Apollo Lunar Surface Experiments Package

ALSEP
INTERIM TRAINING MODEL
MANUAL

Prepared for

NASA/Manned Spacecraft Center

by

Aerospace Systems Division

ALSEP-LS-08

APOLLO LUNAR SURFACE
EXPERIMENTS PACKAGE
(ALSEP)

ALSEP
INTERIM TRAINING MODEL
MANUAL

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INTRODUCTION

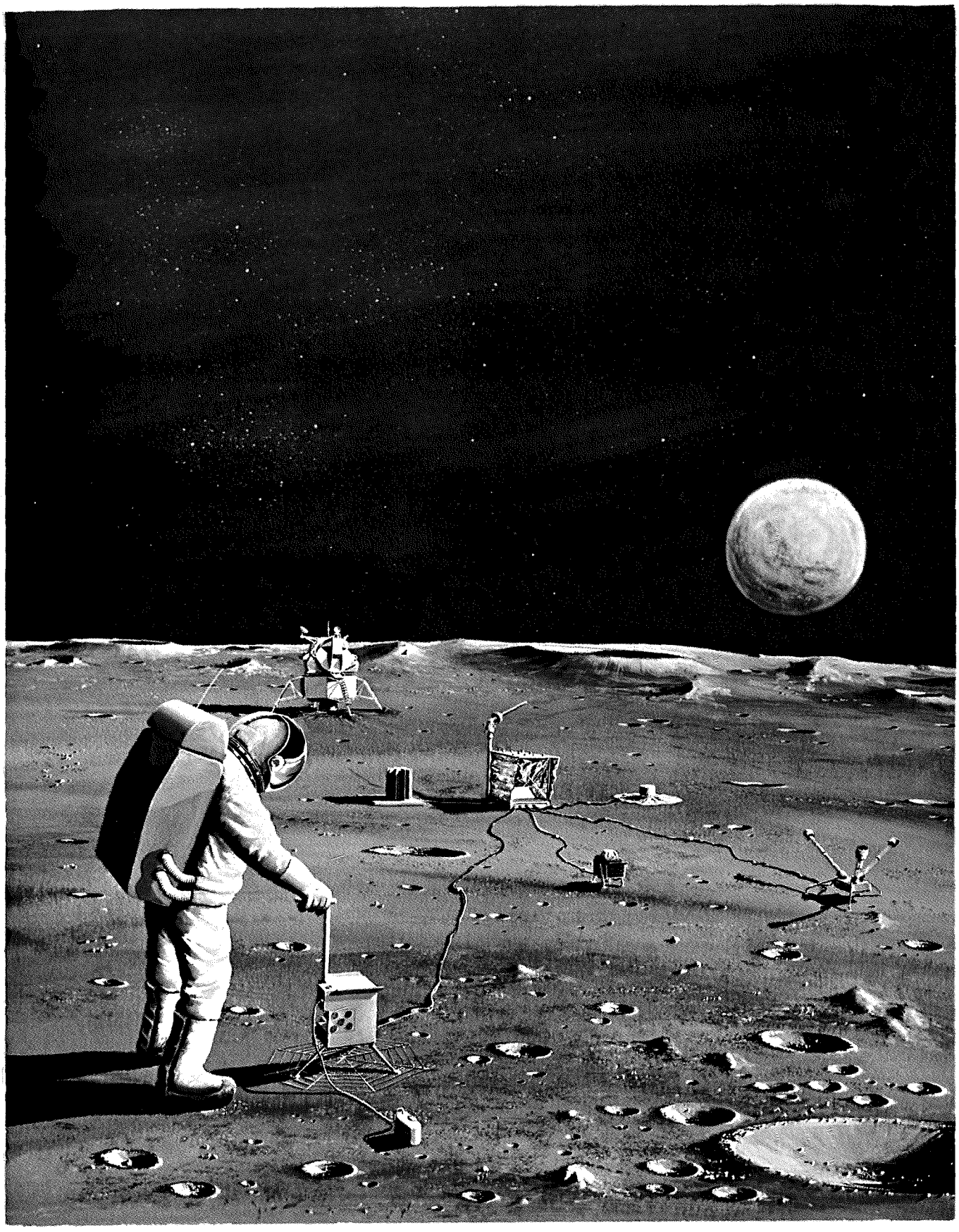
This revision of the ALSEP Interim Training Model Manual ALSEP-LS-08 incorporates hardware and maintenance procedure modifications effected since the original 15 December 1967 publication date and prior to 1 June 1968.

The Apollo Lunar Surface Experiments Package (ALSEP) will be used to obtain long-term scientific measurements of various physical and environmental properties of the Moon consistent with the scientific objectives of the Apollo Program. The ALSEP comprises scientific experiment packages with supporting subsystems. ALSEP will be transported to the lunar surface aboard the Apollo Lunar Module (LM). The ALSEP will remain on the lunar surface after the return of the astronauts and will transmit scientific and engineering data to the Manned Space Flight Network (MSFN).

The ALSEP Interim Training Model is designed to simulate the flight configuration of the ALSEP system to facilitate training and familiarization with ALSEP design and mechanical interfaces. The model is electrically inert, but duplicates the mechanical features of the electrical interfaces.

The ALSEP Interim Training Model Manual describes the model (Section I), its preparation for use (Section II), handling and stowage (Section III), and maintenance (Section IV), including a repair parts list (Section V).

The ALSEP deployment sequence is not contained in this manual. A typical deployment sequence is described in the ALSEP Flight Systems Familiarization Manual, ALSEP-MT-03 which also contains additional information concerning the ALSEP system and subsystems.



Idealized ALSEP Deployment

SECTION I

DESCRIPTION

1-1 GENERAL

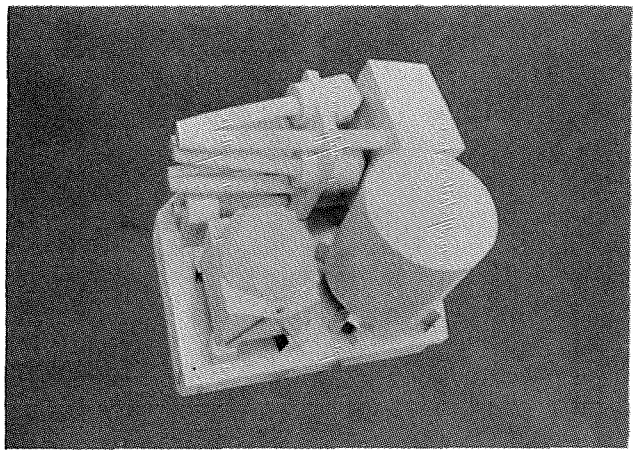
The ALSEP Interim Training Model is a simulation of the ALSEP system flight configuration mechanical design. The training model duplicates crew interfaces, outside envelope features, mass properties, center of gravity, and mechanical and manipulative features. The trainer consists of the following major assemblies: Subpackage No. 1 (non-deployable); Subpackage No. 1 (deployable); Subpackage No. 2 (deployable); non-deployable subpallet for Subpackage No. 2; and the fuel cask and mounting assembly (see figure 1-1).

1-2 SUBPACKAGE NO. 1 (NON-DEPLOYABLE)

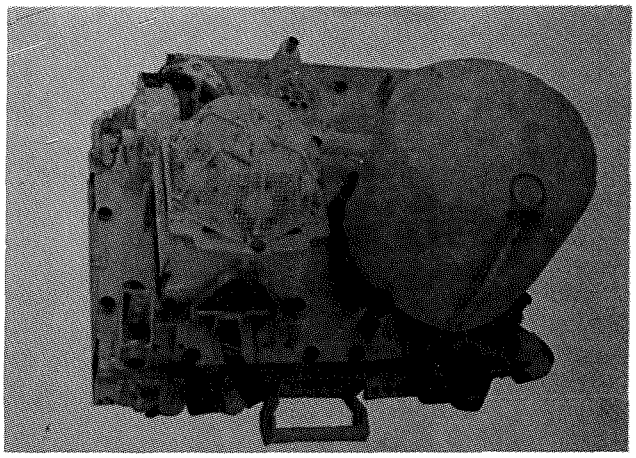
Non-deployable Subpackage No. 1 represents the gross form factor of the flight Subpackage No. 1 comprised of the central station, passive seismic experiment (PSE), magnetometer experiment (ME), solar wind experiment (SWE), antenna, and dust detector (see figure 1-2). The subpackage is an integral unit with the mounted experiments and is designed and fabricated as close as structurally feasible to lunar weight and yet retain compatibility with the light weight Subpackage No. 2. The non-deployable Subpackage No. 1 is used in deployment training sequences for removal of the subpackage from the Lunar Module (LM) Scientific Equipment Bay (SEQ) and for the barbell carry mode of traverse to the deployment site.

1-3 SUBPACKAGE NO. 1 (DEPLOYABLE)

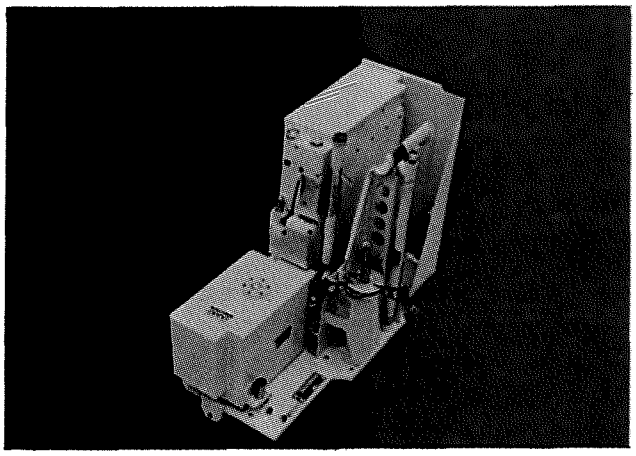
Deployable Subpackage No. 1 simulates the mass properties and component weight of the flight Subpackage No. 1 based on a one G environment (see figure 1-3). Deployable Subpackage No. 1 is used for central station and experiment deployment training. However, because of its weight, it will not be used for removal from the LM or the traverse to the deployment site (the antenna mast section will not support the weight.) The primary structure provides the LM interface, the bar carry attachment hard point, thermal curtains, erectors and specular reflector. The thermal plate interfaces with cable exits, exit spring effects, and with front panel and switch assemblies. The sunshield provides mounting brackets for the PSE, SWE, ME, antenna, dust detector, and associated items. The sunshield also provides attachment points for thermal curtains, specular reflector, and erectors, as well as mating fasteners for subsystem and experiment tiedown. The deployable PSE, SWE, ME, cables and cable reels are mounted on the subpackage sunshield. The antenna is also secured to the sunshield with retainers and fasteners.



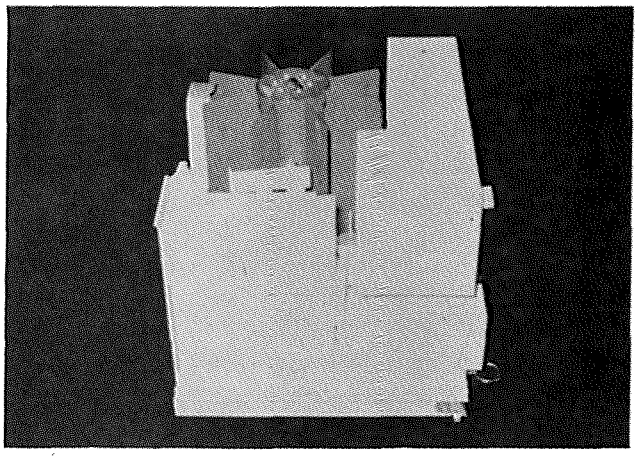
Non-Deployable Subpackage No. 1



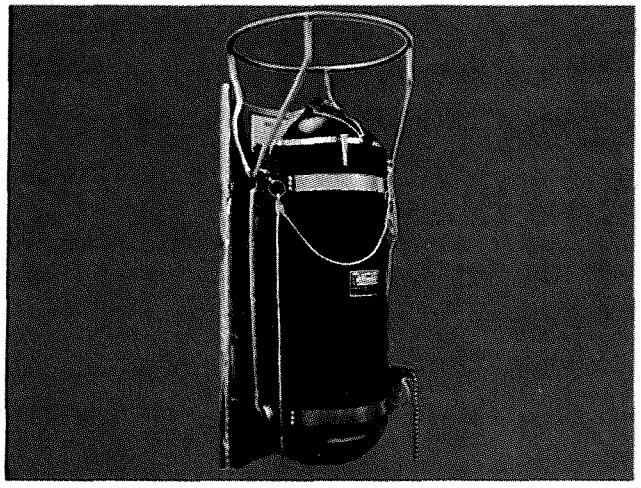
Deployable Subpackage No. 1



Deployable Subpallet



Subpackage No. 2 With
Non-Deployable Subpallet



Fuel Cask

Figure 1-1 ALSEP Interim Training Model

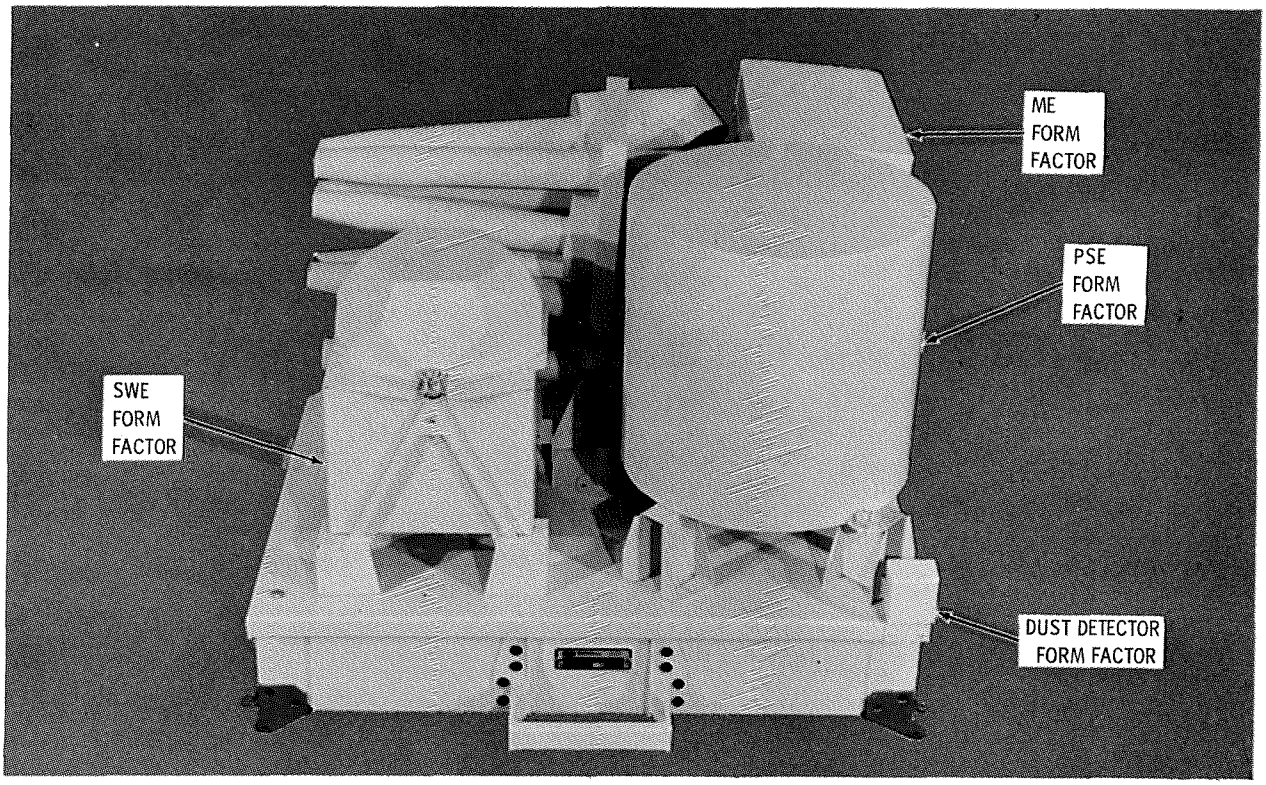


Figure 1-2 Subpackage No. 1 (Non-Deployable)

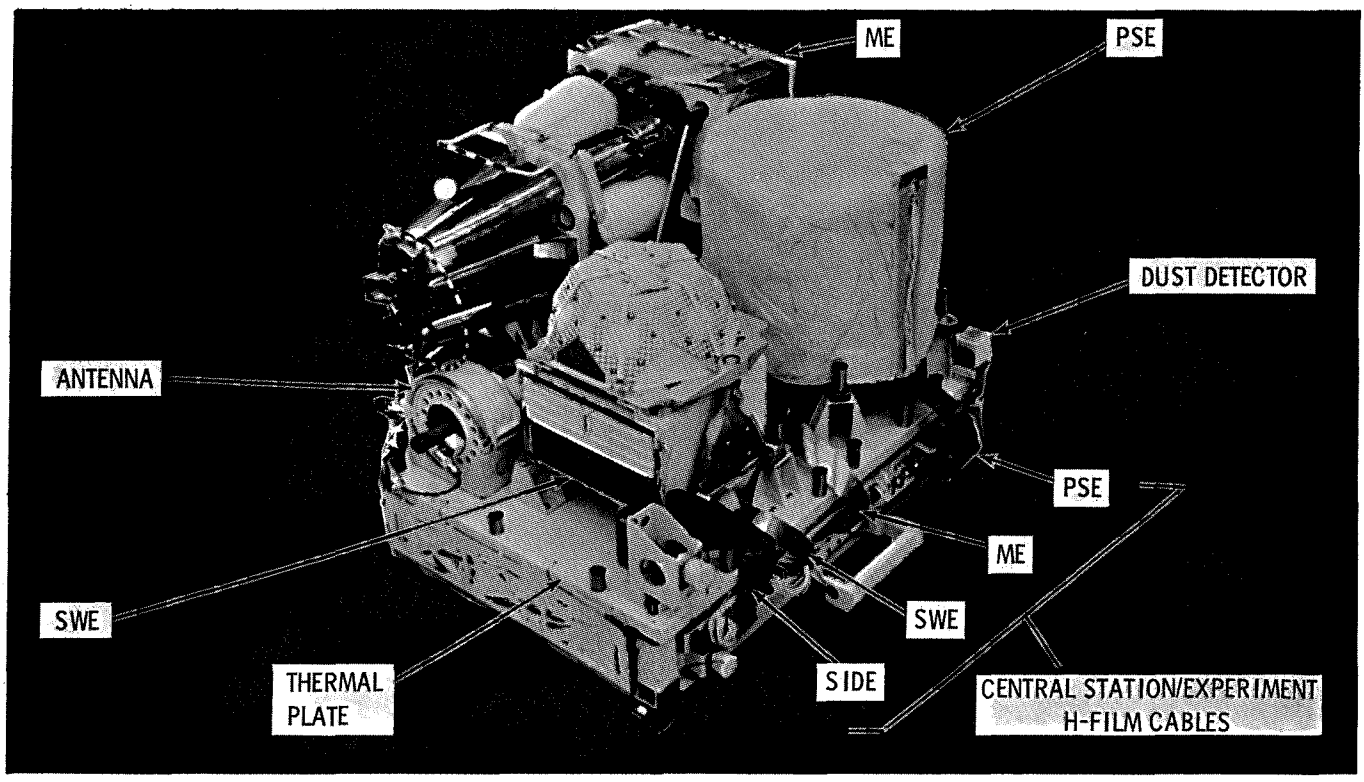


Figure 1-3 Subpackage No. 1 (Deployable)

1-4 SUBPACKAGE NO. 2 (DEPLOYABLE AND NON-DEPLOYABLE)

Subpackage No. 2 is comprised of a common primary pallet and back support structure with deployable or non-deployable subpallets installed as required for deployment training. The primary pallet mounts the light weight radioisotope thermoelectric generator (RTG), light weight Apollo Lunar Hand Tools (ALHT), and subpallet assembly. Fasteners, where employed, are Boyd bolt fasteners. Two subpallets of similar design are provided; deployable and non-deployable (see figures 1-4 and 1-5.) Both subpallets provide facilities to mount antenna mast sections, dome removal tool (DRT), two universal handling tools (UHT), fuel transfer tool (FTT), PSE stool, suprathermal ion detector experiment (SIDE) and cold cathode ion gauge (CCIG), and antenna aiming mechanism stowage box. However, the SIDE and antenna aiming mechanism stowage box are form factors attached to the subpallet in the non-deployable configuration. The deployable subpallet mounts a deployable SIDE/CCIG and antenna aiming mechanism stowage box.

1-5 FUEL CAPSULE STOWAGE ASSEMBLY

The fuel capsule stowage assembly is comprised of the fuel cask, mounting assembly, and the fuel capsule designed to simulate the actual size, shape, and mechanical features of the flight hardware. The fuel cask and fuel capsule are designed to lunar weight. The mounting assembly and heat shield provide LM interface hardpoints, cask support, cask tilt release, cask tilt mechanism, and dome band release (see figure 1-6). The cask dome removal tool is provided for dome locking mechanism, and cask dome rotation release and removal.

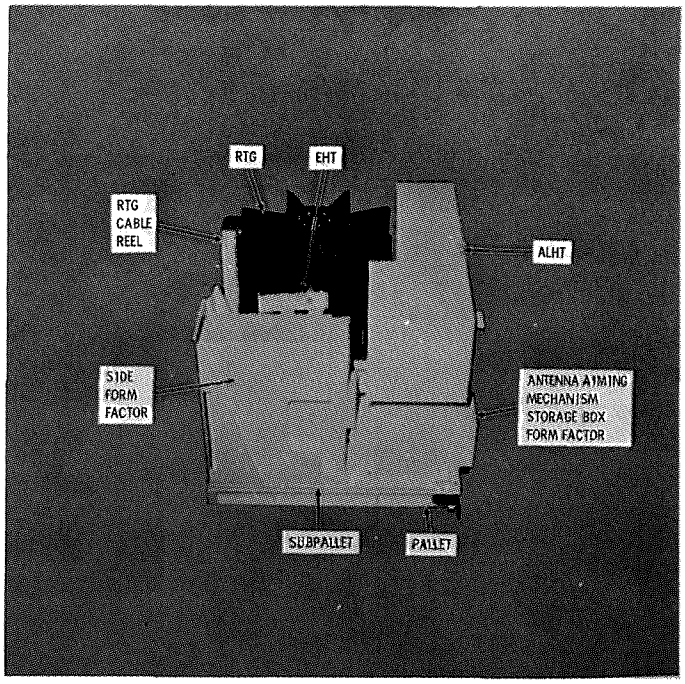


Figure 1-4 Subpackage No. 2 With Non-Deployable Subpallet

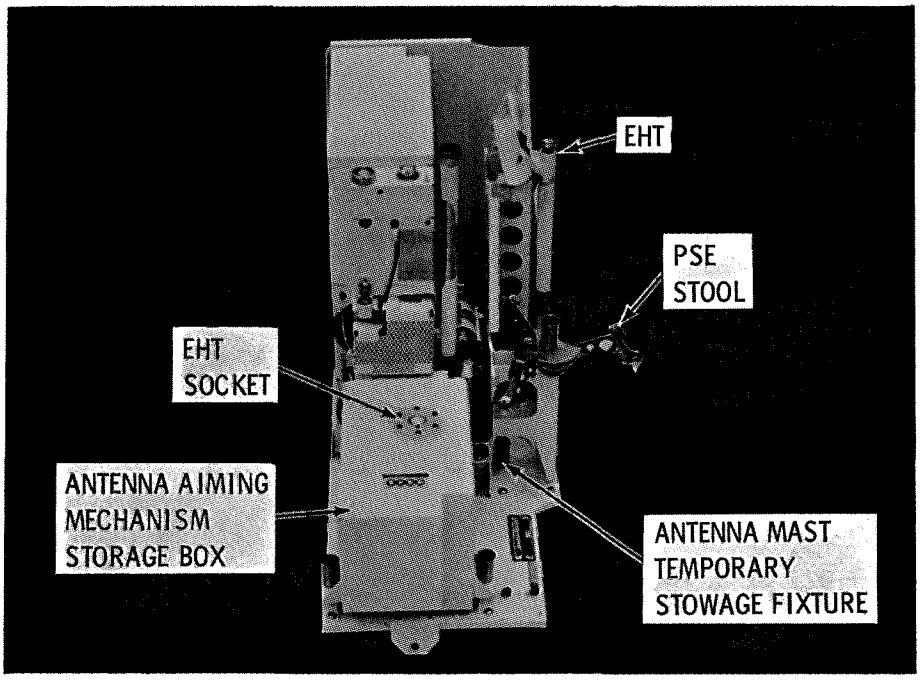


Figure 1-5 Subpackage No. 2 Deployable Subpallet

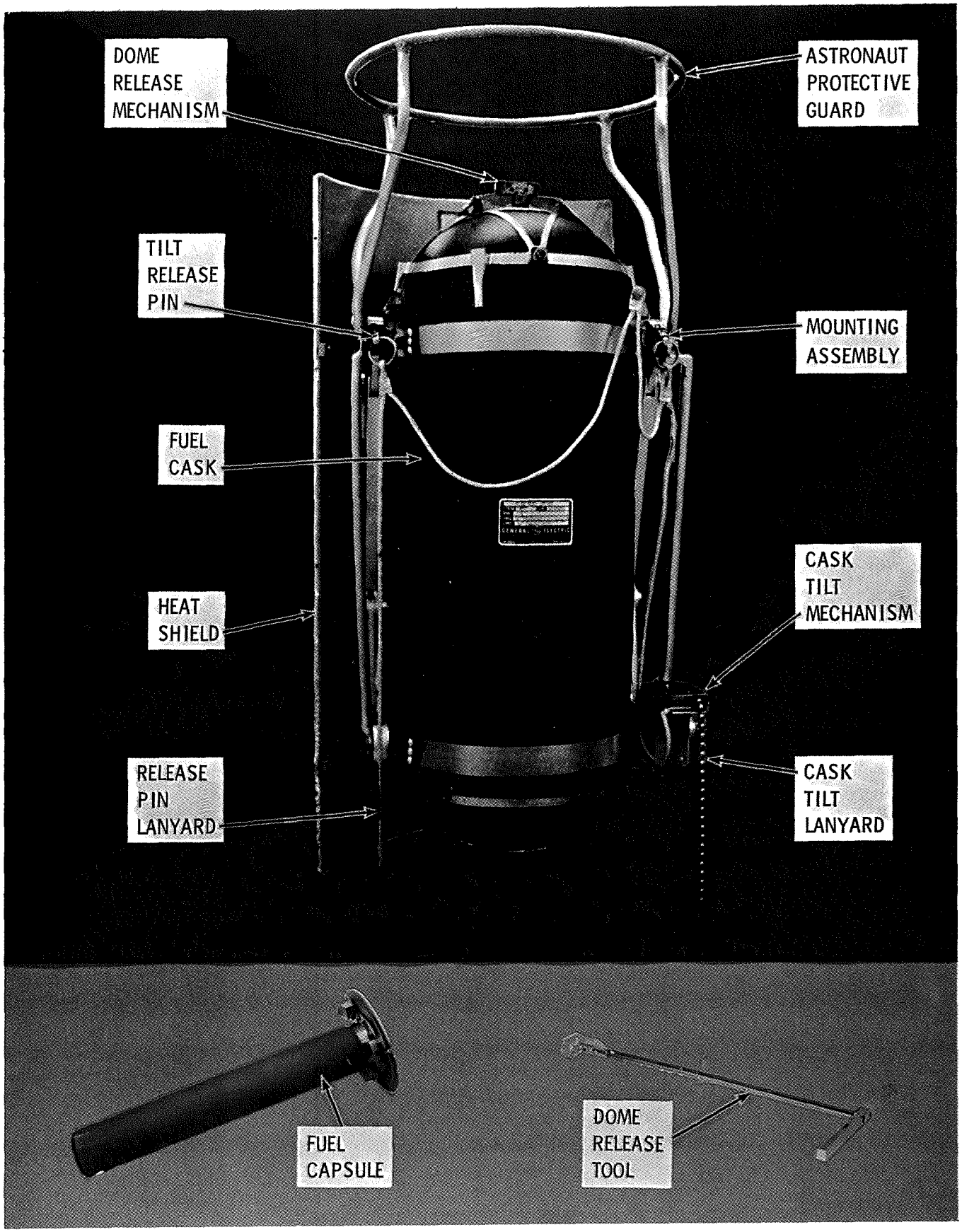


Figure 1-6 Fuel Capsule Stowage Assembly

SECTION II

PREPARATION FOR USE

2-1 GENERAL

The ALSEP Interim Training Model is packaged in reusable plywood containers lined with polyurethane foam and designed to permit fork-lift truck handling. Handles are provided on the containers for ease of handling in storage or work areas. The containers provide adequate protection from normal environmental conditions during transportation and storage.

2-2 REMOVAL AND INSPECTION

Determine the area of deployment and transport the models in the containers to the deployment site. To remove the models from the containers, release the hasp, raise the top of the container, and release hook and eye latches to open the front of the container, if applicable. To reduce the possibility of accidental damage, the models should be removed from the containers by a two-man team.

After removal, conduct a visual inspection for possible damage, missing elements, loose attachments, and other possible defective conditions.

2-3 ASSEMBLY

If the LM simulator is to be used, attach the fuel cask containing the fuel capsule to the LM simulator hard points using the mounting assembly. Place the non-deployable Subpackage No. 1 and Subpackage No. 2, with non-deployable subpallet attached, in the LM simulator scientific equipment bay, and secure with pull pins. Subpackage No. 2 is stowed with deployable subpallet in place. If LM simulator and barbell traverse are to be used, the deployable subpallet must be replaced with the non-deployable subpallet. Emplace deployable Subpackage No. 1 at the approximate site of the central station deployment. Place deployable subpallet at approximate site of Subpackage No. 2 deployment.

2-4 TOOLS AND EQUIPMENT

When working with the training model, assemble required tools, cleaning materials, packing containers, clean drop cloths and other items required to complete restowing the Interim Trainer Model.

NOTE

Two technicians are required to restow the ALSEP Interim Training Model, a third should be available to assist.

A representative list of tools and materials required or recommended includes the following:

- Cable rewind tool
- Erector spring retainers
- Sunshield supports (4)
- Thermal curtain folding aids
- PSE shroud folding platform
- Boyd bolt installation tools
- ME stowage tools
- Packing containers
- 3/8" Hex nut driver
- Forceps
- 0-1" micrometer
- 0-1" inside caliper
- Needle nose pliers
- Screw driver (small)
- Clean lint-free cloths
- Brush
- Soap (mild) and water
- Light leather gloves
- Isopropyl alcohol
- Mild cleanser
- Air supply (low pressure)

The packing containers may serve a dual purpose, as storage and shipment containers, and as a level bench-type surface during the restowing process. Overlaid with clean drop cloths, the packing containers provide a working surface at a height which enhances the efficiency of restowage. The containers may also be used to elevate the PSE shroud folding platform for shroud stowage. (The PSE folding platform is a 4 x 4-foot plywood board with an eight-inch diameter hole in the center to receive and hold the PSE sensor base during shroud stowage.)

Figure 2-1 shows configuration of the cable rewind tool and erector spring retainer. Figure 2-2 shows configuration of the Boyd bolt installation tools.

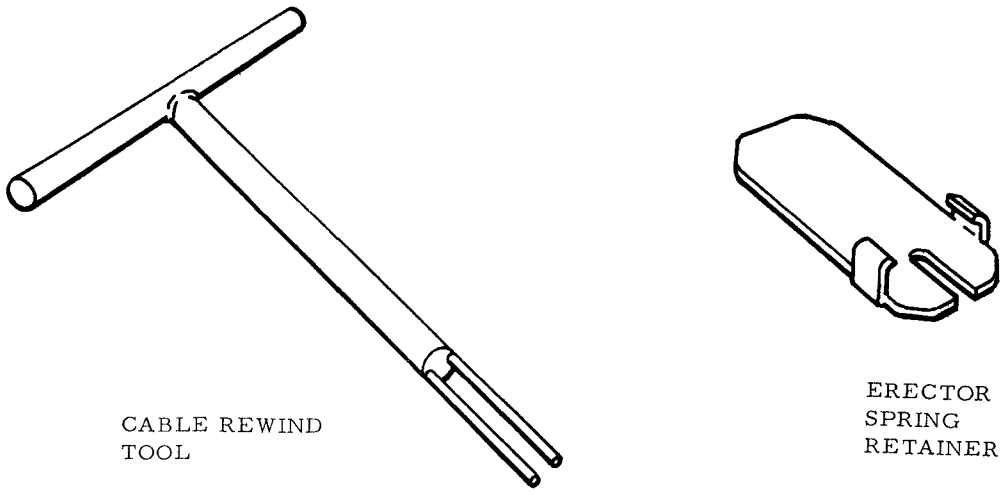


Figure 2-1 Cable Rewind Tool and Erector Spring Retainer

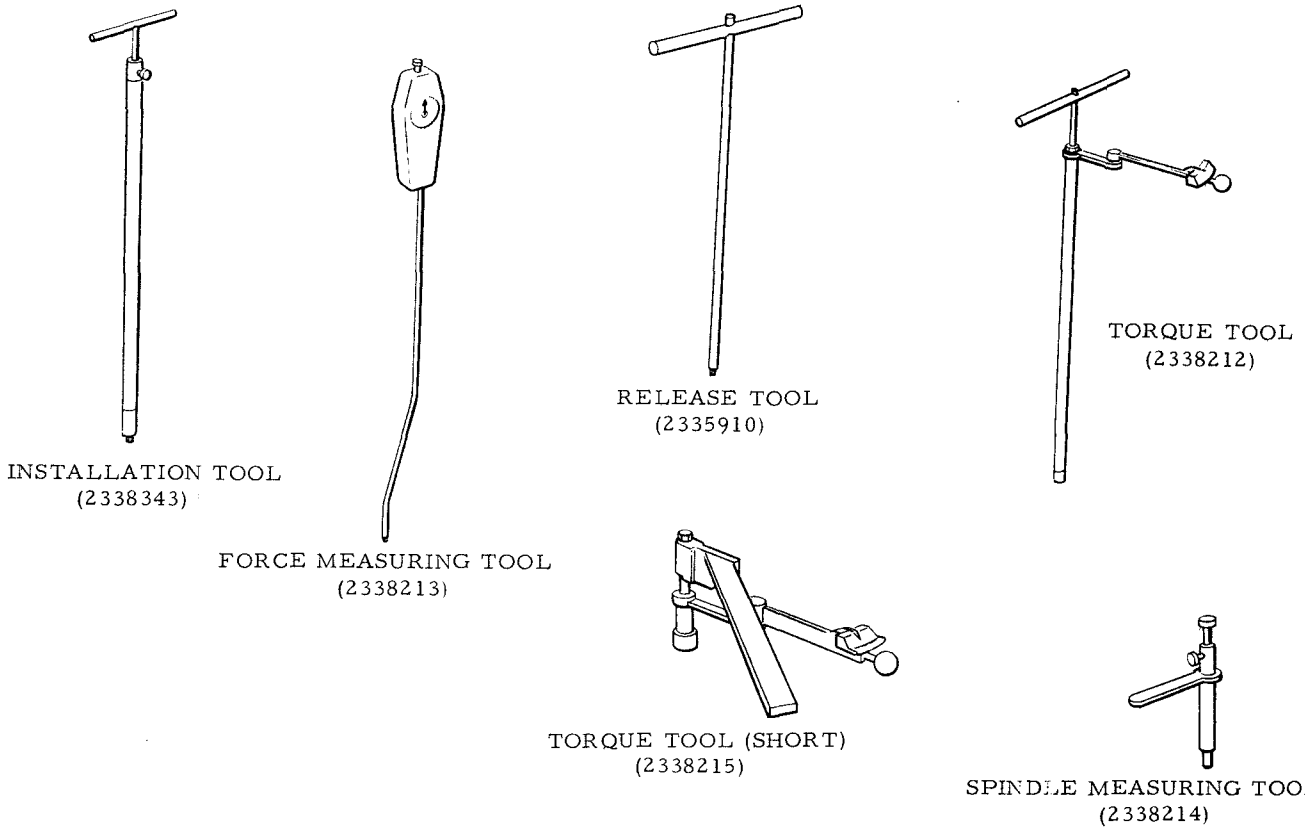


Figure 2-2 Boyd Bolt Tools

SECTION III

TRAINER HANDLING AND STOWAGE

3-1 GENERAL

After deployment, trainer assemblies and sub-assemblies are dispersed over a relatively large area. (See Frontispiece, page v, for idealized deployment.) To assure complete retrieval and reassembly, the following procedures should be followed. A check list of dispersed components or subassemblies, excluding experiments includes:

Subpackage No. 1 LM constraining fasteners (2)

Subpackage No. 2 LM constraining fasteners (2)

Cask retaining pin lanyard pins (2)

Dome Removal Tool (DRT)

Tool support bracket with fasteners (from Subpackage No. 2)

Fuel transfer tool (FTT)

Universal handling tool (UHT)

ALHT quick release pins (2)

Experiment handling tool (EHT)

ALHT T-shaped retaining pins (2)

RTG back support structure tie-down fasteners (3)

Back support structure outer structure

RTG cable reel

Shorting plug

RTG power receptacle dust cover on central station

Boyd bolts (43)

SIDE cable connector dust cover on central station

ME metal collar and foam inserts

EGFU release assembly

PSE leveling stool tiedown with fasteners

Thermal shroud retainer and girdle

RF cable restraint and discs

Antenna tiedowns

Thermal curtain restraints (3)

Antenna aiming mechanism clam shells, housing, and cover

ME carrying strap

CCIG retaining bracket

SIDE ground screen tube including mylar shroud

Collect all sub-assemblies and discarded components, including the non-deployable subpallet, and secure on a clean flat surface at the deployment site. Inspect each item for damage. Clean, as required, when the components have been exposed to sand, dirt, or moisture during deployment.

3-2 STOWAGE SEQUENCE

The following paragraphs describe the restowage of the ALSEP Interim Training Model by major elements. The major elements of Subpackage No. 1 and Subpackage No. 2 are depicted in Figures 3-1 and 3-2 respectively. The initial step is to disconnect the RTG and SIDE cables from the central station, thus physically disconnecting the two subpackages. The following stowage sequence has proven effective in assuring all elements are restowed and that the buildup of the subpackages is sequential. Refer to paragraph 4-14 for Boyd bolt installation procedure. The subpallet and subpackage No. 2 should be raised to a convenient working height for restowage.

3-3 SUPRATHERMAL ION DETECTOR EXPERIMENT (SIDE)

a. Rewind the SIDE cable into the cable reel using the cable rewind tool. (See Figure 3-3.)

b. Stow the cable and reel in the SIDE compartment.

c. Collapse and secure the legs with the leg release pin.

d. Remove back support structure from subpallet, then position the SIDE on the deployable subpallet of Subpackage No. 2 and secure the four Boyd bolt fasteners. Replace back support structure.

e. Fold the SIDE ground screen as follows:

Spread ground screen (GS) out on a table or other flat surface.

Slowly raise GS partly off flat table by lifting extractor with one hand.

Place palm of other hand immediately under hub of GS.

Slowly close palm of hand (holding hub) folding all rods upward to a closed position. Note, use other hand to guide and assist in this step.

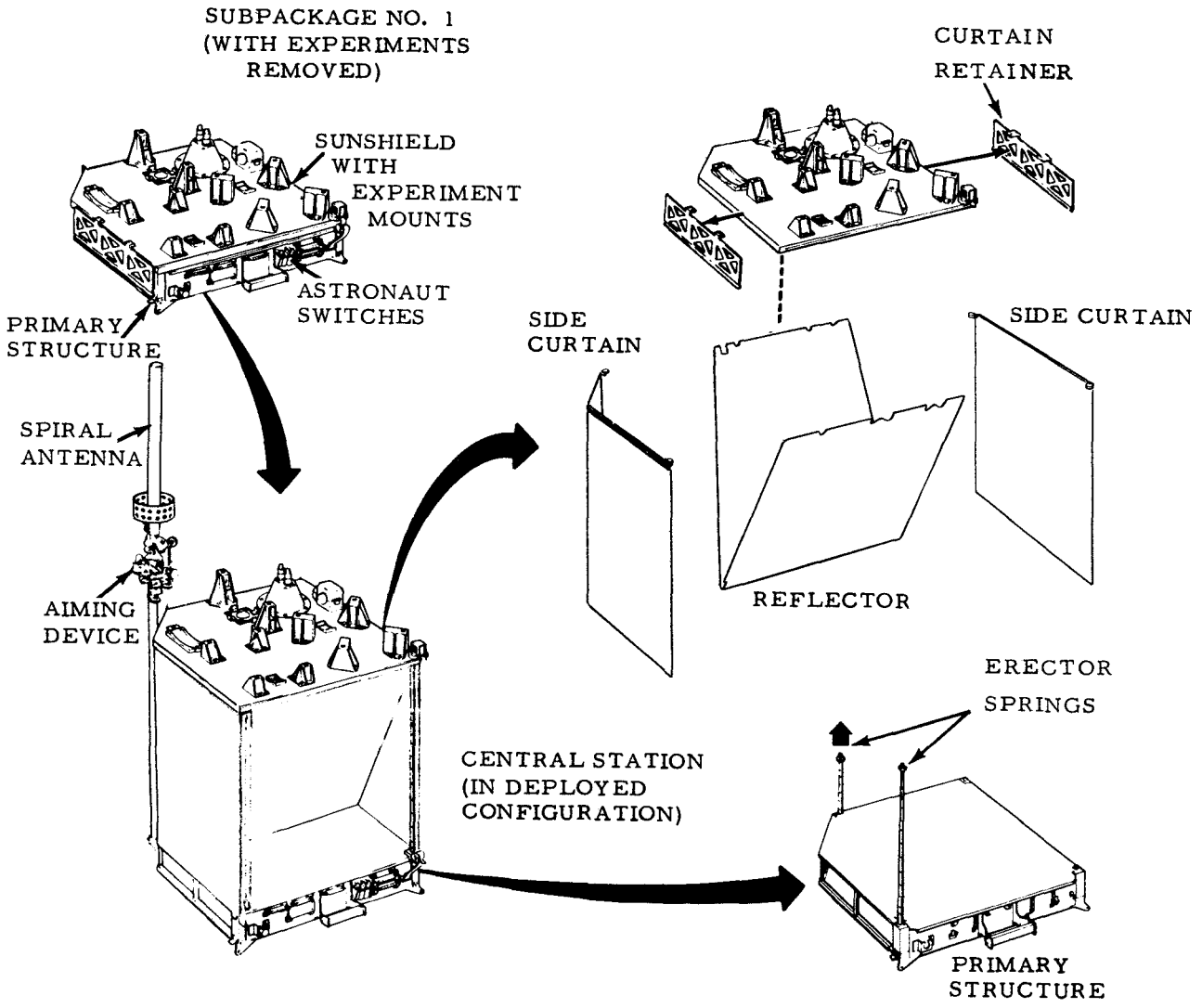


Figure 3-1 ALSEP Subpackage No. 1

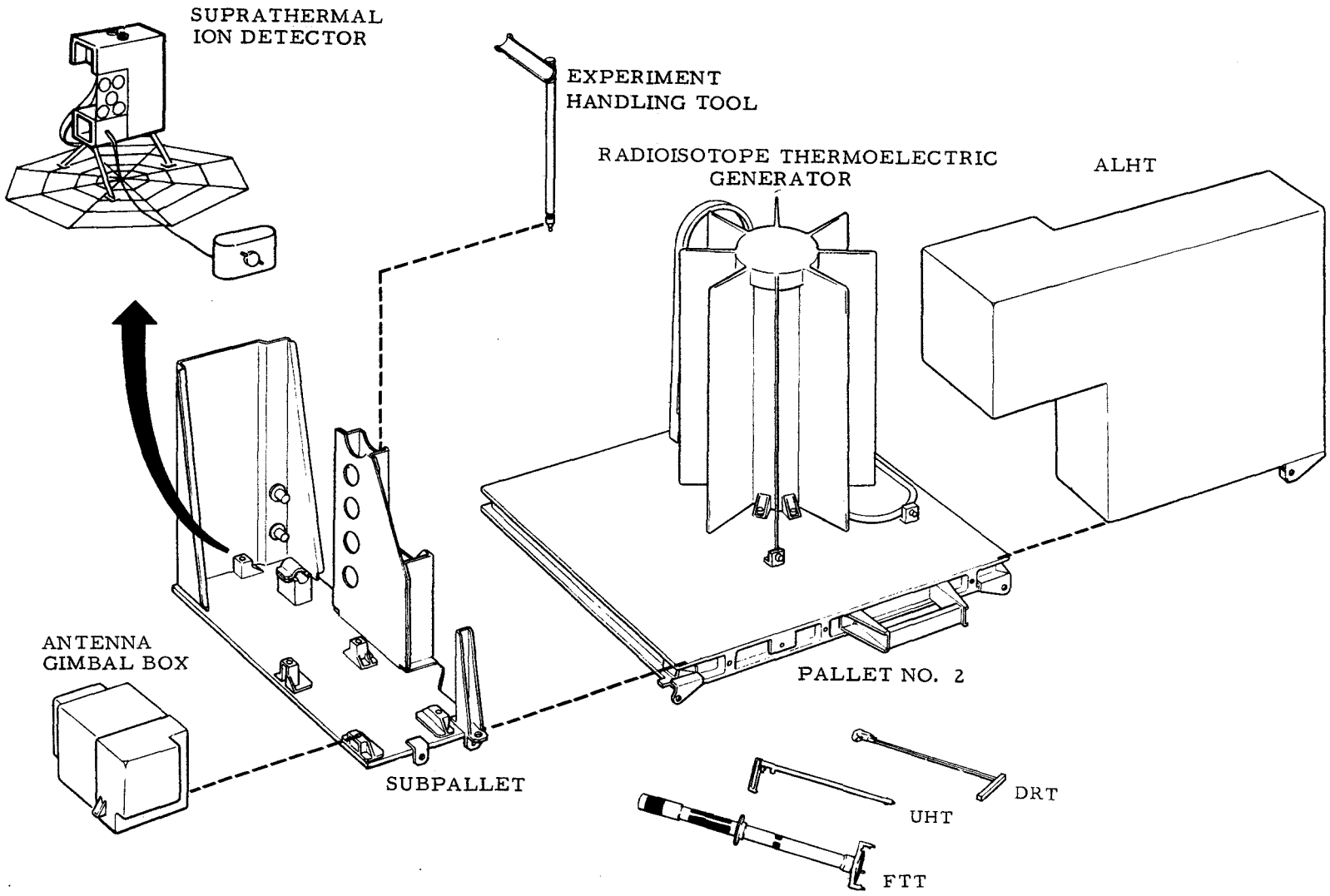


Figure 3-2 ALSEP Subpackage No. 2

Drape all wire loops downward. Caution: do not put sharp bends in wire.

Lay ground screen (in folded position) horizontally on spread-out mylar sleeve. Slowly and tightly roll mylar sleeve around ground screen rods.

Slowly insert hub end of GS into ground screen tube.

Continue inserting GS into tube with a twisting motion. Caution: do not wrinkle mylar sleeve. If wrinkles occur reassemble as necessary.

f. Stow wire along length of back of ground screen tube, and snap the tube into the clips on the SIDE, ensuring wire is stowed properly behind tube.

g. Stow the CCIG in the SIDE compartment.

h. Stow CCIG lanyard and cable as follows:

With the CCIG in position, hold the lanyard straight out horizontally.

Twist lanyard 180° clockwise to form a 3" loop at its end.

Fold loop under to form a pile of two loops.

Twist lanyard again 180° clockwise and fold under the pile to form a third loop.

Repeat this action until a total of five loops is obtained.

Fold the loops down flatly against the side of the CCIG and hold temporarily in place with tape.

Coil CCIG cable counterclockwise into a 3-inch diameter pile. Continue coiling until all slack is taken up.

Remove tape from lanyard coil and combine the lanyard and cable piles.

Hold the piles in place while securing cover.

3-4 SUBPALLET (Non-Deployable)

a. Slide the non-deployable subpallet under the clips at the rear of Subpackage No. 2 and secure with a quick-release pin at the front. Secure subpallet with Boyd bolt.

b. Stow the EHT on the subpallet (see figure 3-11).

3-5 ANTENNA

a. Remove the antenna helix from the aiming mechanism.

b. Orient the antenna with the cable exiting from the base to the left front of the Subpackage No. 1 sunshield. (see Figure 3-4.)

c. Secure the antenna to the sunshield with retainers and fasteners.

3-6 ANTENNA AIMING MECHANISM

a. Remove the aiming mechanism from the antenna mast.

b. Adjust aiming mechanism to fit smoothly into clam shell foam protection (note scale readings for future use), and insert into one half of clam shell. Verify fit, and place remaining half of clam shell over aiming mechanism. (See Figure 3-5.)

c. Slide the foam-protected aiming mechanism into the antenna aiming mechanism box and position the cover.

d. Secure the antenna aiming mechanism box to the subpallet with the two fasteners.

3-7 RADIOISOTOPE THERMOELECTRIC GENERATOR (RTG)

a. Replace the shorting plug on the RTG cable.

b. Rewind the RTG cable on its reel.

c. Slide the retainer on the cable and cable reel, ensuring cable loop is under the retaining clips.

d. Secure the cable reel assembly to Subpackage No. 2, securing with fasteners at the rear and then the front.

e. Using FTT remove fuel capsule from the RTG and stow in the fuel cask.

f. Stow the FTT on subpallet of Subpackage No. 2.

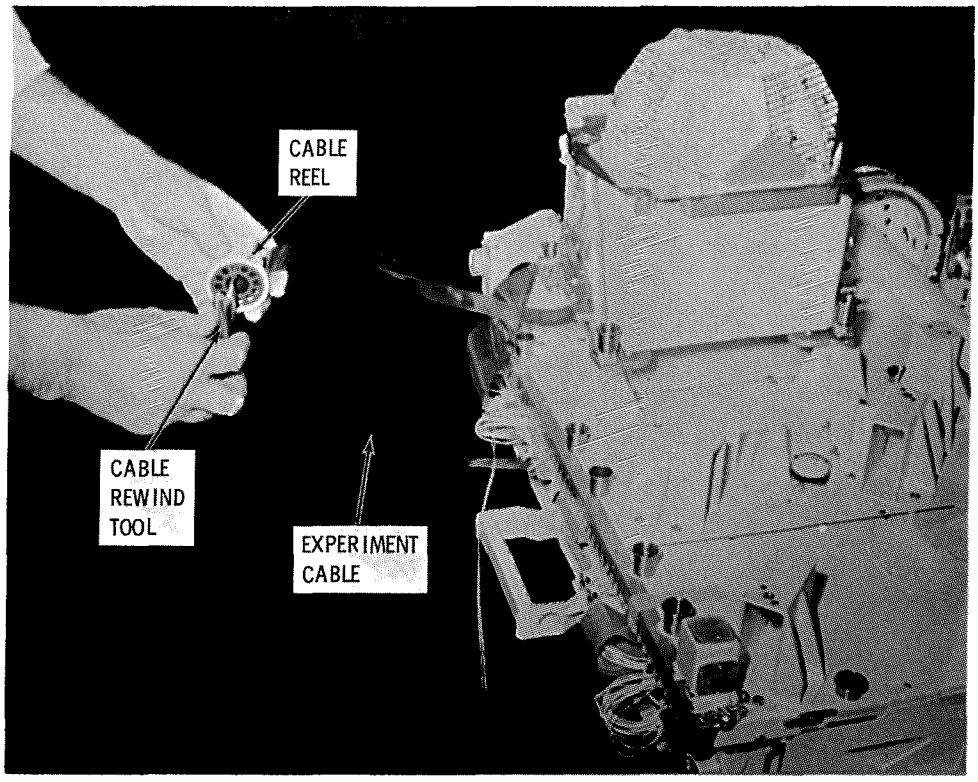


Figure 3-3 Experiment Cable Rewind (Typical)

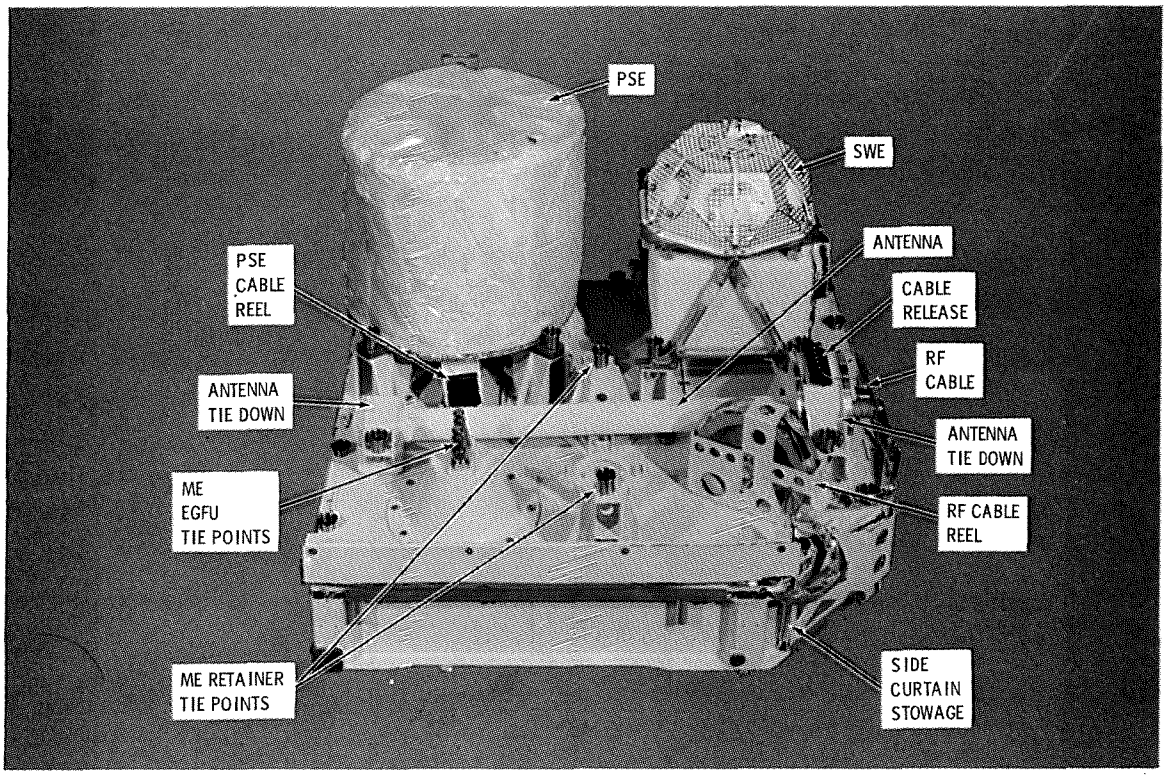


Figure 3-4 Antenna Stowage

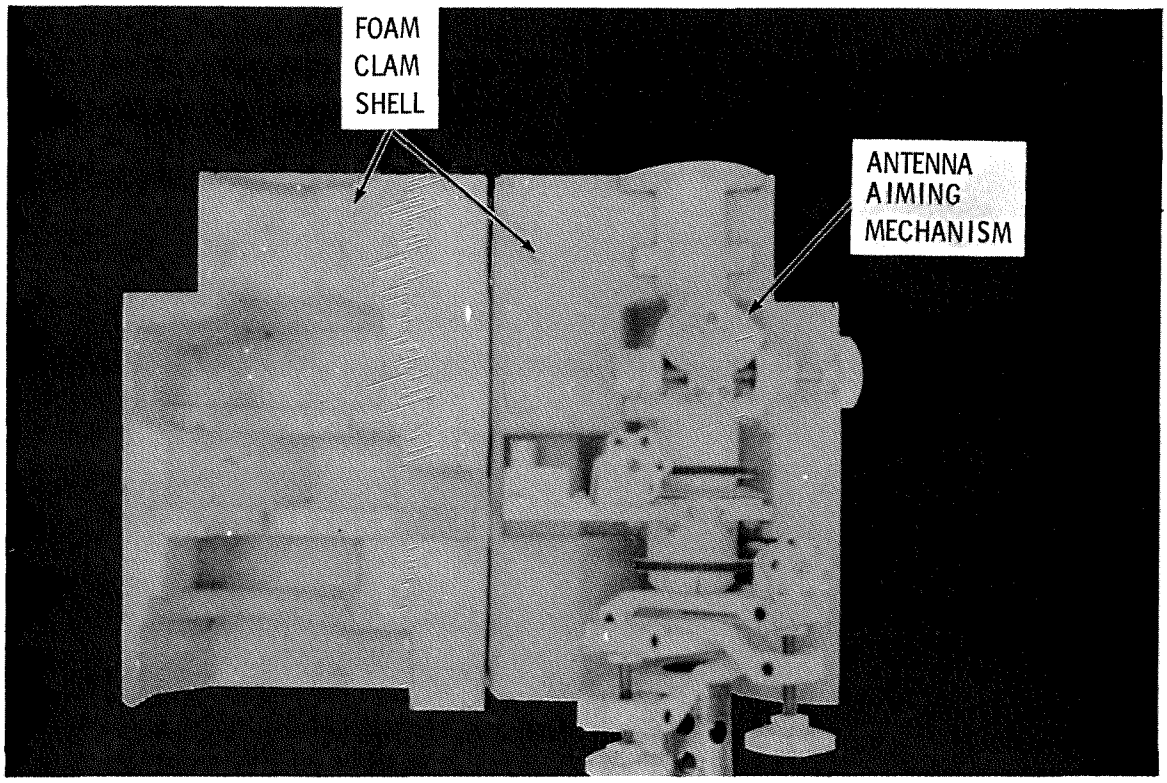


Figure 3-5 Antenna Aiming Mechanism Stowage

3-8 ANTENNA MAST

a. Disconnect the antenna mast from Subpackage No. 1, separate the sections, and position on non-deployable subpallet mounting fixtures. (See figure 3-6)

b. Position the tool forward support bracket on the subpallet and align the mating parts.

c. Secure the tool support bracket to the subpackage with the quick-release pin (See figure 3-11).

3-9 PASSIVE SEISMIC EXPERIMENT (PSE) STOOL

a. Remove the PSE from the stool and place in previously positioned PSE folding platform.

b. Position PSE stool on mount provided on the subpallet. (See figure 1-4)

c. Add the PSE stool retainer and secure with fastener.

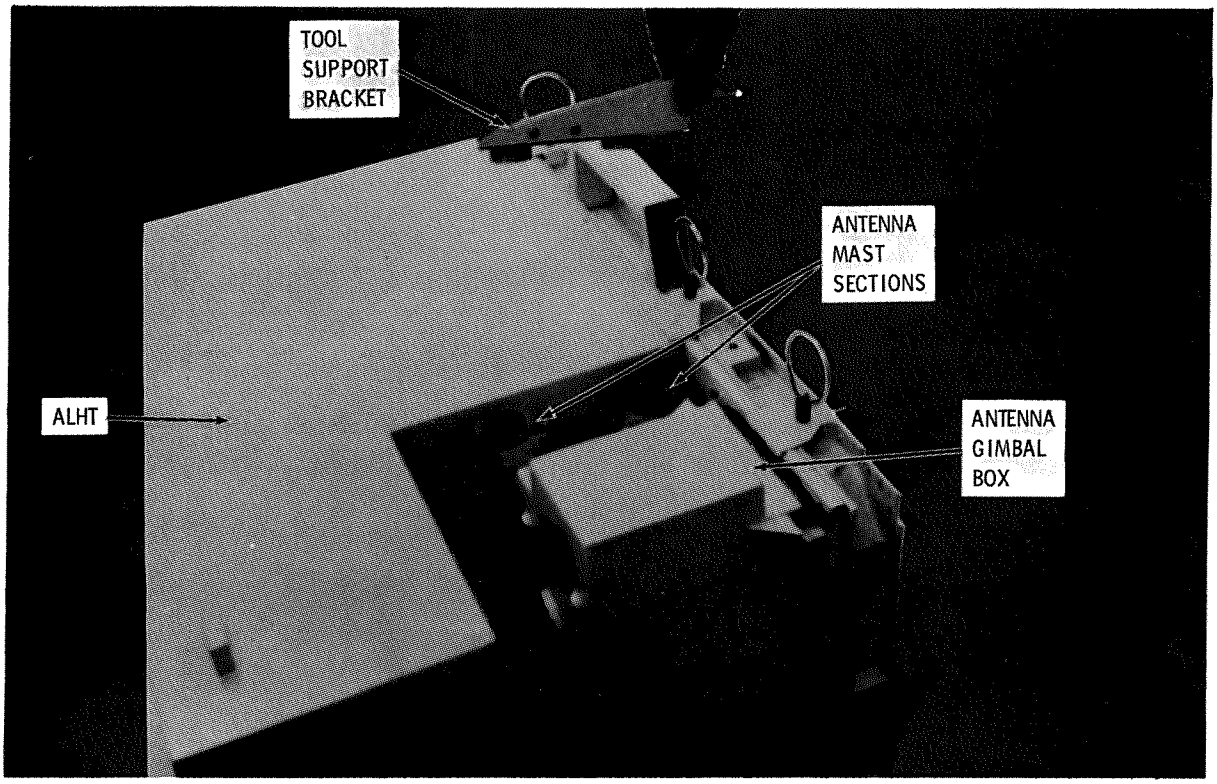


Figure 3-6 Antenna Mast Stowage

3-10 APOLLO LUNAR HAND TOOLS (ALHT)

a. Replace tools on carrier and fold carrier (see Figure 3-11).

b. Replace T-shaped locking pins.

c. Position ALHT on Subpackage No. 2.

d. Secure with two quick-release pins at front of subpackage.

3-11 CENTRAL STATION

Verify experiments to be mounted on sunshield (ME, PSE, and SWE) have been relocated near the central station to avoid strain on deployed cables.

NOTE

Two or more technicians should be available during restowage of the Central Station. The technicians should be familiar with the ALSEP Interim Training Model design, use, and structural materials.

Using a two-man team lift the central station atop a table, bench, or one of the packing cases covered with a clean drop cloth. Elevating the deployed central station facilitates the restowage process.

a. Insulation

Verify the insulation between the primary structure and thermal plate is aligned.

Temporarily insert fasteners at key locations to hold the insulation aligned.

b. Erector springs (see figure 3-7)

Position a sunshield support adjacent to each of the erector springs, exercising care to avoid placing supports on aluminized mylar of the thermal plate and the underside of the sunshield.

Remove nuts from top of each erector spring using 3/8-inch nut driver, and retain.

Position an erector spring retaining clip near each of the erector springs on the primary structure.

Release Velcro at bottom of right and left side thermal curtains and fold curtains across top of sunshield.

NOTE

It is recommended that light leather gloves be worn for the following spring stowing procedure to protect hands and to improve grasp on the erector spring.

Individually free each erector spring from the sunshield and stow by twisting and inserting layer by layer, ensuring initial spring layer is seated and extends to the outer edge of the stowage cavity.

c. Sunshield lowering

NOTE

Two or more technicians are required to accomplish the tasks involved in lowering the sunshield.

Remove the fasteners temporarily installed to hold the insulation between the thermal plate and primary structure in place.

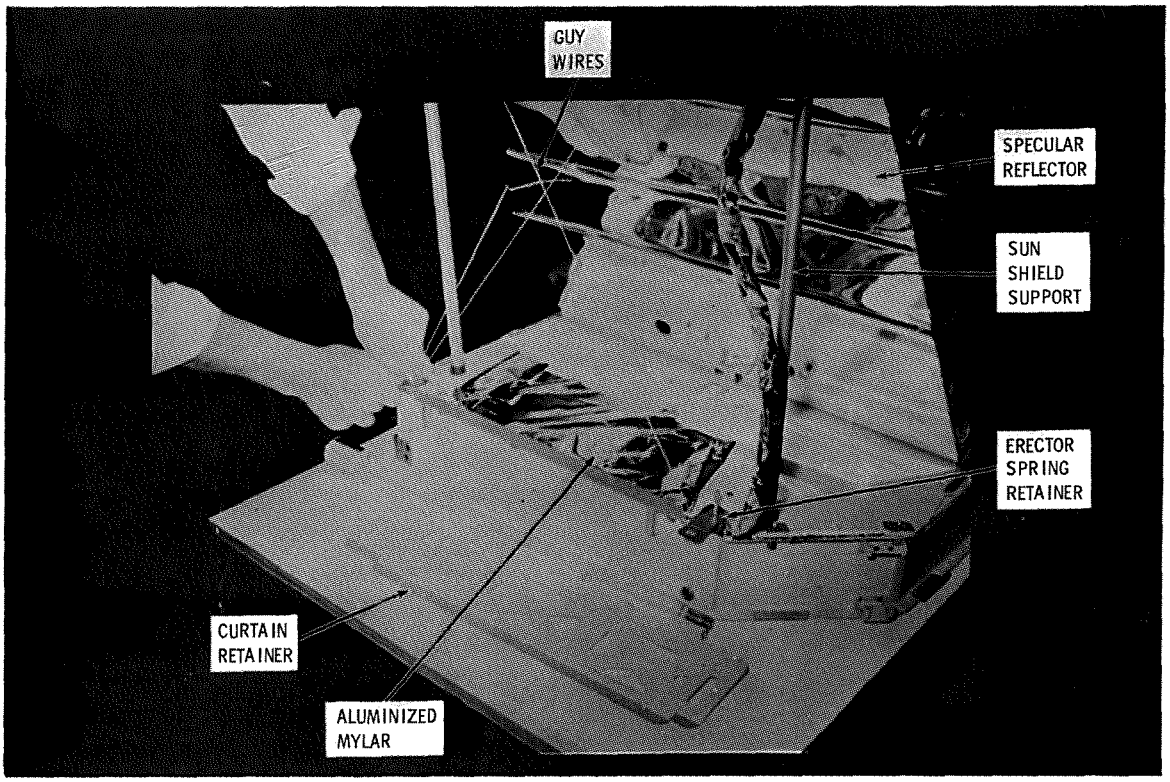


Figure 3-7 Erector Spring Stowage

Verify that all insulation is in place.

Verify specular reflector retainer is in place.

Verify guy wires are clear.

Remove the sunshield supports and gently lower the sunshield verifying that the specular reflector folds in pre-creased places and is aligned to provide clearance around the three center fasteners.

Verify that side thermal curtains and guy wires are free from between sunshield and thermal plate.

After sunshield is lowered, install the three center fasteners and two others on opposite sides to retain the sunshield and ensure stowage clearance.

d. Dust detector cable

Rewind dust detector cable on cable reel, using rewind tool and clip.

Stow dust detector cable and reel in right corner between sunshield and retainer.

Install spring clip for dust detector cable into reel.

e. Guy wires

Stow the front and rear guy wires; the rear wires between the sunshield and rear lunar reflector; and the front wires between the sunshield and front lunar reflector. Work from both sides toward the center of the subpackage.

NOTE

Guy wire stowage may be expedited if two or more technicians are available. Release the partial restraint of the sunshield as one technician maintains downward pressure on the sunshield. Allow the sunshield to raise approximately 3/4 inch and hold in that position while another technician restows the guy wires.

h. Sunshield

After guy wire stowage, remove erector spring retaining tools and torque all sunshield fasteners.

Replace and tighten nuts on top of each erector spring.

i. Thermal curtains (See figure 3-8)

Double right side thermal curtain inward, insuring guy wires are inside the curtain, and secure to underside of top flange on the primary structure with attached Velcro tape.

Using three, three-inch wide folding aids, accordion fold the thermal curtain into the compartment. The initial fold must be toward the primary structure, alternating direction as each of the accordion folds is accomplished. Secure the right thermal curtain with the curtain retainer and fasten retainer to sunshield using rivets (3).

Double the left side thermal curtain, insuring guy wires are inside, and secure to underside of top flange on primary structure using attached Velcro tape.

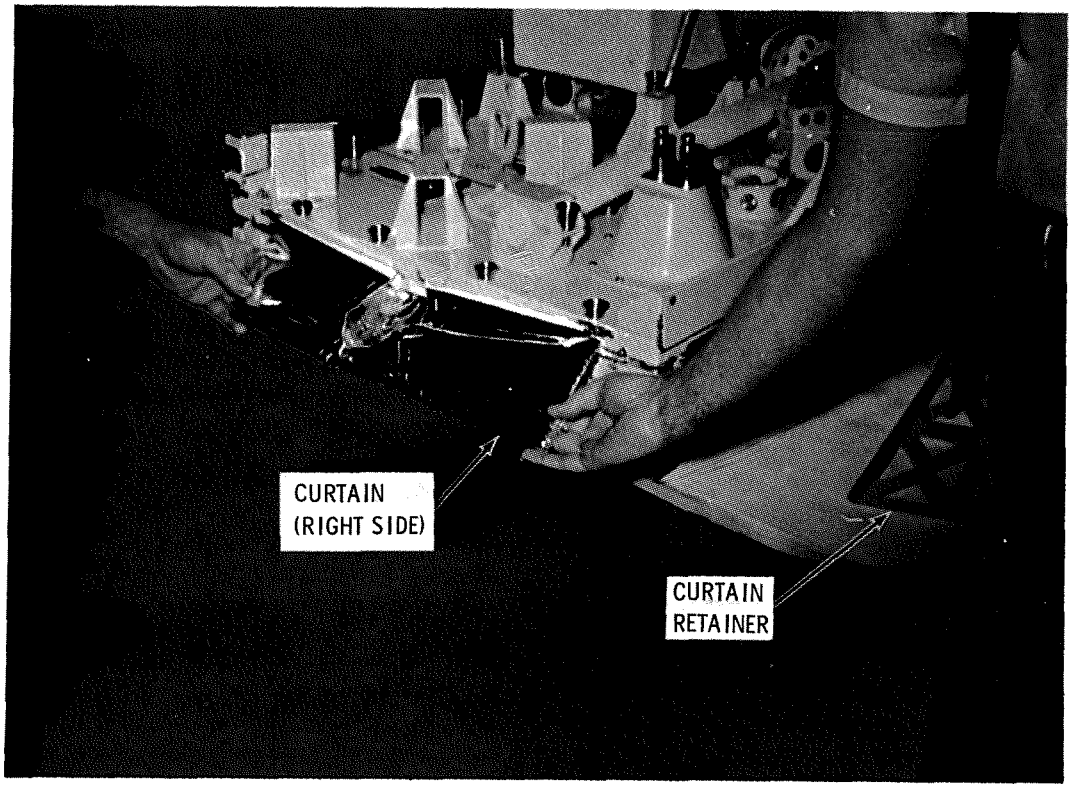


Figure 3-8 Thermal Curtain, Final Fold

Using the three three-inch wide folding aids, accordion fold the thermal curtain into the compartment. Initial fold must be toward the primary structure alternating direction as the accordion folding is completed. Wedge the corner portion of the thermal curtain, at the left rear, behind the antenna mounting flange and secure with small curtain retainer and rivet (1). Fit the parallel portion of the curtain into the compartment and secure with the longer curtain retainer and rivets (2).

3-12 RF Cable

a. Stow the rf cable on the two discs and place in retainer on sunshield. (See figure 3-4.)

b. Replace top bracket by straightening the spring-loaded clips and secure with cable retaining pin.

c. Secure the rf cable release device with Velcro tape on the sunshield.

3-13 MAGNETOMETER EXPERIMENT (ME)

a. Fold and stow the three ME sensor booms.

b. Position the boom inserts, and fold the legs into place.

c. Replace the carrying strap.

CAUTION

Two persons are required to replace the ME on the subpackage; one to lift the ME and one to carry the cable reel.

d. Install the ME as follows:

Pick up the ME by grasping the A-brace near the EGFU with both hands.

Have the other person inspect the locking mechanism through the pin holes to determine that the locking yokes are withdrawn, then pick up the cable reel.

Transport the ME to the subpackage and lower it to a point adjacent the position of installation.

Install the cable reel into its mounting bracket on the subpackage. (See figure 3-9.) During this operation, respool or remove cable from the reel as required to correctly route the cable. Care must be exercised to insure that cable is removed from the reel equally at both ends.

Carefully lower the ME into position on the sunshield pins (See figure 3-4) of the subpackage while another person removes cable slack by stowing excess cable in the reel.

CAUTION

During this step, make sure the thermal blanket is not damaged or carried into the pin holes by the pins.

Push the ME firmly down to the pin shoulders.

Insert the electronics unit locking tool and lock the electronics unit in position, then remove locking tool.

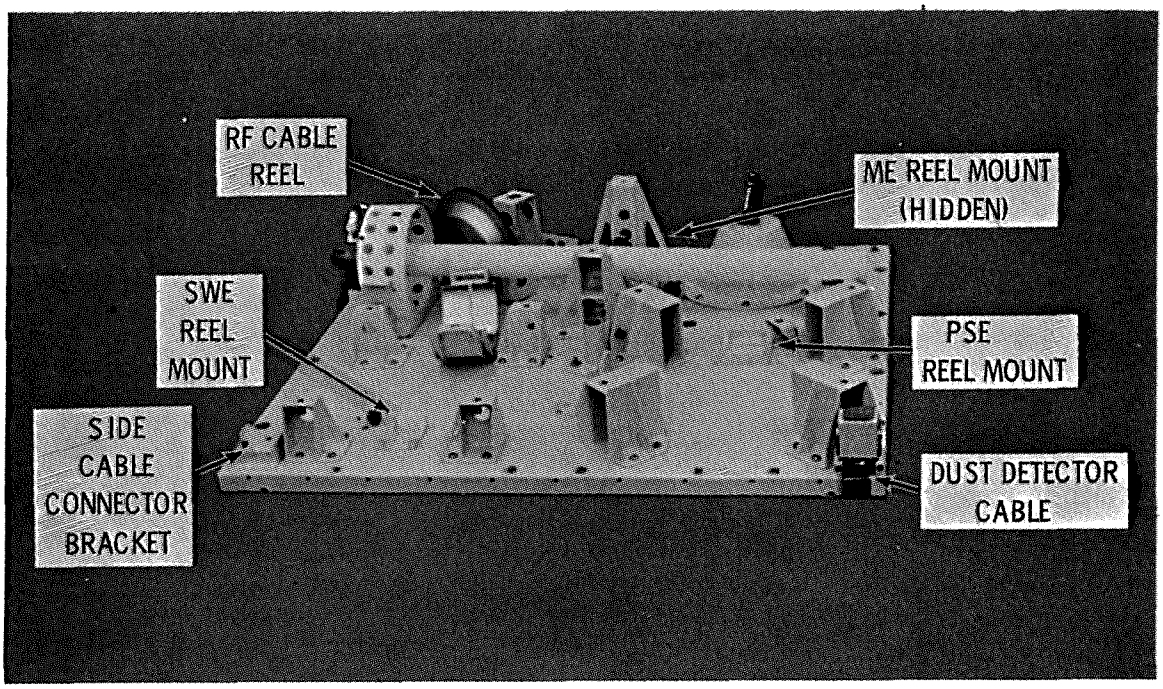


Figure 3-9 Cable Reel Stowage

Insert two quick-release fasteners through the keyed cable lugs and the forward mounting holes of the ME.

Reeve the upper mounting bracket securing cable through the guides.

Push the securing cable tensioner lug on the end opposite the head; the head will move against its retainer spring. While in this free position, turn the fastener in a clockwise direction, using the UHT, until the bracket securing cable is tight. Push the head while slightly rotating the lug to find a locking position.

3-14 SOLAR WIND EXPERIMENT (SWE)

a. Retract the SWE legs and secure.

b. Rewind the SWE cable on the reel using the cable rewind tool.

CAUTION

Two persons are required to position the SWE on the subpackage; one to hold the SWE while the other holds the cable reel.

c. Position the SWE on the sunshield mounting brackets as follows:

Pick up the SWE and place it on the subpackage, being careful to maintain pressure on expandable legs.

Place the Boyd Bolt spacer washer under cup on the SWE leg.

Have the second person place the cable reel in its mounting fixture (See figure 3-9), then engage the four SWE Boyd Bolts as instructed in paragraph 4-11.

d. Close the SWE sunshield by lifting on the top of the experiment, depressing the SWE sunshield and allowing the latches to engage the notches near the end of the sunshield. Release the top of the experiment.

3-15 PASSIVE SEISMIC EXPERIMENT (PSE)

a. Position the PSE in the folding platform so that the base of the sensor extends through the hole in the center of the jig. Verify sensor base is free from contact with abrasive surfaces.

b. Spread shroud out on flat surface smoothing to remove air trapped underneath. (Smoothing process should be repeated during shroud stowage process to evacuate air and assure compact packing.)

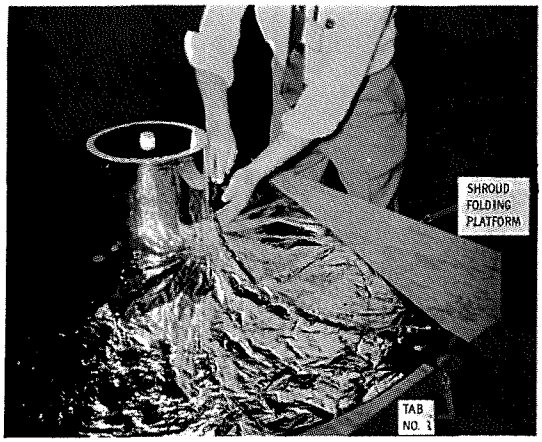
c. Locate deployment tab on shroud labeled No. 1. Select next tab counterclockwise from No. 1 tab and fold shroud to center of base of PSE. Continue counterclockwise from tab to tab folding to the center and smoothing to remove trapped air. (See figure 3-10.)

d. After folding the No. 1 tab to the center, proceed to the next fold point and fold to the center of the top of the sensor. Hold the folds on top of the sensor with one hand and continue folding until all folds are positioned to the center of the top of the sensor.

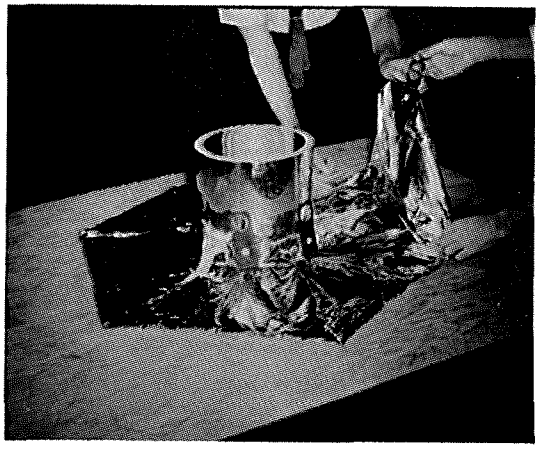
NOTE

Two technicians are required to complete PSE shroud stowage and girdle emplacement.

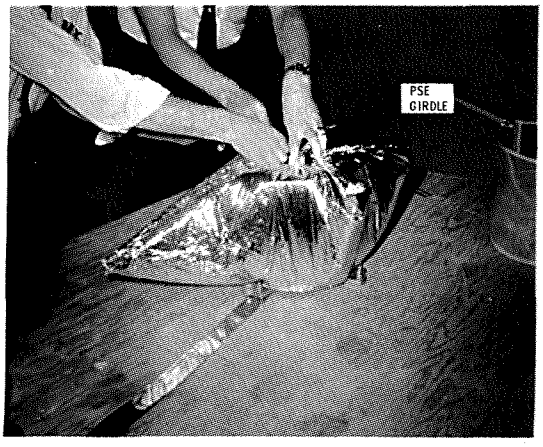
e. As one technician holds the shroud in place on the PSE, the other technician places the girdle over the shroud ensuring that the retained pin opening is near and to the left of the UHT socket.



First Fold
To PSE Base



Last Fold
(Tab No. 1)
To PSE Base



Folding
Shroud
Over PSE

Placing
Girdle
on PSE

Figure 3-10 PSE Shroud Folding Sequence

f. Insert the retainer (hairpin) into the girdle securing the shroud.

g. Position the PSE on the sunshield mounts with the UHT socket in the front right quarter.

h. Rewind PSE cable on reel using cable rewind tool.

i. Lift PSE and position cable and reel in retaining bracket (See figure 3-9).

j. Center PSE on mounts and secure with fasteners.

3-16 DUST COVERS

a. Replace RTG connector dust cover on Subpakcage No. 1.

b. Replace SIDE connector dust cover on Subpackage No. 1.

3-17 TOOL STOWAGE

a. Stow FTT and DRT in their stowage locations on the non-deployable subpallet.

b. Insert UHT through tool support bracket and lower antenna mast section on non-deployable subpallet, and secure in place by engaging trigger guard locking clip (see figure 3-11).

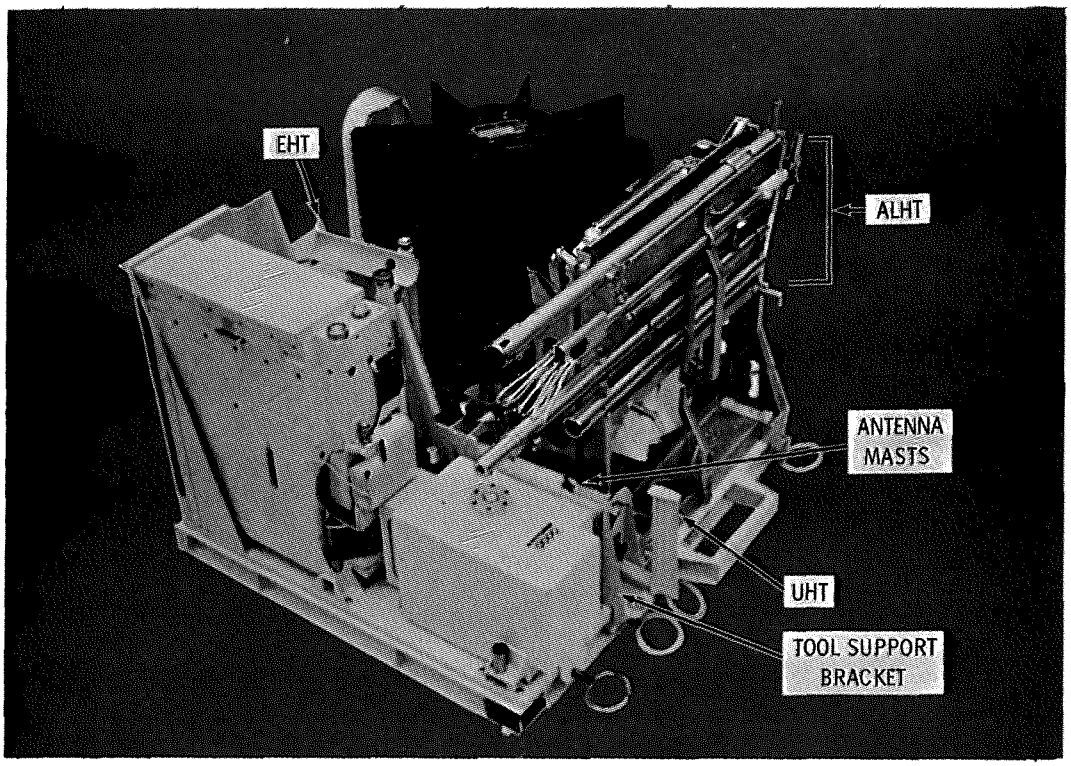


Figure 3-11 Tool Stowage

3-18 FUEL CASK AND MOUNTING ASSEMBLY

a. Replace the cask dome, locking mechanism (spider), and spline.

b. Return the cask to vertical by operating the lanyard lock and lock in place.

c. Remove cask mounting assembly from LM attaching points, exercising care to avoid dropping cask and assembly.

3-19 TRAINER STOWAGE (Post and Pre-deployment Configuration)

Four reusable plywood containers are provided for transportation and storage of the Interim Training Model. The smaller container is used to contain the fuel cask, mounting assembly, and handling tool. The two medium containers are used to house deployable Subpackage No. 1 and Subpackage No. 2 with the non-deployable subpallet in place. The larger container is used to house non-deployable Subpackage No. 1, the deployable subpallet for Subpackage No. 2, and any accessory items required. The front side of the containers for the deployable subpackages is hinged to facilitate removal and replacement of the subpackages.

To repackage the training model:

a. Verify polyurethane foam lining of all sides and bottom of containers is in place.

b. Cover models with vinyl sheeting and place in respective containers.

c. Insure sufficient dessicant is placed into each container to assure a relative humidity not greater than fifty (50) percent.

d. Fill void areas in each container with dunnage.

e. Place polyurethane foam over the top of the models and close and secure containers.

f. Transport containers to the storage area.

Packaging the models in the foregoing manner provides adequate protection from normal environmental conditions for transportation and storage.

SECTION IV

MAINTENANCE

4-1 GENERAL

The ALSEP Interim Training Model is fabricated as closely as possible to the flight configuration to simulate actual deployment conditions. The flight article is designed for one-time operational deployment. The Interim Training Model will undergo several deployment cycles and therefore must be handled with care to prevent damage. Maintenance of the Interim Training Model consists of preventive maintenance and corrective maintenance. Preventive maintenance includes inspection, cleaning, and lubrication. Corrective maintenance is essentially the removal and replacement of worn or damaged components.

4-2 PREVENTIVE MAINTENANCE

The tools and equipment required to accomplish preventive maintenance are listed in paragraph 2-4.

NOTE

All personnel conducting maintenance of any type should be thoroughly familiar with the ALSEP Training Model design, use, and structural materials. Inadvertent damage caused by unskilled handling could seriously reduce the effective life of the training model.

4-3 INSPECTION

The Interim Training Model should be inspected prior to and after each deployment, and prior to and after shipment by common carrier. The inspection shall consist of the following:

a. Check all mounting hardware for looseness.

b. Verify that all major components are present and free from scratches, tears, dents, or other breakage.

c. Verify that all cables and cable reels are properly stowed.

d. Verify quick-release pins are fully inserted and fasteners are secured.

e. Verify dust covers are in place on RTG and SIDE connectors on Subpackage No. 1 and dust cover is on the SIDE connector on Subpackage No. 2.

4-4 CLEANING

Use of the Interim Training Model will inevitably result in smudges, dust accumulation, and intrusion of other foreign particles or materials. To maintain effective and realistic operation of the model, it must be kept clean.

a. Use of clean lint-free cloths and a soft brush to wipe or brush surface clean will eliminate most soil accumulations.

b. Isopropyl alcohol on a soft lint free cloth will remove smudges and finger marks from the aluminized mylar surfaces.

c. Thermal painted surfaces, e.g., SWE, ME, and SIDE, must be cleaned with a mild solution of soap and water.

d. Surfaces finished with Dupont Lucite 4024L paint, e.g., non-deployable Subpackage No. 1, can be cleaned with a mild cleanser and water.

e. Use of an air supply, of sufficient pressure to remove particles and yet avoid damaging the training model, will aid in cleaning and drying the components of the model.

f. Boyd bolt fasteners shall be cleaned with low pressure air only. During restowage after deployment, major element and subpackage tie-down mounting holes should be cleaned with low pressure air.

Cleaning, as necessary after each deployment and restowage should adequately prevent malfunctions and unsightliness caused by soiling.

4-5 LUBRICATION

Lubrication requirements for the Interim Training Model are minimal, but should be performed after every second or third deployment to assure effective operation. The following items should be lubricated with a clean dry lubricant (Dri-Slide or Slip-Spray).

a. Fuel cask mounting assembly (See figure 4-1)

Worm gears

Sprocket

Release tabs

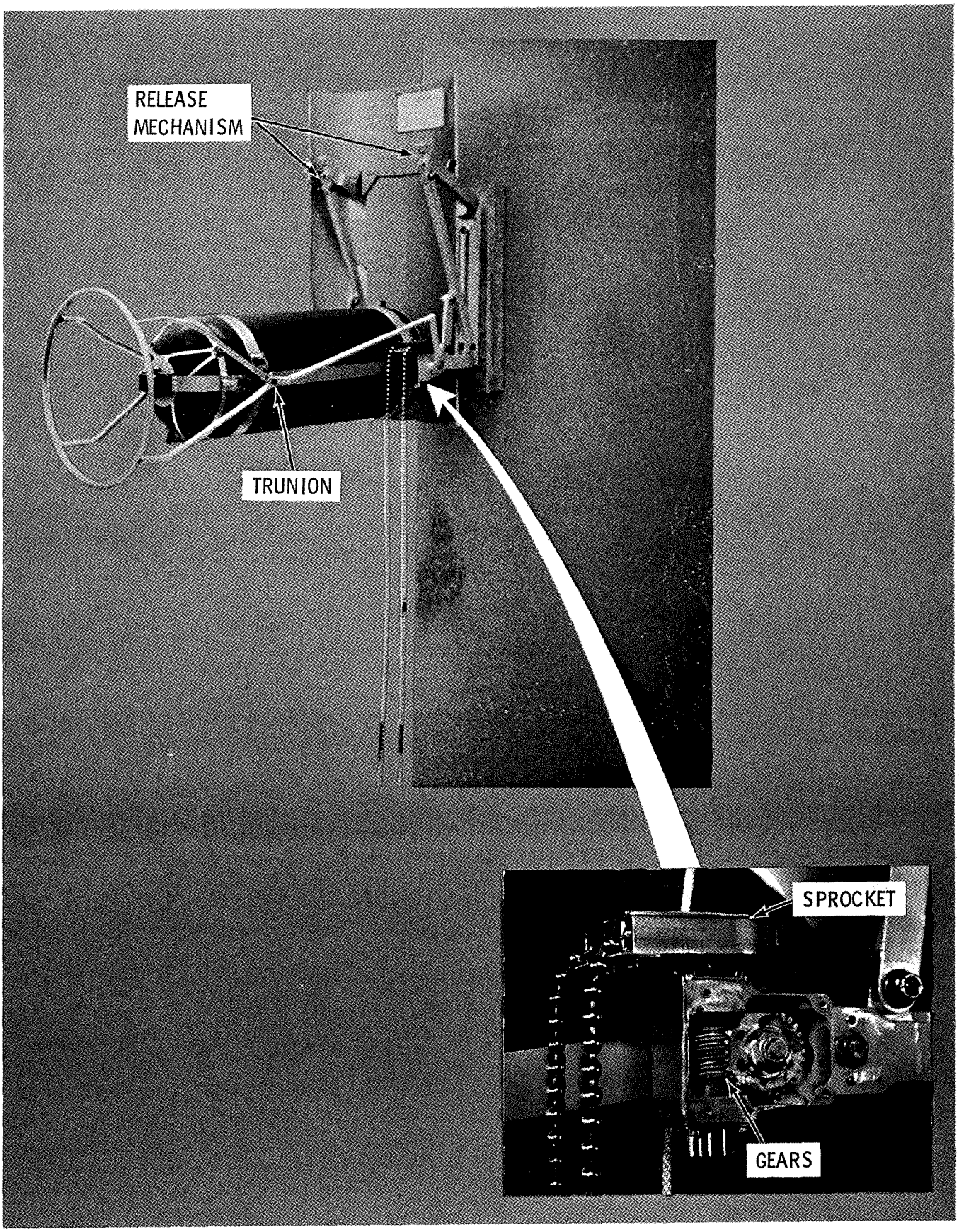


Figure 4-1 Fuel Cask Assembly Lubrication

Upper trunnions at points that slide into upper cradle members

b. Subpackage No. 1 (deployable)

Erector Springs (4)

4-6 CORRECTIVE MAINTENANCE

Corrective maintenance consists essentially of minor repairs and removal and replacement of worn or damaged components. Adequate spare parts are provided to support approximately 50 deployments. (Refer to Section V) It is recommended that a record of deployments and maintenance performed be maintained to assist in maintaining the training model.

4-7 ALUMINIZED MYLAR

Tears or slits in the aluminized mylar components, e. g., specular reflector, thermal curtains, and PSE shroud, may be repaired using the aluminized mylar adhesive tape provided, or with adhesive transparent tape.

4-8 BONDED COMPONENTS

In the event any components bonded to other surfaces, e. g., thermal plate spacers, should become loose or dislodged, rebonding may be accomplished by thoroughly cleaning both surfaces and rebonding with a quick-curing epoxy (Epon 901/B1 Shell Oil).

4-9 PAINT REPAIRS

Painted surfaces that have become marred or defaced may be touched-up using Dupont Lucite 4024L paint. Verify surfaces are clean and dry. Exercise care in paint application to avoid splattering and potential binding of mechanically operative components. Painted surfaces should be kept in good repair to enhance the effectiveness of trainer simulated deployments.

4-10 REMOVE AND REPLACE

Fasteners, attaching hardware, erector springs, retaining clips, cable connectors, cable assemblies, guides, and other similar components should be removed and replaced if inoperable or damaged. Exercise caution in disassembly and reassembly to avoid damage to relatively fragile components e. g., thermal curtains, specular reflector, cables, experiments, etc. With the exception of Boyd bolt fasteners, no special techniques are required for removal and replacement.

4-11 BOYD BOLT INSTALLATION

Boyd bolts are used to provide a quick-release fastening that retains the major elements on the subpackage tie-down mounts. The fastener quick-release feature permits bolt disengagement with a total movement of 75° rotation between locked and release position.

4-12 BOYD BOLT DESCRIPTION

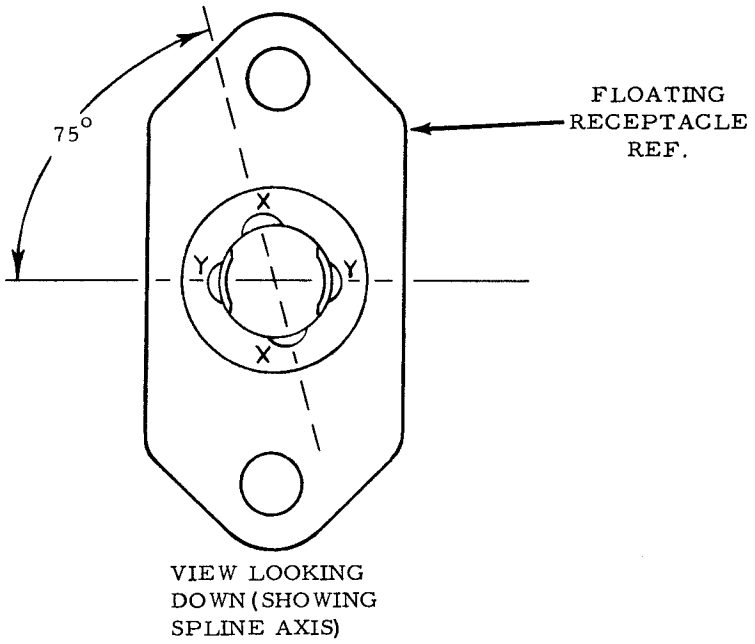
The Boyd bolt assembly is comprised of a floating receptacle and bolt assembly that mate to clamp major elements to the subpackage tie-down mounts. Figure 4-2 illustrates the bolt assembly.

The floating receptacle is attached to the subpackage tie-down mount structure with rivets or screws. The upper receptacle bore contains two locking splines (X axis) and two release splines (Y axis). A threaded section below the spline area on the receptacle is threaded to provide a 4-lead thread area in which the thread is removed in 90 degree segments. The end of the Boyd bolt assembly is threaded with the same 4-lead thread that engages the receptacle threads (breech type engagement).

Two captive locking balls located above the 4-lead thread section of the bolt are controlled by the position of the central spindle that operates in a bore through the bolt centerline. The balls fit in a notched section of the spindle which is spring loaded upward. When the spindle is free (not mechanically depressed), a ramp section machined in the notch cams the balls outward to provide positive ball engagement in the locking (X axis) or release (Y axis) splines in the floating receptacle.

The bolt head contains an internal double-hex socket that accommodates an Allen-type internal wrench that is incorporated in the special tools used in conjunction with bolt installation, assembly, or release. The bolt head is externally threaded to permit installation of a pre-tensioning nut on the bolt during installation. A release spring, held captive under the nut, is compressed against the mounting surface of the major assembly during nut installation, to provide an upward release force to assist in disengaging the bolt from the floating receptacle during bolt release.

The Boyd bolt assembly is installed by inserting a special Boyd bolt tool in the double hex socket in the bolt head. The Allen-type fitting on the tool tip depresses the central spindle releasing the outward cam pressure on the locking balls to permit bolt insertion into the floating receptacle. The bolt, with tool attached, is inserted through the major element mounting hole with the locking balls oriented with the Y axis in the floating receptacle. The bolt is then rotated approximately 75° clockwise until bolt rotation is stopped when the balls contact the edges of the X axis splines. The tool is then removed, releasing the central spindle which is then forced upward locking the balls in the X axis splines. This action prevents



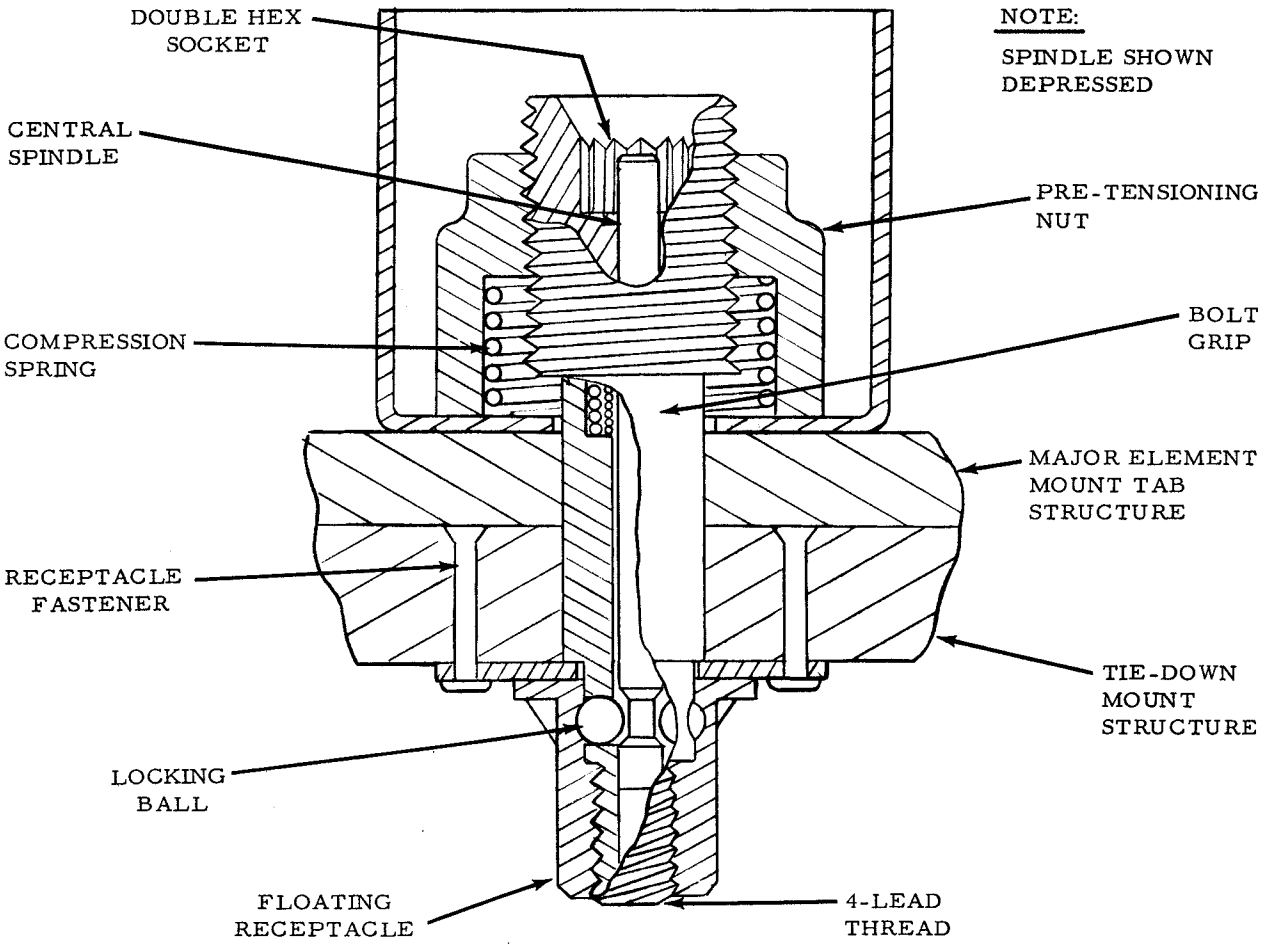


Figure 4-2 Boyd Bolt Assembly

bolt rotation and subsequent thread disengagement under load or vibration. The spring, and pre-tensioning nut is then installed on the bolt head and tightened to provide the bolt preload.

Bolt release procedure consists of inserting a Boyd bolt release tool in the double hex socket in the bolt head which automatically releases the locking balls. Bolt rotation of approximately 75° counterclockwise will disengage the bolt threads from the floating receptacle threads and permit the release spring to drive the bolt and pre-tension nut assembly out of the floating receptacle. Removal of the release tool causes the locking balls to be forced outward by the central spindle locking the balls to prevent thread re-engagement. A spiral pin in the floating receptacle provides a positive stop feature to prevent bolt rotation past the release spline during bolt release.

4-13 BOYD BOLT TOOLS

Boyd bolt tools consist of an installation tool, 2 torque tools (long and short), force measurement tool, spindle position measuring tool, and release tool. Tool operation will be described in the applicable steps of the Boyd bolt installation procedures contained in this paragraph. The tools are illustrated in figure 4-3.

4-14 BOYD BOLT INSTALLATION PROCEDURES—GENERAL

Boyd bolts can be re-used until physical damage (spline brinelling, thread abrasion, etc.) occurs, mechanism malfunction is observed, or the established number of deployment cycles have been accomplished. Procedures for Boyd bolt re-installation after deployment or installation of a replacement bolt are nearly identical. The following installation procedures will be applicable to either task.

The procedures assume the Boyd bolt assembly and pre-tensioning nut are separated. If a post deployment operation (restowage) is being performed, remove the nut from the bolt body with an Allen wrench and box end wrench.

Boyd bolt locations on Subpackage No. 1 and Subpackage No. 2 tie down mounts are shown in figures 4-4 and 4-5 respectively. Each illustration includes the bolt part number and grip length to identify the correct bolt required for each tie-down location.

4-15 PROCEDURE

Secure major elements to associated subpackage tie-down mounts as follows:

a. Refer to figure 4-4 or 4-5, as applicable, to identify and select bolt required for tie-down.

b. Inspect bolt, spring, and pre-tensioning nut for cleanness, physical damage, or mechanical malfunction.

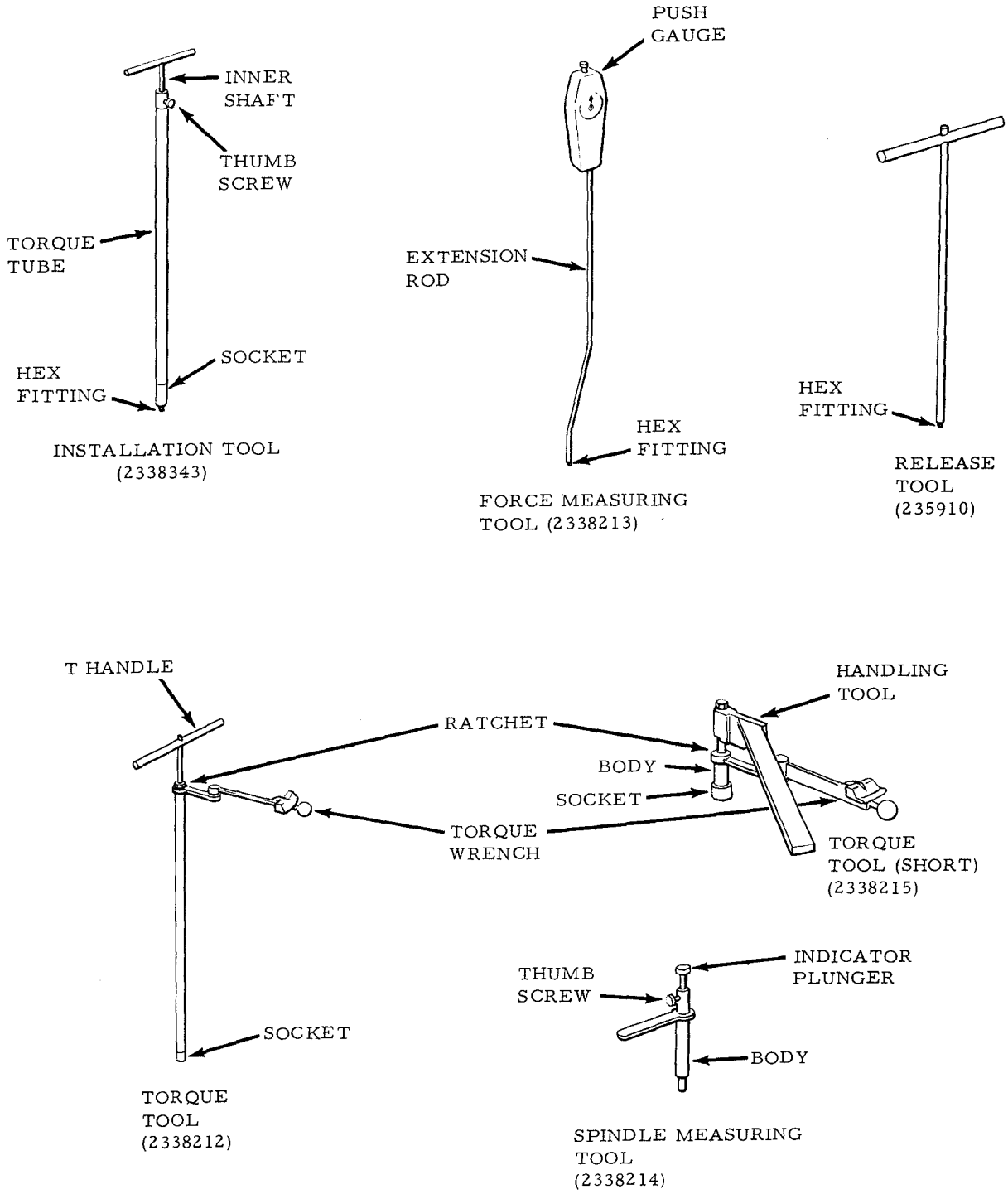
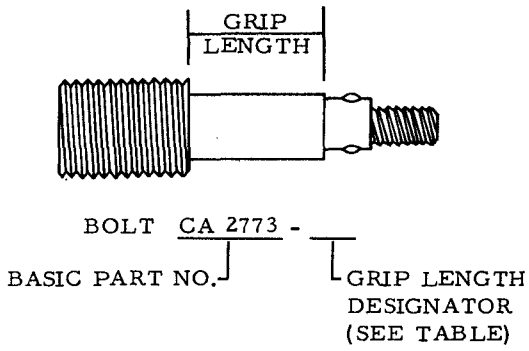


Figure 4-3 Boyd Bolt Installation Tools

INDEX NO.	PART NO.	GRIP LENGTH	
		MIN	MAX
1	CA 2773-2	0.001	0.125
2	CA 2773-4	0.126	0.250
3	CA 2773-10	0.501	0.625
4	CA 2773-14	0.751	0.875
5	CA 2773-20	1.126	1.250
6	CA 2773-24	1.376	1.500



KEY

O SUBPACKAGE TOP SURFACE MOUNT POINTS

[O] RAISED MOUNT POINTS

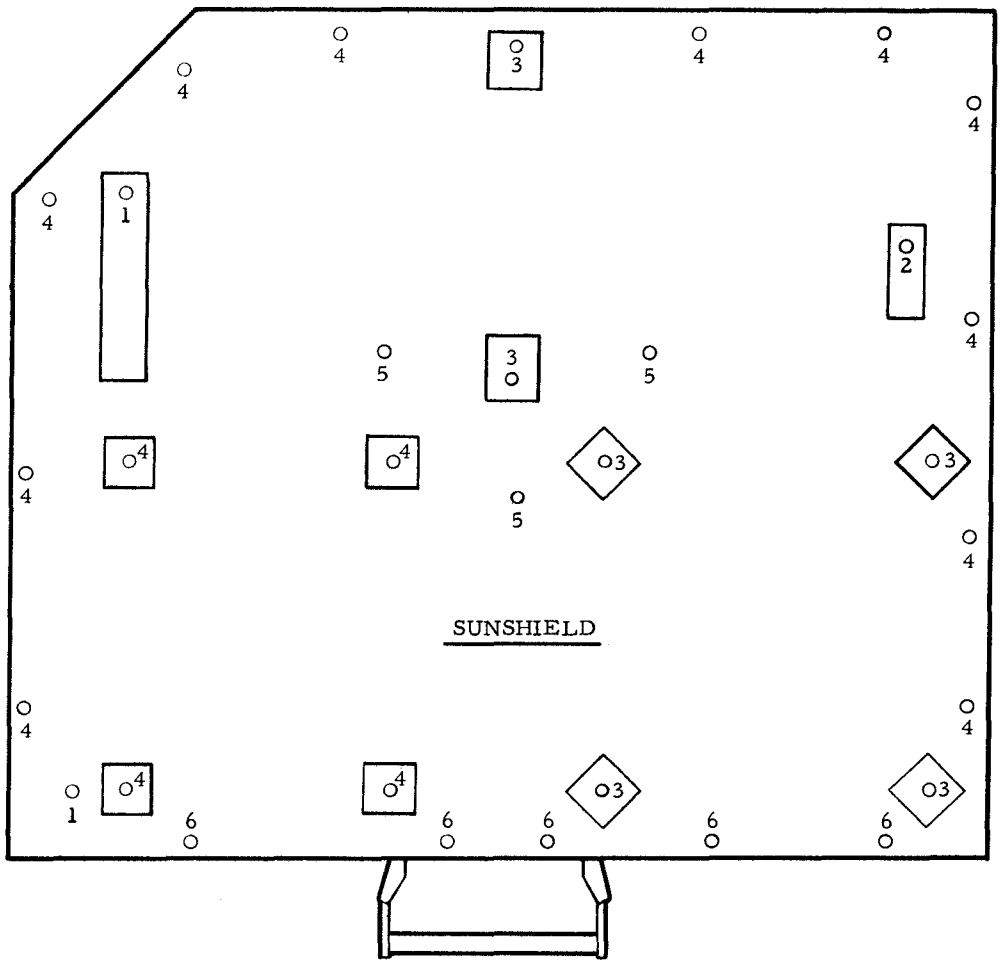
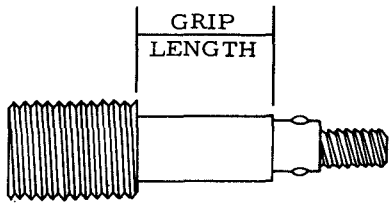


Figure 4-4 Boyd Bolt Locations, Subpackage No. 1

INDEX NO.	PART NO.	GRIP LENGTH	
		MIN	MAX
1	CA 2773-4	0.126	0.250
2	CA 2773-6	0.251	0.375
3	CA 2773-10	0.501	0.625



BOLT CA 2773 - ___

BASIC PART NO. — GRIP LENGTH DESIG. (SEE TABLE)

KEY

- SUBPACKAGE TOP SURFACE MOUNT POINTS
- RAISED MOUNT POINTS
- PSE STOOL MOUNT POINT (RAISED)
- PIP PIN LOCATIONS

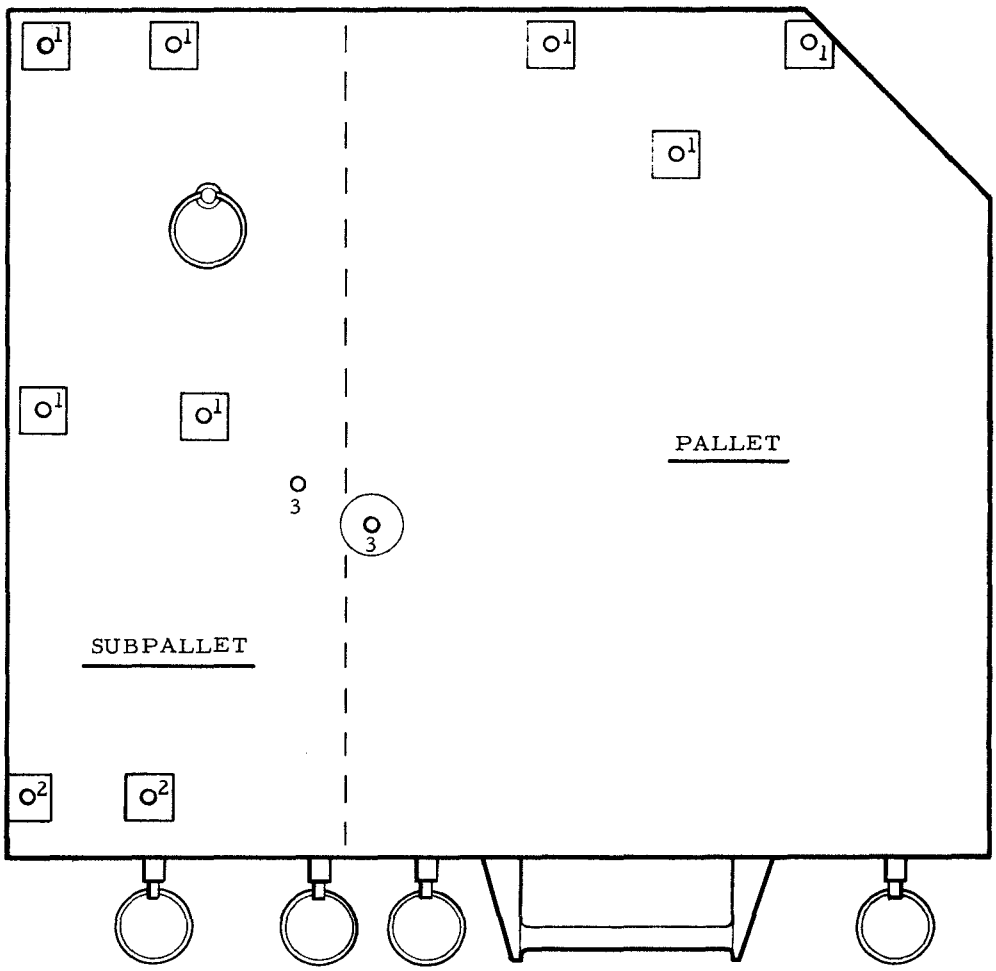


Figure 4-5 Boyd Bolt Locations, Subpackage No. 2

c. Clean tie-down and major element mount holes with low pressure air.

d. Align major element mount holes with tie-down mount holes.

e. Measure bolt spindle position with spindle measuring tool (2338214) as follows: (See figure 4-3.)

Release thumb screw to free indicator plunger in tool body.

Insert end of tool into double hex socket in bolt head. Ensure outer circumference of tool is in full contact with bolt head.

Lower indicator plunger until it contacts the top of bolt central spindle. Ensure plunger is not depressing spindle and lock in place with thumb screw.

Remove tool and measure distance between top of tool and plunger with calipers and micrometer. Note measurement.

f. Attach installation tool (2338343) to bolt as follows:

Release thumb screw and retract inner shaft into torque tube.

Screw bolt head into end of tool.

Engage double hex socket with Allen fitting on end of inner shaft and push T handle downward to depress bolt central spindle (free locking balls). Lock inner shaft with thumb screw.

g. Install guide cup on bolt and insert bolt into floating receptacle with locking balls oriented to enter the Y splines. (See figure 4-2.)

h. Rotate installation tool approximately 75^{o} clockwise until further rotation is stopped (locking balls contact outer edge of X axis splines).

i. Release installation tool thumb screw and remove torque tube from bolt head.

j. Remove T handle from torque tool (2338212) and engage Allen fitting on end of handle with double hex socket in bolt head. Apply a small CW, then CCW torque to ensure bolt is locked in X splines.

k. Set helical spring in place on bolt head.

NOTE

Use short torque tool (2338349) in SIDE mount that does not allow clearance for torque tool (2338212)

l. Insert nut in socket on end of torque tool and set in place on bolt head. On long tool (2338212) engage allen fitting in end of T handle with double hex socket in bolt: on short tool (2338215), the allen fitting is on the end of the holding handle.

NOTE

ESNA nut torque may be reduced to extend the useable life of the Boyd bolt. Sufficient torque must be maintained to preclude inadvertent bolt disengagement during subpackage handling.

m. Rotate T handle or holding handle CCW until X spline stops are felt. Relax tension slightly, then hold handle or tool firmly to prevent bolt movement as the tool is rotated with the torque wrench to tighten nut on bolt. Torque nut to 55 $\pm$ 2 inch pounds. Remove tool.

NOTE

If requirements of steps n. or o. are not met, the bolt must be removed and the bolt and floating receptacle inspected for damage. Any brinelling that results in material deformation over a length of 0.025 inch is unacceptable. Replace defective part. Bolt removal is accomplished with the release tool (2335910).

Spindle break-free force may exceed 7 pounds but in no event should exceed 20 pounds. Ensure spindle is free before making force measurement.

n. Insert extension rod end of force measuring tool (2338213) into double hex socket in bolt. Press downward on push gauge until spindle breaks free and depresses fully (bottoms out). Spindle must depress under a maximum force of 7 pounds after initial break-free.

o. Repeat step e. Note new spindle measurement obtained. Compare measurement taken in step e with new measurement. Measurement must be within .010 of initial measurement.

SECTION V

REPAIR PARTS LIST

5-1 ALSEP LEVELS OF MAINTENANCE

Two basic levels of maintenance, field - MSC (Level A) and factory (Level B), are established to provide a total maintenance capability for support of the ALSEP operational program.

5-2 LEVEL A MAINTENANCE

Level A Maintenance consists of preventive and corrective maintenance to be performed in the field, and is generally limited to inspection, adjustment, removal, and installation of subsystems and components.

5-3 LEVEL B MAINTENANCE

Level B Maintenance consists of factory repair and overhaul of ALSEP equipment. Factory maintenance will consist of detailed repair, overhaul, and component part removal and replacement as well as required adjustments necessary to achieve equipment redelivery requirements.

Level B maintenance will be performed at MSC by MSC personnel to the level of the repair parts list (Table 5-1). Major overhaul or refurbishment will be performed at the contractor's facility.

Table 5-1 Repair Parts List

Prime Contractor's Part No. Federal Stock No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
	ALSEP Interim Trainer			0
BSX 6259	Subpackage No. 1 07038	1	1	0
BSX 6651	Thermal Curtain, Side, L. H. 07038	1	1	1
BSX 6650	Thermal Curtain, Side, R. H. 07038	1	1	1
BSX 6341-1	Curtain Support 07038	1	1	2
BSX 6341-2	Curtain Support 07038	1	1	2

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No. Federal Stock No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
BSX 6340	Visor, Front 07038	1	1	1
BSX 6452	Visor Assembly & Support, Rear 07038	1	1	1
BSX 6390	Rod Extension, Visor 07038	2	2	8
BSX 6364	Reflector, Lunar Surface 07038	1	1	1
BSX 6602	Spectral Reflector 07038	1	1	1
BSX 6396	Pad, Clamp 07038	1	1	2
	Tape, Mylar Alum., Adhesive G102700-2 07955	AR	AR	1 Roll
	Rivet MS 20470AD3-3 96906	54	54	250
BSX 6370	Switch Assembly, Actuator 07038	1	1	1
BSX 6371	Switch, Electrical MS 27216-1 07038	6	6	2
BSX 6377	Spring, Switch 07038	1	1	2
BSX 6381	Spring, Switch 07038	1	1	2
	Extenders, Sunshield C1324 80545	4	4	12
BSX 6392	Pin, Outboard Support 07038	2	2	12

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
NAS 56165-28	Pin, Antenna Grd. Plane 07038	1	1	4
BSX 6806	Clamp, Antenna Grd. Plane 07038	1	1	2
	Stud Nut CA18007-1 11907	1	1	5
	Stud Nut CA18007-15 11907	4	4	10
	Stud Nut CA18007-17 11907	2	2	5
	Stud Nut CA18007-21 11907	4	4	10
	Stud Nut CA18007-25 11907	11	11	20
	Stud Nut CA18007-34 11907	3	3	10
	Stud Nut CA18007-42 11907	5	5	15
	Ring, Retaining CA1825 11907	30	30	50
	Receptacle, Stud Nut C180018 11907	16	16	20
BSX 6393	Guide, Fastener 07038	32	32	20
BSX 6805	Cap, Guide, Fastener 07038	32	32	2400
BSX 6358	Retainer, Cable, Dust Detector 07038	1	1	1
BSX 6357	Reel, Dust Detector 07038	1	1	1

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
BSX 6506	Cable Assembly, Dust Detector 07038	1	1	1
BSX 6428-10	Spool, Cable 07038	1	1	1
BSX 6428-3	Spool, Cable 07038	1	2	1
BSX 6428-1	Spool, Cable 07038	1	1	1
BSX 6504	Cable Assembly, PSE 07038	1	1	1
BSX 6502	Cable Assembly, PSE 07038	1	1	1
BSX 6207	Thermal Control Assembly, PSE 23345	1	1	1
BSX 6428-2	Spool, Cable 07038	1	1	1
BSX 6500	Cable Assembly, Ion Detector 07038	1	1	1
BSX 6428-6	Spool, Cable 07038	1	1	1
BSX 6476	Cable Assy., Magnetometer 07038	1	1	1
BSX 6428-9	Spool, Cable 07038	1	1	1
BSX 6456	Cable Assembly, Solar Wind 07038	1	1	1
	Paint, Spray GM-White 07038	AR	AR	1 Qt.
	Tufbraid 50DOR16 07038	AR	AR	50 Ft.

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
BSX 6741	Fuel Cask MTG Assembly 07038	1	1	0
BSX 6736	Tilt Mechanism Assembly 07038	1	1	1
BSX 6750	Band, Fuel Cask, Upper 07038	1	1	1
BSX 6780	Band, Fuel Cask, Lower 07038	1	1	1
	Pin, Quick Release Fuel Cask MS179906403 07038	2	2	4
	Cord, Nylon 07038	AR	AR	100 Ft.
BSX 6211	Tool, Cask Cap Removal 07038	1	1	0
BSX 6704-4	Spring, Lock Assy 07038	1	1	1
BSX 6800-1	Subpackage No. 2 (1G-Model) 07038	1	1	0
BSX 6493	Tool, Experiment Handling 07038	1	1	1
BSX 6563	Shorting Plug, Dummy 07038	1	1	1
BSX 6331	Pin, Antenna Wire 07038	1	1	2
BSX 6534	Spool, RTG 07038	1	1	1
2333270	Socket, EHT 07038	1	1	5
BSX 6536	Socket, EHT 07038	1	1	5

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
BSX 6527	Support Cable, Back 07038	1	1	1
BSX 6329	Cable Stowage Assembly 07038	1	1	1
BSX 6477	Clip, RTG Cable 07038	1	1	1
	Tape, Velcro Pile 100-81-306-1754 11153	AR	AR	1 Roll 25 Yd.
	Tape, Velcro Hook 100-46-306-1754 11153	AR	AR	1 Roll 25 Yd.
BSX 6387	Erector Hold Down Tool 07038	4	4	12
	PIN, Quick Release MS-179900-403 96906	2	2	4
BSX 6320-2	Connector, Housing 07038	1	1	3
BSX 6320-3	Connector, Housing 07038	1	1	3
BSX 6320-4	Connector 07038	2	2	5
	Connector 095-9036-0012 15116	1	1	2
BSX 6503	Tip, Tie Down Release Tool 07038	1	1	2
BSX 6505	End Cap, Tie Down Release Tool 07038	1	1	2
BSX 6738	Clam Shell, Antenna Gimbal 07038	1	1	6
BSX 6495	Head, Exp. Handling Tool 07038	1	1	2

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
BSX 6715-2	Dust Cover Connector 07038	1	1	10
BSX 6715-1	Dust Cover Connector 07038	2	2	20
BSX 6521	Carry Bar/Ant. Mast, Lower 07038	1	1	1
BSX 6508	Carry Bar/Ant. Mast, Upper 07038	1	1	1
BSX 6694	Bracket, Antenna Mounting 07038	1	2	6
BSC 6524	Bracket, Antenna Mast 07038	1	1	1
2338102	Tool, Universal Handling 07038	1	1	1
2335619	Spring, Side Curtain 07038	1	8	24
2335931-1	Guide, Boyd Bolt 07038	31	31	80
2335931-2	Guide, Boyd Bolt 07038	1	1	5
2335931-4	Guide, Boyd Bolt 07038	1	1	5
2335931-5	Guide, Boyd Bolt 07038	3	5	10
2338118	Socket, Subpallet 07038	1	1	5
2338390	Socket, Subpackage #2 Stowage 07038	1	1	5
2338119	Insert, Socket 07038	1	1	1

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
2338114	Insert, Socket 07038	1	1	1
2338116	Insert, Socket 07038	1	1	1
2338211	Insert, Socket 07038	1	1	1
2338115	Insert, Socket 07038	1	1	1
2335520	Plug, Shorting 07038	1	1	1
BSX 6715-2	Connector, Dust Cover 07038	1	1	2
2335009	Nut, Pretension 07038	1	1	6
	Screw MS51959-13 96906	AR	AR	250
	Screw MS51957-3 96906	AR	AR	200
	Screw MS51957-14 96906	AR	AR	100
	Screw MS51957-17 96906	AR	AR	100
	Screw MS51957-26 96906	AR	AR	100
	Screw MS51957-28 96906	AR	AR	100
	Screw MS35218-12 96906	AR	AR	100
	Screw MS35275-213 96906	AR	AR	100

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
	Screw NAS1190-C04P4N 80205	AR	AR	50
	Screw NAS1191-C04P5N 80205	AR	AR	50
	Screw NAS662-C2-3 80205	AR	AR	100
	Screw NAS1190-C3P6L 80205	AR	AR	50
	Washer MS15795-803 96906	AR	AR	100
	Washer MS15795-802 96906	AR	AR	100
	Washer AN960-C6 88044	AR	AR	100
	Nut MS21043-04 96906	AR	AR	100
	Nut MS35649-21 96906	AR	AR	100
	Nut MS35649-83 96906	AR	AR	50
	Nut MS35649-224 96906	AR	AR	100
	Nut MS20500-428 96906	AR	AR	50
	Nut MS20365-632 96906	AR	AR	100
	Nut NAS1291-C02M 96906	AR	AR	50

Table 5-1 Repair Parts List (Cont.)

Prime Contractor's Part No.	Nomenclature Manufacturer's Part No. & Federal Mfr Code	Qty Per Assy	Qty Per End Item	Total Qty RECM/ Ordered
	Boyd Bolt CA2773-2 11907	2	2	8
	Boyd Bolt CA2773-4 11907	8	8	33
	Boyd Bolt CA2773-6 11907	2	2	10
	Boyd Bolt CA2773-10 11907	8	8	37
	Boyd Bolt CA2773-14 11907	11	11	52
	Boyd Bolt CA2773-18 11907	4	4	20
	Boyd Bolt CA2773-20 11907	3	3	15
	Boyd Bolt CA2773-24 11907	5	5	25
	Spring, Boyd Bolt CA 1011 11907	1	43	200
	Nut, Boyd Bolt SP1015 11907	1	43	200
	Receptacle, Nut Plate CA2774	1	43	200

ALSEP GLOSSARY

Abbreviation	Definition
ALHT	Apollo Lunar Hand Tools
ALPS	ALSEP Launch Preparation Site
ALSD	Apollo Lunar Surface Drill
ALSEP	Apollo Lunar Surface Experiments Package
AMU	Atomic Mass Unit
ASE	Active Seismic Experiment
ASI	Apollo Standard Initiator
CCGE	Cold Cathode Gauge Experiment
CCIG	Cold Cathode Ion Gauge
CM	Command Module
CPA	Current Plate Analyzer
CPLEE	Charged-Particle Lunar Environment Experiment
DRT	Dome Removal Tool
EGFU	Electronics/Gimbal-Flip Unit
EHT	Experiment Handling Tool
EMU	Extravehicular Mobility Unit
EPS	Electrical Power Subsystem
FCA	Fuel Capsule Assembly
FTT	Fuel Transfer Tool
GLA	Grenade Launch Assembly
HFE	Heat Flow Experiment
IPU	Integrated Power Unit
IST	Integrated Systems Test

ALSEP GLOSSARY (CONT.)

Abbreviation	Definition
KSC	Kennedy Space Center
LM	Lunar Module
LP	Long Period
LSRL	Lunar Sample Receiving Laboratory
LTA	Launch Tube Assembly
MCC-H	Mission Control Center - Houston
ME	Magnetometer Experiment
MSC	Manned Spacecraft Center
MSFN	Manned Space Flight Network
MSOB	Manned Spacecraft Operation Building
NASA	National Aeronautics and Space Administration
PCU	Power Conditioning Unit
PSE	Passive Seismic Experiment
RTG	Radioisotope Thermoelectric Generator
RF	Radio Frequency
SBASI	Single Bridgewire Apollo Standard Initiator
SEQ	Scientific Equipment, a bay in LM
SIDE/CCIG	Suprathermal Ion Detector Experiment
SM	Service Modal
SP	Short Period
SWE	Solar Wind Experiment

ALSEP GLOSSARY (CONT.)

Abbreviation	Definition
UHT	Universal Handling Tool
USGS	United States Geologic Survey
VAB	Vertical Assembly Building