

APOLLO TWELVE
LUNAR SURFACE PROCEDURES
LMP CUFF CHECKLIST

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Lunar Module Pilot

EMU
MALF

EVA 2

CHANGE MAG
STOW LEC
SEQ. CAM. ON [8, 6 FR]
(FOR FAM., TV & S-BAND)

0+40
LMP EGRESS
INGRESS ✓
CLOSE HATCH
ASCENT ✓



0-45
FAM
MOBILITY & STABILITY
CG SHIFT
DOWNWARD REACH
ARM MOTION
WALKING (BALANCING, BOOT
PENETRATION, SOIL
SCATTERING & ADHESION)



PRE-EGRESS
EGRESS
ALSEP
FFLOOD
SIDE
DEPLOY
AVERSE
PLTFE

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DATE: 10/27/69

LMP - EVA 1

0+10 PRE-EGRESS

PASS LEC

PHOTO CDR [5.6, 5, 6]

SEQ. CAM. ON [2.8/60, 12 FR] SHADE
[8/250, 12 FR] SUN

PRE-EGRESS

DESCENT

FAM

THERE'S NO
MORE
CLEAN
SAND
LEFT!

CHANGE 8 min
MAG



ETB TRANS

SEQ. CAM. ON [8, 12 FR]

AFTER 3 min.
SEQ. CAM. OFF

FINAL LM & EMU ✓
CONFIRM GO FOR EVA

SEQ. CAM. ON [2.8/60, 12 FR]

5 min

TRANSFER ETB

STOW BATTS (OPS AREA)

STOW LiOH (ASC ENG COVER)

STOW CONT SAMPLE (LUN. BOOT COMP.)

PACK 70 mm (2)

TRANSFER ETB

VERIFY CB & VOX SENS



CONT SAMPLE

ETB TRANSFER

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TV
DEPLOY

0+50 TV DEPLOYMENT

TV TO TRIPOD

- UNSTOW CABLE
- POSITION 20 FT AT (10)
- PAN 13 SEC MINIMUM, FOV OVERLAP, OMIT UPSUN

ORIENT: S-BAND & MESA

0+57 SWC DEPLOY

ATTACH 70 mm TO EMU
 DEPLOY SWC 60 FT FROM LM

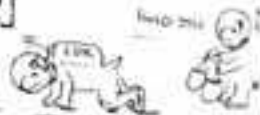
SWC [11, 5, 1] DN SUN
 [11, 5, 1] LM BK GND

LM/EARTH [11, 74, 2]
 [11, 15, 2]

EMU ✓

1+02 FLAG DEPLOY

ATTACH SADDLE BAG TO CDR



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EMU
MALE

EVA 2

1+08 LM INSPECTION/PHOTO

POS. TV 20 FT @ (8)/SEQ. BAY

- Y PAD/SURFACE [8, 5, 2] X SUN
- +Z PAD/SURFACE [5.6, 5, 2] UP SUN
- +Y PAD/SURFACE [8, 5, 2] X SUN
- Z PAD/SURFACE [11, 5, 2] DN SUN

1+15 ALSEP OFFLOAD

DECAL

- REMOVE PKG 2
- DEPLOY HTC
- UNSTOW CASK TOOLS
- LOWER CASK
- FUEL RTG
- CONNECT PKGS

EMU ✓

1+36 ALSEP TRAVERSE

REPORT START & END

CARRY PKGS 1 & 2 >300 FT

EMU ✓

DECAL

PRE-EGRESS
 GEO
 AVERS
 OFFLOAD
 ALSEP
 DEPLOY
 SIDE
 TRAVERSE
 MPLETE

SYSTEM TV INTERCON EMPLOY

1+48 SYSTEM INTERCONNECT
POSITION PKGS
REMOVE BAR FROM RTG PKG
PLACE C/S TO RIGHT OF RTG
TILT PKG 2
DEPLOY CABLE
REPORT AMPS

- *STOW CARRY BAR
- *POSITION PSE STOOL
- *TILT & ALIGN PKG 1

1+58 PSE DEPLOY
DECAL
REPORT ALIGNMENT
PSE [11, 5, 1] X SUN
[11, 5, 1] C/S IN BK GND

EMU ✓

2+06 LSM DEPLOY
DECAL
REPORT ALIGNMENT
LSM [11, 5, 1] X SUN
[11, 5, 1] C/S IN BK GND



DATE: 10/27/65
BASE 1624650
RT 10 9 24/65

EMU
MAIF

EVA 2

2+16 SIDE DEPLOY
DECAL
REPORT ALIGNMENT
SIDE [11, 5, 1] X SUN

2+26 PHOTO ALSEP SITE
C/S [11, 5, 2] X SUN
C/S [11, 5, 2] DN SUN
LM [11, 74, 1] C/S FOREG.
SWE [11, 15, 1] C/S FOREG.
SIDE [11, 74, 1] C/S FOREG.
VERIFY EXPM'TS UNDISTURBED
EMU ✓

2+30 RETURN TRAVERSE/SEL SAMPLE
COLLECT SAMPLES (INC. SOFTBALL)
EMU ✓
POS. TV 10 FT @ (2) / MESA/LADDER
ALSEP SITE FROM LM [11, 74, 2]

PRE-EGRESS
GEO
AVERSE
RAVERSE
REQ MITG
SIDE
DEPLOY
AVERSE
MPLETE

EVA 2

2+52 CORE TUBE SAMPLE
ASSEMBLE TUBE
SAMPLE SITE [8, 5, 2] X SUN
[11, 5, 1] DN SUN

DRIVE TUBE
TUBE [8, 5, 2]
STOW TUBE IN SRC 1
REMOVE SADDLE BAGS
EMU ✓



2+58 EVA TERMINATION
STOW 70 mm IN ETB
CLEAN EMU & CHECK CDR
INGRESS
LM & EMU ✓
S-BAND ANT - Lunar Stay
TRACK MODE - Off
REPOSITION SEQ. CAM
MOUNT LEC
TRANSFER ETB , THEN SRC 1
HANDOUT LEC

EMU
MALE



DON'T FORGET - DESCRIBE THE PROTUBERANCES.

PRE-EGRESS
GEO
AVERSE
RAVERSE
REQ. MTS.
JRVYOR
RAVERSE
COMPLETE

EVA TERM INTERCON EMPLOY

DATE: 20/12/68

EVA 2

CORE TUBE SYSTEM INTERCON TV EVA TERM EMPLOY

EMU MALE

LMP - EVA 2

0+10 PRE-EGRESS
 RECEIVE LEC
 STOW 70 mm (2) & COLOR MAG IN ETB
 CONFIGURE LEC
 TRANSFER ETB
 STOW LEC
 VERIFY CB + VOX SENS
 SEQ CAM ON [8, 6 FR]
 (CENTER MESA AREA)



0+18 LMP EGRESS
 EGRESS
 ATTACH SADDLE BAG
 ATTACH PARTS BAG TO CDR PLSS
 STOW CUTTERS IN PARTS BAG
 ATTACH 70 mm TO EMU
 STOW COLOR MAG IN SADDLE BAG
 STOW SAFETY LINE IN SADDLE BAG

PRE-EGRESS
 GEO
 AVERSE
 REVERSE
 REQ MINS.
 RVEYOR
 2AVERSE
 MFILETE

DATE 07/16/70
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EVA 2

CONTRAST CHART PHOTOS

• REPORT-CHART VISIBILITY

1. (ON FLAT SURFACE)

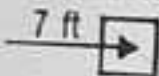


PHOTO
[11, 5 ft, 1]

PHOTO
[5.6, 5 ft, 1]



2. (IN SHADE)

3. (IN SUN)



PHOTO
[11, 5 ft, 1]



EMU
MALE

POSITION TV FOR GEO TRAVERSE

0+30 TRAVERSE

REPORT:

- START AND END OF TRAV.
- LOCATION WRT LM
- PHOTOS OTHER THAN NOM.
- SAMPLE BAG NUMBERS

BACK SITE SURVEY BETWEEN EACH LEG OF TRAVERSE [3] AND PANORAMA AT FURTHEST POINT [12]

DOCUMENTED SAMPLE

SAMPLE AND GNOMON [11, 5, 1] DN BAG

SAMPLE SITE & GNOMON [11, 5, 1] DN

EMU MALE
1-3
TRAVERSE
GEO
RAVERSE
REQ. MITS.
IRVEYOR
TRAVERSE
COMPLETE

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CORE TUBE
EVA TERM
SYSTEM
INTERCON
TV
EMPLOY
CONTRAST
CHARTS

EVA 2

CONTRAST
PARTS

CORE
SYSTEM
INTERCO
SAMPLE

CORE TUBE
EVA TERM

CORE TUBE SAMPLES (2)

ASSEMBLE TUBE

SAMPLE SITE & GNOMON [11, 5, 1] DN
DRIVE TUBE

TUBE & GNOMON [11, 5, 1] DN
STOW TUBE IN HTC

TRENCH SAMPLING (ENVIRO/CORE TUBE)

PHOTO SITE [11, 5, 2] STEREO DN
HOLD LARGE CAN FOR SUBSURFACE SOIL
PHOTO TRENCH [11, 5, 2] STEREO DN
RETRIEVE HAMMER

DRIVE TUBE

PHOTO TUBE [11, 5, 1] DN

GAS ANALYSIS SAMPLE (SMALL CAN/ROCK)

SAMPLE SITE & GNOMON [11, 5, 1] DN
INSERT SURFACE ROCK FRAGMENT
SAMPLE SITE & GNOMON [11, 5, 1] DN

DATE: 11/2/87
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1102
1103
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1198
1199
1200

EMU
MALE

TRAVERSE REQUIREMENTS

DOCUMENTED SAMPLE INCLUDES:

- TOP & BOTTOM OF ROCKS NEAR AND FAR FROM LM
- SOIL NEAR AND FAR
- SOIL UNDER AND NEXT TO A ROCK
- CORE TUBES (2)
- ENVIRON. SAMPLE (LARGE CAN/SOIL)
- GAS SAMPLE (SMALL CAN/ROCK)
- TRENCH SAMPLES (ENVIRO/CORE TUBE)
- TYPES OF MATERIALS
 - FINE GRAIN IGNEOUS ROCKS
 - COARSE GRAIN IGNEOUS ROCKS
 - BRECCIAS
 - FINE MATERIAL
 - GLASS "SPLASH"

EMU MALE
3
CONTI

TRAVERSE
REQ/MTS.

IRVEYOR

TRAVERSE
COMPLETE

EVA 2

CONTRAST
HARTS

CORE
IMPLE

BONUS
COMMENTS

CORE TUB
EVA TER

BONUS COMMENTS

SURFACE IRREGULARITIES (RILLS,
CRACKS, EMBANKMENTS, CRATERS)

BOOT/SURFACE INTERACTIONS,
ADHESION & SCUFF RESISTANCE

DYNAMICS OF LOOSE MATERIAL

USE OF GLASS/BRUSH

COLOR/ALBEANO VARIATIONS OF
DISTURBED & UNDISTURBED



Houston won't
believe this!



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EMU
MALE



EMU MALE
COND - 3
MU MALE
COND - 6
MU MALE
COND - 10
MU MALE
COND - 11
SURVEYOR
IMPLETE

SURVEY - HER ACTIVITY

EVA 2

CONTRAST
PARTS

CORE
SAMPLE

BONUS
COMMENTS

LAB
EVA TERI

DATE 10/30/71

EMU
MALE

SURVEYOR SITE DOC. SAMPLES

- LUNAR BEDROCK
- LAYERED ROCK
- ROUND ROCKS IN RAY PATTERNS

2+00

SURVEYOR ACTIVITIES

PERFORM D.P.

PHOTO BAY A [11, 15, 1]

PHOTO:

- TV SECTOR [8, 15, 3]
- SCOOP IMPRINTS [8, 5, 2] STEREO
- F/P 2 PRINTS [8, 5, 2] STEREO

DISTURB SURFACE; F/P 2 AREA

PHOTO:

- F/P 2 AREA [8, 5, 2] STEREO
- VERNIER ENG BAY A [11, 5, 1]
- LARGE BOX A [8, 5, 1]



EMU MALE
CONTI - 1
- 3
- 6
- 10
- 11
SURVEYOR
COMPLETE
RAVERSE

EVA 2

PHOTO:

- WIPE - LARGE BOX A [8, 5, 1]
- SMALL BOX [8, 5, 1]
- WIPE - SMALL BOX [8, 5, 1]
- BAY B [11, 15, 1]
- SOLAR ARRAY [5.6, 15, 1]
- F/P 3 [11, 5, 1]
- SCOOP TRENCHES [8, 5, 2] STEREO
- TV MIRROR [8, 5, 1]
- WIPE - TV MIRROR [8, 5, 1]

RETRIEVE CUTTER & LRG. CAN FROM CDR
 COLLECT CABLE & PAINTED TUBE SAMPLES
 STOW LARGE CAN IN BAG
 CATCH AL TUBE SAMPLE
 STOW AL TUBE IN BAG
 COLLECT GLASS SAMPLE
 REPORT: % DEBONDED
 CATCH AND BAG TV

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EMU MALF.

2+45 TRAVERSE COMPLETION
 POS. TV 20 FT @ ② / MESA & LADDER
 REMOVE & PLACE PARTS BAG ON
 +Y FOOTPAD
 REMOVE SADDLE BAG

2+48 STEREO CLOSE UP PHOTOS
 RETRIEVE ALSCC
 DEPLOY SKIRT
 PHOTO:

- UNEXPECTED FEATURES
- GLASSY FEATURES
- ROCK-SOIL JUNCTION (UP/DN HILL)
- UNDISTURBED SURF (LEVEL/SLOPE)
- ROCK SURFACE
- BOOTPRINTS: LM FOOTPAD
- MAT. ADHERING (BOOT, LM, EQ)



EMU MALF. CONT - 6
 EMU MALF. 10 - 11
 TRAVERSE COMPLETE

CONTRAST PARTS
 CORE SAMPLE
 BONUS COMMENTS
 SURVEYOR

EVA 2

EMU
MALF.

- CRATERS
- CLUMPS (DISTURBED/UNDIST.)

THREE EXTRA PHOTOS
PUT FILM IN ETB

2+55 EVA TERMINATION

STOW 70 mm IN ETB

CLEAN EMU & CHECK CDR

INGRESS

LM & EMU ✓

REPOSITION SEQ CAM

MOUNT LEC

TRANSFER ETB

TRANSFER SRC 2

TRANSFER SURVEYOR PARTS

DISCARD LEC

IT'S A HIGH PLACE
TO VISIT BUT



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EMU MALFUNCTIONS

EMU 1: VENT/TONE [P]

FAN OFF/ON

IF FLAG STILL ON AFTER 10 SEC,
ACTUATE OPS AND PURGE VLV

EMU 2: PRESS/TONE [O]

ACTUATE OPS

IF FLAG ON, CK. CUFF GAGE,
VER. TM; OPS OFF (SEN. FAIL)

EMU 3: O₂/TONE [O]

CK. LOW PGA PRESS OR PLSS O₂
DECREASING

IF LEAK CONFIRMED, ACT. OPS
IF NO LEAK, VER. TM (SEN. FAIL)

EMU MALF. MU MALF. MU MALF.
1 - 3
CONT - 6
10 - 11

CONTRAST PARTS
CORE SAMPLE
BONUS COMMENTS
SURVEYOR
EVA TERMINATE

EVA 2

EMU
MALF.

EMU 4: H₂O/TONE [A]

VERIFY FEEDWATER OPEN
IF CLOSED: DIV VLV MIN COOL,
FEEDWATER OPEN, WAIT 4 MIN.
IF ADD'L COOL REQ'D, ACTUATE
OPS AND PURGE VLV

EMU 5: TONE/NO FLAGS

CUFF GAGE: IF <3.4, ACTUATE OPS
IF CUFF GAGE >3.4 & TONE OFF:
CYCLE MODE SW MOMENTARILY -
NO TONE, NO FAILURE.

IF TONE ON AGAIN:

FAN OFF 5 SEC, VENT FLAG [P]
SHOULD COME ON; FAN ON. IF
NO FLAG, ACTUATE OPS AND PURGE
VLV (FLAG FAIL)

EMU 5: (CONT)

OBSERVE PLSS O₂: IF DECREASING,
ACTUATE OPS.

IF FEEDWATER CLOSED: IF CLSD,
DIV VLV MIN COOL, FEEDWATER
OPEN. AFTER 4 MIN, IF COOL
INADEQUATE, ACTUATE OPS AND
PURGE VLV.

EMU 6: CUFF GAGE <3.7 - NO FLAG

ACTUATE OPS: CUFF GAGE SHOULD
RISE (EMU LEAK OR REG. SHIFT)
IF NO GAGE RESPONSE, VERIFY TM -
OPS OFF (GAGE FAIL)

EMU MALF
4-5

CORE
AMPLE

BONUS
MENTS

URVEYOR

EVA
TERMINATE

EMU MALF
MU MALF
5 (CONT) - 6 10 - 11

EVA 2

EMU
MALE

EMU 7: PLSS O₂ QUANTITY ABNORMAL
CK CUFF GAGE, PRESS FLAG [O] &
O₂ FLAG [O]

IF LEAK CONFIRMED, ACTUATE OPS
IF NOT, VERIFY TM (GAGE FAIL)

EMU 8: CUFF GAGE >4.0

IF O₂ FLAG [O], ACTUATE OPS AND
PLSS O₂ OFF (PLSS REG FAIL)
IF NOT, VERIFY TM (POSS. GAGE FAIL)

EMU 9: LOSS OF PUMP NOISE

IF NO SIDETONE, ACTUATE OPS AND
PURGE VLV (POWER FAIL)

IF SIDETONE OK:

CHECK PUMP ON.

VERIFY TM FOR PUMP CONDITION.

IF ADDITIONAL COOLING REQUIRED,
ACTUATE OPS AND PURGE VLV.

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EMU 10: COOLING INADEQUATE

VERIFY DIV VLV MAX
ACTUATE GAS TRAP FOR 5 SEC.,
IF FEASIBLE

AFTER 3 MIN., IF ADDITIONAL
COOLING REQUIRED, ACTUATE OPS
AND PURGE VLV

EMU 11: LOSS OF VOICE COMMUNICATION

CHECK VOL CONTROLS (WHEEL A,
FLADE B)

CYCLE PTT SW - MAIN & MOM
CDR MODE SW TO B, LMP TO A
(HAND SIGNALS)

IF NO COMM, CDR TO A, LMP TO B

EVA
TERMINATE
URVEYOR
BONUS
COMMENT
EMU MALE
7-9
EMU MALE
4-5

EMU MALE
10-11