

TIR # 729-S-0014(S)  
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MODULAR EQUIPMENT TRANSPORTER (MET)

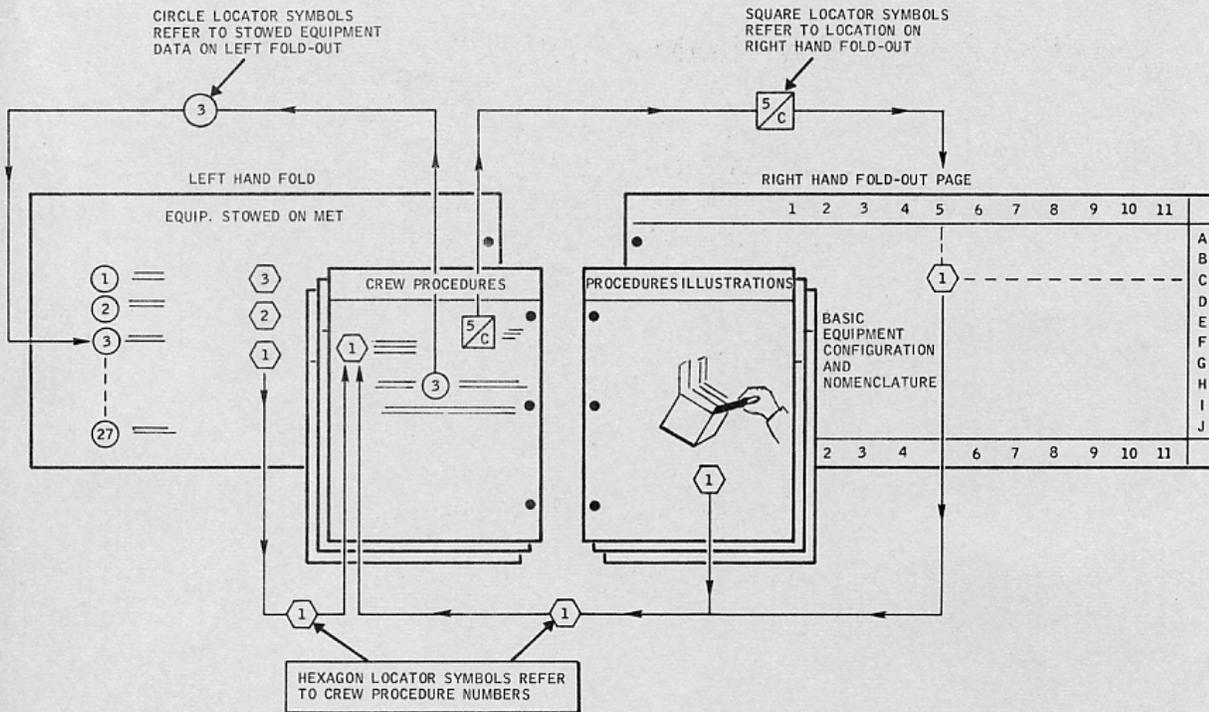
OPERATOR'S  
FAMILIARIZATION MANUAL

PREPARED BY

**GENERAL  ELECTRIC**

APOLLO SYSTEMS  
HOUSTON PROGRAMS

THIS IS AN OPERATING LOGIC TYPE TRAINING DOCUMENT THAT UTILIZES THE FOLLOWING FORMAT AND CROSS INDEXING SYSTEM.



STOWED ITEM #	ITEMS STOWED ON MET	QUANTITY	MET CREW PROCEDURES #	LM-8 STOWAGE		
				STAGE		STOWAGE*
				ASCENT	DESCENT	AREA CODE
1	CAMERA/POWER PACK, 16 MM	1 (ON TOOL CARRIER)	31 M	X		A4
2	MAGAZINE, 16 MM	3 (1 IN CAMERA)	30 B	X		A4
3	CAMERA, 70 MM HASSELBLAD	1	23	X		F2B
4	MAGAZINE, 70 MM	3 (1 IN CAMERA)	24	X		F2B
5	HANDLE, 70 MM CAMERA	1	23	X		F2B
6	TRIGGER, 70 MM CAMERA	1	23	X		F2B
6A	RCU/70 MM CAMERA BRACKET	1	23	X		F9A
7	CAMERA ASSY., LGEC	1	21		X-MESA	MLR
8	MAGAZINE ASSY.	2 (1 IN CAMERA)	22		X-MESA	MLF
9	MAGAZINE ASSY. COVER	1	22		X-MESA	MLF
9A	RCU/LGEC CAMERA BRACKET	1	21		X-MESA	TBD
10	CAMERA, CLOSE-UP STEREO	1	25		X-MESA	MLN
11	WEIGH BAGS	4	26 27 28 29		X-MESA	(2)MLP(SRC) X-MESA (2)MLQ(SRC)
12	TRENCHING TOOL	1	34		X-MESA	MLW
13	SPECIAL ENVIRON. SAMPLE CONTAINER (SESC)	2	30 A		X-MESA	MLP(SRC)
14	PORTABLE MAGNETOMETER: TRIPOD & SENSOR CABLE REEL ELECTRONICS PACKAGE	1	33		X	QUAD 2 OUTSIDE IM ADJACENT TO SEQ BAY
15	ALHTC (TOOL CARRIER)	1	31		X-SEQ	ALSEP
16	CAMERA STAFF	1	31 A		X-SEQ	ALSEP
17	HAMMER	1	31 B		X-MESA	MLK
18	SCOOP	1	31 C		X-MESA	MLM
19	LENS/BRUSH	1	31 D		X-SEQ	ALSEP
20	TONGS	1	31 E		X-MESA	MLG
21	EXTENSION HANDLE	1	31 F		X-MESA	MLH
22	CORE TUBES	5	31 G		X-MESA	IN EACH SRC
23	CORE TUBE CAP ASSY.	2	31 I		X-MESA	IN EACH SRC
24	35-BAG DISPENSER	1	31 H		X-MESA	MIT(SRC)
25	PENETROMETER	1	31 J		X-SEQ	ALSEP
26	GNOMON	1	31 K		X-MESA	MLA
27	COLOR CHART & TRAVERSE MAP	1 EA.	31 N		X-SEQ	ALSEP

MET DESIGN CRITERIA

- DEPLOYABLE WITHOUT USE OF TOOLS
- MAX. PAYLOAD CAPABILITY-----340 EARTH LBS.  
  
PAYLOAD CONSISTS OF TOOLS, CAMERAS, EXPERIMENT  
INSTRUMENTS AND LUNAR SAMPLES AS NOTED IN  
MET STOWAGE LIST.
- MAX. MET WEIGHT-----30 EARTH LBS.
- DIMENSIONAL LIMITS
  - WORKTABLE HEIGHT-----30"
  - STOWAGE ENVELOPE-----28" X 36" X 8"  
(ATTACH POINTS ARE OUTSIDE  
THESE DIMENSIONS)
- OPERATIONS
  - NOMINAL PULLING SPEED-----4-7 MPH
  - NOMINAL DRAW BAR PULL-----3-5 LBS.
  - DESIGN TRAVERSE-----20,000 FT.
  - CAPABLE OF TRAVERSING-----4" DIAM. ROCKS
  - TIRE TEMPERATURES:
    - MINUS 68°F AT DEPLOYMENT
    - 0°F TO 200°F WHEN PARKED
    - 70°F AVERAGE WHEN ROLLING
  - TIRE PRESSURE-----1.5 PSIA.

\*FIELD SITE STOWAGE DRAWINGS

MODULAR EQUIPMENT TRANSPORTER (MET)

The MET is a two-wheeled vehicle that is used as an equipment hauling device on traverses across the lunar surface. Small items of crew and scientific equipment are stowed on the MET to free the astronaut from the cumbersome crew activities required if carrying this equipment by hand. The MET serves as a portable workbench with a place for handtools and their carrier, cameras, spare camera magazines, rock sample bags, environmental sample containers, and the portable magnetometer with its sensor and tripod.

The MET is stowed during lunar transit on the exterior of the MESA that is located in Quad 4 of the LM descent stage.

On the lunar surface the MET is removed from the MESA. Depending on timeline, it may be immediately deployed or placed temporarily in the sun on the LM +Y footpad with the MET thermal blanket-shroud covering the MET. When required, the MET is then deployed and loaded for the lunar surface traverses.

The following MET related crew procedures provide familiarization data on the MET, the stowed equipment, and related loading techniques. The procedures are presented in the following general groupings:

	Crew Proced. #'s	
A. Removal of the MET from the MESA	①	— ⑥
B. MET Deployment-----	⑦	— ①⑨
C. Loading of MET for traverse-----	②⑦	— ③④

CREW OPERATING PROCEDURES

A. REMOVAL OF MET FROM THE MESA

- ① PULL MESA D-RING  TO DEPLOY MESA.
- ①/A (THIS RELEASES MESA AND IT DEPLOYS TO A "DOWN" POSITION OF APPROXIMATELY 120° FROM THE LM DESCENT STAGE.) 
- AFTER DESCENT TO SURFACE:
- ② ADJUST MESA STRAP  UNTIL FRONT OF MESA IS APPROXIMATELY 40" ABOVE LUNAR SURFACE. (THIS ALLOWS CLEARANCE FOR MET TO SWING OUT AND CLEAR SURFACE.)

FROM RIGHT SIDE OF MESA:

- ③ PULL MET BLANKET LOOP  DOWN AND FORWARD TO REMOVE MET BLANKET DOOR 

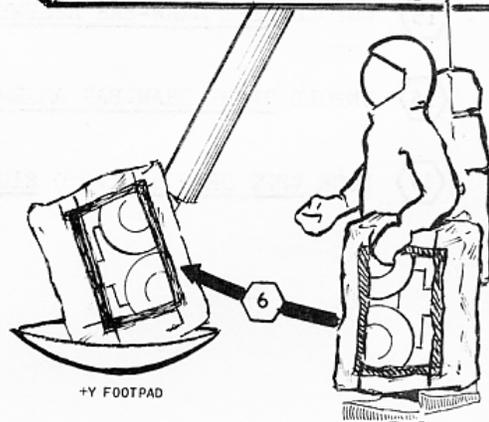
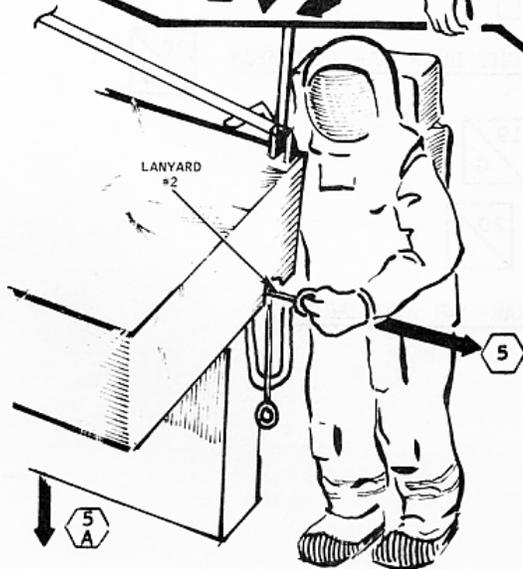
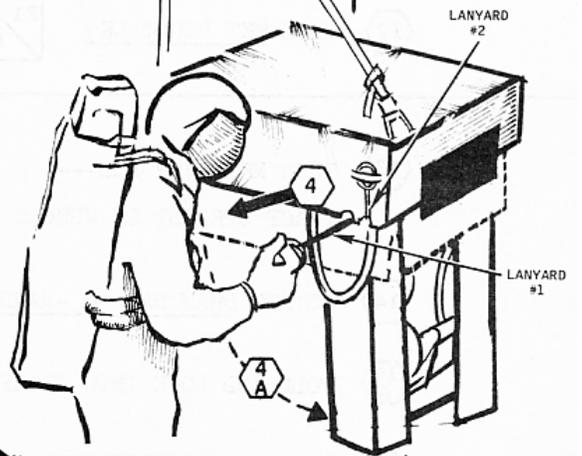
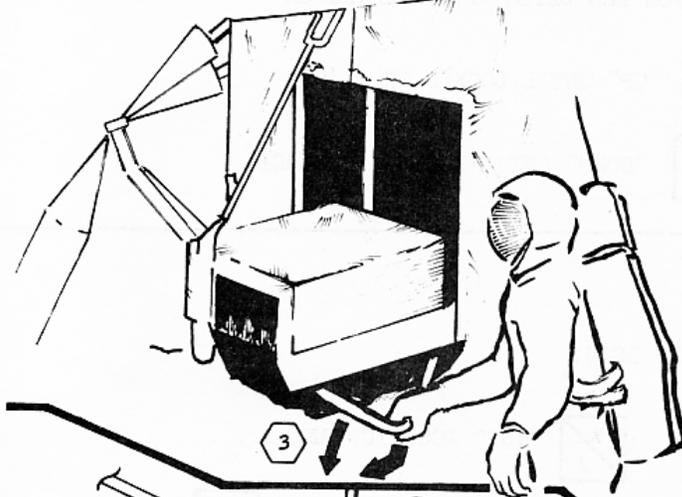
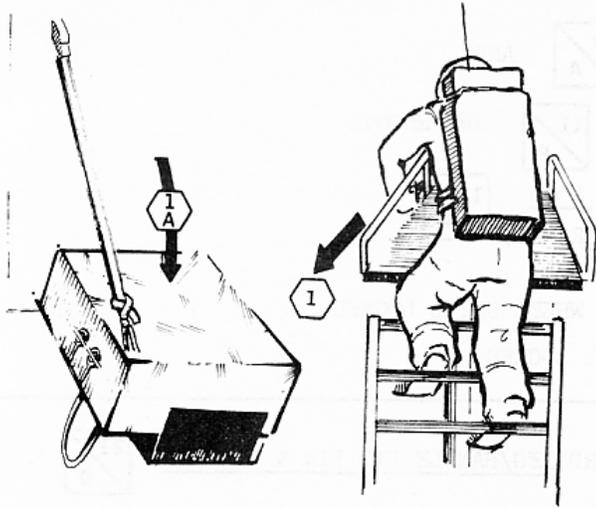
FROM LEFT SIDE OF MESA:

- ④ PULL YELLOW LANYARD #1  TO RELEASE PIP PIN #1 
- ④/A (THIS RELEASES THE MET AND MET BLANKET FROM REAR ATTACHMENT POINT AND ALLOWS UNIT TO SWING FORWARD TO FRONT OF MESA.)

NOTE: IF TIMELINE PERMITS OR IF IMMEDIATE USAGE OF THE MET IS REQUIRED, IT COULD BE DEPLOYED (⑦ - ⑨) AT THIS POINT IN PROCEDURES. NOMINALLY IT WILL BE LEFT ON SURFACE UNTIL NEEDED LATER IN EVA.

- ⑤ HOLD MET WITH RIGHT HAND, PULL LANYARD #2  TO RELEASE PIP PINS #2 & 3 
- ⑤/A (THIS SEPARATES MET AND MET BLANKET FROM MESA. RIGHT HAND HOLDS MET TO KEEP FROM FALLING FLAT ON LUNAR SURFACE.)
- ⑥ STOW THE MET TEMPORARILY IN THE SUN ON THE +Y FOOTPAD 

PROCEDURES ILLUSTRATIONS

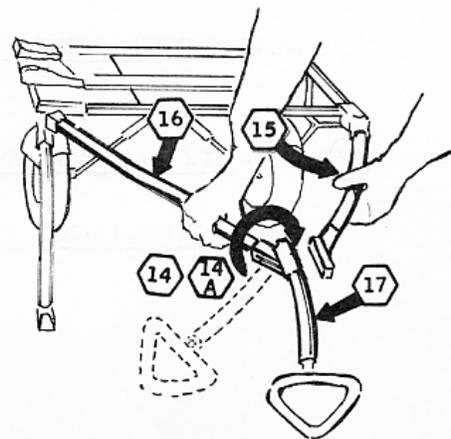
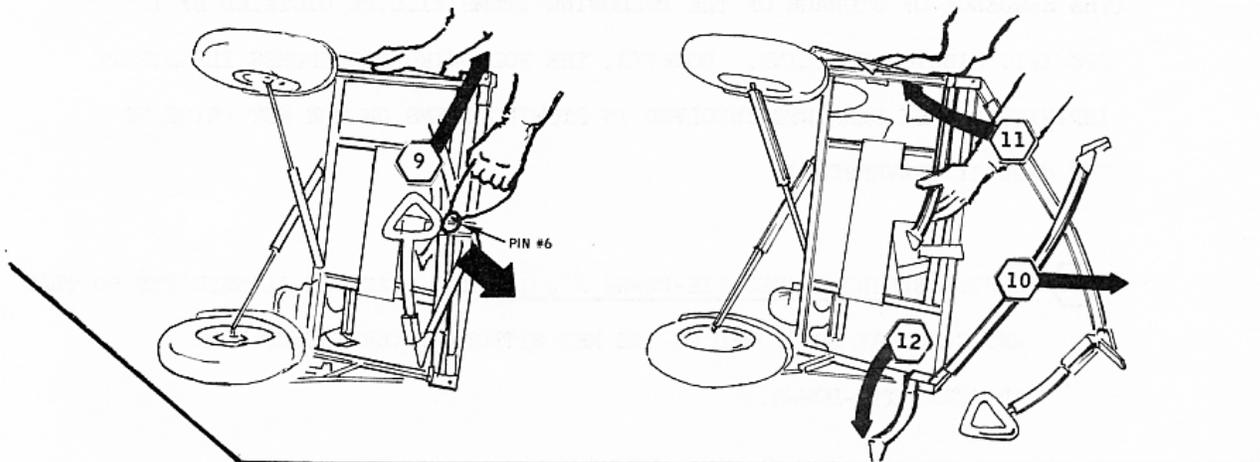
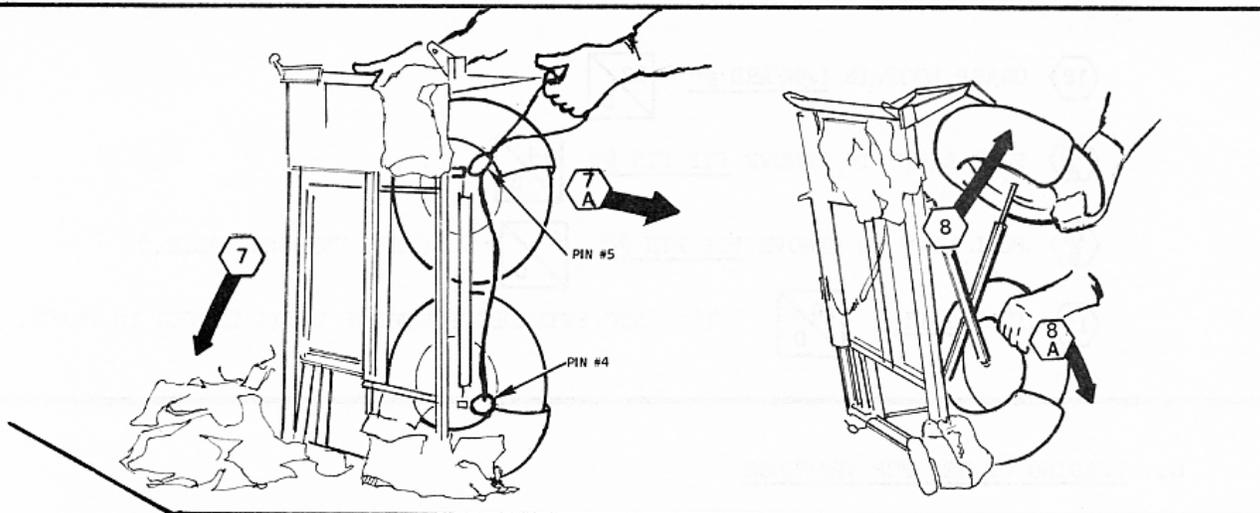


CREW OPERATING PROCEDURES

B. MET DEPLOYMENT

- 7 REMOVE THERMAL BLANKET  AND . . .
- 7A PULL WHEELPIN LANYARD #3  AND REMOVE  
BOTH WHEELLOCK PIP PINS #4 & #5  .  
(THIS UNLOCKS WHEELS FROM FRAME.)
- 8 DEPLOY WHEELS: LIFT UPPER WHEEL UNTIL LOCKED.
- 8A PUSH LOWER WHEEL DOWN UNTIL LOCKED.
- 
- 9 GRASP LOOP, PULL AND DISCARD LEG/HANDLE PIP PIN & BRACKET  .
- 10 PARTIALLY DEPLOY HANDLES FOR LEG DEPLOYMENT CLEARANCE.
- 11 PULL MET LEFT LEG  "UP" UNTIL LOCKED IN PLACE.
- 12 PUSH MET RIGHT LEG  "DOWN" UNTIL LOCKED IN PLACE.
- 
- 13 TURN MET OVER AND---  
PLACE UPRIGHT ON WHEELS AND LEGS.
- 14 ROTATE DRAW BAR Δ -HANDLE  INTO POSITION AND . . .
- 14A FOLD AND LOCK INTO PLACE INTO RIGHT DRAW BAR ASSEMBLY  .
- 15 UNFOLD LEFT DRAW-BAR ASSEMBLY  .
- 16 UNFOLD RIGHT DRAW-BAR ASSEMBLY  .
- 17 LOCK LEFT DRAW BAR INTO RIGHT DRAW-BAR AND HANDLE.

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

B. MET DEPLOYMENT (CONTINUED)

- ⑮ GRASP LOOP IN LANYARD #4  .
- ⑮<sub>A</sub> PULL RIGHT TO REMOVE PIP PIN #7  . . . .
- ⑮<sub>B</sub> PULL LEFT TO REMOVE PIP PIN #8  . (THIS UNLOCKS TABLE.)
- ⑯ PULL TABLE  "UP" INTO EXTENDED POSITION UNTIL LOCKED IN PLACE.

C. LOADING OF MET FOR TRAVERSE

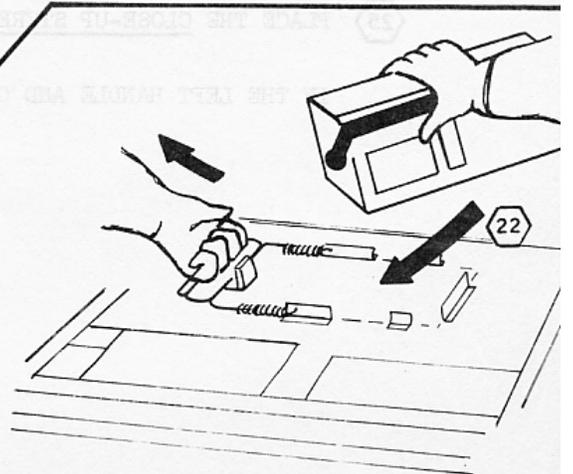
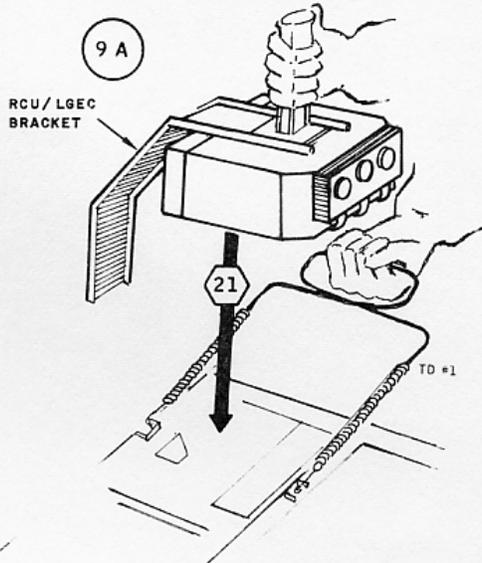
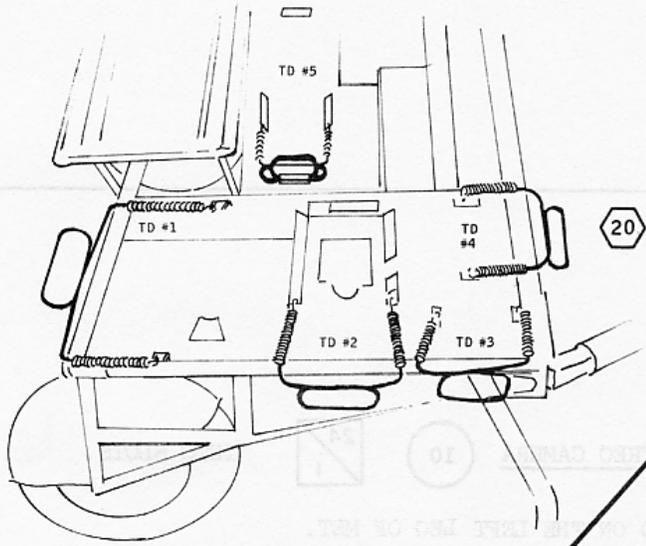
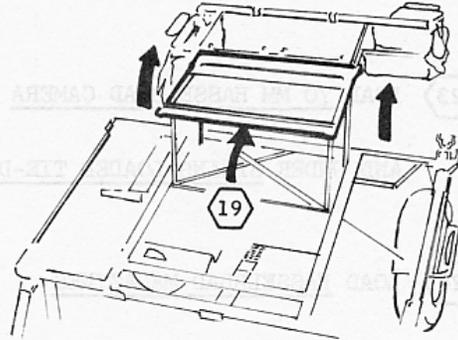
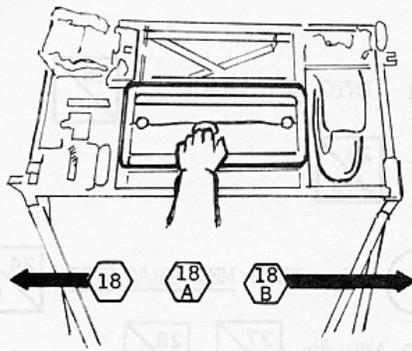
(THE SEQUENCE OF STOWAGE OF THE FOLLOWING ITEMS WILL BE DICTATED BY THE SPECIFIC MISSION TIMELINE. HOWEVER, THE FOLLOWING PROCEDURES ILLUSTRATE INDIVIDUAL TASK ELEMENTS INVOLVED IN STOWING ITEMS ON THE MET PRIOR TO THE GEOLOGY TRAVERSES.)

- ⑳ UNSTOW SPRING-LOADED TIE-DOWNS #'s 1-5 AND PLACE AS ILLUSTRATED SO THAT ARTICLES MAY BE STOWED ON THE MET WITHOUT INTERFERENCE FROM ADJACENT TIE-DOWNS.

- ㉑ LOAD 35 MM LGEC CAMERA  INTO MET BRACKETS  AND UNDER SPRING-LOADED TIE-DOWN #1  .

- ㉒ LOAD LGEC CAMERA MAGAZINE  INTO MET BRACKETS  AND UNDER SPRING-LOADED TIE-DOWN #5  .

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

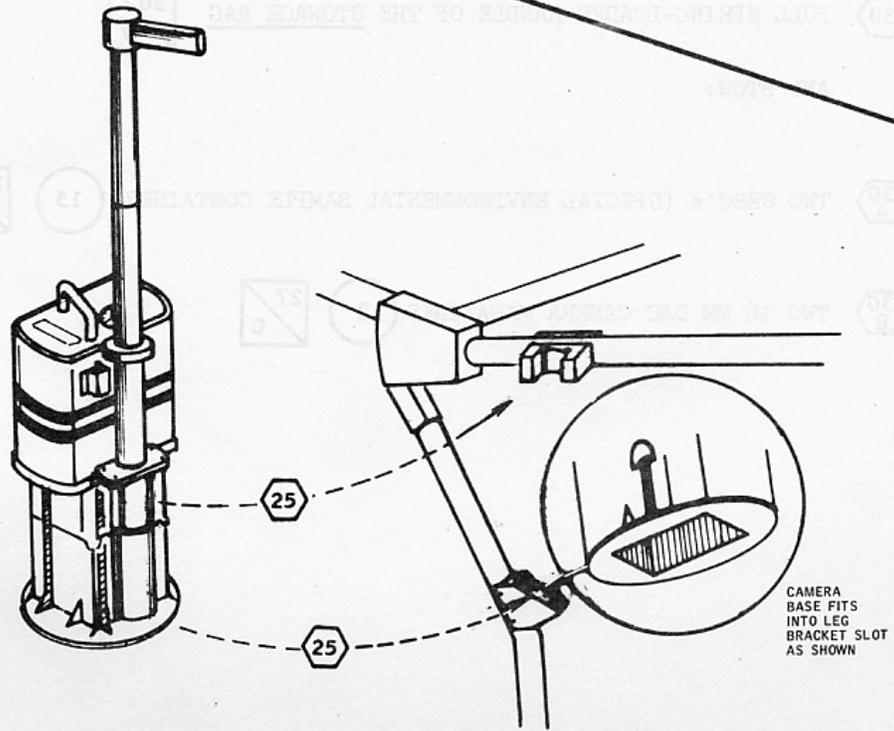
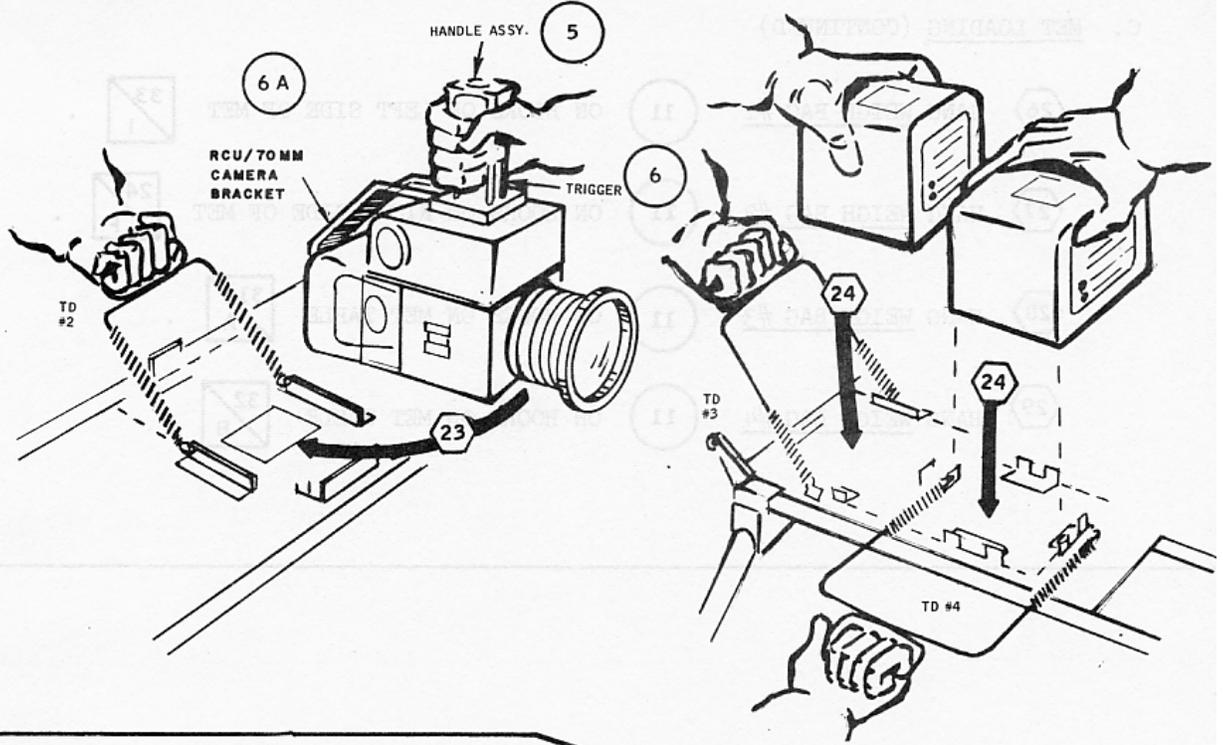
C. MET LOADING (CONTINUED)

23 LOAD 70 MM HASSELBLAD CAMERA 3 INTO MET BRACKETS 26/B  
AND UNDER SPRING-LOADED TIE-DOWN #2 28/D

24 LOAD HASSELBLAD MAGAZINES 4 INTO MET BRACKETS 24/C  
AND UNDER SPRING-LOADED TIE-DOWNS #3 AND #4 27/E 28/F

25 PLACE THE CLOSE-UP STEREO CAMERA 10 24/I INTO SLOTS  
IN THE LEFT HANDLE AND ON THE LEFT LEG OF MET.

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

C. MET LOADING (CONTINUED)

- |    |                          |    |                               |         |
|----|--------------------------|----|-------------------------------|---------|
| 26 | HANG <u>WEIGH BAG #1</u> | 11 | ON HOOKS ON LEFT SIDE OF MET  | 33<br>I |
| 27 | HANG <u>WEIGH BAG #2</u> | 11 | ON HOOKS ON RIGHT SIDE OF MET | 24<br>F |
| 28 | HANG <u>WEIGH BAG #3</u> | 11 | ON HOOKS ON MET TABLE         | 31<br>A |
| 29 | HANG <u>WEIGH BAG #4</u> | 11 | ON HOOKS ON MET TABLE         | 32<br>B |

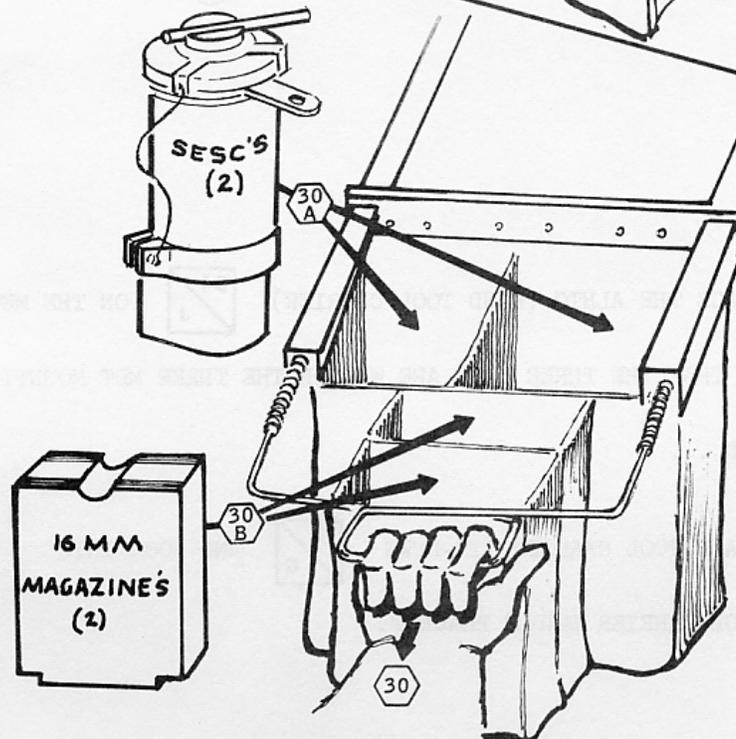
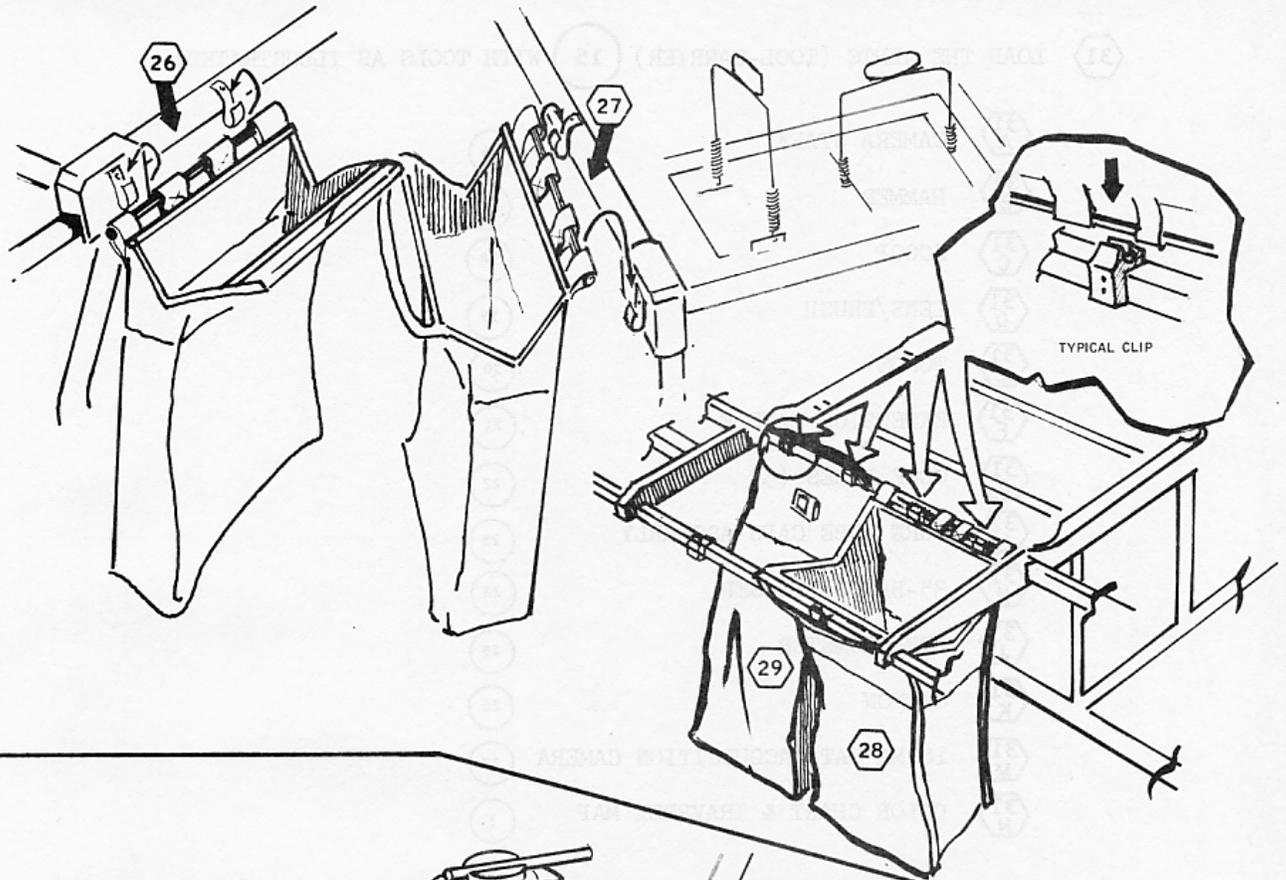
- 30 FULL SPRING-LOADED HANDLE OF THE STOWAGE BAG 30  
D

AND STOW:

- 30 A TWO SESC's (SPECIAL ENVIRONMENTAL SAMPLE CONTAINER) 13 29  
C

- 30 B TWO 16 MM DAC CAMERA MAGAZINES 2 27  
C

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

C. MET LOADING (CONTINUED)

31 LOAD THE ALHTC (TOOL-CARRIER) 15 WITH TOOLS AS ILLUSTRATED:

- |      |                               |    |
|------|-------------------------------|----|
| 31 A | CAMERA STAFF                  | 16 |
| 31 B | HAMMER                        | 17 |
| 31 C | SCOOP                         | 18 |
| 31 D | LENS/BRUSH                    | 19 |
| 31 E | TONGS                         | 20 |
| 31 F | EXTENSION HANDLE              | 21 |
| 31 G | CORE TUBES (5)                | 22 |
| 31 L | CORE TUBE CAPS ASSEMBLY       | 23 |
| 31 H | 35-BAG DISPENSER              | 24 |
| 31 J | PENETROMETER                  | 25 |
| 31 K | GNOMON                        | 26 |
| 31 M | 16 MM DATA ACQUISITION CAMERA | 27 |
| 31 N | COLOR CHART & TRAVERSE MAP    | 1  |

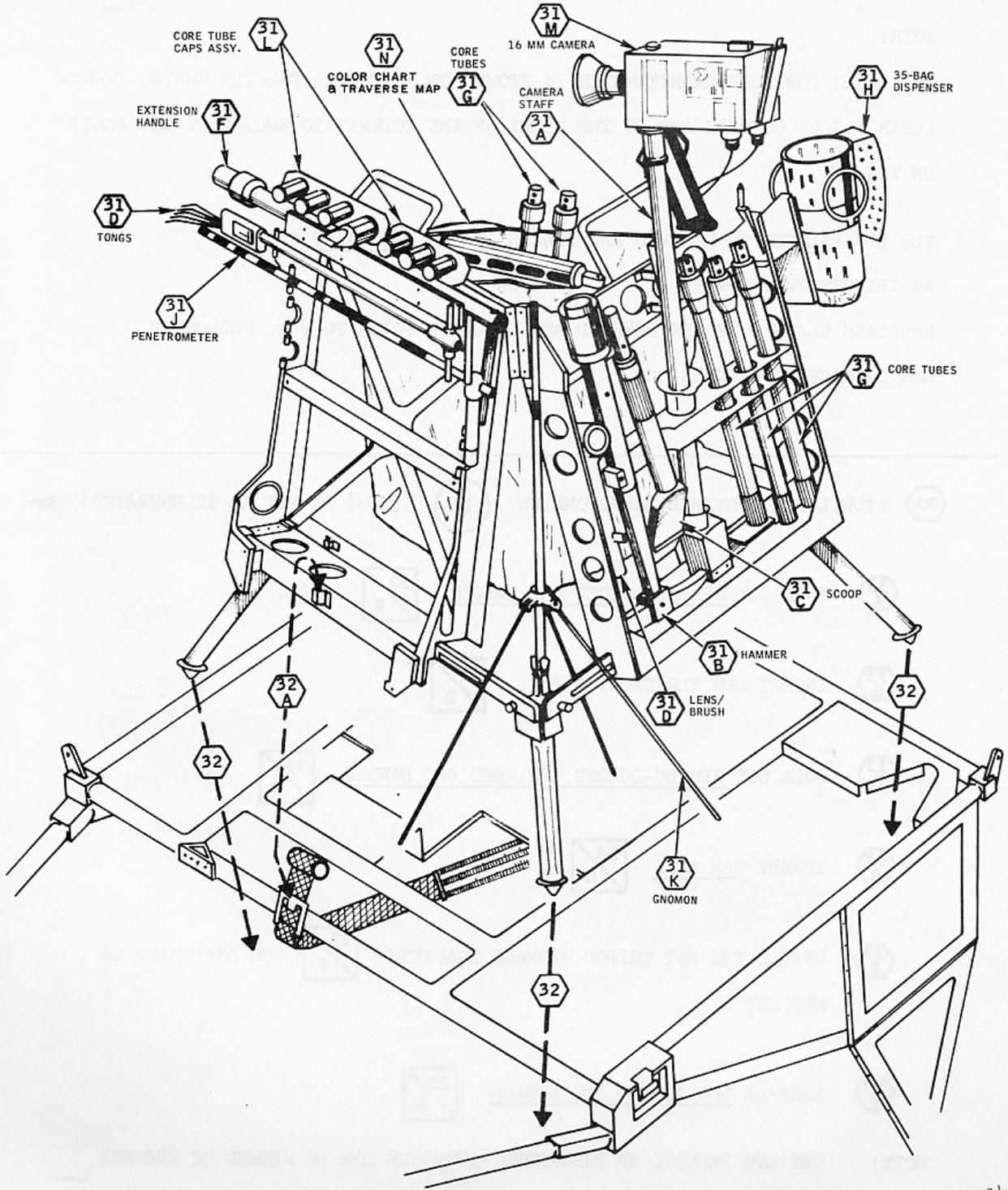
32 PLACE THE ALHTC (HAND TOOL CARRIER) 34 J ON THE MET

SO THAT THE THREE LEGS ARE WITHIN THE THREE MET MOUNTING POINTS

AND . . .

32 A GRASP TOOL CARRIER TIE-DOWN 28 G AND HOOK INTO  
TOOL CARRIER HANDLE BRACKET.

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

C. MET LOADING (CONTINUED)

NOTE:

THE LUNAR PORTABLE MAGNETOMETER IS STOWED ON A SPECIAL PALETTE DURING TRANS-LUNAR FLIGHT OUTSIDE AND TO THE RIGHT OF THE SCIENTIFIC EQUIPMENT BAY (SEQ) ON THE LM.

THE LPM PALETTE IS REMOVED AND PLACED ON THE MET TABLE RACK AS ILLUSTRATED: →

RETAINER CLAMP PINS ARE REMOVED AND UNFOLDED PRIOR TO THE FOLLOWING MET STOWAGE PROCEDURES.

③③ STOW LUNAR PORTABLE MAGNETOMETER ①④ (LPM) ON MET AS ILLUSTRATED: →

③③ A PULL OUT SPRING-LOADED BAG HANDLE ③② E AND . . .

③③ B INSERT LPM ELECTRONICS PKG. ③③ B .

③③ C PULL OUT SPRING-LOADED LPM REEL BAG HANDLE ③② D AND . . .

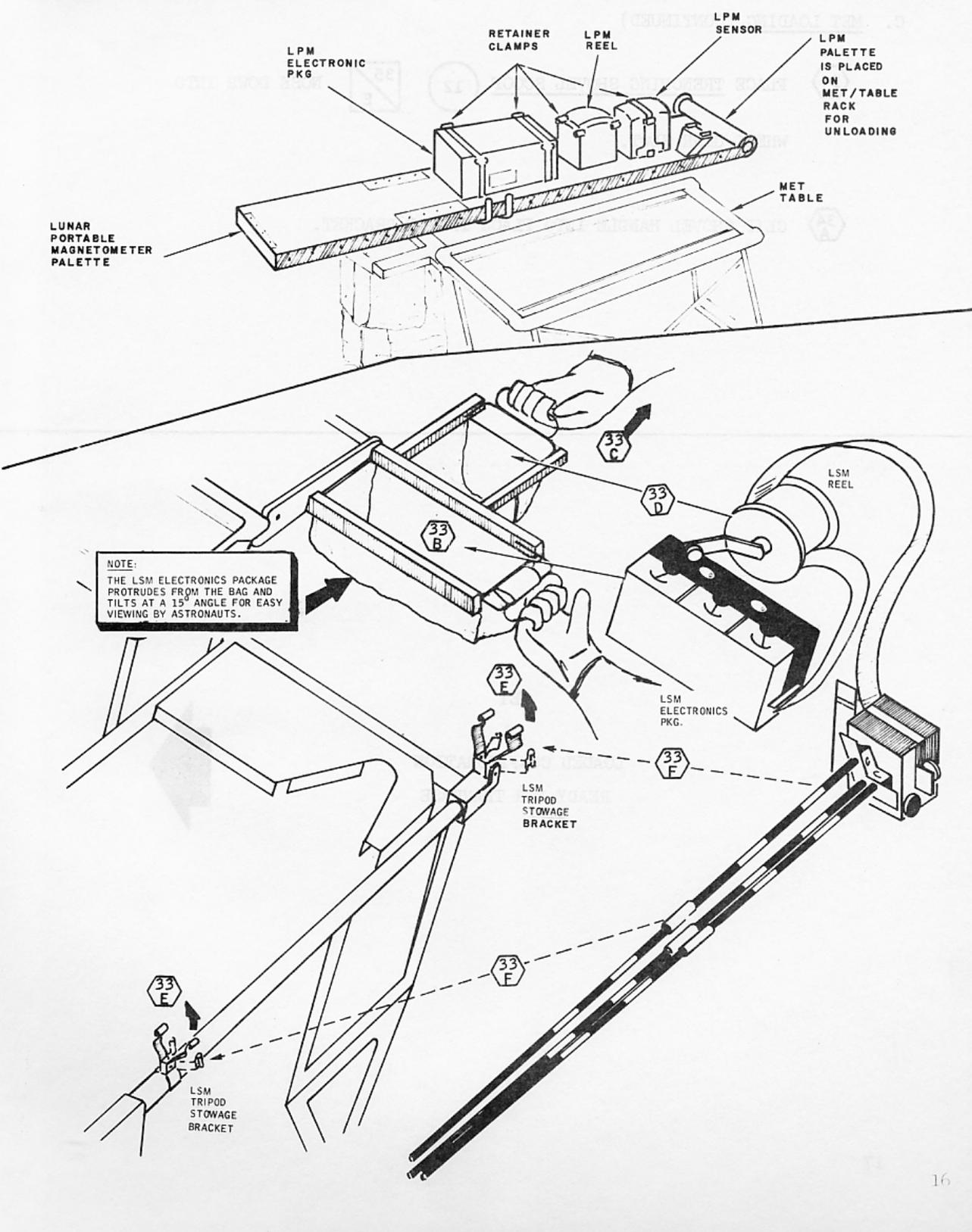
③③ D INSERT LPM REEL ③④ D .

③③ E UNFOLD THE MET TRIPOD STOWAGE BRACKETS ③② F ON LEFT SIDE OF MET AND . . .

③③ F INSTALL LPM TRIPOD AND SENSOR ③⑤ D .

NOTE: THE LPM PALETTE IS DISCARDED AFTER THE LPM IS STOWED ON THE MET.

PROCEDURES ILLUSTRATIONS



CREW OPERATING PROCEDURES

C. MET LOADING (CONTINUED)

34

PLACE TRENCHING SHOVEL SCOOP

12

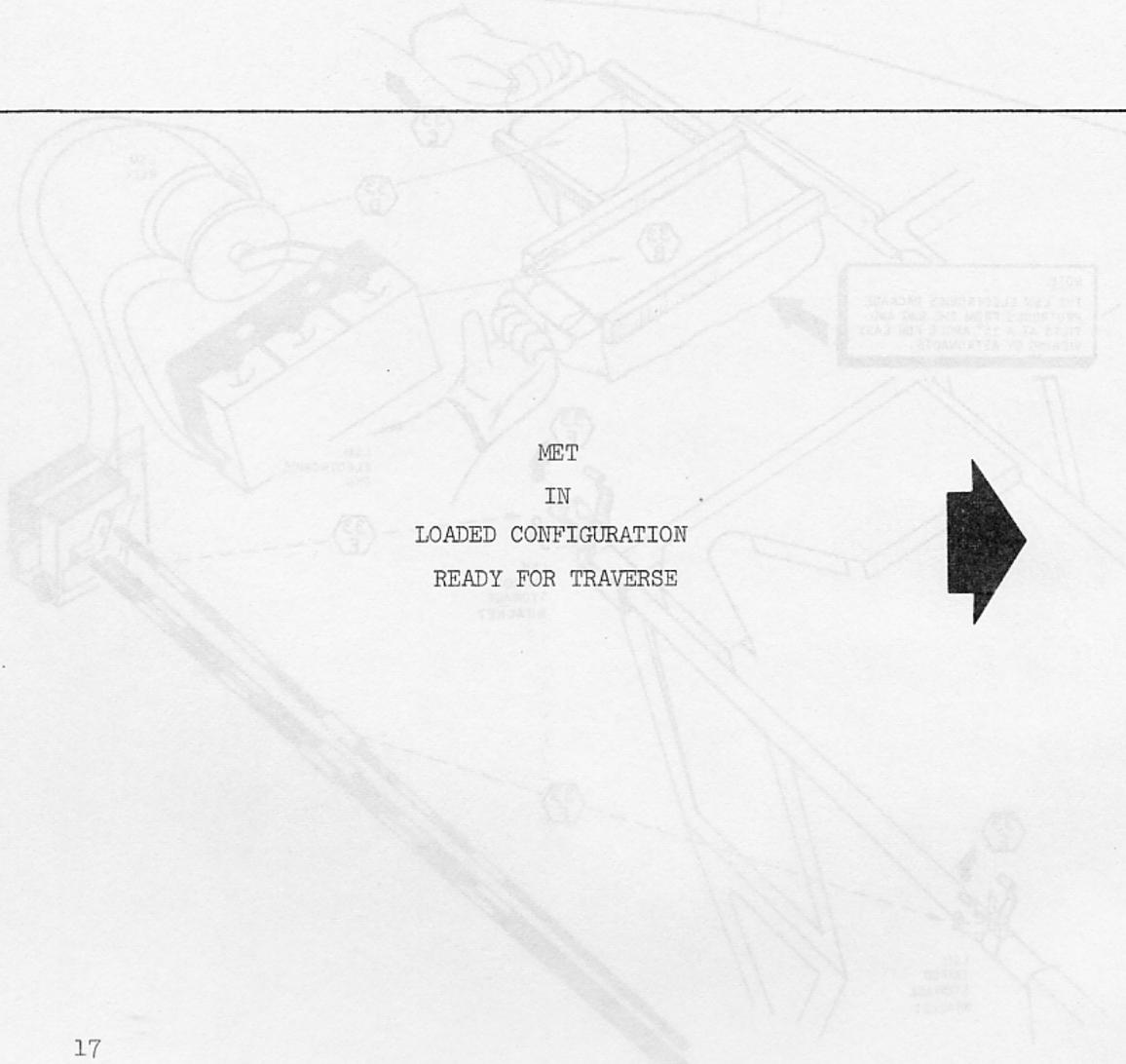
35  
E

NOSE DOWN INTO

WHEEL GEAR SLOT.

34  
A

CLIP SHOVEL HANDLE INTO PLACE IN MET BRACKET.



PROCEDURES ILLUSTRATIONS

