregularities or rocks that may obscure the field-of-view of the HFE sunshield reflector.
Alignment	Align the HFE Electronics Package to within $\pm5°$ 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 30 foot minimum separation between probes and RTG and probe-to-probe.
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°.

2g) HFE (Cont'd)

PARAMETER	CONSTRAINTS
HFE Bore Holes	Use the Apollo Lunar Surface Drill to make a lined bore hole greater than 2.3 meters deep in the lunar surface and aligned to within 15 degrees of vertical.
	Each hole should be 1-1/2 diameters from the rims of "fresh" craters more than 1 meter across.
	Each hole should be 3 or more diameters from boulders more than 1 meter across.
	Try to avoid having a "fresh" crater greater than 2 meters across between bore holes.
	Try to avoid having a "fresh" crater greater than 5 meters across between the HFE bore holes and the core sample hole.
Core Hole	HFE Core Holes should be drilled within 15 degrees of vertical.

2h) LPM (Lunar Portable Magnetometer)

PARAMETER	CONSTRAINTS
LPM Leveling	Sensor should be level within 5 degrees, utilizing bubble level on tripod.
LMP Alignment	Align sensor to within 3 degrees of sunline utilizing shadowgraph on tripod.
Interrelation	After deploying sensor assembly and returning to LRV, astronaut should allow a minimum of 60 seconds for magnetometer stabilization. Deploy the LPM a minimum of 250 feet from the LM and approximately 50 feet from other deployed equipment.
Power	Between readings do not leave READ switch on since only 17 minutes of ON time exists in the battery. Approximately 4 hours total of sensor time exists.

2i) LSUC (Lunar Surface Ultraviolet Camera)

PARAMETER	CONSTRAINTS
LSUC Deployment	The LSUC should be located to remain within the shadow of the LM.
Power	The battery box should be located to remain in direct sunlight during at least the first two-thirds of the lunar surface stay.
LSUC Leveling	Utilize leveling jacks as necessary to center the bubble level within the case and then turn leveling jack to lock the base in level position.
LSUC Alignment	Center the earth in the reticles of the earth sight. Read azimuth and elevation coordinates. These azimuth and elevation coordinates will be used to update the settings in real time.
Interrelation	Astronaut should leave the vicinity of the camera as soon as possible after retargeting due to the venting of waste gases from the life support system which could locally increase the ambient pressure thus causing the camera to stop operating.

2j) CRD (Cosmic Ray Detector)

PARAMETER	CONSTRAINTS
Deployment	Do not pull red ring on Cosmic Ray Detector Sheets while the RTG is in the vicinity of the LM
	Describe the amount of lunar dust on the visible thermal plates. Excessive dust exposure may require early retrieval.
Retrieval	Detector panels should be carefully protected from dust during removal from the frame and folding.

2k) SWC (Solar Wind Composition)

PARAMETER	CONSTRAINTS
SWC Deployment	Deploy the SWC 60 to 100 feet from the LM.
SWC Orientation	Orient the SWC facing the sun.
SWC Leveling	Level the SWC in a vertical position.
SWC Alignment	Align the SWC to within 30 degrees of the sun line.

5.3 Equipment Decals

Decals are provided as required to supplement the crew cuff checklists and to provide detailed information for tasks that require step-by-step operations. Figure 5.3-1 shows the decals for the lunar surface cameras and the lunar surface drill. Figure 5.3-2 shows the decal attached to the Far UV Camera giving initial setup procedures and retargeting data for each EVA.

Front

TO SET UP FAR UV CAMERA

1. PULL PINS (3) -- LEGS FALL
2. ELEVATE CAMERA UNTIL LEGS LATCH
3. VERIFY LEGS LATCHED
4. POINT CAMERA DOWNSUN
5. IMBED LEGS IN GROUND, STABILIZE CAMERA
6. REMOVE BATTERY (2 PINS) - DEPLOY IN SUN TO SOUTH
7. PULL AZIMUTH PIN (1) BY AZIMUTH RELEASE
8. PULL ELEVATION PINS (2) & PLATE PIN (1)
9. CHECK AZIMUTH ZERO, CAMERA POINTS DOWNSUN

IF AZ NOT ZERO:
- AZIMUTH RELEASE - RELEASE
- POINT BARREL DOWNSUN
- AZIMUTH RELEASE - LOCK
- UNLOCK AZIMUTH SCALE (THUMBSCREW)
- ZERO SCALE
- LOCK AZIMUTH SCALE

10. REMOVE PROTECTIVE COVER
11. LEVEL CAMERA (BUBBLE): KNOB 2 CCW KNOBS 1 & 3 TO LEVEL, LOCK DOWN 2 CW OR - LEVEL BY ADJUST LEG DEPTH IN GROUND
12. SET TARGET 1 (AZ - 14° EL - 48°)
13. POWER SW - ON
14. VERIFY GEAR TRAIN MOVES (ON CASSETTE)

CAUTION - KEEP AWAY FROM DOWNSUN OF CAMERA

Back

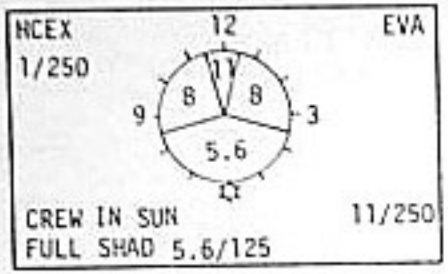
PUNCH RESET BEFORE EACH SETTING

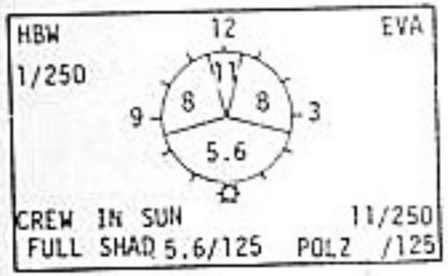
	SETTING AZIMUTH	SETTING ELEVATION	
EVA 1			
1. INITIAL SETTING	14	48	MILKY WAY CENTER
2. BEFORE ALSEP	54	77	EARTH, GEOCORONA
CENTER EARTH IN SIGHT, READ AZ & EL TO MSC.			
UNLOCK AZ CIRCLE & PLACE ON 54 IF IT IS NOT THERE.			
WAIT UNTIL MODE CHANGE (2-1/4 min)			
PUNCH RESET - COUNT 15 SEC AFTER FILM ADVANCE			
PUNCH RESET - COUNT 5 SEC AFTER FILM ADVANCE			
PUNCH RESET - COUNT 1 SEC AFTER FILM ADVANCE			
PUNCH RESET			
3. RETURN TO LM	126	33	N7317GP
4. BEFORE INGRESS	230	53	N 134 CLUSTER
EVA 2			
5. AFTER EGRESS	91	79	GEOCORONA, BOW CLOUD
6. BEFORE TRAV	274	14	LMC
7. RETURN TO LM	310	56	PAVO GRP
8. BEFORE INGRESS	137	39	A2634 CLUSTER
EVA 3			
9. AFTER EGRESS	198	38	N1068 GP
10. BEFORE TRAV	237	28	FORNAX CLUSTER
11. RETURN TO LM	84	27	CYGNUS NEBULA

PUNCH RESET 4 TIMES AND REMOVE CASSETTE (PULL PIN & TWIST CASSETTE CW) FOR RETURN TO EARTH.

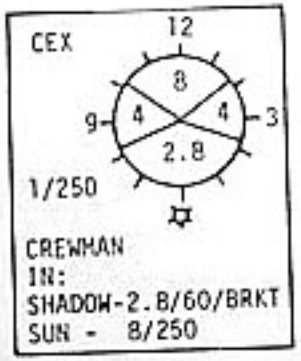
Figure 5.3-1 Far UV Camera Decal

This decal is printed on both sides of a cronapaque sheet, which is attached to the Far UV Camera by a velcro strap.





These decals are affixed to the CDR and LMP Hasselblad Electric Data Cameras.



This decal is affixed to the lunar surface Data Acquisition Camera.

1. PUSH SWITCH TO TEST
2. PULL PIN 2 (LEFT SIDE)
3. TURN LOCK 3(BOTTOM RIGHT)CCW
4. TURN LOCK 4(RIGHT SIDE)CCW
   PULL UP-PULL LANYARD TO RIGHT
5. REMOVE & INSTALL HANDLE-BLACK
   PIN UP
6. REMOVE RACK - LIFT VERTICALLY
7. PUSH LEG FROM CLIP
8. EXTEND & LOCK LEGS (3)
9. PLACE RACK ON SURFACE
10. PULL PIN 5 - SWING COLLAR UP
11. REMOVE DRILL

These decals are affixed to the Lunar Surface Drill thermal cover.

REMOVE THERMAL COVER
BEFORE DRILLING

Figure 5.3-2 Equipment Decals

5.4 EMU Malfunction Procedures

The following Cuff Checklist pages contain the malfunction crew procedures for eleven (11) EMU malfunctions, for loss of voice communications through the LCRU on the LRV and BSLSS donning, activation and doffing procedures. These pages are included as the last section in both the CDR and LMP Cuff Checklist.

EMU 3
EMU 1,2

EMU MALFUNCTIONS

EMU MALF-1
3/20/72

EMU 1: Vent Flag-P, Tone-On

Fan-Off/On
If Flag Still On After 10 Sec:
OPS-On, Purge Vlv-LO (Fan Fail)

EMU 2: Pres Flag-O, Tone-On

OPS-On
If Pres Flag Clears:
Cap PRV, OPS-Off/On
If Cuff Gage Stable, OPS-Off (PRV Fail)
If Cuff Gage Decays w/OPS Off, (Leak Or PLSS Reg Fail)
If Pres Flag Still On: Verify Cuff Gage & TM >3.4, OPS-Off (Pres Sens Fail)

EMU 1,2
EMU 3

EMU 3: O2 Flag-O, Tone-On

Ck Cuff Gage & PLSS O2 Qty
If Cuff Gage >4.0: OPS-On, PLSS O2 - Off (PLSS Reg Fail)
If Cuff Gage <3.7, OPS-On
Cap PRV, OPS-Off/On
If Cuff Gage Stable, OPS-Off (PRV Fail)
If Cuff Gage Decays w/OPS Off, (Leak Or PLSS Reg Fail)
If PLSS O2 Qty Decr: OPS-On(Leak)

EMU MALF-2
3/20/72

EMU MALF-3

3/20/72

EMU 4: H2O Flag-A, Tone-On(Prim)

Ver Prim H2O - Open, If Open
Ver TM For Subl Restart Or Aux H2O Act: Subl Restart: Prim H2O Clsd, Diverter-MAX, Wait 5 Min, Diverter-MIN, Prim H2O - Open, Wait 4 Min Or H2O Flag Off, Diverter As Desrd (Subl Brkthru)
Aux H2O Act: Diverter-MIN, Aux H2O - Open, Wait 4 Min Or H2O Flag Off, Diverter As Desrd (Prim H2O Depletion)

If TM Does Not Ver Subl Brkthru Or Prim H2O Depletion: (H2O Press Sw Fail)

If Add'l Cooling Reqd, Act. BSLSS (Subl Degrd) If No BSLSS, OPS - On, Purge Vlv-Hi

If Prim H2O - Clsd: Diverter-MIN, Prim H2O - Open, Wait 4 Min Or H2O Flag Off, Diverter As Desrd

EMU 4 | EMU 4

EMU 4A: H2O Flag-A, Tone-On(Aux)

Ver Prim & Aux H2O-Open, If Open & Add'l Cooling Reqd, Act. BSLSS (SUBL Degrd)[If No BSLSS OPS-On, Purge Vlv-Hi]

Ver TM For Subl Restart: Prim H2O-Clsd, Diverter-MAX, Wait 5 Min, Diverter-MIN, Prim H2O-Open, Wait 4 Min Or H2O Flag Off, Diverter As Desrd (Subl Brkthru)

If TM Does Not Ver Subl Brkthru: (H2O Press Sw Fail or H2O Blocked Or Depleted)

If Prim Or Aux H2O-Clsd: Diverter-MIN, Prim & Aux H2O Open, Wait 4 Min Or H2O Flag Off, Diverter As Desrd

EMU MALF-4

3/20/72

EMU 4 | EMU 4

EMU MALF-5

3/20/72

EMU 5: Tone-On, No Flags

Ck Cuff Gage
If <3.4: OPS-On (Pres Flag Fail & Leak Or PLSS Reg Shift)
If >3.4: After Tone Off, Cycle Mode Sel A/AR
If Tone On Again:
Fan-Off 5 Sec,
If No Vent Flag: OPS-On, Purge Vlv-Lo (Vent Flag & Fan Fail)
If Vent Flag On: Fan-On, Check PLSS O2 Qty, If > Than Normal Decr Rate: OPS-ON (O2 Flag Fail & EMU Leak)
If No Tone & TM Confirms Low H2O Press (H2O Flag Failed & H2O Sys Problem-Go To EMU 4 If PRIM In Use, Or 4A If AUX In Use)
If TM H2O Press Good (Transient Cond Or Tone Fail)

EMU 5 | EMU 6,7

EMU 5 | EMU 6,7

EMU 6: Cuff Gage <3.7, (All Other Indicators OK)

OPS-On
If Cuff Gage Increase, (PLSS Reg Shift)
If No Gage Increase, Ver TM >3.7, OPS - Off (Cuff Gage Fail)

EMU 7: PLSS O2 Qty Ind Abnormal

Ck Cuff Gage Or O2 Flag-O
If Cuff Gage >4.0, OPS-On, PLSS O2-Off (PLSS Reg Fail)
If Cuff Gage <3.7 Or O2 Flag-O, OPS-On (Leak)
If No Apparent Failure, Ver TM (Ind Or X-ducer Fail Or Leak)

EMU MALF-6

3/20/72

EMU MALF-7

3/20/72

EMU 8: Cuff Gage >4.0

If O2 Flag-O Or PLSS O2 Decr, OPS-On, PLSS O2-Off (PLSS Reg Fail)

If Neither, Ver TM (Gage Fail)

EMU 9: Loss Of Pump Noise

If No Side Tone, OPS-On, Purge Vlv-LO, Act. BSLSS (Power Fail)[If No BSLSS, OPS-On, Purge Vlv-Hi]

If Sidetone OK, Ver Pump-On. If Add'l Cooling Reqd, Act. BSLSS (Pump Fail)[If No BSLSS, OPS-On, Purge Vlv-Hi]

EMU 8,9

EMU 10

EMU 10: Cooling Inadequate

Ver Diverter-MAX & Pump-On

Ver Prim & (If On Aux) Aux H2O Open: If Open, Act. Gas Trap 5 Sec, Wait 3 Min, If Add'l Cooling Reqd, Act. BSLSS (Flow Restr, Subl Or Pump Degrd, Or Heat Leak) [If No BSLSS, OPS-On, Purge Vlv-Hi]

Ver TM For Aux H2O Act: Diverter MIN, Aux H2O-Open, Wait 4 Min, Diverter As Desrd (Prim H2O Depletion)

If Prim Or (If On Aux) Aux H2O Clsd: Diverter-MIN, Prim & (If On Aux) Aux H2O-Open, Wait 4 Min, Diverter As Desrd (H2O Flag Fail)

EMU 8,9

EMU 10

EMU MALF-8

3/20/72

EMU MALF-9

3/20/72

EMU 11: Loss Of Voice Comm (LM)

Ck Vol Controls (Wheel A-Hou, Blade-B-EVA)

Cycle PTT Sw-MAIN & MOM

CDR Mode Sel To B, LMP To A (Hand Signals)

If No Comm, CDR To A, LMP To B

LCRU 1: Loss Of Voice Comm (LCRU)

If no comm between crewmen, perform EMU 11.

If no comm with MSFN:

- Ck Vol Control (Wheel-A-Hou)
- Repoint LCRU antenna
- Select alternate mode--
  - MODE - PM1/WB or FM/TV
  - Point selected antenna
- LCRU cb - close
- LRV AUX cb - close
- LCRU POWER Sw - alt pos (INT/EXT)

EMU11.LCRU | BSLSS-DON

BSLSS Don And Activate

1 Unstow BSLSS
2 Conn Tether Between Crewmen: BSLSS H2O Flow Divider At Good PLSS, Good PLSS On RH Side
3 Remove Dust Cover From BSLSS H2O Flow Divider
4 Discon Good PLSS H2O From PGA
5 Conn BSLSS H2O Flow Divider To PGA With Good PLSS
6 Failed PLSS Pump-Off
7 Discon Failed PLSS H2O From PGA & Secure
8 Discon BSLSS H2O From BSLSS H2O Flow Divider
9 Conn BSLSS H2O To PGA With Failed PLSS
10 Conn Good PLSS H2O To BSLSS H2O Flow Divider

EMU MALF-10

3/20/72

EMU11.LCRU | BSLSS-DON

EMU MALF-11

3/20/72

BSLSS-DOF

BSLSS Doff

1 Discon BSLSS From Failed PLSS
  PGA
2 Discon Tether From Both PGA's
3 Discon PLSS H2O From BSLSS
4 Discon BSLSS From PGA & Discard
5 Conn Good PLSS H2O To PGA
6 Ingress LM

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