

EMU MAF

ALSEP
GEOLOGY



EGRESS
H2O YER
RU ME
V OFFID GA & IV
TB UNPK AT #1 AT #2
ALIGN AT #1

APOLLO 15

LUNAR SURFACE EVA 1
CUFF CHECKLIST

PREPARED BY: Joe H. Roberts
Joe H. Roberts

APPROVED BY: R. G. Zedekar
R. G. Zedekar

D. Scott

D. Scott
CDR, Apollo 15

EMU MALT

ALSEP
GEOLOGY

PLSS TO LM H2O TRANSFER

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

LM TO PLSS H2O TRANSFER

CB(16) ECS: LCG Pump - OPEN
Disconnect LM H2O
Connect PLSS H2O
PLSS Pump - ON

EGRESS
H2O XFER
RU MF
V OFFID GA & TV
AT #1
AT #2

20 XFER
EGRESS

CDR - EVA 1

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

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

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

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

EMU MAF

ALSEP
GEOLOGY

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

0+29 [LRV] Thermal Blanket - Remove
Ck - Walking hinges - Locked
- Chassis - Parallel
- Outrigger Cables - Taut

LRV Left Tape - over Strut
LRV Right Tape - Deploy
[LMP: D-ring & Aft Lanyard]
Right Tape - Pull - MARK; Aft
Chassis Deploy - Fwd Unlock
Outrigger Cables - DISCNT
Left Tape - Pull

0+37 LRV - Set Up
•Chassis Hinge Pins - Check
•Ind. Lock Pins - Pull

STAT #1 CRU MF
STAT #1 CRU MF
LRV OFFLD GA & TV
TB UNPK
AT #1
ALIGN AT #1
AT #2

LRV OFFLD) XFER
LCRU MF, PRESS

EMU MALF

ALSEP
GEOLOGY

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

0+46 **LCRU** Post Locks - Lift
Velcro Tab - Release
TCU Cable - To Batt Cover

LCRU - To LRV
Cable - Connect

TCU - To LRV
Cable - Connect
[LMP: EVA 1 Pallet to MESA]
Rake - To MESA Side
LGA - To Handhold
LGA Cable - Connect To LCRU

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

Cable - Route behind TCU
- Connect to LCRU

[LMP: Unstow tools]

0+56 **TV** / Tripod to +Z Strut
TV PWR SW - OFF
TV Cable - Disconnect & Stow

TV Camera - To TCU
TV Cable - Connect

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

STAT #3	SHUFF	ETB UNPK	AT #1	AT #2
STAT #2	LT #3	HGA & TV	ALIGN	AT #1

HGA & TV OFFLD) XFER
ETB UNPK RU ME PRESS

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

HGA Dish - Deploy
HGA - Point To Earth

[ETB] Contents - To LRV
ETB (Empty) - To Ladder Hook
LMP PLSS Ant. - Stow

[LMP: Ingress]

1+09 LEC - To Pallet #1
Pallet #1 - Transfer
LEC Hooks - To Ladder Hook

HGA - Stow

1+12 LCRU Sel - PM1/WB

EMU MALF

ALSEP
GEOLOGY

Tidy up LRV

1+13

[START]

Drive to Nav. Init. Site

NAV CB - CLOSE

LRV Systems - Readout

[NAV ALIGN]

[STOP]

LMP PLSS Ant. - Unstow

1+18

Attach To LMP EMU:

- Hammer
- Core rammer
- Core Tube Caps (Bag #1 pkt.)
- C-Bag #4

[LMP: C-Bag #1 - To CDR]

Tongs - Tether

70mm Cam - To RCU

STAT #3 SHUFFLE RMT STAT #1 AT #2
STAT #2 LT #3 EP OFF NAV ALIGN AT #1

NAV ALIGN A & TV V OFFLD3 XFER
STAT #1 B UNPK RU MF 3RESS

START Gyro - To Hou Update

1+25 TRAVEL (0:17)

- Possible Ray
- Lineaments, fillets, mounds
- Raised rille rim (levee)
- Block distribution
- 16mm - (f4; 1/260; 12 FPS)

1+42 CP1 (0:02) Canyon Crater
(023°/2.0 To LM)

1+44 TRAVEL (0:07)

- Elbow Ejecta distribution
- Drive close to rim

1+51 Geology Station #1 (0:15)

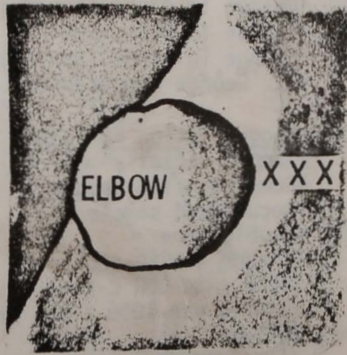
- Pan from rim
- Sample radially(rim/blanket)

EO

EMU MALF

ALSEP
GEOLOGY

EO = ENTHUSIASTIC
OBSERVATIONS



STATION 1

125m

STAT #3 SHUFFLE RMTS BLE C STAT #2
STAT #2 T #3 P OFFLD SEP D STAT #1

EMU MAF

ALSEP
GEOLOGY

2+06 TRAVEL (0:08)

- Elbow ejecta distribution
- Change in slope toward front
- Change in rock type
- Change in ground texture
- St. George ejecta dist.

2+14 Geology Station #2 (0:45)

- Sample radially
- Comprehensive sample
- Documented sample
- Double core
(Trench - SESC and soil)
(SESC - to CDR C-Bag)
(Stereo pan-100m along front)
(500mm)
(Penetrometer)



STAT #3 SHUFFLE ROMTS BLE CNT PRE
STAT #2 T #3 EP OFFLD SEP DIA DBES

STAT #1 / ALIGN A & TV V OF STAT #2
STAT #2 AT #1 B UNPK RU M STAT #3

2+59 TRAVEL (0:09)

- Lateral/Vertical changes along front
- Block distribution
- Possible rock flows
- Patterned ground
- Cmpre crater frequency/state
- Observe EVA II route

3+08 Geology Station #3 (0:14)

- Describe "Flow" Mtrl/source
- Vertical/lateral changes
- Documented samples-
 -"Flow"/Front
 (-Mare)

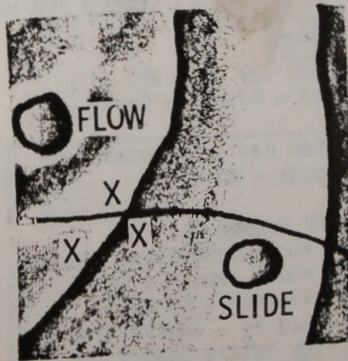
E0

3+22 TRAVEL (0:28)

- Observe EVA II route
- Front/Mare relations
- Possible ray material
- Compare to earlier mare
- Extent of "slide" boundary

EMU MAF

AL SEP
GEOLOGY



STATION 3

125m

LRRR EQ SHUFFLE ROOMS BLE CNT DRE
CORE STAT #3 EP OFFLD SEP DIA DBES

GEOLOGY
ALSEP

3+50 Park LRV

- Heading SE; facing SEQ Bay
- Nav CB - Open

STOP

LCRU Sel - TV RMT

HGA - Point To Earth

70mm Cam - To Under Seat

Tongs - To HTC

LMP Geo Equip:

- Core Tube Caps - Discard
- Core rammer - To HTC
- Hammer - To HTC

C-Bag #4 - Remove from LMP

Tidy Velcro Covers

[LMP: Remove C-Bag #1]

C-Bag #4 - Under LMP Seat

C-Bag #2 - To HTC (R)

EMU MALF !

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

Drill - To LRV
LRRR - To LRV

HGA - Stow

LCRU Sel - PM1/WB

4+70 **START**

Drive to ALSEP SITE

CAUTION

Do Not Point HGA or LGA
within $\pm 20^\circ$ of ALSEP
Antenna

GEOLOGY
ALSEP

EMU MALF 1

SITE REQUIREMENTS:

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

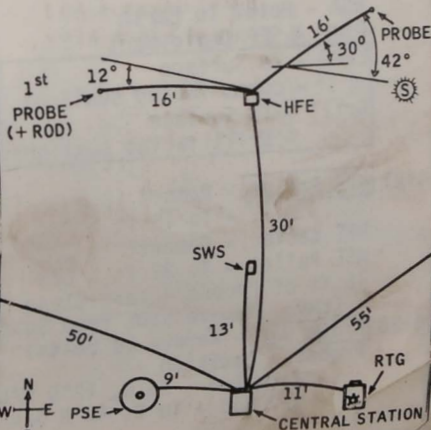
4+15 Park LRV

- Heading North
- Facing C/S Site

LRV Battery Temps - Readout

STOP

ALSEP ARRAY A-2H LAYOUT FOR A NORTHEAST LANDING SITE



GEOLOGY
ALSEP

EMU MALF

4+18

LCRU Sel - TV RMT
HGA - Point To Earth
Plan ALSEP Deployment

LRRR - To Surface
- cubes facing sunlight
Drill - To Surface
- Drill facing sunlight

4+21 **HFE Pallet** - Remove (2 bolts)
- To 15 ft N. C/S

HFE Cable - Connect To C/S
HFE Pallet - To 30 ft N C/S
16 ft of Probes - Keep Clean

[LMP: Remove SIDE from Subp]

4+28 **Probe Box** - Remove (4 bolts)

Probes - Position
- With Rod - To W, 12°S S/L
- W/O Rod - To E, 42°N S/L

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

Pa'llet - Discard 16 ft North
[LMP: PSE deploy]

4+37 **Drill** - To LMP Seat

• **DECAL**

Drill & Rack - To West Probe
[LMP: SWE & LSM deploy]
Insert Bore Stem Into Surface

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

STAT #ALSEP DIA SEP OFFLOAD AT #2
STAT #CABLE CNT TE RQMTS SHUFFLE AT #3

LRRR
CORE

SEP-LM
EP PHO

AR FIELD
R FIELD

B LOA
PRESS

CORE
PROBES

11 LCRU

GEOLOGY
ALSEP

EMU MAF

PROBES
CORE
EP DIA SEP OFFLOAD #3 AT #2
IF CNT TE RQMTS SHUFFLEAT #3

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

Implant Bore Stem Into Surface
Insert Probe Into Stem

5+20 Report Probe Depth

[LMP: SIDE deploy]

• Check 16 ft Area Clean

• Check Elect Box Level & Align

Drill & Rack - To Core Site

Drill Chuck - Remove & Discard

Treddie To Drill Site

16mm Cam Mag - Change To "D"

16mm Photo - Drill Site

(f8, 12 fps, 1/250)

[LMP: Activate C/S]

5+26 Implant Core Stem - 1 inch/sec

Break Drill from stem

5+37 70mm Cam - Retrieve From LRV

70mm Photo Pan - 7ft S. Stem

70mm Cam - To LRV

[LMP: LRRR deploy]

Core Stem Caps - To C-Bag #1

C-Bag #2 - To LMP Seat

C-Bag #4 - To HTC

Core Tubes - To C-Bag #4

5+42 Check Stem Free In Surface

Drill - Remove From Stem

[LMP: ALSEP photos]

Cap Drill Stem (Black - #A)

Rotate Stem Clockwise &

Pull Stem From Treddie

Core Stem Top End - To Vise

Cap Stem, Bit End #B

Stems - to C-Bag #1 (2/pkt.)

LRRR
CORE

SEP-LM
SEP PHO

AR FIELD
R FIELD

BRESS
B LOAD

11,LCRU
10

GEOLOGY
ALSEP

EMU MAF

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

For ALSEP Photography

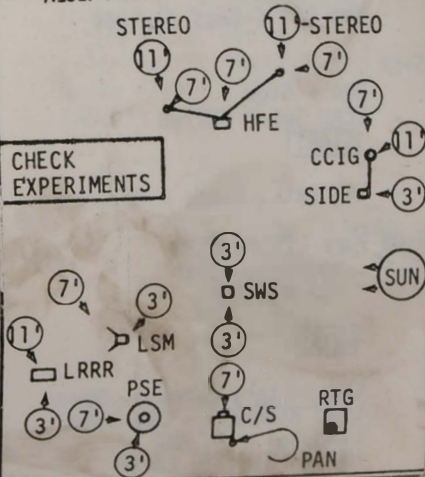
- 70mm Cam - To RCU
- 70mm Mag - To Color, "KK"

LRRR - Deploy

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

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

ALSEP PHOTOS TAKEN AT (f: 11; 1/250)



GEOLOGY
ALSEP

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

5+57
HGA - Stow
LCRU Sel - PM1/WB

START

LRV Batt. Temps - Readout

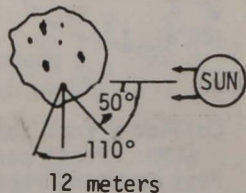
6+03 Park LRV At MESA
• Heading North
• In Sunlight

STOP

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

EMU MALT

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

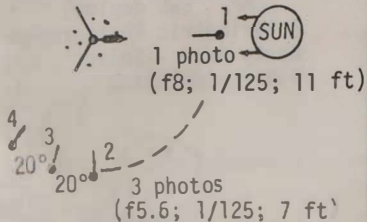


3 photos 20° 3 photos

(f5.6, 1/125; 74 ft)

GEOLOGY
ALSEP

6+19 Gnomon Place
Near Field Photos



Collect 4 Rock Samples
[LMP: Photo pans]

Post Sampling Photos

- 1 Down Sun
- 2 X-Sun

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

EMU MAF

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

6+28 ETB - To CDR Footpan
Collect in ETB

- 70mm Cams (2) (OO), (KK)
- 70mm Mags (2) (NN), (LL)
- 500mm Lens Cam Mag (MM)
- 16mm Mags (3) (CC), (DD) (EE)
- Maps

[LMP: Pack SRC #1]
Reseau Cover - To 500mm Cam
500mm Cam - Under CDR Seat
16mm Cam - Point North

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

GEOLOGY
ALSEP

EMU MALE

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

6+36 [LMP: Ingress]

LEC - To SRC #1
SRC #1 - Transfer

ETB - Transfer

6+46 LEC Hooks - To ladder hook

LCRU Pwr SW - OFF
Ck LCRU Blankets - 35% open
Clean EMU

6+50 Ascend Ladder with C-Bag #4
Stow LEC On Platform
Ingress LM

EMU MALFUNCTIONS

EMU 1: Vent Flag-P, Tone-On
Fan-Off/On

If Flag Still On After 10 Sec:
OPS 02-On, Purge Vlv - LOW
(FAN Fail)

EMU 2: Pres Flag - D, Tone - ON
OPS -2 - ON, Pres Flag - Off
(Leak Or PLSS Reg Fail)
If Flag Still On: Ck Cuff Gage
>3.4, Ver TM, Ops 02 - OFF
(Press Sensor Fail)

GEOLOGY
ALSEP

EMU MALE

EMU 3: 02 Flag-0, Tone - On
Ck Cuff Gage & PLSS 02 Qty
If Cuff Gage >4.0: OPS 02 - On,
PLSS 02 - Off (PLSS Reg Fail)
If Cuff Gage <3.7 Or PLSS 02
Decr: OPS 02 - On (Leak)
If No Apparent Fail (02 Sen Fail)

EMU 4: H2O Flag-A, Tone-On(Prim)
Ver Prim H2O - Open, If Open
Ver TM For Subl Restart Or Aux
H2O Act: Subl Restart: Prim H2O
Clsd, Diverter-MAX, Wait 5 Min,
Diverter-MIN, Prim H2O - Open,
Wait 4 Min Or H2O Flag Off,
Diverter As Desrd (Subl Brkthru)
Aux H2O Act: Diverter-MIN, Aux
H2O - Open, Wait 4 Min Or H2O
Flag Off, Diverter As Desrd
(Prim H2O Depletion)

If TM Does Not Ver Subl Brkthru
Or Prim H2O Depletion:
(H2O Press Sw Fail)
If Add'l Cooling Reqd, Act.
BSLSS (Subl Degr) [If No BSLSS,
OPS 02 - On, Purge Vlv-Hi]
If PRIM H2O - Clsd: Diverter-MIN,
Prim H2O - Open, Wait 4 Min Or
H2O Flag Off, Diverter As Desrd

EMU 4A: H2O Flag-A, Tone-On (Aux)
Ver Prim & Aux H2O-Open, If Open
& Add'l Cooling Reqd, Act.
BSLSS (Subl Degr) [If No BSLSS,
OPS 02-On, Purge Vlv-Hi]
Ver TM For Subl Restart: Prim
H2O-Clsd, Diverter-MAX, Wait 5
Min, Diverter-MIN, Prim H2O-
Open. Wait 4 Min Or H2O Flag

PROBES ETB LOAD IR FIELD SEP EMU 1,2
CORE INGRESS IR FIELD SEP-EMU 3,4

EMU MALE-2
EMU MALE-3

B-SLSS
B-SLSS
EMU 4A
U 5 (CONT)
U 5 (CONT)
U 6.7
11,LCRU
10

GEOLOGY
ALSEP

EMU MALE

Off, Diverter As Desrd
(Subl Brkthru)

If Prim Or Aux H2O-Clsd:
Diverter-MIN, Prim & Aux H2O
Open, Wait 4 Min Or H2O Flag
Off, Diverter As Desrd

EMU 5: Tone-On, No Flags

Ck Cuff Gage

If <3.4: OPS 02-On (Pres Flag
Fail & Leak Or PLSS Reg Shift)

If >3.4 & After Tone Off: Cycle
Mode Sel Sw, No Tone, No Fail.
If Tone On Again: Fan-Off 5 Sec,
Ver Vent Flag-P, Then Fan-On.

If No Flag: OPS 02-On, Purge
Vlv-Low (Vent Flag & Fan Fail)

If PLSS 02 Decr: OPS 02-On
(02 Flag Fail & Leak)

Ver Prim H2O-Open, If Open & On
Prim H2O, Ver TM For Subl
Restart Or Aux H2O Act:
(H2O Flag Fail)

Subl Restart: Prim H2O-Clsd,
Diverter-MAX, Wait 5 Min,
Diverter-MIN, Prim H2O-Open,
Wait 4 Min, Diverter As Desrd
(Subl Brkthru)

Aux H2O Act: Diverter-MIN, Aux
H2O-Open, Wait 4 Min, Diverter
As Desrd (Prim H2O Depletion)

If TM Does Not Ver Subl Brkthru
Or Prim H2O Depletion(Tone Fail)
If Add'l Cooling Reqd, Act.

BSLSS (Subl Degrd) [If No BSLSS,
OPS 02-On, Purge Vlv-Hi]

If Prim H2O-Open, If Open &
Add'l Cooling Reqd, Act. BSLSS

U 1.2
U 3.4

PROBES ETB LOAD AR FIELEMU 4A
CORE INGRESS CAR FIFEMU 5

EMU MALE F24

EMU MALE F-5

B-SLSS DOF
B-SLSS DON

EMU 5 (CONT)

8.9
6.7

11,LCRU
10

GEOLOGY
ALSEP

EMU MALE

(Tone Or H2O Flag Fail Or Subl
Degr'd) [If No BSLSS, OPS 02-On,
Purge Vlv-Hi]

Ver TM For Subl Restart: Prim
H2O-Clsd, Diverter-MAX, Wait
5 Min, Diverter-MIN, Prim H2O
Open, Wait 4 Min, Diverter As
Desrd (Subl Brkthru)

If Prim Or Aux H2O-Clsd & On
Aux H2O: Diverter-MIN, Prim &
Aux H2O-Open, Wait 4 Min,
Diverter As Desrd (H2O
Flag Fail)

EMU 6: Cuff Gage <3.7, (All Other
Indicators OK)

OPS 02-On, Cuff Gage Should
Rise (PLSS Reg Shift)
If No Gage Incr, Ver TM,
OPS 02-Off (Gage Fail)

EMU 7: PLSS 02 Qty Ind Abnormal

Ck Cuff Gage Or 02 Flag-0
If Cuff Gage >4.0, OPS 02-On,
PLSS 02-Off (PLSS Reg Fail)
If Cuff Gage <3.7 Or 02 Flag-0,
OPS 02-On (Leak)
If No Apparent Failure, Ver TM
(Ind Or X-ducer Fail Or Leak)

PROBES ETB LOA EMU 5 (CONT) 11 4A
CORE INGRESS EMU 5 (CONT) 15 3.4

EMU MALE-6
EMU MALE-7

B-SLSS DOF
B-SLSS DON
EMU 8,9
11,LCRU
10

GEOLOGY
ALSEP

EMU MALE

EMU 8: Cuff Gage >4.0

If 02 Flag-0 Or PLSS 02 Decr,
OPS 02-On, PLSS 02-Off
(PLSS Reg Fail)

If Neither, Ver TM (Gage Fail)

EMU 9: Loss Of Pump Noise

If No Side Tone, OPS 02-On,
Purge Vlv-LOW, Act. BSLSS
(Power Fail) [If No BSLSS,
OPS 02-On & Purge Vlv-Hi]

If Sidetone OK, Ver Pump-On. If
Add'l Cooling Req'd, Act. BSLSS
(Pump Fail) [If No BSLSS,
OPS 02-On, Purge Vlv-Hi]

EMU 10: Cooling Inadequate

Ver Diverter-MAX & Pump-On

Ver Prim & (If On Aux) Aux H2O

Open: If Open, Act. Gas Trap

5 Sec, Wait 3 Min, If Add'l

Cooling Req'd, Act. BSLSS (Flow

Restr, Subl Or Pump Degr'd, Or

Heat Leak) [If No BSLSS, OPS

02-On, Purge Vlv-Hi]

Ver TM For Aux H2O Act; Diverter

MIN, Aux H2O-Open, Wait 4 Min,

Diverter As Desrd (Prim H2O

Depletion)

If Prim Or (If On Aux) Aux H2O

Clsd: Diverter-MIN, Prim & (If

On Aux) Aux H2O-Open, Wait 4

Min, Diverter As Desrd

(H2O Flag Fail)

B-SLSS DOF
B-SLSS DON

EM 11,LCRU
EMU 10

GEOLOGY
ALSEP

EMU MALE

EMU 11: Loss Of Voice Comm (LM)

Ck Vol Controls (Wheel-A-Hou,
Blade-B-EVA)

Cycle PTT Sw-MAIN & MOM

CDR Mode Sel To B, LMP To A
(Hand Signals)

If No Comm, CDR To A, LMP To B

LCRU 1: Loss Of Voice Comm (LCRU)

If no comm between crewmen,
perform EMU 11.

If no comm with MSFN:

Ck Vol Control (Wheel-A-Hou)

Repoint LCRU antenna

Select alternate mode--

MODE - PM1/WB or FM/TV

Point selected antenna

LCRU cb - close

LRV AUX cb - close

LCRU POWER Sw - EXT

BSLSS Don And Activate

- 1 Unstow BSLSS
- 2 Conn Tether Between Crewmen
BSLSS H2O Flow Divider At Good
PLSS (*Good PLSS on Rh side*)
- 3 Remove Dust Cover From BSLSS
H2O Flow Divider
- 4 Discon Good PLSS H2O From PGA
- 5 Conn BSLSS H2O Flow Divider To
PGA With Good PLSS
- 6 Failed PLSS Pump-Off
- 7 Discon Failed PLSS H2O From
PGA & Secure
- 8 Discon BSLSS H2O From BSLSS
H2O Flow Divider
- 9 Conn BSLSS H2O To PGA With
Failed PLSS
- 10 Conn Good PLSS H2O To BSLSS
H2O Flow Divider

B-SLSS DOF
B-SLSS DON

GEOLOGY
ALSEP

EMU MALE

BSLSS Doff

- 1 Discon BSLSS From Failed PLSS
PGA
- 2 Discon Tether From Both PGA's
- 3 Discon PLSS H2O From BSLSS
- 4 Discon BSLSS From PGA &
Discard
- 5 Conn Good PLSS H2O To PGA
- 6 Ingress LM

BASE
EMU 10
EM 11, LCRU
U 6, 7
U 8, 9
U 5 (CONT) 1 4A B-SLSS DON
U 5 (CONT) 1 5 B-SLSS DOF

1/2/77
EMU MALE 12

GEOLOGY
ALSEP

EMU MALE

Tom Matney

