Bendix

Aerospace Systems Division

NO.	REV. NO.
ATM-1102	A

ALSEP Contingency Procedures
For Apollo 17

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DATE 9-11-72

The following contingency procedures represent various remedies for contingency events which may arise during the ALSEP deployment period. It is obvious that all contingency situations cannot be represented in this document and it is understood that real time circumstances can modify those situations which are represented. In some cases, the last action stated for a contingency situation is "abandon effort". It should be understood that this action is only taken after the problem has been explored rigorously. And, such action, if made, will be with the concurrence of the Surface Science Teams and the responsible elements in the Mission Control Center.

Revision A to the "ALSEP Contingency Procedures for Apollo 17" represents the comments, additions and corrections received from the BxA review of these procedures. The revision to each page is noted by a marker in the left hand margin.

This information will be used by the Apollo 17 crew and CAPCOM during training exercises with CPD and FOD and will be incorporated in the Mission Science Requirements Document which is to be used in the Science Support Room during the J-3/Apollo 17 mission. This document adheres to the ALSEP deployment procedure that is currently being used to train the Apollo 17 crew.

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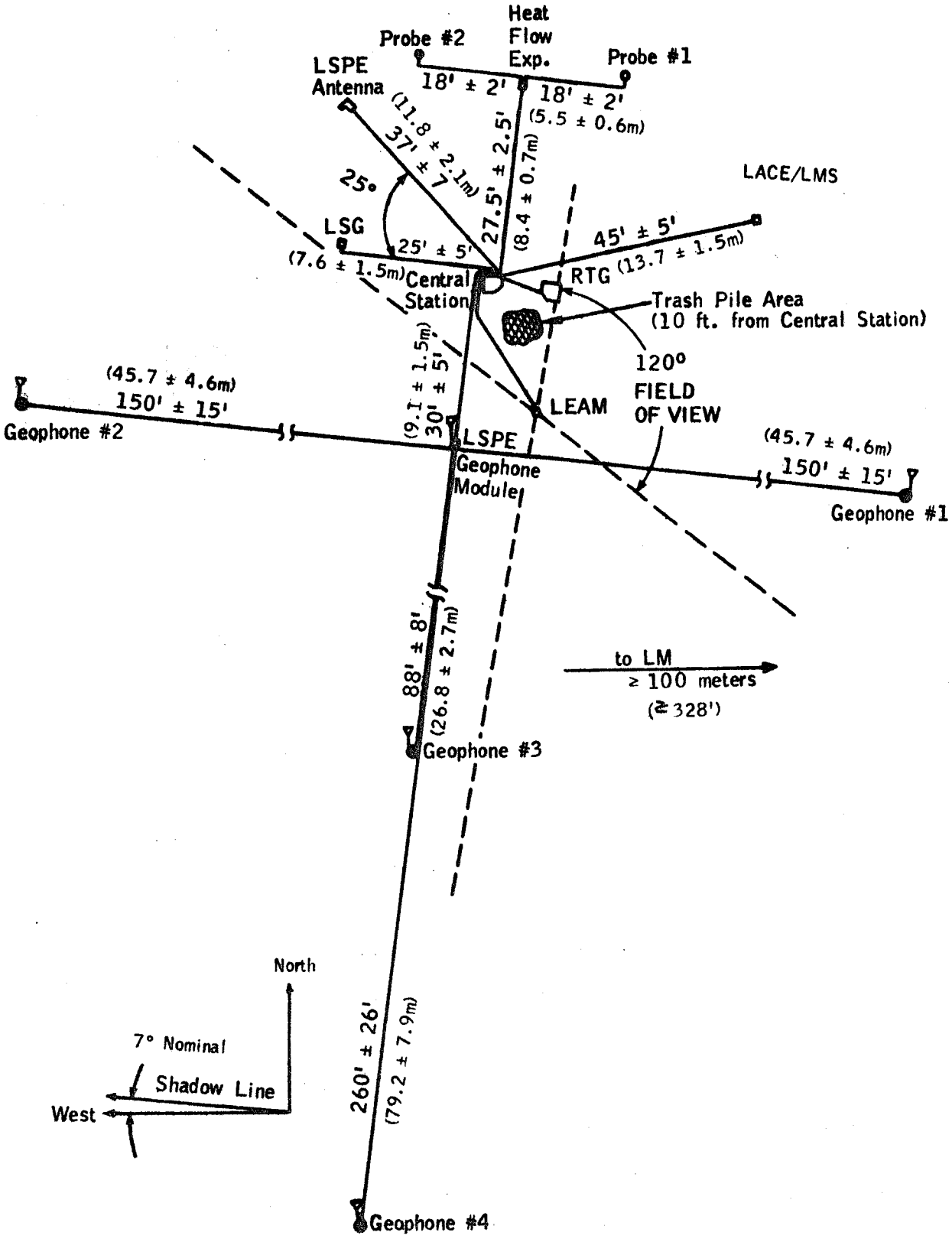
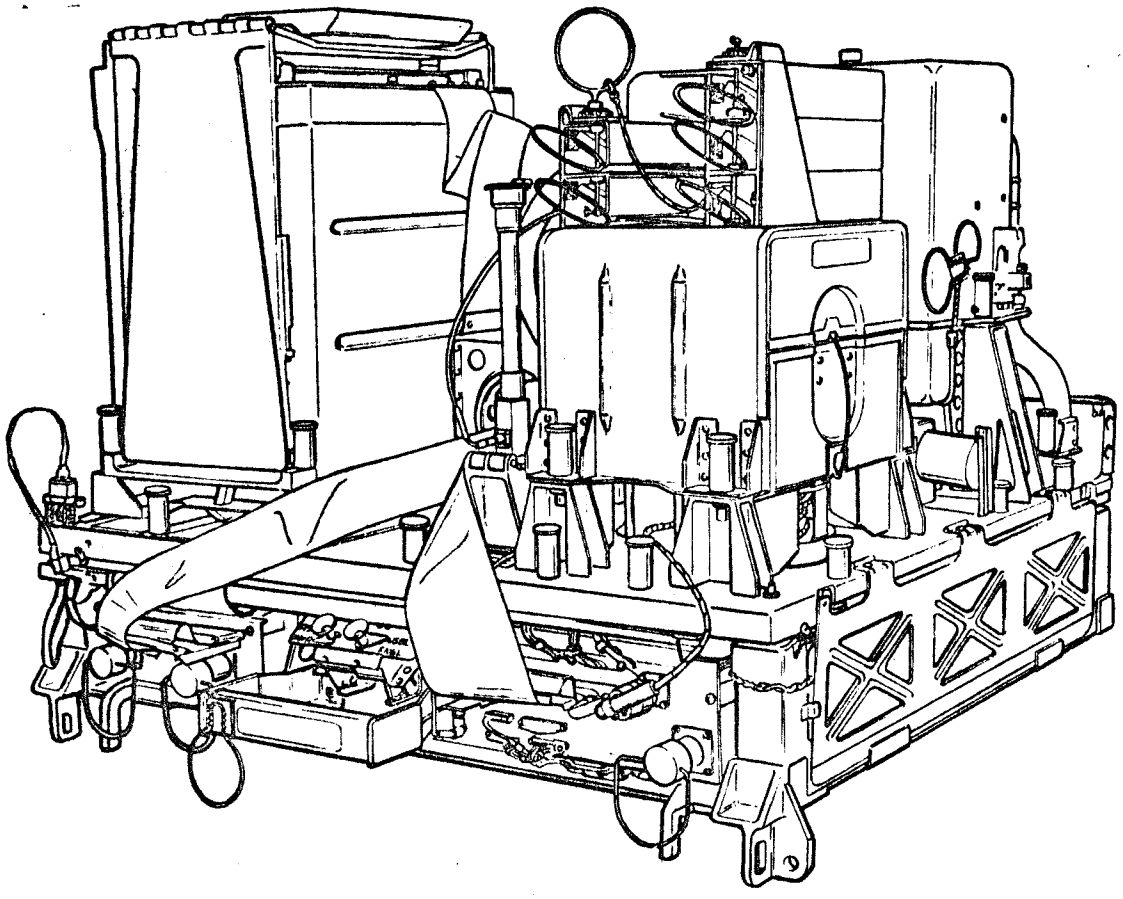


Apollo 17 ALSEP Array E Normal Deployment Arrangement



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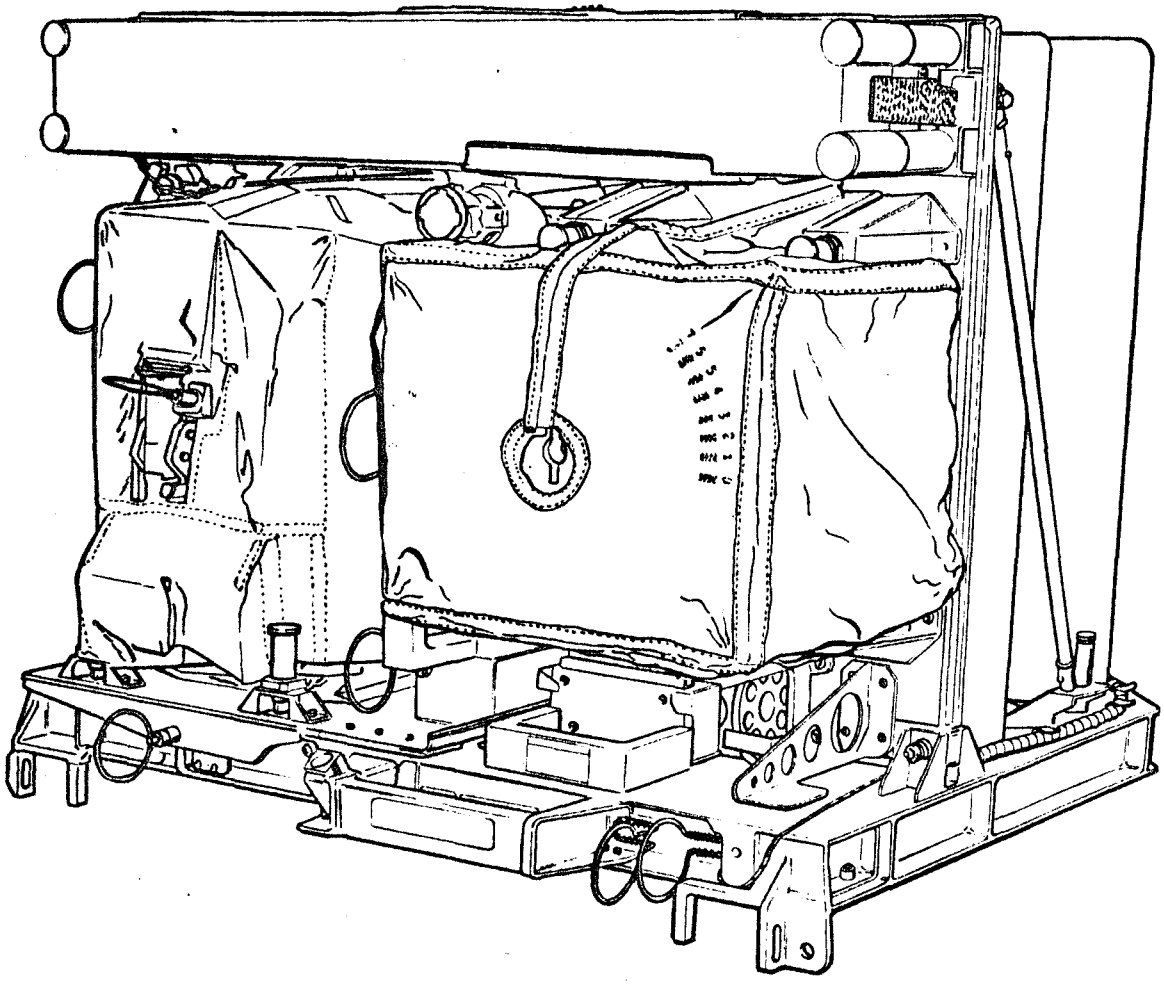

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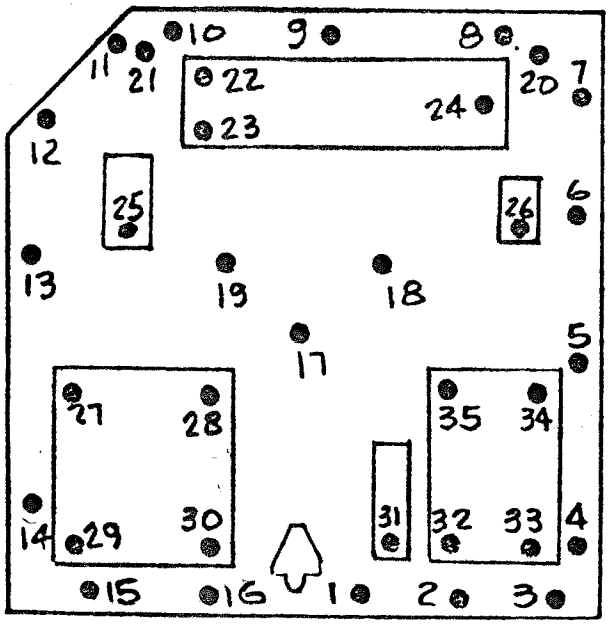

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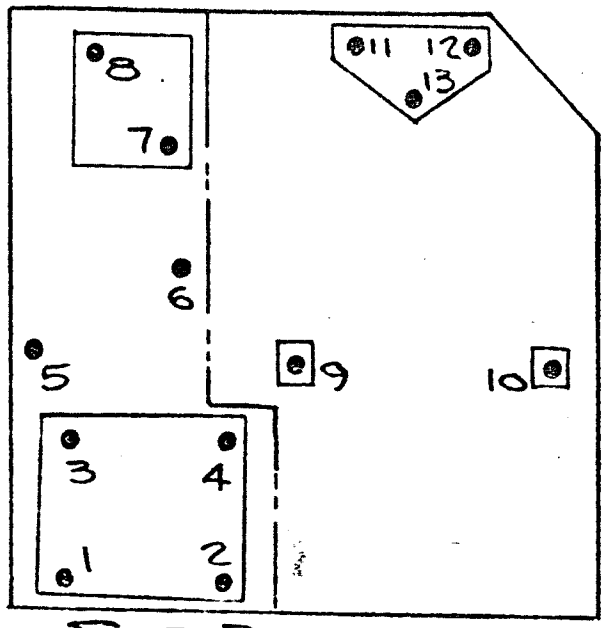

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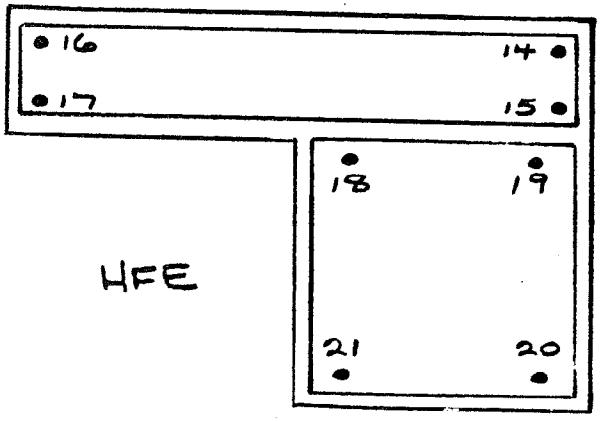

Boyd Bolt Locations

A contingency event is defined as a possible malfunction or off-nominal event; an event that is not likely to occur, but still possible under certain circumstances.

These procedures represent, in approximately chronological order, the lunar surface EVA contingency events and the appropriate remedial actions to be undertaken by the astronauts or MCC in conjunction with the astronauts. The procedures encompass the following EVA functions pertaining to ALSEP.

If a contingency event occurs, the astronauts will generally spend up to a maximum of ten minutes engaged in remedial actions and then, if unsuccessful, abandon the deployment of the malfunctioning equipment. Additional time may be allocated for certain remedial actions (i.e., for ALSEP Offload, RTG Fueling and Cable Interconnect and for Central Station Deployment tasks required for successful ALSEP system operation). An additional time allocation will be based on a real-time decision made by the Flight Director and CAPCOM depending on PLSS consumable usage and timeline constraints.

In the event of a PLSS or operational contingency (i.e., a PLSS malfunction or an imminent consumables redline due to an inability to complete the deployment tasks within the nominal timeline), the sequence of ALSEP deployment tasks may be temporarily stopped after the completion of any one of the following hold points. In case the ALSEP deployment cannot be completed during EVA 1 and part of the deployment must be deferred to EVA 2, three prime hold points (following the completion of Tasks #3, 6 and 13) provide the highest return from an ALSEP system viewpoint. The deployment may be resumed at a later point in time by continuing with the next series of tasks.

1. Open SEQ Bay doors, offload ALSEP Subpackages #1 and #2, and emplace subpackages with handles upward, in and facing the sun. (Close SEQ Bay doors before a hold.)

2. Remove tools.

3. Rotate fuel cask. (PRIME EVA 1 HOLD POINT)

4. Remove fuel cask dome.

5. Unstow ALSD, place on LRV

6. Remove fuel capsule from cask and insert into RTG, close SEQ Bay doors, carry ALSEP and drive LRV to ALSEP deployment site, offload HFE subpallet, connect RTG and HFE cables to Central Station, offload LEAM Carrier, deploy HFE subpallet(*), connect LEAM cable to Central Station, offload and deploy HFE Probe Package (*), and rotate Central Station. (PRIME EVA 1 HOLD POINT)

7. Offload and deploy LSG.

8. Offload and deploy HFE Electronics Package.

9. Offload and deploy LSPE Geophone Module.

10. Offload and deploy ALSD. (*)

11. Offload and deploy LMS.

12. Drill first bore hole and insert first probe into bore stem. (*)

13. Release sunshield Boyd bolts, deploy antenna mast, raise sunshield, install aiming mechanism on mast, install antenna on aiming mechanism and aim antenna (**). (PRIME EVA 1 HOLD POINT)

14. Turn on shorting switch.

15. Drill second bore hole and insert second probe into bore stem.

16. Offload and deploy LEAM.

17. Deploy LSPE Antenna.

18. Deploy LSPE Geophones

19. Activate LSPE Enable Switch

(*) May be deferred if a hold is imminent. HFE and ALSD tasks may be interrupted in order to permit completion of other, less time consuming ALSEP tasks.

(**) Turn on shorting switch if a hold is imminent. Experiments are unpowered so no hazard would exist for astronauts.

Real time decisions by the CDR, LMP, CAPCOM and SSR will cover any contingencies not anticipated in this document.

1.0 EVA Decisions

Event No.	Contingency	Agent	Action	Remarks
1.1	No time for EVA or time for one brief EVA only (1 or 2 man).	Crew	Do not deploy ALSEP.	
1.2	One man EVA 1 only.	Crew	1. Collect contingency sample.	
			2. Deploy ALSEP at least 300 feet west of LM.	Central Station thermal control and experiments' thermal control and science will be degraded if deployment site is east, south or north of LM.
			3. Perform lunar geology investigation on return traverse from ALSEP deployment site.	
1.3	Two man EVA 1 only.	Crew	1. Collect contingency sample.	
		Crew/ MCC	2. Make decision on ALSEP deployment site, trading off desire to deploy ALSEP in direction toward the nearest available and recognizable Taurus Littrow geological material and ALSEP requirement for deployment at least 300 feet west of LM. If trade-off dictates deployment in other than a westerly direction, ALSEP deployment should be at least 300 feet east of LM or, if this is not a satisfactory direction, first south and then north of LM. (If north, go 400 feet).	Central Station thermal control and experiments' thermal control and science will be degraded if deployment site is east, south or north of LM.
		Crew	3. Perform lunar geology investigation during return traverse from ALSEP deployment site.	

1.0 EVA Decisions

Event No.	Contingency	Agent	Action	Remarks
1.4	One man EVA 1; EVA 2 planned.	Crew	1. Collect contingency sample. 2. Deploy all of ALSEP at least 300 feet west of LM. 3. Perform lunar geology investigation on return from ALSEP deployment site.	

2.0 SEQ Bay Door Deployment

Event No.	Contingency	Agent	Action	Remarks
2.1	SEQ Bay door lanyards unusable.	Crew	1. If lanyard free from cable, pull cable. 2. If lanyard melted and fused to Inconel, attempt to break lanyard free with hard pull. 3. If unable to manually break lanyard free, use MESA hammer to free lanyard and pull cable.	
2.2	SEQ Bay doors will not open when lanyard is pulled and there is no cable movement.	Crew	1. Pry open astronaut protection door, fail mechanism, and pull on lanyard again. 2. If unsuccessful, use MESA hammer to chop hole in main door Inconel shield at center patch, hook MESA hammer behind cable, pull to release latch and open door while latch is pulled, and continue to open door upward.	Exercise caution when working in close proximity to hot fuel cask.
2.3	SEQ Bay doors will not open when lanyard is pulled and there is a small cable movement.	Crew	1. Ensure that lanyard is not tangled. 2. Discontinue lanyard use and manually open astronaut protection door and raise SEQ Bay door.	Exercise caution when working in close proximity to hot fuel cask.
2.4	SEQ Bay door partially open and jammed.	Crew	1. Ensure that lanyard is not tangled. 2. Discontinue lanyard use and manually open astronaut protection door and raise SEQ Bay door. 3. If unsuccessful, continue pulling on lanyard and get assistance from second crewman to manually raise door.	Exercise caution when working in close proximity to hot fuel cask.

2.0 SEQ Bay Door Deployment

Event No.	Contingency	Agent	Action	Remarks
2.5	Astronaut protection door will not stay open.	Crew	1. Verify that door is fully open. 2. Continue with nominal ALSEP deployment sequence.	Exercise caution when working in close proximity to hot fuel cask.
2.6	SEQ Bay door will not stay open.	Crew	1. Verify that door is fully open and folded up over SEQ Bay. 2. If Quad II is low, secure door with velcro strap.	

3.0 ALSEP Offload

Event No.	Contingency	Agent	Action	Remarks
3.1	Subpackage unlatching mechanism will not function.	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. 2. If unsuccessful, use MESA hammer to pry outward from structure on right-hand link of latching mechanism, forcing latch over center and releasing subpackages.	
3.2	White portion of deployment lanyard will not release from base of subpackage.	Crew	1. Grasp release latch at base of subpackage and twist in an effort to break the latch or the slot. 2. If unsuccessful, attempt to cut lanyard with MESA hammer against LM or rock in order to break or fear (webbing) loose.	
3.3	Subpackage will not slide on rails.	Crew	Get assistance from second crewman.	
3.4	Subpackage strikes rails during offload.	Crew/ MCC	Check subpackage for visible signs of damage and notify MCC if there are visible signs of damage.	Equipment operation may be degraded if there are visible signs of damage.

3.0 ALSEP Offload

Event No.	Contingency	Agent	Action	Remarks
3.5	Handling assembly pull pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force on pin with MESA hammer on break pin. 3. Attempt to pry handling assembly away from subpackage. 4. If unsuccessful, attempt to break the handling assembly off at the point where the pin jammed, either manually or with MESA hammer. 5. If still unsuccessful, leave handling assembly on subpackage.	Access to Subpackage #1 temporary stowage socket will be prevented. Left strut on HFE subpallet would have to be collapsed to permit HFE subpallet removal from Subpackage #2.

4.0 ALSEP Tool Offload

Event No.	Contingency	Agent	Action	Remarks
4.1	Tool support pull pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force on pin with MESA hammer or break pin.	
			3. If unsuccessful, use MESA hammer to fail bracket in an attempt to retrieve tools.	
			4. If still unsuccessful, abandon ALSEP.	ALSEP can not be deployed without FTT and one UHT.
4.2	ALSEP tool binds in stowage bracketry.	Crew	1. Jiggle tool and/or apply additional force as appropriate.	
			2. Obtain assistance from second crewman.	
			3. If unable to remove one UHT, continue deployment using second UHT.	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.
			4. If unable to remove either UHT, abandon ALSEP.	ALSEP can not be deployed without one UHT.
			5. If unable to remove carry bar, use suitcase carry mode to transport ALSEP to deployment site.	

4.0 ALSEP Tool Offload

Event No.	Contingency	Agent	Action	Remarks
			6. If unable to remove DRT, attempt to gain access to fuel capsule by using MESA hammer/extension to destroy cask dome and pry away bands. 7. If dome can not be removed, abandon ALSEP. 8. If unable to remove FTT, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.
4.3	UHT will not engage in subpackage temporary stowage socket.	Crew	Stow in alternate socket on LEAM, HFE, HFE subpallet, or on Yo-Yo or LRV. Hook UHT handle in subpackage carry handle in order to rotate subpackage.	
4.4	Carry bar does not extend and/or lock.	Crew	1. If carry bar does not extend, use suitcase carry mode. 2. If carry bar does not lock when extended, collapse carry bar to stowage position and re-extend. 3. If carry bar still does not lock, use as is but position gloves at outer sections of bar when transporting packages.	
4.5	Carry bar will not engage in Subpackage #1 keyhole socket.	Crew	1. Examine carry bar flange for obstructions, dislodge obstructions by impact and re-engage carry bar in subpackage keyhole socket.	

Event No.	Contingency	Agent	Action	Remarks
			2. Examine subpackage keyhole socket for obstructions, dislodge obstructions and re-engage carry bar in subpackage keyhole socket. 3. If keyhole socket is unusable, use suitcase carry mode.	

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.1	Astronaut is about to contact or has come in contact with hot fuel cask or metal part of cask lanyard.	Crew/ MCC	Warn astronaut to keep his distance from hot fuel cask and not to touch metal part of cask lanyard.	Direct exposure to hot fuel cask or metal part of cask lanyard could damage or fail the space suit.
5.2	Lanyard breaks or pulls away from cam lever.	Crew	1. Use MESA hammer/extension as hook and pull forward on cam lever to release cask. 2. If cam lever can not be rotated, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.
5.3	Cam lever fails to release the upper trunnion after lever is fully deployed.	Crew	1. Use MESA hammer/extension as hook on astronaut guard to break cask free at trunnions, while second crewman pulls lanyard to tilt cask. 2. If upper trunnion can not be released, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.
5.4	Lanyard breaks or fails to remove spline lock from cask/dome.	Crew	1. Use MESA hammer/extension to release second trunnion lock, rotate cask if required, and use MESA hammer/extension as hook to remove spline. 2. If unable to remove spline, rotate cask and attempt to gain access to fuel capsule by using MESA hammer/extension to destroy cask dome and pry away bands. 3. If spline can not be removed from dome or dome can not be removed by impacting with MESA hammer/extension, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.5	Cask will not rotate with lanyard pull.	Crew	1. Verify upper trunnion release by hooking MESA hammer/extension on astronaut guard and insure that the cask is free of the upper trunnion.	Exercise caution when working in close proximity to hot fuel cask.
			2. Request aid of the second crewman to apply forward and downward force with MESA hammer/extension on the astronaut guard, while the first crewman attempts to rotate cask with the lanyard.	
			3. Attempt to fail gear box.	If gear box is failed, second crewman will have to use MESA hammer/extension to support cask at proper viewing angle for fuel capsule removal.
			4. If unsuccessful, use LRV as a platform to permit vertical removal of fuel capsule.	
			5. If still unable to gain access to fuel capsule, abandon ALSEP.	
5.6	Tempilabel indicates temperature of component is in excess of 250°F.	Crew/ MCC	Do not handle component manually. Notify MCC. Use UHT, MESA tool, etc. to avoid direct contact with hot component and continue deployment, if possible, but exercise caution when indirectly handling component. Request aid of second crewman if tasks can not be safely carried out by one crewman. If unable to continue deployment without coming into direct contact with component, attempt to place component in shade and work around deployment of hot component until MCC directs that component should have cooled off enough to permit manual handling.	CAUTION: Direct exposure to temperatures in excess of 250°F could damage or fail the space suit.

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.7	Engaging mechanism on DRT does not lock on cask dome.	Crew	1. Attempt to remove dome by applying forward pressure or side loading on the DRT. The dome will rotate without the locking pin engaged. 2. After dome is rotated (without locking pin engagement) use MESA hammer/extension to remove dome. 3. If unable to remove dome without DRT engagement, attempt to gain access to fuel capsule by using MESA hammer/extension to destroy cask dome and pry away bands. 4. If dome can not be removed, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.
5.8	Lock nut assembly will not rotate.	Crew	1. Use MESA hammer/extension to impact the DRT, cask or dome in order to overcome any binding, while continuing to rotate DRT. 2. If unable to rotate lock nut assembly, attempt to gain access to fuel capsule by using MESA hammer/extension to destroy cask dome and pry away bands. 3. If dome can not be removed, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.9	Pretension bands will not release, causing excessive loading on dome locking lugs.	Crew	1. Use MESA hammer/extension to free lugs at the lock nut assembly on the dome. 2. If unable to release bands, attempt to gain access to fuel capsule by using MESA hammer/extension to destroy cask dome and pry away bands. 3. If dome can not be removed, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.
5.10	FTT fingers will not engage in fuel capsule.	Crew	1. Check for side loading on FTT and for full inward travel of FTT fingers. 2. Apply additional force to FTT knob. 3. Examine FTT fingers for obstructions, dislodge obstructions by impacting and attempt to re-engage FTT in fuel capsule. 4. Retract FTT fingers, rotate FTT 120°, attempt to re-engage FTT in capsule, and repeat task in all three positions, if required. 5. Jar mechanism by banging FTT knob against the LM landing gear. 6. If FTT will not function, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.11	Capsule will not release from cask after FTT is attached and locked to capsule.	Crew	1. Apply side loads to FTT while attempting to pull capsule out of cask. 2. Retract FTT fingers, rotate FTT 120°, attempt to re-engage FTT in capsule, and repeat task in all three positions, if required. 3. Use MESA hammer/extension to impact side of cask to free the capsule. 4. Use MESA hammer/extension to impact the end of the FTT to free the capsule. 5. If unsuccessful, allow for backplate cool-down (5-10 minutes) and repeat task. 6. If capsule will not release, abandon ALSEP.	Exercise caution when working in close proximity to hot fuel cask.

5.0 RTG Fueling

Event No.	Contingency	Agent	Action	Remarks
5.12	FTT fingers will not release from fuel capsule.	Crew	1. Check for side loading on FTT and for full outward travel of FTT fingers.	Exercise caution when working in close proximity to hot fuel capsule.
			2. Apply additional force to FTT knob.	
			3. Use MESA hammer/extension to impact the end of the FTT in an attempt to free the FTT.	
			4. If FTT will not release from capsule, leave FTT in place on the fueled RTG and ensure capsule is locked into RTG.	There will be no problem of excessive heat buildup if the FTT can not be disengaged from the fueled RTG.
			5. If fuel capsule is not locked in RTG, manually carry Subpackage #2 in horizontal position or transport on LRV. (Carry Subpackage #1 in suitcase mode).	

6.0 Preparation for ALSEP Traverse

Event No.	Contingency	Agent	Action	Remarks
6.1	UHT disengages from Subpackage #2 UHT socket due to accidental triggering of UHT release mechanism.	Crew	1. Attempt to re-engage UHT in socket. 2. If UHT engagement fails, hook UHT handle in subpackage carry handle in order to rotate subpackage and stow UHT on Yo-Yo.	
6.2	Carry bar will not engage in Subpackage #2 keyhole socket.	Crew	1. Examine carry bar flange for obstructions, dislodge obstructions by impact and re-engage carry bar in subpackage keyhole socket. 2. Examine subpackage keyhole socket for obstructions, dislodge obstructions with UHT or MESA tools and re-engage carry bar in subpackage keyhole socket. 3. If keyhole socket is unusable, use suitcase carry mode.	
6.3	SEQ Bay door will not close when lanyard is pulled and there is no cable movement.	Crew	1. Attempt to manually initiate door closure and pull on lanyard again. 2. If unsuccessful, use MESA hammer to fail mechanism in order to close door.	SEQ Bay door must be closed to thermally insulate LM.
6.4	SEQ Bay door partially closed and jammed.	Crew	1. Ensure that lanyard is not tangled. 2. Continue pulling on lanyard while second crewman manually assists in closing door. 3. If unsuccessful, discontinue use of lanyard and use MESA hammer to fail mechanism in order to close door.	SEQ Bay door must be closed to thermally insulate LM.

7.0 ALSEP Traverse

Event No.	Contingency	Agent	Action	Remarks
7.1	Planned ALSEP deployment site more than 300 feet west of LM is not level or is otherwise unsuitable for ALSEP deployment.	Crew	1. Select another site more than 300 feet west of LM. 2. If no site is available west of LM, select a site more than 300 feet northwest or southwest of LM. 3. If no site is available northwest or southwest of LM, select a site more than 300 feet south of LM. 4. If no site is available south of LM, select a site more than 400 feet north of LM.	Landing site analysis may provide additional inputs.
7.2	Carry bar becomes disengaged from subpackage.	Crew	1. Attempt to re-engage carry bar in subpackage keyhole socket. 2. If carry bar will not remain in keyhole socket, use suitcase carry mode.	

8.0 ALSEP Site Survey

Event No.	Contingency	Agent	Action	Remarks
8.1	Planned ASLEP 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. (Ref. - HFE probes should be 1.5 diameters from any sharp craters 3 feet diameter or larger).	Do not emplace ALSEP components in craters with walls that slope more than 5°.
8.2	Planned ALSEP 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. 2. If outcroppings cannot be avoided, move ALSEP parallel to equator so that ALSEP component thermal radiators are away from outcropping (so as to achieve a clear view of space). (Ref. - HFE probes should be at least 5 diameters from boulders greater than 2 feet across exposed at the surface).	
8.3	Planned ALSEP deployment site is in LM shadow.	Crew	Locate ALSEP components outside LM shadow but within ± 15° of E-W axis drawn through LM.	Separation distance from LM is more critical than angular relationship with respect to LM E-W axis.
8.4	Local slope of planned ALSEP deployment site is in excess of 5°.	Crew	Find level area, if nearby, and other constraints are not compromised.	This contingency is not critical.
8.5	Planned ALSEP deployment site is comprised of loose, granular soil.	Crew	Compact individual areas prior to final emplacement of each ALSEP component, with the exception of HFE.	
8.6	Planned deployment areas for ALSEP components include small rocks.	Crew	Attempt to avoid emplacing ALSEP components on small rocks.	

9.0 Subpackage #2 Placement

Event No.	Contingency	Agent	Action	Remarks
9.1	Carry bar binds in keyhole socket on Subpackage #1.	Crew	1. Ensure release button is operable. 2. Apply additional downward pressure to carry bar while pushing on Subpackage #1. 3. If unsuccessful, use contingency release method (peel off velcro strip, release pull pins (2) and disengage carry bar from flange). 4. If still unsuccessful, attempt to break carry bar off at keyhole socket or flange by using MESA hammer. 5. If still unsuccessful, dig or bore hole in lunar surface, attempt to collapse carry bar using MESA hammer, and emplace subpackage #1 with attached carry bar embedded in lunar surface. 6. Attempt to accurately level and align Central Station.	Without accurate leveling and alignment, Central Station thermal control may be degraded.
9.2	Carry bar binds in keyhole socket on Subpackage #2.	Crew	1. Ensure release button is operable. 2. Apply additional downward pressure to carry bar while pushing on Subpackage #2. 3. If unsuccessful, use contingency release method (peel off velcro strip, release pull pins (2) and disengage carry bar from flange). 4. If still unsuccessful, attempt to break carry bar off at keyhole socket or flange by using MESA hammer.	

9.0 Subpackage #2 Placement

Event No.	Contingency	Agent	Action	Remarks
			5. If still unsuccessful, dig or bore hole in lunar surface, separate carry bar from Subpackage #1, attempt to collapse carry bar using MESA hammer, and emplace Subpackage #2 with attached carry bar embedded in lunar surface.	
			6. Attempt to rough level Subpackage #2.	Without rough leveling, RTG will not radiate heat evenly, causing excessive heat buildup.
9.3	Unable to locate Subpackage #2 10 feet due east of Subpackage #1 due to presence of craters, etc.	Crew	1. Locate Subpackage #2 as far from Subpackage #1 as RTG cable will permit.	
			2. Deploy Subpackage #2 south of planned location.	
			3. If no site available south of planned location, deploy Subpackage #2 north of planned location, but no more than 5 feet north, in order to keep RTG out of field of view of Central Station radiator.	
9.4	Astromate pull pin lanyard breaks.	Crew	1. Attempt to remove pin by grasping any remaining lanyard.	
			2. Manually remove pin.	

9.0 Subpackage #2 Placement

Event No.	Contingency	Agent	Action	Remarks
9.5	Astromate Pull pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force with MESA hammer or break pin.	
			3. If unsuccessful, use MESA hammer to break bracket.	
		Crew/MCC	4. If Astromate connector can not be released, notify MCC and abandon HFE deployment after removing HFE subpallet.	HFE cannot be connected to Subpackage #1 without releasing Astromate connector.
9.6	HFE subpallet pull pin lanyard breaks.	Crew	1. Attempt to remove pin by grasping any remaining lanyard.	
			2. Manually remove pin.	
9.7	HFE subpallet pull pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force with MESA hammer or break pin.	
			3. If unsuccessful, use MESA hammer to break bracket.	
			4. If still unsuccessful and if other subpallet pull pin can be removed, remove the subpallet Strut Boyd bolts, rotate subpallet onto its corner and break bracket by using subpallet as a lever.	
			5. If still unsuccessful, leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately.	If HFE subpallet can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

9.0 Subpackage #2 Placement

Event No.	Contingency	Agent	Action	Remarks
9.8	LEAM carrier pull pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force on pin with MESA hammer or break pin. 3. If unsuccessful, use MESA hammer to break bracket. 4. If still unsuccessful, leave LEAM carrier on Subpackage #2, but remove LEAM and Aiming Mechanism immediately after subpackage is rotated to the ground.	If LEAM carrier can not be removed, RTG will not radiate heat evenly, causing heat buildup.
9.9	UHT will not disengage from Subpackage temporary stowage socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the subpackage and continue deployment using second UHT.	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.
9.10	UHT can not be attached to Yo-Yo or Yo-Yo has failed.	Crew	Engage UHT in subpackage, subpallet or experiment UHT sockets, as required, for temporary stowage.	Do not place UHT in lunar soil because soil may foul the UHT balls.

10.0 HFE Subpallet Offload

Event No.	Contingency	Agent	Action	Remarks
10.1	HFE subpallet carry handle will not lock.	Crew	Continue HFE deployment, using UHT if required.	
10.2	HFE subpallet Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, use MESA hammer to break bracket or strut. 6. If still unsuccessful, leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately and then attempt to bend struts to minimize subpallet view by RTG.	If HFE subpallet can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
10.3	HFE subpallet Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Forcefully rotate UHT to overcome Boyd bolt. 3. If unsuccessful, use MESA hammer to break bracket or strut. 4. If still unsuccessful, leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately and then attempt to bend struts to minimize subpallet view by RTG.	If HFE subpallet cannot be removed, RTG will not radiatc heat evenly, causing excessive heat buildup.

10.0 HFE Subpallet Offload

Event No.	Contingency	Agent	Action	Remarks
10.4	HFE Subpallet will not come off Subpackage #2.	Crew	1. Ensure both Boyd bolts have been released. 2. Use UHT to ensure that Boyd bolts have been sprung upward. 3. Use MESA hammer to break bracket or strut. 4. If unsuccessful, leave HFE subpallet on Subpackage #2, but remove Astromate connector, HFE Electronics Package and HFE Probe Package immediately and then attempt to bend struts to minimize subpallet view by RTG.	If HFE subpallet can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

11.0 RTG Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
11.1	RTG cable reel temp-ilabel dots are all all black.	Crew/ MCC	1. Do not manually handle RTG cable reel assembly and notify MCC. Request aid of second crewman if tasks can not be safely carried out by one crewman.	CAUTION: Direct exposure to temperatures in excess of 250°F could damage or fail the space suit.
		Crew	2. Use UHT handle to deploy RTG cable, release shorting plug pull pin and retrieve shorting plug, but exercise caution when indirectly handling components.	
			3. Attempt to carry out RTG cable inter-connect using available tools and materials to avoid direct manual contact with hot com-ponents.	
		Crew/ MCC	4. If unsuccessful, stow shorting plug on Subpackage #1 (in the shade) and continue nominal ALSEP deployment sequence until MCC directs that shorting plug has cooled off enough to handle manually. Ensure shorting switch in "short" position.	
11.2	RTG cable reel Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	Exercise caution when working in close proximity to hot RTG.
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls.	
			3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle.	

11.0 RTG Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
			4. Attempt to overcome spline lock by forcefully rotating UHT.	
			5. If unsuccessful, leave RTG cable reel on subpackage.	If RTG cable reel can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
			6. Use UHT handle to deploy RTG cable, release shorting plug pull pin and retrieve shorting plug.	
11.3	RTG cable reel Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	Exercise caution when working in close proximity to hot RTG.
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, leave RTG cable reel on subpackage.	If RTG cable reel can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
			4. Use UHT handle to deploy RTG cable, release shorting plug pull pin and retrieve shorting plug.	
11.4	UHT will not engage in RTG cable reel carry socket.	Crew	1. Try to engage second UHT in carry socket	Exercise caution when working in close proximity to hot RTG.
			2. If UHT engagement fails, deploy by using handle of UHT. Do not deploy RTG cable reel manually if it can be avoided.	

11.0 RTG Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
11.5	RTG cable reel will not come off subpackage.	Crew	1. Ensure all Boyd bolts have been released.	Exercise caution when working in close proximity to hot RTG.
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. Leave RTG cable reel on subpackage and use UHT handle to deploy RTG cable, release shorting plug pull pin and retrieve shorting plug.	If RTG cable reel can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
11.6	Cable reel falls to the lunar surface when final Boyd bolt is released or falls off UHT due to accidental triggering of UHT release mechanism.	Crew	Retrieve cable reel with UHT handle, grasp reel assembly, connect UHT, and continue nominal deployment.	
11.7	Crewman walks too far and jerks Subpackage #2.	Crew	1. Obtain assistance from second crewman to move Subpackage #1 closer to Subpackage #2 to provide sufficient slack cable for RTG cable interconnect and continue deployment of RTG cable.	
		Crew/ MCC	2. Check cable and connectors at shorting plug and RTG interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	Exercise caution when working in close proximity to hot RTG. Central Station operation may be degraded if there are visible signs of damage.

11.0 RTG Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
11.8	Shorting Plug pull pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force on pin with MESA hammer or break pin. 3. If unsuccessful, use MESA hammer to fail bracket in an attempt to retrieve shorting plug. 4. If shorting plug can not be released from cable reel, abandon ALSEP.	
11.9	Shorting plug falls to lunar surface.	Crew	Retrieve shorting plug with UHT handle.	Ensure shorting plug is free of debris.
11.10	UHT will not disengage from RTG cable reel UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the RTG cable reel and continue deployment using second UHT.	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.
11.11	Ammeter does not indicate any amperage prior to plug-in.	Crew	1. Recycle (from "SHORT" to "ON" and back to "SHORT") shorting switch and check ammeter for amperage reading.	

11.0 RTG Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
		Crew/ MCC	2. If there is still no amperage reading, notify MCC, remove shorting plug from RTG cable and connect RTG cable directly to Central Station	Absence of amperage reading prior to plug-in is an indication of possible failure of shorting plug. Direct connection of RTG cable to Central Station will result in ALSEP having RTG power available after plug-in.
11.12	Ammeter cannot be zeroed by operation of shorting switch.	Crew/ MCC	If the ammeter reading is greater than zero, and cannot be zeroed by operation of the shorting switch, remove shorting plug from RTG cable and connect RTG cable directly to Central Station.	Unable to zero ammeter by operation of shorting switch prior to plug-in is an indication of possible failure of the shorting plug. Direct connection of RTG cable to Central Station will result in ALSEP having RTG power available after plug-in.
11.13	Shorting plug will not engage and lock ("T" handle will not rotate to lock).	Crew	1. Check shorting plug for proper orientation and, if not oriented properly, reorient shorting plug and attempt to re-engage shorting plug. 2. Check shorting plug and connector on Central Station for debris, and, if debris is visible, remove or shake out debris and attempt to re-engage shorting plug. 3. Ensure shorting plug outer flange is free to travel to the lock position and, if flange is free to travel, attempt to re-engage shorting plug and rotate handle 90° CW to lock.	

Event No.	Contingency	Agent	Action	Remarks
		Crew/ MCC	4. Check shorting plug and connector on Central Station for bent pins and, if bent pins are visible on Central Station connector, notify MCC and attempt to force re-engagement of shorting plug.	ALSEP operation may be degraded.
		Crew	5. If shorting plug is properly oriented, there is no debris visible, outer flange is not free to travel or if bent pins are visible on shorting plug, manually separate the shorting plug from the RTG cable and connect RTG cable directly to Central Station.	
			6. If RTG cable connector can not be mated to Central Station, abandon ALSEP.	
11.14	Shorting plug engages, but falls off when subpackage is rotated.	Crew	1. Return subpackage to vertical position, retrieve cable, remove any debris, check ammeter for amperage reading, ensure shorting plug outer flange is free to travel, remate connector and ensure locking mechanism is fully forward and rotate handle 90° CW to lock.	
			2. If outer flange is not free to travel or shorting plug falls off again, manually separate the shorting plug from the RTG cable and connect RTG cable connector to Central Station.	
			3. If RTG cable connector will not stay mated to Central Station, abandon ALSEP.	

12.0 HFE Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
12.1	Astromate connector will not come out of stowage assembly.	Crew	1. Apply additional force.	
			2. Obtain assistance from second crewman.	
			3. If unsuccessful, use MESA hammer to tap the Astromate connector through the retaining brackets or bend brackets out using MESA hammer as a lever.	
		Crew/ MCC	4. If Astromate connector can not be removed from stowage assembly, notify MCC and abandon HFE deployment.	HFE cannot be connected to Subpackage #1 without removing Astromate connector from stowage assembly.
		Crew	5. If Astromate connector is partially deployed, but is hung up, ensure that cable reel is free of stowage bracket.	
12.2	Astromate connector falls to lunar surface.	Crew	Retrieve connector with UHT handle.	Ensure connector is free of debris.
12.3	Crewman walks too far and jerks HFE subpallet.	Crew	1. Unreel additional cable or move HFE subpallet closer to Central Station to provide sufficient slack cable for HFE cable interconnect and continue deployment of HFE cable.	
		Crew/ MCC	2. Check cable and connectors at Astromate and HFE Electronics Package interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	HFE operation may be degraded if there are visible signs of damage.
12.4	HFE subpallet falls over on lunar surface.	Crew	Use UHT handle to hook HFE subpallet carry handle and retrieve HFE subpallet.	Reduced experiment thermal control due to degradation of of thermal paint with lunar debris.

12.0 HFE Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
12.5	Astromate connector dust cover cannot be removed.	Crew	1. Apply additional force and twist whole dust cover back and forth while pulling outward on dust cover.	Excessive force on Astromate connector locking lever could damage lock mechanism.
			2. Obtain assistance from second crewman.	
12.6	Astromate connector will not engage and lock.	Crew	1. Check connector for proper orientation and, if not oriented properly, reorient connector and attempt to re-engage connector.	
			2. Check connectors on cable and Central Station for debris and, if debris is visible, remove or shake out debris and attempt to re-engage connector.	
			3. If unsuccessful, verify that astromate connector locking lever is in unlocked position by rotating lever counter-clockwise (CCW looking at the top of the handle) and attempt to re-engage the connector.	
		Crew/ MCC	4. If unsuccessful, check connectors on cable and Central Station for bent pins and, if bent pins are visible, notify MCC.	Do not attempt to force re-engagement of connector if bent pins are visible.
		Crew	5. If Astromate connector cannot be mated to Central Station, abandon HFE deployment.	
12.7	Astromate connector locking lever will not rotate and lock.	Crew	1. Gently pull the Astromate connector handle to test if the primary locking mechanism is holding. If it is, attempt to rotate locking lever again.	
			2. If unsuccessful, abandon effort to rotate locking lever.	Primary locking feature should suffice.

12.0 HFE Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
12.8	Astromate connector engages, but falls off when subpackage is rotated.	Crew	1. Return subpackage to vertical position, retrieve cable, remove any debris, remate connectors, and ensure locking lever is fully rotated. 2. If Astromate connector will not stay mated to Central Station, abandon HFE deployment.	

13.0 LEAM Carrier Offload

Event No.	Contingency	Agent	Action	Remarks
13.1	LEAM carrier Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2^{o}) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, leave LEAM carrier on Subpackage #2, but remove LEAM and Aiming Mechanism immediately after subpackage is rotated to the ground.	If LEAM carrier can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
13.2	LEAM carrier Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Forcefully rotate UHT to overcome Boyd bolt. 3. If unsuccessful, leave LEAM carrier on Subpackage #2, but remove LEAM and Aiming Mechanism immediately after subpackage is rotated to the ground.	If LEAM carrier can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.

13.0 LEAM Carrier Offload

Event No.	Contingency	Agent	Action	Remarks
13.3	UHT will not engage in LEAM carrier carry socket.	Crew	1. Try to engage second UHT in carry socket. 2. If UHT engagement fails, remove manually by grasping back support structure or tool bracket.	
13.4	LEAM carrier will not come off Subpackage #2.	Crew	1. Ensure both Boyd bolts have been released. 2. Use UHT to ensure that Boyd bolts have been sprung upward. 3. Ensure that front of tool carrier has been raised 3/8 inch to clear mounting stud. 4. Kick LEAM carrier to force forward movement. 5. If unsuccessful, use MESA hammer to force forward movement of the LEAM carrier. 6. If still unsuccessful, leave LEAM carrier on Subpackage #2, but remove LEAM and Aiming Mechanism immediately after subpackage is rotated to the ground.	If LEAM carrier can not be removed, RTG will not radiate heat evenly, causing excessive heat buildup.
13.5	LEAM carrier falls off UHT due to accidental triggering of UHT release mechanism.	Crew	1. Attempt to re-engage UHT in socket. 2. If UHT engagement fails, use UHT handle to hook back support structure and emplace LEAM carrier.	

13.0 LEAM Carrier Offload

Event No.	Contingency	Agent	Action	Remarks
13.6	UHT will not disengage from LEAM carrier UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LEAM carrier and continue deployment using second UHT.	LEAM carrier 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.

14.0 HFE Subpallet Deployment

Event No.	Contingency	Agent	Action	Remarks
14.1	Unable to deploy HFE subpallet 30 feet north of Central Station due to presence of craters, etc.	Crew	1. Locate HFE as far from RTG, Central Station and other ALSEP experiment sites as cable permits. 2. Deploy HFE west of planned location, but located so that HFE probe will be at least 25 feet from Central Station and at least 17 feet from LSPE antenna. Attempt to locate HFE so that HFE cables will not cross other cables or run along with and in contact with another cable. 3. If no site available west of planned location, deploy HFE east of planned location, but located so that HFE probe will be at least 30 feet from RTG, 25 feet from Central Station and 20 feet from LMS site. Attempt to locate HFE so that HFE cables will not cross other cables or run along with and in contact with another cable.	
14.2	HFE subpallet falls to lunar surface.	Crew	Use UHT handle to hook HFE subpallet carry handle and retrieve HFE subpallet.	Reduced experiment thermal control due to degradation of thermal paint with lunar debris.
14.3	Crewman walks too far and jerks Central Station.	Crew	1. Carry HFE subpallet back toward Central Station to provide sufficient slack cable and continue deployment of HFE.	
		Crew/ MCC	2. Check cable and connectors at experiment and Central Station interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	HFE operation may be degraded if there are visible signs of damage.

14.0 HFE Subpallet Deployment

Event No.	Contingency	Agent	Action	Remarks
14.4	HFE subpallet strut will not collapse.	Crew	1. Apply additional force. 2. Apply additional force with MESA hammer. 3. If unsuccessful, continue nominal HFE deployment sequence with strut uncollapsed.	Subpallet instability will not prevent completing HFE deployment.
14.5	HFE subpallet falls over on lunar surface.	Crew	Use UHT handle to hook HFE subpallet carry handle and properly emplace HFE subpallet.	Reduced experiment thermal control due to degradation of thermal paint with lunar debris.

15.0 LEAM Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
15.1	Astromate pull pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force with MESA hammer or break pin. 3. If unsuccessful, use MESA hammer to break bracket. 4. If Astromate connector can not be released, abandon LEAM deployment.	
15.2	Astromate connector will not come out of stowage assembly.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If unsuccessful, use MESA hammer to break bracket. 4. If Astromate connector can not be removed from stowage assembly, abandon LEAM deployment. 5. If Astromate Connector is partially deployed, but is hung up, ensure that cable reel is free of stowage bracket.	
15.3	Astromate connector falls to lunar surface.	Crew	Retrieve connector with UHT handle.	Ensure connector is free of debris.

15.0 LEAM Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
15.4	Crewman walks too far and jerks LEAM carrier.	Crew	1. Unreel additional cable or move LEAM carrier closer to Central Station to provide sufficient slack cable for LEAM cable interconnect and continue deployment of LEAM cable.	
		Crew/ MCC	2. Check cable and connectors at Astromate and LEAM experiment interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	LEAM operation may be degraded if there are visible signs of damage.
15.5	Astromate connector dust cover can not be removed.	Crew	1. Apply additional force and twist whole dust cover.	
			2. Obtain assistance from second crewman.	
15.6	Astromate connector will not engage and lock.	Crew	1. Check connector for proper orientation and, if not oriented properly, reorient connector and attempt to re-engage connector.	
			2. Check connectors on cable and Central Station for debris and, if debris is visible, remove or shake out debris and attempt to re-engage connector.	
		Crew/ MCC	3. Check connectors on cable and Central Station for bent pins and, if bent pins are visible, notify MCC and attempt to force re-engagement of connector.	LEAM operation may be degraded.
		Crew	4. If Astromate connector can not be mated to Central Station, abandon LEAM deployment.	

15.0 LEAM Cable Interconnect

Event No.	Contingency	Agent	Action	Remarks
15.7	Astromate connector locking lever will not rotate and lock.	Crew	1. Apply additional force 2. Abandon effort to rotate locking lever.	Primary locking feature should suffice.
15.8	Astromate connector engages, but falls off when subpackage is rotated.	Crew	1. Return subpackage to vertical position, Retrieve cable, remove any debris, remate connectors, and ensure locking lever is fully rotated. 2. If Astromate connector will not stay mated to Central Station, abandon LEAM deployment.	

16.0 HFE Probe Package Offload

Event No.	Contingency	Agent	Action	Remarks
16.1	HFE Probe Package Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, remove the Velcro straps from both ends of the probe package, use MESA hammer at the end corners inboard of the subpallet and underside to rip the probe package apart and retrieve probes and emplacement tool.	HFE science will be severely degraded if probes and emplacement tool are damaged.
16.2	HFE Probe Package Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Forcefully rotate UHT to overcome Boyd bolt. 3. If unsuccessful, remove the Velcro straps from both ends of the probe package, use MESA hammer at the end corners inboard of the subpallet and underside to rip the probe package apart and retrieve probes and emplacement tool.	HFE science will be severely degraded if probes and emplacement tool are damaged.

16.0 HFE Probe Package Offload

Event No.	Contingency	Agent	Action	Remarks
16.3	HFE Probe Package will not come off HFE subpallet.	Crew	1. Ensure all Boyd bolts have been released. 2. Use UHT to ensure that Boyd bolts have been sprung upward. 3. If unsuccessful, remove the Velcro straps from both ends of the probe package, use MESA hammer at the end corners inboard of the subpallet and underside to rip the probe package apart and retrieve probes and emplacement tool.	HFE science will be severely degraded if probes and emplacement tool are damaged.

17.0 Subpackage #1 Emplacement

Event No.	Contingency	Agent	Action	Remarks
17.1	UHT will not engage in subpackage temporary stowage socket.	Crew	Hook UHT handle in subpackage carry handle in order to rotate subpackage.	
17.2	Subpackage #1 dust cover gets hung up during removal or drawstring or pull rings fails.	Crew	1. Use UHT handle to peel off dust cover. 2. Request aid of second crewman.	
17.3	UHT will not disengage from subpackage temporary stowage socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the subpackage and continue deployment using second UHT.	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.

18.0 HFE Probe Package Deployment

Event No.	Contingency	Agent	Action	Remarks
18.1	HFE Probe Package halves will not separate.	Crew	1. Verify that Velcro straps have been removed from both ends of the probe package.	
			2. Turn probe package upside down and tap corners to induce locking cylinders to drop down.	
			3. If unsuccessful, attempt to use MESA hammer to rip HFE Probe Package apart and retrieve probes and emplacement tool.	HFE science will be severely degraded if probes and emplacement tool are damaged.
18.2	Unable to deploy HFE Probe Package half 18 feet west or east of HFE Electronics Package due to presence of craters, etc.	Crew	1. Locate HFE Probe Package half as far from RTG, the other Probe Package half, Central Station and other ALSEP experiment sites as cable permits.	
			2. Deploy HFE Probe Package half north of planned location and maintain maximum separation from other Probe Package half.	
			3. If no site available north of planned location, deploy HFE Probe Package half south of planned location, but Probe Package No. 1 should be at least 30 feet from RTG, 25 feet from Central Station, 20 feet from LMS site and maintain maximum separation from Probe Package No. 2. Probe Package No. 2 should be at least 25 feet from Central Station, 17 feet from LSPE antenna and maintain maximum separation from Probe Package No. 1.	
18.3	HFE Probe Package half falls to lunar surface.	Crew	Use UHT handle to hook handle or carry strap and retrieve HFE Probe Package half.	
18.4	Crewman walks too far and jerks HFE Electronics Package.	Crew	1. Carry HFE Probe Package half back toward HFE Electronics Package to provide sufficient slack cable for probe emplacement and continue deployment of HFE.	

18.0 HFE Probe Package Deployment

Event No.	Contingency	Agent	Action	Remarks
		Crew/ MCC	2. Check cable, connector at HFE Electronics Package interface and probe interface for visible signs of damage and notify MCC if there are visible signs of damage.	HFE operation may be degraded if there are visible signs of damage.

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
19.1	LSG Boyd bolt spindle will not depress	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, use MESA hammer in an attempt to break and release Boydbolt. 6. If still unsuccessful, leave LSG on sunshield and deploy LSG/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment. 7. If still unsuccessful, attempt to cut or break the LSG cable or break the LSG connector in order to permit sunshield deployment.	LSG may be demaged resulting in experiment thermal control and science degradation. Experiment science, as well as Central Station thermal control, will be degraded. If unsuccessful, sunshield will not deploy and Central Station Thermal Control will be degraded. Loss of LSG does not preclude successful operation of remainder of ALSEP.

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
19.2	LSG Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer in an attempt to break and release Boyd bolt.	LSG may be damaged, resulting in experiment thermal control and science degradation.
			4. If still unsuccessful, leave LSG on sunshield and deploy LSG/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment thermal control and science, as well as central station thermal control, will be degraded.
			5. If still unsuccessful, attempt to cut or break the LSG cable or break the LSG connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and central station thermal control will be degraded. Loss of LSG does not preclude successful operation of remainder of ALSEP.
19.3	UHT will not engage in LSG carry socket.	Crew	1. Try to engage second UHT in socket.	
			2. If UHT engagement fails, deploy manually.	Do not use LSG sunshade handle to carry experiment.
19.4	LSG will not come off sunshield.	Crew	1. Ensure all Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	

Event No.	Contingency	Agent	Action	Remarks
			3. If unsuccessful, use MESA hammer in an attempt to break and release Boyd bolt.	LSG may be damaged resulting in experiment thermal control and science degradation.
			4. If still unsuccessful, leave LSG on sunshield and deploy LSG/central station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment thermal control and science, as well as central station thermal control, will be degraded.
			5. If still unsuccessful, attempt to cut or break the LSG cable or break the LSG connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and central station thermal control will be degraded. Loss of LSG does not preclude successful operation or remainder of ALSEP.
19.5	LSG 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 thermal paint with lunar debris.
			2. If UHT engagement fails, deploy manually	Do not use LSG sunshade handle to carry experiment.
19.6	Crewman walks too far and jerks central station.	Crew	1. Carry experiment back toward central station to provide sufficient slack cable and continue deployment of LSG.	
		Crew/ MCC	2. Check cable and connectors at experiment and central station interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	LSG operation may be degraded if there are visible signs of damage.

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
19.7	Unable to deploy LSG 25 feet west of central station due to presence of craters, etc.	Crew	1. Locate LSG as far from central station, RTG and other experiment sites as LSG cable will permit. 2. Deploy LSG south of planned location, but attempt to locate LSG so that LSG cable will not cross other cables or run along with and in contact with another cable. 3. If no site available south of planned location, deploy LSG north of planned location, but maintain at least a 25 degree angle between the LSG cable and LSPE antenna cable and attempt not to block Central Station field of view. Attempt to locate LSG so that LSG cable will not cross other cables or run along with and in contact with another cable.	
19.8	LSG dust cover pull ring fails.	Crew	1. Manually peel off dust cover. 2. Request aid of second crewman.	
19.9	LSG sunshade will not lock in place when extended.	Crew	1. Check to ensure sunshade guy wires or gimbal release lanyard are not inhibiting full sunshade deployment. 2. If sunshade is fully deployed, manually lock sunshade latches or obtain assistance from second crewman. 3. Apply additional force to achieve complete sunshade deployment and ensure locking. 4. If unsuccessful, use MESA hammer to force sunshade latches to lock in place.	

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
			5. If still unsuccessful, manually release sunshade latches, if required, and collapse sunshade to stowage configuration in order to cover radiator area.	LSG data will be lost during lunar day.
19.10	LSG Boyd bolt falls into cavity when sunshade is deployed.	Crew	1. Manually tilt entire experiment to allow boyd bolt to fall free.	Boyd bolt could cause gimbal mechanism to operate incorrectly.
			2. Determine if boyd bolt is lodged near gimbal mechanism and attempt to manually dislodge boyd bolt while avoiding electrical wires.	
			3. If unsuccessful or if boyd bolt is not lodged near gimbal mechanism, abandon effort and continue LSG deployment.	Experiment science and thermal control may be degraded.
19.11	LSG sunshade will not tilt toward equator to predetermined angle for landing site latitude.	Crew	1. Lightly tap sector gears with UHT to dislodge debris.	Lunar debris may have degraded operation of sector gears.
			2. Apply additional pulling force on sunshade while holding experiment steady with UHT.	
			3. Obtain assistance from second crewman.	
			4. If unsuccessful, manually release sunshade latches and collapse sunshade to stowage configuration in order to cover radiator area.	Experiment science and thermal control will be degraded.
19.12	LSG Detent does not hold sunshade at appropriate tilt angle.	Crew	Position in next detent that will hold tilt angle nearest the degree reading specified for the site.	

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
19.13	Lunar debris degrades readability of bubble level or alignment marks, or bubble level or alignment marks are damaged.	Crew	1. Manually attempt to clean bubble level. Use brush from LRV if necessary.	Misadjustment of level can cause severe loss of science data.
			2. If unsuccessful, level by using estimation of true vertical and other equipment as a reference; align by using shadows and other equipment as a reference and ensure ample photo coverage is obtained to verify experiment orientation.	Without accurate leveling and alignment, experiment science and thermal control will be degraded. If more than 3° off level science will be severely degraded.
19.14	Uncaging lanyard breaks.	Crew	1. Attempt to uncage LSG by grasping any remaining lanyard.	Satisfactory uncaging is indicated by an absence of the red signal flag inside the radiator area.
			2. Manually or use UHT if necessary to uncage LSG by rotating the uncaging cam 90° (a retracting spring will automatically rotate the cam the additional 90°).	
19.15	LSG sensor will not uncage when uncaging lanyard is pulled.	Crew	1. Attempt to uncage LSG by manually rotating the uncaging cam.	Satisfactory uncaging is indicated by an absence of the red signal flag inside the radiator area (a caged condition is indicated by an orange flag).
			2. If unsuccessful, continue LSG deployment. After initial alignment and leveling, attempt to align bubble in exact center of level.	Experiment science may be severely degraded or loss.

19.0 LSG Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
19.16	UHT will not disengage from LSG carry socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LSG and continue deployment using second UHT. Check level and alignment and if necessary prop up LSG to maintain experiment stability.	Experiment science, leveling, alignment, stability and thermal control may 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.

20.0 HFE Electronics Package Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
20.1	HFE Electronics Package Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT, and if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. If unsuccessful, attempt to overcome spline lock by forcefully rotating UHT. 5. If still unsuccessful, leave HFE Electronics Package on HFE subpallet and attempt to level and align assembly.	HFE thermal control may be degraded and the HFE pallet will not be able to be used as a mounting base for the LSPE antenna.
20.2	HFE Electronics Package Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Forcefully rotate UHT to overcome Boyd bolt. 3. If unsuccessful, leave HFE Electronics Package on HFE subpallet and attempt to level and align assembly.	HFE thermal control may be degraded and the HFE pallet will not be able to be used as a mounting base for the LSPE antenna.
20.3	UHT will not engage in HFE Electronics Package carry socket.	Crew	1. Try to engage second UHT in carry socket 2. If UHT engagement fails, attempt to remove, emplace, level and align HFE Electronics Package manually and use UHT as a gnomon without engaging tool.	Reduced thermal control due to degradation of thermal paint with lunar debris from astronaut's gloves. HFE thermal control will be further degraded if alignment is inaccurate.

20.0 HFE Electronics Package Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
20.4	HFE Electronics Package will not come off HFE subpallet.	Crew	1. Ensure all Boyd bolts have been released. 2. Use UHT to ensure that Boyd bolts have been sprung upward. 3. If unsuccessful, leave HFE Electronics Package on HFE subpallet and attempt to level and align assembly.	HFE thermal control may be degraded and the HFE pallet will not be able to be used as a mounting base for the LSPE antenna.
20.5	Experiment falls off UHT due to accidental triggering of UHT release mechanism	Crew	1. Attempt to re-engage UHT in socket. 2. If UHT engagement fails, attempt to emplace, level and align HFE Electronics Package manually and use UHT as a gnomon without engaging tool.	Reduced thermal control due to degradation of thermal paint with lunar debris. Reduced thermal control due to degradation of thermal paint with lunar debris from astronaut's gloves. HFE thermal control will be further degraded if alignment is inaccurate.
20.6	HFE dust cover pull ring fails.	Crew	1. Manually peel off dust cover. 2. Request aid of second crewman.	
20.7	Lunar debris degrades readability of bubble level of compass rose, or bubble level or compass rose is damaged.	Crew	Level by using estimation of true vertical and other equipment as a reference; align by using shadows and other equipment as a reference; and ensure ample photo coverage is obtained to verify experiment orientation.	Without accurate leveling and alignment, thermal control will be degraded.

20.0 HFE Electronics Package Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
20.8	UHT will not disengage from HFE Electronics Package UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the HFE Electronics Package and continue deployment using second UHT. Prop up the experiment, as required, to maintain experiment stability.	Experiment leveling, alignment, stability, and thermal control 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.

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.1	LSPE GM Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls.	
			3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle.	
			4. Attempt to overcome spline lock by forcefully rotating UHT.	
			5. If unsuccessful, use MESA hammer in an attempt to break bracket.	LSPE may be damaged, resulting in experiment science degradation.
			6. If still unsuccessful, leave LSPE GM on sunshield and deploy LSPE GM/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment science will be lost. Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE Geophones cannot be deployed.
			7. If still unsuccessful, attempt to cut or break the LSPE GM cable or break the LSPE GM connector in order to permit sunshield deployment.	If unsuccessful sunshield will not deploy and Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE Geophones cannot be deployed.

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.2	LSPE GM Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forecfully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer in an attempt to break bracket.	LSPE may be damaged, resulting in experiment science degradation.
			4. If still unsuccessful, leave LSPE GM on sunshield and deploy LSPE GM/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment science will be lost. Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE geophones cannot be deployed.
			5. If still unsuccessful, attempt to cut or break the LSPE GM cable or break the LSPE GM connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE geophones cannot be deployed.
21.3	UHT will not engage in LSPE GM carry socket.	Crew	1. Try to engage second UHT in socket.	
			2. If UHT engagement fails, deploy manually.	

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.4	LSPE GM will not come off sunshield	Crew	1. Ensure all Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. If unsuccessful, use MESA hammer in an attempt to break bracket.	LSPE may be damaged, resulting in experiment science degradation.
			4. If still unsuccessful, leave LSPE GM on sunshield and deploy LSPE GM/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment science will be lost. Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE geophones cannot be deployed.
			5. If still unsuccessful, attempt to cut or break the LSPE GM cable or break the LSPE GM connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE geophones cannot be deployed.
21.5	LSPE GM 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 reengage UHT in socket.	
			2. If UHT engagement fails, deploy manually.	

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.6	Crewman walks too far and jerks Central Station.	Crew	1. Carry experiment back toward Central Station to provide sufficient slack cable and continue deployment of LSPE GM.	
		Crew/ MCC	2. Check cable and connectors at experiment and Central Station interfaces for visible signs of damage and notify MCC if there are visible signs of damage.	LSPE operation may be degraded if there are visible signs of damage.
21.7	Unable to deploy 30 feet south of Central Station due to presence of craters, etc.	Crew	1. Locate LSPE GM as far from Central Station, RTG and other experiment sites as LSPE GM cable will permit.	
			2. Deploy LSPE GM west of planned location, but do not cross cables or run LSPE GM cable along with and in contact with another cable.	
			3. If unable to deploy LSPE GM west of planned location, deploy LSPE GM east of planned location, but do not cross cables or run LSPE GM cable along with and in contact with another cable.	

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.8	Geophone flag release pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force with MESA hammer or break pin. 3. If unsuccessful, abandon effort and continue LSPE deployment without flags.	Flags are primarily used for photographic purposes and as an aid in correct interrelation of the four geophones.
21.9	Geophone flag release lanyard breaks.	Crew	1. Attempt to remove pin by grasping any remaining lanyard. 2. Manually remove pin.	
21.10	Geophone flag will not unfold or lock.	Crew	1. Apply additional force in an attempt to unfold and/or lock flag. 2. Obtain aid of second crewman. 3. If unsuccessful, abandon effort and continue deployment of another flag if available.	Flags are primarily used for photographic purposes and as an aid in correct interrelation of the four geophones.

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.11	UHT will not disengage from LSPE GM carry socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LSPE GM and continue deployment using second UHT. Prop up LSPE GM, as required, to maintain stability.	It will be required to remove the LSPE GM cover by manually sliding the cover up the UHT shaft and holding the cover while the second crewman manually removes and deploys each geophone reel. 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.
21.12	Cover will not release from LSPE GM.	Crew	1. Stand directly over LSPE GM and pull straight up on UHT shaft. 2. Attempt to pry the cover loose with the UHT handle. 3. Manually remove cover. 4. If unsuccessful, attempt to break cover with MESA hammer. 5. If still unsuccessful, abandon LSPE deployment.	Explosive Packages should not be deployed if LSPE geophones cannot be deployed since all science is lost.

21.0 LSPE Geophone Module Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
21.13	Geophone Flag can not be embedded in lunar surface because its planned location is too hard.	Crew	1. Locate LSPE GM west or east of planned location and at least 30 feet from Central Station. 2. If still unable to embed the Geophone Flag in lunar surface, abandon effort, but exercise caution during geophone deployment. Second crewman can assist in achieving satisfactory alignment of the geophones.	Flags are primarily used for photographic purposes. Geophone alignment accuracy may be degraded without flag anchor at LSPE GM.
21.14	All flags are unusable.	Crew	Use any available discarded hardware to anchor LSPE GM.	
21.15	Less than five flags available.	Crew	Use one flag to anchor LSPE Geophone module.	

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
22.1	LMS vent lanyard breaks.	Crew	1. Attempt to open vent by grasping any remaining lanyard. 2. If unsuccessful, remove LMS from sunshield and manually open vent by triggering vent lever.	
22.2	LMS Boydbolt Spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boydbolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, use MESA hammer in an attempt to break bracket. 6. If still unsuccessful, leave LMS on sunshield and deploy LMS/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment. 7. If still unsuccessful, attempt to cut or break the LMS cable or break the LMS connector in order to permit sunshield deployment.	LMS may be damaged, resulting in experiment thermal control and science degradation. Experiment thermal control and science, as well as Central Station thermal control, will be degraded. If unsuccessful, sunshield will not deploy and Central Station thermal control will be degraded. Loss of LMS does not preclude successful operation of remainder of ALSEP.

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
22.3	LMS Boydbolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boydbolt.	
			3. If unsuccessful, use MESA hammer in an attempt to break bracket.	LMS may be damaged, resulting in experiment thermal control and science degradation.
			4. If still unsuccessful, leave LMS on sunshield and deploy LMS/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment thermal control and science, as well as Central Station thermal control will be degraded.
			5. If still unsuccessful, attempt to cut or break the LMS cable or break the LMS connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and Central Station thermal control will be degraded. Loss of LMS does not preclude successful operation of remainder of ALSEP.
22.4	UHT will not engage in LMS carry socket.	Crew	1. Try to engage second UHT in socket.	
			2. If UHT engagement fails, deploy manually.	
22.5	LMS will not come off sunshield.	Crew	1. Ensure all Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
			3. If unsuccessful, use MESA hammer in an attempt to break bracket.	LMS may be damaged, resulting in experiment thermal control and science degradation.
			4. If still unsuccessful, leave LMS on sunshield and deploy LMS/Central Station as one unit. Use UHT to unreel sufficient cable to permit sunshield deployment.	Experiment thermal control and science, as well as Central Station thermal control, will be degraded.
			5. If still unsuccessful, attempt to cut or break the LMS cable or break the LMS connector in order to permit sunshield deployment.	If unsuccessful, sunshield will not deploy and Central Station thermal control will be degraded. Loss of LMS does not preclude successful operation of remainder of ALSEP.
22.6	LMS 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. 2. If UHT engagement fails, deploy manually.	Reduced thermal control due to degradation of thermal paint and second surface mirrors with lunar debris.
22.7	LMS carry socket does not rotate or lock.	Crew	1. Apply additional force in an attempt to rotate socket. 2. If unsuccessful in attempt to rotate socket or socket will not lock, deploy manually.	

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
22.8	Crewman walks too far and jerks Central Station.	Crew	1. Carry experiment back toward Central Station to provide sufficient slack cable and continue deployment of LMS.	
		Crew/ MCC	2. Check cable and connectors at experiment and Central Station interfaces for visible signs of damage and notify MCC if there are visible signs of damage. Check LSG leveling and alignment, and relevel, realign and notify MCC if experiment was disturbed.	LMS operation may be degraded if there are visible signs of damage.
22.9	Unable to deploy LMS 45 feet Northeast of Central Station due to presence of boulders, etc.	Crew	1. Locate LMS as far from Central Station, RTG, and other experiment sites as LMS cable will permit. 2. Deploy LMS north of planned location, but at least 20 feet from nearest HFE probe and attempt not to block HFE Electronics Package and Central Station field of view. Attempt not to cross cables or run LMS cable along with and in contact with another cable. 3. If no site available north of planned location, deploy LMS south of planned location, but do not allow LMS cable to touch RTG and attempt not to block RTG field of view. Attempt not to cross cables or run LMS cable along with and in contact with another cable.	

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
22.10	Lunar debris degrades readability of bubble level or bubble level is damaged.	Crew	Level by using estimation of true vertical and other equipment as a reference and ensure ample photo coverage is obtained to verify experiment orientation.	Without accurate leveling, experiment science and thermal control will be degraded.
22.11	UHT will not disengage from LMS UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LMS and continue deployment using second UHT.	LMS stability and thermal control 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.
22.12	UHT will not engage in LMS breakseal socket.	Crew	1. Try to engage second UHT in socket. 2. If UHT engagement fails, apply additional force. 3. If still unsuccessful, abandon effort and continue ALSEP deployment.	Loss of LMS does not preclude successful operation of remainder of ALSEP.

22.0 LMS Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
22.13	LMS seal will not break when UHT is moved in direction of arrow.	Crew	1. Apply additional downward and forward force in direction of arrow. 2. Obtain assistance from second crewman. 3. If still unsuccessful, disengage UHT from breakseal socket. Abandon experiment and continue ALSEP deployment.	Loss of LMS does not preclude successful operation of remainder of ALSEP.
22.14	Dust cover will not deploy automatically over entrance aperture.	Crew	Use UHT handle as a pry to loosen dust cover.	
22.15	UHT will not disengage from LMS breakseal.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If unsuccessful, use MESA hammer to break off seal from UHT. 4. If still unsuccessful, leave seal on UHT and continue deployment using second UHT.	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.

23.0 ALSD Operations

Event No.	Contingency	Agent	Action	Remarks
23.1	Unable to drill one or both bore holes or to complete drilling of bore hole(s).	Crew/ MCC	Ref. - Science Contingency Procedures	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.1	Alignment mechanism fails to self deploy.	Crew	Deploy alignment mechanism manually or use UHT handle as a pry.	
24.2	Lunar debris degrades readability of bubble level or compass rose, or bubble level or sun compass is damaged.	Crew	Level by using estimation of true vertical and other equipment as a reference; align by using shadows and other equipment as a reference; and ensure ample photo coverage is obtained to verify Central Station orientation.	Without accurate leveling and alignment, Central Station thermal control may be degraded. If primary structure is not leveled to within ±5°, leveling capability of antenna aiming mechanism will be exceeded and antenna aiming accuracy will be degraded.
24.3	Lunar shield Boyd bolt spindle will not depress	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx 2°) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, use MESA hammer to break Lunar Shield tie-down brackets. 6. If still unsuccessful, attempt to use MESA hammer to bend or break rear thermal curtain cover.	Access to the three rear Boyd bolts must be accomplished in order to release the sunshield.

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			7. If still unsuccessful, leave sunshield in stowed condition.	Central Station thermal control will be degraded.
24.4	Lunar shield Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer to break Lunar Shield tie-down brackets.	
			4. If still unsuccessful, attempt to bend or break rear thermal curtain cover.	Access to the three rear Boyd bolts must be accomplished in order to release the sunshield.
			5. If still unsuccessful, leave sunshield in stowed condition.	Central Station thermal control will be degraded.
24.5	UHT will not engage in lunar shield UHT socket.	Crew	Use UHT handle to hook lunar shield and remove from sunshield.	
24.6	Lunar Shield will not come off sunshield.	Crew	1. Ensure both Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. Use MESA hammer to break lunar shield tie-down brackets.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			4. If unsuccessful, attempt to use MESA hammer to bend or break rear thermal curtain cover.	Access to the three rear Boyd bolts must be accomplished in order to release the sunshield.
			5. If still unsuccessful, leave sunshield in stowed condition.	Central Station thermal control will be degraded.
24.7	UHT will not disengage from Lunar Shield UHT socket.	Crew	1. Apply additional force.	
			2. Obtain assistance from second crewman.	
			3. If UHT will not disengage, discard it and continue deployment using second UHT.	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.
24.8	Antenna Boyd bolt spindle will not depress	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls.	
			3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle.	
			4. Attempt to overcome spline lock by forcefully rotating UHT.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			5. If unsuccessful, use MESA hammer to pry antenna free or break bracket.	
			6. If still unsuccessful in attempt to gain access to ALSEP antenna, abandon effort and continue Central Station Sunshield deployment.	Central Station thermal control and antenna aiming accuracy will be degraded.
		MCC/ Crew	7. Adjust Central Station as required, in real time, to achieve good communication.	
24.9	Antenna Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer to pry antenna free or break bracket.	
			4. If still unsuccessful in attempt to gain access to ALSEP antenna, abandon effort and continue Central Station Sunshield deployment.	Central Station thermal control and antenna aiming accuracy will be degraded.
		MCC/ Crew	5. Adjust Central Station as required, in real time, to achieve good communication.	
24.10	LSPE Antenna Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	

Event No.	Contingency	Agent	Action	Remarks
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to release compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, use MESA hammer to break bracket. 6. If still unsuccessful, abandon effort and continue Central Station sunshield deployment.	Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE antenna cannot be deployed. LSPE science will be lost except for "listening mode".
24.11	LSPE Antenna Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Forecfully rotate UHT to overcome Boyd bolt. 3. If unsuccessful, use MESA hammer to break bracket.	

Event No.	Contingency	Agent	Action	Remarks
			4. If still unsuccessful, abandon effort and continue Central Station sunshield deployment.	Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE antenna cannot be deployed. LSPE science will be lost except for "listening mode".
24.12	Antenna mast pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force with MESA hammer or break pin or bracket.	
			3. If unsuccessful, place aiming mechanism and antenna on sunshield and prop up for stability and to ensure assembly is level.	If assembly is not leveled to within ± 5°, leveling capability of antenna aiming mechanism will be exceeded and antenna aiming accuracy will be degraded.
		MCC/ Crew	4. Adjust antenna as required in real time, to achieve good communication.	
24.13	Antenna mast support pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force with MESA hammer or break pin.	
			3. If unsuccessful, use MESA hammer to break bracket.	
			4. If still unsuccessful, abandon Central Station sunshield deployment.	Central Station thermal control and antenna aiming accuracy will be degraded.

Event No.	Contingency	Agent	Action	Remarks
		MCC/ Crew	5. Adjust Central Station as required, in real time, to achieve good communication.	
24.14	Antenna restraining arm will not rotate.	Crew	1. Ensure Boyd bolt has been released.	
			2. Use UHT to ensure that Boyd bolt has been sprung upward.	
			3. If unsuccessful, use UHT handle to force antenna restraining arm rotation.	
			4. If still unsuccessful, use MESA hammer to pry antenna free or break bracket.	
			5. If unsuccessful in attempt to gain access to ALSEP antenna, abandon effort and continue Central Station Sunshield deployment.	Central Station thermal control and antenna aiming accuracy will be degraded.
		MCC/ Crew	6. Adjust Central Station as required, in real time, to achieve good communication.	
24.15	UHT will not engage in ALSEP antenna cable reel UHT socket.	Crew	Use UHT handle to hook lanyard and deploy ALSEP antenna cable reel and cable.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.16	ALSEP antenna cable reel lanyard breaks.	Crew	1. Attempt to release cable reel by grasping any remaining lanyard.	
			2. Manually remove pins and use UHT handle to release cable reel.	
24.17	ALSEP antenna cable reel pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. Apply additional force on pin with MESA hammer or break pin.	
			3. If unsuccessful, attempt to use UHT handle to bend or break antenna cable reel.	
			4. If still unsuccessful, leave sunshield in stowed condition, deploy antenna on stowed sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Central Station thermal control and antenna aiming accuracy will be degraded.
		MCC/ Crew	5. Adjust antenna as required, in real time, to achieve good communication,	
24.18	ALSEP antenna cable reel jams.	Crew	1. Use UHT handle to bend or break antenna cable reel and to deploy antenna cable.	
			2. If unsuccessful, leave sunshield in stowed condition, deploy antenna on stowed sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Central Station thermal control and antenna aiming accuracy will be degraded.
		MCC/ Crew	3. Adjust antenna as required, in real time, to achieve good communications.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.19	UHT will not disengage from ALSEP antenna cable reel UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, discard it and continue deployment using second UHT.	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.
24.20	Sunshield Boyd Bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT. 2. Apply steady downward pressure with UHT and rotate bolt (approx. 2^{o}) CW to relieve compression of balls. 3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle. 4. Attempt to overcome spline lock by forcefully rotating UHT. 5. If unsuccessful, leave sunshield in stowed condition.	Central station thermal control will be degraded.

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.21	Sunshield Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, leave sunshield in stowed condition.	Central Station thermal control will be degraded.
24.22	Antenna mast does not lock when extended	Crew	1. Apply additional force.	
			2. Obtain assistance from second crewman.	
			3. If unsuccessful to lock sections, place aiming mechanism and antenna on sunshield and prop up for stability and to ensure assembly is level.	If assembly is not leveled to within ±5°, leveling capability of antenna aiming mechanism will be exceeded and antenna aiming accuracy will be degraded.
		MCC/ Crew	4. Adjust antenna as required, in real time, to achieve good communication.	
24.23	Sunshield will not move when depressed by UHT to check for Boyd bolt release or will not deploy.	Crew	1. Ensure all Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. Check to see if thermistor cable, curtain covers or thermal curtains are jammed, or if ALSEP antenna cable or LSPE Remote Antenna cable is clear of sunshield and release them with UHT handle, if required.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			4. Engage UHT in Subpackage #1 temporary stowage socket and use UHT as a lever to raise sunshield.	
			5. If unsuccessful, use UHT handle in an attempt to pry sunshield upward.	
			6. If guy wire is preventing sunshield extension, attempt to free the guy wire if it is entangled or caught.	
			7. If guy wire can not be freed, fail the tufbraid in order to permit sunshield extension.	
			8. If unsuccessful, use MESA hammer to jar or break sunshield free, if site of resistance to deployment can be located.	Central Station thermal control may be degraded.
			9. If sunshield can not be deployed, leave sunshield in stowed condition.	Central Station thermal control will be degraded.

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.24	Antenna falls off sunshield.	Crew	Use UHT handle to retrieve antenna from lunar surface and remove debris, as required.	
24.25	Central Station is not properly leveled, but sunshield is fully extended. (Note to see that guy wires are taut.)	Crew	1. Use UHT to relevel Central Station by pressing downward on front of Central Station, "scrunching" the subpackage, or lifting up the primary structure to kick dirt underneath.	Do not relevel if primary structure will be misleveled more than ± 5°, which would exceed the leveling capability of the antenna aiming mechanism and would degrade the antenna aiming accuracy. Do not use sunshield as a handhold for releveling. The extenders could be failed and the thermal control system would be degraded.
			2. If unsuccessful, use UHT handle to lift rear or side of primary structure, as required, to kick dirt underneath.	
			3. If still unsuccessful, step on subpackage carry handle to force subpackage into lunar surface.	
			4. If still unsuccessful in attempt to relevel Central Station, continue nominal ALSEP deployment sequence.	Without accurate leveling, Central Station thermal control may be degraded. If primary structure is not leveled to within ±5°, leveling capability of antenna aiming mechanism will be exceeded and antenna aiming accuracy will be degraded.

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
24.26	Central Station is not properly leveled and sunshield is not fully extended. (Guy wires will not be taut.)	Crew	1. Attempt to manually ensure full sunshield erection.	
			2. If front extender can not be fully extended, gently press downward on rear of sunshield to level sunshield and increase size of (open) front side of Central Station.	Do not press downward on front of sunshield to level sunshield or decrease size of Central Station opening since Central Station thermal control would be degraded.
			3. Use UHT to relevel Central Station by pressing downward on front of Central Station, "scrunching" the subpackage, or lifting up the primary structure to kick dirt underneath.	Do not relevel if primary structure will be misleveled more than 5°, which would exceed the leveling capability of the antenna aiming mechanism and would degrade the antenna aiming accuracy. Do not use sunshield as a handhold for releveling. The extenders could be failed and the thermal control system further compromised.
			4. If unsuccessful, use UHT handle to lift rear or side of primary structure, as required, to kick dirt underneath.	
			5. If still unsuccessful, step on subpackage carry handle to force subpackage into lunar surface.	

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			6. If still unsuccessful in attempt to re-level Central Station, continue nominal ALSEP deployment sequence.	Without accurate leveling, Central Station thermal control may be degraded. If primary structure is not leveled to within 5°, leveling capability of antenna aiming mechanism will be exceeded and antenna aiming accuracy will be degraded
24.27	Central Station is not properly aligned, but sunshield is fully extended. (Note to see that guy wires are taut.)	Crew	1. Ensure Central Station is properly leveled.	Proper alignment is dependent on meeting leveling requirement.
			2. Use UHT handle in subpackage carry handle to realign Central Station.	Do not use sunshield as a hand-hold for realignment. The extenders could be failed and the thermal control system would be degraded.
			3. If unsuccessful, kick subpackage primary structure.	
			4. If still unsuccessful in attempt to re-align Central Station, continue nominal ALSEP deployment sequence.	Without accurate alignment, Central Station thermal control may be degraded.
24.28	Central Station is not properly aligned and sunshield is not fully extended. (Guy wires will not be taut.)	Crew	1. Attempt to manually ensure full sun-shield erection.	
			2. Ensure Central Station is properly leveled.	Proper alignment is dependent on meeting leveling requirement.

24.0 Central Station Sunshield Operations

Event No.	Contingency	Agent	Action	Remarks
			3. Use UHT handle in subpackage carry handle to realign Central Station.	Do not use sunshield as a handhold for realignment. The extenders could be failed and the thermal control system would be further compromised.
			4. If unsuccessful, kick subpackage primary structure.	
			5. If still unsuccessful in attempt to realign Central Station, continue nominal ALSEP deployment sequence.	Without accurate alignment, Central Station thermal control may be degraded.
24.29	Side thermal curtain cover can not be removed.	Crew	Use UHT handle to bend or break side thermal curtain cover.	
24.30	Velcro tabs on side curtains will not mate or match up properly.	Crew	1. Run UHT between mating surfaces to release velcro and attempt to reattach velcro properly.	
			2. If unsuccessful in attempt to mate or match up velcro properly, continue nominal ALSEP deployment sequence.	Central Station thermal control may be degraded.

25.0 ALSEP Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
25.1	Aiming Mechanism housing Boyd bolt spindle will not depress	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2^{o}) CW to relieve compression of balls.	
			3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle.	
			4. Attempt to overcome spline lock by forcefully rotating UHT.	
			5. If unsuccessful, use MESA hammer to break housing off mounting lugs in order to gain access to aiming mechanism.	
			6. If unable to gain access to aiming mechanism, place antenna on Central Station sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Antenna aiming accuracy will be degraded.
		MCC/ Crew	7. Adjust antenna as required, in real time, to achieve good communication.	

25.0 ALSEP Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
25.2	Aiming Mechanism housing Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer to break housing off mounting lugs in order to gain access to aiming mechanism.	
			4. If unable to gain access to aiming mechanism, place antenna on Central Station sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Antenna aiming accuracy will be degraded.
		MCC/ Crew	5. Adjust antenna as required, in real time, to achieve good communication.	
25.3	Aiming mechanism housing will not come off LEAM carrier.	Crew	1. Ensure both Boyd bolts have been released.	
			2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. Use MESA hammer to break housing off mounting lugs in order to gain access to aiming mechanism.	
			4. If unable to gain access to aiming mechanism, place antenna on Central Station sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Antenna aiming accuracy will be degraded.
		MCC/ Crew	5. Adjust antenna as required, in real time, to achieve good communication.	

25.0 ALSEP Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
25.4	Aiming mechanism housing falls to lunar surface.	Crew	Use UHT handle to hook handle and retrieve aiming mechanism housing.	
25.5	Aiming mechanism release pin can not be removed.	Crew	1. Apply additional force.	
			2. Apply additional force on pin with MESA hammer or break pin.	
			3. If unsuccessful, obtain aid of second crewman.	
			4. If unable to gain access to aiming mechanism, place antenna on Central Station sunshield and prop up for stability and to ensure antenna is pointed toward earth.	**Antenna aiming accuracy will be degraded.**
		MCC/ Crew	5. Adjust antenna as required, in real time, to achieve good communication.	
25.6	Aiming mechanism housing can not be removed.	Crew	1. Apply additional force.	
			2. Obtain aid of second crewman.	
25.7	Clam shells can not be removed.	Crew	1. Use UHT handle to pry clam shells off.	
			2. Obtain aid of second crewman.	

25.0 ALSEP Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
25.8	Antenna will not seat on aiming mechanism.	Crew	1. Ensure cable outlet is properly oriented.	
			2. Apply additional force.	
			3. If unsuccessful, examine antenna and aiming mechanism for obstructions, dislodge obstructions by impact and reseat antenna on aiming mechanism.	
			4. If antenna is partially seated and stable, continue with nominal ALSEP deployment sequence.	Antenna aiming accuracy may be degraded.
			5. If antenna can not be seated on aiming mechanism or is unstable, place antenna on sunshield and prop up for stability and to ensure antenna is pointed toward earth.	Antenna aiming accuracy will be degraded.
		MCC/ Crew	6. Adjust antenna as required, in real time, to achieve good communication.	
25.9	Aiming mechanism knob will not rotate.	Crew	1. Disengage the appropriate contingency override lock level (longitude, latitude or shadow adjustment)and manually adjust orientation. Reengage lock lever after adjustment has been made.	
			2. If unsuccessful, apply additional force with hand or MESA hammer, being careful not to damage mechanism.	

25.0 ALSEP Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
			3. If still unsuccessful, attempt to intentionally fail mechanism, achieve approximately correct orientation using visual sighting, and shim or brace antenna to maintain aiming accuracy.	Antenna aiming accuracy may be degraded.
			4. If still unsuccessful, remove antenna from aiming mechanism, place it on sunshield, achieve approximately correct orientation using visual sighting and shim or brace antenna to maintain aiming accuracy.	Antenna aiming accuracy will be degraded.
		MCC/ Crew	5. Adjust antenna as required, in real time, to achieve good communication.	
25.10	Lunar debris degrades readability of bubble level or sun compass, 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 a reference, and ensure ample photo coverage is obtained to verify aiming mechanism orientation.	Without accurate leveling and alignment, antenna aiming accuracy will be degraded.
		MCC/ Crew	2. Adjust antenna as required, in real time, to achieve good communication.	
25.11	ALSEP equipment is lying on lunar surface adjacent to Central Station PDM panel.	Crew	Move any debris away from PDM panel to the recommended trash pile area which is at least 10 feet south from Central Station.	

26.0 HFE Probe Deployment

Event No.	Contingency	Agent	Action	Remarks
26.1	Emplacement tool can not be locked in extended position.	Crew	1. Apply additional force, but be careful not to fail the tool.	
			2. Obtain assistance from second crewman.	
		Crew/ MCC	3. Use tool as is, report which section would not lock and insert probe into bore hole as far as possible.	HFE science may be degraded.
26.2	Probe end piece can not be removed or sail cloth strip separates from end piece.	Crew	Use MESA tool to pry end piece from probe.	
26.3	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/ MCC	2. If emplacement tool collapses again, insert probe into bore hole as far as possible and report collapse of tool.	HFE science may be degraded.
26.4	Probe can not be fully inserted into bore stem or emplacement tool reading is off-nominal	Crew	1. Continue probe emplacement and apply additional force.	
		Crew/ MCC	2. Abandon effort and report depth of insertion.	HFE science may be degraded.

26.0 HFE Probe Deployment

Event No.	Contingency	Agent	Action	Remarks
26.5	HFE probe does not lock in bore stem (cable or probe is pulled out when emplacement tool is withdrawn from bore hole).	Crew Crew/ MCC	1. Repeat probe emplacement. 2. Abandon effort and report depth of insertion.	HFE science may be degraded.

27.0 ALSEP Activation

Event No.	Contingency	Agent	Action	Remarks
27.1	Shorting switch is 'ON" position, but ammeter indicates a non-zero reading.	Crew	Wait for downlink verification.	
27.2	ALSEP Signal is not received or is not functioning properly.	MCC	1. Ref. - Mission Rules and Operations Plan.	
		MCC/ Crew	2. If unsuccessful notify crew to check ammeter for zero reading, to ensure shorting plug is properly connected to Central Station, to check ALSEP antenna for general pointing direction, to check if aiming mechanism settings are correct, to perform visual examination of antenna cable and RTG cable for signs of damage, and to report to MCC.	Action 2 through 5 are representative of the tasks which the crew may be asked to perform but not necessarily in the order listed.
			3. If still unsuccessful, notify crew to turn Switch #1 CW to "RESET" and then return to "PWR".	
			4. If still unsuccessful, and ammeter indicates a non-zero reading or shorting plug is not properly connected to Central Station, notify crew to disconnect shorting plug from the RTG cable and connect RTG cable directly to Central Station.	To perform this contingency procedure, the crew will be required to tilt the fully erected Central Station or to kneel to make the reconnection without disturbing Central Station.
			5. If still unsuccessful, notify crew to turn Switch #1 CW to "RESET" and then return to "PWR".	
			6. If visible signs of damage and ALSEP signal is still not received, abandon ALSEP.	

28.0 LEAM Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
28.1	LEAM Boyd bolt spindle will not depress.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Apply steady downward pressure with UHT and rotate bolt (approx. 2°) CW to relieve compression of balls.	
			3. Use MESA hammer on top of UHT to force depression of Boyd bolt spindle.	
			4. Attempt to overcome spline lock by forcefully rotating UHT.	
			5. If unsuccessful, use MESA hammer in an attempt to break the carrier bracket.	LEAM may be damaged, resulting in experiment thermal control and science degradation.
			6. If still unsuccessful, deploy LEAM still mounted to carrier.	East sensor cover will still release and internal temperature can be controlled by power management thus getting some scientific data.
28.2	LEAM Boyd bolt will not rotate.	Crew	1. Check hex head of UHT and, if damaged, use second UHT.	
			2. Forcefully rotate UHT to overcome Boyd bolt.	
			3. If unsuccessful, use MESA hammer in attempt to break the carrier bracket.	LEAM may be damaged, resulting in experiment thermal control and science degradation.

Event No.	Contingency	Agent	Action	Remarks
			4. If still unsuccessful, deploy LEAM still mounted to carrier.	East sensor cover will still release and internal temperature can be controlled by power management, thus, getting some scientific data.
28.3	UHT will not engage in LEAM carry socket.	Crew	1. Try to engage second UHT in socket. 2. If UHT engagement fails, deploy manually.	
28.4	LEAM will not come off carrier.	Crew	1. Ensure all Boyd bolts have been released. 2. Use UHT to ensure that Boyd bolts have been sprung upward.	
			3. If unsuccessful, use MESA hammer in an attempt to break the carrier bracket.	LEAM may be damaged, resulting in experiment thermal control and science degradation.
			4. If still unsuccessful, deploy LEAM still mounted to carrier.	East sensor cover will still release and internal temperature can be controlled by power management, thus getting some scientific data.
28.5	LEAM 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. When handling the experiment, attempt not to get dust accumulations in the experiment dust cover or sensor areas.	Reduced thermal control due to degradation of thermal paint with lunar debris.
			2. If UHT engagement fails, deploy manually. When handling the experiment attempt not to get dust accumulations in the experiment dust cover of sensor areas.	

28.0 LEAM Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
28.6	LEAM dust cover pull ring fails.	Crew	1. Manually peel off dust cover.	
			2. Request aid of second crewman.	
28.7	Crewman walks too far and jerks central station.	Crew	1. Carry experiment back toward central station to provide sufficient slack cable and continue deployment of LEAM.	
		Crew/ MCC	2. Check cable and connectors at experiment and central station interfaces for visible signs of damage and notify MCC if there are visible signs of damage. Check LSG, LMS, and central station leveling and alignment, and relevel, realign and notify MCC if experiments or central station was disturbed.	LEAM operation may be degraded if there are visible signs of damage.
28.8	Unable to deploy LEAM 25 feet southeast of central station due to presence of craters, boulders, etc.	Crew	1. Locate LEAM as far from central station, RTG and other experiment sites as LEAM cable will permit and keep RTG out of LEAM sensors field of view.	
			2. Deploy LEAM north or east of planned location, but remember that east and west sensors require a free 120° field of view with the look angle of the east sensor aligned 25° north of east.	Any debris from the unpacking of the experiments should be piled out of the sensors' field of view to avoid any possible thermal reflections directed at the sensors.

28.0 LEAM Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
28.9	LEAM carry socket pin jams.	Crew	1. Apply additional force while rotating pin.	
			2. If unsuccessful, deploy manually.	Do not use the Gnomon as a handle.
28.10	LEAM carry socket does not rotate or lock.	Crew	1. Apply additional force in an attempt to rotate socket.	
			2. If unsuccessful in attempt to rotate socket or socket will not lock, deploy manually.	Do not use the Gnomon as a handle.
28.11	LEAM leg/gnomon release lanyard breaks.	Crew	1. Attempt to release legs and gnomon by grasping any remaining lanyard.	
			2. Manually release Velcro to deploy gnomon and release pin to deploy legs.	
28.12	One leg (or more) fails to deploy, to lock or leg(s) collapse.	Crew	1. Apply additional force manually to achieve complete leg deployment or ensure locking.	
			2. Drag defective leg in the lunar soil to bind it in the extended position.	

28.0 LEAM Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
			3. If unsuccessful, fold all legs into stored configuration and set LEAM upon a nearby rock or an array of smaller rocks sufficiently high to isolate the experiment from the lunar soil. Allow adequate room for the deployed dust covers (to avoid sensor shielding)	Experiment stability, science and thermal control will be degraded.
28.13	Gnomon fails to self deploy.	Crew	Deploy gnomon manually.	
28.14	Lunar debris degrades readability of bubble level or sun compass, or bubble level or sun compass is damaged.	Crew	Visually level the upper horizontal edges of the LEAM with the lunar horizons; align LEAM west sensor axis toward LSPE Geophone Module; and ensure ample photo coverage is obtained to verify experiment orientation.	Without accurate leveling and alignment, experiment science and thermal control will be degraded.
28.15	Gnomon fails to remain in vertical position.	Crew	1. Forcefully bend or remove gnomon as necessary. 2. Align LEAM west sensor axis toward LSPE Geophone Module. 3. Ensure ample photo coverage is obtained to verify experiment orientation. Include the full shadow (as feasible) of LEAM in photographs.	This constitutes a threat to successful subsequent dust cover removal.

28.0 LEAM Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
28.16	UHT will not disengage from LEAM carry socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LEAM and continue deployment using second UHT. Prop up LEAM, as required, to maintain experiment stability.	Experiment science, stability and thermal control 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.

29.0 LSPE Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
29.1	HFE Subpallet unavailable for use as LSPE Antenna Mounting Base.	Crew	Remove LSPE Antenna and cable reel from Central Station, deploy at planned location, extend antenna sections, imbed into lunar surface and prop up, as required, with rocks or other lunar debris.	Antenna stability and RF link to EP's will be degraded.
29.2	LSPE Antenna will not come off mounting bracket on sunshield.	Crew	1. Ensure Boyd bolt has been released. 2. Use UHT to ensure that Boyd bolt has been sprung upward. 3. If unsuccessful, use MESA hammer to break bracket. 4. If still unsuccessful, abandon LSPE deployment.	Central Station thermal control will be degraded. Explosive packages should not be deployed if LSPE antenna cannot be deployed.

29.0 LSPE Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
29.3	Unable to locate LSPE Antenna 40 feet northwest of Central Station due to presence of craters, etc.	Crew	1. Locate LSPE Antenna as far from Central Station, RTG, LSG and the nearest HFE probe site as cable permits. 2. Deploy LSPE Antenna south of planned location, but maintain at least a 25 degree angle between the LSG cable and LSPE Antenna cable. Do not cross cables or run LSPE Antenna cable along with and in contact with another cable. 3. If unable to deploy LSPE Antenna south of planned location, deploy north of planned location but at least 17 feet from the nearest HFE probe site. Do not cross cables or run LSPE Antenna cable along with and in contact with another cable.	
29.4	LSPE Antenna cannot be extended or cannot be fully extended.	Crew	Apply additional force in an attempt to extend antenna to its maximum length.	LSPE Antenna is fragile and subject to damage.
29.5	LSPE Antenna breaks.	Crew	Jam broken section into antenna and make all sections have been extended.	It is essential to have all sections extended.

29.0 LSPE Antenna Deployment

Event No.	Contingency	Agent	Action	Remarks
29.6	UHT will not engage in LSPE Antenna UHT socket.	Crew	1. Try to engage second UHT in socket. 2. If UHT engagement fails, push downward on UHT handle to lock antenna into HFE subpallet antenna socket.	
29.7	LSPE Antenna will not lock into HFE Subpallet Antenna socket.	Crew	1. Apply additional downward force on UHT handle. 2. If unsuccessful, prop up with rocks and continue ALSEP deployment.	Antenna stability and RF link to EP's may be degraded.
29.8	UHT will not disengage from LSPE Antenna UHT socket.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If UHT will not disengage, leave it on the LSPE Antenna and continue deployment using second UHT.	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.

30.0 LSPE Geophone Deployment

Event No.	Contingency	Agent	Action	Remarks
30.1	UHT will not engage in geophone cable reel	Crew	1. Try to engage second UHT in reel socket. 2. If UHT engagement fails deploy cable manually.	
30.2	Geophone cable reel will not come out of LSPE Geophone Module	Crew	1. Apply upward force while rocking the geophone cable reel in an attempt to free the reel from the geophone module. 2. If unsuccessful, use center geophone (#3) as alternate to assure triangular configuration of the geophones.	
30.3	Less than four or no flags available for geophone deployment.	Crew	1. Assure one flag will be available for the center geophone (#3). 2. If no flags or not enough flags are available to complete the geophone deployments, use discarded hardware, if available, to anchor and visually depict the geophone deployment location. Also look for geological mark for interrelation of the geophones.	Flags are primarily used for photographic purposes and as an aid in correct interrelation of the four geophones. LSPE science will be degraded without some sort of hardware to flag and depict the geophone deployment location.
30.4	Unable to deploy geophones at planned deployment location due to presence of craters, boulders, etc	Crew	Walk around crater, boulder, etc., and deploy geophones as far out as cable permits and emplant in flat terrain, not in craters. Geophones should be deployed so that three of them comprise the vertices of an equilateral triangle with the fourth in the center of the triangle.	

30.0 LSPE Geophone Deployment

Event No.	Contingency	Agent	Action	Remarks
30.5	Geophone cable reel falls off UHT due to accidental triggering of UHT release mechanism.	Crew	1. Use UHT handle to retrieve cable, gently lift cable reel, remove debris, and attempt to re-engage UHT in socket. 2. If UHT engagement fails, deploy cable manually.	
30.6	Geophone cable reel does not turn freely or will not rotate.	Crew	Deploy cable manually.	
30.7	Cable spews off Geophone cable reel	Crew	Remove any kinks or snarls in cable.	
30.8	During deployment the cable becomes suspended between crater rim edges.	Crew	If geophone cable is deployed over depression more than two feet deep, insure that the cable has enough slack to follow the contour of the lunar surface.	
30.9	Crewman walks too far and jerks geophone module/geophones and/or flag out of ground, disturbs Central Station, etc.	Crew	1. Carry geophone back toward geophone module to provide sufficient slack cable and continue geophone deployment.	
		Crew/MCC	2. Re-emplant flag anchor at geophone module if required. Check cable and connectors at geophone, geophone module and central Station interfaces for visible signs of damage and check central station and ALSEP antenna leveling and alignment. Relevel and realign central station and ALSEP antenna if required, and notify MCC if there are visible signs of damage or if releveling and realignment were required.	LSPE operation may be degraded if there are visible signs of damage.

30.0 LSPE Geophone Deployment

Event No.	Contingency	Agent	Action	Remarks
		Crew	3. Determine if other deployed geophones and flags are still emplanted into lunar surface. If geophones and/or flags were disturbed re-emplant into lunar surface.	
		Crew/MCC	4. Upon return from geophone deployment, if Central Station and ALSEP antenna were disturbed, check other experiments leveling and alignment, and relevel, realign and notify MCC if experiments were disturbed.	
30.10	Geophone falls on lunar surface.	Crew	Use UHT handle to retrieve geophone cable, grasp geophone and continue geophone deployment.	
30.11	Geophone and/or flag cannot be embedded in lunar surface because its planned placement location is too hard or due to presence of craters, etc.		1. Locate geophone and flag as far from the LSPE Geophone Module as cable permits and emplace on flat terrain. 2. Move the geophone and flag laterally with respect to the geophone deployment line to a softer surface. 3. If flag cannot be embedded, use discarded hardware, if available, to anchor geophone and look for geological mark for interrelation of the four geophones.	Flags are primarily used for photographic purposes and as an aid in correct interrelation of the four geophones.
30.12	UHT will not disengage from LSPE geophone reel socket.	Crew	1. Apply additional force 2. Use MESA hammer to break reel loose from UHT. 3. If UHT will not disengage, leave UHT on the geophone reel and continue deployment using the second UHT.	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.

30.0 LSPE Geophone Deployment

Event No.	Contingency	Agent	Action	Remarks
30.13	LSPE Enable Switch can not be turned CW to "ENBL" position	Crew/MCC	1. Report to MCC.	
		Crew	2. Apply additional force to switch.	
		Crew/MCC	3. Report to MCC.	LSPE will not operate unless LSPE Enable Switch is in CW (ENBL) position. Explosive Packages should not be deployed.

31.0 Post-ALSEP Deployment Contingencies

Event No.	Contingency	Agent	Action	Remarks
31.1	ALSEP and/or experiment transmissions are not as expected or equipment is not accepting commands properly.	MCC/ Crew	MCC may request crew to return to ALSEP deployment site to check-out equipment and perform operations as required.	

32.0 Explosive Packages Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
32.1	Explosive Packages Transport Frame pull pin jams.	Crew	1. Apply additional force while rotating pin. 2. Apply additional force on pin with MESA hammer or break pin. 3. If unsuccessful, use MESA hammer to break bracket. 4. If still unsuccessful, leave Transport Frame on Expt. Pallet, and stow entire pallet on LRV.	
32.2	Transport Frame will not interface correctly with LRV.	Crew	Crewman should carry transport frame while riding on LRV.	
32.3	Aborted EVA after start of EP deployment.	MCC/ Crew	1. Deploy Explosive Packages a minimum of 50 feet apart in rapid sequence and a minimum of 500 feet from ALSEP.	
		Crew/ MCC	2. Report deployment locations.	
32.4	The camlock which secures EP to transport Frame will not rotate CCW.	Crew	1. Apply additional force. 2. Obtain assistance from second crewman. 3. If unsuccessful, use MESA hammer to release camlock.	
		Crew/ MCC	4. If still unsuccessful, abandon effort, notify MCC, and continue deployment of the next Explosive Package.	Experiment Science may be partially degraded.

32.0 Explosive Packages Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
32.5	Explosive Package will not come off of Transport Frame.	Crew	1. Apply additional force while rotating the Explosive Package on the outboard retaining pin until the inboard retaining pin is clear.	
			2. A slight inboard push may be required to disengage the hook projection from the outboard retaining pin.	
		Crew/MCC	3. If unsuccessful abandon effort, notify MCC and continue deployment of the next Explosive Package.	Experiment Science may be partially degraded.
32.6	Safe/Arm Slide Switch in "Arm" position	Crew/MCC	Discontinue Explosive Package deployment, notify MCC and lower EP to lunar surface. Report EP No. and location.	Additional contingency to be determined by ground safety.
32.7	Safe/Arm Slide Switch in "Resafe" position.	Crew/MCC	Discontinue Explosive Package deployment, notify MCC , lower EP to lunar surface and continue on to the deployment of the next Explosive Package. Report EP No. and location.	Experiment Science may be partially degraded.
32.8	EP Antenna can not be extended or cannot be fully extended.	Crew	1. Apply additional force in an attempt to extend antenna.	Explosive Package antenna is fragile and subject to damage.
		Crew/MCC	2. If unsuccessful, release pull pins and lower to lunar surface. Report EP No. and location.	Experiment Science may be partially degraded.
32.9	EP Antenna breaks	Crew	1. Attempt to jam broken section into antenna and make sure antenna has been fully extended.	Experiment Science may be partially degraded.
		Crew/MCC	2. If unsuccessful, release pull pins and lower to lunar surface. Report EP No. and location.	

32.0 Explosive Packages Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
32.10	One or all of the EP pull pins jam.	Crew	1. Apply additional upward force while rotating pin. 2. If pull ring #2, rotate approx. 70° in a CCW direction before pulling straight up. 3. If pull ring #3, apply only upward force since two pull pins (thermal battery timer and firing pin safing) are ganged together.	
		Crew/MCC	4. If unsuccessful, notify MCC, abandon effort and continue deployment of the next Explosive Package.	Experiment science may be partially degraded.
32.11	Explosive Package falls to lunar surface.	Crew	Use UHT handle to retrieve EP from lunar surface and remove debris, as required.	Thermal control may be degraded.
32.12	Unable to deploy Explosive Package at planned location due to presence of obstruction, crevice or soft deep dust.	Crew	1. If obstruction or crevice near deployment site, place a minimum of 10 feet from obstruction or crevice. 2. If soft deep dust at deployment site, relocate at site nearby or pack dust in a 1 foot diameter circle before emplacing EP on lunar surface. 3. EP#1, the 6 lb. explosive package, must be deployed at the greatest distance from the LSPE geophone array, but should not exceed 11,500 feet. 4. EP #3 and #4, the 1/8 lb. explosive packages must be deployed a minimum of 500 feet from the geophone array.	

32.0 Explosive Packages Offload and Deployment

Event No.	Contingency	Agent	Action	Remarks
32.13	Explosive Packages inadvertently deployed in wrong sequence.	Crew/ MCC	Continue deployment but notify MCC of the deployment sequence.	