MSC-04105

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SCIENTIFIC EXPERIMENTS CONTINGENCY PLANNING AND PROCEDURES

MISSION J-1/APOLLO 15

FINAL

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

June 1, 1971

Revised July 12, 1971

MSC FORM 2026A (REV MAY 68)

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO ATTN OF: TD5

JUL 15 1971

MEMORANDUM

TO: See Distribution

FROM: TA/Deputy Director of Science and Applications

SUBJECT: Scientific Experiments Contingency Planning and Procedures, Mission J-1/Apollo 15

This change notice is revision A and should be incorporated into the basic document dated June 1, 1971, according to the change instructions sheet enclosed. Incorporation of revision A will make this document current as of July 12, 1971.

Comments regarding the Scientific Experiments Contingency Planning and Procedures document for Mission J-1/Apollo 15 should be directed to the Science Requirements and Operations Branch (TD5), Manned Spacecraft Center, Houston, Texas 77058.

James A. Lovell

Enclosure

Enclosure

SCIENTIFIC EXPERIMENTS CONTINGENCY PLANNING AND PROCEDURES

MISSION J-1/APOLLO 15

CHANGE INSTRUCTION SHEET

Update the Scientific Experiments Contingency Planning and Procedures Document for Mission J-1/Apollo 15 with the following instructions.

Remove and replace the following changed pages:

Page 3

Page 4

Remove the following pages:

Page 6
Page 7
Page 8
Page 9
Page 10
Page 11
Page 12

Add the following new pages:

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Page 7
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SCIENTIFIC EXPERIMENTS CONTINGENCY PLANNING AND PROCEDURES

MISSION J-1/APOLLO 15

Prepared for the

Science Requirements and Operations Branch
Science Missions Support Division

Science and Applications Directorate
Manned Spacecraft Center
Houston, Texas

FINAL

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D. K. Slayton, Director
Flight Crew Operations
Directorate

Any comments or questions on this document should be forwarded to J. R. Bates or G. P. Barnes, Science Requirements and Operations Branch, TD5, extension 5851 or 5028.

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ILLUSTRATIONS

SCIENTIFIC EXPERIMENTS CONTINGENCY PLANNING AND PROCEDURES

MISSION J-1/APOLLO 15

1.0 GENERAL

1.1 ASSUMPTIONS

a. Launch delays of more than a few days may require replacement or adjustment of some experiment hardware.

b. For earth orbit mission case, the altitude and inclination will both be increased within operational limitations.

c. An experiment may be operated for engineering tests only, if orbit will not allow for science data collection.

d. A lunar flyby mission will not allow for proper attitude and operating time for SIM experiment operations.

e. If the mission is off-nominal so that it appears unlikely that there will be no more than one surface EVA, in order to increase the possibility of collecting Hadley Rille material in the geology samples, the ALSEP should be deployed in a direction toward the nearest available and recognizable Hadley Rille material.

1.2 TIME CONSTRAINT

For any malfunction on a scientific task: spend a maximum of 10 minutes on malfunction procedures, then abandon. Additional time may be allocated on certain malfunctions before resulting in total experiments abandonment. This additional time will be a real-time decision based on consumables and timeline constraints.

1.3 HOLD POINTS

The sequence of the experiment deployment or operation may be stopped after the completion of any one of the following hold points, to be continued at some time later by going to the next series of tasks.

a. Offload LRRR and emplace LRRR Array in and facing the sun.

b. Remove ALSEP sub-packages #1 and #2; close SEQ bay door; emplace ALSEP sub-packages on the lunar surface facing the sun.

c. Tilt fuel cask; dome not removed. Remove drill from MESA and depress microswitch on battery to confirm operation.

d. Remove dome; fuel RTG sub-package No. 2; carry ALSEP and LRRR to deployment site; remove subpallets from sub-package No. 2; place SIDE or HFE in sun but do not deploy, carry sub-package No. 1 to emplacement site, interconnect SIDE, HFE, and RTG cables to Central Station, rotate sub-package No. 1 (do not actuate shorting switch), emplace LRRR facing the sun.

e. Deploy PSE.

f. Deploy SWS.

g. Partially deploy LSM (including legs), and rough sun align.

h. Remove HFE, deploy electronics package and first probe. Complete hole #1, insert probe, and return drill to MESA and cover.

i. Raise sunshield; remove gimbal box from SIDE subpallet, mount and aim antenna, activate shorting plug with UHT.

j. Deploy second probe. Complete hole #2, insert probe and return drill to MESA and cover.

k. Remove SIDE/CCGE from subpallet and complete SIDE/CCGE deployment.

l. Complete LSM deployment.*

m. Deploy LRRR.

n. Recheck aiming mechanism alignment and document deployment with photographs.

* Shorting plug can apply and remove short to RTG before and after experiment deployment if deemed necessary. Applying short is not recommended since experiments can be commanded to standby power OFF so no hazard would exist for astronauts.

1.4 EXPERIMENT RESCHEDULING

In the event of a change in mission profile, e.g., no TLI capability-earth orbit only, deployment and operation of non-lunar surface experiments will be affected. Table 1 shows which experiments may be scheduled for alternate missions. Lunar surface experiments are covered in Tables 2 through 19. Lunar orbit experiments are covered in Tables 20 through 27.

Experiments should be exercised during any alternate mission to verify hardware operation and to evaluate procedures.

1.5 EXPERIMENT PRIORITIES

Mission priorities for Lunar Surface Experiments Deployment, Orbital Photography and Lunar Geology Investigation are defined as follows:

LUNAR SURFACE ACTIVITIES

PRIORITY	OBJECTIVE/EXPERIMENT
1.	Contingency Sample Collection
2.	Documented Samples at Apennine Front
3.	Apollo 15 ALSEP • HFE • LSM • PSE • CCGE • SWS • SIDE • Lunar Dust Detector
4.	Drill Core Sample
5.	Laser Ranging Retro-Reflector
6.	Lunar Geology Investigations
7.	Solar Wind Composition
8.	Soil Mechanics

1.5 (CONT'D)

LUNAR ORBITAL ACTIVITIES

PRIORITY	OBJECTIVE/EXPERIMENT
1.	Gamma-Ray Spectrometer
2.	X-Ray Fluorescence
3.	SM Orbital Photographic Tasks
4.	Subsatellite • Particle Shadows/Boundary Layer • Magnetometer • S-Band Transponder
5.	Bistatic Radar
6.	S-Band Transponder (CSM/LM)
7.	Alpha Particle Spectrometer
8.	Mass Spectrometer
9.	UV Photography - Earth and Moon
10.	Gegenschein from Lunar Orbit
11.	CM Photographic Tasks

TABLE 1. Science Data Return Matrix for Alternate Missions

EXPERIMENT	MISSION TYPE				
	SL	EO	LF	LO/ NSE	NTE
SM Orbital Photographic Tasks:					
o 24-Inch Panoramic Camera	G[3]	G[1]	N	G	N
o 3-Inch Mapping Camera	G[3]	G[1]	N	G	N
o Laser Altimeter*	G	N	N	G	G
CM Photographic Tasks	G	G[1]	G[4]	G	G
UV Photography - Earth and Moon	G	G[4]	G[4]	G	G
Gegenschein from Lunar Orbit	G	N	N	G	G
Gamma-Ray Spectrometer	G[5]	N	G[4]	G	G
Alpha Particle Spectrometer*	G[5]	N	G[4]	G	G
X-Ray Fluorescence	G[5]	G[1]	G[4]	G	G
Mass Spectrometer	G[5]	N	G[4]	G	G
S-Band Transponder (CSM/LM)	G	N	N	G	N/A
Subsatellite:					
o Magnetometer*	N[2]	N	G[4]	G	N/A
o Particle Shadows/Boundary Layer	N[2]	G[1]	G[4]	G	N/A
o S-Band Transponder	N[2]	N	N	G	N/A
Bistatic Radar	G	N/A	N/A	G	N/A
*No useful science data in earth orbit					

LEGEND:

SL - Scrubbed launch: can be recycled without experiment effect.
EO - Earth Orbit
LF - Lunar Flyby
LO/NSE - Lunar Orbit/No Surface EVA
NTE - No Transearth Coast EVA

X - TBD
G - Go
N - No/Go
N/A - Not Applicable

Note: 1. Objectives may be changed if operated during alternate missions.
2. Batteries may have to be recharged.
3. Film may require reloading.
4. Possible particle and/or degraded data.
5. Dependent upon time period (calibration sources may have to be renewed).

TABLE 2. EVA DECISIONS

TABLE 2. EVA DECISIONS

TABLE 2.1 - OFF NOMINAL EVA PLANNING

TABLE 2. EVA Decisions

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Crew unable to locate touch-down point in the landing ellipse.	Crew	Make visual observations and describe features around the LM.	
		MCC	1. Compare television images and the astronauts' description of features to the overall features in the map package.	
		MCC/ Crew	2. Revise ALSEP deployment and traverse plans as required	

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Not enough time for EVA.	Crew	Make careful observations and descriptions of surface through LM windows. Numerous still camera photos should be taken with both black and white and color films from both windows. Photos with polarizing filter in three different positions should be made.	
		MCC	Study landing area on maps and submit pertinent questions relating to surface smoothness or roughness, the contours of surface size of rocks and craters in area.	

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Time for brief EVA. (1 or 2 men)	Crew	1. Repeat activity in Event 2 above.	
		Crew	2. Collect contingency sample.	
		Crew	3. If possible, take a panorama of area and shots of surface nearby. Take shots of surface under LM descent engine and around footpads.	

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	EVA 1 only. (2 men)	Crew	1. Collect contingency sample.	
		Crew	2. Collect documented samples at the Apennine Front.	Photograph and describe geological features as well as collect samples (including the core samples).
		Crew	3. Deploy ALSEP as normal and according to priority listing in Mission Requirements Document, but in direction toward the nearest available and recognizable Hadley Rille material.	
		Crew	4. Perform lunar geology investigation during return traverse from ALSEP site.	Cut down the number of stations and distance attempted.
		Crew	5. Deploy LRRR	LRRR science data may be degraded if deployed less than 300 feet from LM.

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	One Man EVA 1. (No EVA 2 or 3.)	Crew	1. Collect contingency sample.	
		Crew	2. Collect documented samples at the Apennine Front.	
		Crew	3. Deploy ALSEP as normal and according to priority listing in Mission Requirements Document, but in direction toward the nearest available and recognizable Hadley Rille material.	
		Crew	4. Perform lunar geology investigation during traverse from ALSEP site.	Cut down the number of stations and distance attempted.
		Crew	5. Deploy LRRR.	LRRR science data may be degraded if deployed less than 300 feet from LM.

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	One man EVA 1 (EVA 2 planned, no EVA 3).	Crew	1. Collect contingency sample.	
		Crew	2. Collect documented sample at the Apennine Front.	
		Crew	3. Deploy ALSEP as normal.	
		Crew	4. Perform lunar geology investigation during return traverse from ALSEP site.	Cut down the number of stations and distance attempted.
		Crew	5. Deploy LRRR.	LRRR science may be degraded if deployed less than 300 feet from LM.
		Crew	6. Deploy SWC.	

TABLE 2. EVA Decisions (Cont'd)

TABLE 2.1 - OFF NOMINAL EVA PLANNING

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
7.	One man EVA 2 or EVA 3.	Crew	1. If LRV is usable:	
			a. Perform geology sample collection and documentation.	Collect material.
			b. Take panorama shots of traverse area.	
		Crew	2. If LRV is not usable.	Crew will have to carry HTC.
			a. Perform geology sample collection and documentation.	Crew may abbreviate documentation requirements for samples if MCC concurs.
			b. Take panorama shots of traverse area.	

TABLE 2. EVA DECISIONS

TABLE 2.2 - OFF NOMINAL LANDINGS

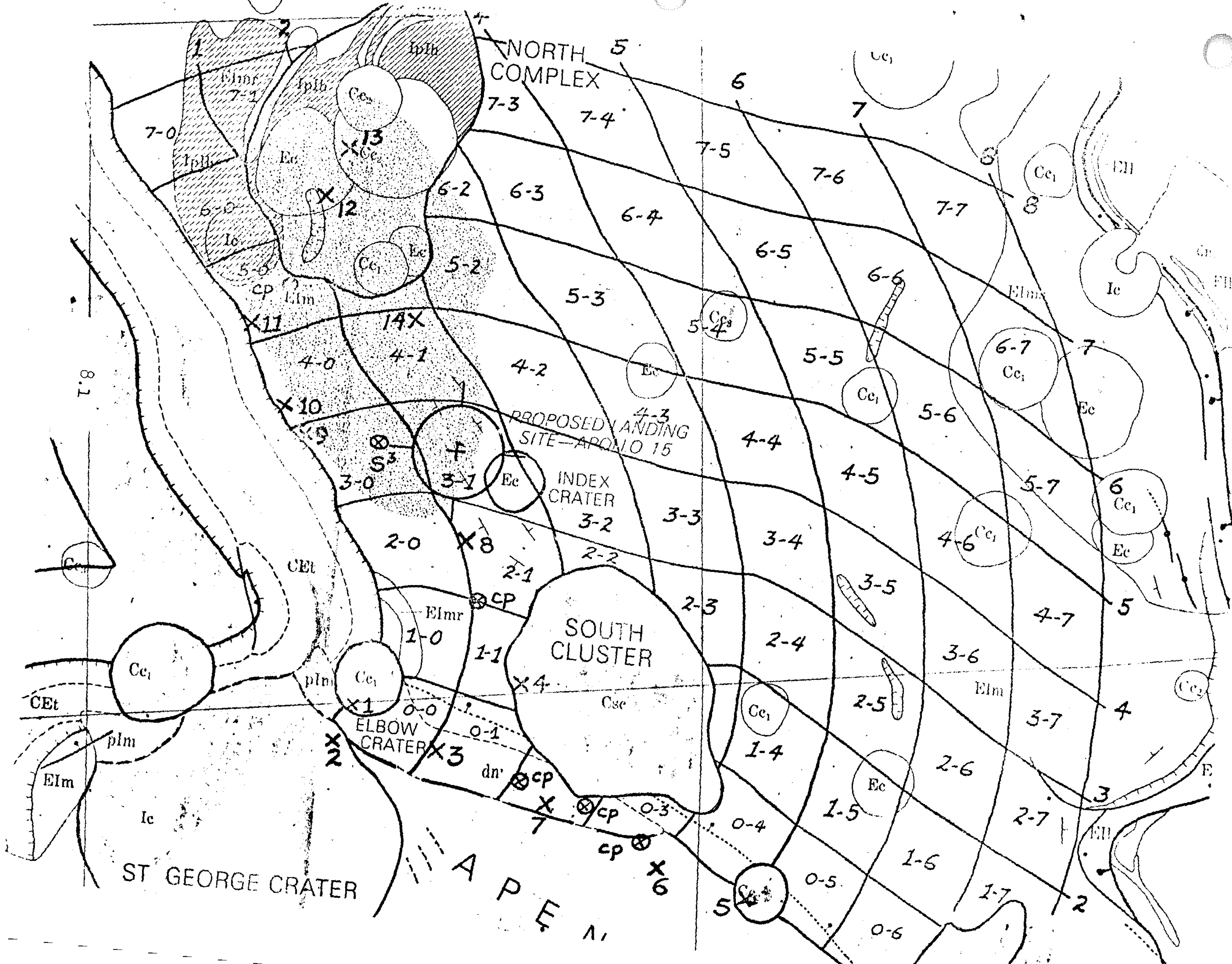

NORTH COMPLEX
PROPOSED LANDING SITE—APOLLO 15
INDEX CRATER
SOUTH CLUSTER
ELBOW CRATER
ST GEORGE CRATER
A P E N
8.1

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

LANDING POINT CONTINGENCIES

Contingencies have been selected for the following cases:

1. Dispersions in normal landing ellipse 35 (within 3-1) N-S $\pm$ 1 bm.
   E-W $\pm$ 700 m.

2. Dispersions within no noun 69 ellipse 35
   N-S $\pm$ 1 bm.
   E-W $\pm$ 3.5 bm.

3. Selected points of interest around TCT for no landmark tracking N-S $\pm$ 7.8 bm.
   E-W $\pm$ 3.1 bm.

4. Selected points of interest around the TCT for west landing point.

Limit: 7.6 km north of front to do 1 hour of front geology.

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

LANDING POINT (GRID LOCATION)	EVA IMPACT AND ACTION		
	EVA - 1	EVA - 2	EVA - 3
2 - 0	Gain time for front exploration (approx. 10 min.)	Essentially nominal (move Station 8)	Addition of 1 bm Reduce 10 to 15 minutes from North Complex
2 - 1	Essentially nominal	Essentially nominal (move Station 8)	Same as 2 - 0
2 - 2	Same as 3 - 2	Same as 3 - 2	Same as 3 - 2

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

LANDING POINT (GRID LOCATION)	EVA IMPACT AND ACTION EVA - 1	 EVA - 2	 EVA - 3
3 - 0	No significant impact Adjust traverse distances and times	No significant impact Station 5 may be beyond distance limit	No significant impact
3 - 1	Normal landing point.	Normal landing point.	Normal landing point.
3 - 2	Minor adjustment to distances	Minor adjustments to distances	Shorten Station 14 to accommodate tasks from EVA 1, 2.
3 - 3	Do traverse on east side of sec crater cluster Do ALSEP on Refern.	a) Approx. $1\frac{1}{2}$ hr. at Front (1,2,3) + approx. 1 hr. 24 min. of Stop 8 b) Approx. $1\frac{1}{2}$ hr. at 1, 2, 3 + traverse along Front toward Stop 6. + Stop 8	a) North Complex - Sta.12 & 13 + Mare Stops within 3.7 bm. b) Rille Stops only (9,10,11) + Mare Stops within 3.7 bm.
3 - 4	Same as 3 - 3	a) Approx. $1\frac{1}{2}$ hr. at Front (1, 2, 3) + Rille tasks 9, 10, 11 one bm. south of planned site. + Station 8 b) Approx. $1\frac{1}{2}$ hr. at Front + traverse along Front toward Stop 7 + Stop 8	a) North Complex - Sta. 12 & 13 + Mare Stops within 3.7 bm. b) Rille Stops only (9, 10, 11) + Mare stops within 3.7 bm.

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

LANDING POINT (GRID LOCATION)	EVA IMPACT AND ACTION		
	EVA - 1	EVA - 2	EVA - 3
4 - 0	Adds 16 min driving time 16 min. of tasks at end of EVA 1. Accomplish later EVA's.	Adds 16 min. driving time a) Drive by Stop 4 and return after Front Stops. If it looks important. b) Do all or part of 8 depending importance of 4. c) May not reach Sta. 5 d) Add in EVA 1 LM tasks at LM. Move 8 in close to LM	Pursue normal EVA - consider further N. Complex and/or further exploration up the Rille
4 - 1	Same as 4 - 0	Same as 4 - 0	Same as 4 - 0
4 - 2	Adds 1 km distance to Front (16 min. driving time) Same as 4 - 0	Same as 4 - 0	Adds 1 km to Rille (8 min. NET drive time) May have to pickup up to 30 min. tasks from EVA Sta. 8. Near LM.
4 - 3	Adds 25 min. driving time. Present ground rules call for deleting 25 min. of post ALSEP.	a) Adds 25 min. drive time on normal EVA 2 traverse. b) Use approach to east of secondary crater cluster means new location for Station 4 (33 min. to front crater.)	Adds 33 min. drive time Delete SSS's Delete 16 min. at 12, 13 Do leftover tasks at LM with LM tasks to eliminate extra stop and allow completion of Sta 8 tasks at same site.

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

LANDING POINT (GRID LOCATION)	EVA IMPACT AND ACTION		
	EVA - 1	EVA - 2	EVA - 3
4 - 4	Adds 41 min. driving time Treat as 45 min. late at Stop 1.	Same as 4 - 3.	Must shorten 9, 10, 11 by 20 minutes. Keep 12, 13 within walk back limit. Stop 14 can be increased by 15 min. because of walk back. Remaining tasks from EVA 1.
4 - 3b	Traverse to South in vicinity of Front crater - Return to deploy ALSEP (50 MN time at Front).	Traverse to Front in vicinity of Elbow and St.George (Sta. 1,2,3) and traverse to Rille (Sta. 9,10,11).	Traverse to North Complex and Mare.
4 - 4b	Same as 4 - 3b. (1 hr. at Front)	Same as 4 - 3b. (1 hr. 3 min. at Front) (1 hr. at Rille)	Same as 4 - 3b.

TABLE 2. EVA Decisions

TABLE 2.2 - OFF NOMINAL LANDINGS

CONTINGENCY LANDING POINT ON WEST SIDE OF RILLE

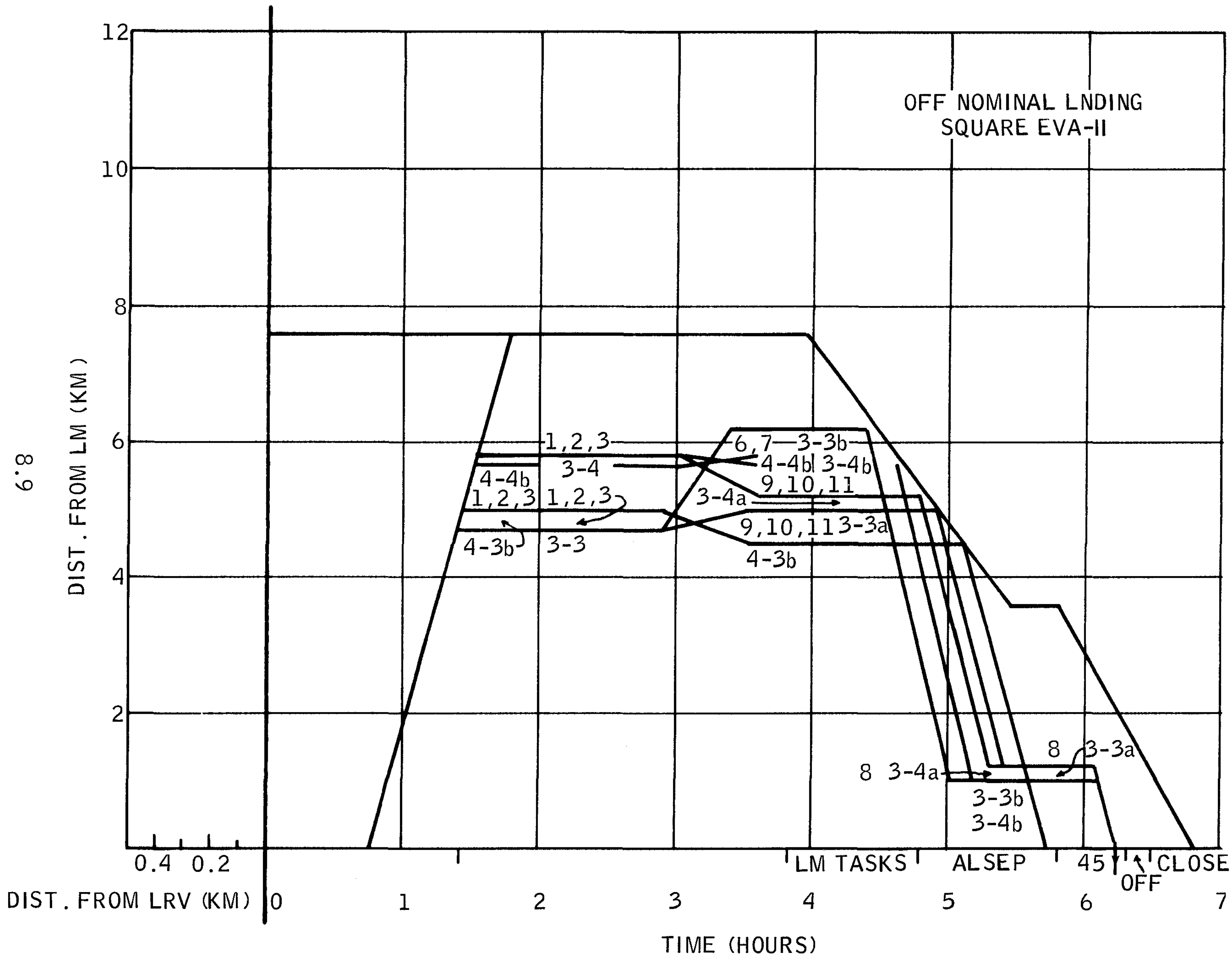
(Degraded descent propulsion)

Prime Targets:

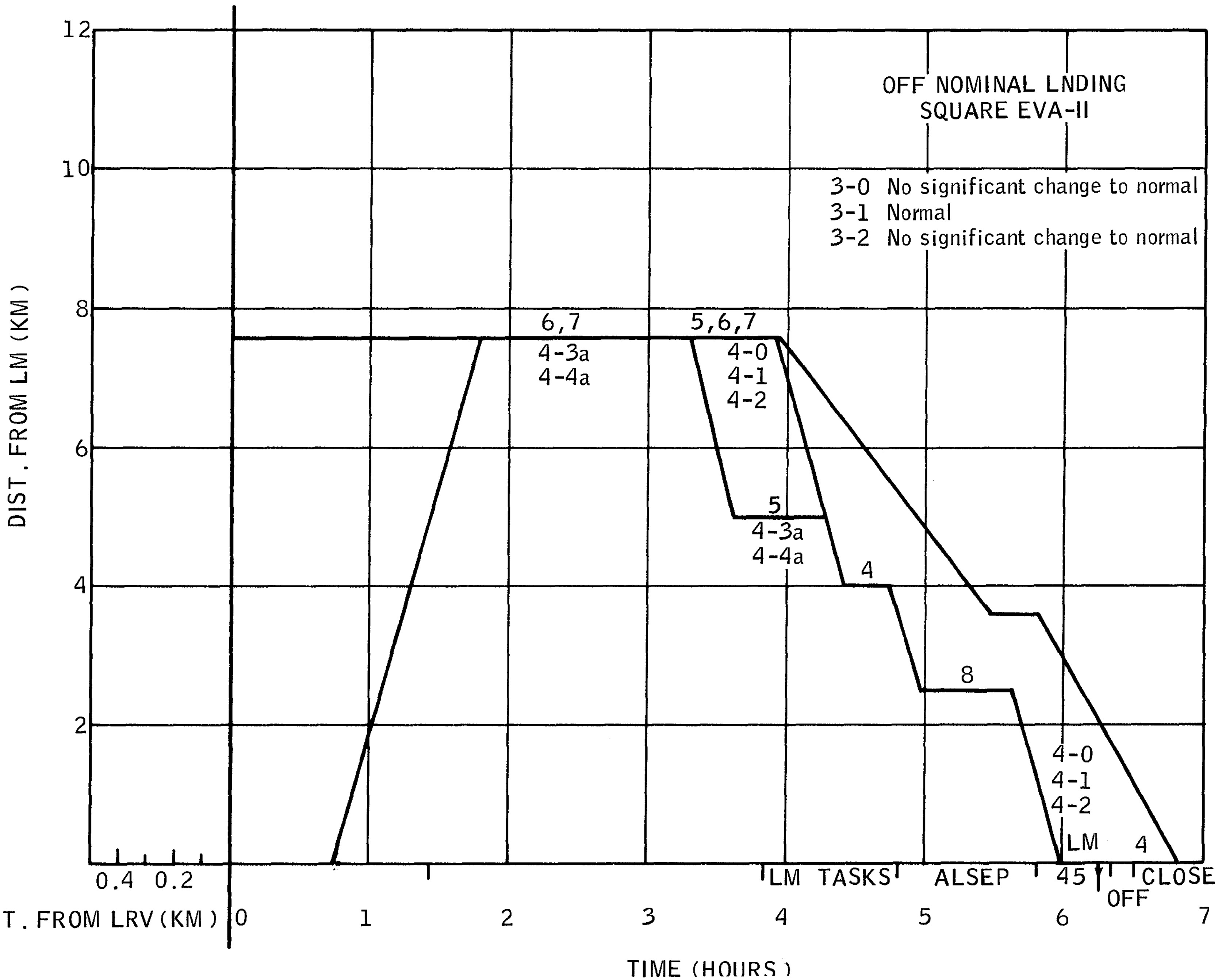
1. Detailed sampling at Bridge Crater to look for Front throwout - breccias - radial sampling.

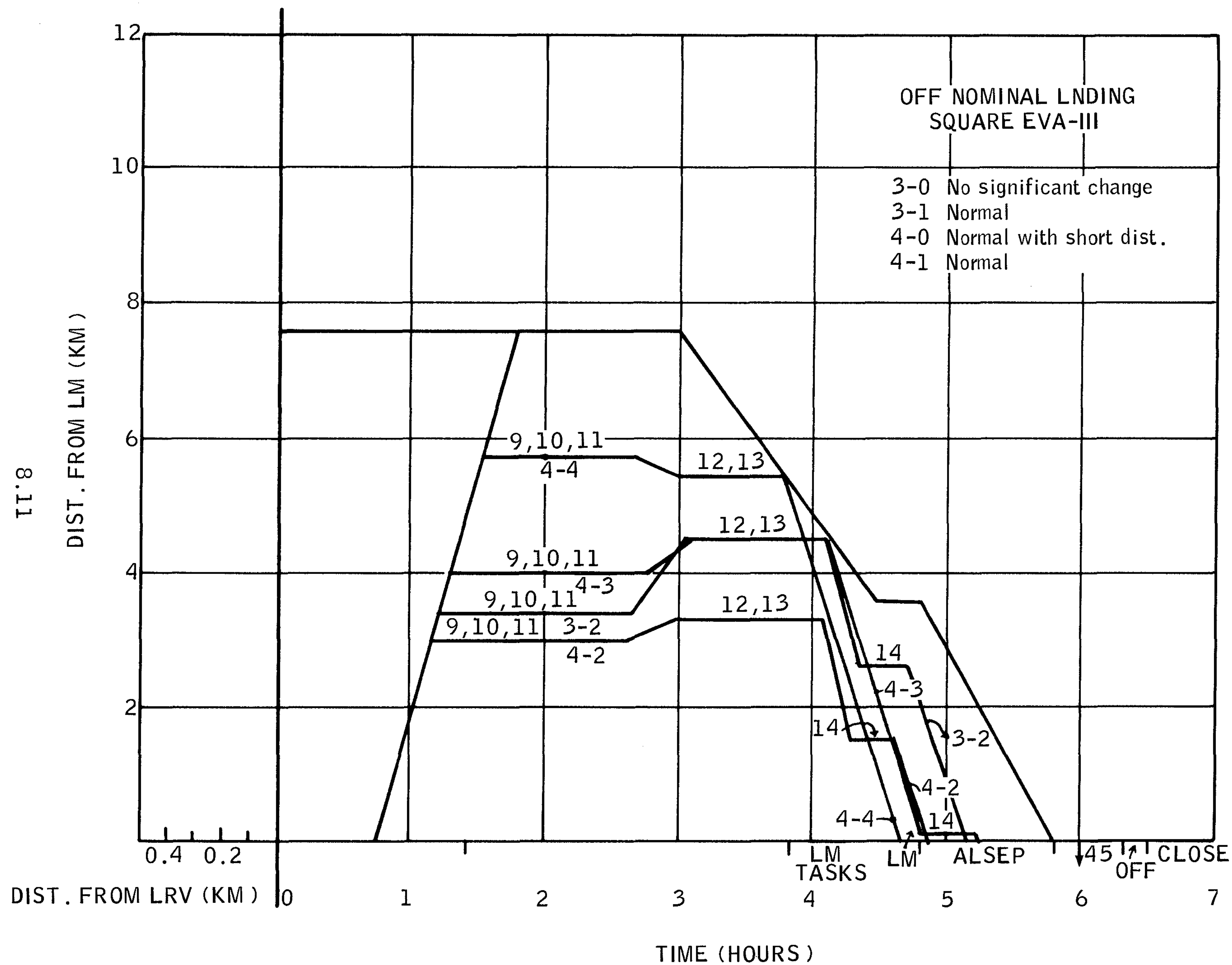
2. Sampling of Mare using craters such as Crook and OS.

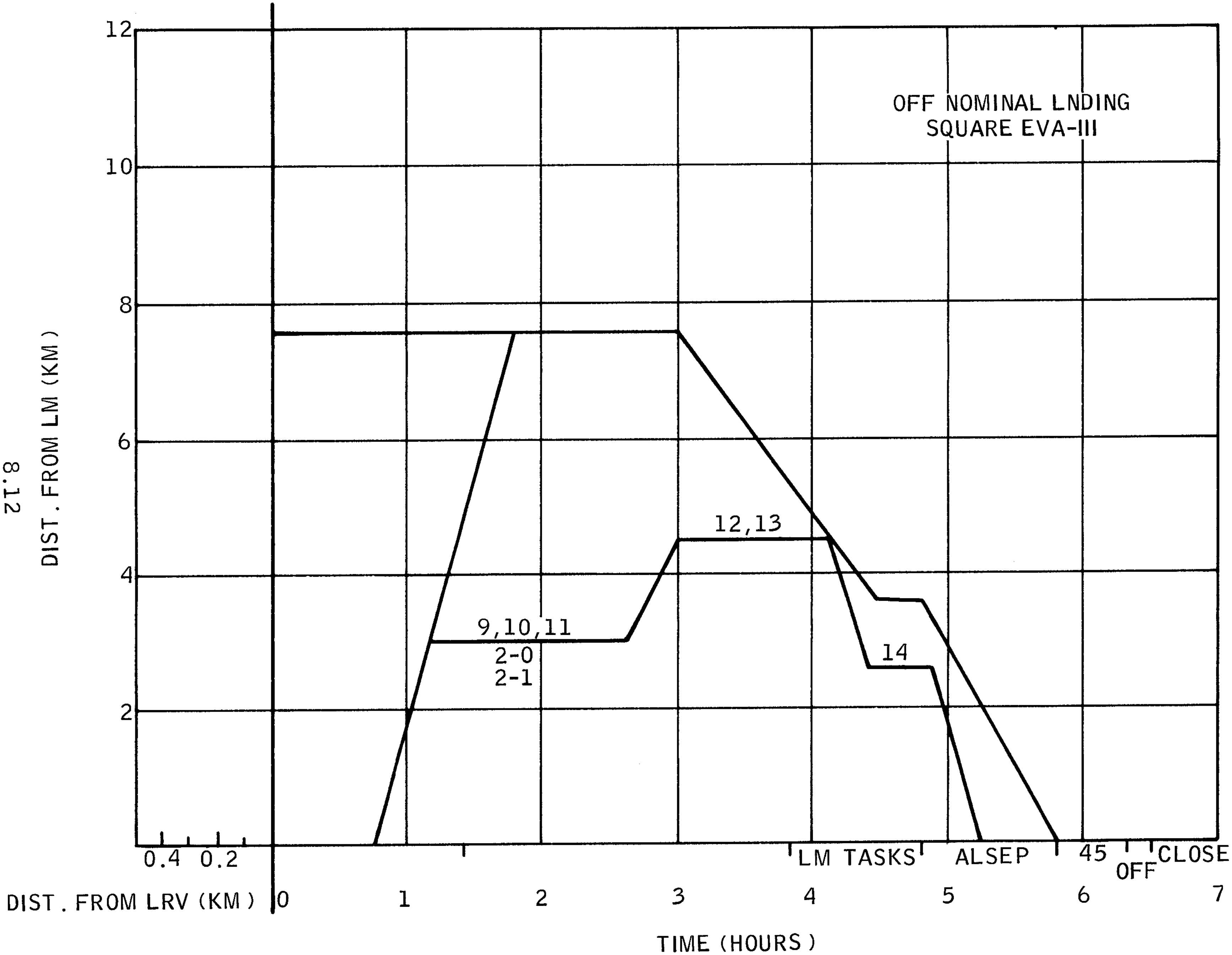
3. Sampling of Rays.



OFF NOMINAL LNDING
SQUARE EVA-II
DIST. FROM LM (KM)
12
10
8
6
4
2
1,2,3
3-4
4-4b
1,2,3
1,2,3
4-3b
3-3
6,7
3-3b
4-4b
3-4b
9,10,11
3-4a
9,10,11
3-3a
4-3b
8
3-3a
8
3-4a
3-3b
3-4b
0.4
0.2
LM TASKS
ALSEP
45
OFF
CLOSE
DIST. FROM LRV (KM)
0
1
2
3
4
5
6
7
TIME (HOURS)


OFF NOMINAL LNDING
SQUARE EVA-II
3-0 No significant change to normal
3-1 Normal
3-2 No significant change to normal
6,7
4-3a
4-4a
5,6,7
4-0
4-1
4-2
5
4-3a
4-4a
4
8
4-0
4-1
4-2
LM
4
LM TASKS
ALSEP
45
OFF
CLOSE
DIST. FROM LM (KM)
12
10
8
6
4
2
0.4
0.2
DIST. FROM LRV (KM)
0
1
2
3
4
5
6
7
TIME (HOURS)


OFF NOMINAL LNDING
SQUARE EVA-III
3-0 No significant change
3-1 Normal
4-0 Normal with short dist.
4-1 Normal
9,10,11
4-4
12,13
9,10,11
4-3
12,13
9,10,11
9,10,11
3-2
4-2
12,13
14
4-3
14
3-2
4-2
4-4
14
DIST. FROM LM (KM)
12
10
8
6
4
2
0.4
0.2
LM TASKS
LM
ALSEP
45
OFF
CLOSE
DIST. FROM LRV (KM)
0
1
2
3
4
5
6
7
TIME (HOURS)



OFF NOMINAL LNDING
SQUARE EVA-III
12
10
8
6
4
2
DIST. FROM LM (KM)
9,10,11
2-0
2-1
12,13
14
0.4
0.2
LM TASKS
ALSEP
45
OFF
CLOSE
DIST. FROM LRV (KM)
0
1
2
3
4
5
6
7
TIME (HOURS)

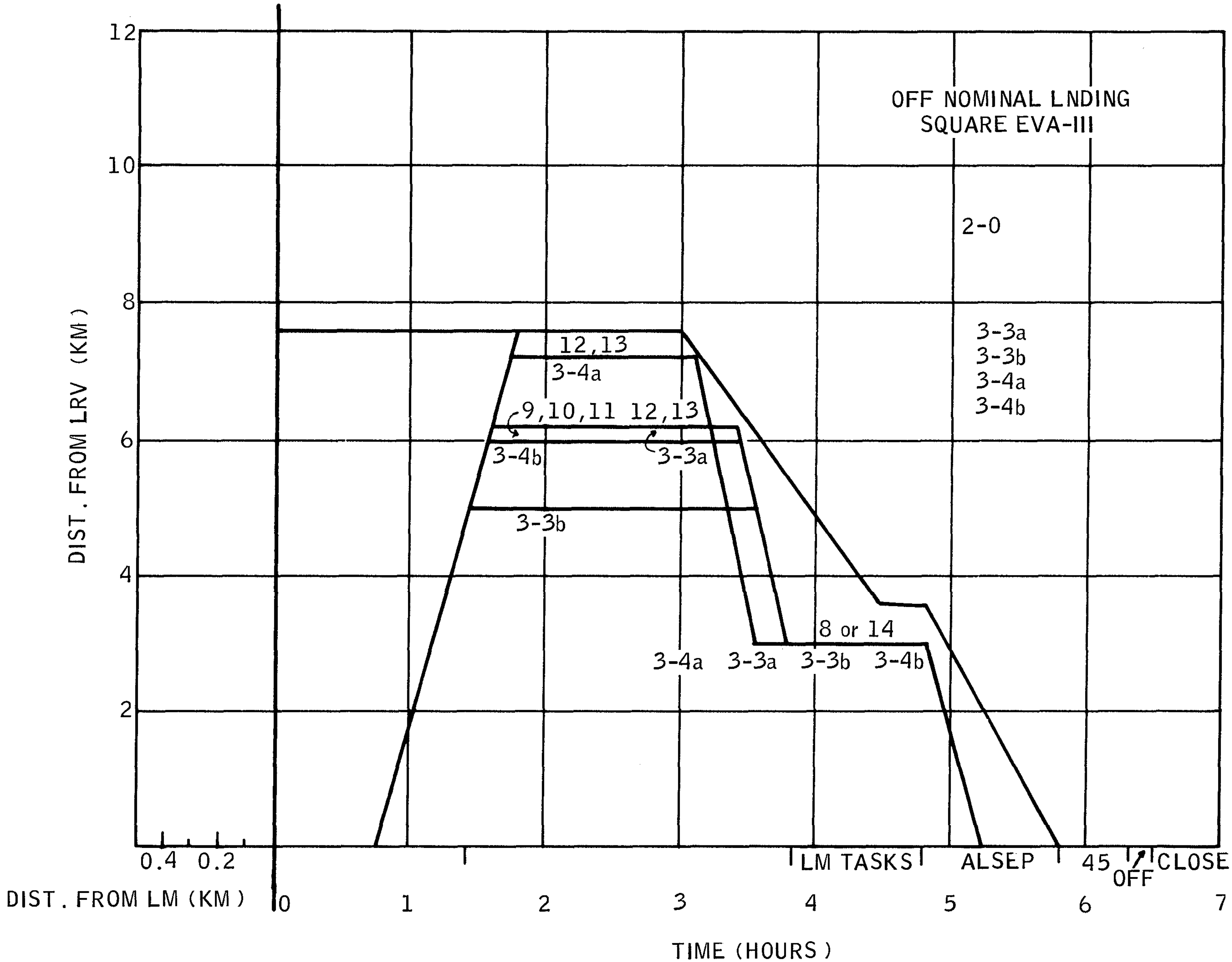

OFF NOMINAL LNDING
SQUARE EVA-III
2-0
3-3a
3-3b
3-4a
3-4b
12,13
3-4a
9,10,11 12,13
3-4b
3-3a
3-3b
8 or 14
3-4a 3-3a 3-3b 3-4b
DIST. FROM LRV (KM)
12
10
8
6
4
2
0.4 0.2
DIST. FROM LM (KM)
0 1 2 3 4 5 6 7
LM TASKS
ALSEP
45
OFF
CLOSE
TIME (HOURS)

TABLE 2. EVA DECISIONS

TABLE 2.3 - DELAYED EVA TIMELINES

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES

PROBLEM	EFFECT	EVA #1 ACTION	EVA #2 ACTION	EVA #3 ACTION
EVA Plan - Update #1 - Arrive at Stop #1				
A. Up to 17-Minute Delay	Delete portions of tasks at LM.	Switch LM site photos to CDR while LMP deploys SWC. Delete: • Samples at ALSEP site • Polarimetric Photog.		
B. 17 to 36-Minutes Delay	Delete portions of tasks at LM. Reduce geology time.	Delete tasks in A above. Reduce or Delete: Station 3 and 5 minutes travel down front.	Perform items deleted from EVA #1 at Station 8 or at LM at end of EVA #2.	
C. 36 to 46-Minutes Delay	Delete portions of tasks at LM. Reduce geology time.	LMP: Deploys SWC CDR: Deploy LRRR LM Site Photog. Delete: • Polarimetric Photog. • Samples at ALSEP Site • Station 3	Perform ALSEP Photog.	
		Drill deep core stem sample and leave drill core in hole until EVA #2.	Finish deep core stem sample.	

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES (CON'T)

PROBLEM	EFFECT	EVA #1 ACTION	EVA #2 ACTION	EVA #3 ACTION
D. 46 to 54-Minutes Delay	Must shorten geology time. Delete portions of tasks at LM.	Deploy LRRR Delete: • Polarimetric Photog. • Samples at ALSEP Site • Station 3 Drill deep core stem sample and leave drill core in hole until EVA #2.	Perform ALSEP Photog. Do SWC Deployment. Do LM Site Photos. Finish deep core stem sample. Do Station 8 activities at ALSEP site. Comprehensive Sample (negates need for ALSEP samples) • Rake Sample • Double Core Sample • Soil Sample • Rock Sample • Deep Trench Sample • Trench Samples • Special Environmental Sample (SESC)	
E. More than 54-Minutes Delay	Must shorten time at Front. Delete portions of tasks at LM.	Leave drill at ALSEP site in proper oriented stowed positions. Deploy LRRR Shorten time at Front. Delete: • Polarimetric Photog. • Samples at ALSEP Site • Station 3 • Delete portions of ALSEP deployment.	Do SWC Deployment. Do LM Site Photos. Do ALSEP Photos. Drill deep core stems. Finish ALSEP deployment. Do Station 8 activities at ALSEP site. Comprehensive Sample (negates need for ALSEP samples) • Rake Sample • Double Core Sample • Soil Sample • Rock Sample • Deep Trench Sample • Trench Samples • Special Environmental Sample (SESC)	Return to Front <u>or</u> North Complex depending on real time evaluation of EVA #1 and EVA #2.

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES (CON'T)

PROBLEM	EFFECT	EVA #1 ACTION	EVA #2 ACTION	EVA #3 ACTION
F. More than 90-Minutes Delay	a) If 1-hour minimum at Front is possible ---	Do Front traverse. Delete portions of ALSEP deployment.		Return to Front or North Complex depending on real time evaluation of EVA #1 and EVA #2.
	b) If 1-hour minimum at Front is not possible.	Delete Front traverse. Perform ALSEP deployment	Front traverse - to St. George and traverse to East.	

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES (CON'T)

PROBLEM	EFFECT	EVA #1 ACTION	EVA #2 ACTION	EVA #3 ACTION
EVA Plan - Update #2 - Arrive at LM Late For ALSEP Deployment				
17-Minute Delay	Delete tasks at LM	Same as 17-min. late at Stop 1.		Same as EVA #1 cont arr Stop 1.
36-Minute Delay	Delete tasks at LM	Same as applicable Stops in 36-min. delay at Stop 1, plus may drill deep core sample and leave drill core in hole until EVA #2.	Finish deep core sample.	" " " "
46-Minute Delay	Delete tasks at LM	Same as 46-min. late at Stop 1.	Finish deep core sample.	" " " "
46-90 Minute Delay	Cannot complete all of ALSEP deployment.	Leave ALSEP at completion of last experiment deployment.	Complete ALSEP at beginning EVA #2 (0-40 min. required)	" " " "
90-105 Minute Delay	Cannot complete ALSEP C/S Deployment	Offload, carry ALSEP to site, fuel RTG and connect cable.	Complete ALSEP at beginning EVA #2 (60-min. required)	" " " "
105-135 Minute Delay	Cannot emplace ALSEP at site.	Offload ALSEP - do not fuel.	Complete ALSEP at beginning EVA #2 (1 + 35 required)	" " " "
135 + Minute Delay	Cannot offload ALSEP.	Deploy SWC, flag polarimetric photog, etc.	Complete ALSEP at beginning EVA #2 (2 + 40 required)	" " " "

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES (CON'T)

PROBLEM	EFFECT	EVA #1 ACTION	EVA #2 ACTION	EVA #3 ACTION
LRV Traverse Rates				
8 KPH	None	-	-	-
7 KPH	Adds 9 min. total driving time (4 min. in return to LM)	Same as 17-min. delay.	-	-
6 KPH	Adds 23 min. total driving time (10 min. in return to LM)	Same as 36-min. delay.		
5 KPH	Adds 39 min. total driving time (17 min. in return to LM)	Same as 46-min. delay.		
4.5 KPH	Adds 50 min. total driving time (22 min. in return to LM)	Same as 54-min. delay.		
3.3 KPH (Walking Equivalent)	Adds 50 min. total driving time. Limited to 3.7 KM dist.	Same as Walking Traverses.		

TABLE 2. EVA Decisions

TABLE 2.3 - DELAYED EVA TIMELINES (CON'T)

LRV TRAVERSE RATE	EFFECT ON EVA - 2	ACTION
8 KPH	None	Preplanned.
7 KPH	Adds 17 min driving time (stop 5 outside LRV/BSLSS limit)	Reduce distance along front to keep science time same. Eliminate stop 5 (can go Z 2.75 KM past turn do stop 6 and 7 select feature to do 5 type activities.
6 KPH	Adds 41 min driving time	Reduce distance down front between 7 and 6 2 + 30 time on front. Consider deleting stop 4 and reducing stop 8.
5 KPH	Adds 71 min driving time	Reduce distance down front 2 + 30 time on front. Consider deleting stop 4 and reducing stop 8.
4 KPH	Adds 119 min driving time (max distance ≤ 4.1 KM with Zero range from LRV limit.)	Consider going to front toward west to ~~keep max~~ distance from LRV higher. Delete stop 4, reduce stop 8.
3.3 KPH	Limited to 3.7 KM (BSLSS/OPS limit)	Same as walking traverse.

TABLE 2. EVA DECISIONS

TABLE 2.d - EVA WALKING TRAVERSE

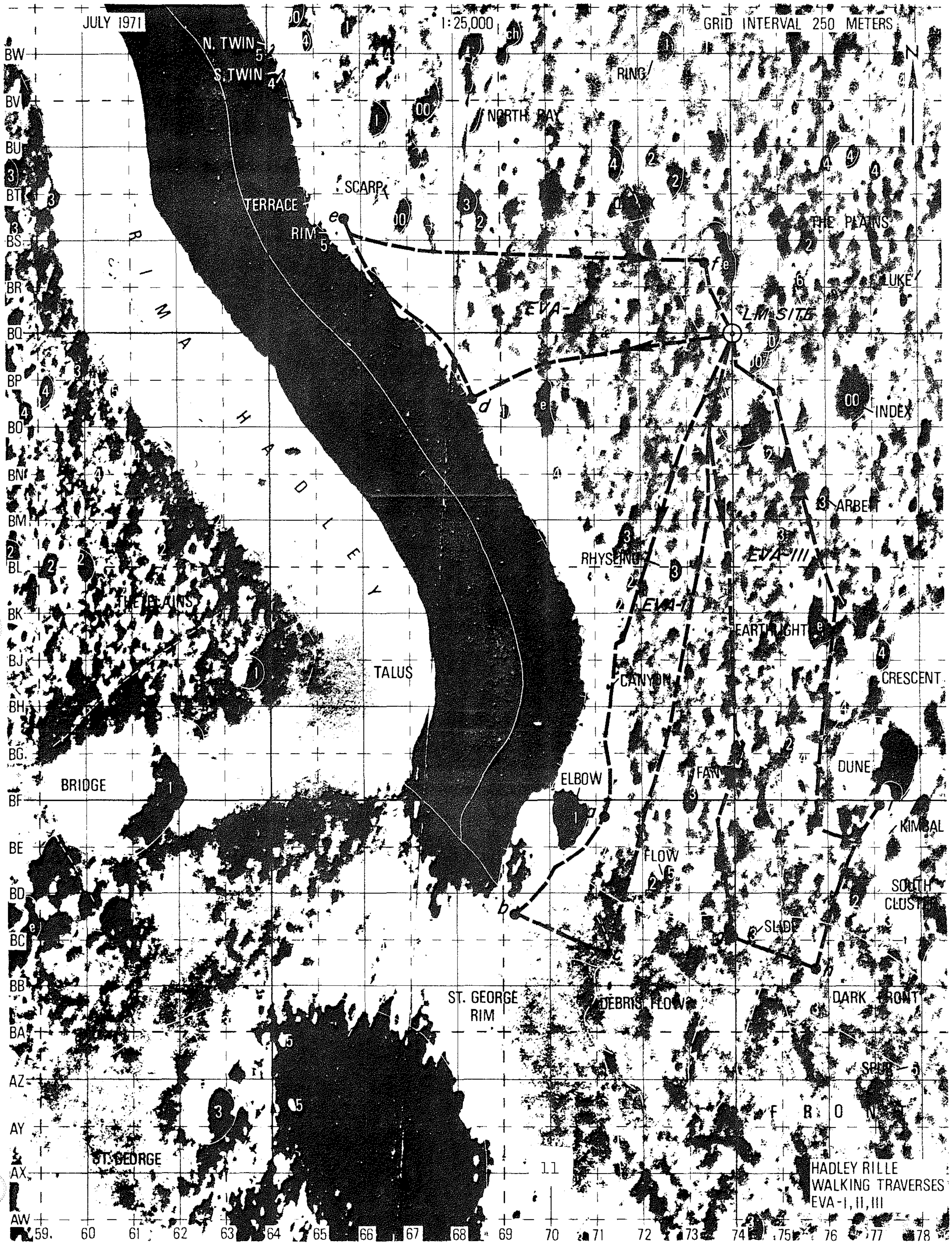

JULY 1971
1:25,000
GRID INTERVAL 250 METERS
N
N. TWIN
S. TWIN
RING
NORTH RAY
SCARP
TERRACE
RIM
THE PLAINS
LUKE
LM SITE
INDEX
R I M A H A D L E Y
EVA III
EVA-I
EARTHLIGHT
CRESCENT
THE PLAINS
TALUS
CANYON
DUNE
ELBOW
FAN
BRIDGE
KIMBAL
FLOW
SOUTH CLUSTER
SLIDE
ST. GEORGE RIM
DEBRIS FLOW
DARK FRONT
SPUR
F R O N T
ST. GEORGE
HADLEY RILLE
WALKING TRAVERSES
EVA-I, II, III

TABLE 2.4 - EVA I WALKING TRAVERSE

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	1:43	SMOOTH MARE	SEE SECTION ____
TRAVEL	1:43	1:10	ACROSS TYPICAL SMOOTH MARE FILL TOWARD RIM OF HADLEY RILLE	OBSERVE AND DESCRIBE TRAVERSE OVER SMOOTH MARE FILL MATERIAL DESCRIBE SURFACE FEATURES AND BLOCK DISTRIBUTION NOTE ANY DIFFERENCES BETWEEN MARE AND RILLE RIM MATERIAL
a	2:53	0:15	NEAR SOUTHERN PART OF ELBOW CRATER EJECTA BLANKET	RADIAL SAMPLING OF ELBOW CRATER PAN
TRAVEL	3:08	0:17	TO APENNINE FRONT SLOPE NORTH OF ST. GEORGE CRATER	LOOK FOR CHANGES IN LITHOLOGY OR GROUND TEXTURE AS INDICATIONS OF BASE OF FRONT COMPARE MARE AND RILLE RIM MATERIAL TO APENNINE FRONT OBSERVE CHARACTER AND DISTRIBUTION OF ST. GEORGE EJECTA BLANKET
b	3:25	0:43	NEAR BASE OF APENNINE FRONT NORTH OF ST. GEORGE CRATER	RADIAL SAMPLE OF ST. GEORGE CRATER AS SLOPE PERMITS COMPREHENSIVE SAMPLE AREA AT APENNINE FRONT DOUBLE CORE TUBE STEREO PAN FROM HIGH POINT - 100 m BASE ALONG FRONT FILL SESC AT APENNINE FRONT

TABLE 2.4 - EVA I WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	4:08	0:13	ACROSS BASE OF APENNINE FRONT ADJACENT TO POSSIBLE DEBRIS FLOW	OBSERVE APENNINE MATERIAL AND RELATION TO MARE SURFACE
c	4:21	0:16	AT BASE OF APENNINE FRONT ADJACENT TO POSSIBLE DEBRIS FLOW	EXAMINE FLOW AND COMPARE TO MARE AND FRONT DOCUMENTED SAMPLES OF APENNINE FRONT AND 'FLOW' MATERIAL OBSERVE AND DESCRIBE VERTICAL AND LATERAL CHANGES IN APENNINE FRONT; COMPARE TO PREVIOUS STOP PAN OBSERVE CHARACTERISTICS OF EVA III ROUTE
TRAVEL	4:37	1:23	FROM BASE OF APENNINE FRONT ACROSS MARE TO LM	OBSERVE CHARACTERISTICS AND EXTENT OF POSSIBLE DEBRIS FLOW OBSERVE AREA TO BE TRAVERSED ON EVA III COMPARE MARE MATERIAL TO APENNINE FRONT AND RILLE RIM OBSERVE POSSIBLE RAY MATERIAL
LM	6:00	1:00	SMOOTH MARE	LM AREA ACTIVITIES EVA CLOSEOUT

TABLE 2.4 - EVA II WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	2:48	SMOOTH MARE	EGRESS LM ALSEP DEPLOYMENT PREPARE FOR TRAVERSE
TRAVEL	2:48	0:34	ACROSS SMOOTH MARE BETWEEN LM AND RIM OF HADLEY RILLE	COMPARE SMOOTH MARE MATERIAL TO RILLE RIM MATERIAL
d	3:22	0:31	AT RIM OF HADLEY RILLE	OBSERVE AND DESCRIBE RILLE AND FAR WALL 500-mm LENS CAMERA PHOTOGRAPHY COMPREHENSIVE SAMPLE AREA SINGLE (DOUBLE) CORE TUBE PAN DOCUMENTED SAMPLING OF CRATER AT EDGE OF RILLE
TRAVEL	3:53	0:29	ALONG RILLE RIM TO TERRACE	DESCRIPTION OF RILLE AND RIM MATERIAL PHOTOGRAPHY AS APPROPRIATE
e	4:22	0:28	RILLE RIM AT TERRACE	OBSERVE AND DESCRIBE RILLE AND FAR RILLE WALL; COMPARE TO PREVIOUS OBSERVATIONS 500-mm LENS CAMERA PHOTOGRAPHY DOCUMENTED SAMPLES OF RILLE RIM AND CRATER AT EDGE OF RILLE PAN COMPARE RILLE RIM MATERIAL TO OTHER TERRAIN

TABLE 2.4 - EVA II WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	4:50	0:48	FROM RILLE RIM EAST ACROSS MARE	OBSERVE CHANGES IN MATERIAL BETWEEN RILLE RIM AND MARE
f	5:38	0:37	160 m CRATER IN MARE	COMPREHENSIVE SAMPLE AREA DOUBLE CORE TUBE DOCUMENTED SAMPLING OF LARGE MARE CRATER POSSIBLE FILLET/ROCK SAMPLE POSSIBLE LARGE AND SMALL EQUIDIMENSIONAL ROCK SAMPLES PAN TRENCH POSSIBLE BURIED ROCK SAMPLE FILL SESC
TRAVEL	6:15	0:10	ACROSS SMOOTH MARE	COMPARE MARE MATERIAL WITH OTHER TERRAIN OBSERVE POSSIBLE RAY MATERIAL
LM	6:25	0:35	SMOOTH MARE	EVA CLOSEOUT

TABLE 2. EVA Decisions

TABLE 2.4 - EVA III WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	SEGMENT TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
LM	-	0:22	SMOOTH MARE	EGRESS LM, PREPARE FOR TRAVERSE
TRAVEL	0:22	1:19	SOUTH ALONG SMOOTH MARE ON WEST SIDE OF SECONDARY CRATER CLUSTER TO BASE OF APENNINE FRONT	OBSERVE SMOOTH MARE CHARACTERISTICS OBSERVE SECONDARY CRATER CLUSTER CHARACTERISTICS PHOTOGRAPHY AS APPROPRIATE
g	1:41	0:48	SLIDE CRATER NEAR BASE OF APENNINE FRONT	DOCUMENTED SAMPLES: SLIDE CRATER IN APENNINE FRONT OTHER AREAS STEREO PAN; 100-m SEPARATION ALONG APENNINE FRONT EXPLORATORY TRENCH UPSLOPE OF SLIDE CRATER 70-mm CAMERA STEREO PAIRS UPSLOPE AT TARGETS OF OPPORTUNITY
TRAVEL	2:29	0:12	EAST ALONG APENNINE FRONT	TRAVERSE ALONG APENNINE FRONT OBSERVE POSSIBLE DEBRIS FLOWS, SOURCE AND DOWNSLOPE MOVEMENT PHOTOGRAPHY AS APPROPRIATE
h	2:41	0:34	AT BASE OF APENNINE FRONT NEAR SMALL CRATER	DESCRIPTION OF APENNINE FRONT IN SAMPLING AREA COMPARISON OF APENNINE FRONT AND MATERIAL TO OTHER SURFACE UNITS DOCUMENTED SAMPLES OF APENNINE FRONT MATERIAL PAN EXPLORATORY TRENCH POSSIBLE CORE TUBE 70-mm CAMERA STEREO PAIRS OF TARGETS OF OPPORTUNITY UPSLOPE

TABLE 2.4 - EVA III WALKING TRAVERSE (CONT)

STATION/ ACTIVITY	ELAPSED TIME AT START	TIME	GEOLOGICAL FEATURES	OBSERVATIONS AND ACTIVITIES
TRAVEL	3:15	0:24	FROM BASE OF APENNINE FRONT TO SOUTH OF DUNE CRATER IN SECONDARY CLUSTER	OBSERVE SECONDARY CRATER DEPOSITS AND RELATION TO OTHER TERRAIN OBSERVE EASTERN EDGE OF POSSIBLE DEBRIS FLOW FROM APENNINE FRONT PHOTOGRAPHY AS APPROPRIATE
i	3:39	0:21	SECONDARY CRATER CLUSTER: SOUTH OF DUNE CRATER	SOIL SAMPLE DOCUMENTED SAMPLING PAN EXPLORATORY TRENCH POSSIBLE CORE TUBE THROUGH SECONDARY EJECTA OBSERVE CRATER INTERIOR AND EJECTA SAMPLE TYPICAL AND EXOTIC ROCK TYPES COMPARE SECONDARY CRATER MATERIAL TO OTHER TERRAIN UNITS
TRAVEL	4:00	1:15	ALONG WEST SIDE OF SECONDARY CRATER CLUSTER, AND ACROSS SMOOTH MARE	OBSERVE SECONDARY CRATER DEPOSITS COMPARE MARE MATERIAL WITH OTHER TERRAIN OBSERVE POSSIBLE RAY MATERIAL
LM	5:15	0:45	SMOOTH MARE	EVA CLOSEOUT

TABLE 3. MESA Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	MESA release handle will not release.	Crew	1. Attempt to free release handle by exerting side loads on pip pin.	
		Crew	2. Attempt to reach cable from release handle to MESA. Pull on this cable or cable bell crank mechanism with hand to deploy MESA.	
		Crew	3. Attempt to reach cable beyond bell crank and pull to deploy MESA.	
2.	Release handle releases, MESA does not deploy.	Crew	1. Try repeated pulls on release handle.	
		Crew	2. Manually deploy MESA from surface with lanyard.	
		Crew	3. One crewman pull on MESA lanyard while other crewman pulls release handle.	
3.	MESA fails to stop and hits lunar surface (lanyard breaks).	Crew	1. Attempt to block up MESA with LRRR pallet.	
		Crew	2. Attempt to tie up MESA if lanyard available.	

TABLE 3. MESA Deployment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Unable to open SRC	Crew	1. Hit corners of SRC lid with available tools and attempt to pull lid free.	
		Crew	2. If forced to abandon SRC #1, use MESA sample collection bag for Selected Samples and transfer the bag to LM ascent stage in ETB and stow in the ISA.	Loss of SRC #1 will result in the loss of 40 documented sample bags, 6 drill stems and 1 environmental soil sample container (SESC).
		Crew	3. If forced to abandon SRC #2, use MESA sample collection bags for documented samples and transfer the bags to LM ascent stage in the ETB and stow in the ISA.	Loss of SRC #2 will result in the loss of 6 core tubes, 2 SESC, and 80 documented sample bags.
5.	SRC Seal Area Dirty.	Crew	Use hand brush to clean seal.	

TABLE 3. MESA Deployment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	Unable to latch SRC.	Crew	1. Check that spacer has been removed. If not, remove.	
		Crew	2. Open and look for interference. a. Relocate item, shake or pat to settle loaded collection bag. If "O" ring is out of groove, pull out and discard. b. Remove excess packing material or sample and repack.	
		Crew	3. If no apparent interference close and engage other strap latch. If this latch will rotate to within 30° of being closed, place other hand on back of box to permit application of maximum closing pressure by a muscular squeezing action. a. If this strap latches, try first latch again in the same manner.	

TABLE 3. MESA Deployment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6. (Cont'd)			b. If the second latch will not latch, return to earth with the first latch closed.	
			c. If still cannot latch at least one side, abandon SRC.	
		Crew	4. Transfer samples in Sample Containers.	
7.	Unable to transfer items via LEC.	Crew	1. Use LEC as a tether, attach and pull it up to hatch.	
		Crew	2. If possible climb ladder while holding SRC.	

TABLE 4. Apollo Lunar Hand Tools

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Hand tool carrier (HTC) damaged or unuseable.	Crew	Stow hand tools in bag under seat of LRV.	There may be a reduced geology capability if the HTC is not available.
2.	ALSEP tool subpallet pull pin jams.	Crew	1. Apply additional force while rotating pin with the aid of the second crewman.	
		Crew	2. Use hammer to pry pin free or break pin.	If subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
		Crew	3. Remove all accessible tools, stow on MESA and deploy subpackage #2 with HTC attached.	

TABLE 4. Apollo Lunar Hand Tools (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	ALSEP forward tool support pull pin jams.	Crew	1. Apply additional force on pin with hammer.	ALSEP cannot be deployed without DRT, FTT and one UHT.
		Crew	2. Remove UHT and DRT pins, remove UHT's, and attempt to pry open the outer half to break the bracket off at the point where the pin is jammed	
		Crew	3. Use hammer to break bracket.	
		Crew	4. The tools can be removed by prying the bracket away far enough to gain access to the tools.	

TABLE 4. Apollo Lunar Hand Tools (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	ALSEP UHT pull pin jams.	Crew	1. Apply additional force on pin with hammer.	Note: ALSEP cannot be deployed without access to DRT, FTT and one UHT.
		Crew	2. Remove DRT pin and attempt to break the bracket off at the point where the pin jammed.	
		Crew	3. Use hammer to break bracket.	
		Crew	4. The tool can be removed if the bracket is pried away far enough to gain access to the tools.	
5.	ALSEP DRT pull pin jams.	Crew	1. Apply additional force while rotating pin.	ALSEP cannot be deployed without DRT, FTT, and one UHT.
		Crew	2. Apply additional force on pin with hammer or break pin.	
		Crew	3. Attempt to break the bracket off at the point where the pin jammed.	
		Crew	4. Use hammer to break bracket.	
		Crew	5. The tools can be removed if the bracket is pried away far enough to gain access to the tools.	The DRT may be used with the bracket attached.

TABLE 4. Apollo Lunar Hand Tools(Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	Handle comes off Contingency Lunar Sample Return Container before sampling, container falls on lunar surface.	Crew	1. Attempt to retrieve with handle.	
		Crew	2. Get tongs and retrieve bag from surface, then re-install bag ring on handle.	
7.	Handle will not come off Contingency Lunar Sample Return Container after sampling.	Crew	1. Remove clip.	
			2. If handle is stuck, bend sampler toward cup ring until bag retaining pin is free of cup ring (approximately 90^{o}) and remove bag.	
8.	Unable to open special environmental sample containers (SESC).	Crew	1. Unable to open - hit rotation handle with hammer.	If it is not possible to open and close container, abandon sample task.
		Crew	2. Unable to seal - check/remove both seal protectors. Check/free lanyard if impeding proper lid manipulation.	

TABLE 5. Cameras

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Still camera not working.	Crew	1. Try new magazine and take test photograph	Still camera includes all 16mm, 70mm, and 35mm cameras.
			2. Keep in view of television and time sequence cameras so long as data return not compromised.	
		Crew	3. Use photomap if LM location is known, to locate sampling sites with reference to LM.	

TABLE 6. Solar Wind Composition Experiment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Pole will not go into surface.	Crew	Lean against LM, facing sun.	
2.	Pole partially extended.	Crew	1. If pole is half or more of normal length, continue experiment.	
		Crew	2. Remove foil and proceed to event 6.2.	
3.	Reel not removable. No foil exposed to solar radiation.	Crew	Discard experiment.	
4.	Foil torn during extension.	Crew	Continue experiment.	
5.	Foil comes off reel.	Crew	Hang foil on pole by lanyard.	
6.	Foil reel comes off poles.	Crew	1. Reconnect to pole.	
		Crew	2. Hang foil on LM structure facing most available solar radiation.	
7.	Unable to reroll foil by spring.	Crew	Roll by hand or fold as conveniently as possible.	
8.	No SWC bag available.	Crew	Continue experiment. Bag not mandatory. Attempt to put a bag over each end.	

TABLE 6. Solar Wind Composition Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Deployment selection alternative.	Crew	In full sunlight at least 6 feet from any shadow.	

TABLE 7. Laser Ranging Retro-Reflector Experiment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Unable to deploy LRRR at least 25 feet west of Central Station.	Crew	1. Locate LRRR as far west of Central Station as possible. 2. Locate LRRR as far northwest or north of Central Station as possible and at least 300 feet from the LM. 3. Locate LRRR as far southwest or south of Central Station as possible, and at least 300 feet from the LM. 4. Locate LRRR east or northeast of Central Station at least 300 feet from LM, and at least 10 ft. from the RTG. 5. Locate LRRR southeast of Central Station, at least 300 feet from LM, at least 10 feet from RTG.	Note: Possible thermal degradation of LRRR due to deposition of lunar debris kicked up by LM ascent stage blast, and RTG heating.

TABLE 7. Laser Ranging Retro-Reflector Experiment (Continued)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	UHT will not engage in LRRR UHT socket.	Crew	1. Try to engage UHT in second UHT socket.	
		Crew	2. Try to engage second UHT in both UHT sockets.	
		Crew	3. If UHT engagement fails, use UHT handle hooked into carry handle to rotate LRRR to lunar surface. Attempt to use UHT handle hooked into carry handle to level and align LRRR.	
3.	UHT disengages from experiment due to accidental triggering of UHT release mechanism.	Crew	Use UHT handle to hook carry handle, retrieve LRRR and attempt to re-engage UHT in socket.	Reduced thermal control due to degradation of thermal point with lunar dust.
4.	LRRR tips over during deployment.	Crew	1. Pick up unit using UHT handle as a hook.	Dust will degrade performance if the unit tips over on the array with the dust cover off.
		Crew	2. Brush off with EMU brush.	

TABLE 7. Laser Ranging Retro-Reflector Experiment
(Continued)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Leveling leg pull pin jams or unable to deploy.	Crew	1. Attempt to pry pin out or jar leg free.	Leveling may be out of limits.
		Crew	2. Attempt to level using core tube or penetrometer for props.	Experiment aiming accuracy stability on the thermal control may be degraded.
6.	Reflector array pull pin jams or lanyard breaks.	Crew	1. If lanyard breaks, attempt to remove pin manually.	
		Crew	2. If pin jams, apply additional force while rotating pin.	
		Crew	3. Apply additional force with hammer or break pin.	
		Crew	4. Use hammer to break bracket.	
		Crew	5. Leave reflector array in stowed position, but continue with LRRR deployment.	Experiment science data may be degraded.

TABLE 7. Laser Ranging Retro-Reflector Experiment
(Continued)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
7.	Small array will not fully rotate or lock in position.	Crew	1. Examine for obstructions, dislodge obstructions with UHT or MESA tools and re-rotate small array into deployed position.	Force small array into deployed position if necessary.
		Crew	2. Leave small array in partially deployed position. Continue with LRR deployment.	Experiment science data may be degraded.
8.	Alignment mechanism pull pin jams.	Crew	1. Apply additional force while rotating pin.	
		Crew	2. Use UHT handle and attempt to bend or break alignment mechanism free.	Experiment aiming accuracy may be degraded.
		Crew	3. Level by using estimation of true verticle and other equipment as a reference, align by using shadows and other equipment orientations.	Without accurate leveling and alignment science data and thermal control will be degraded.
9.	Dust cover will not release.	Crew	1. Apply additional force.	
		Crew	2. If unsuccessful or lanyard breaks, use UHT handle to pry dust cover free at velcro attachment points.	

TABLE 7. Laser Ranging Retro-Reflector Experiment (Continued)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
10.	Lunar dust degrades readability of bubble level or compass rose, or bubble level or sun compass is damaged.	Crew	1. Level by using estimation of true vertical and other equipment as a reference, align by using shadows and other equipment as references. Ensure ample photo is obtained to verify experiment orientation.	Without accurate leveling and alignment, science data and thermal control may be degraded.
11.	UHT will not disengage from LRRR UHT socket.	Crew	1. Apply additional force:	
		Crew	2. Obtain assistance from second crewman.	
		Crew	3. Leave UHT in socket.	Experiment aiming accuracy, stability or thermal control may be degraded.

TABLE 8. ALSEP Offload

8.1 SEQ Bay Door

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	SEQ Bay door lanyards unusable (for opening)	Crew	1. Lanyard free from cable, pull cable.	
		Crew	2. Lanyard melted and fused to Inconel--if unable to break free with hand pull, use hammer to free and pull cable.	
2.	SEQ Bay doors will not open.	Crew	1. No cable movement (worse case) pry open astronaut protection door and fail mechanism. Pull on lanyard again.	
		Crew	2. Use hammer to chop hole in main door Inconel shield at center patch. Hook hammer behind cable and pull to release latch and open door while latch is pulled. Continue to open door upward.	
		Crew	3. With small cable movement, doors are unlatched and can be opened manually.	
3.	SEQ Bay door partially open and jammed.	Crew	1. Continue pulling on lanyard. Get assistance to aid in manually raising door.	
		Crew	2. Discontinue use of lanyard and manually raise door.	

TABLE 8. ALSEP Offload (Cont'd)

8.1 SEQ Bay Door

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	SEQ Bay Door will not lower (for closing)	Crew	Attempt to close manually.	Note: SEQ Bay door should be closed to thermally insulate the LM.
5.	SEQ Bay door partially closed.	Crew	1. Continue pulling on lanyard while second crewman manually assists in closing door.	
		Crew	2. Discontinue use of lanyard and manually close door or use hammer to fail mechanism in order to close door.	

TABLE 8. ALSEP Offload (Cont'd)

8.2 Subpackage Removal by Boom

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Subpackage latching mechanism will not release.	Crew	1. If lanyard pulls loose or mechanism jams, remove thermal covering from bottom of SEQ Bay and attempt to move release mechanism lever forward.	
		Crew	2. Use hammer to pry outward from structure on right-hand link of latching mechanism forcing latch over center and releasing packages.	
2.	Subpackage will not slide on rails.	Crew	Get assistance from second crewman.	
3.	Boom will not deploy.	Crew	Release hockey stick at boom interface and manually deploy subpackage.	
4.	Boom partially deployed.	Crew	Use two-man deployment: one supports, other man releases hockey stick at boom interface and manually deploys subpackage.	
5.	Ratchet fails.	Crew	Use two-man deployment: One supports, other pulls small lanyard to release hockey stick from boom interface and manually deploy subpackage.	

TABLE 8. ALSEP Offload (Cont'd)

8.2 Subpackage Removal by Boom

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	White portion of deployment lanyard will not release from base of subpackage.	Crew	1. Grasp release latch at base of subpackage and twist with an upward motion in an effort to break the latch or the slot.	
		Crew	2. Attempt to cut lanyard with hammer against LM or rock to break or tear lanyard (webbing) loose.	
7.	Unable to release hockey stick at boom interface (pin jams or lanyard breaks)	Crew	1. Attempt to pull pin manually.	
		Crew	2. Release hockey stick at handle interface.	
8.	Unable to release hockey stick at subpackage interface (pin jams).	Crew	1. Apply additional force on pin with hammer or break pin.	
		Crew	2. Attempt to break the hockey stick off at the point where the pin jammed either manually or with hammer.	
		Crew	3. Attempt to pry hockey stick away from package.	
		Crew	4. Leave hockey stick on subpackage.	Central Station thermal control may be degraded

TABLE 8. ALSEP Offload (Cont'd)

8.2 Subpackage Removal by Boom

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Boom does not retract.	Crew	1. Attempt retraction by both crewmen working simultaneously, one pulling the lanyard and the second pushing on boom (if within reach).	Crewmen should spend a minimum amount of time on task before abandoning.
		Crew	2. Apply loads on end of the boom with the hammer while second crewman pulls lanyard.	

TABLE 8. ALSEP Offload

8.3 Manual Subpackage Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Unable to release hockey stick at boom interface (Pin jammed or lanyard breaks)	Crew	1. Attempt to pull pin at pin interface.	
		Crew	2. Remove package on boom.	
		Crew	3. Remove entire hockey stick by removing pull pin at carry handle interface after boom removal.	
2.	Subpackage latching mechanism will not release.	Crew	1. If lanyard pulls loose or mechanism jams, remove thermal covering from bottom of SEQ bay and attempt to move release mechanism lever forward.	
		Crew	2. Use hammer claw to pry outward from structure on right-hand link of latching mechanism forcing latch over center and releasing subpackages.	
3.	White portion of deployment lanyard will not release from base of subpackage.		1. Grasp release latch at base of subpackage and twist with an upward motion in an effort to break the latch or the slot.	
		Crew	2. Attempt to cut lanyard with hammer against LM or rock to break or tear (webbing) loose.	

TABLE 8. ALSEP Offload (Cont'd)

8.3 Manual Subpackage Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Subpackage will not slide on rails.	Crew	Using MESA tools with assistance of second crewman, attempt to clear package.	
5.	Unable to release hockey stick at subpackage interface (pin jams).	Crew	1. Apply additional force on pin with hammer or break pin.	
		Crew	2. Attempt to break the hockey stick off at the point where the pin jammed, either manually or with hammer.	
		Crew	3. Attempt to pry hockey stick away from package.	
		Crew	4. Leave hockey stick on subpackage.	Central Station thermal control may be degraded.

TABLE 9. RTG Fueling

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Lanyard breaks or pulls away from cam lever.	Crew	1. Use hammer/extension as hook and pull forward on cam lever to release	<u>Caution</u>: Direct exposure to hot fuel cask could damage or fail the space suit.
		Crew	2. If cam lever cannot be released, abandon ALSEP.	
2.	Cam lever fails to release the upper trunnion after lever is fully deployed.	Crew	1. Use hammer/extension as hook on astronaut guard to break cask free at trunnions while second crewman pulls lanyard to tilt.	
		Crew	2. If upper trunnion cannot be released, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Lanyard fails to remove spline lock from cask/dome or breaks.	Crew	1. Use hammer/extension to release second trunnion lock, rotate cask if required, and use hammer/extension as hook to remove spline.	
		Crew	2. Rotate cask, attempt to gain access to fuel capsule by using hammer/extension to destroy cask dome and pry away bands.	
		Crew	3. If spline lock cannot be removed from dome, or dome cannot be removed by impacting with hammer/extension, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Cask will not rotate with lanyard pull.	Crew	1. Verify upper trunnion release by attaching extension to hammer, hook hammer on astronaut guard and ensure that the cask is free of the upper trunnion.	Exercise caution when working in close proximity to hot fuel cask.
		Crew	2. Request aid of the second crewman to apply forward and downward force with hammer/extension on the guard while the first crewman attempts to rotate with the lanyard.	
		Crew	3. Continue to apply force to fail gear box if required.	If gear box fails, second crewman must support cask with the hammer/extension handle to the proper angle for fuel capsule removal.
		Crew	4. If cask cannot be rotated, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Engaging mechanism on DRT does not lock on cask dome due to mechanical failure.	Crew	1. Apply forward pressure and rotate. Attempt to remove dome with side loading on the DRT so it will be removed with some assistance from the tool. (Caution: Stand clear of dome when finally released and removed.)	
		Crew	2. After dome is rotated (without locking pin engagement) use hammer/extension to remove dome.	
		Crew	3. Attempt to gain access to fuel capsule by using hammer to destroy cask dome and pry away bands.	
		Crew	4. If dome cannot be removed, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	Lock nut assembly will not rotate.	Crew	1. Apply additional force with hammer on end of the DRT to jar loose the binding while continuing to rotate DRT.	
		Crew	2. Attempt to gain access to fuel capsule by using hammer to destroy cask dome and pry away bands.	
		Crew	3. If assembly cannot be removed,abandon ALSEP.	
7.	Pretension bands do not release causing excessive loading on dome locking legs.	Crew	1. Use hammer/extension to free lugs at the lock nut assembly on the dome.	
		Crew	2. Attempt to gain access to fuel capsule by using hammer to destroy cask dome and pry away bands.	
		Crew	3. If dome cannot be removed, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
8.	FTT engagement fingers do not expand (inoperative).	Crew	1. Visually inspect fingers for debris and re-engage FTT in fuel cask.	
		Crew	2. Request aid of second crewman to apply additional force to FTT knob.	
		Crew	3. Apply impact pressure on knob by knocking on the LM landing gear.	
		Crew	4. If FTT will not function, the RTG cannot be fueled and ALSEP will be abandoned.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Capsule will not release from cask body after FTT is attached and locked.	Crew	1. Apply additional side loads by wiggling on FTT while pulling capsule out.	
		Crew	2. Retract FTT, rotate 120° and repeat task in all three positions.	
		Crew	3. Using hammer/extension apply impact force on side of cask body to free the capsule.	
		Crew	4. Using hammer, apply impact force on the end of the FTT to free the capsule.	
		Crew	5. Allow for back plate cool down (5-10 min.) and repeat task.	
		Crew	6. If capsule cannot be released, abandon ALSEP.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
10.	FTT will not release from capsule while in RTG body.	Crew	1. Visually check engagement alignment.	There will be no problem of excessive heat buildup if the FTT cannot be disengaged from the fueled RTG.
		Crew	2. Check for full outward travel of FTT fingers.	
		Crew	3. Apply additional force to release knob.	
		Crew	4. Leave FTT in place on the fueled RTG. Manually carry subpackage #2 in the barbell mode, or on the LRV. Monitor the RTG/Capsule during preparation for the traverse to the site.	
		Crew	5. If fuel capsule is not locked in RTG, carry subpackage #1 in suitcase mode and transport carry bar on LRV.	

TABLE 9. RTG Fueling (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
11.	Tempilabel indicates temperature of component is in excess of 250°F.	Crew	1. Do not handle component manually. Use UHT or MESA tool to avoid direct contact with hot component and continue deployment, if possible.	Caution: Direct exposure to temperatures in excess of 250°F could damage or fail the spacesuit.
		Crew	2. Unable to continue deployment without coming into direct contact with component, place component in shade and work around hot component until MCC notifies that component should have cooled off enough to permit manual handling.	Crew should verify that temperature is less than 250°F before handling.

TABLE 10. ALSEP Traverse

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Carry bar will not engage in subpackage keyhole socket.	Crew	1. Check mating bar to see if properly mated. Mating bar could be mated 180° out of phase.	The carry bar is required for use as an antenna mast and must be transported to the ALSEP deployment site.
		Crew	2. Ensure flange on carry bar is free of debris; if not, clean by impact or with gloved hand.	
		Crew	3. Ensure keyhole socket is clean; if not, clean with available MESA tools.	
		Crew	4. If one or both sockets are unuseable, the LMP must carry subpackage #1 and subpackage #2 in suitcase mode.	Transport carry bar on LRV.

TABLE 10. ALSEP Traverse (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Carry bar sections become disengaged and rotate.	Crew	1. Attempt to relock carry bar sections.	If carry bar sections do not lock, ensure that sections are properly aligned when they are used as an antenna mast in order to permit proper alignment of ALSEP antenna.
		Crew	2. If carry bar sections do not lock, disengage carry bar from subpackages. Use suitcase carry mode and transport carry bar on LRV.	
3.	Carry bar becomes disengaged from subpackage.	Crew	1. Attempt to re-engage carry bar in subpackage keyhole socket.	The carry bar is required for use as an antenna mast and must be transported to the ALSEP deployment site.
		Crew	2. If carry bar will not remain in keyhole socket, use suitcase carry mode and transport carry bar on LRV.	

TABLE 10. ALSEP Traverse (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Carry bar binds in keyhole socket on subpackage.	Crew	1. Ensure trigger release is operable.	
		Crew	2. If trigger is released, apply additional downward pressure while applying side loads to subpackage #2.	
		Crew	3. Request aid of CDR to lift subpackage #1.	
		Crew	4. With second crewman's UHT, depress antenna lock and rotate subpackage #1 to separate masts. With single section attached to subpackage #2, continue as in step #2 above.	
		Crew	5. Attempt to break carry bar off at keyhole socket.	
		Crew	6. Separate two carry bar sections and emplace subpackages #1 and #2 with carry bar section still attached to subpackage.	The ALSEP antenna may be roughly aligned with the antenna aiming mechanism mounted on the central station sunshield.

TABLE 10. ALSEP Traverse (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Planned deployment site $>$ 300 feet west of LM (12 o'clock) unsuitable for ALSEP deployment.	Crew	Select alternate site $>$ 300 feet Northwest to West or Southwest to West of LM.	Landing site analysis may provide additional inputs.
6.	Planned deployment site includes a crater with walls that slope more than 5°.	Crew	Locate ALSEP components on rim of crater, on elevated local terrain or select another deployment site.	If the crater's south wall slopes more than 5°, select another deployment site.
7.	Planned deployment site includes an outcropping whose height is greater than one foot.	Crew	1. Locate ALSEP components at least 12 feet from a one-foot outcropping, 24 feet from a two-foot outcropping, etc.	
		Crew	2. If outcropping cannot be avoided, orient ALSEP components thermal radiators away from outcropping (so as to achieve a clear view of space).	
8.	Planned deployment site is in LM shadow.	Crew	Locate ALSEP components outside LM shadow, but within $\pm 15^{\circ}$ of E-W axis drawn through LM.	Separation distance from LM is more critcal than angular relationship with respect to LM E-W axis.

TABLE 10. ALSEP Traverse (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Planned deployment site is comprised of loose, granular soil or small rocks.	Crew	1. Compact individual areas prior to final emplacement of each ALSEP component.	
		Crew	2. Attempt to avoid emplacing ALSEP components on small rocks.	

TABLE 11. Subpallet Removal

11.1 General

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Carry bar will not stow on subpallet taper fitting	Crew	1. Examine carry bar for obstruction, dislodge obstruction by impact and restow carry bar on subpallet taper fitting.	
		Crew	2. Examine subpallet taper fitting for obstruction, dislodge obstruction with UHT or MESA tools and restow carry bar on subpallet taper fitting.	
		Crew	3. If taper fitting is unusable, stow carry bar on LRV.	The carry bar is required for use as an antenna mast and cannot be discarded or emplaced on the lunar surface where debris might foul the subpackage or aiming mechanism interfaces.
2.	Unable to locate subpackage #1 10 feet due West of subpackage #2.	Crew	Locate subpackage #1 as far from subpackage #2 as possible and attempt to keep RTG out-of-field of view of Central Station radiator.	

Table 11. Subpallet Removal (Cont'd)

11.2 HFE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Astronaut pull pin james or lanyard breaks.	Crew	1. If lanyard breaks, attempt to remove pins manually. 2. If pin jams, apply additional force while rotating pin. 3. Apply additional force with hammer or break pin. 4. Use hammer to break bracket.	If Astromate connector cannot be released, abandon HFE deployment after removing HFE subpallet.

Table 11. Subpallet Removal (Cont'd)

11.2 HFE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	HFE subpallet pull pin jams of lanyard breaks.	Crew	1. If lanyard breaks, attempt to remove pin manually. 2. If pin jams, apply additional force while rotating pin. 3. Apply additional force with hammer or break pin. 4. Use hammer to break bracket. 5. Leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately.	If HFE subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
3.	HFE subpallet carry handle will not lock.	Crew	Continue HFE deployment using UHT if required.	

TABLE 11. Subpallet Removal (Cont'd)

11.2 HFE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	HFE subpallet Boyd bolt spline will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	If HFE subpallet cannot be removed, RTG will not radiate heat evenly causing excessive heat buildup.
		Crew	2. Use hammer on top of UHT to force depression of Boyd bolt spline.	
		Crew	3. Attempt to overcome spline lock by forcefully rotating UHT.	
		Crew	4. Use hammer to break bracket or strut.	
		Crew	5. Leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package, and HFE Probe Package immediately	

TABLE 11. Subpallet Removal (Cont'd)

11.2 HFE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	HFE subpallet Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	If HFE subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
		Crew	2. Attempt to overcome boyd bolt threads by forcefully rotating UHT.	
		Crew	3. Use hammer to attempt to break bracket or strut.	
		Crew	4. Leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately.	

TABLE 11. Subpallet Removal (Cont'd)

11.2 HFE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	HFE subpallet will not come off Subpackage #2.	Crew	1. Ensure both Boyd bolts have been released.	
		Crew	2. Use UHT to ensure that Boyd bolts have been sprung upward.	
		Crew	3. Ensure that front of subpallet has been rasied to clear the mounting stud.	
		Crew	4. Use hammer to force forward movement of subpallet or to break bracket or strut.	
		Crew	5. Leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package, and HFE Probe Package immediately.	If subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

TABLE 11. Subpallet Removal (Cont'd)

11.3 Side/CCGE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Side subpallet Boyd bolt spline will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
		Crew	2. Use hammer on top of UHT to force depression of Boyd bolt spline.	
		Crew	3. Attempt to overcome spline lock by forcefully rotating UHT.	
		Crew	4. Leave side subpallet on Subpackage #2, but remove Side/CCIG and aiming mechanism immediately.	If side subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
2.	Side subpallet Boyd bolt will not rotate.	Crew	1. Check hex head of UHT, and if damaged, use second UHT.	
		Crew	2. Attempt to overcome Boyd bolt threads by forcefully rotating UHT.	
		Crew	3. Leave side subpallet on Subpackage #2, but remove Side/CCIG and aiming mechanism immediately.	If side subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

TABLE 11. Subpallet Removal (Cont'd)

11.3 Side/CCGE Subpallet Removal

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Side subpallet will not come off Subpackage #2.	Crew	1. Ensure both Boyd bolts have been released.	
		Crew	2. Use UHT to ensure that Boyd bolts have been sprung upward.	
		Crew	3. Ensure that front of side subpallet has been raised 3/8 inch to clear mounting stud.	
		Crew	4. Kick side subpallet to force forward movement.	
		Crew	5. Use hammer to force forward movement of the side subpallet.	
		Crew	6. Leave side subpallet on Subpackage #2, but remove side/CCIG and aiming mechanism immediately.	If side subpallet cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

TABLE 12. RTG Cable Interconnect

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	RTG cable reel tempilabel dots are all black.	Crew	1. Do not touch RTG cable reel, cable or shorting plug.	Direct exposure to temperature in excess of 250^{o}F could damage space suit.
		Crew	2. Use UHT handle to deploy RTG cable, release shorting plug pull pin and retrieve shorting plug.	
		Crew	3. Attempt to carry out RTG cable interconnect using available tools and materials.	
		Crew	4. Stow shorting plug on Subpackage #1 until cool enough to handle manually.	If shorting plug cannot be mated to Central Station, abandon ALSEP.

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	RTG cable reel Boyd bolts cannot be released.	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	Exercise caution when working in close proximity to hot RTG.
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Repeat release procedure, i.e., engage depress, rotate ccw 75°.	
		Crew	4. Insert UHT and apply downward pressure on center spline. Use hammer if necessary, turn ccw to release.	
		Crew	5. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	6. Visually check hex head on UHT and if broken, use second tool.	

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2. (Cont'd)		Crew	7. If procedure fails to release bolts, tilt package on carry handle side, and utilize UHT to unwind cable manually to expose shorting plug.	If RTG cable reel cannot be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Cable reel falls to the lunar surface when final Boyd bolt is removed.	Crew	1. Retrieve cable reel with UHT handle. Determine tempilabel temperature. If under 250°F, grasp reel assembly, connect UHT, and continue deployment.	
		Crew	2. If tempilable indicates a temperature over 250°F, request the aid of the second crewman. The CDR will retrieve reel with UHT, deploy the cable, lay the reel assembly on subpackage #1, secure with UHT and continue deployment.	

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Shorting plug pull pin does not release.	Crew	1. Apply additional force while rotating pin.	
		Crew	2. Apply additional force on pin with hammer or break pin.	
		Crew	3. Use hammer to break bracket.	
		Crew	4. Attempt to separate cable from shorting switch.	
		Crew	5. If shorting plug cannot be mated to Central Station, abandon ALSEP.	If ALSEP deployment is terminated anytime prior to Central Station activation, the RTG shorting plug reset lanyard will be pulled to assure the RTG is shorted.

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Shorting plug connector fails to engage and lock to Central Station (C/S).	Crew	1. Check shorting plug connector for proper orientation.	
		Crew	2. Check both connectors for debris on pins or Central Station receptacle.	
		Crew	3. Depress outer flange of shorting plug connector to ensure proper function.	
		Crew	4. Reconnect applying additional downward pressure on the flange assembly with the LMP helping to provide additional stability (LMP can aid by holding PLSS).	
		Crew	5. Manually separate the shorting plug from the RTG cable, discard and connect RTG cable directly to Central Station.	If RTG cable connector cannot be mated to Central Station, abandon ALSEP.

TABLE 12. RTG Cable Interconnect (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	Ampere gauge unreadable due to debris or arrow in ampere gauge is at zero (no movement).	Crew	1. Report condition and continue ALSEP deployment.	
		Crew	2. Reset the shorting switch if reading is zero.	
7.	Shorting plug depressed but ammeter shows no drop in amperage.	Crew	1. Reset the switch, and redepress.	
		Crew	2. Apply additional force to shorting plug and note if amperage drops.	Absence of amperage drop is not justification for abandoning ALSEP deployment.
		Crew	3. Disconnect shorting plug from Central Station, separate shorting plug from the RTG cable and connect RTG cable connector to Central Station.	
8.	Shorting plug engages, but falls off when subpackage is rotated.	Crew	1. Return subpackage to vertical position, retrieve cable, remove any debris and remate connectors.	
		Crew	2. Ensure locking mechanism is fully forward.	

TABLE 13. Passive Seismic Experiment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Deploy PSE Stool (Boyd bolt fails to release).	Crew	1. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	2. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	3. Visually check hex head on UHT, if broken, use second tool.	
		Crew	4. Attempt to pry the retainer bracket assembly loose with hammer.	The PSE sensor could be placed directly on the lunar surface, if the PSE stool cannot be released. Experiment thermal control and science may be degraded.
2.	Unable to deploy PSE stool 10 feet west of Central Station.	Crew	Locate PSE stool as far from Central Station and other experiments as possible.	

TABLE 13. Passive Seismic Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Unable to pack lunar surface.	Crew	Provide best PSE stool to lunar surface coupling that site will permit.	
4.	Boyd bolts do not release on PSE mounts.	Crew	1. Visually check (if possible to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. Leave experiment on sunshield and deploy PSE/Central Station as one unit. Do not deploy PSE skirt.	Sunshield can be raised with sensor mounted.

TABLE 13. Passive Seismic Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4. (Cont'd)		Crew	7. Force cable reel free from retainer bracket and deploy sufficient cable to allow sunshield deployment.	
5.	PSE binds on pallet and will not come off in normal manner using UHT.	Crew	1. Ensure the front portion of the subpallet has been raised (3/8") to clear the mounting stud.	
		Crew	2. Apply side loads. Kick with lunar boot (foot) as necessary to eliminate binding.	
		Crew	3. Assist the forward movement of the PSE with the lunar boot making sure the mounting stud is clear.	
		Crew	4. With the second crewman's help, manually aid in removal by using the back support structure as additional lever.	
		Crew	5. Leave PSE on sunshield and deploy PSE/Central Station as one unit. Do not deploy PSE skirt.	Experiment thermal control and science data, as well as Central Station thermal control, may be degraded.
		Crew	6. With UHT, tear away or deploy cable from cable reel.	

TABLE 13. Passive Seismic Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	UHT will not engage in PSE carry socket.	Crew	1. Try to engage second UHT in carry socket.	
		Crew	2. If UHT engagement fails, deploy manually or remove girdle, partially open shroud/skirt assembly and manually emplace experiment using gnomon.	Reduced alignment accuracy if gnomon is handled. NOTE: At 1/6 gravity the skirt should not unfold and cause interference.
7.	Experiment falls off UHT due to accidental triggering of UHT.	Crew	1. Using UHT, retrieve cable and gently lift experiment with cable. Secure mounting lug (tab) with hand and attempt to re-engage UHT in socket.	Reduced thermal control due to degradation of skirt and shroud assembly with lunar debris.
		Crew	2. If UHT engagement fails, deploy manually or remove girdle, partially open shroud/skirt assembly and manually emplace experiment using gnomon.	Reduced alignment accuracy due if gnomon is handled. NOTE: At 1/6 gravity, skirt should not unfold and cause interference.
8.	Experiment falls off PSE stool while leveling after skirt fully deployed.	Crew	1. Retrieve experiment with UHT handle hooked into gnomon opening and lift experiment.	Reduced thermal control due to degradation of skirt and shroud assembly with lunar debris and reduced alignment accuracy due to handling of gnomon.

TABLE 13. Passive Seismic Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Thermal shroud will not lay flat at outer edge.	Crew	Place discarded ALSEP parts and/or lunar rocks on shroud edge.	
10.	UHT punctures thermal shroud during leveling sequence.	Crew	Remove UHT from puncture and attempt to cover the opening, if the hole remains.	Experiment thermal control may be degraded
11.	Lunar debris degrades readability of bubble leveling indicator and alignment index on shroud.	Crew	1. Level by using the local surface area as a reference (PSE shadow).	Improper alignment will result in difficulty correlating PSE data to a position on the lunar surface. Without $\pm 5^\circ$ leveling of LP $XY\overline{Z}$ and tidal sensors, sensors will not operate.
		Crew	2. Ensure ample picture coverage is obtained to verify experiment orientation.	

TABLE 14. Heat Flow Experiment

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Astromate connector will not come out of stowage assembly.	Crew	1. Apply additional force.	
		Crew	2. Obtain assistance from second crewman.	
		Crew	3. Use hammer to break bracket.	If astromate connector cannot be removed from stowage assembly, abandon HFE deployment.
2.	Astromate connector falls to lunar surface.	Crew	Retrieve connector with UHT handle.	Ensure connector is free of debris.
3.	Astromate connector fails to engage and lock.	Crew	1. Check connector for proper orientation.	
		Crew	2. Check connectors on cable and Central Station for debris and bent pins.	
		Crew	3. Remove or shake out debris.	
		Crew	4. Ensure flange is free to travel to the lock position.	
		Crew	5. Attempt to reconnect.	If astromate connector cannot be mated to Central Station, abandon HFE deployment.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Astromate connector locking lever fails to rotate and lock.	Crew	1. Apply additional force.	
		Crew	2. Abandon effort to rotate locking lever.	Primary locking feature should suffice.
5.	Astromate connector engages, but falls off when subpackage is rotated.	Crew	1. Return subpackage to vertical position, retrieve cable, remove any debris and remate connectors.	
		Crew	2. Ensure locking mechanism is fully forward and locking lever is fully rotated.	
6.	Unable to deploy heat flow experiment electronics thirty feet from Central Station	Crew	1. Deploy electronics as far as possible from the Central Station, staying as far as possible from the RTG.	
		Crew	2. Probe should be placed in bore hole pattern as shown in Figure 1.	The objectives of this pattern in Figure 1. are to remove the probes as far as possible from the RTG and yet maintain them a distance of approximately 20 feet apart.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
7.	UHT will not engage in HFE carry socket.	Crew	1. Try to engage second UHT in carry socket.	
		Crew	2. If UHT engagement fails, deploy manually.	
8.	HFE falls off UHT.	Crew	1. Use UHT handle to retrieve cable, gently lift experiment and attempt to re-engage UHT in socket.	Reduced thermal control due to degradation of experiment with lunar dust.
		Crew	2. If UHT engagement fails deploy manually.	Carry experiment to deployment site by holding the leg.
9.	Crewman walks too far and jerks Centrol Station.	Crew	1. Carry HFE subpallet back toward Central Station to provide slack cable and continue deployment of HFE.	
		Crew	2. Check cable and connectors of experiment and Central Station interfaces for visible sign of damage.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
10.	HFE subpallet strut will not collapse.	Crew	1. Apply additional force. 2. Apply additional force with hammer.	
		Crew	3. Continue HFE deployment with strut uncollapsed.	
11.	HFE subpallet falls over on lunar surface.	Crew	Use UHT handle to hook HFE subpallet carry handle and properly emplace HFE subpallet.	Reduced thermal control due to degradation of thermal point with lunar debris.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
12.	HFE Probe Package boyd bolts will not depress.	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. Rip probe containers apart with hammer, attempt to retrieve emplacement tool and probes, and deploy probes as far as possible from Central Station.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
13.	HFE Probe Package boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
		Crew	2. Forcefully rotate UHT to wipe out boyd bolt threads.	
		Crew	3. Use hammer in an attempt to break HFE Probe Package free.	
		Crew	4. Attempt to use hammer claw to rip HFE Probe Package apart starting at seams and retrieve probes and emplacement tool.	
		Crew	5. Cover HFE Probe Package with lunar surface debris.	HFE science data will be severely degraded.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
14.	HFE Probe Package binds on subpallet and will not come off in normal manner using UHT.	Crew	1. Ensure all boyd bolts have been released.	
		Crew	2. Use UHT to ensure that Boyd bolts have been sprung upward.	
		Crew	3. Use hammer in an attempt to break HFE Probe Package free.	
		Crew	4. Attempt to use hammer claw to rip HFE Probe Package apart starting at seams, and retrieve probes and emplacement tool.	
		Crew	5. Cover HFE Probe Package with lunar surface debris.	HFE science data will be severely degraded.
15.	HFE Probe Package halves will not separate.	Crew	1. Apply additional force.	
		Crew	2. Obtain assistance from second crewman and attempt to use hammer claw to rip HFE Probe Package apart at the seams and retrieve probes and emplacement tool.	
		Crew	3. Cover HFE Probe Package with lunar surface debris.	HFE science data will be severely degraded.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
16.	Unable to deploy HFE Probe Package 16 feet west or northeast of HFE Electronics Package.	Crew	Locate HFE Probe Package as far from RTG, Central Station and other surface experiments as possible.	
17.	HFE Probe Package falls to lunar surface.	Crew	Use UHT to hook handle or carry strap and retrieve HFE Probe Package.	
18.	Crewman walks too far and jerks HFE Electronics Package.	Crew	1. Carry HFE Probe Package back toward HFE Electronics Package to provide sufficient slack cable for probe emplacement and continue deployment of HFE.	Orange and black marker at 16' on probe cable.
		Crew	2. Check cable and connector at HFE Electronics Package interface for visible signs of damage	
19.	GAC pip pin on ALSD difficult to withdraw.	Crew	Apply side loads to drill using ALSD handle, while exerting removal force on pip-pin.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
20.	Drill not available at ALSEP site or difficulty in deploying drill.	Crew	1. Use core stem to make deepest possible hole in the lunar surface.	Use extreme care when removing core stem, to minimize cave-in of the hole.
		Crew	2. Remove core stem before inserting probes.	
		Crew	3. After removing core stems, insert heat flow probes into hole as far as possible.	Astronaut should get as close to the open hole as possible; grasp the lower section near its midpoint and insert probe very carefully to prevent cave-in of material.
		Crew	4. Should cave-in of hole occur place adapter over bore stem tapered joint and drive in bore stem with hammer into existing hole as far as possible. Adapter should be in the release mode.	If more than one section can be buried in this way so that drill stem will remain standing unattended, insert probes to maximum depth possible.

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Deployment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
20.		Crew	5. If upper section and cable cannot be placed in hole, dig small trench approximately three to six inches deep out from the hole approximately 5 feet and bury the upper section of the probe and the first four feet of the cable in the trench. Cover lightly with soil using the trenching tool.	Caution: Once the probe has been placed in hole, do not try to remove.
21.	Drill and tools not available at ALSEP site but the adjustable Sampling Scoop is available.	Crew	1. Dig trench approximately 4-feet long sloping from one inch depth at one end to approximately 18 inches at the other end.	Actual slope not critical. Astronaut should dig trench with a sloping floor as deeply as possible.
		Crew	2. Lay heat flow probe in tandem along the bottom of the trench; fill trench with soil using the adjustable Sampling Scoop.	NOTE: Any of these contingencies may arise after successfully drilling the first hole. In this case the contingency given above could be used to emplace heat flow probe #2.

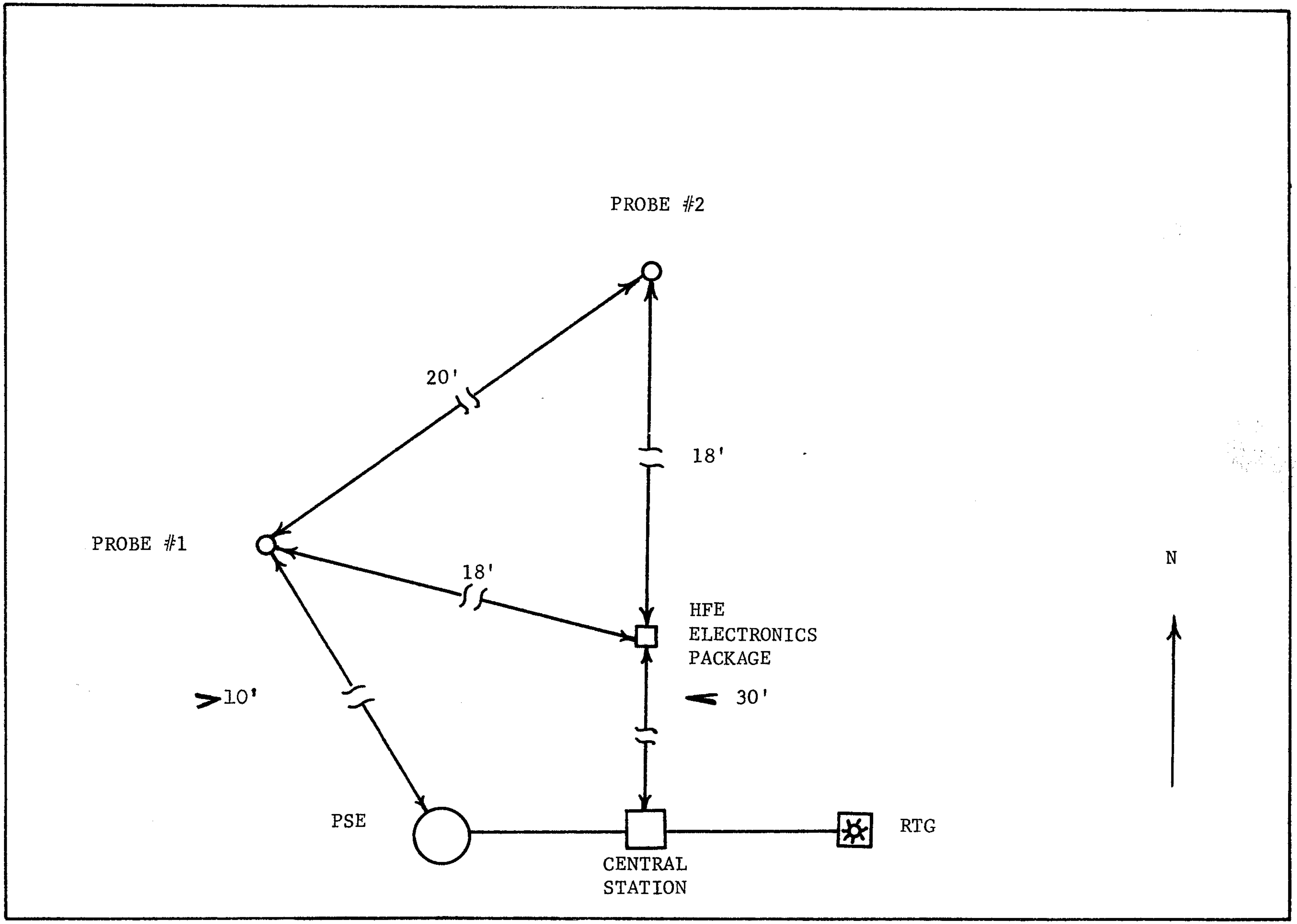


FIGURE 1. CONTINGENCY DEPLOYMENT PATTERN FOR HFE

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Temporary delay (any period exceeding 30 minutes) in ALSD operations after removal of drill from MESA torque box and drill is in the stowed configuration.	Crew	Place drill on lunar surface with battery end down and oriented such that the back of the battery is directed toward the sun (decal on thermal shroud 90° to sun).	Do not place ALSD in any shaded area.
2.	Carry rack binds while being removed from treadle assembly.	Crew	1. Grasp rack in area where rack support legs converse. 2. Pull rack up while holding treadly assembly down on HTC.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Handle assembly fails to lock properly to battery.	Crew	1. Ensure handle is free of interference.	
		Crew	2. Check alignment of handle.	
		Crew	3. Ensure that fixed pin is fully engaged and slap handle to engagement position with additional force.	
		Crew	4. Request second crewman to depress engagement pin and slap handle to engagement position.	
		Crew	5. With the aid of the second crewman attempt drilling operations without the handle.	
		Crew	6. If unsuccessful use treadle assembly to drive bore stems.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Power Head does not operate during pre-deployment test (no spindle rotation).	Crew	1. Remove power head and place on ALHT and check operations again.	Special attention should be given to switch and connectors.
		Crew	2. Rotate spindle with wrench, ccw from the spindle end.	
		Crew	3. Try to loosen spindle with wrench and hammer (turn ccw).	
		Crew	4. Use power head to hand auger and insert probes in holes as far as possible.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	ALSD operations are interrupted after drill deployment from stowage configuration and drilling commenced.	Crew	1. Replace thermal shroud. Place power head and battery assembly into MESA. Properly reposition MESA blankets.	
		Crew	2. If not feasible to place power head and battery into MESA then replace thermal shroud and place drill on lunar surface with battery end down and oriented such that the back of the battery is oriented toward the sun (decal on thermal shroud 90° to sun).	Do not place ALSD in in shaded area.
6.	Power head bracket jams causing difficulty in removal from the treadle.	Crew	Grasp spindle with left hand and press down on treadle with thumb.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
7.	Difficulty in drilling hole with first two sections.	Crew	1. If drilling rate is $<$ 5 in./min., remove drill and move 3 feet to new location.	
		Crew	2. If unsuccessful, repeat Step 1 up to 2 new locations.	
		Crew	3. If unsuccessful at third location, continue drilling until 10 minutes power-on-time has elapsed.	If crewman is drilling on first hole then proceed to second hole after completing Step #3. If drilling on second hole, proceed to coring operation after completion of Step #3.

TABLE 14. Heat Flow Experiments (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
8.	Unable to add additional stem sections due to adapter not releasing.	Crew	1. Set adapter to release mode and check visually to see that adapter is set correctly.	
		Crew	2. Apply power to drill to force release of stems.	
		Crew	3. Drill hole to minimum handle height.	
		Crew	4. Break stem off using power head and inspect adapter.	
		Crew	5. Assure that taper joint does not remain inside adapter.	If part of stem remains inside adapter, use end of wrench to clean adapter.
		Crew	6. If unsuccessful in cleaning adapter, proceed to coring operation.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	Unable to drill successfully with new stem sections.	Crew	1. Remove power head and check visually for damaged male or female taper joints.	A damaged male taper on top section would be indicated by non-rotation of stem.
		Crew	2. If damaged, attempt to remove damaged section and replace with new stem section.	
		Crew	3. If unable to remove damaged section, replace power head and drill hole to minimum handle height.	
		Crew	4. Remove power head and if male taper joint is damaged, insert handle of wrench and clean out the damaged taper joint.	Proceed to second hole or coring operation.

TABLE 14. Heat Flow Experiments (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
10.	Adapter contaminated with lunar debtis.	Crew	1. Tap lightly to remove debris, cycle by hand several times to assure free movement.	
		Crew	2. If adapter is separated from power head, adjust retaining clips, replace carefully and repeat step 1.	
		Crew	3. If unsuccessful in removing debris, use short burst of power to aid in cleaning effort.	
		Crew	4. If lunar debris remains, use lunar dust brush first and then use lens brush to more thoroughly clean adapter.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.2 Drill Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
11.	High torque exists during drilling operations.	Crew	1. Leave power head operating and lift repeatedly until torque decreases.	
		Crew	2. If unsuccessful, continue drilling.	Slip clutch will prevent excessive torque from over-powering astronaut.
12.	Power head runs slowly.	Crew	1. Tap relief valve with hammer or wrench.	
		Crew	2. If unsuccessful, use hand auger and apply power only when necessary.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.1 Probe Emplacement

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Possible to drill only a shallow bore hole.	Crew	1. If bore stems are drilled into the lunar surface and will remain standing unattended, emplace heat flow probes into bore hole as far as possible.	
		Crew	2. Make careful measurement with the emplacement tool to determine the depths of hole and depth of probe emplacement.	
		Crew	3. If less than two sections of bore stem are drilled into the lunar surface and drill string will not stand unattended, use available tools to make deepest possible hole and emplace probes into bore hole as far as possible.	Refer to contingency action outlined in Section 14.1, Event 21.
		Crew	4. Cover any exposed area of the probes and cable with lunar soil.	At least the first four feet of cable should be buried.

TABLE 14. Heat Flow Experiment (Cont'd)

14.3 Probe Emplacement

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Heat flow emplacement tool sections do not lock in extended position.	Crew	1. Rotate unlocked section and attempt to lock, apply additional force.	
		Crew	2. Restow unlocked section and attempt to lock again by applying additional force.	
		Crew	3. If only one section is inoperative, continue to use as is.	HFE science data may be degraded.
		Crew	4. Insert probe with cable as deep as possible.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.3 Probe Emplacement

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Emplacement tool collapses while driving probe into bore hole.	Crew	1. Withdraw emplacement tool, re-extend and lock emplacement tool and resume driving probe into bore hole.	
		Crew	2. If emplacement tool collapses again, insert probe into bore hole as far as possible and report collapse of tool.	HFE science data may be degraded.
4.	Obstructions in the bore stem prevent probe from being inserted completely.	Crew	1. Use the emplacement tool to attempt to clear obstruction from the hole.	Caution: Exercise care when removing probes. Probes can safely be pulled with a force up to 30 lbs.
		Crew	2. Emplace brobe in bore hole.	
		Crew	3. If unsuccessful, repeat Steps 1 and 2 until able to emplace probe.	Note: The most likely cause of an obstruction in the bore stem is that one of the male taper joints has been peened over so that filaments of glass project into the center portion of the bore stem.

TABLE 14. Heat Flow Experiment (Cont'd)

14.3 Probe Emplacement

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Obstruction prevents heat flow probes from being pushed to bottom of bore stems but probes cannot be removed.	Crew	Push on top of heat flow probes with emplacement tool as firmly as possible.	Do not hit top of probes. Astronaut should use caution in determining strength of the resistance in the bore stem (probes should withstand 40 lbs. of pressure.
6.	Heat flow probe does not lock on bottom "Hook" of first bore stem.	Crew	1. Repeat downward pressure cycles to engage hook.	
		Crew	2. Emplace probe as deep in stem as possible utilizing emplacement tool.	
		Crew	3. Read depth on emplacement tool.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.4 Core Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Core sections do not engage at male/female connections.	Crew	1. Check axial alignment and attempt rearrangement.	
		Crew	2. Inspect male joint for foreign material and clean.	
		Crew	3. Attempt to add new stem sections and repeat Steps 1 and 2 until engagement.	
		Crew	4. If unsuccessful in mating by hand, use wrench for additional torque.	Aid of second crewman is necessary.
2.	Power head will not couple to core stem.	Crew	1. Hold power head spindle to the core stem and rotate the power head until full thread engagement is achieved	Care should be exercised to assure proper axial alignment.
		Crew	2. If unsuccessful, use new core stems (6 stems available) and repeat Step 1 until engagement is achieved.	Consult P.I. before abandoning coring operations.
		Crew	3. If unsuccessful in mating by hand, use wrench for additional torque.	Aid of second crewman is necessary.

TABLE 14. Heat Flow Experiment (Cont'd)

14.4 Core Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	Core bit will not pass through treadle lock.	Crew	1. Hold stem and rotate treadle assembly ccw with foot using wrench if necessary. (Start of coring operation.)	
		Crew	2. Remove power head, place treadle lock over the top of stem assembly and replace power head.	Assure male joint is free from foreign material.
		Crew	3. (End of Coring Operation) Remove power head from core stem, attempt to remove treadle lock over top of male joint.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.4 Core Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Core stem cannot be unscrewed from power head spindle.	Crew	1. Turn and lift stems to attempt to set treadle lock.	
		Crew	2. If unsuccessful, use wrench to hold core stem and decouple.	Aid of second crewman needed.
		Crew	3. If unsuccessful, tap stem spindle interface with hammer and repeat Step 2.	If successful, inspect and clean exposed male joint and consult P.I. concerning cleaning of female joint.
		Crew	4. If unsuccessful, retract stem until second joint is exposed, remove power head with first stem attached, and continue coring operation by adding core stems at this interface.	

TABLE 14. Heat Flow Experiment (Cont'd)

14.4 Core Operations

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Power head spindle binds on male end of core stem after drilling.	Crew	1. Cradle handle assembly between thumbs and fore-fingers and lift up and forward.	Align power head vertically.
		Crew	2. Use wrench to decouple power head and core stem and repeat Event 1, Steps 1 and 2.	
		Crew	3. Use hammer impact force to free binding.	
6.	Core stems do not disengage at male/female connections.	Crew	1. Use treadle as additional torque.	Aid of second crewman is necessary.
		Crew	2. Tap interface with hammer and repeat Step 1.	
		Crew	3. Bypass joint and attempt disengagement at next core joint.	Consult P.I. about status of double length core stem.
7.	Core stem vice jaws on LRV aft pallet fails or supporting structure fails.	Crew	Use treadle core stem lock and ALSD wrench to separate core stems.	

TABLE 15. Lunar Surface Magnetometer Experiment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Boyd bolts do not release on LSM mounts.	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. Leave experiment on sunshield and deploy LSM/Central Station as one unit.	Sunshield can be raised with sensor mounted.
		Crew	7. Force cable reel free from retainer bracket and deploy sufficient cable to allow sunshield deployment.	

TABLE 15. Lunar Surface Magnetometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Upper support bracket handle does not deploy.	Crew	1. Use the UHT to pry handle into the upright position for grasping.	
		Crew	2. Apply tension to the center lanyard with glove or UHT to release "pip pin" at the Electronic Gimbal Flip Unit.	
		Crew	3. If successful, apply tension to other two lanyards to release "A" frame swing brackets from the Electronic Gimbal Flip Unit.	The forward bar bracket upper and lower sections can be separated later after removal from subpackage #1.
		Crew	4. Use hammer in an attempt to break bracket.	
		Crew	5. Leave LSM on sunshield and deploy LSM/Central Station as one unit.	Experiment thermal control and science data, as well as Central Station thermal control, may be degraded.

TABLE 15. Lunar Surface Magentometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3.	LSM binds on pallet and will not come off in normal manner using UHT.	Crew	1. Check center lanyard and if untied or broken, there is no means of unlocking from the mounting pins.	
		Crew	2. If lanyard is intact, pry under the Electronic Gimbal Flip Unit handle to effect unlocking.	
		Crew	3. If unlocked, but binding on mounting pins, attempt to pry under rear of the Electronic Gimbal Flip Unit with the UHT.	
		Crew	4. Leave LSM on sunshield and deploy LSM/Central Station as one unit.	Experiment thermal control and science data, as well as Central Station thermal control, may be degraded.
		Crew	5. Force cable reel free from retainer bracket and deploy sufficient cable to allow sunshield deployment.	
4.	UHT will not engage in LSM carry socket.	Crew	1. Try to engage second UHT in carry socket.	
		Crew	2. If UHT engagement fails, deploy LSM manually.	

TABLE 15. Lunar Surface Magnetometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Experiment falls off UHT due to accidental triggering of UHT release mechanism.	Crew	1. Use UHT handle to retrieve cable, gently lift experiment and attempt to re-engage UHT in socket.	Reduced thermal control due to degradation of experiment with lunar dust.
		Crew	2. If UHT engagement fails, deploy manually.	
6.	Unable to deploy legs.	Crew	1. If spring-loaded legs do not self-deploy after removal of forward bracket, assist their deployment by hand.	
		Crew	2. Emplace experiment on local surface with legs in stowed position and prop up with rocks or debris to provide the best possible leveling.	Experiment stability will be degraded.
		Crew	3. As a last resort, lay the Electronic Gimbal Flip Unit flush on the lunar surface and attempt leveling.	
7.	UHT punctures thermal shroud during leveling sequences.	Crew	Remove UHT from puncture and attempt to smooth thermal surface.	Experiment thermal control may be degraded.

TABLE 15. Lunar Surface Magnetometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
8.	LSM tips over on booms while emplacing experiment.	Crew	1. Attempt to pick up experiment with UHT.	Reduced thermal control due to degradation of experiment with lunar dust.
		Crew	2. Grasp experiment by boom and reinsert UHT.	
		Crew	3. Clean experiment with thermal glove.	
9.	Lunar debris degrades readability of bubble leveling indicator and alignment index on shroud.	Crew	1. Level by using the local surface area as a reference (LSM shadow).	Improper alignment will result in difficulty correlating data to a position on the lunar surface.
		Crew	2. Ensure ample picture coverage is obtained to verify experiment orientation.	

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Connector fails to engage to Central Station.	Crew	1. Check connectors on cable and Central Station for foreign material and bent pins.	
		Crew	2. Remove or shake out debris.	
		Crew	3. Ensure outer flange is free to travel to the lock position.	
		Crew	4. Attempt to reconnect checking visual indicator (orange ring).	
2.	Connector engages but falls off when package is rotated.	Crew	1. Return package to vertical position, retrieve cable (as above) check for foreign matter and remove connectors.	
		Crew	2. Ensure locking mechanism is fully forward and orange ring is visible.	
3.	Connector retainer pull pin does not release.	Crew	1. Attempt release by pushing down on fasterner before pulling up, using UHT.	
		Crew	2. Apply additional force while rotating pin.	
		Crew	3. Use hammer or break pin.	

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	Cable reel does not deploy from experiment stowage cavity.	Crew	1. Check to see if Boyd bolt and cup are free; if not, remove manually.	
		Crew	2. Grasp the reel and remove manually.	
		Crew	3. Use second UHT handle to aid in extracting the reel.	
		Crew	4. Deploy as much cable as possible which tends to force the reel out.	
		Crew	5. Deploy experiment as far from ALSEP in the preferred direction as possible.	Experiment thermal control and science may be degraded.
5.	SIDE connector falls to lunar surface.	Crew	1. Retrieve connector with UHT handle in pull ring on lanyard.	
		Crew	2. Retrieve connector by lifting cable and working hand along cable to connector.	
		Crew	3. Ensure connector is free of foreign particles.	

TABLE 16. Suprathermal Ion Detector Experiment/ Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
6.	UHT will not engage in SIDE/ CCGE carry socket.	Crew	1. Try to engage second UHT in carry socket.	
		Crew	2. If UHT engagement fails, deploy manually by grasping back support structure or tool brackets.	
7.	Experiment falls off UHT due to accidental triggering of UHT release mechanism.	Crew	1. Use UHT handle to re-trieve cable, gently lift experiment, manually secure ground screen tube or leg and attempt to re-engage UHT in socket.	
		Crew	2. If UHT engagement fails, deploy manually by grasping ground screen tube.	
8.	Crewman walks too far and jerks Central Station out of alignment.	Crew	1. Carry experiment back toward Central Station to provide slack cable, con-tinue deployment of SIDE/CCGE and realign Central Station and check other experiments upon return.	
		Crew	2. Check cable and connector at experiment and Central Station interfaces for visible signs of damage.	

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
9.	UHT will not disengage from SIDE subpallet UHT socket.	Crew	1. Apply additional force.	
		Crew	2. Obtain assistance from second crewman.	
		Crew	3. If UHT will not disengage, leave it on the SIDE subpallet and continue deployment using second UHT.	SIDE subpallet stability will be degraded. Although only one UHT is needed for deployment, deployment time will be increased. Second crewman could carry out geological tasks while first astronaut completes ALSEP deployment.
10.	SIDE/CCGE will not come off subpallet.	Crew	1. Ensure all boyd bolts have been released.	
		Crew	2. Use UHT to ensure that boyd bolts have been sprung upward.	
		Crew	3. Leave SIDE/CCGE on subpallet and deploy SIDE/CCGE subpallet. Remove ground screen and discord.	Experiment thermal control and science may be degraded.

TABLE 16. Suprathermal Ion Detector Experiment/ Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
11.	Unable to deploy legs.	Crew	1. If lanyard breaks, attempt to remove pin manually.	
		Crew	2. Emplace experiment on lunar surface with legs in a stowed position.	Experiment stability may be degraded.
12.	UHT will not engage in ground screen socket.	Crew	1. Attempt to release ground screen with UHT and to remove and deploy ground screen manually.	
		Crew	2. Try to engage second UHT in ground screen socket.	
		Crew	3. If unsuccessful, continue SIDE/CCGE deployment without ground screen.	SIDE science will be degraded.

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
13.	Ground screen will not disengage from UHT with trigger during screen deployment.	Crew	1. Manually remove screen from UHT.	
		Crew	2. Deploy screen manually and drop on the lunar surface as flat as possible.	
		Crew	3. If UHT will not disengage, leave it on the screen and continue deployment using second UHT.	Loss of one UHT will increase deployment time. Second crewman could carry out geological tasks while first crewman completes ALSEP deployment.

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
14.	SIDE falls over while emplacing experiment.	Crew	1. Attempt to pick up experiment by cable after retrieving cable with UHT.	Reduced thermal control due to degradation of experiment with lunar dust.
		Crew	2. Grasp experiment at reel housing and reinsert UHT.	
		Crew	3. Clean experiment with thermal glove or through gentle impact.	
15.	SIDE leg breaks.	Crew	1. Prop experiment on RTG cable reel, rock, or other lunar debris.	Place ground screen beside experiment (not touching SIDE or CCGE). Experiment thermal control may be degraded.

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
16.	CCGE Boyd bolt jams or will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
		Crew	2. Forcefully rotate UHT to wipe out boyd bolt threads.	
		Crew	3. Leave CCGE in stowage cavity and continue SIDE deployment.	Loss of CCGE will not interfere with successful operation of SIDE.
17.	Deutsch fastener will not rotate.	Crew	1. Check hex head of UHT and if damaged, use second UHT.	
		Crew	2. Forcefully rotate UHT to wipe out Deutsch fastener.	
		Crew	3. Use UHT or MESA tools to pry or fail retention bracket in an attempt to gain access to CCGE.	
		Crew	4. Deploy SIDE/CCGE as one unit.	Loss of CCGE will not interfere with successful operation of SIDE.

TABLE 16. Suprathermal Ion Detector Experiment/ Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
18.	CCGE cannot be removed from stowage cavity.	Crew	1. Ensure that CCGE Boyd bolt is not preventing CCGE removal.	
		Crew	2. Use second UHT to aid in extracting CCGE.	
		Crew	3. Pull on cable in order to force the CCGE out of the cavity.	
		Crew	4. Leave CCGE in stowage cavity and continue SIDE deployment.	
19.	CCGE cannot be attached to ground screen tube.	Crew	Deploy CCGE by using the cable instead of the fixed deployment tube.	
20.	Dust cover releases when pull pin is removed.	Crew	Deploy with cover open, but minimize dust contamination.	Experiment thermal control science may be degraded.
21.	Dacron dust bag does not come free.	Crew	Manually lift experiment and remove dacron bag.	

TABLE 16. Suprathermal Ion Detector Experiment/
Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
22.	SIDE/CCGE connector pull pin jams.	Crew	1. Apply additional force while rotating pin.	
		Crew	2. Apply additional force on pin with hammer or break pin.	
		Crew	3. Use hammer to break bracket.	If SIDE/CCGE connector cannot be released, abandon SIDE/CCGE deployment. Ensure concector is free of debris.
23.	SIDE/CCGE connector falls to lunar surface.	Crew	Retrieve connector with UHT handle.	
24.	SIDE/CCGE connector fails to engage and lock.	Crew	1. Check connector for proper orientation.	
			2. Check connectors on cable and Central Station for debris and bent pins.	
			3. Remove or shake out debris.	
			4. Ensure outer flange is free to travel to the lock position.	
			5. Attempt to reconnect and check visual indicator (orange ring).	If SIDE/CCGE connector cannot be mated to Central Station, abandon SIDE/CCGE deployment.

TABLE 16. Suprathermal Ion Detector Experiment/ Cold Cathode Gauge Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
25.	SIDE/CCGE connector engages but falls off when subpackage is rotated.	Crew.	1. Return subpackage to vertical position, retrieve cable, remove any debris and remate connectors.	
		Crew	2. Ensure locking mechanism is fully forward and orange ring is visible.	

TABLE 17. Solar Wind Spectrometer Experiment

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Boyd bolts fail to release	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. Leave experiment on sunshield and deploy SWS/Central Station as one unit.	Experiment thermal control and science data, as well as Central Station thermal control, may be degraded.

TABLE 17. Solar Wind Spectrometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1. (Cont'd)		Crew	7. Force cable reel free from retainer bracket and deploy sufficient cable to allow sun-shield deployment.	If unsuccessful, sun-shield will not deploy and Central Station thermal control will be degraded. Loss of SWS will not effect the successful operation of remainder of ALSEP.

TABLE 17. Solar Wind Spectrometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Carry/removal socket unusable. UHT will not lock in socket.	Crew	1. Remove manually by grasping leg.	
		Crew	2. Deploy cable from reel while grasping leg.	
		Crew	3. Emplace experiment while grasping thermal plate, using UHT (as required) to aid in emplacing unit upright.	
		Crew	4. Use UHT on thermal plate to align and level unit.	
3.	Swivel socket pull pin jams.	Crew	1. Apply additional force while supporting experiment on HTC.	
		Crew	2. If unsuccessful, disengage UHT, emplace experiment by grasping thermal plate, and use UHT to level and align experiment.	
4.	SWS sensor dust cover comes off during deployment.	Crew	Do not reinstall.	Continue deployment.

TABLE 17. Solar Wind Spectrometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Experiment falls off UHT due to accidental triggering of UHT release mechanism.	Crew	1. Use UHT handle to retrieve experiment by hooking the lip of the handle through the "A" frame leg. Grasp the experiment by the top part of the leg and slide the hand up to the bottom of the thermal plate and manually secure experiment. Attempt to re-engage UHT in socket.	Reduced thermal control due to degradation of experiment with lunar dust.
		Crew	2. If UHT engagement fails, deploy manually.	
6.	Unable to deploy SWS 13 feet north of Central Station.	Crew	1. Locate SWS as far from Central Station as possible.	
		Crew	2. Attempt to maintain a 13 foot separation between SWS and Central Station.	
		Crew	3. Attempt to maintain at least 10 foot separation between RTG and SWS.	

TABLE 17. Solar Wind Spectrometer Experiment (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
7.	Unable to deploy legs.	Crew	1. If leg is sticking attempt to pull harder on the foot pad.	
		Crew	2. Emplace experiment on local rock or debris to provide the best possible leveling.	Experiment stability will be degraded.
8.	Leg breaks off while emplacing the experiment.	Crew	1. Prop up experiment with core tube, penetrometer, or lunar debris, to provide the best possible leveling.	Experiment thermal control may be degraded.

TABLE 18. Central Station

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Boyd bolt(s) fail to release.	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw then turn back ccw.	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. Engage UHT in Subpackage #1 temporary stowage socket and use UHT as a lever to raise sunshield.	
		Crew	7. Leave sunshield in stowed condition and attempt to gain access to antenna mass bracket.	Central Station thermal control will be degraded.

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1. (Cont'd)		Crew	8. If unsuccessful, mount antenna aiming mechanism on sunshield.	Antenna aiming accuracy will be degraded.
2.	Sunshield fails to raise after all Boyd bolts are released.	Crew	1. Engage UHT in temporary stowage socket and raise sunshield manually with UHT as lever arm.	
		Crew	2. Check to see if rear thermal curtain on ALSEP antenna cable is jammed and release it with UHT handle, if required.	
		Crew	3. Check to see if curtain covers are marred.	
		Crew	4. If sunshield does not raise, remove curtain retainers and mount antenna mast bracket on the bottom shoe of the structure bracket.	
3.	RF antenna cable reel lanyard breaks or pin jams.	Crew	1. Use handle of UHT to engage (hook) restraining brackets and bend/break restraining brackets off the sunshield.	
		Crew	2. Deploy cable using UHT.	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	UHT will not engage in aiming mechanism housing carry socket.	Crew	1. Try to engage second UHT in carry socket.	
		Crew	2. If UHT engagement fails, deploy manually.	
5.	Aiming mechanism Boyd bolts fail to release.	Crew	1. Visually check (if possible) to see if bolt is released and not loose/raised due to side loading.	
		Crew	2. Check for spring loading on bolt.	
		Crew	3. Insert UHT and apply downward pressure on center spline. Use hammer if necessary; turn ccw to release.	
		Crew	4. If spline is depressed and bolt will not rotate, back off slightly cw, then turn back ccw.	
		Crew	5. Visually check hex head on UHT, if broken, use second tool.	
		Crew	6. If unsuccessful, break housing off mounting legs with side loading to gain access to aiming mechanism.	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5. (Cont'd)		Crew	7. If unable to gain access to aiming mechanism, mount antenna on Central Station sunshield brackets and point antenna toward earth.	Antenna aiming accuracy will be degraded.
6.	Antenna mast binds on subpallet taper fitting.	Crew	Stand on edge of subpallet and rotate mast while applying additional lifting force on lower half.	
7.	Aiming mechanism housing will not come off subpallet.	Crew	1. Ensure both Boyd bolts have been released.	
		Crew	2. Use UHT to ensure that Boyd bolts have been sprung upward.	
		Crew	3. If unsuccessful, use hammer to break housing off mounting legs in order to gain access to aiming mechanism.	
		Crew	4. If unable to gain access to aiming mechanism, mount antenna on Central Station sunshield.	Antenna aiming accuracy will be degraded.

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
8.	Antenna mast bracket on Central Station covered with lunar debris.	Crew	Clear area with lunar boot or use UHT to probe or jar bracket and free it of debris.	
9.	Aiming mechanism falls out of housing onto lunar surface.	Crew	Retrieve mechanism with UHT handle and shake off debris. Clean taper fitting with glove.	Reduced operational capability or jamming of the gears and pivot points is possible due to degradation of the aiming mechanism surfaces with lunar debris.
10.	Aiming mechanism knobs will not rotate.	Crew	1. Apply additional force with hand and hammer, being careful not to damage mechanism.	
		Crew	2. Attempt to intentionally fail mechanism, achieve approximately correct orientation using sighting and shim or brace antenna to maintain aiming accuracy.	
		Crew	3. Remove antenna mast from Central Station and push it into surface pointing at earth (rough alignment).	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
10. (Cont'd)		Crew	4. Adjust as required in real-time communication to capsule communicator.	
11.	Antenna mast will not seat in bracket on Central Station.	Crew	1. Examine antenna mast for obstructions, dislodge obstructions by impact and reseat antenna mast in bracket in Central Station.	If antenna mast cannot be fully seated in bracket, the antenna aiming accuracy may be degraded.
		Crew	2. Use hammer to apply additional force.	Caution: Do not damage aiming mechanism interface.
		Crew	3. If antenna mast is partially seated, continue with nominal deployment sequence.	
		Crew	4. If antenna mast cannot be seated in bracket or is unstable, mount aiming mechanism and antenna on sunshield.	
		Crew/ MCC	5. Adjust antenna and aiming mechanism as required, in real time, to achieve good communication.	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
12.	Aiming mechanism will not seat on antenna mast.	Crew	1. Examine antenna mast for obstructions, dislodge obstructions by impact and reseat aiming mechanism on antenna.	If aiming mechanism cannot be fully seated on antenna mast the antenna aiming accuracy may be degraded.
		Crew	2. If aiming mechanism is partially seated and stable, continue with nominal deployment.	
		Crew	3. Examine antenna mast for damage and if damaged, mount aiming mechanism and antenna on sunshield.	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
13.	Antenna will not seat on aiming mechanism.	Crew	1. Ensure cable outlet is properly oriented.	
		Crew	2. Examine antenna and aiming mechanism for obstructions, dislodge obstructions by impact and reseat antenna on aiming mechanism.	
		Crew	3. If antenna is partially but firmly seated on aiming mechanism, continue with nominal deployment.	
		Crew	4. Examine antenna and aiming mechanism for damage and, if damaged, mount antenna on sunshield.	

TABLE 18. Central Station (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
14.	ALSEP deployment time becomes constrained.	Crew	1. If antenna is level and aligned, actuate the RTG shorting switch and ASTRO switch No. 1.	
		Crew	2. If antenna is not aligned or level and there will be a second EVA, do not actuate these switches.	
		Crew	3. If no second EVA, level and align as accurate as possible and actuate switches.	
		Crew	4. Do not activate any switches if none of the experiments have been deployed and no second EVA.	

TABLE 19. ALSEP Activation

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Switch #1 cannot be turned cw to ON position.	Crew/ MCC	1. Report to MCC.	
		Crew	2. Verify that switch is in ccw position.	
		Crew	3. Apply additional force to switch.	
		Crew/ MCC	4. Report to MCC and continue ALSEP deployment.	
		MCC	5. Compute time when PCU will activate assuming normal RTG warmup, command transmitter on (Octal 013), confirm ALSEP data and verify crew to complete ALSEP deployment.	

TABLE 19. ALSEP Activation (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
2.	Central Station contingency antenna alignment.	Crew	1. Point antenna in general direction of earth.	
		Crew	2. Adjust antenna pointing angle in small increments, stepping back after each adjustment to avoid distortion of antenna beam pattern.	
		Crew/ MCC	3. Perform required offsets under MCC direction.	
3.	Turn-on of ALSEP transmitter	Crew/ MCC	1. Astronaut standby for manual turn-on of ALSEP transmitter.	Initiate command CD-4 (octal 015) "Transmitter B Select." If no response, advise astronaut via voice link to turn on transmitter.
		Crew/ MCC	2. Actuate ALSEP back-up switch No. 2 with following functions: a. Select Transmitter B. b. Turn on Transmitter. c. Reset receiver circuit breaker. d. Select and turn on data processor Y.	Acknowledge turn-on of transmitter by reception of RF signal from ALSEP.

TABLE 19. ALSEP Activation (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
3. (Cont'd)		Crew/ MCC	3. Advise MCC via voice link back-up switch No. 2 has been actuated.	Advise astronaut via voice link whether transmitter is functioning.
		Crew	4. Acknowledge MCC transmitter message via voice link.	
		Crew	5. If transmitter is not functioning, actuate ALSEP back-up switch No. 1, permitting PCU to operate on marginal voltage output of RTG.	
		Crew/ MCC	6. If transmitter is still not functioning, actuate back-up switch No. 3, energizing all experiments, sequentially.	Acknowledge back-up switch No. 3 actuation via voice link. Confirm power turn-on by telemetry indication (channels 12 and 14).
		Crew/ MCC	7. Advise MCC via voice link that switch No. 3 has been actuated.	Advise astronauts that all experiments have been turned on via voice link.

TABLE 19. ALSEP Activation (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4.	MCC reports downlink signal problems.	Crew	1. Crew should verify that antenna is properly oriented, Central Station is properly leveled and aligned, and RF cable and connectors are intact.	
		Crew	2. Notify MCC if antenna did not require reorientation, leveling or alignment, and if RF cable and connectors are intact.	
		MCC	3. If antenna is properly oriented, Central Station is leveled and aligned and RF cable and connectors are intact, select Trans "B".	
		MCC/ Crew	4. If unsuccessful, notify crew to adjust antenna pointing angle in small increments under MCC direction and to step back after each adjustment to avoid distortion of antenna beam pattern.	

TABLE 19. ALSEP Activation (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
4. (Cont'd)		MCC	5. Request data through a site with 85 foot antenna.	
		MCC	6. Select "Low Bit Rate."	
		Crew/ MCC	7. If signal still too weak to yield useful data, notify crew to complete remainder of ALSEP deployment.	NOTE: High Bit Rate data not usable.

TABLE 19. ALSEP Activation (Cont'd)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
5.	Downlink frequency so unstable that Manned Space Flight Network (MSFN) receiver cannot synchronize.	MCC	1. Select redundant transmitter.	
		MCC/ Crew	2. Select "Low Bit Rate."	
		MCC/ Crew	3. If signal still unstable, notify crew to complete remainder of ALSEP deployment.	

TABLE 20. S-Band Transponder (CSM/LM)

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	No LM docking.	MCC	1. If CSM lunar orbit mission, proceed with CM portion of experiment only.	
		MCC	2. If CSM lunar flyby mission, scrub all experiment items.	

TABLE 21. Down-Link Bistatic Radar Observation of the Moon

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	VHF antenna failure.	Crew	Switch to other VHF antenna. Position S/C so that selected antenna faces lunar surface.	Assumes one antenna failure.
2.	VHF ground equipment failure	Crew	Scrub VHF position of experiment.	Special VHF ground equipment located at Stanford University.
3.	Not enough time to perform a complete pass with S-band and VHF operating simultaneously.	Crew	Perform the experiment for as much of each pass as possible.	Two VHF/S-band passes, separated by approximately 20 hours, are planned.
4.	S-band 210' dish at Goldstone not available.	Crew	Scrub S-band portion of experiment.	
5.	Unable to determine S-band high-gain antenna pointing.	Crew	Perform the experiment using the S-band omni-directional antenna.	

TABLE 22. Subsatellite

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Subsatellite does not launch.	Crew	Position switch to retract and reinitiate extend launch sequence.	
2.	Earth Orbit	MCC	Operations of Subsatellite will be real-time decision depending upon type of orbit obtained.	

TABLE 23. Alpha Particle Spectrometer

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Earth Orbit Only.	Crew	Limited Operation.	Meaningful science data would be attenuated by earth's atmosphere. Would obtain operational and housekeeping data only.
2.	Lunar Polar or Modified Lunar Orbit	Crew	Operate Experiment in Normal Manner.	Excellent opportunity to obtain Lunar Alpha Particle Scientific Information.
3.	Experiment Mechanical/Electrical Malfunction.	Crew	Abort Experiment.	Conserve Spacecraft Power.

TABLE 24. Gamma Ray Spectrometer

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Earth Orbit Only	Crew	Limited Operation	Meaningful science data would be attenuated by earth's atmosphere. Would obtain operational and housekeeping data only.
2.	Lunar Polar or Modified Lunar Orbit	Crew	Normal experiment operation.	Excellent opportunity to obtain lunar gamma ray scientific data.
3.	Boom Fails to Extend	Crew	1. Recycle extension control. 2. Limited operation	Obtain spacecraft background data
4.	Boom Fails to Fully Extend	Crew	1. Recycle retraction and extension controls. 2. Limited operation (real-time P.I. decision.)	Degraded data. Operation based upon real-time data evaluation and P.I. determinations.
5.	Boom Fails to retract for TEI SPS Burn.	Crew	1. Recycle retraction control. 2. Jettison the Boom	
6.	Experiment Mechanical/Electrical Malfunction.	Crew	Abort Experiment	Conserve Spacecraft Power

TABLE 25. X-Ray Fluorescence Spectrometer

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Earth Orbit Only.	Crew	Limited Operation.	Meaningful scientific data would be attenuated by earth's atmosphere. Would obtain operational and housekeeping data only.
2.	Lunar Polar or Modified Lunar Orbit.	Crew	Normal Experiment Operation.	Excellent opportunity to obtain Lunar X-Ray scientific data.
3.	Experiment Sensor Direct Sunlight Exposure.	Crew	Normal Experiment Operation.	Degraded data. P.I. determination based upon real-time data evaluation.
4.	Experiment mechanical/electrical malfunction.	Crew	Abort Experiment	Conserve Spacecraft Power.

TABLE 26. Mass Spectrometer

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Earth Orbit Only	Crew	Limited Operation	Obtain operational and housekeeping data only.
2.	Lunar Polar or Modified Lunar Orbit	Crew	Normal experiment operation.	Excellent opportunity to obtain lunar scientific data.
3.	Boom Fails to Extend	Crew	1. Exercise extension control. 2. Limited operation.	Obtain spacecraft background data.
4.	Boom Fails to Extend	Crew	1. Exercise retraction and extension controls. 2. Limited operation (real-time P.I. decision).	Degraded data. Operation based upon real-time data evaluation and P.I. determinations
5.	Boom Fails to retract for TEI SPS Burn.	Crew	1. Exercise retraction control. 2. Jettison the Boom.	
6.	Experiment Mechanical/Electrical Malfunction.	Crew	Abort Experiment	Conserve Spacecraft Power

TABLE 27. Gegenschein from Lunar Orbit

EVENT NO.	CONTINGENCY	AGENT	ACTION	REMARKS
1.	Not possible to schedule during lunar orbit.	MCC/ Crew	Try during TEC.	Updated pointing.
2.	Film magazine jams or fails.	Crew	Switch to other magazine using dim light (fast) film.	
3.	Attitude rates higher than allowed.	Crew	1. Control rates to low as possible.	May reduce number of exposures.
			2. Try 2 minute exposures.	
4.	Not enough time to accomplish all photography.	Crew	Photo priority	
			1. 2 minute exposures	Of Moulton Point
			2. 2 minute exposures	Of Antisolar Point
			3. 2 minute exposures	Of Midway Point
			4. 1 minute exposures	Of Moulton Point
			5. 1 minute exposures	Of Antisolar Point
			6. 1 minute exposures	Of Midway Point

APPENDIX

ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS	DEFINITIONS
ALSEP	Apollo Lunar Surface Experiment Package
* CCGE	Cold Cathode Gauge Experiment
CDR	Commander
CLSRC	Contingency Lunar Sample Return Container
CSM	Command Service Module
DRT	Dome Removal Tool
EMU	Extravehicular Mobility Unit
EVA	Extravehicular Activity
FTT	Fuel Transfer Tool
HFE	Heat Flow Experiment
HTC	Hand Tool Carrier
LEC	Lunar Equipment Conveyer
LM	Lunar Module
LMP	Lunar Module Pilot
LRRR/LR^3	Laser Ranging Retro-Reflector
LSM	Lunar Surface Magnetometer
MCC	Mission Control Center
MESA	Modularized Equipment Stowage Assembly
PCU	Power Control Unit
PDR	Power Dissipation Resister
PSE	Passive Seismic Experiment
RTG	Radioisotope Thermoelectric Generator
SEQ/Bay	Scientific Equipment Bay
SESC	Special Environmental Sample Container
SIDE	Suprathermal Ion Detector Experiment
SRC	Sample Return Container
SWC	Solar Wind Composition
SWS	Solar Wind Spectrometer
TM	Telemetry
UHT	Universal Handling Tool

* The abbreviations CCIG and CCGE are often used interchangeable, however, CCIG is the nomenclature assigned by NASA Headquarters to the instrument described herein.

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