

LSG 770-154-10 - IM-5

LUNAR MODULE

STRUCTURES

HANDOUT

IM-5

FOR TRAINING PURPOSES ONLY; IN
SUPPORT OF IM-5 STRUCTURES COURSE

FOR

FLIGHT CONTROL DIVISION

AT

MSC, HOUSTON, TEXAS

Prepared By:

Cardis Bryan
Cardis Bryan
IM Instructor

W. Strasburger
William Strasburger
IM Instructor

Approved By:

Henry Kalkowsky, Jr.
Henry Kalkowsky, Jr.
Chief, IM Training

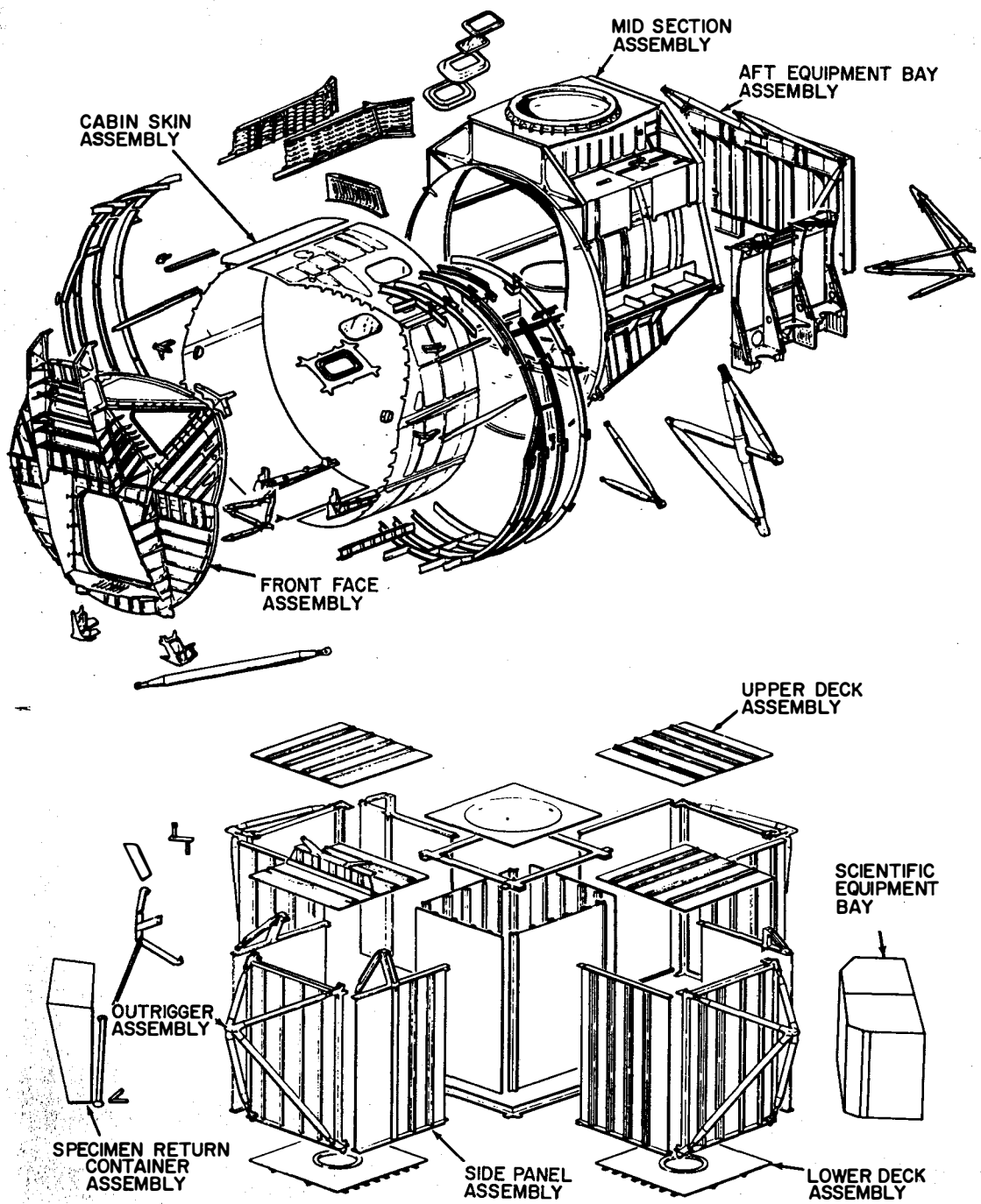
MAY 1969

TABLE OF CONTENTS (Cont)

Chapter 2 <u>Lunar Surface Equipment Deployment</u>	<u>Page</u>
Equipment Locations - Descent Stage	2-1
Modularized Equipment Stowage Assembly (MESA)	
MESA Deployment	2-2
Back-Up Deployment	2-3
MESA Deployed	2-4
MESA Deployment Mechanism	2-5
MESA Deployment Ratchet/Spring Assembly	2-6
Modularized Equipment Stowage Assembly MESA Pallet	2-7
MESA Pallet with Equipment	2-8
MESA Stowage List - IM-5	2-9
MESA Side Views	2-10
MESA Pallet W/O Equipment	2-11
TV Camera and Tripod	2-12
Closeup Stereo Camera - Stowed	2-13
Lunar Stereo Camera	2-14
Tongs	2-15
Gnomon	2-16
Hammer w/Extension Handle	2-17
Scoop	2-18
Solar Wind Composition Experiment	2-19
S-Band Erectable Antenna	
S-Band Deployment Sequence	2-20
S-Band Erectable Antenna Handling	2-21
S-Band Erectable Antenna	2-22
Early Apollo Scientific Equipment Payload (EASEP)	
EASEP Deployment Sequence (1, 2, 3, 4)	2-23 thru 2-26
Scientific Equipment Bay Door	
Frame & Cable Assembly	2-27
Deployment Mechanism	2-28
Lunar Samples	
Sample Return Box	2-29
Scale	2-30
Lunar Equipment Conveyor	2-31

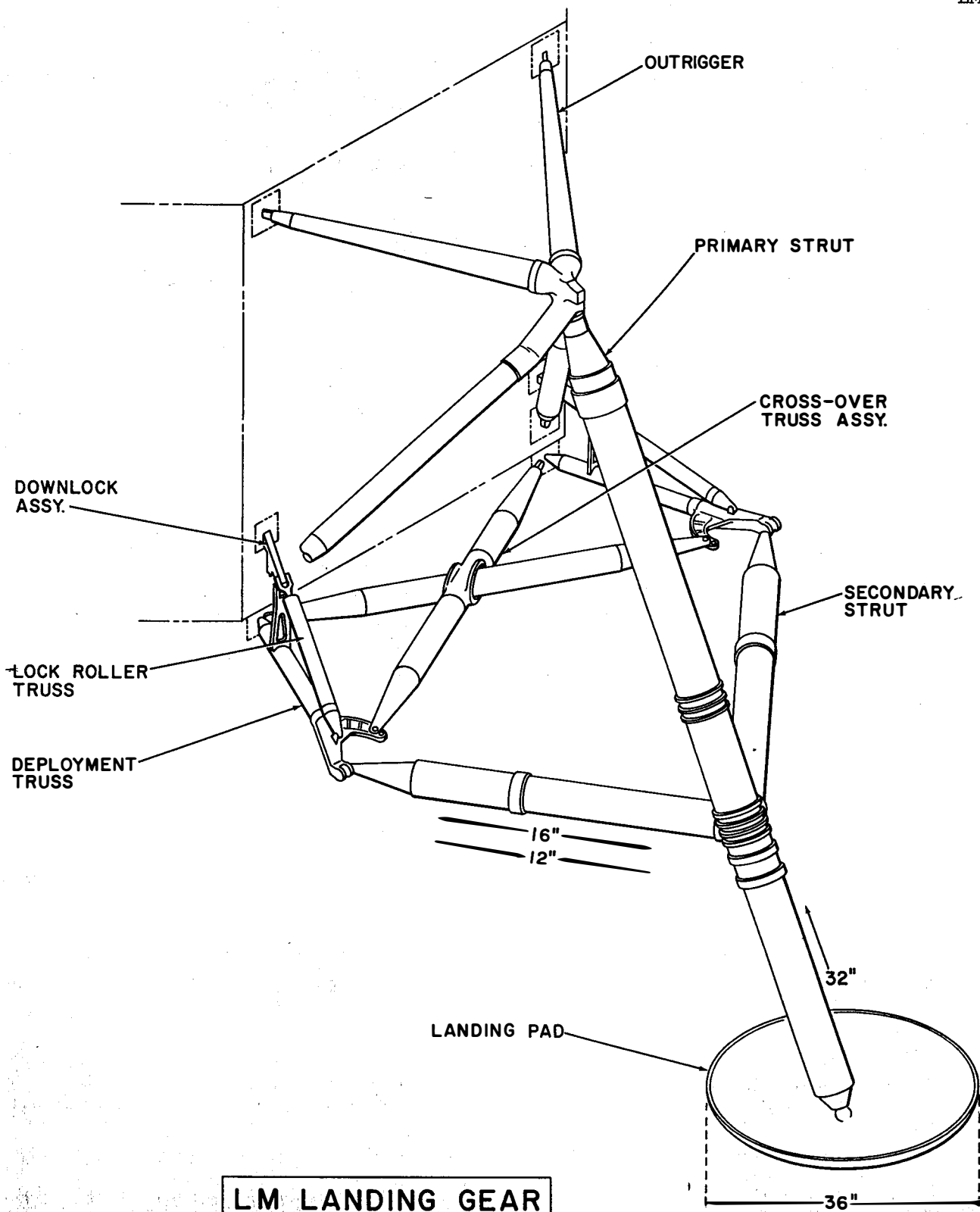
TABLE OF CONTENTS

<u>Chapter 1</u>	<u>Page</u>
Ascent and Descent Stage Structure	1-1
IM Landing Gear	1-2
Landing Gear Primary Strut	1-3
Landing Gear Secondary Strut	1-4
Landing Gear Deployment and Downlock Mechanism	
Stowed Position	1-5
Down and Locked Position	1-6
Translunar Flight	1-7
CSM Separation from IM & SIVB	1-8
Post Transposition Docking	1-9
IM/CSM Undocking	1-10
Thermal Control	1-11
Typical Thermal Shield and Blanket	1-12
Thermal Control Coating	1-13
Blanket Joining	1-14
Abrasion Protection and Penetration Insulation	1-15
Standoff Installation & Blanket Venting	1-16
Panel Shingling - Front View	1-17
Bay Vent	1-18
Landing Gear Thermal Protection	1-19
Micro-meteoroid Protection	1-20
RCS Plume Deflector	1-21
Descent Stage Base Heat Shield	1-22
Temperature Graphs	1-23
EVA Antenna Erection Mechanism (1)	1-24
EVA Antenna Erection Mechanism (2)	1-25



ASCENT AND DESCENT STAGE STRUCTURE

T30915-83.1

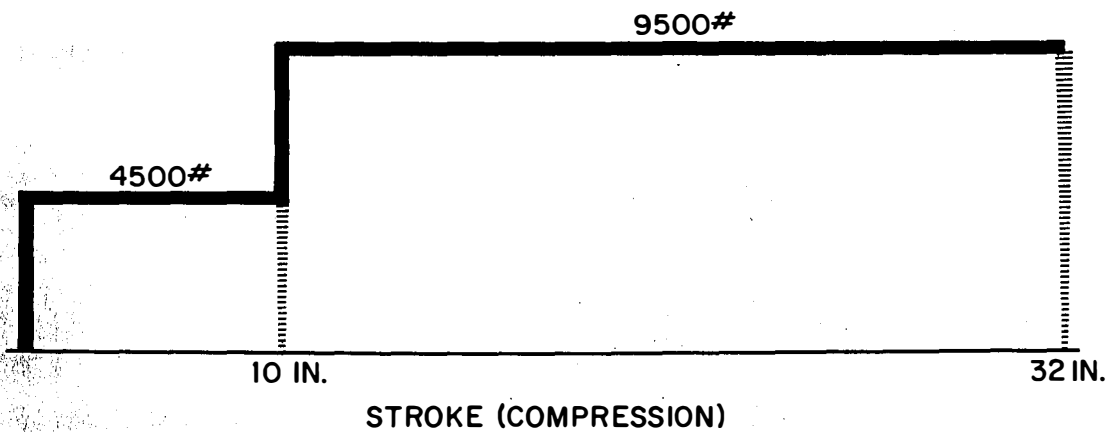
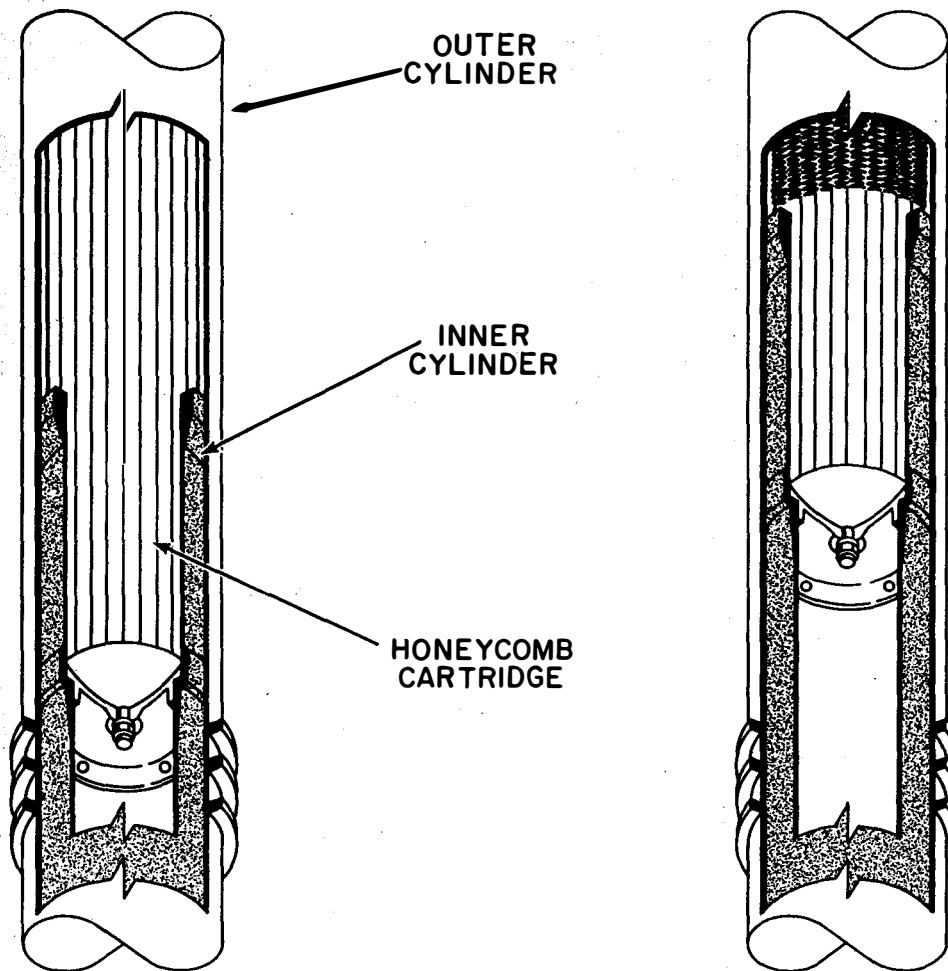


LM LANDING GEAR

T30900-99.3

BEFORE IMPACT

AFTER IMPACT



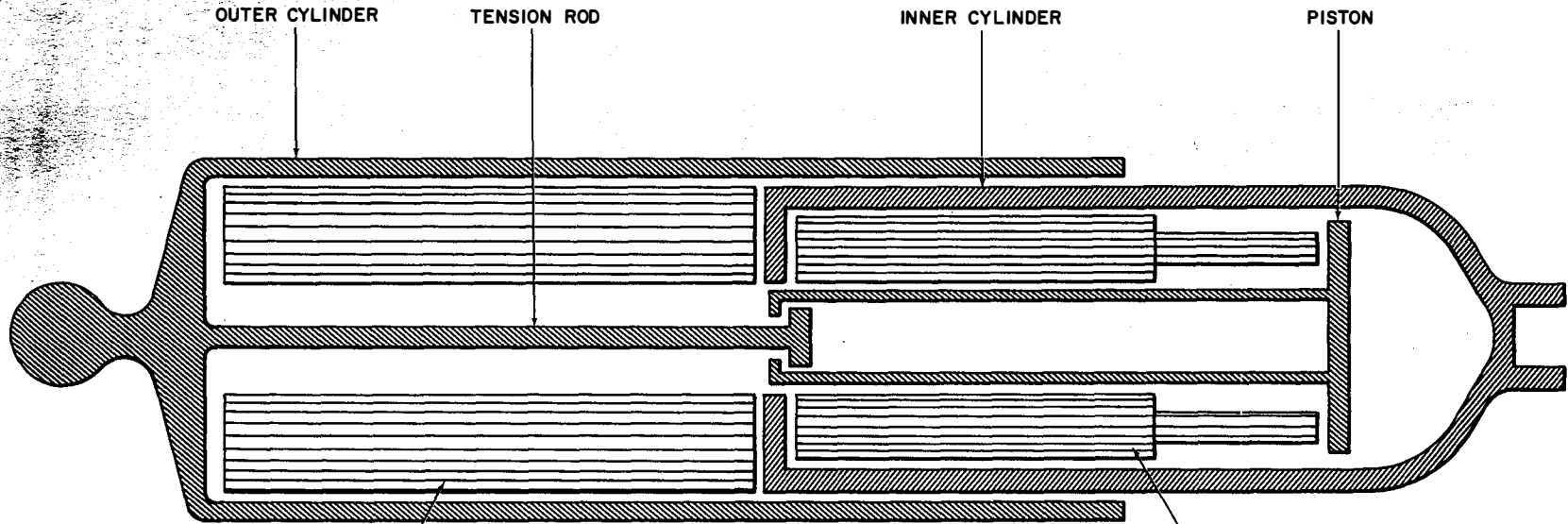
LANDING GEAR PRIMARY STRUT

T 30005-213

Date: May, 1969

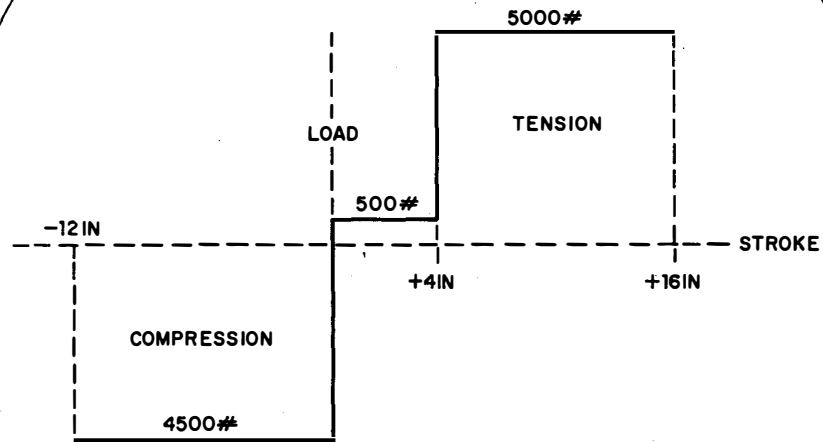
FOR TRAINING PURPOSES ONLY

Page 1-4



COMPRESSION
HONEYCOMB
CARTRIDGE

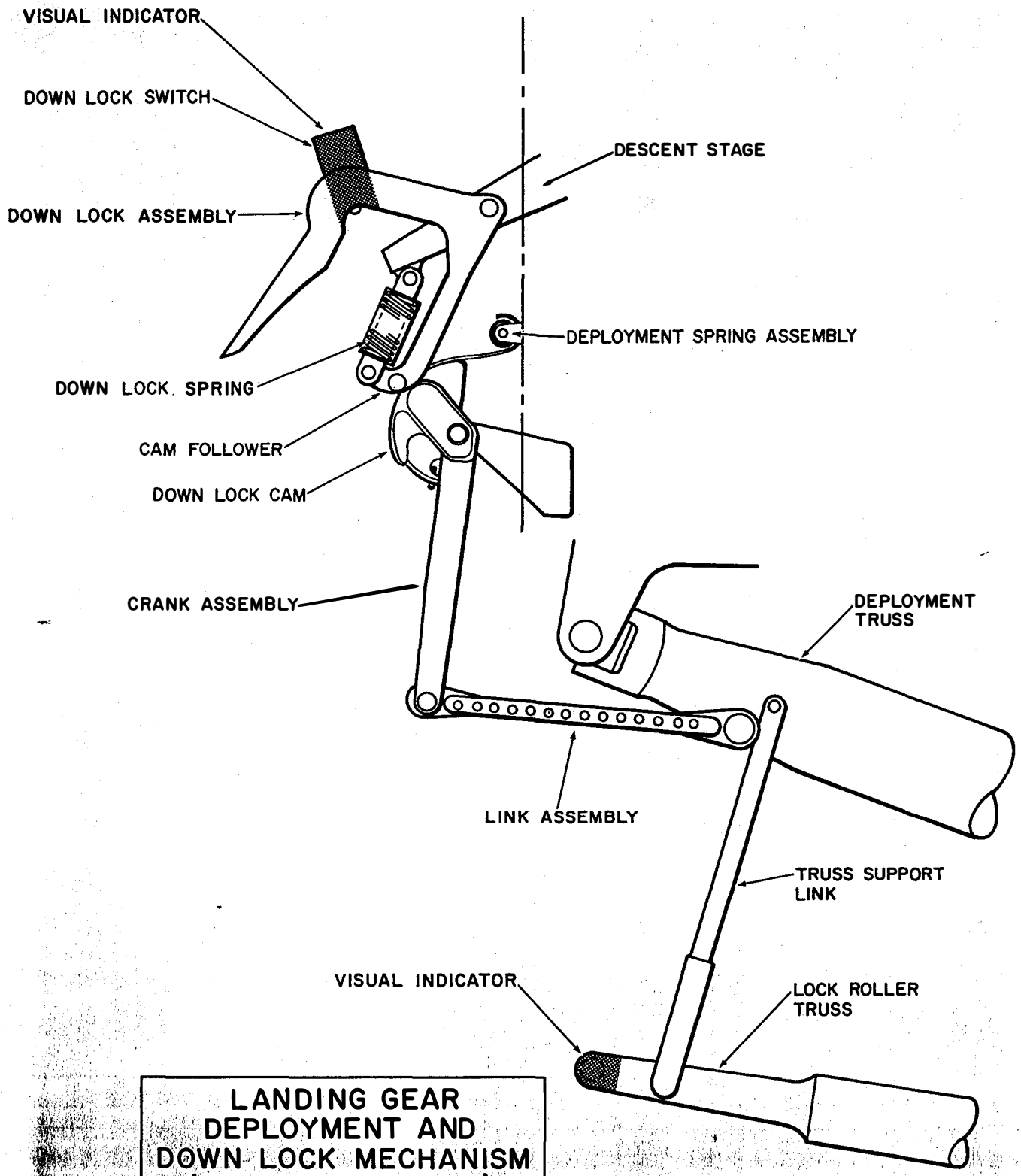
TENSION
HONEYCOMB
CARTRIDGE



LANDING GEAR SECONDARY STRUT

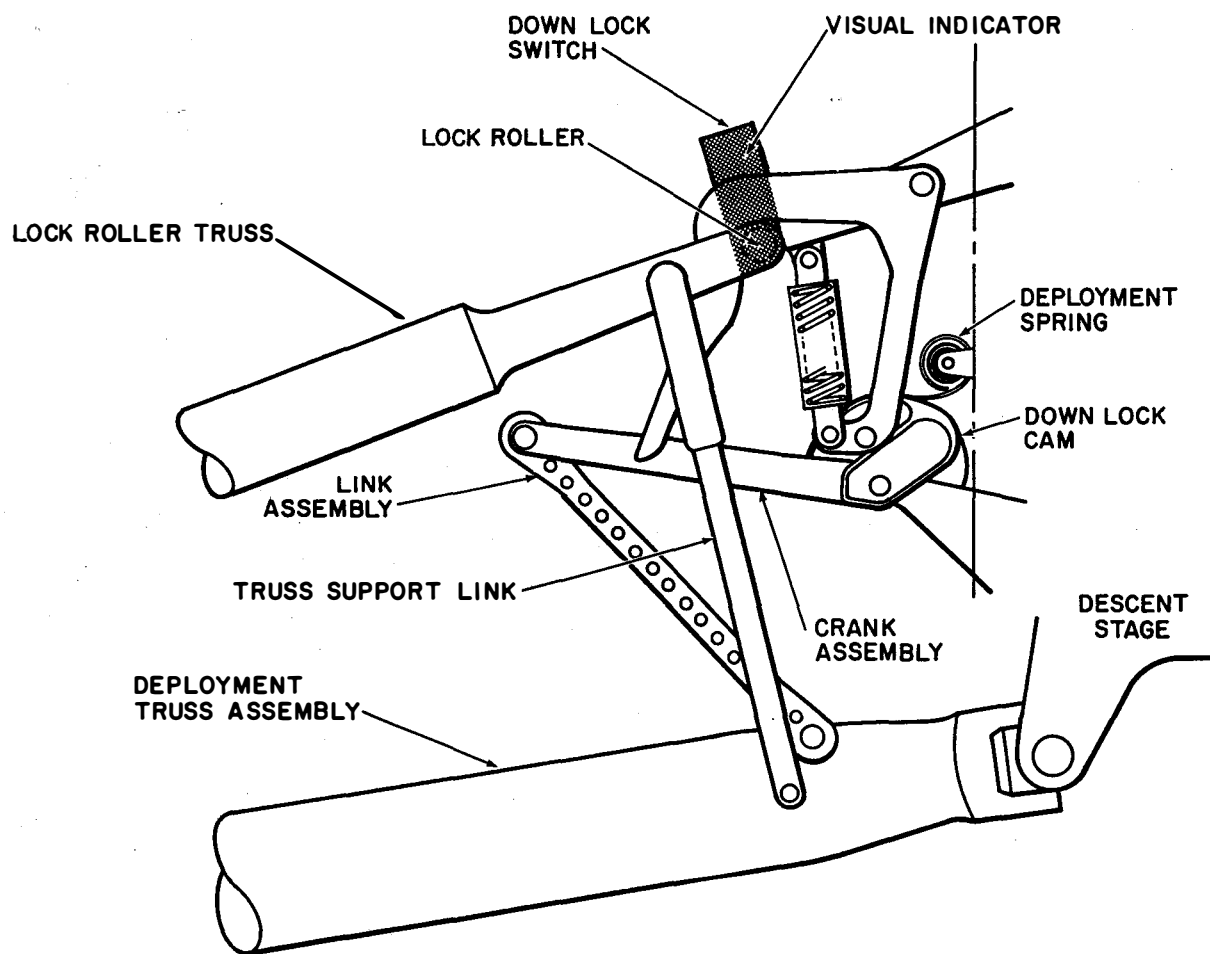
T30005-214

LM-5



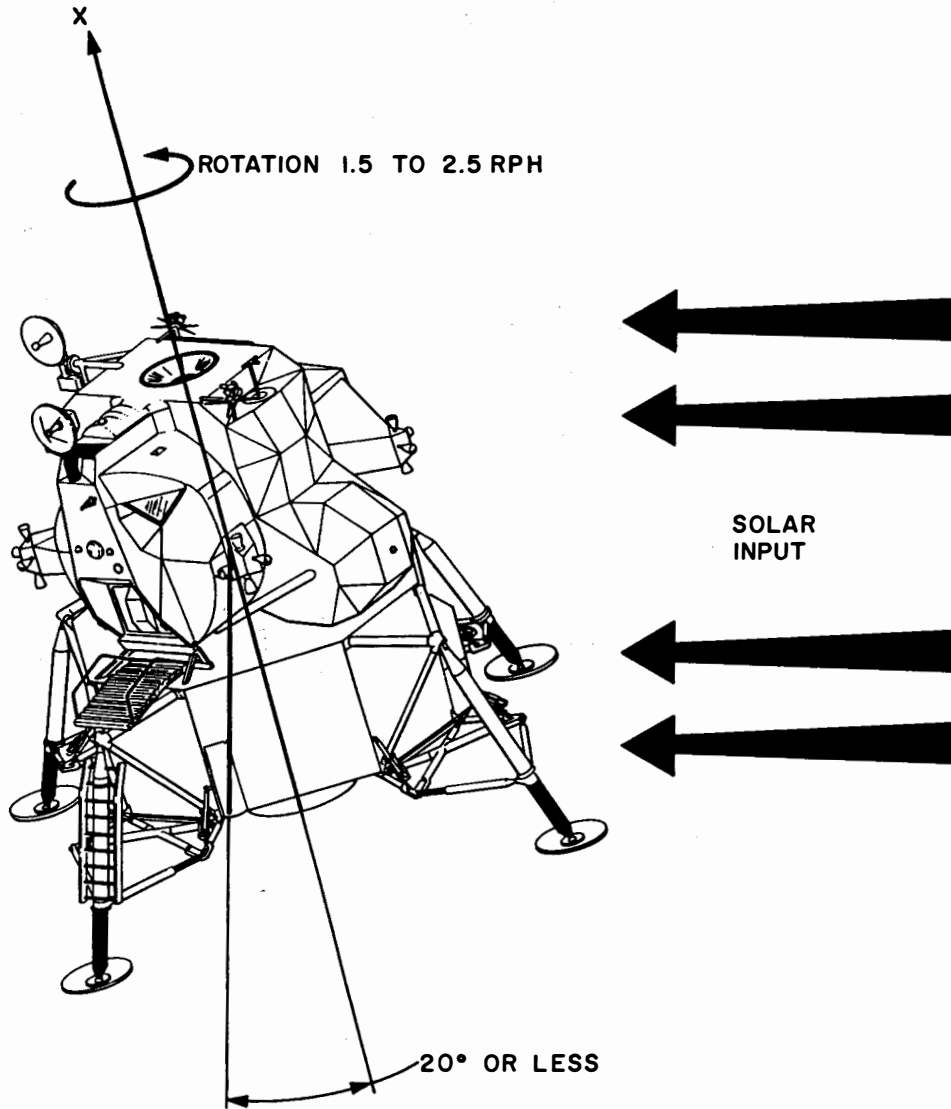
**LANDING GEAR
DEPLOYMENT AND
DOWN LOCK MECHANISM
(STOWED POSITION)**

T30915-18.2



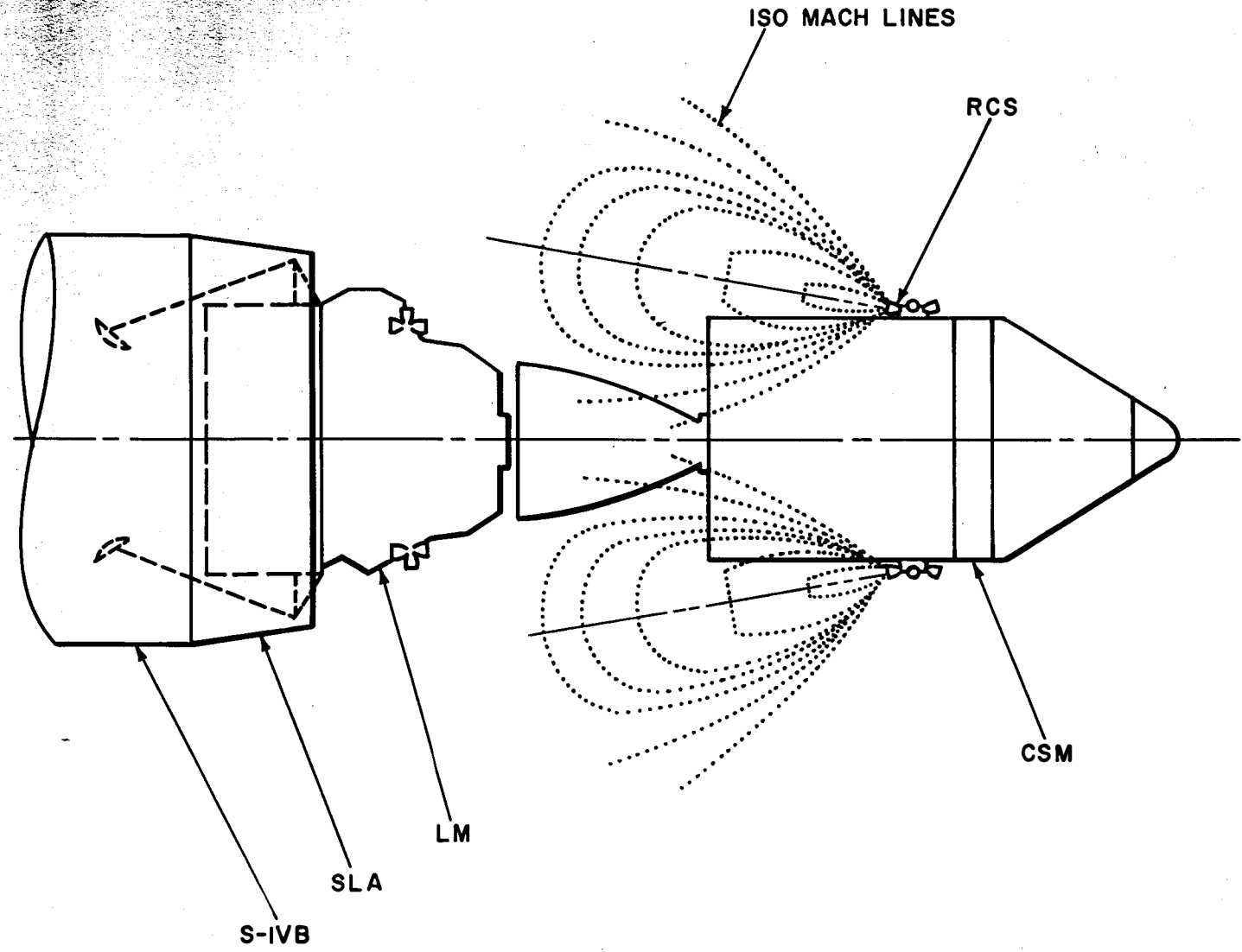
**LANDING GEAR
DEPLOYMENT AND
DOWN LOCK MECHANISM
(DOWN AND
LOCKED POSITION)**

T30915-19.2

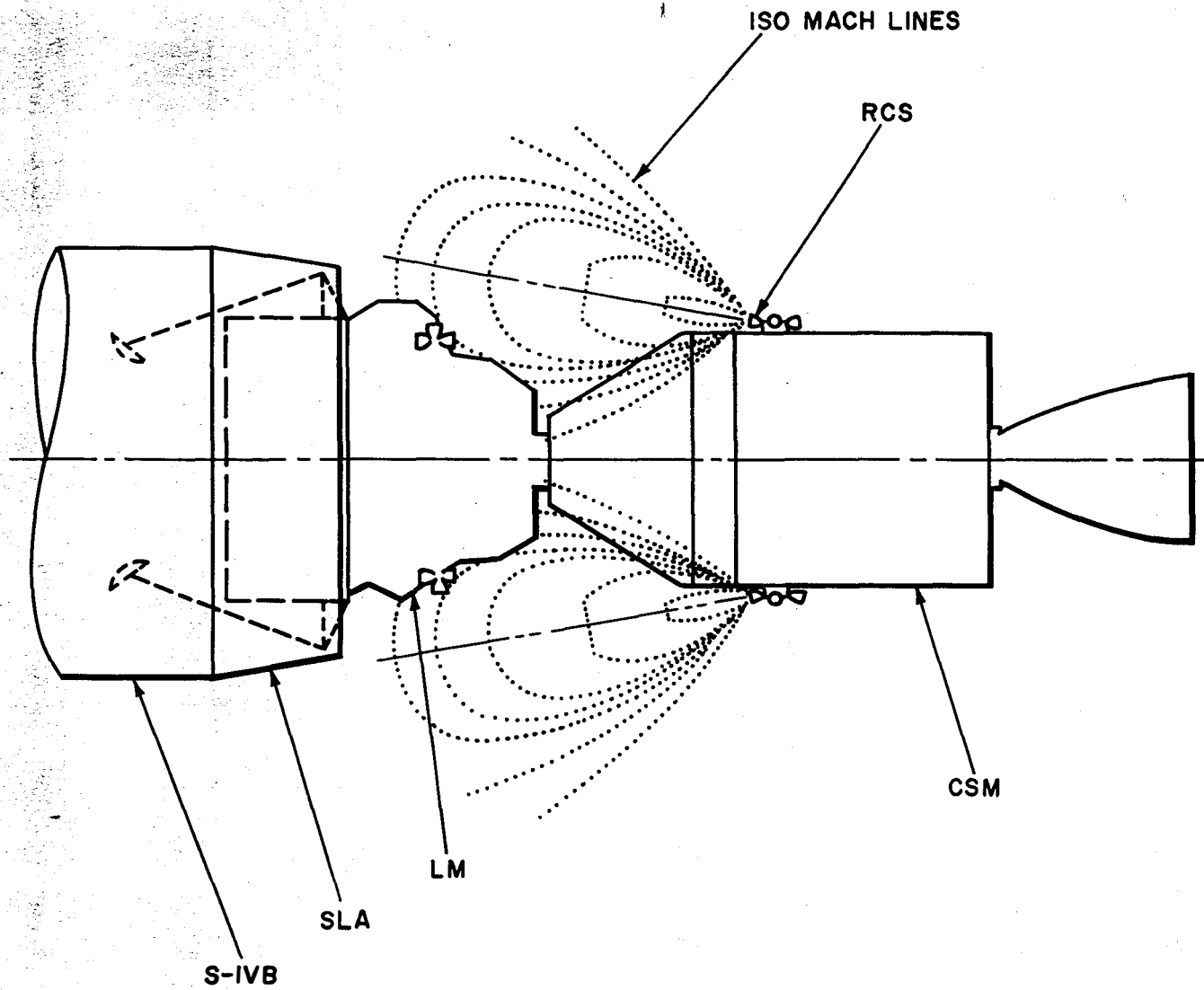


TRANSLUNAR FLIGHT

T30005-201.1



CSM SEPARATION FROM LM & S-IVB



POST TRANSPOSITION DOCKING

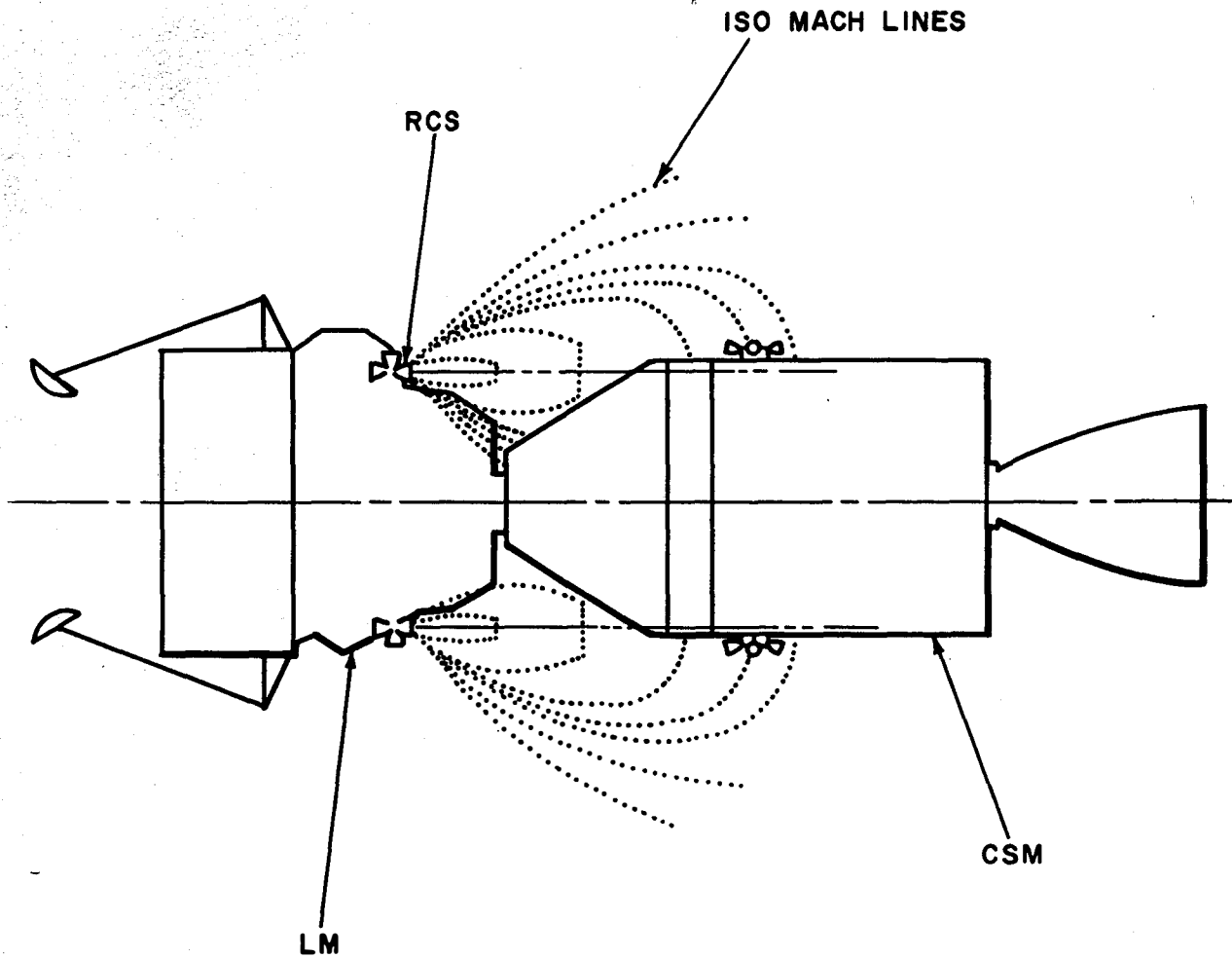
T30915-98.1

LM-5

Date: May 1969

FOR TRAINING PURPOSES ONLY

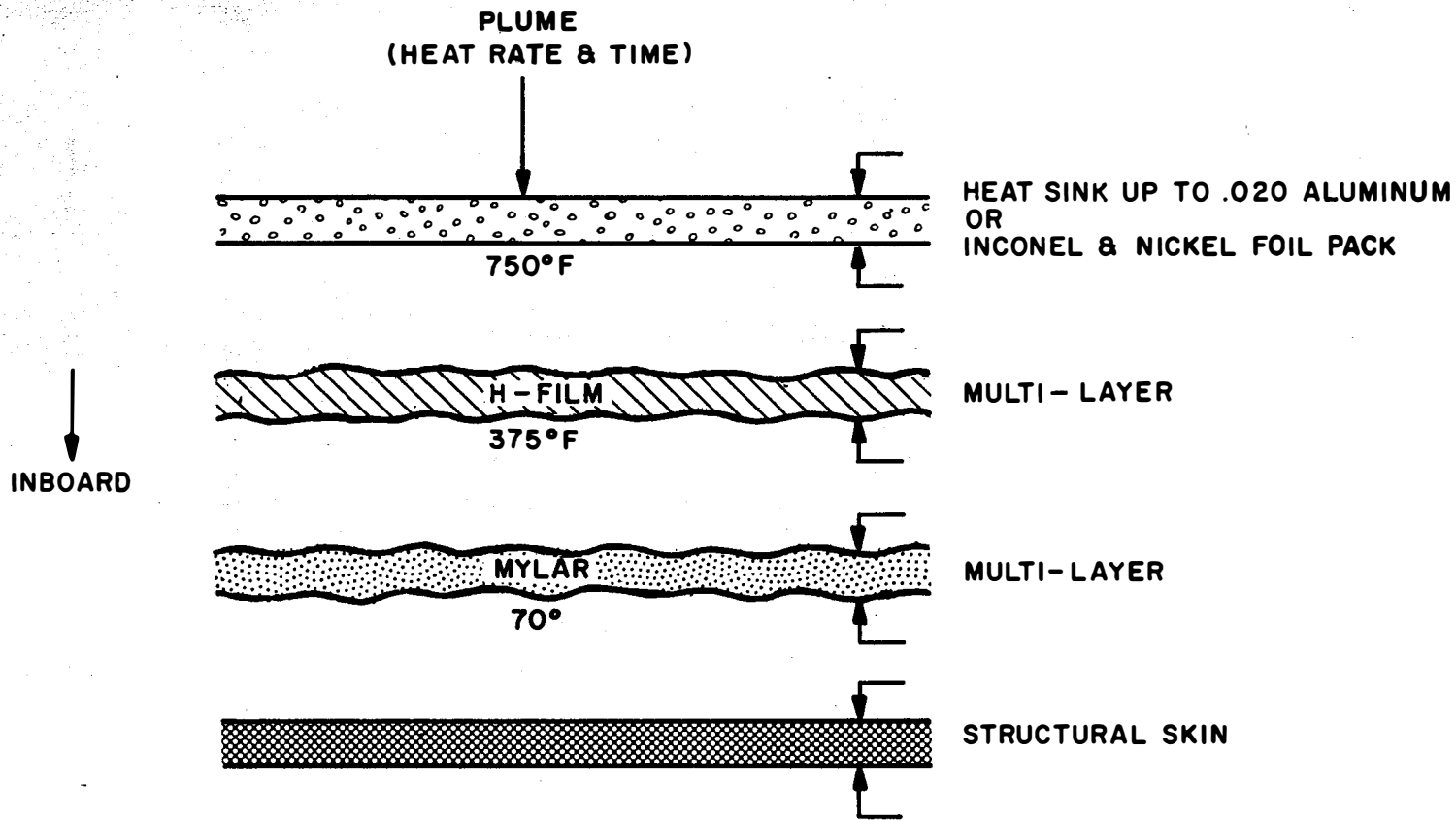
Page 1-10



LM/CSM UNDOCKING

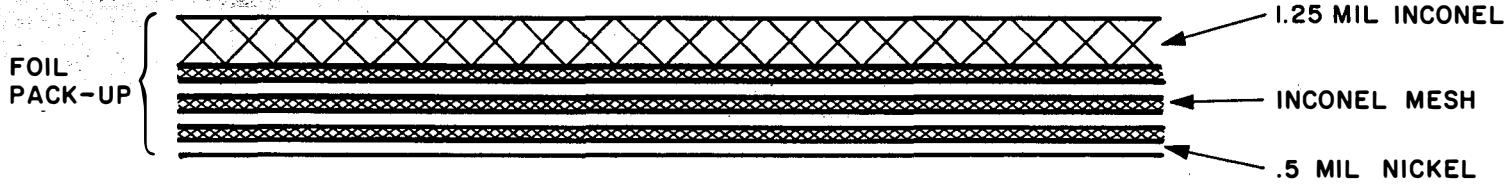
T30915 -97.1

LM-5



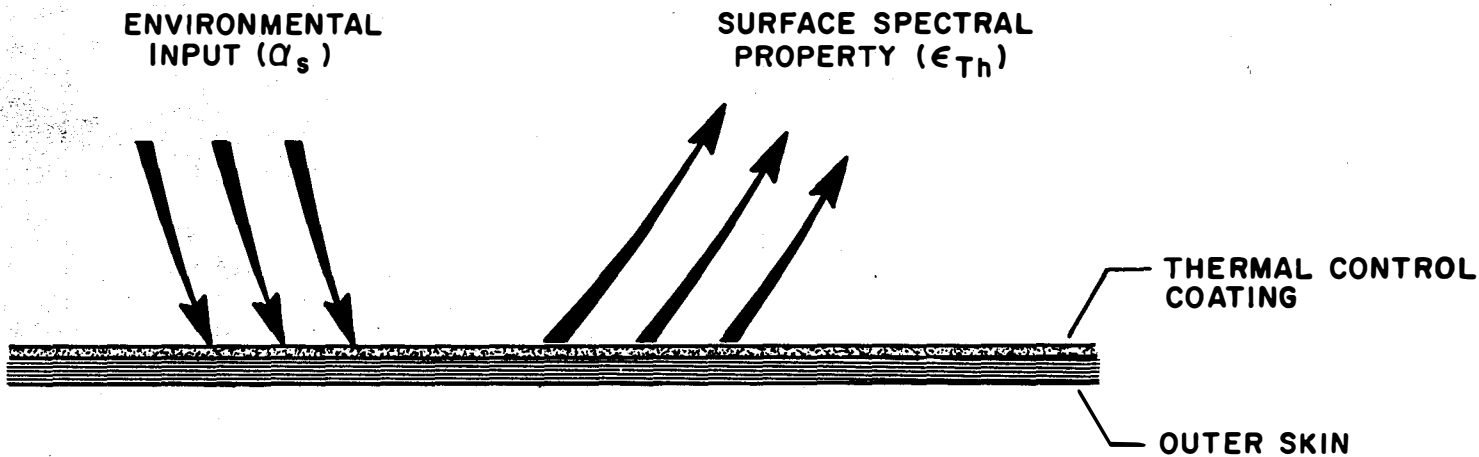
THERMAL CONTROL

T30005 -198.2



TYPICAL THERMAL SHIELD AND BLANKET

T30005-211.1

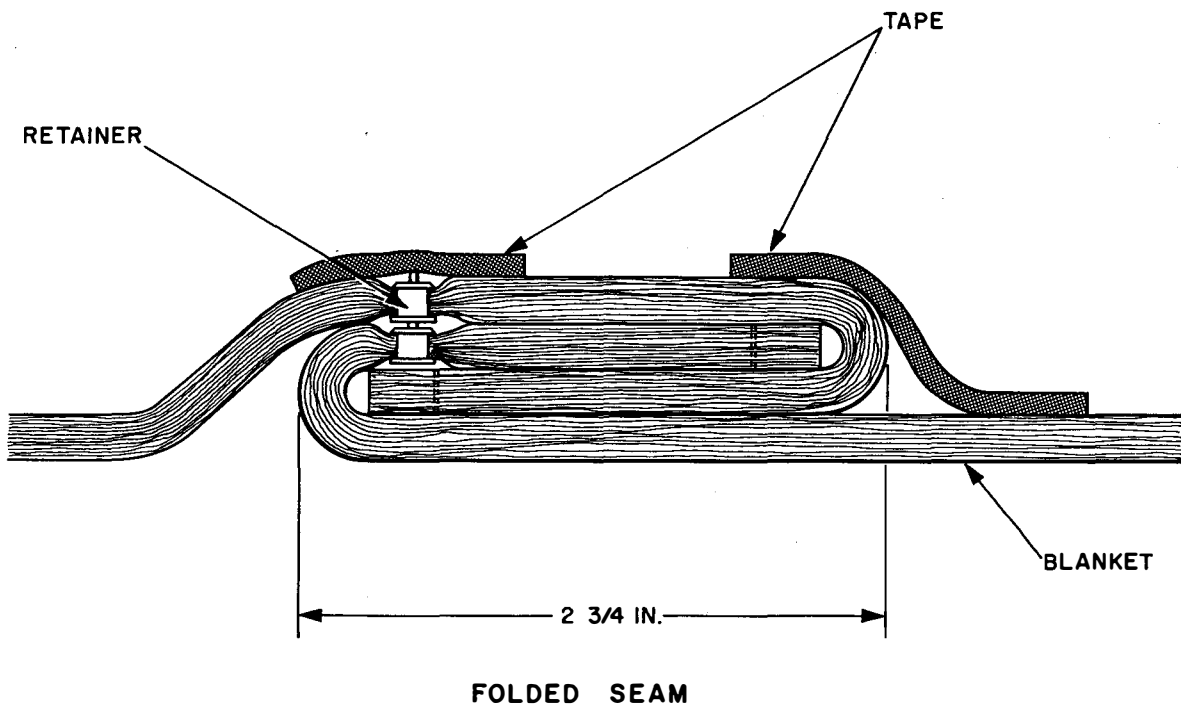
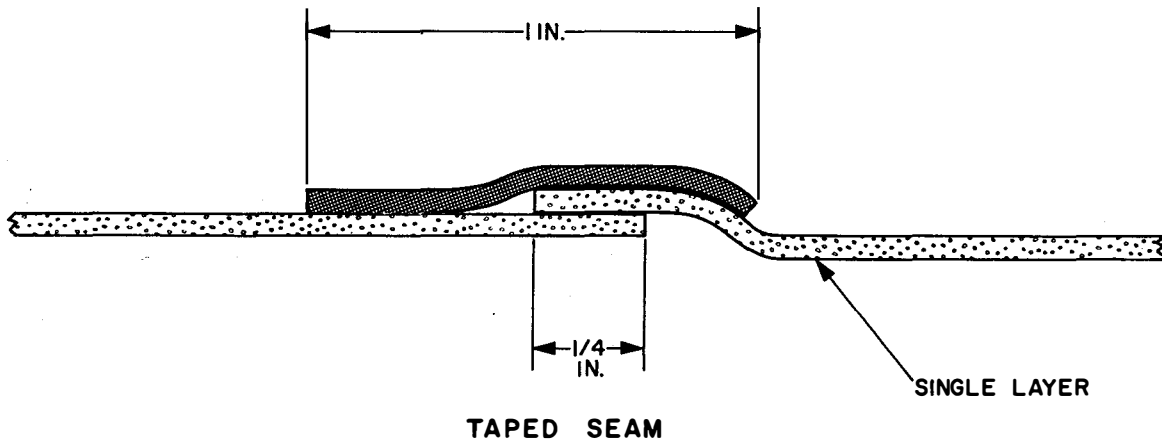


Q_s = % OF THE TOTAL SOLAR ENERGY ABSORBED BY A SURFACE. (0-1.0)

ϵ_{th} = ABILITY OF A SURFACE TO REJECT HEAT TO SPACE. (0-1.0)

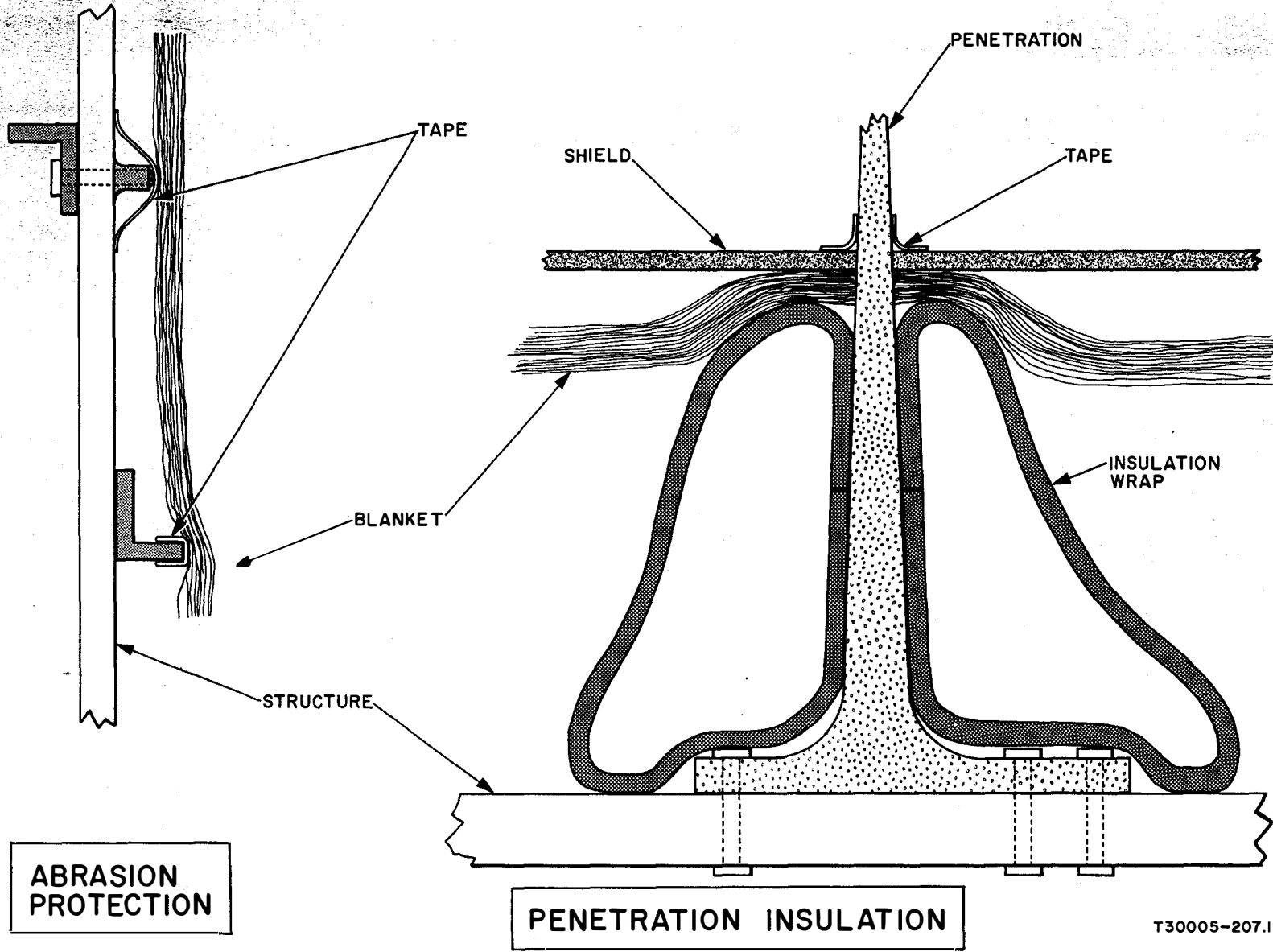
THERMAL CONTROL COATING

T30005-204.1

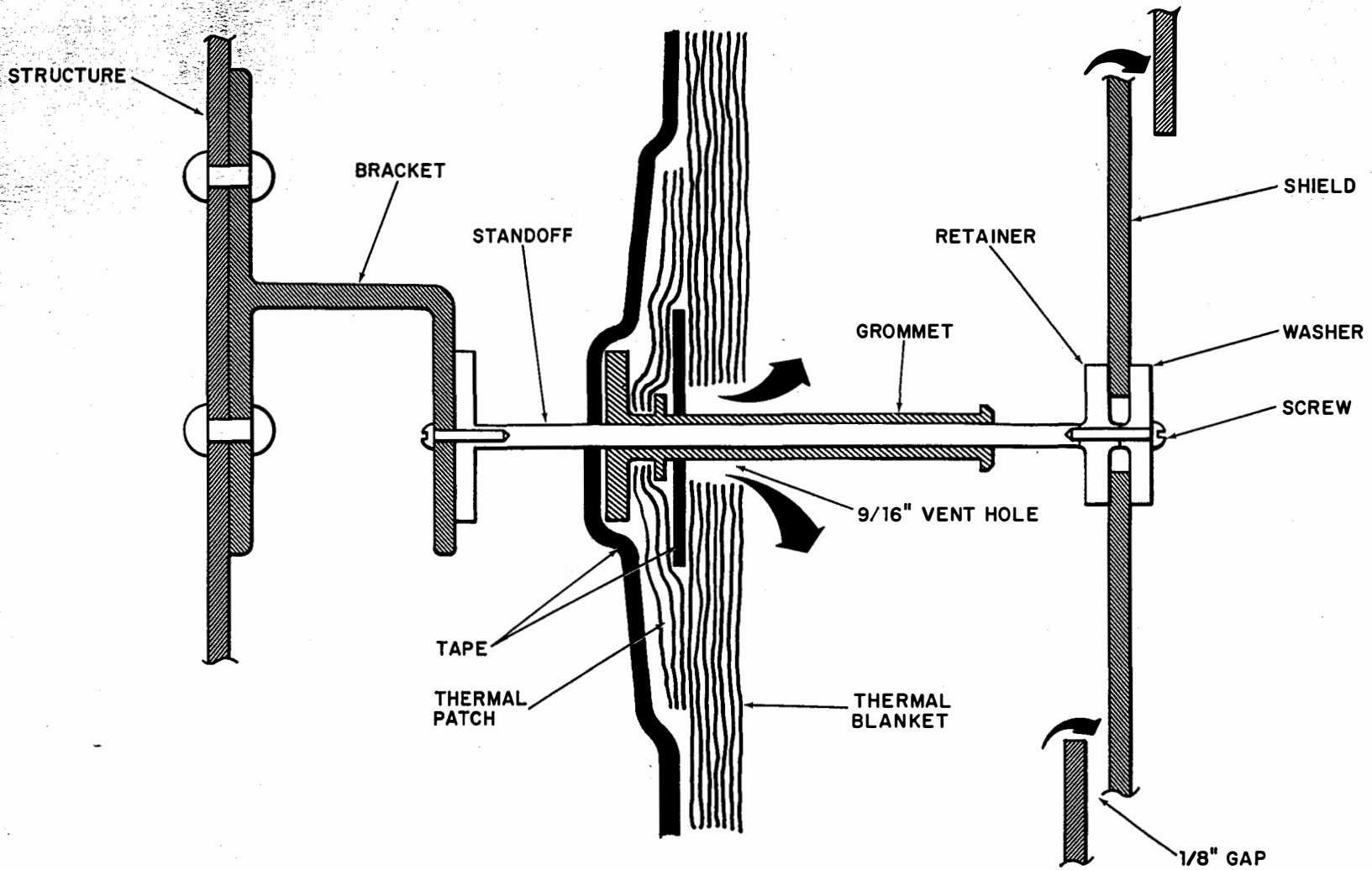


BLANKET JOINING

T30005-205.1



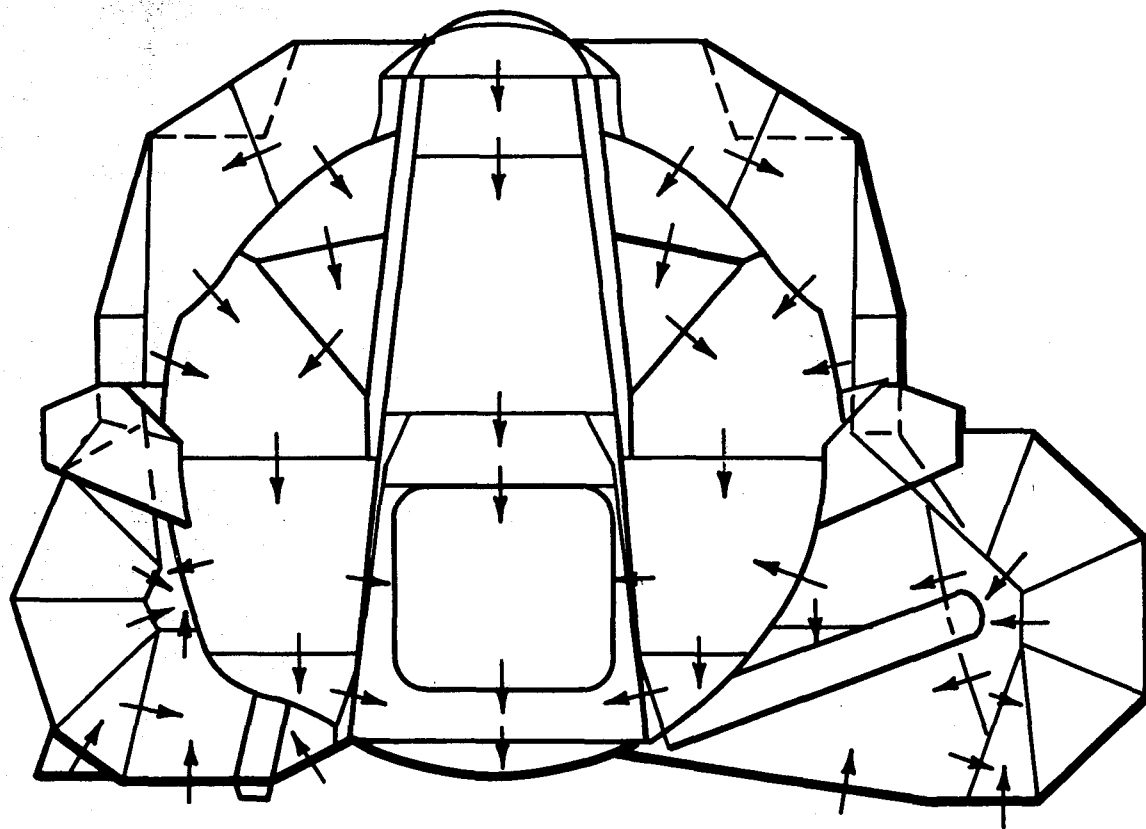
T30005-207.1



STANDOFF INSTALLATION AND BLANKET VENTING

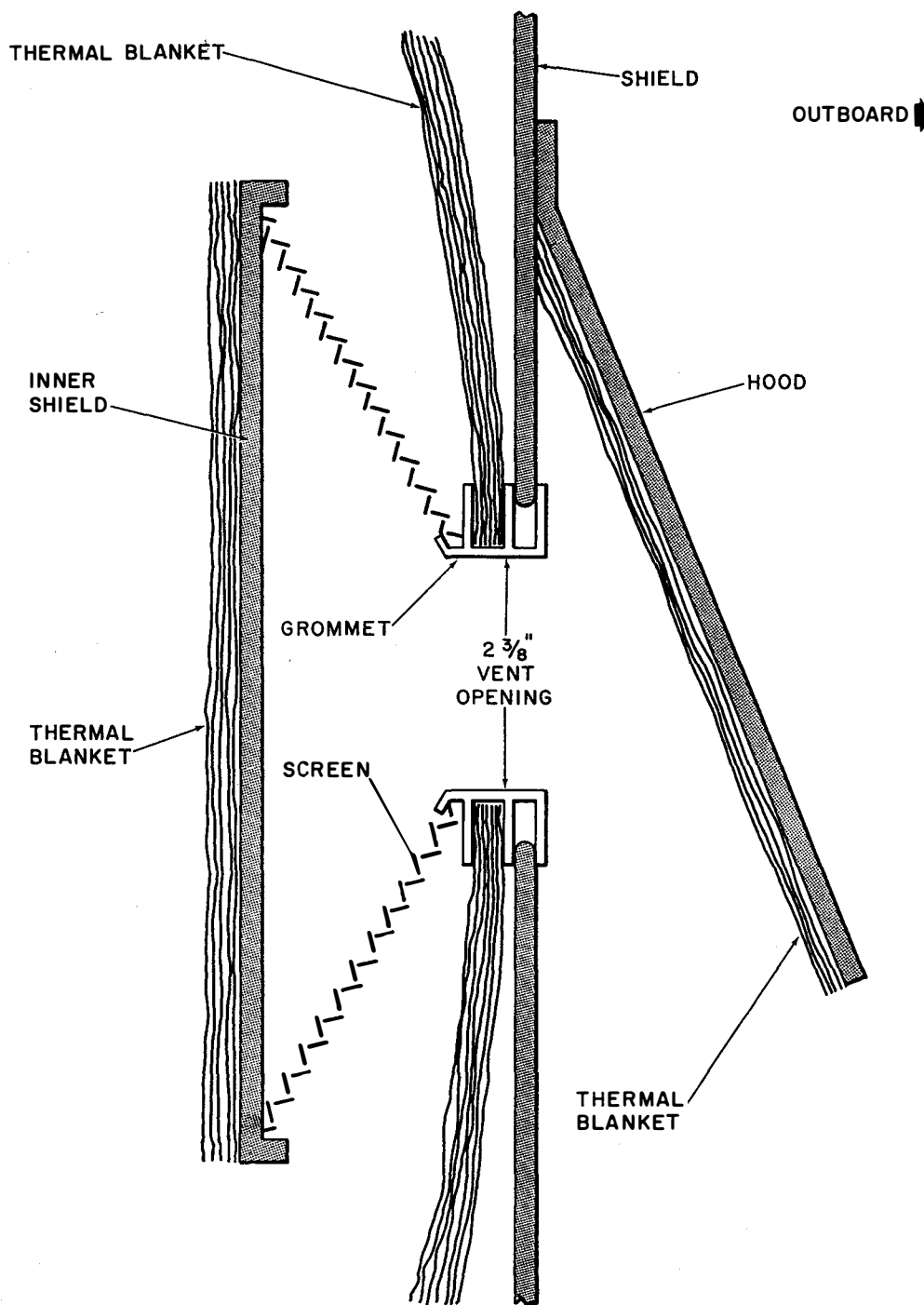
T30005-212

IM-5



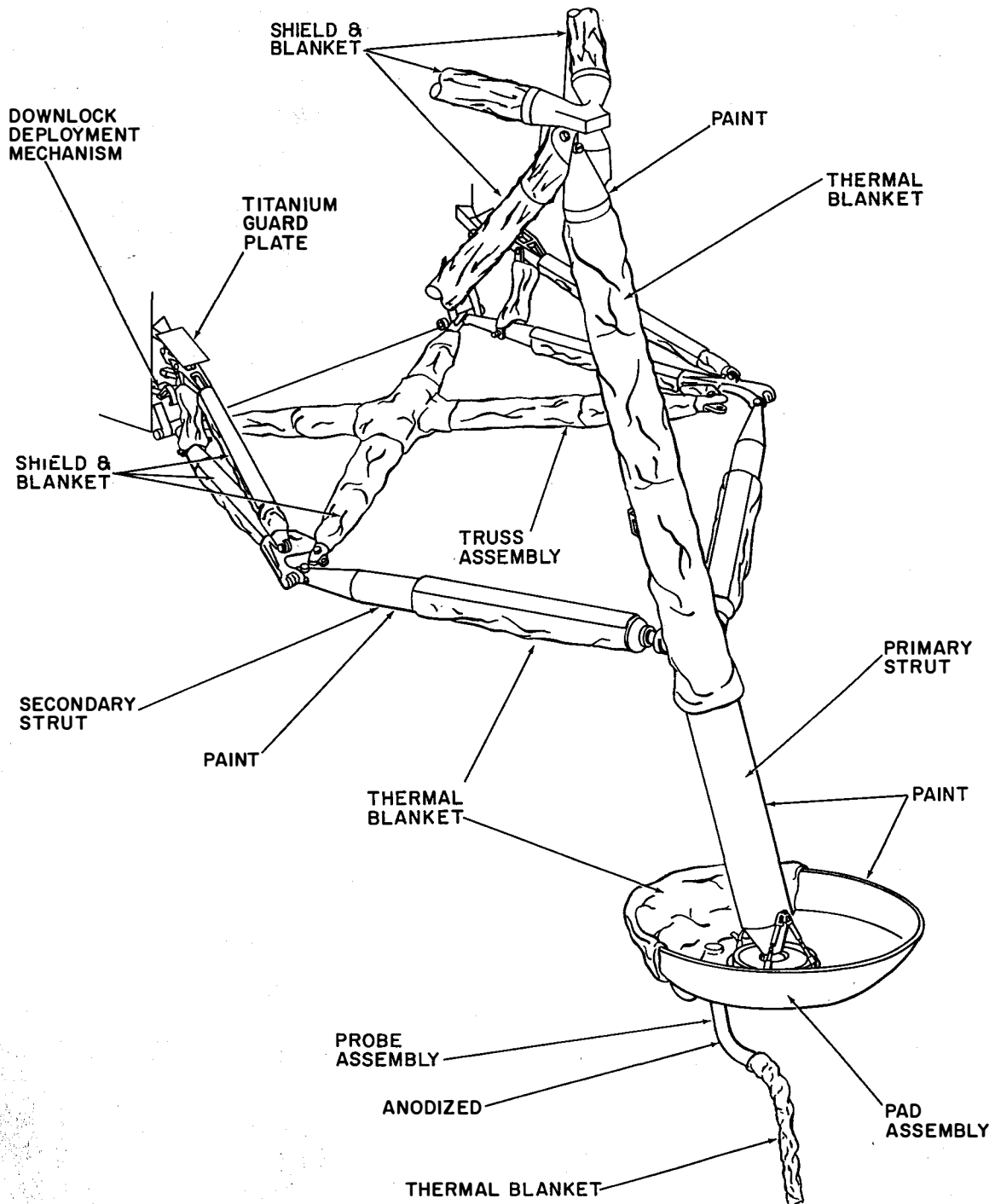
PANEL SHINGLING
FRONT VIEW

T30005 - 203.1



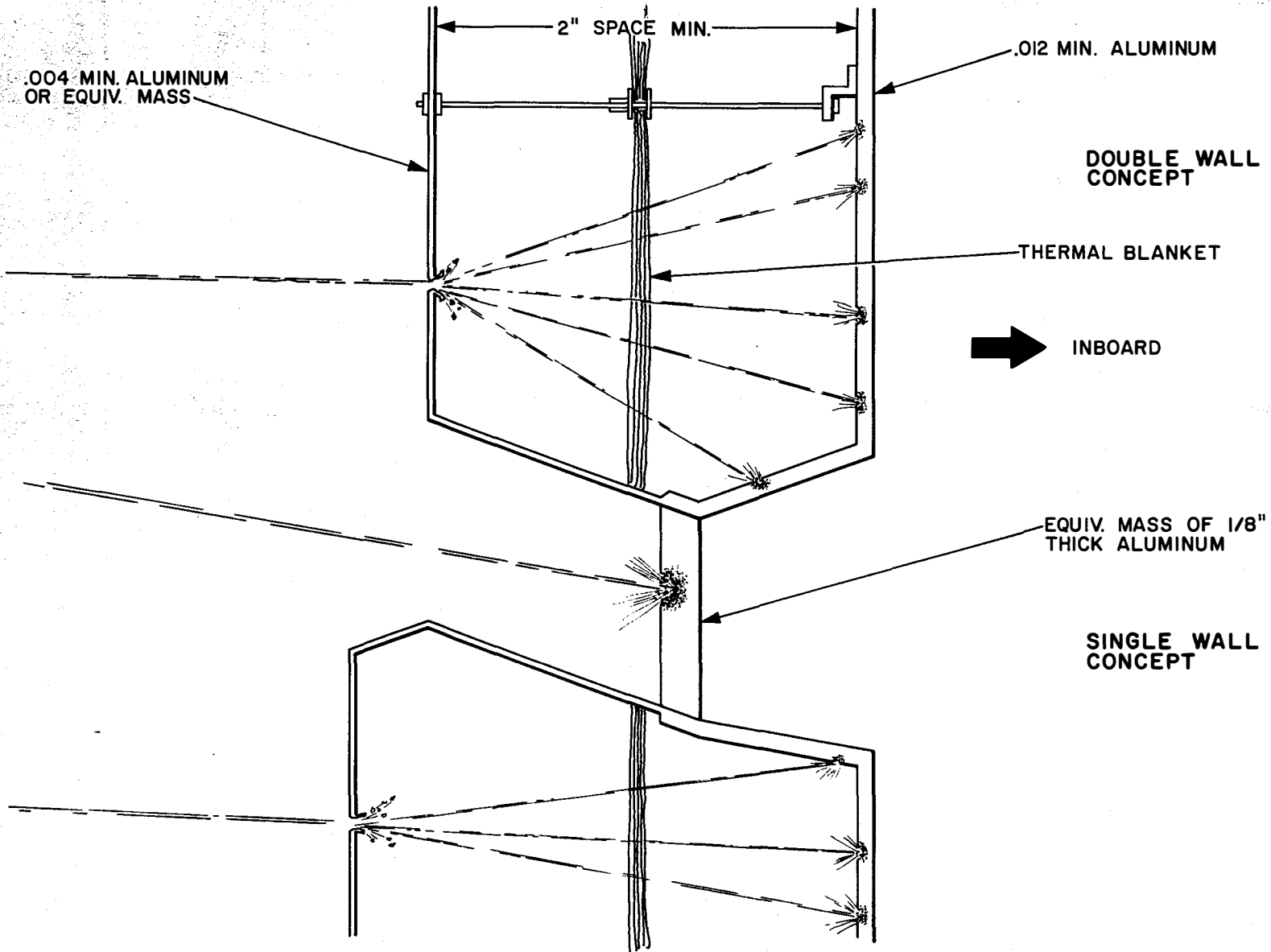
BAY VENT

T30005-215.1



LANDING GEAR THERMAL PROTECTION

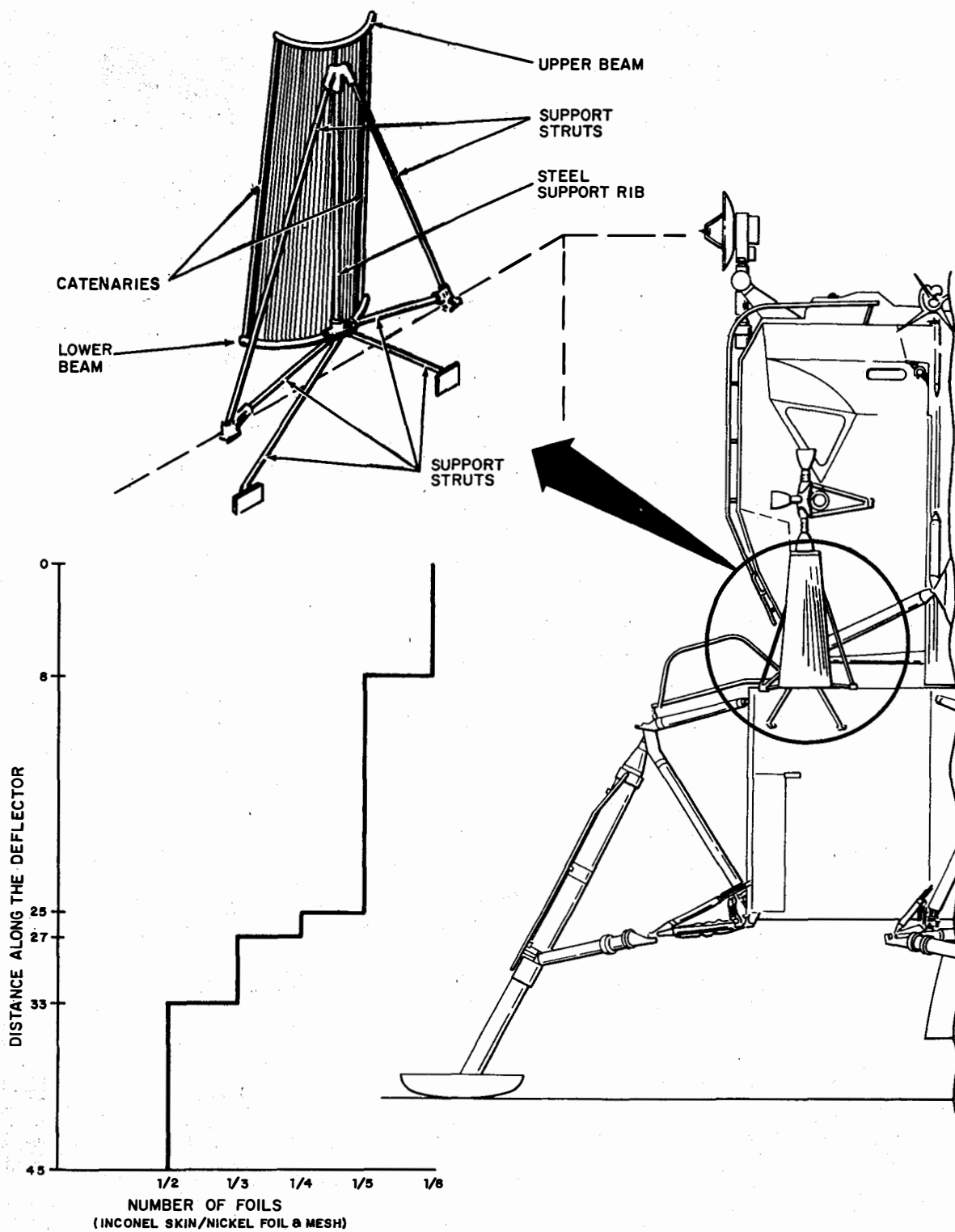
T30915-101.2



MICRO-METEOROID PROTECTION

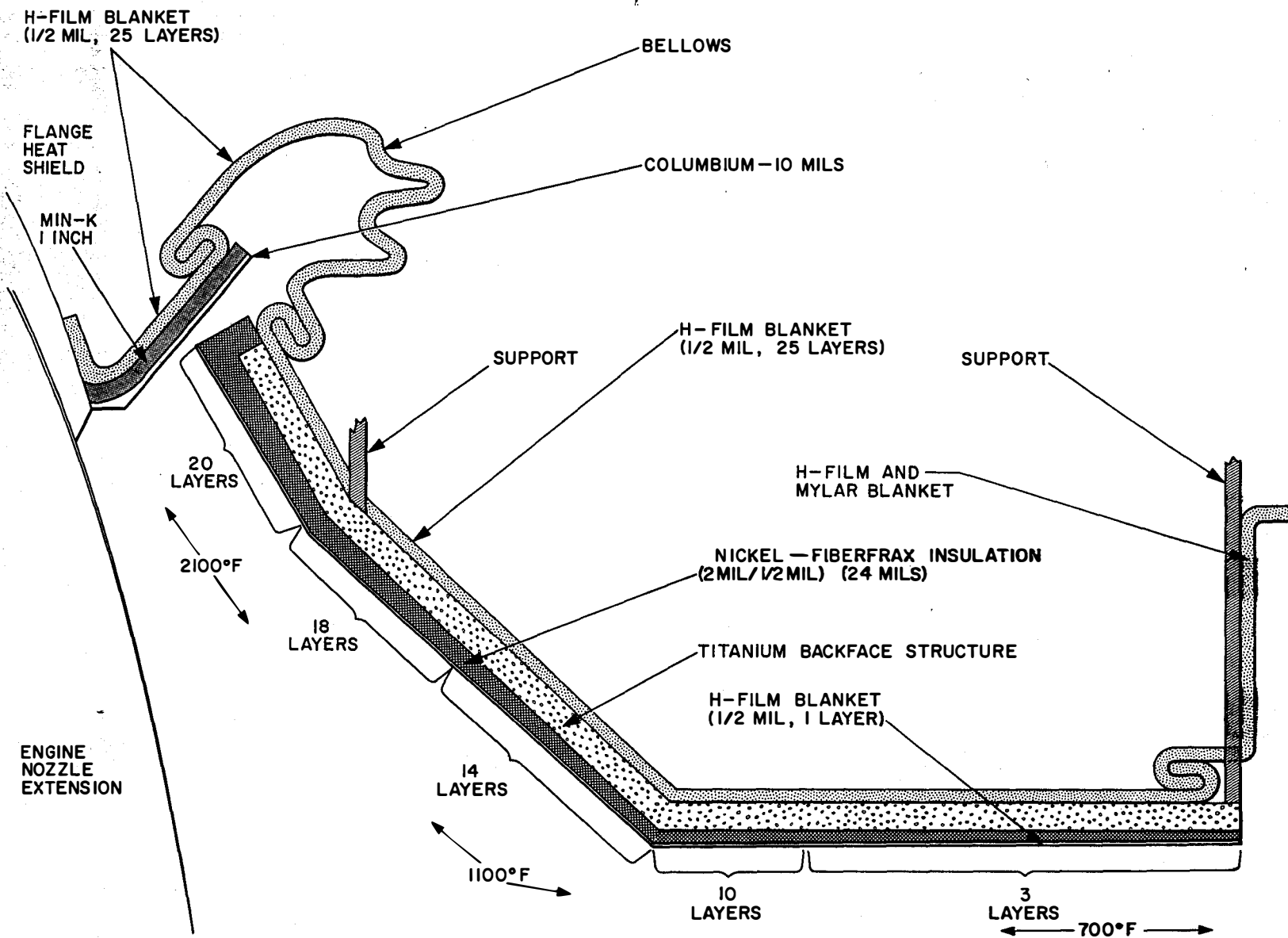
T30005-202.2

LM-5



RCS PLUME DEFLECTOR

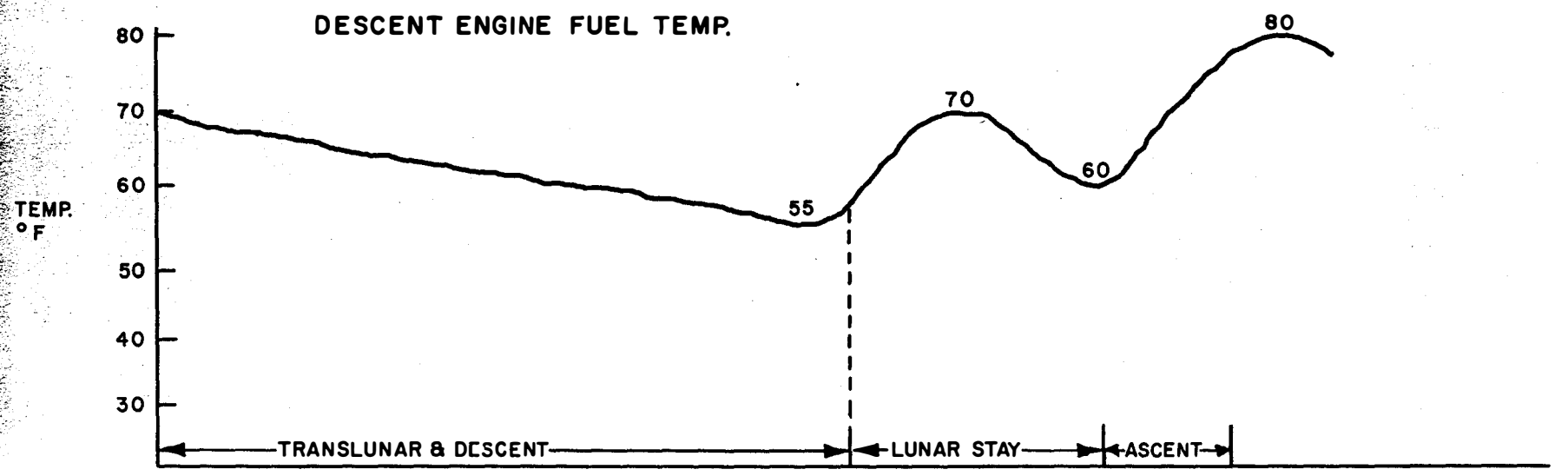
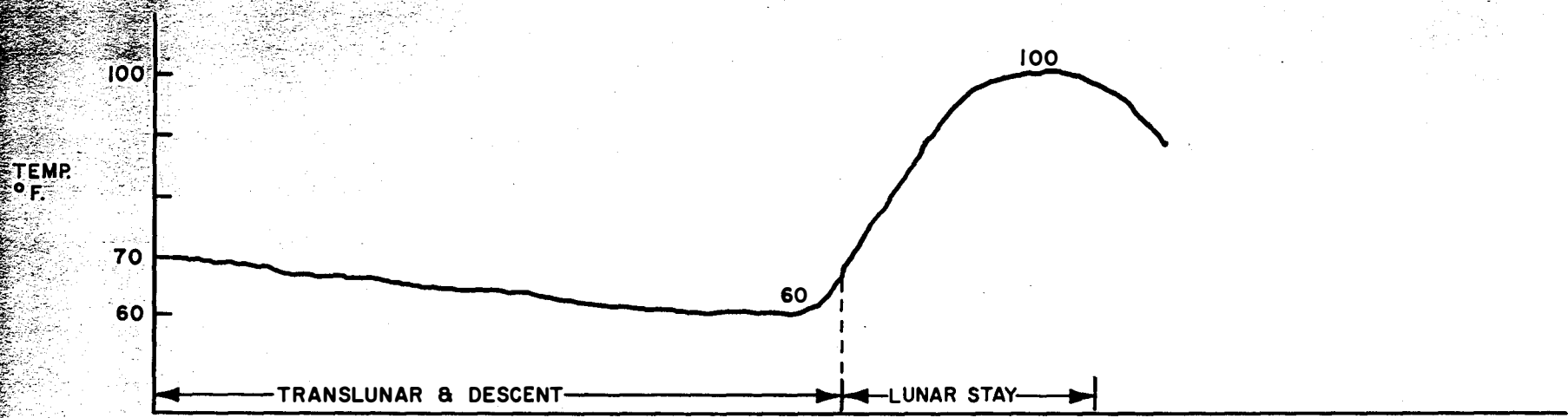
T30005-216



DESCENT STAGE BASE HEAT SHIELD

T30005-196.2

LM-5

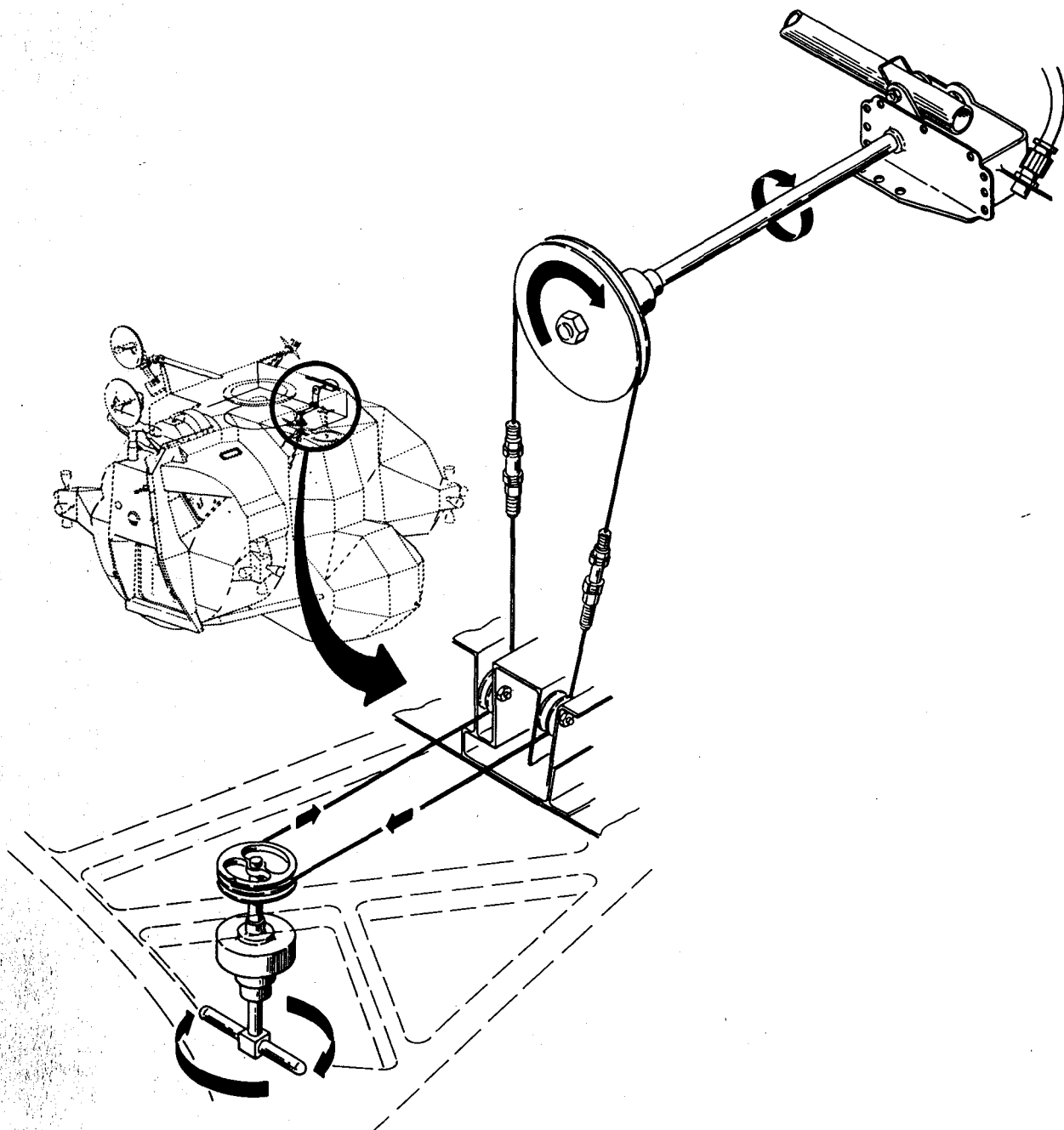


CABIN TEMP.

TEMPERATURE GRAPHS

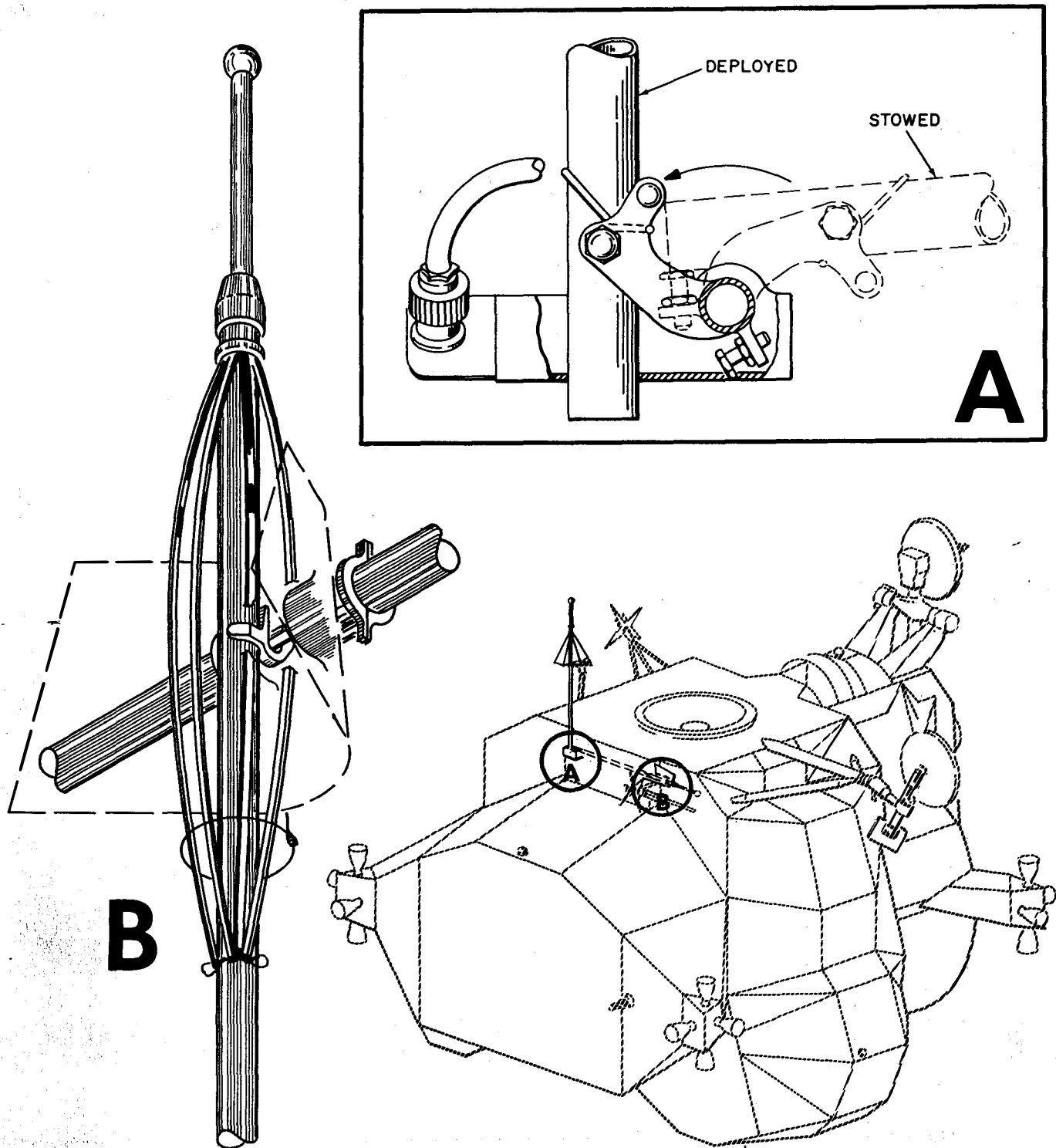
T30005-206.2

LM-5



EVA ANTENNA ERECTION MECHANISM (1)

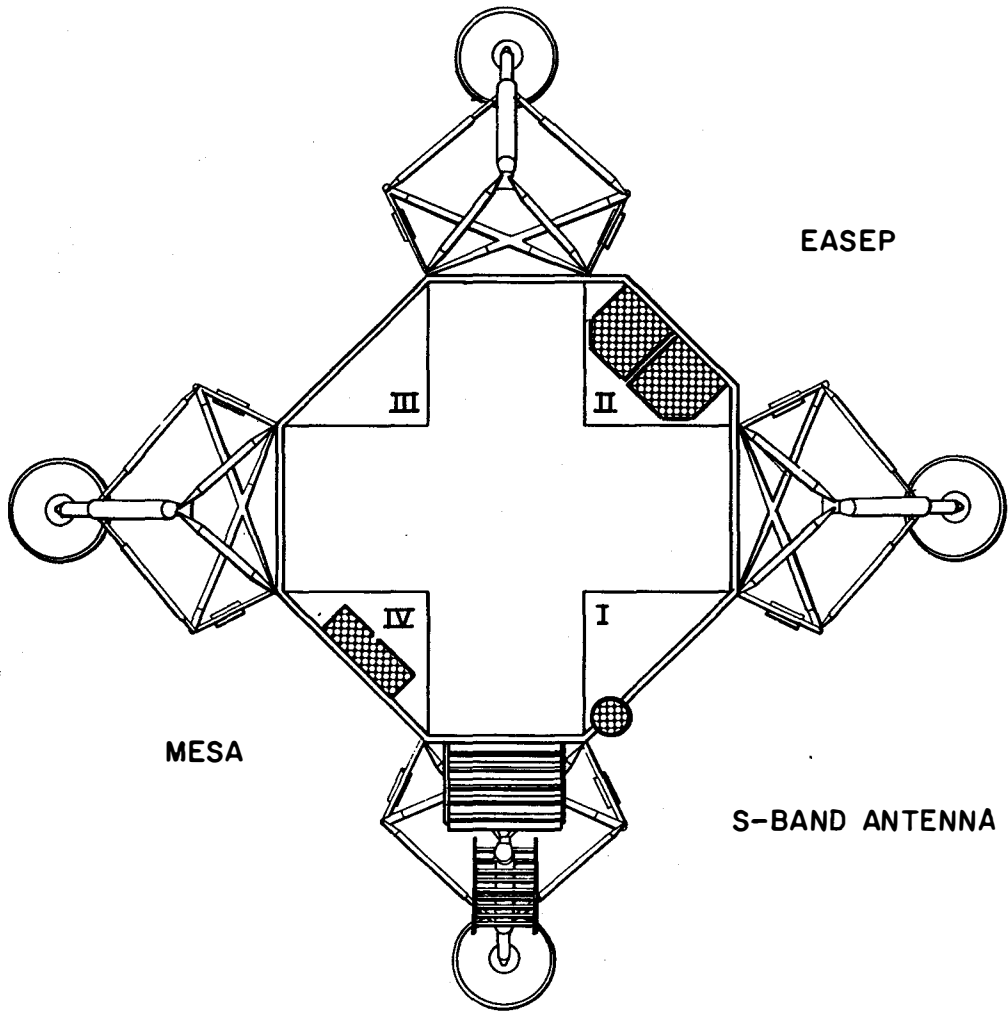
T30715-142



EVA ANTENNA ERECTION MECHANISM (2)

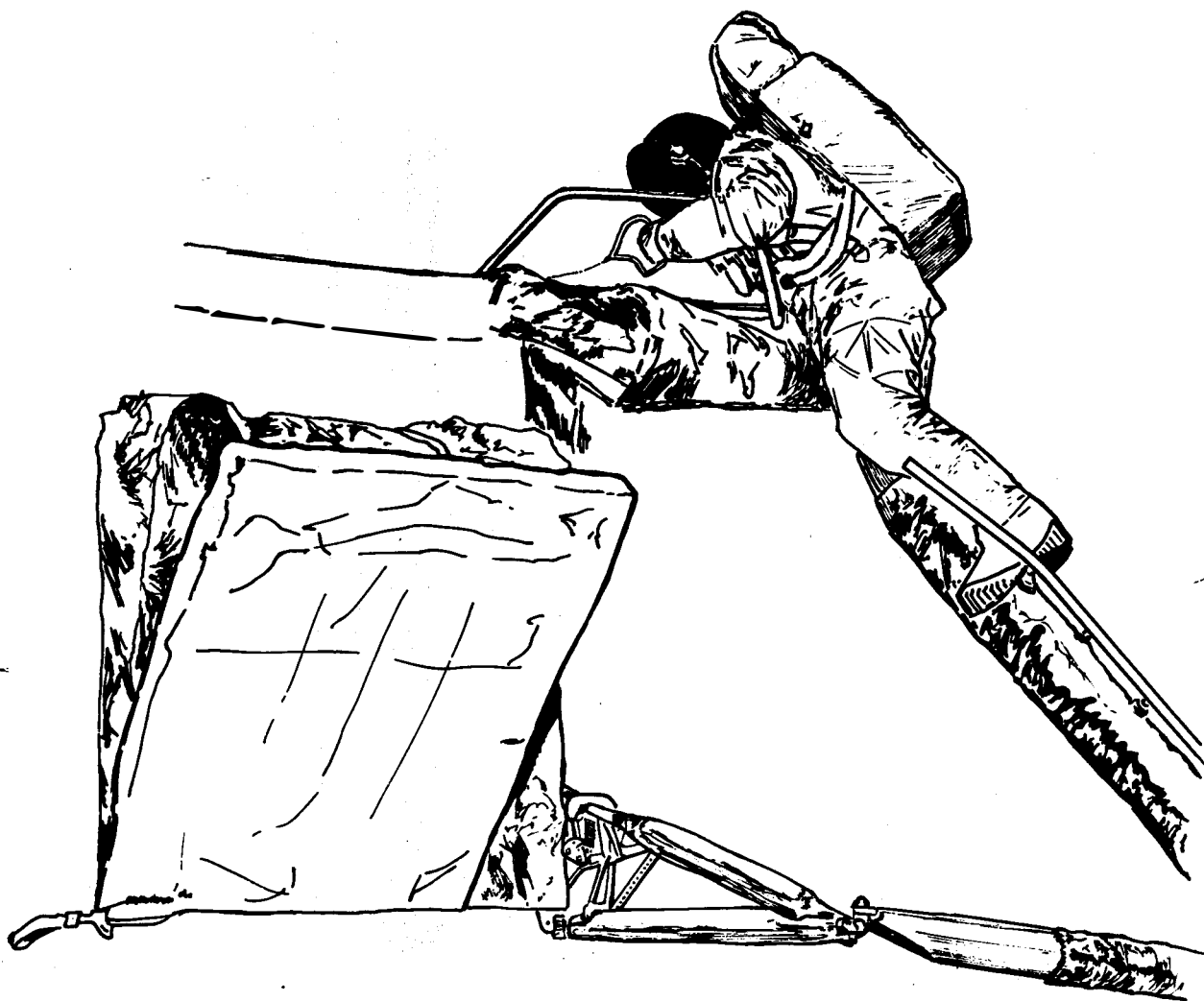
T30715-145

CHAPTER 2



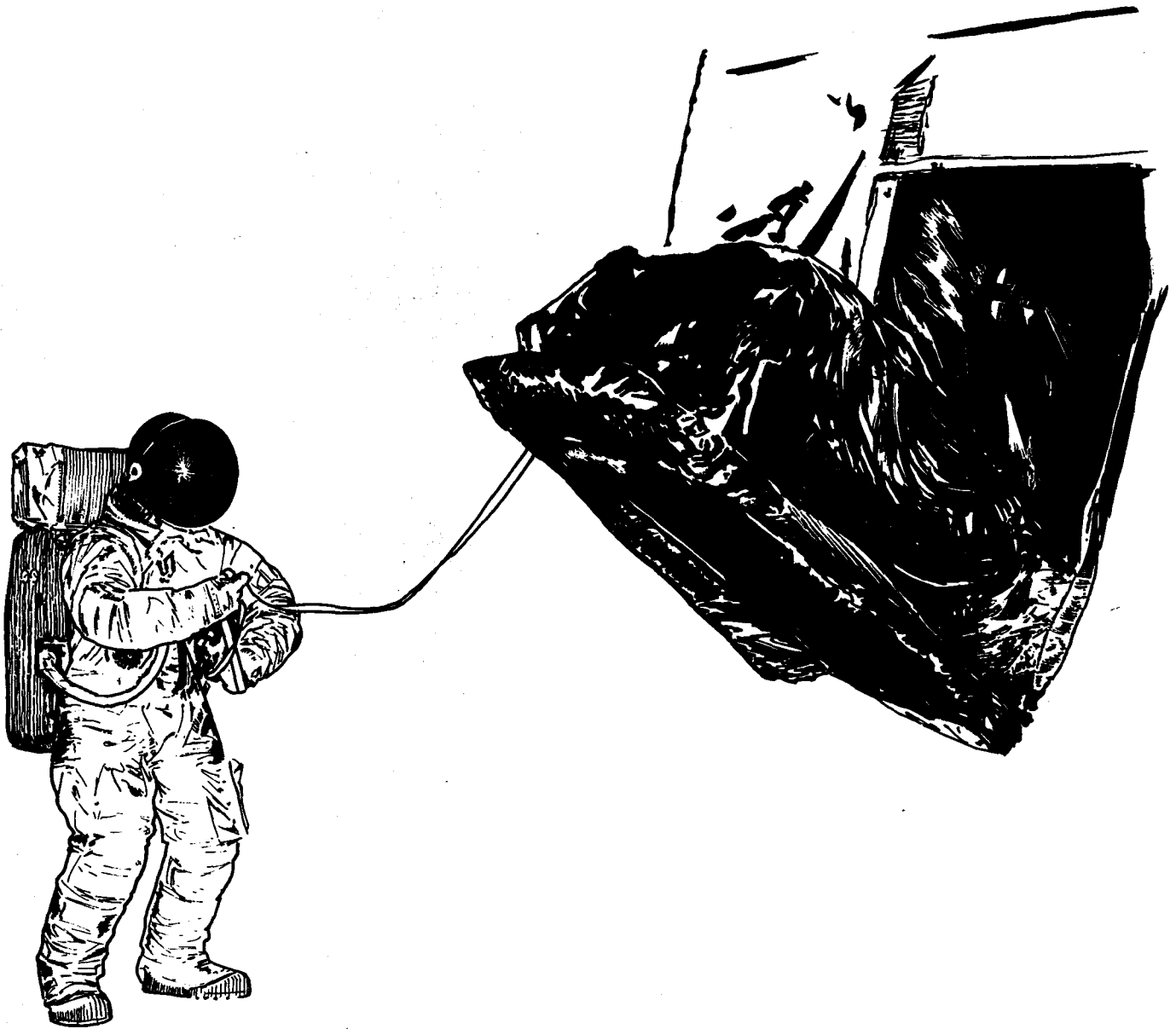
EQUIPMENT LOCATIONS-DESCENT STAGE

T30005-220



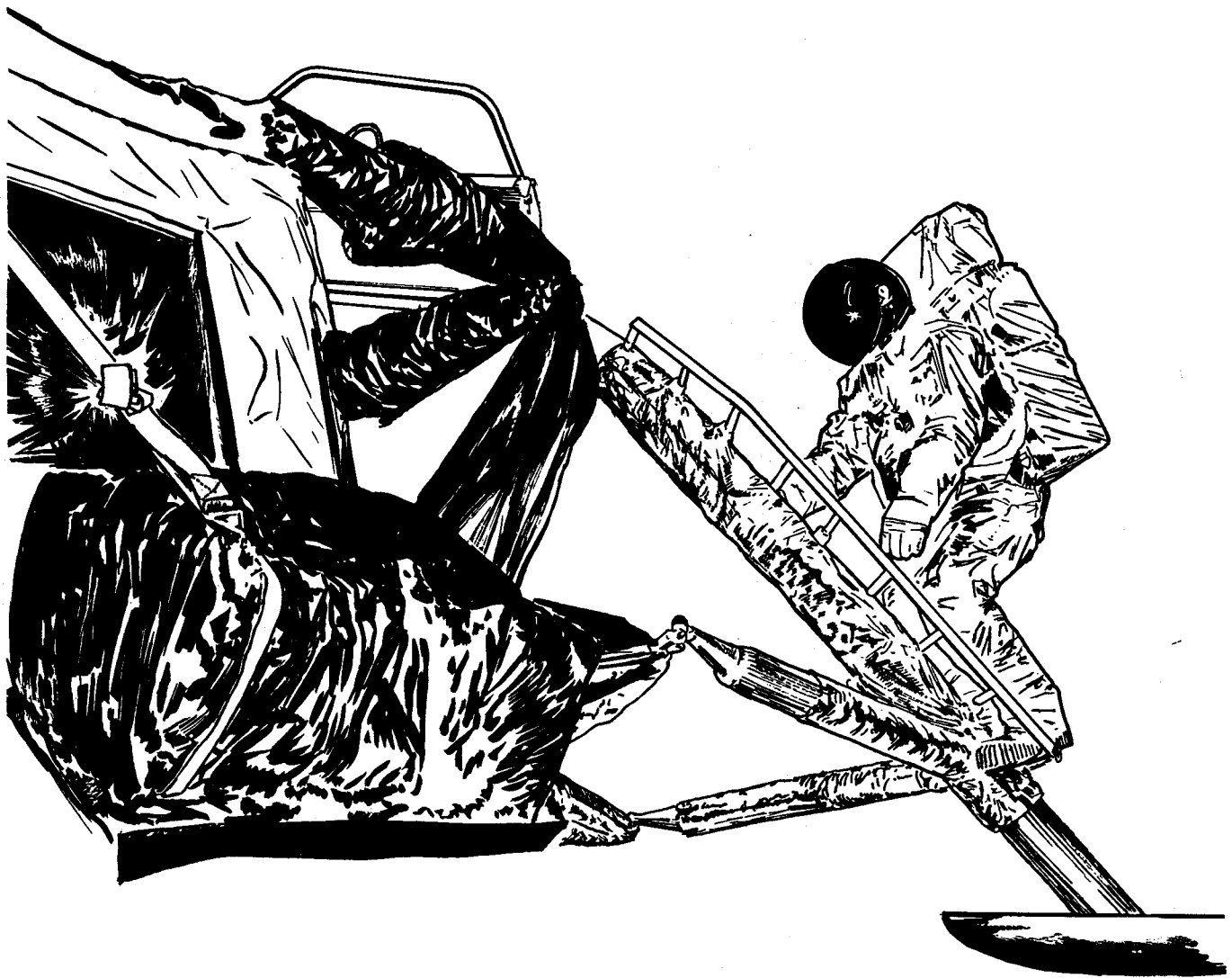
MESA DEPLOYMENT

T30005-222



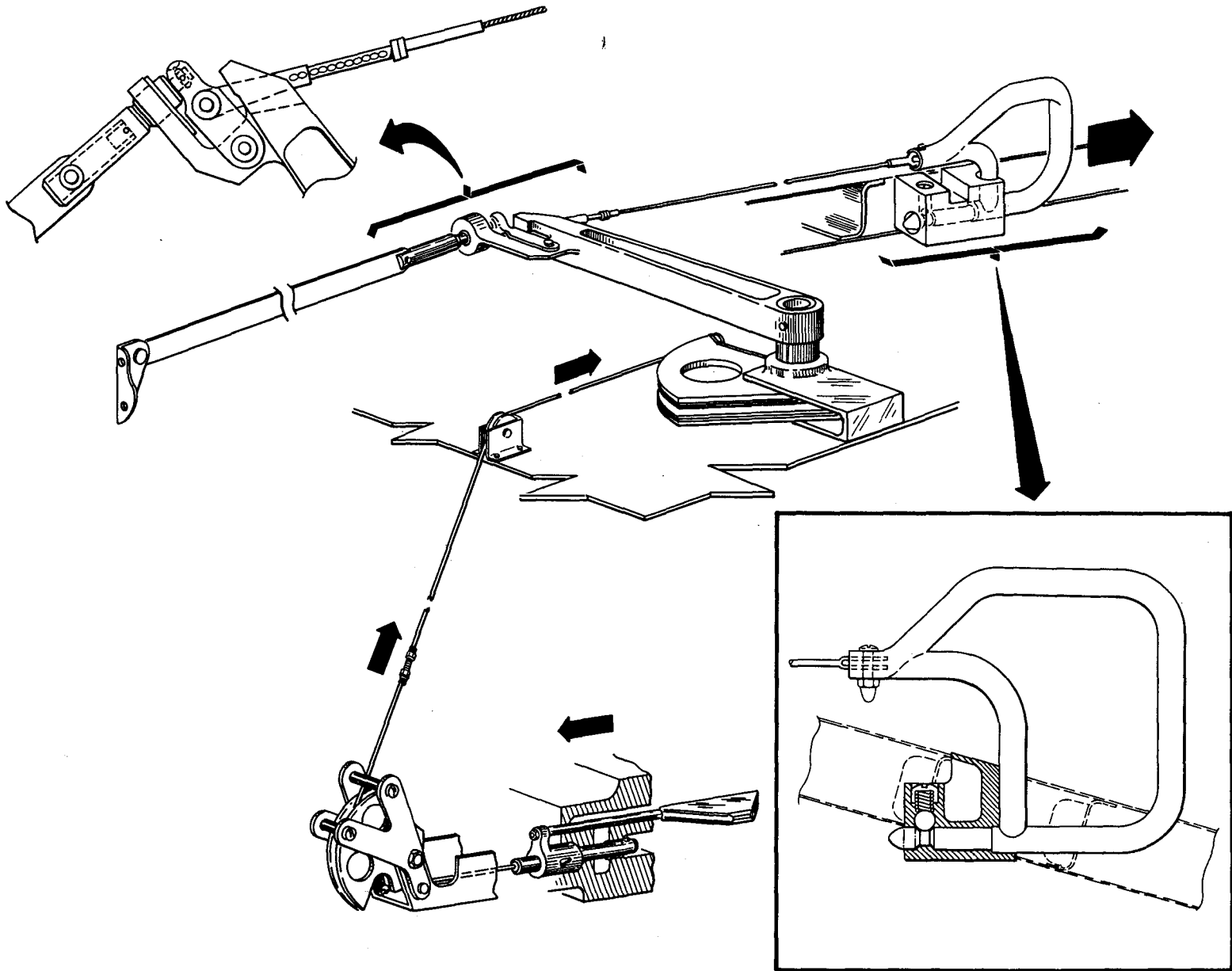
BACK-UP DEPLOYMENT

T30005-221



MESA DEPLOYED

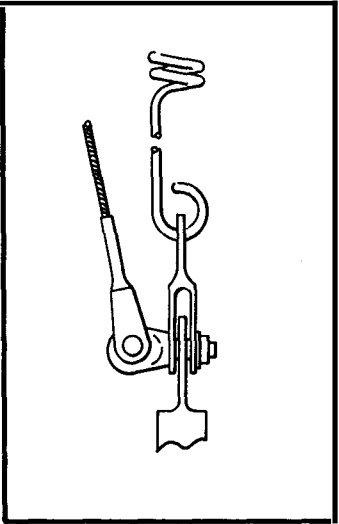
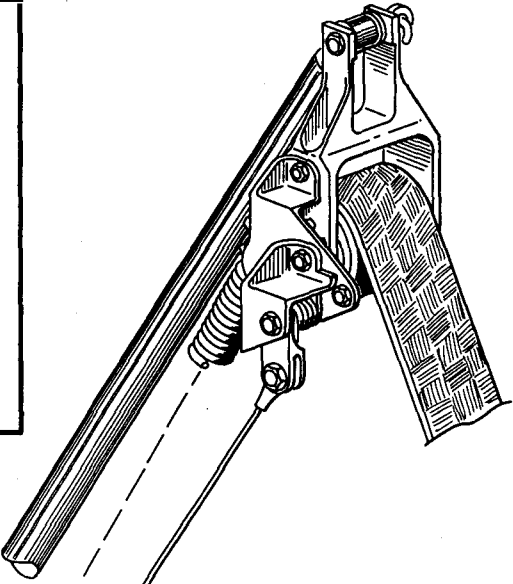
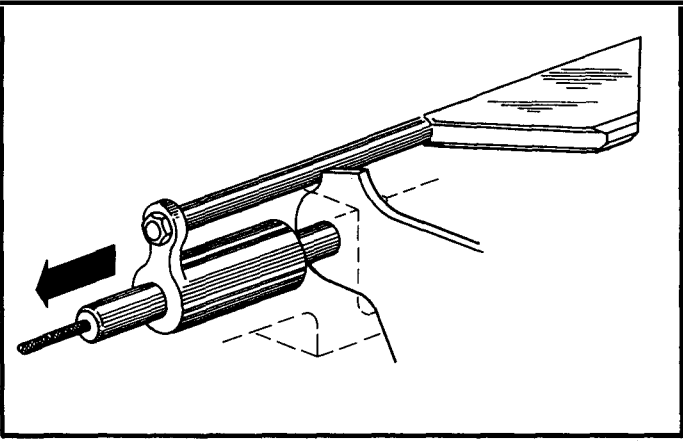
T30005-223.1



MESA DEPLOYMENT MECHANISM

T30005-227

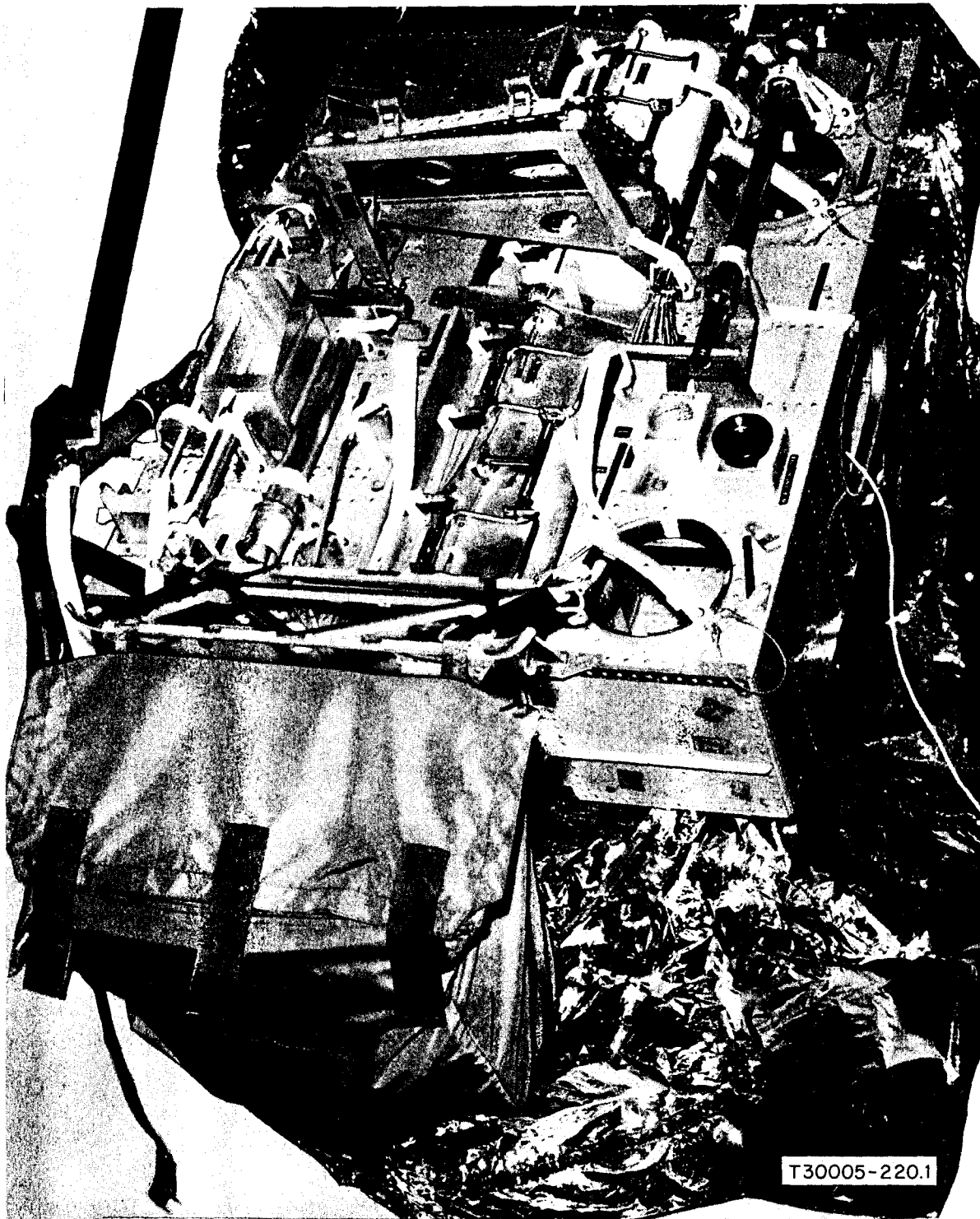
LM-5



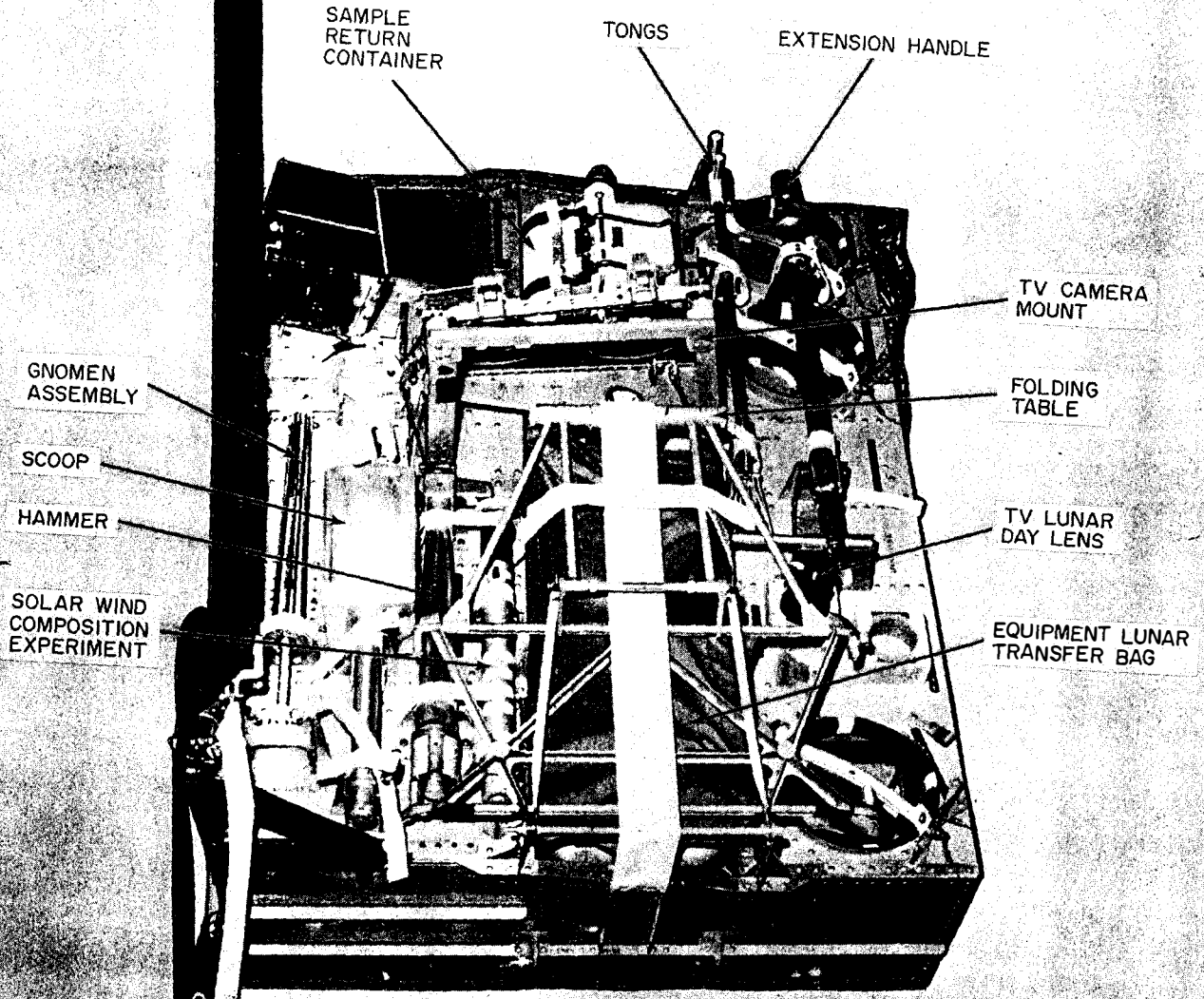
MESA DEPLOYMENT RATCHET/SPRING ASSEMBLY

T30005-226

LM-5



MODULARIZED EQUIPMENT STOWAGE ASSEMBLY
MESA PALLET



MESA PALLET WITH EQUIPMENT

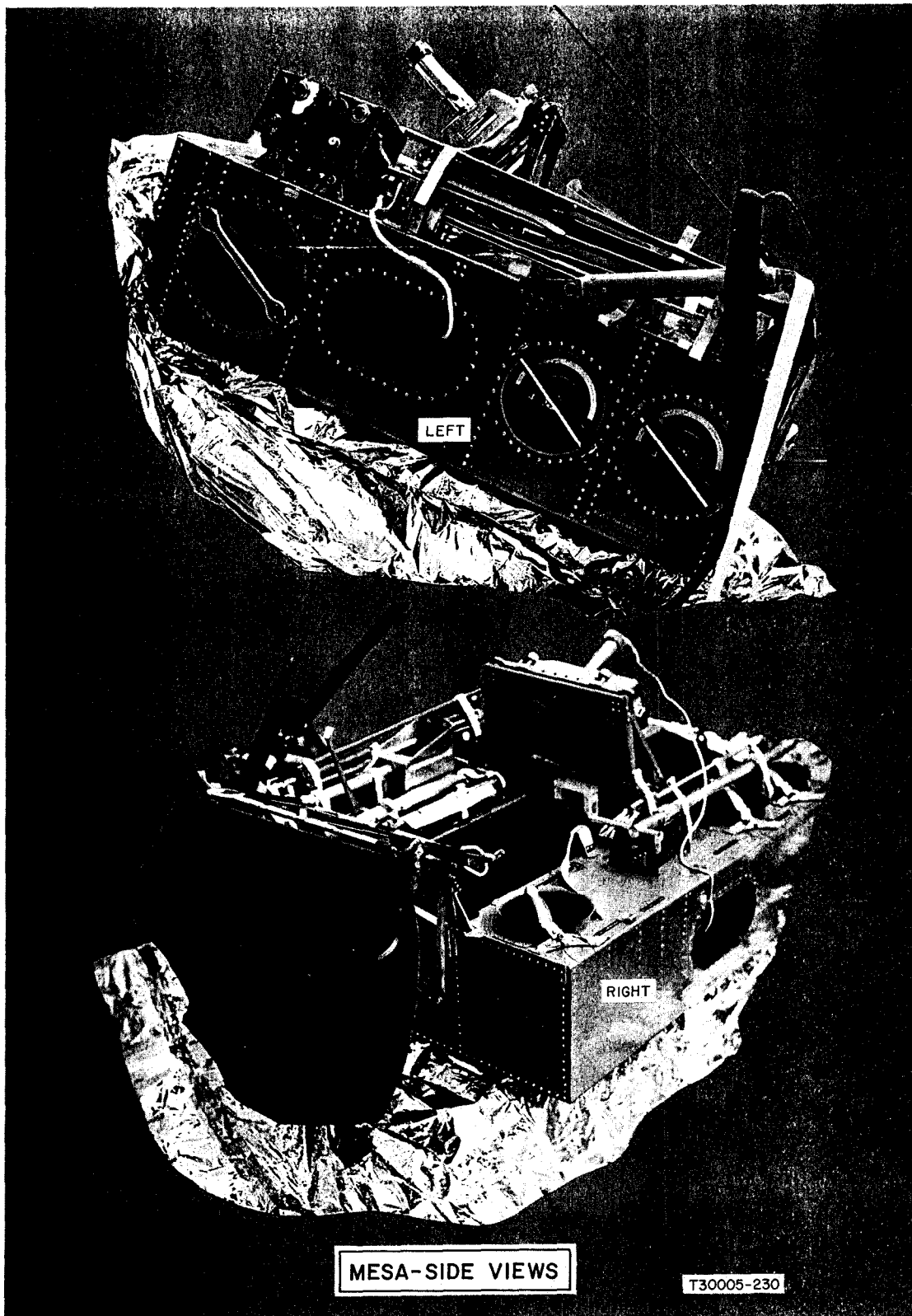
T30005-225.1

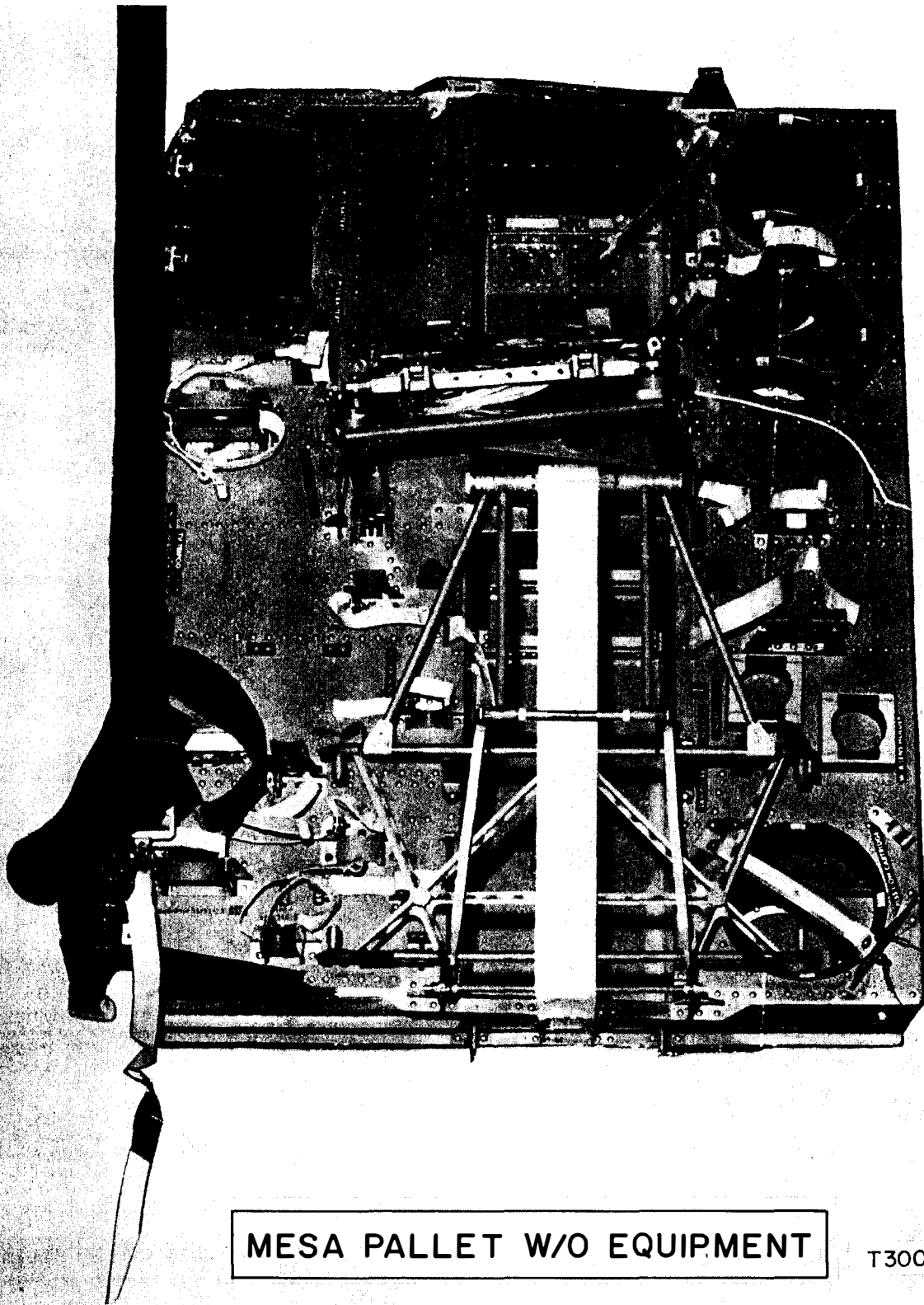
Date: May 1969

FOR TRAINING PURPOSES ONLY

MESA STOWAGE LIST - IM-5

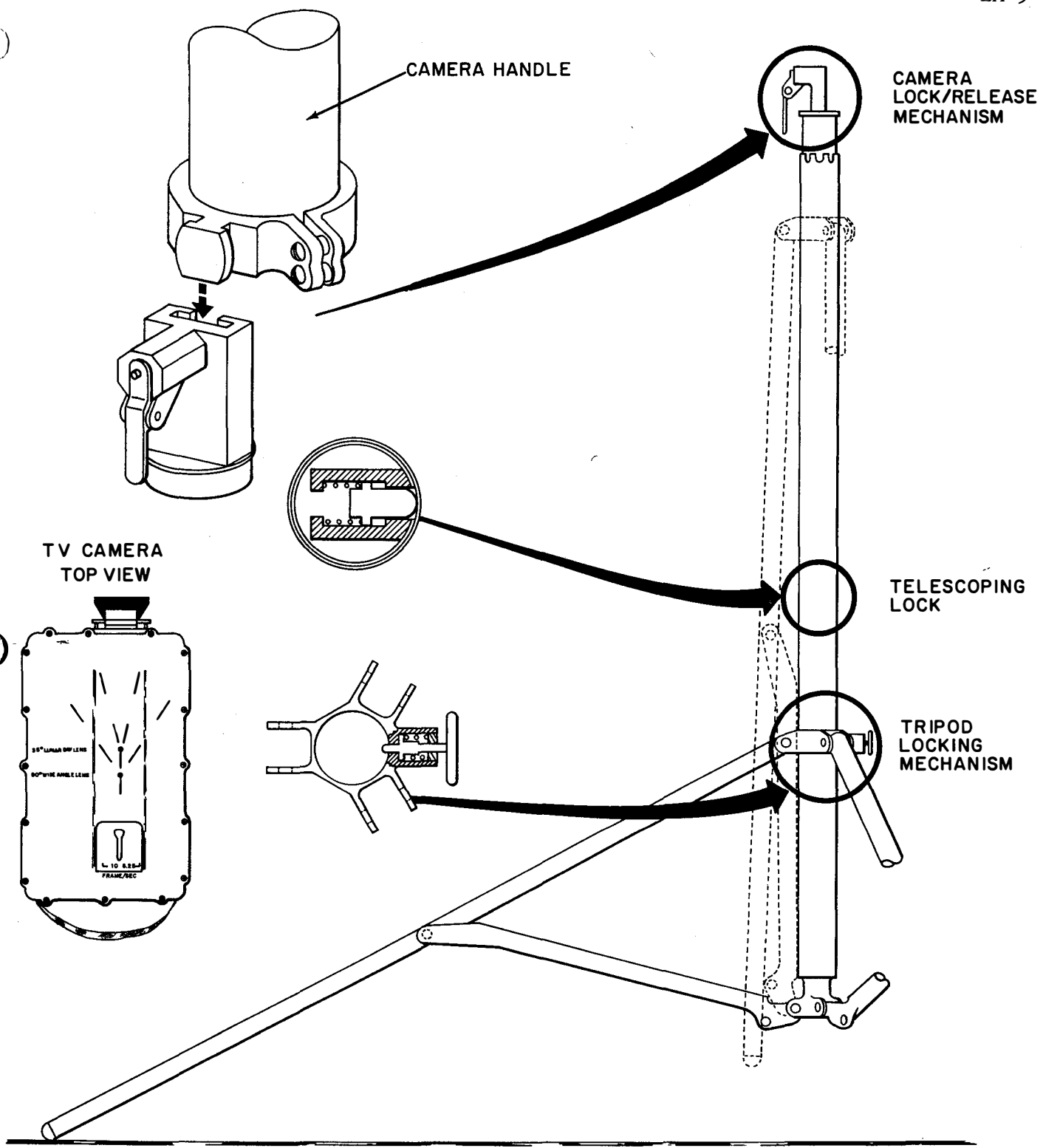
<u>Item</u>	<u>Weight</u> <u>Lbs.</u>	<u>Qty</u>	<u>Earth</u> <u>Launch</u>	<u>Lunar</u> <u>Launch</u>	<u>IM/CSM</u> <u>Transfer</u>
Lunar Television Subsystem					
Lunar Television Camera	7.2	1	*		
TV Wide Angle Lens	.4	1	*		
TV Lunar Day Lens	.4	1	*		
TV Cable Assembly (100 ft)	2.4	1	*		
TV Tripod Assembly	1.74	1	*		
Equipment Lunar Transfer Bag		1	*		
S-Band Antenna Cable	6.0	1	*		
Lunar Sample Scoop	.9	1	*		
Extension Handle	1.2	1	*		
Tongs	.3	1	*		
Gnomon Assembly	.5	1	*		
Hammer	1.8	1	*		
Solar Wind Composition Exp	1.0	1	*	*SRC #2	*SRC #2
Close Up Stereo Camera		1	*	*Film	*Film
Sample Return Container #1	15.6	1	*	*	*
Scale		1			
Solar Wind Composition Bag		1			
Sample Bags		5			
Packing Material					
Bulk Sample Container		1			
Sample Return Container #2	20.9	1	*	*	*
Solar Wind Composition Bag		1			
Core Tubes		2			
Documentation Sample Collection Bag		1			
Sample Bags		15			
Gas Analysis Container		1			
Lunar Environment Sample Container		1			
Packing Material					





MESA PALLET W/O EQUIPMENT

T30005-224.1



TV CAMERA AND TRIPOD

T30915-119.1



T30005-229

CLOSEUP STEREO CAMERA-STOWED



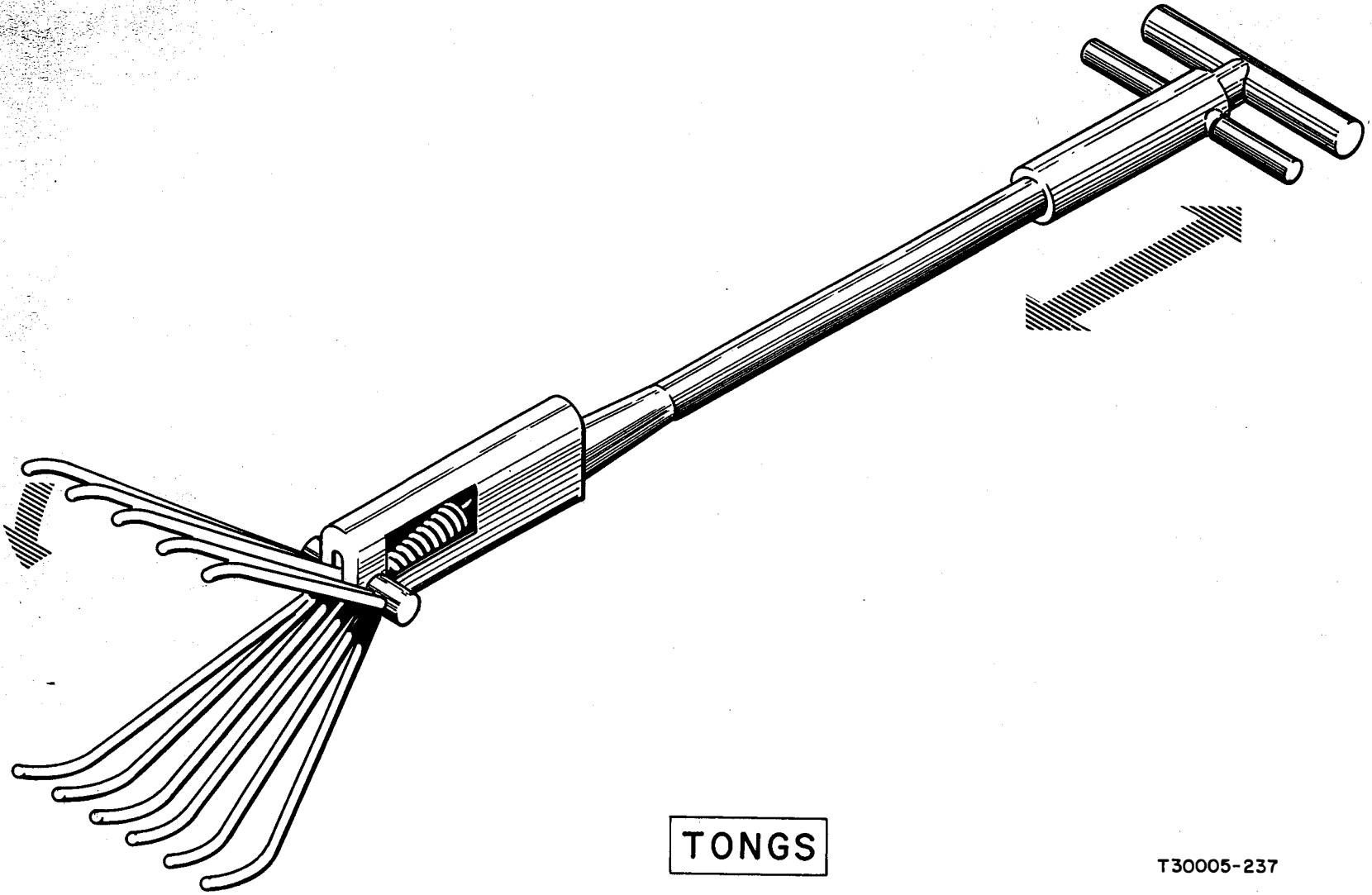
CLOSEUP STEREO CAMERA

T30005-228

Date: May 1969

FOR TRAINING PURPOSES ONLY

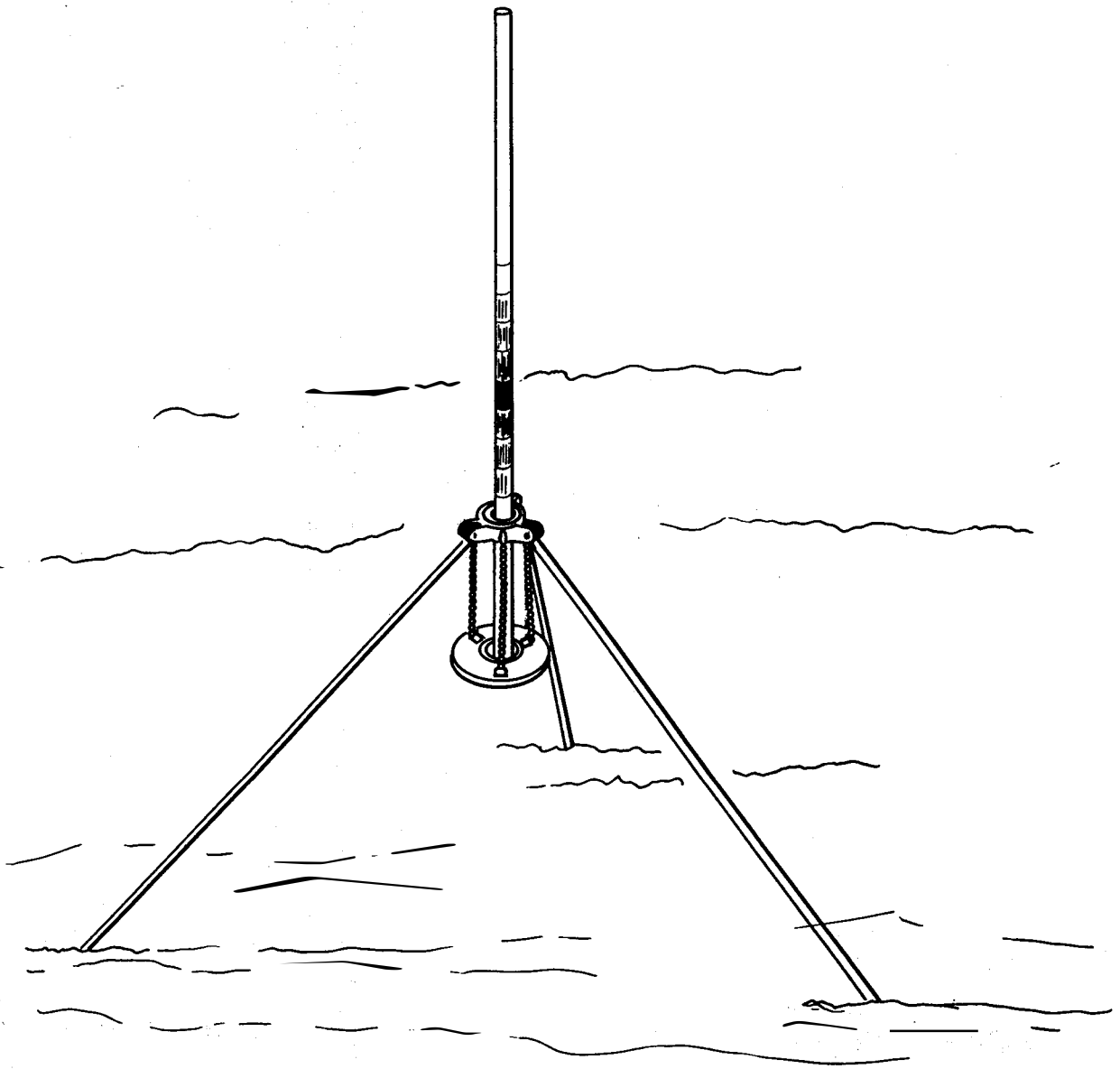
Page 2-15



TONGS

T30005-237

LM-5



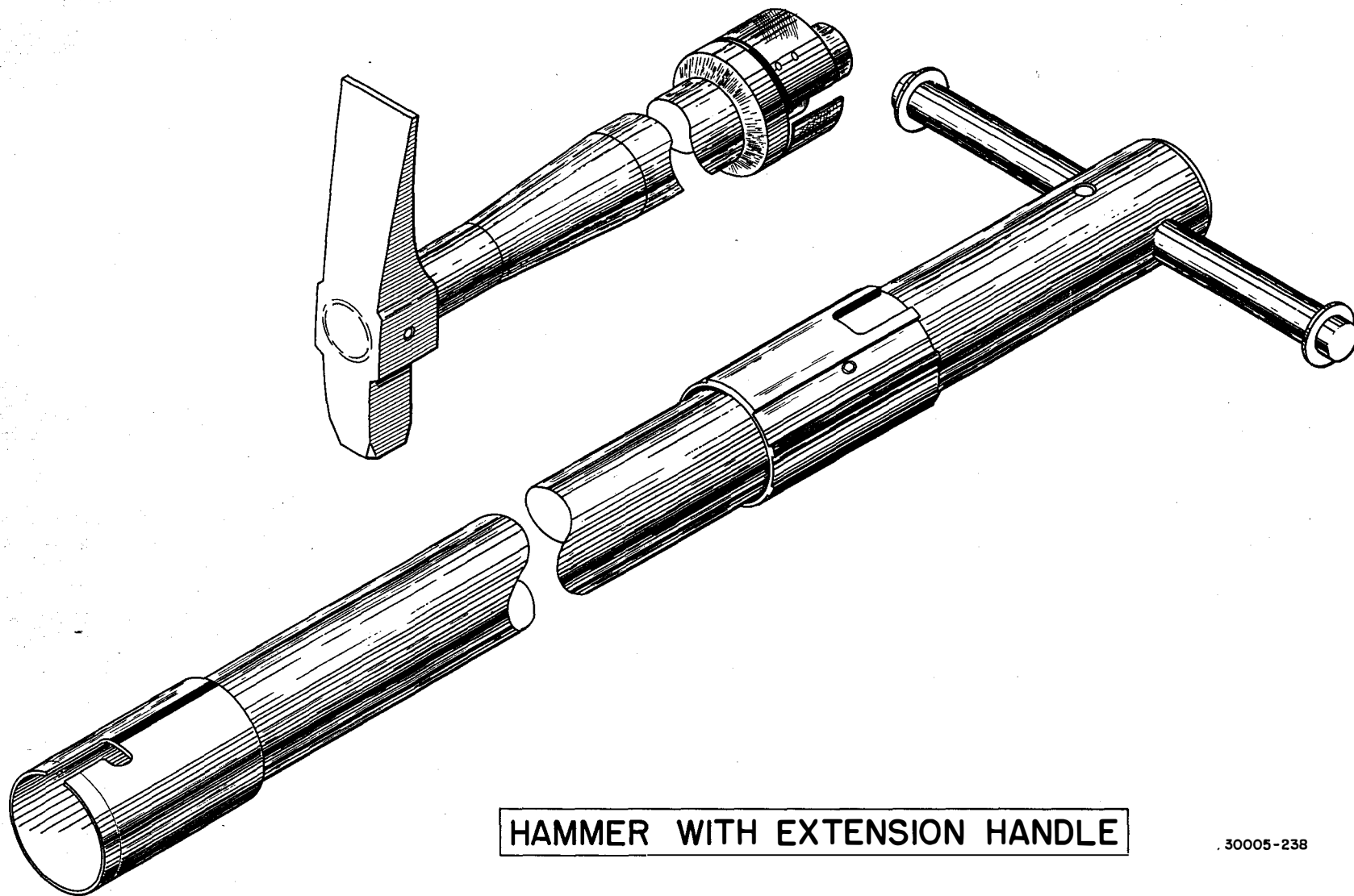
GNOMON

T30005-240

Date: MAY 1969

FOR TRAINING PURPOSES ONLY

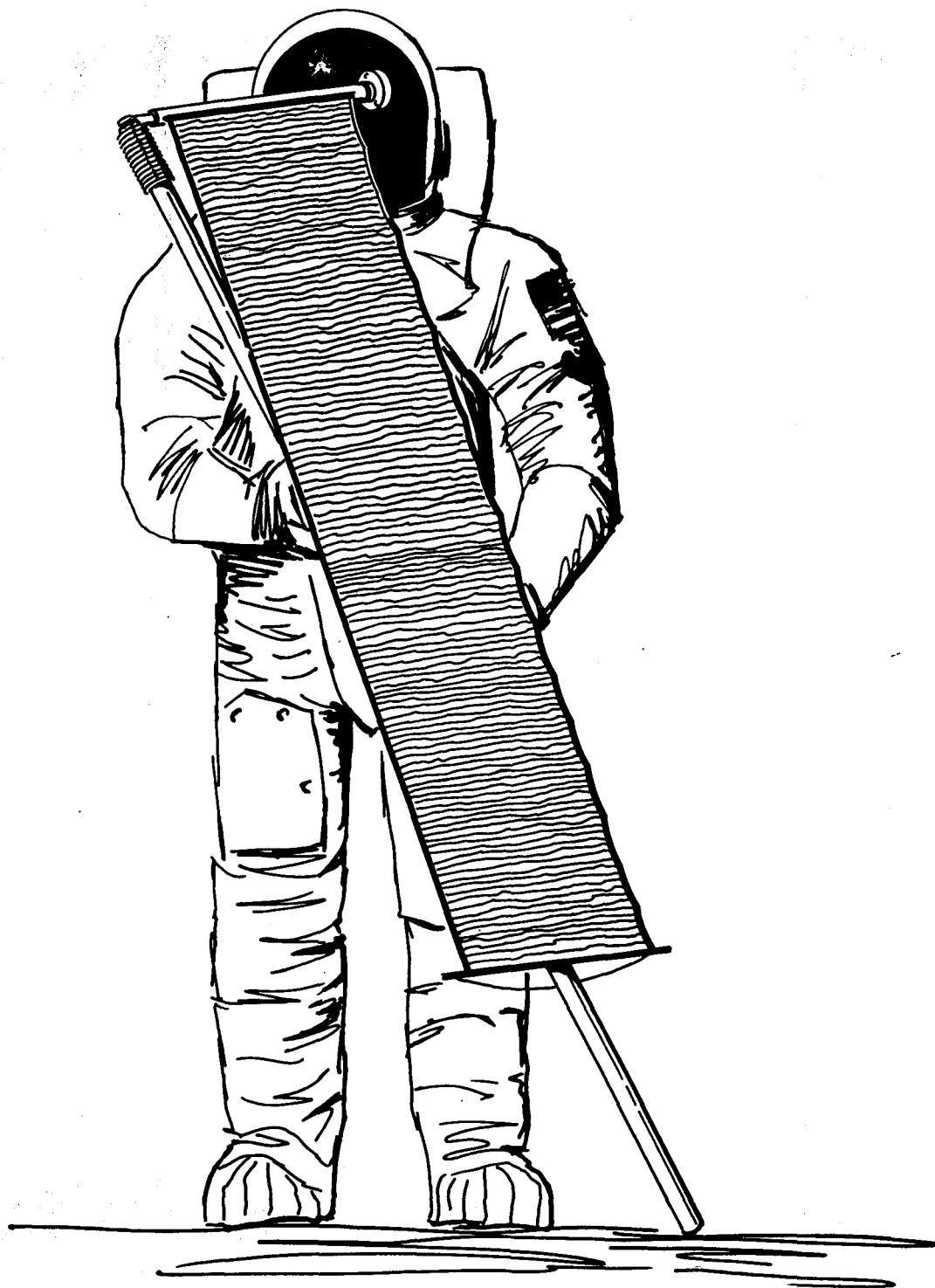
Page 2-17



HAMMER WITH EXTENSION HANDLE

30005-238

LM-5

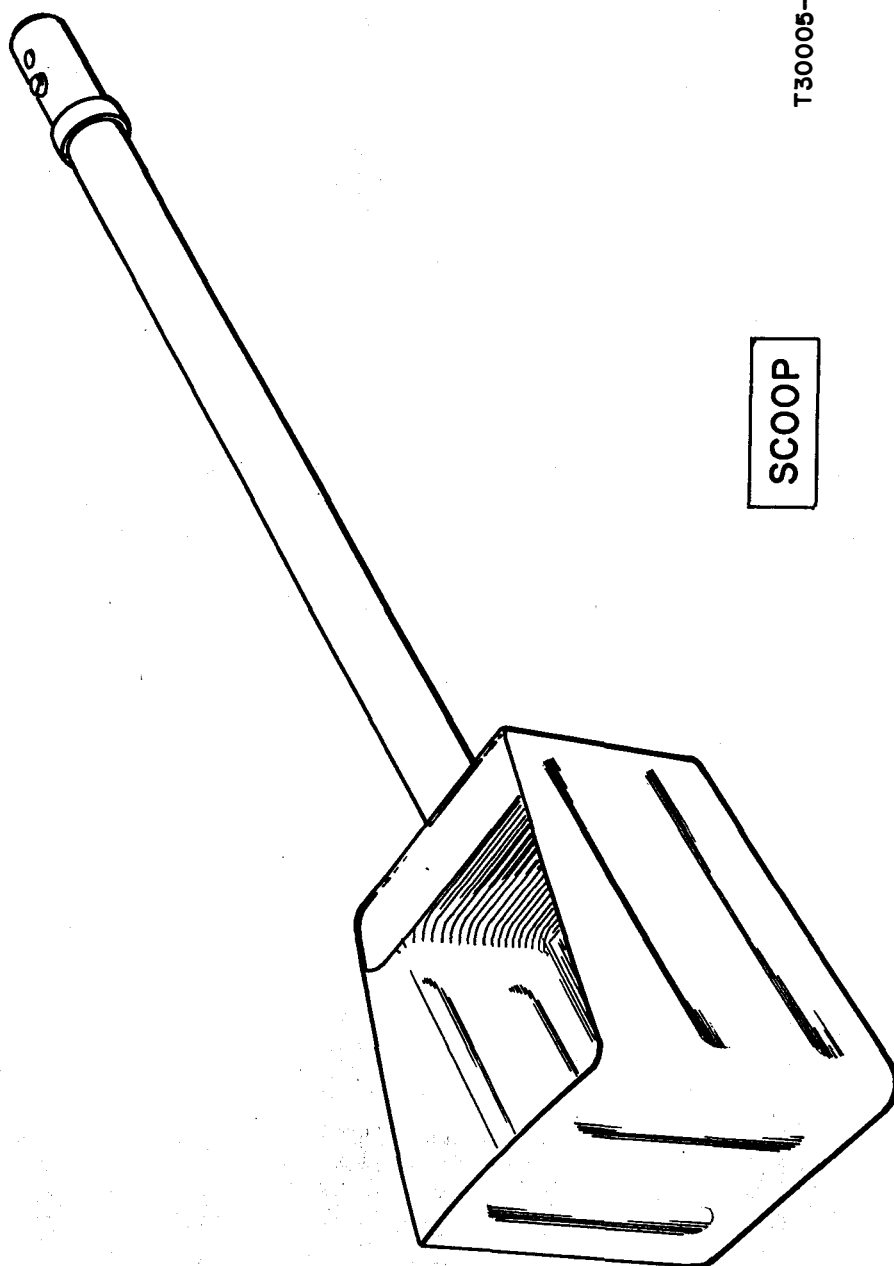


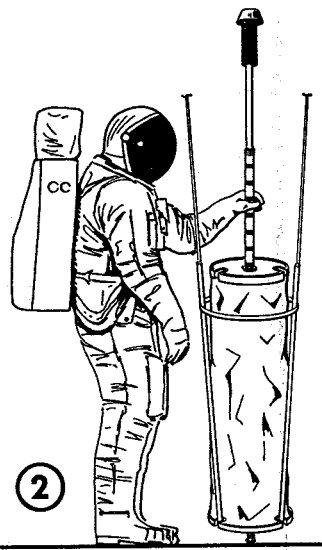
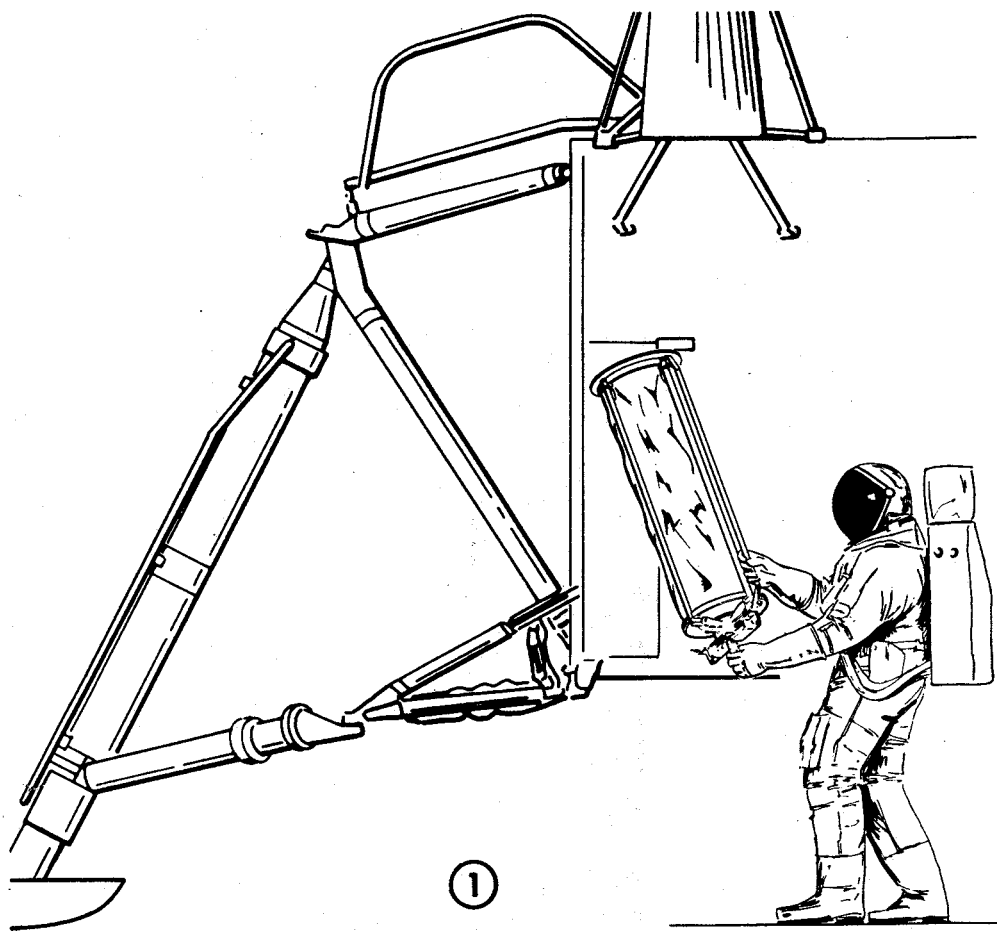
SOLAR WIND COMPOSITION EXPERIMENT

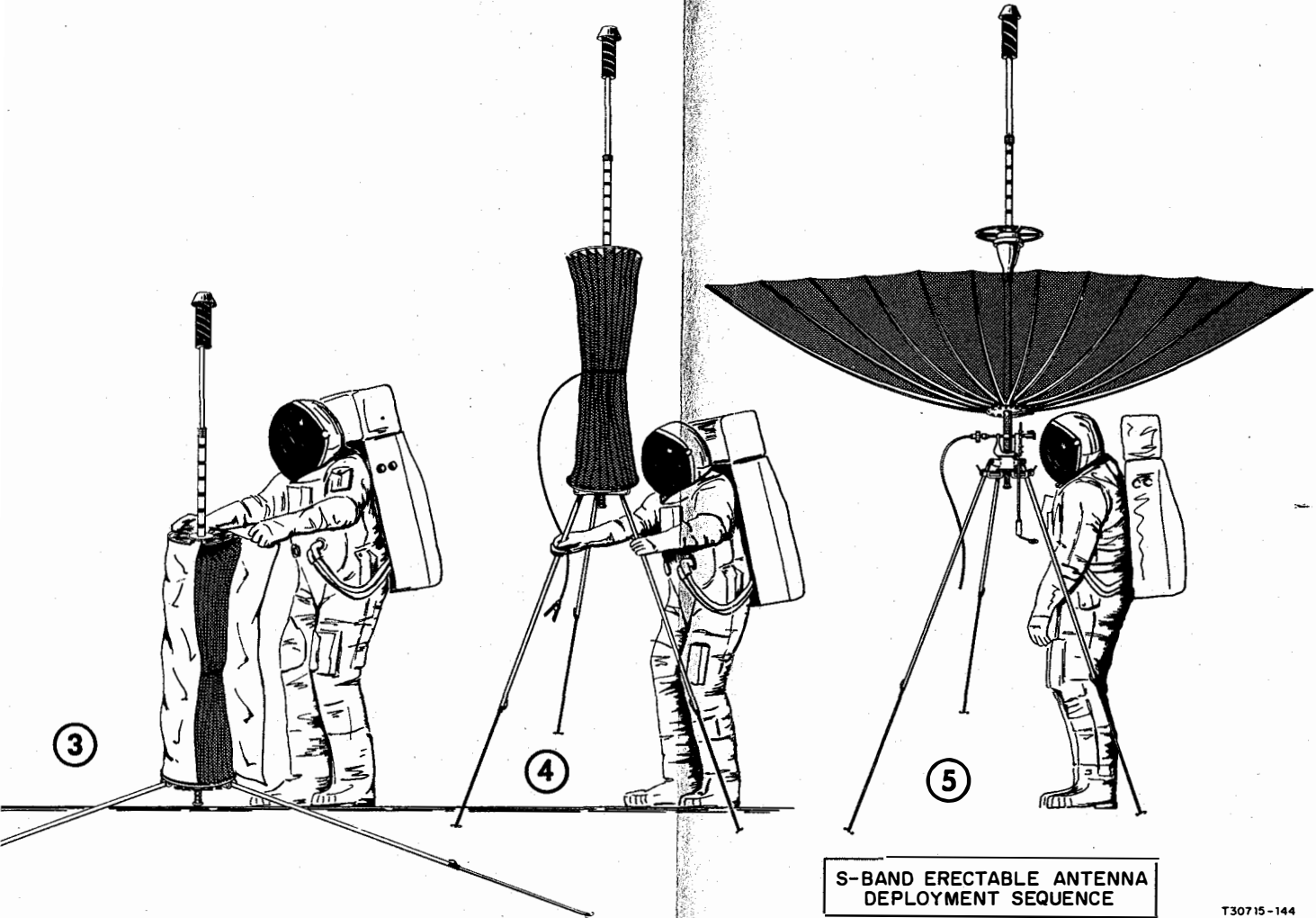
T30005-217

T30005-239

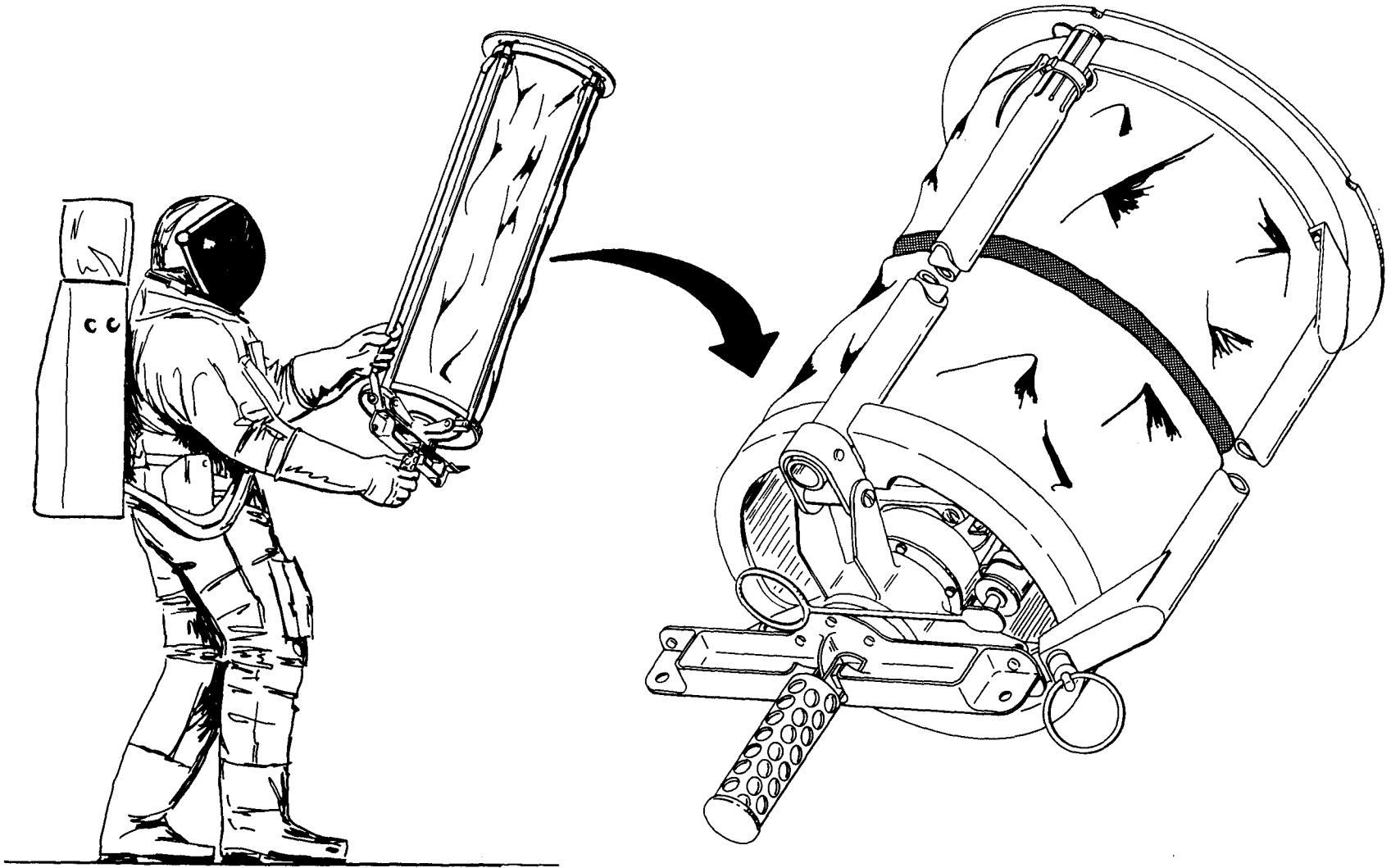
SCOOP







T30715-144



S-BAND ERECTABLE ANTENNA HANDLING

T30715-143

LM-5

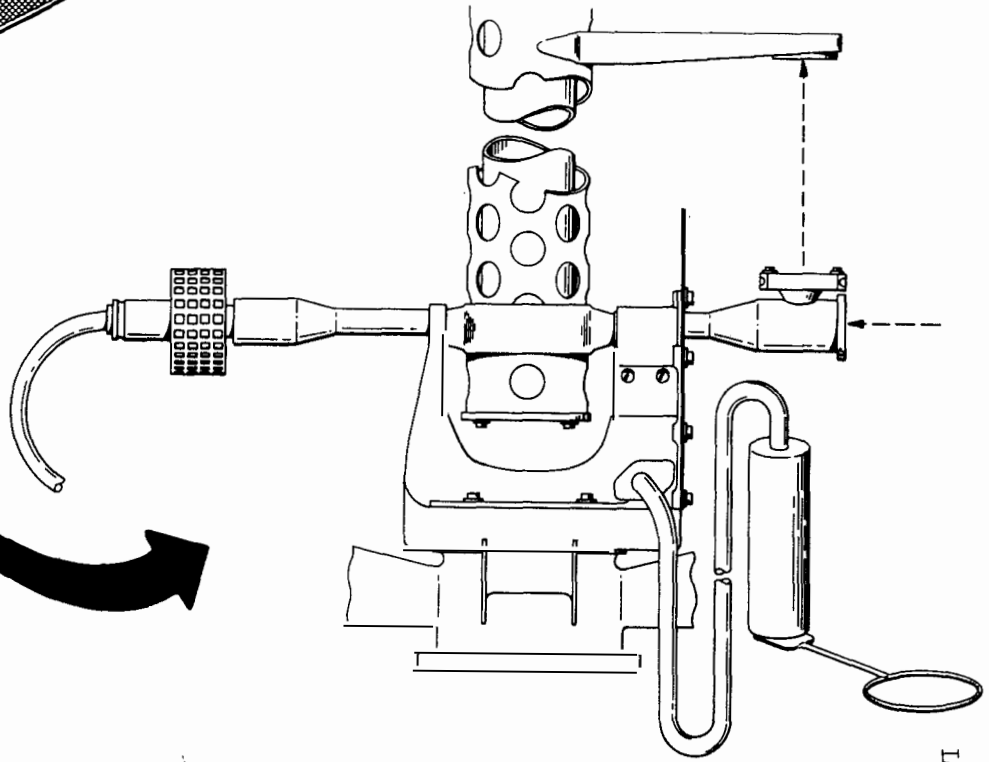
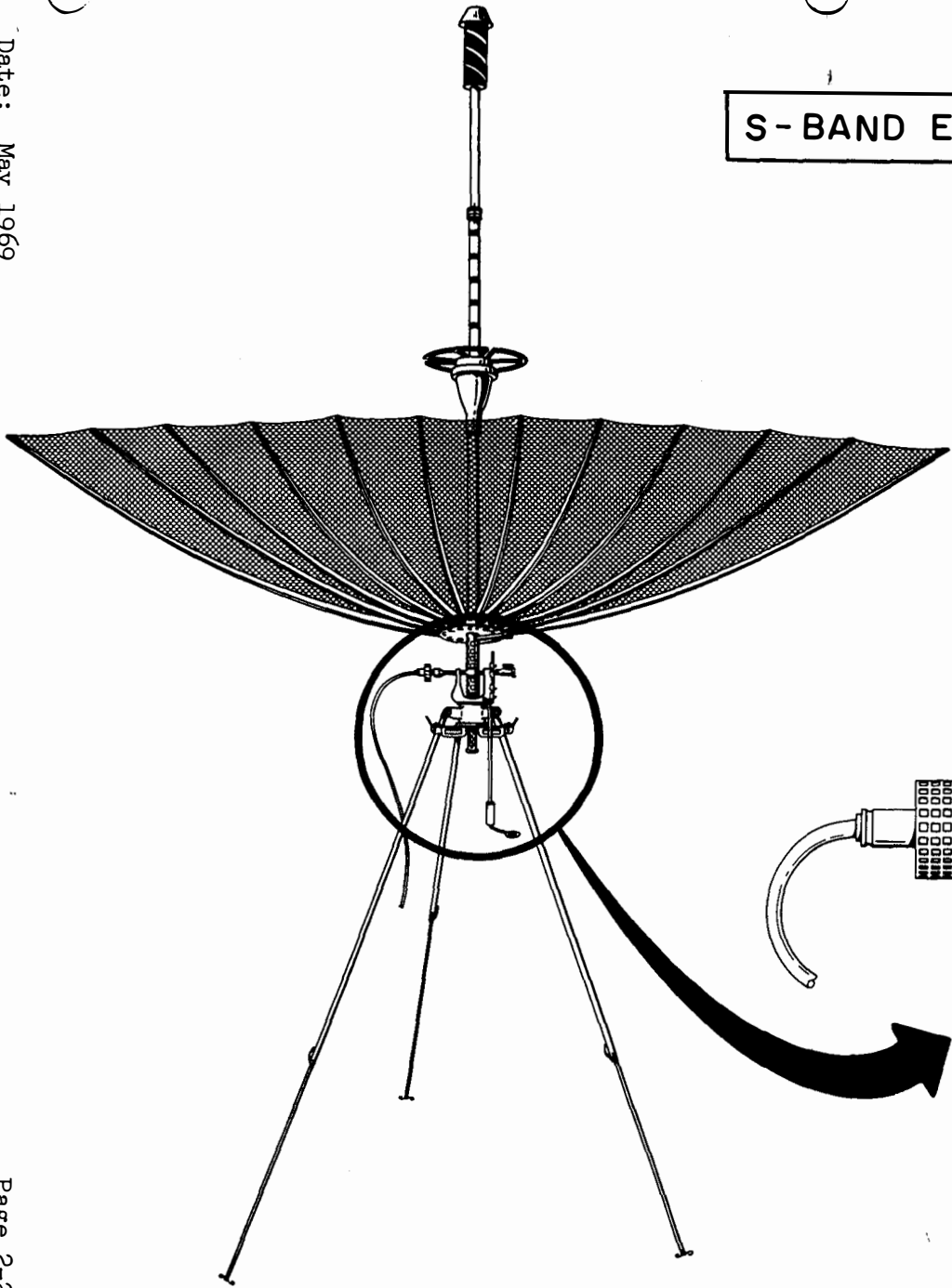
S-BAND ERECTABLE ANTENNA

T30715-141

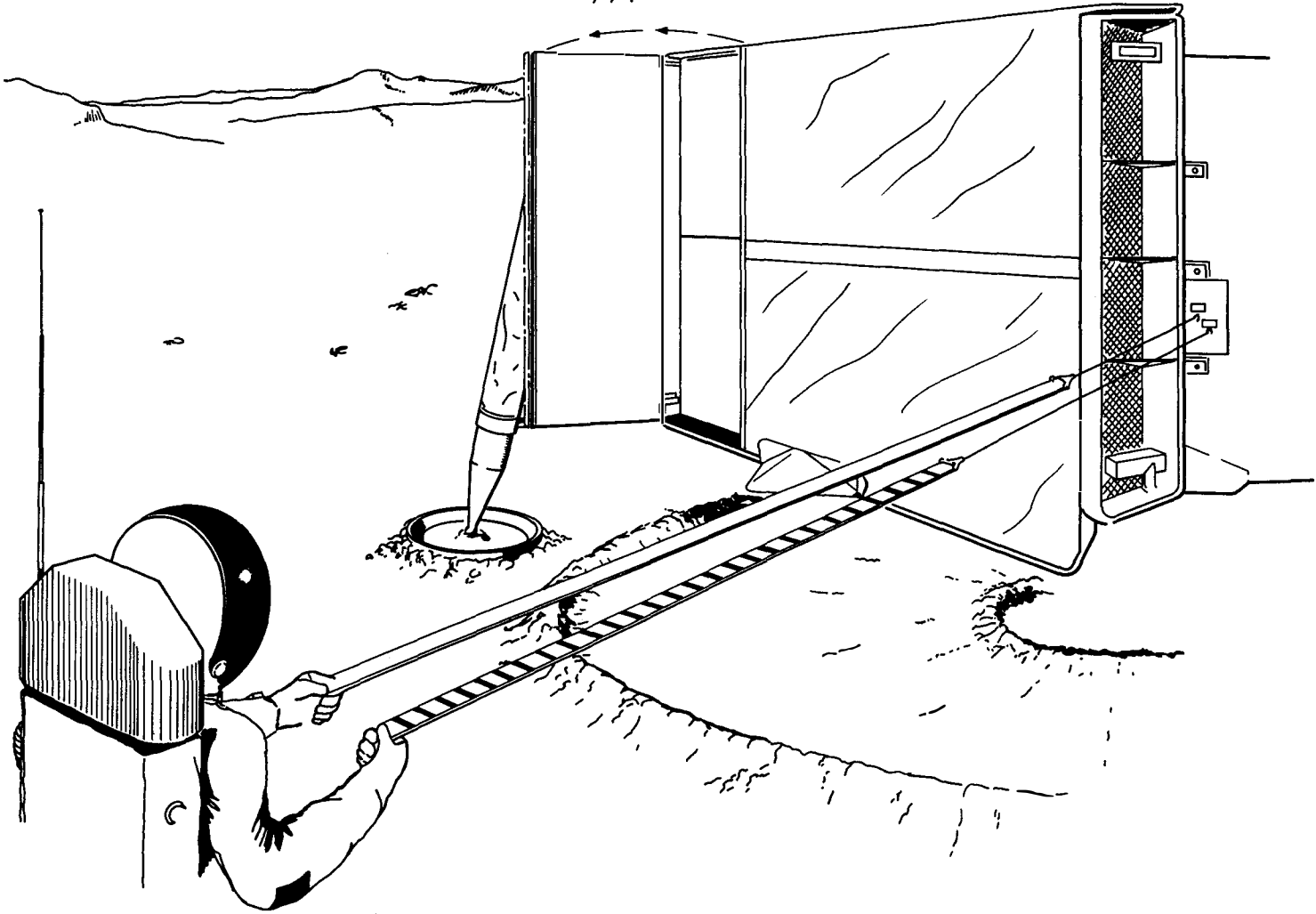
Date: May 1969

FOR TRAINING PURPOSES ONLY

Page 2-22

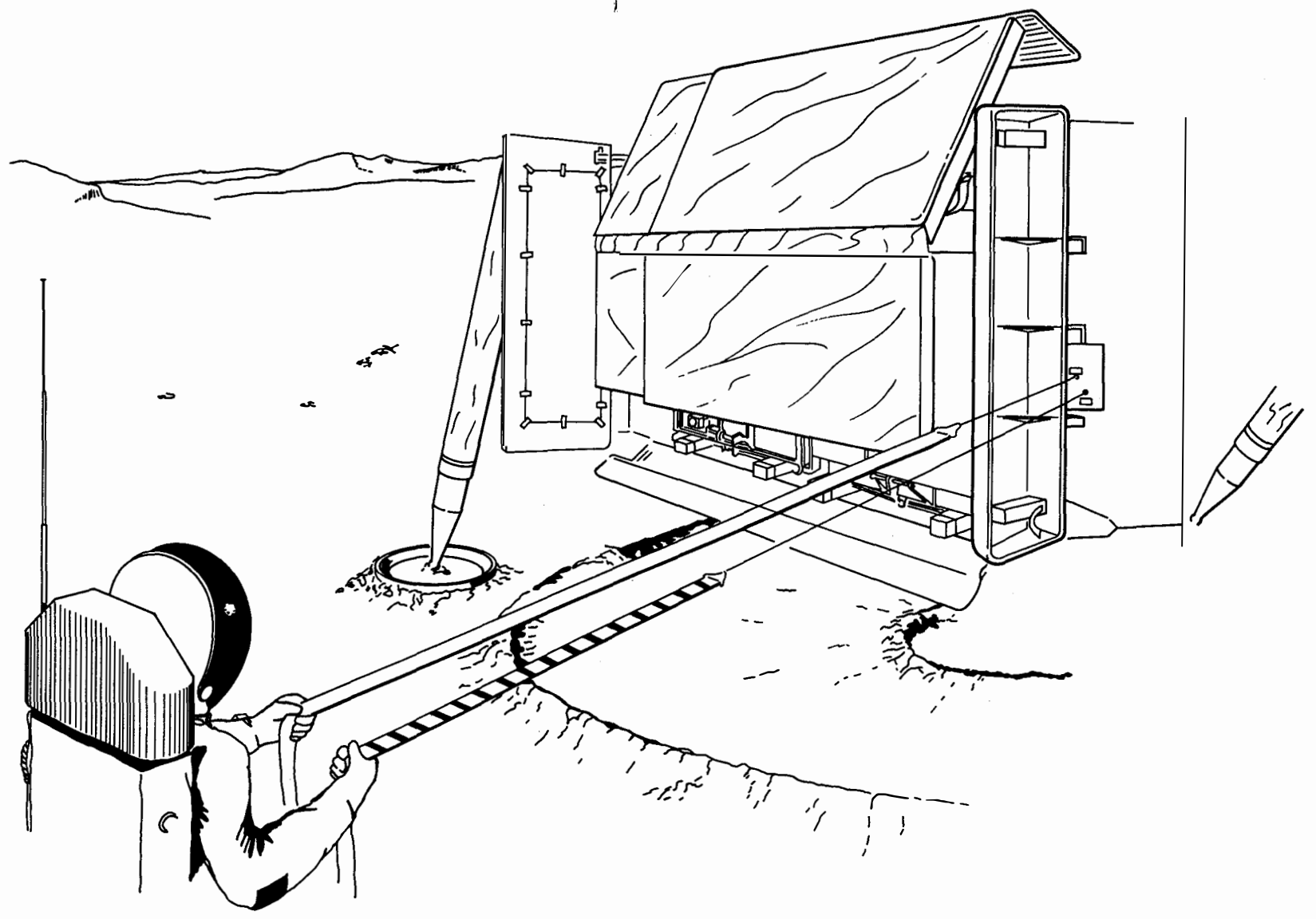


IM-5



EASEP DEPLOYMENT SEQUENCE (1)

T30005-233

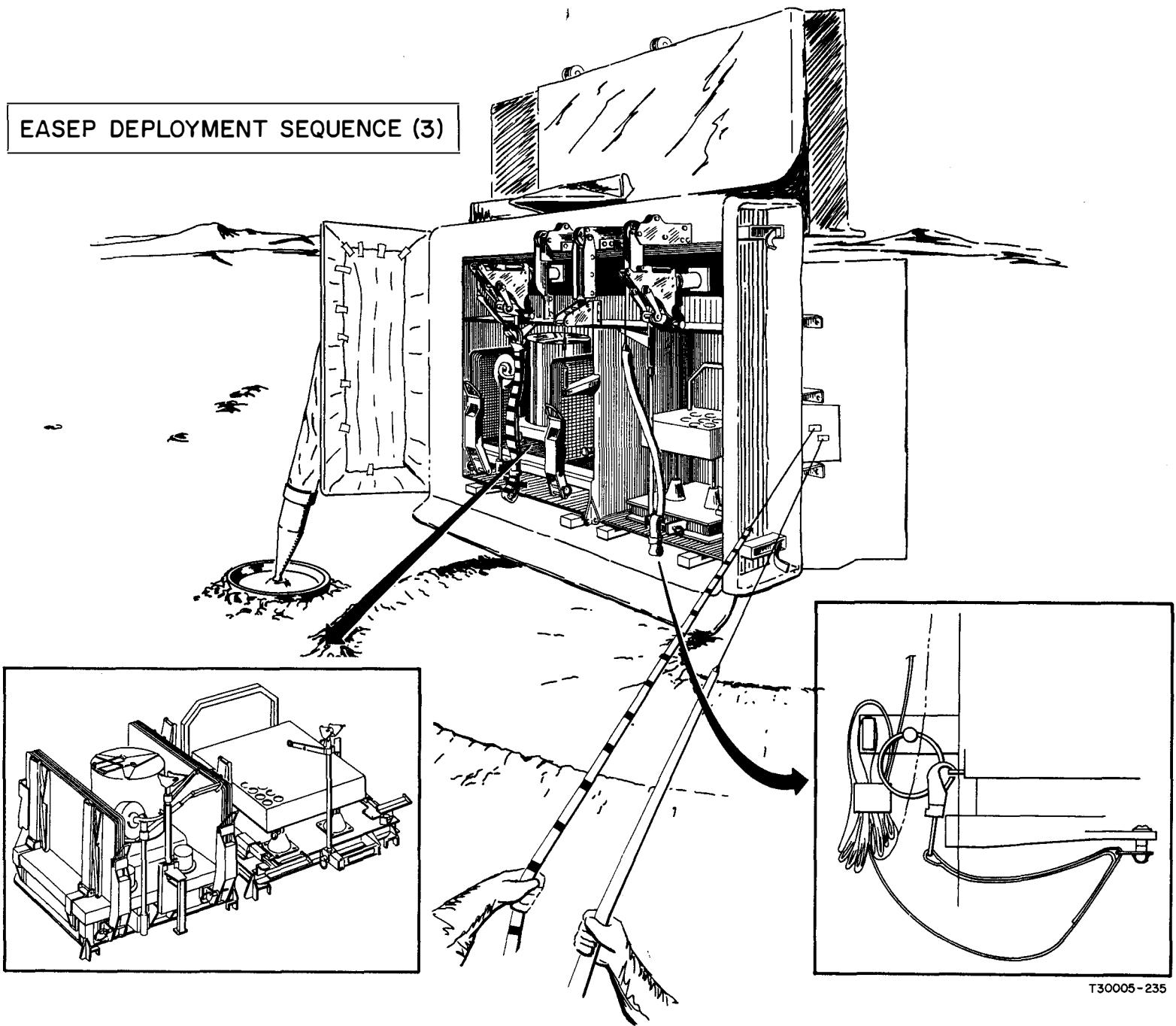


EASEP DEPLOYMENT SEQUENCE (2)

T30005-234

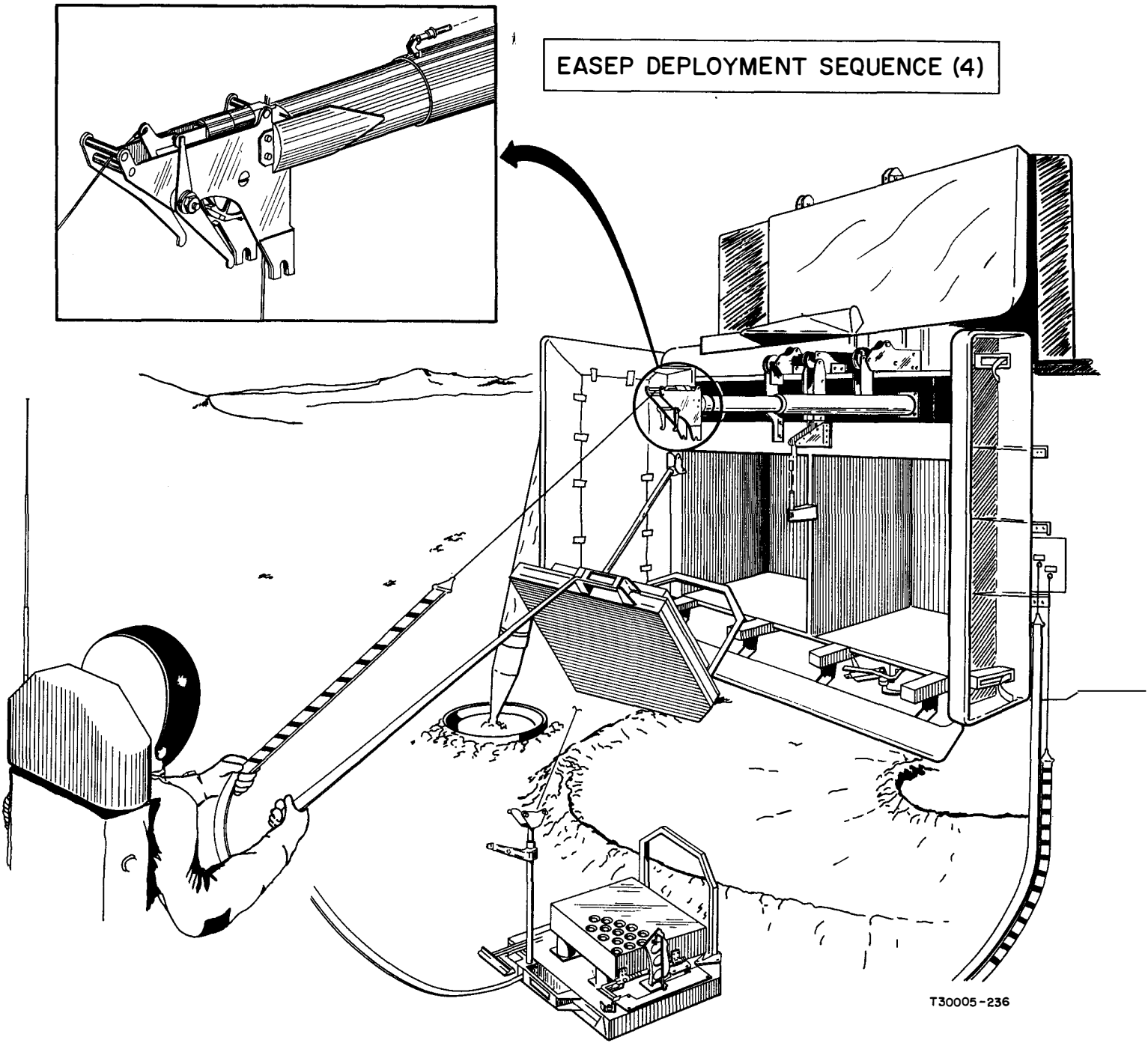
LM-5

EASEP DEPLOYMENT SEQUENCE (3)



T30005-235

EASEP DEPLOYMENT SEQUENCE (4)



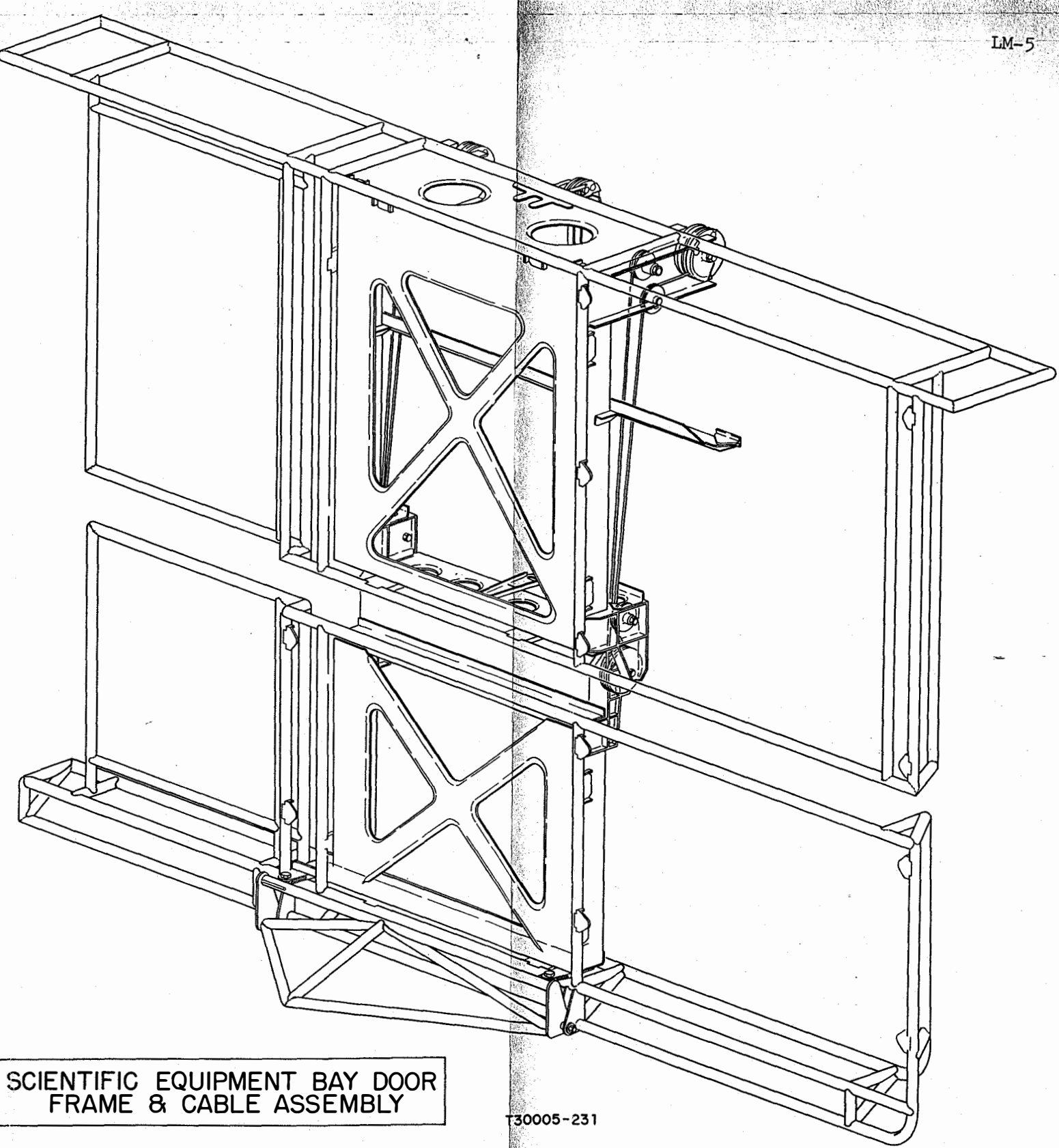
T30005-236

IM-5

Date: May 1969

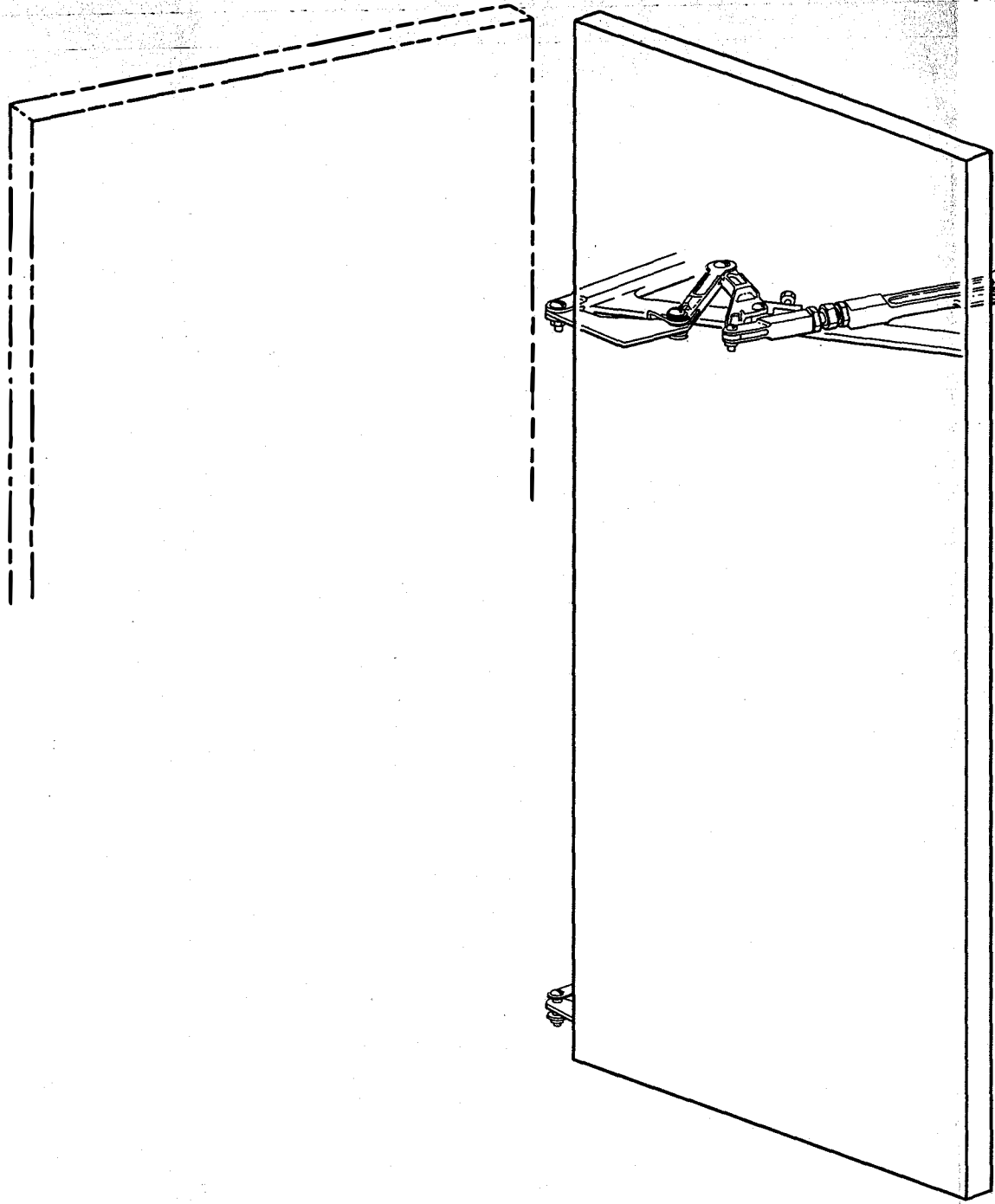
FOR TRAINING PURPOSES ONLY

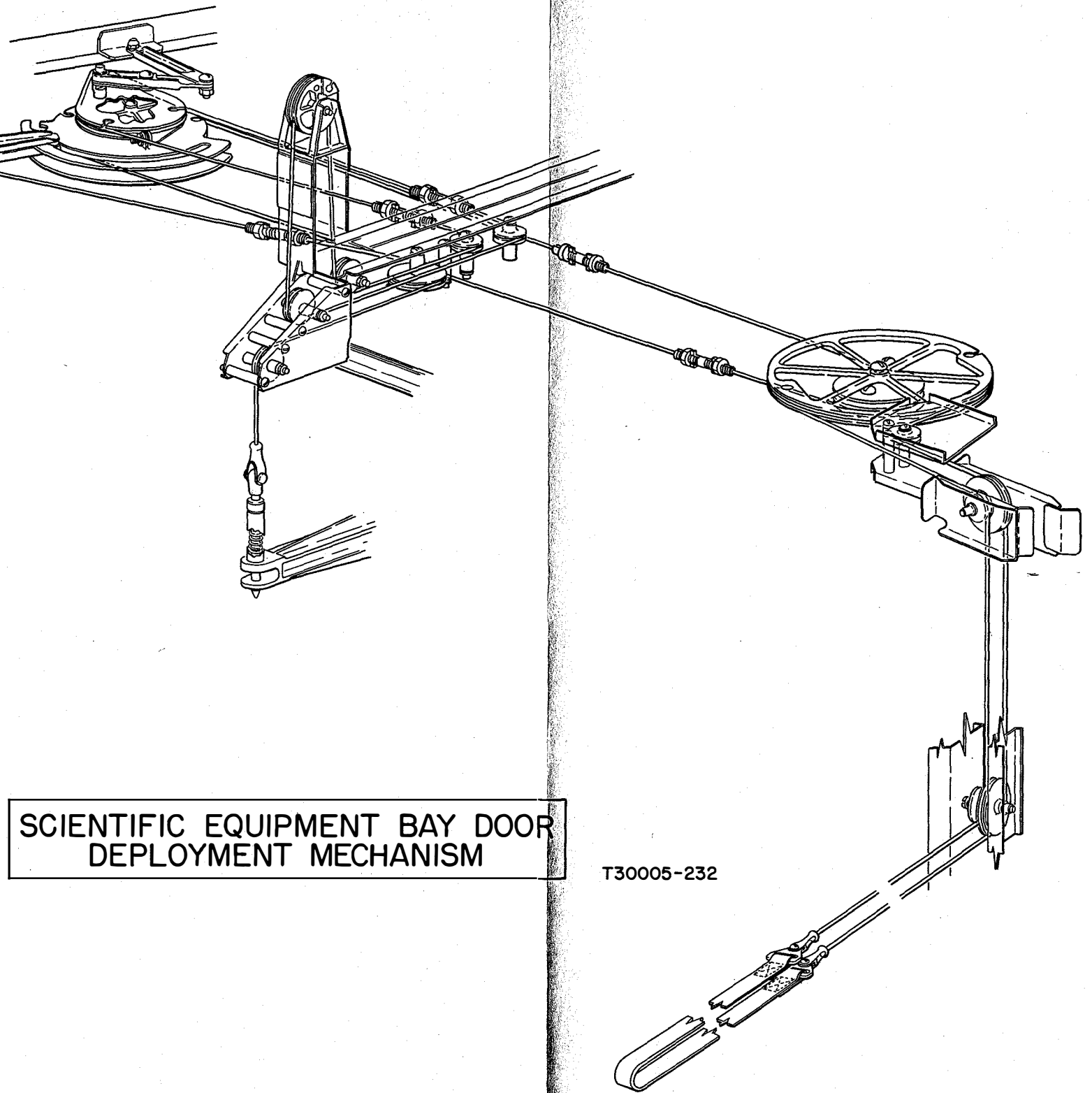
Page 2-26



SCIENTIFIC EQUIPMENT BAY DOOR
FRAME & CABLE ASSEMBLY

T30005-231





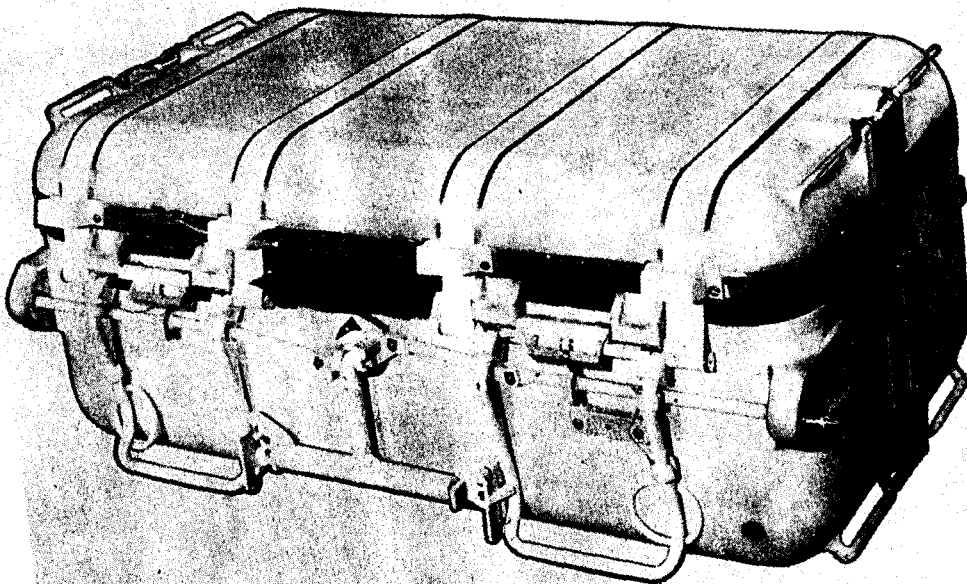
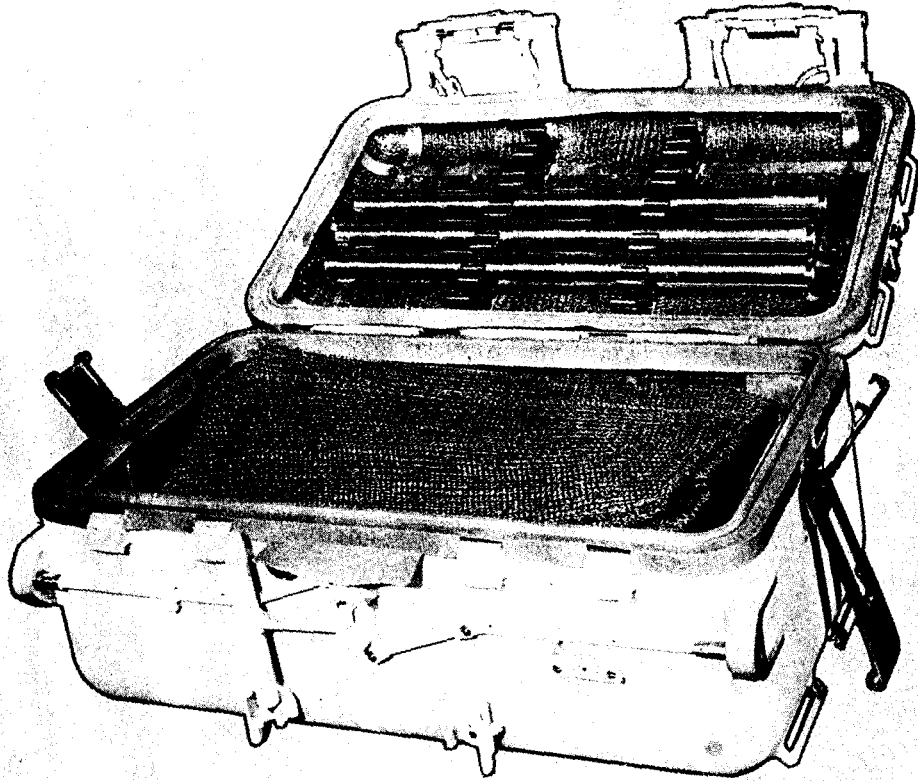
SCIENTIFIC EQUIPMENT BAY DOOR
DEPLOYMENT MECHANISM

T30005-232

Date: May 1969

FOR TRAINING PURPOSES ONLY

Page 2-28

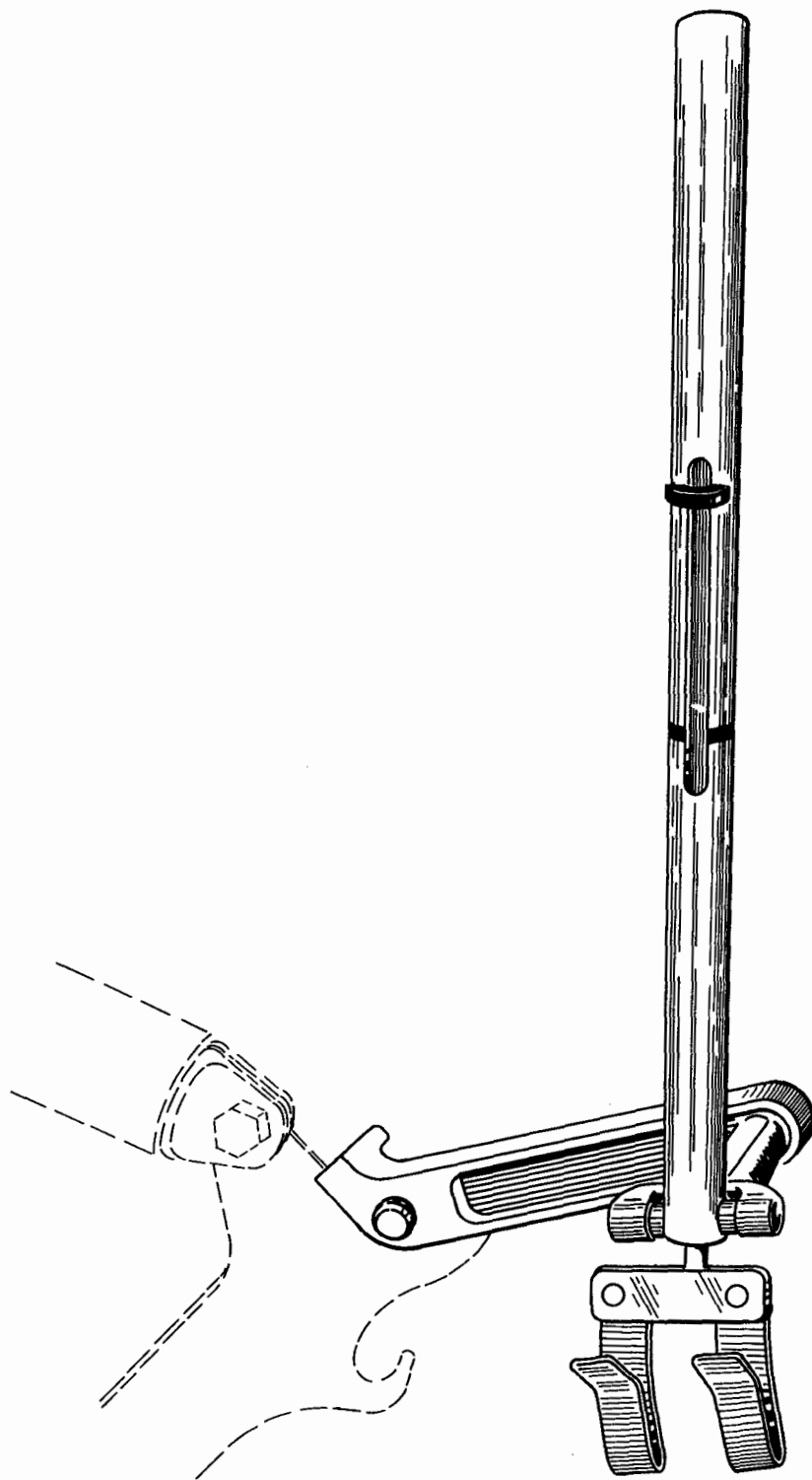


SAMPLE RETURN BOX

T30005-219.1

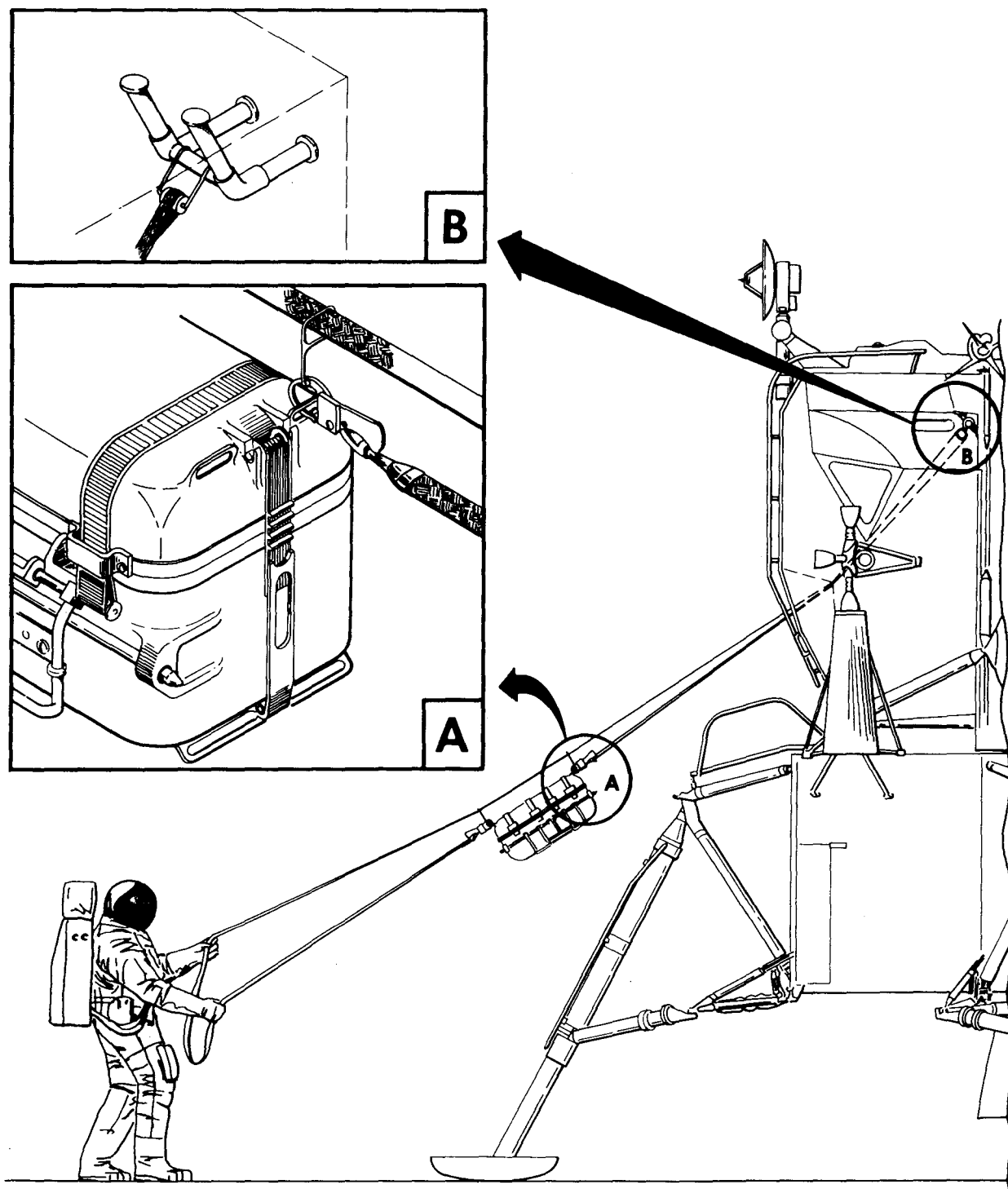
Date: May 1969

FOR TRAINING PURPOSES ONLY



SCALE

T30005-241



LUNAR EQUIPMENT CONVEYOR

T30005-218