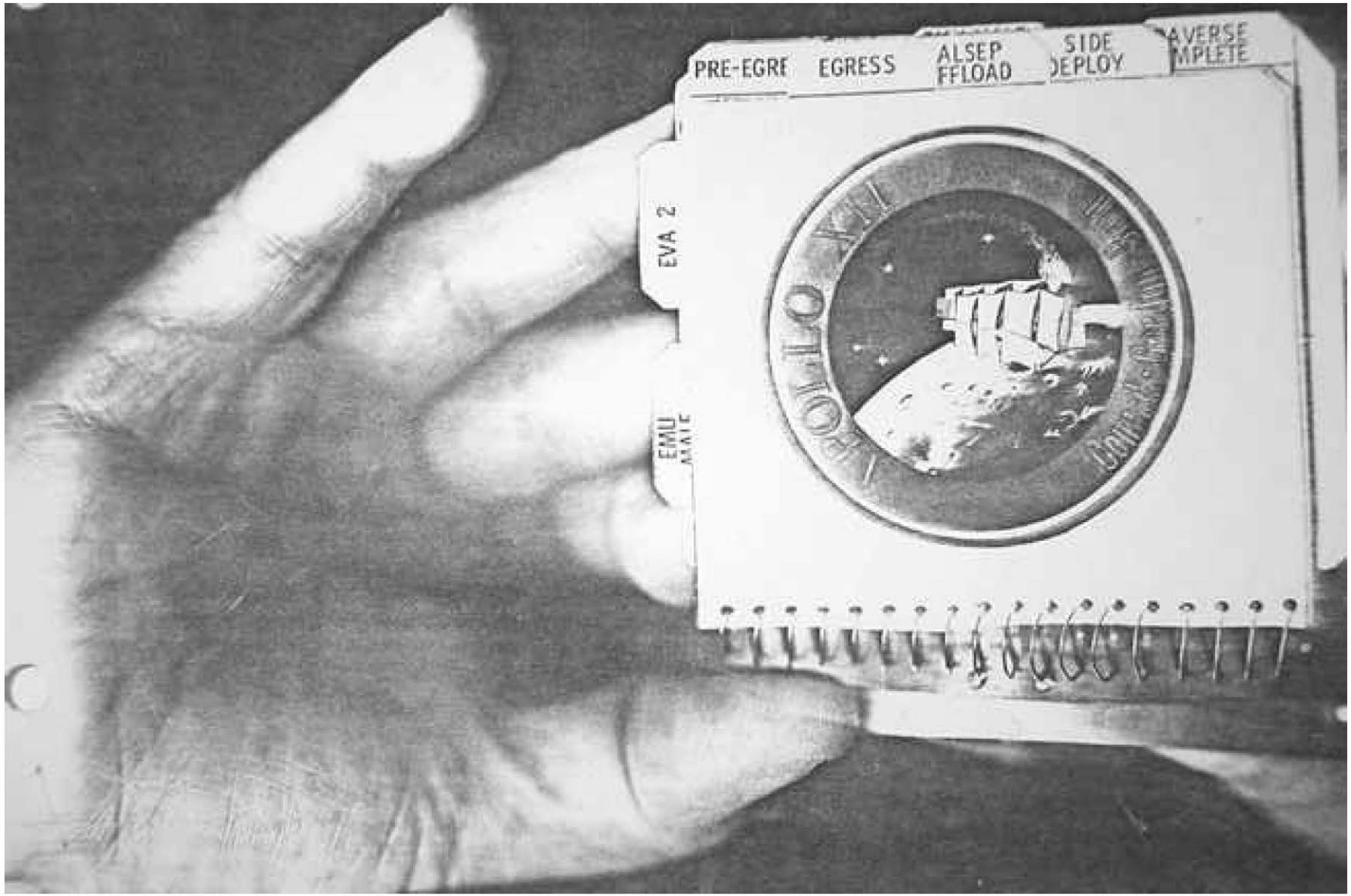

PRE-EGRE
EGRESS
ALSEP
FFLOAD
SIDE
DEPLOY
AVERSE
MPLETE
EVA 2
EMU
APOLLO XII

APOLLO TWELVE

LUNAR SURFACE PROCEDURES

LMP CUFF CHECKLIST

Prepared by:

J. H. Roberts

Approved by:

A. L. Bean
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 PRELOAD | SIDE DEPLOY | TRAVERSE PLATE

DATE: 10/27/69

PRE-EGRESS

LMP - EVA 1

0+10 PRE-EGRESS

PASS LEC

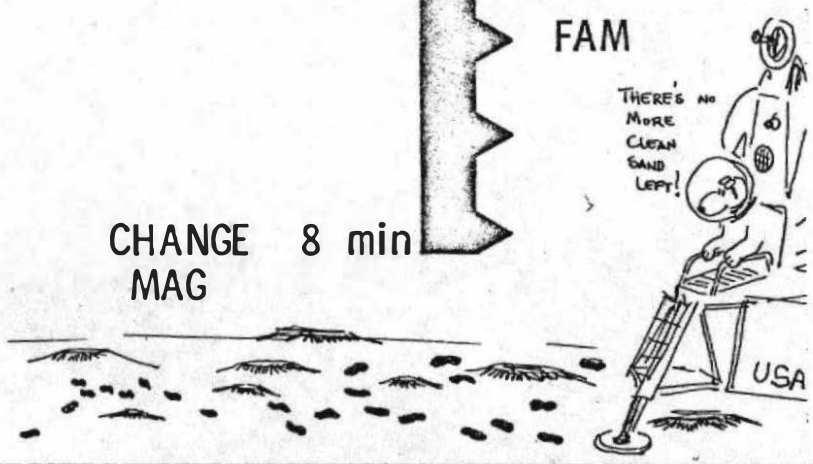
PHOTO CDR [5.6, 5, 6]

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

DESCENT

FAM

CHANGE MAG 8 min



ETB TRANS

SEQ. CAM. ON [8, 12 FR]

CONT SAMPLE

AFTER 3 min.
SEQ. CAM. OFF

FINAL LM & EMU ✓
CONFIRM GO FOR EVA

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

ETB TRANSFER

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

DATE: 10/27/69

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

EMU

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

ALSEP OFFLOAD

SIDE DEPLOY

TRAVERSE COMPLETE

SYSTEM INTERCON | TV DEPLOY

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

EMU MALE | 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 | TRAVERSE REQ'MTS | SIDE DEPLOY | TRAVERSE COMPLETE

EVA TERM NTERCON EPLOY

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.

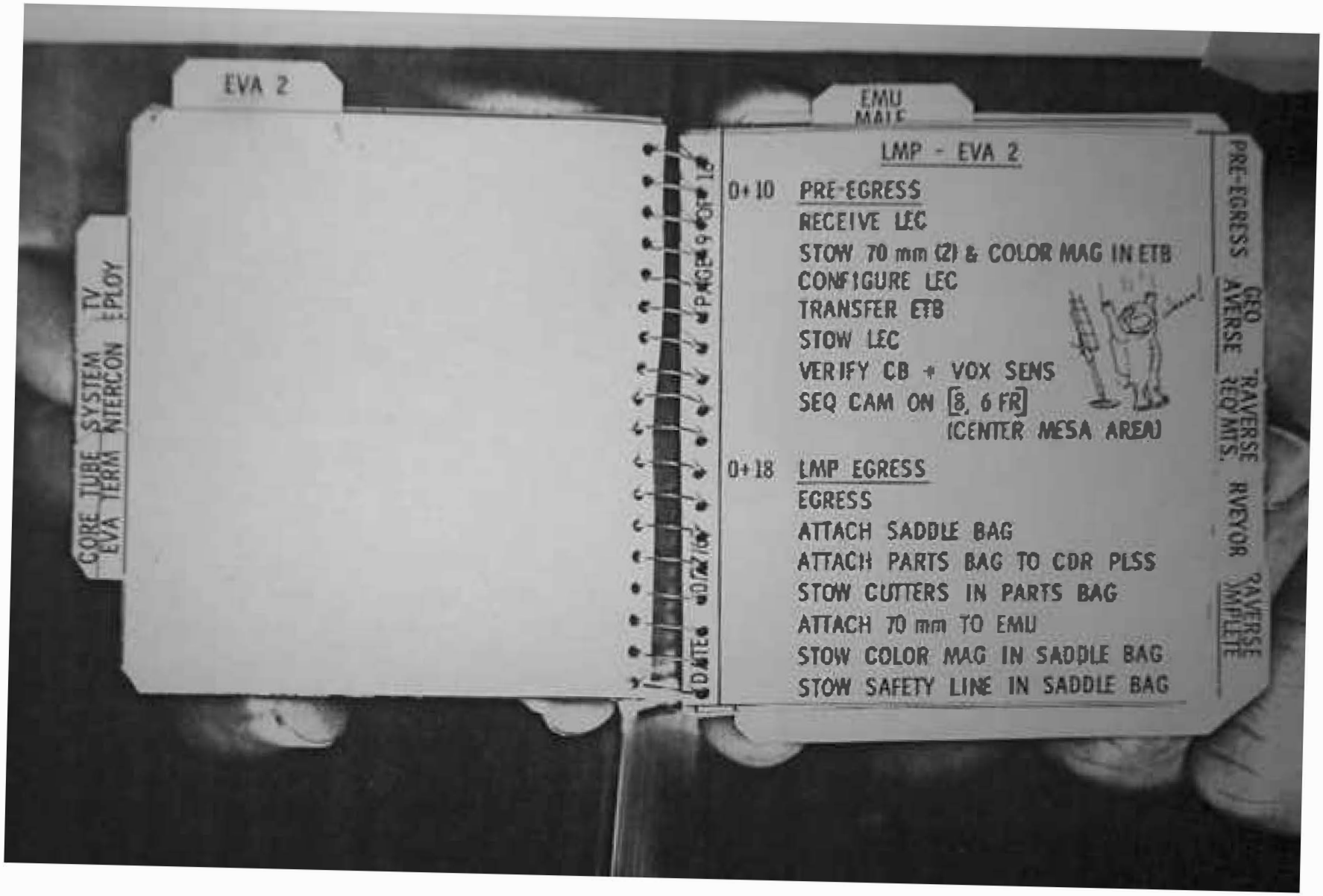
PRE-EGRESS

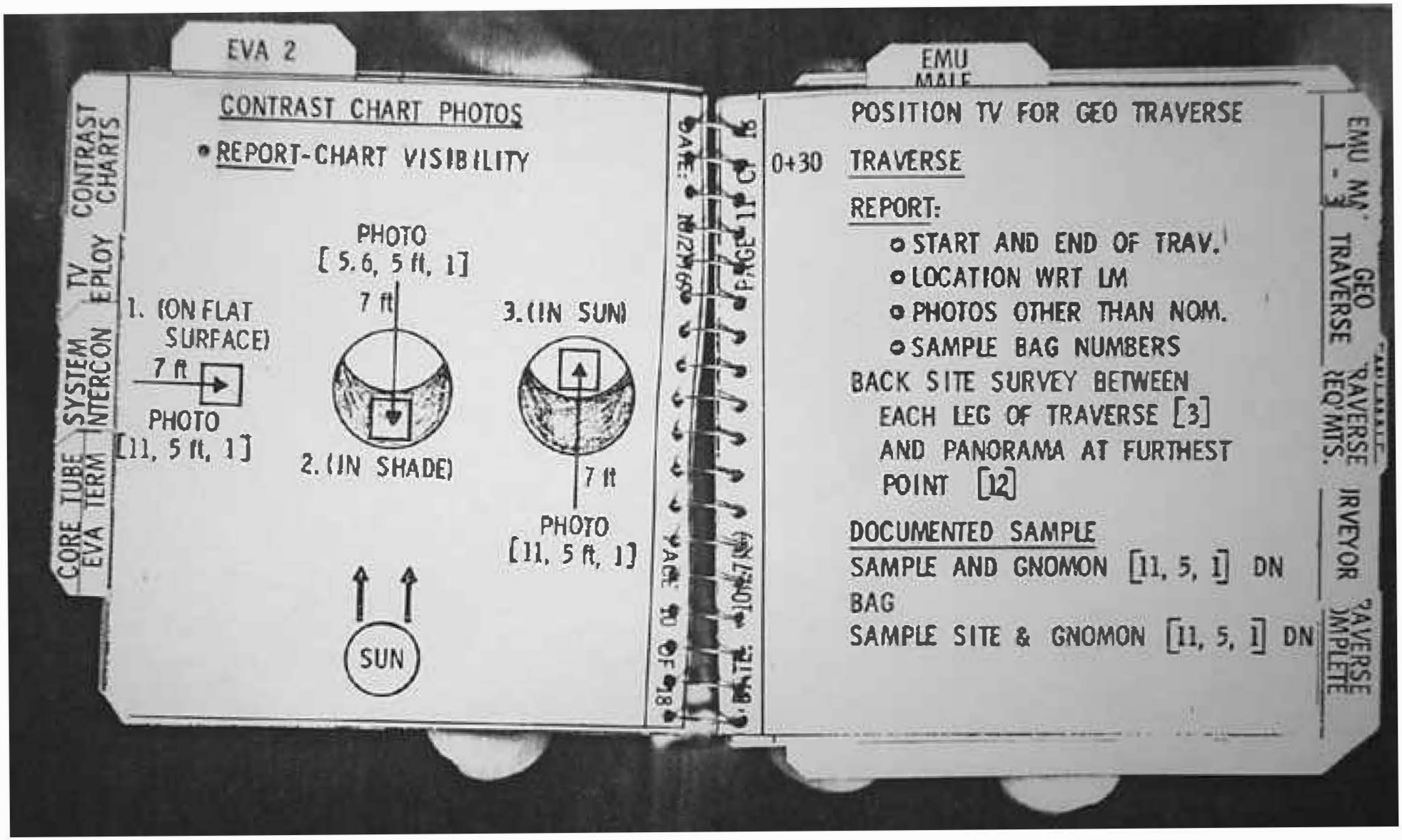
GEO AVERSE

RAVERSE REQ'MTS.

JRVEYOR

RAVERSE OMPLETE


EVA 2
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
RAVERSE
REQ'MTS.
RVEYOR
RAVERSE
MPLETE
CORE TUBE SYSTEM TV
EVA TERM NTERCON EPLOY
PAGE 9 OF 18
DATE


EVA 2
CONTRAST CHARTS
TV EPLOY
SYSTEM INTERCON
CORE TUBE EVA TERM
CONTRAST CHART PHOTOS
• REPORT-CHART VISIBILITY
PHOTO [5.6, 5 ft, 1]
7 ft
1. (ON FLAT SURFACE)
7 ft
PHOTO [11, 5 ft, 1]
2. (IN SHADE)
3. (IN SUN)
7 ft
PHOTO [11, 5 ft, 1]
SUN
DATE: 10/27/69
PAGE 11 OF 18
EMU MALE
POSITION TV FOR GEO TRAVERSE
0+30 TRAVERSE
REPORT:
o START AND END OF TRAV.
o LOCATION WRT LM
o PHOTOS OTHER THAN NOM.
o 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
GEO TRAVERSE
TRAVERSE REQ'MTS.
IRVEYOR
RAVERSE OMPLETE

EVA 2

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

CORE TUBE SYSTEM CORE SAMPLE ENTRAST
EVA TERM INTERCO HARTS

EMU MALF

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 MALF. 1 - 3 MU MA CONT TRAVERSE REQ'MTS. IRVEYOR RAVERSE OMPLETE

EVA 2

CORE TUBE EVA TERR | BONUS COMMENTS | CORE SAMPLE | CONTRAST CHARTS

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

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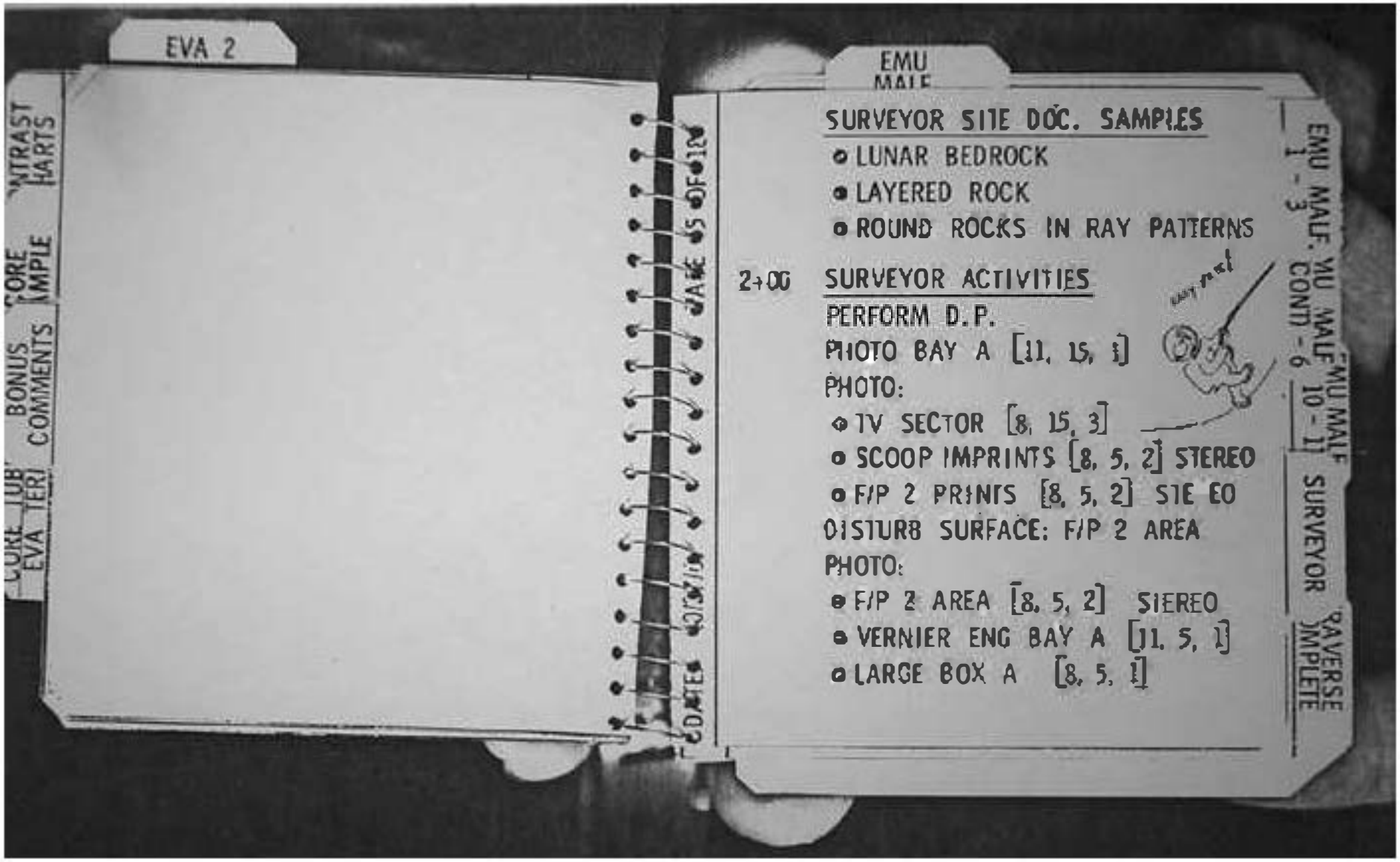
EMU MALE

EMU MALE 1 - 3 | EMU MALE CONT - 6 | EMU MALE 10 - 11 | SURVEYOR | TRAVERSE COMPLETE

SURVEY - HER ACTIVITY


EVA 2
EMU MALF
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 MALF. 1 - 3
EMU MALF. CONT - 6
EMU MALF 10 - 11
SURVEYOR
BONUS COMMENTS
CORE SAMPLE
CONTRAST HARTS
EVA TERI

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

CONTRAST PARTS | CORE SAMPLE | BONUS MOMENTS | SURVEYOR

DATE: 10/27/69 PAGE 17 OF 18

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. 1 - 3 | EMU MALF. CONT - 6 | EMU MALF. 10 - 11 | TRAVERSE COMPLETE

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

EVA TERMINATE | SURVEYOR | BONUS COMMENTS | CORE SAMPLE | CONTRAST PARTS

DATE: 10/27/69 PAGE 18 OF 18

DATE: NOV 2, 1969

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: O_2/TONE [O]

CK. LOW PGA PRESS OR PLSS O_2 DECREASING

IF LEAK CONFIRMED, ACT. OPS

IF NO LEAK, VER. TM (SEN. FAIL)

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

EMU 4: H_2O/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 O_2: IF DECREASING, ACTUATE OPS.
IS 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 7: PLSS O_2 QUANTITY ABNORMAL

CK CUFF GAGE, PRESS FLAG [0] & O_2 FLAG [0]
IF LEAK CONFIRMED, ACTUATE OPS
IF NOT, VERIFY TM (GAGE FAIL)

EMU 8: CUFF GAGE >4.0

IF O_2 FLAG [0], ACTUATE OPS AND PLSS O_2 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.

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