MODULAR EQUIPMENT TRANSPORTER (MET)

OPERATOR'S
FAMILIARIZATION MANUAL

PREPARED BY
GENERAL ELECTRIC
APOLLO SYSTEMS
HOUSTON PROGRAMS

TIR # 729-S-0014(S)
APRIL 27, 1970
This is an operating logic type training document that utilizes the following format and cross indexing system.

Circle locator symbols refer to stored equipment data on left fold-out.

Square locator symbols refer to location on right hand fold-out.

Hexagon locator symbols refer to crew procedure numbers.

Crew procedures

Procedures illustration

Basic equipment configuration and nomenclature
<table>
<thead>
<tr>
<th>STOWED ITEM #</th>
<th>ITEMS STOWED ON NET</th>
<th>QUANTITY</th>
<th>NET CREW PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAMERA/PACK, 16 mm</td>
<td>1 (ON TOOL CARRIER)</td>
<td>1 (ON TOOL CARRIER)</td>
</tr>
<tr>
<td>2</td>
<td>MAGAZINE, 16 mm</td>
<td>3 (1 IN CAMERA)</td>
<td>3 (1 IN CAMERA)</td>
</tr>
<tr>
<td>3</td>
<td>CAMERA, 70 mm HASSELBLAD</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>MAGAZINE, 70 mm</td>
<td>3 (1 IN CAMERA)</td>
<td>3 (1 IN CAMERA)</td>
</tr>
<tr>
<td>5</td>
<td>HANDLE, 70 mm CAMERA</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>TRIGGER, 70 mm CAMERA</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>RCU/70 mm CAMERA BRACKET</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>CAMERA ASSY., LGEC</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>MAGAZINE ASSY.</td>
<td>2 (1 IN CAMERA)</td>
<td>2 (1 IN CAMERA)</td>
</tr>
<tr>
<td>10</td>
<td>MAGAZINE ASSY. COVER</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>RCU/LGEC BRACKET</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>CAMERA, CLOSE-UP STEREO</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>WEIGHT BAGS</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>TRENCHING TOOL</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>SPECIAL ENVIROM. SAMPLE CONTAINER (SESC)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>PORTABLE MAGNETOMETER: TRIPOD &amp; SENSOR CABLE REEL ELECTRONICS PACKAGE</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>ALMTC (TOOL CARRIER)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>CAMERA STAFF</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>HAMMER</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>SCOOP</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>LENS/BRUSH</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>TONGS</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>EXTENSION HANDLE</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>CORE TUBES</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>CORE TUBE CAP ASSY.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>26</td>
<td>35-BAG DISPENSER</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>PENETROMETER</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>GNOMON</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>COLOR CHART &amp; TRAVERSE MAP</td>
<td>1</td>
<td>EA.</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LM-5 STORAGE**:  
- **STORAGE AREA CODE**  
  - A4  
  - F2B  

**STORAGE PROCEDURES**  
- **STORAGE ASCENT**  
  - X  
  - A4  

**STORAGE DESCENT**  
- X  
- F2B

**MEI DESIGN CRITERIA**  
- **DEPLOYABLE WITHOUT USE OF TOOLS**
- **MAX. PAYLOAD CAPABILITY**  
  - 340 LBS.
- **PAYLOAD CONSISTS OF TOOLS, CAMERAS, EXPERIMENT INSTRUMENTS AND LUNAR SAMPLES AS NOTED IN STOWAGE LIST.**
- **MAX. NET WEIGHT**  
  - 30 LBS.
- **DIMENSIONAL LIMITS**  
  - WORKABLE 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: "" DIAM. ROCKS 
- **TIRE TEMPERATURES**:
  - MINUS 68°F AT DEPLOYMENT  
  - 60°F TO 200°F WHEN PARKED 
  - 70°F AVERAGE WHEN ROLLING 
- **TIRE PRESSURE**: 1.5 PSI.

*FIELD SITE STOWAGE DRAWINGS*
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:

<table>
<thead>
<tr>
<th>Crew Proced. #'s</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Removal of the MET from the MESA</td>
</tr>
<tr>
<td>B. MET Deployment</td>
</tr>
<tr>
<td>C. Loading of MET for traverse</td>
</tr>
</tbody>
</table>
CREW OPERATING PROCEDURES

A. REMOVAL OF MET FROM THE MESA

1. Pull MESA D-RING 2 A to deploy MESA.

   (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 1 C 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 11 0 down and forward to remove MET BLANKET DOOR 0.

FROM LEFT SIDE OF MESA:

4. Pull YELLOW LANYARD #1 14 A to release PIP PIN #1 10 B.

   (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 17 A to release PIP PINS #2 & 3 17 B.

   (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 1 C.
B. MET DEPLOYMENT

7. REMOVE THERMAL BLANKET A AND . . .

7A. FULL WHEELPIN LANYARD #2 F AND REMOVE BOTH WHEELLOCK PIP PINS #4 & #5 H (THIS UNLOCKS WHEELS FROM FRAME.)

8. DEPLOY WHEELS: LIFT UPPER WHEEL UNTIL LOCKED.

8A. PUSH LOWER WHEEL DOWN UNTIL LOCKED.

9. GRASP LOOP, FULL AND DISCARD LEG/HANDLE PIP PIN & BRACKET D.

10. PARTIALLY DEPLOY HANDLES FOR LEG DEPLOYMENT CLEARANCE.

11. FULL MET LEFT LEG F "UP" UNTIL LOCKED IN PLACE.

12. PUSH MET RIGHT LEG F "DOWN" UNTIL LOCKED IN PLACE.

13. TURN MET OVER AND—

   PLACE UPRIGHT ON WHEELS AND LEGS.

14. ROTATE DRAW BAR Δ -HANDLE J INTO POSITION AND . . .

15A. FOLD AND LOCK INTO PLACE INTO RIGHT DRAW BAR ASSEMBLY G.

16. UNFOLD LEFT DRAW-BAR ASSEMBLY G.

16. UNFOLD RIGHT DRAW-BAR ASSEMBLY G.

17. LOCK LEFT DRAW BAR INTO RIGHT DRAW-BAR AND HANDLE.
B. MET DEPLOYMENT (CONTINUED)

18. GRASP LOOP IN LANYARD #4. [Diagram]

18A. FULL RIGHT TO REMOVE PIP PIN #1. [Diagram]

18B. FULL LEFT TO REMOVE PIP PIN #2. [Diagram] (THIS UNLOCKS TABLE.)

19. 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 #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 UNDER SPRING-LOADED TIE-DOWN #1.

22. LOAD LGEC CAMERA MAGAZINE INTO MET BRACKETS UNDER SPRING-LOADED TIE-DOWN #5.
C. MET LOADING (CONTINUED)

23. Load 70 mm Hasselblad camera into MET brackets.
   And under spring-loaded tie-down #2.

24. Load Hasselblad magazines into MET brackets.
   And under spring-loaded tie-downs #3 and #4.

25. Place the close-up stereo camera into slots in the left handle and on the left leg of MET.
CAMERA BASE FITS INTO LEG BRACKET SLOT AS SHOWN
C. MET LOADING (CONTINUED)

26 HANG WEIGH BAG #1 ON HOOKS ON LEFT SIDE OF MET

27 HANG WEIGH BAG #2 ON HOOKS ON RIGHT SIDE OF MET

26 HANG WEIGH BAG #3 ON HOOKS ON MET TABLE

29 HANG WEIGH BAG #4 ON HOOKS ON MET TABLE

30 FULL SPRING-LOADED HANDLE OF THE STOWAGE BAG AND STOW:

30 TWO SESG's (SPECIAL ENVIRONMENTAL SAMPLE CONTAINER)

30 TWO 16 MM DAC CAMERA MAGAZINES
C. MET LOADING (CONTINUED)

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

- CAMERA STAFF
- HAMMER
- SCOOP
- LENS/BRUSH
- TONGS
- EXTENSION HANDLE
- CORE TUBES (5)
- CORE TUBE CAPS ASSEMBLY
- 35-BAG DISPENSER
- PENETROMETER
- Gnomon
- 16 MM DATA ACQUISITION CAMERA
- COLOR CHART & TRAVERSE MAP

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

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

AND...

32 GRASP TOOL CARRIER TIE-DOWN AND HOOK INTO TOOL CARRIER HANDLE BRACKET.
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 (LPM) ON MET AS ILLUSTRATED:

1. **33** PULL OUT SPRING-LOADED BAG HANDLE AND ...
2. **33** INSERT LPM ELECTRONICS PKG.
3. **33** PULL OUT SPRING-LOADED LPM REEL BAG HANDLE AND ...
4. **33** INSERT LPM REEL
5. **33** UNFOLD THE MET TRIPOD STOWAGE BRACKETS ON LEFT SIDE OF MET AND ...
6. **33** INSTALL LPM TRIPOD AND SENSOR.

NOTE: THE LPM PALETTE IS DISCARDED AFTER THE LPM IS STOWED ON THE MET.
NOTE:
The LSM Electronics Package protrudes from the bag and tilts at a 15° angle for easy viewing by astronauts.
C. MET LOADING (CONTINUED)

- Place trenching shovel scoop nose down into wheel gear slot.
- Clip shovel handle into place in met bracket.

MET IN LOADED CONFIGURATION READY FOR TRAVERSE