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SNAP-27 INTEGRATED POWER UNIT FAMILIARIZATION MANUAL

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ADVANCED NUCLEAR SYSTEMS OPERATION

GENERAL ELECTRIC

MISSILE AND SPACE DIVISION
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INTRODUCTION

This familiarization manual describes the complete SNAP-27 Integrated Power Unit (IPU) system. Each component is described in general terms and also in sufficient detail to provide a clear understanding of the SNAP-27 IPU. The SNAP-27 radioisotope thermoelectric generator is being developed by the General Electric Company under the direction of the U.S. Atomic Energy Commission. Major subcontractors are the 3M Company and the Solar Division of International Harvester Corporation.

SECTION 1
SYSTEM DESCRIPTION

SECTION 1

SYSTEM DESCRIPTION

The SNAP-27 Integrated Power Unit (IPU) will supply electrical power to the Apollo Lunar Surface Experiments Package (ALSEP) for lunar surface operations. The ALSEP system will be transported to the lunar surface by the Lunar Module (LM) and deployed by the astronaut. The ALSEP system will collect and transmit scientific data to the earth for a minimum period of one year. The IPU is capable of supplying 56.2 watts minimum at a nominal 16 volts during this period. Figure 1-1 shows an overall functional flow diagram of the IPU from development to deployment on the lunar surface. Physical characteristics of the IPU are listed in Table 1-1.

The IPU system includes the following components:

a. Generator Assembly

b. Fuel Capsule Assembly

c. Fuel Cask

d. Flight Handling Tool

e. Ground Handling Tool

f. Ground Test Equipment

g. Cape Kennedy Support Equipment

h. Shipping Containers

GENERATOR ASSEMBLY

The Generator Assembly (GA) will generate and supply electrical energy to the ALSEP Power Conditioning Unit when activiated by the Fuel Capsule Assembly. The GA, shown in Figure 1-2 with the Fuel Capsule Assembly installed, consists basically of a thermopile, the structure to contain the thermopile and the heat rejection system. Wherever possible, beryllium is used as the main structural material to minimize weight. Other materials utilized include Inconel and Haynes superalloys for strength at high temperatures. Total weight of the GA (unfuelded) is approximately 24.6 pounds (earth). The GA is approximately

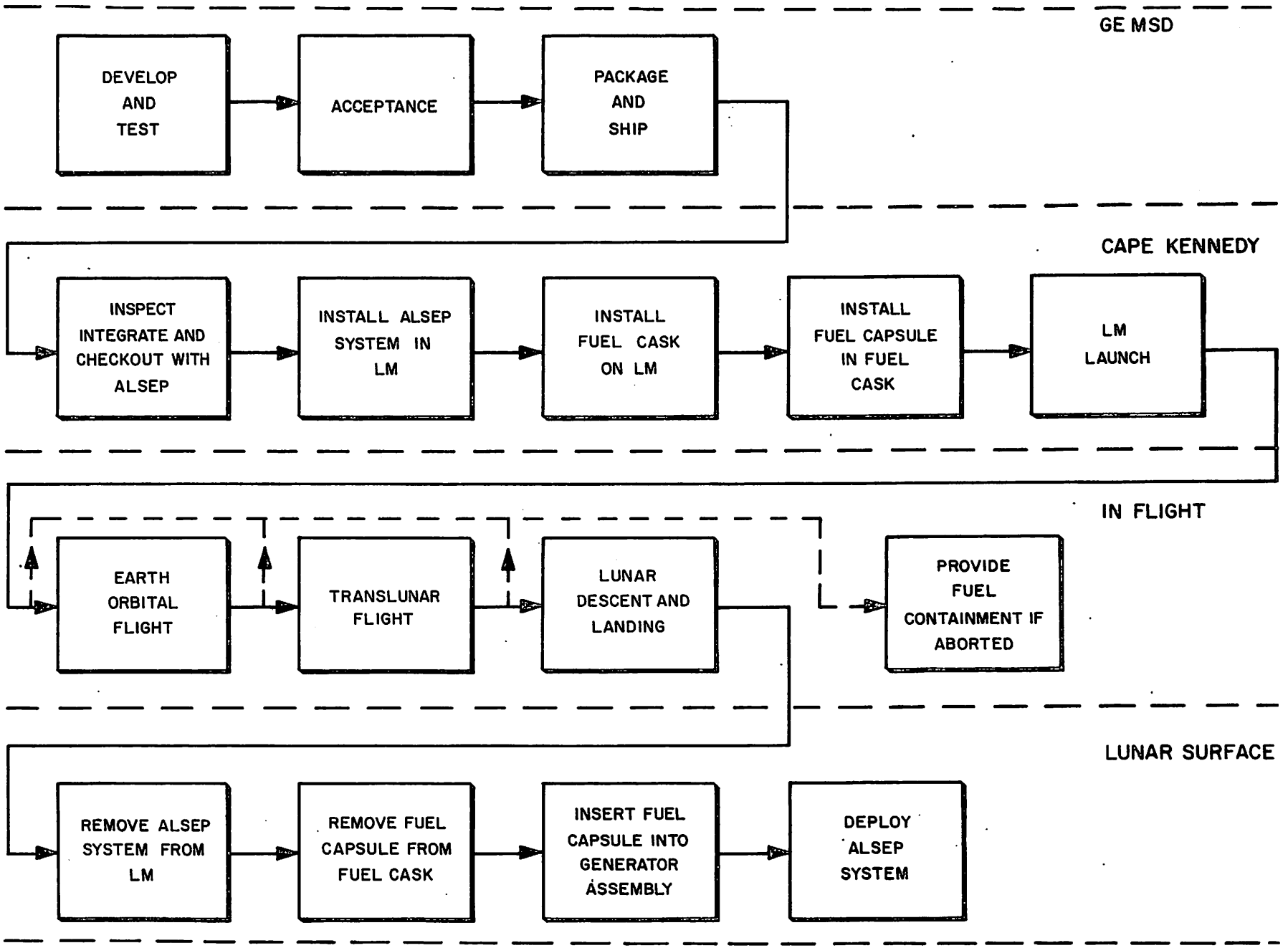

Figure 1-1. IPU Functional Flow Diagram

TABLE 1-1. IPU AND FUEL CASK PHYSICAL CHARACTERISTICS

GENERATOR ASSEMBLY	
DIAMETER	16.0 IN.
LENGTH	18.0 IN.
NUMBER OF FINS	8
FIN RADIAL LENGTH	5.0 IN.
WEIGHT (EARTH)	24.6 LBS.
FUEL CAPSULE ASSEMBLY	
DIAMETER	2.5 IN.
LENGTH	16.5 IN.
WEIGHT (EARTH)	13.5 LBS.
FUEL CASK	
DIAMETER	8.0 IN.
LENGTH	23.0 IN. (APPROXIMATELY)
WEIGHT (EARTH)	20.0 LBS. (APPROXIMATELY)

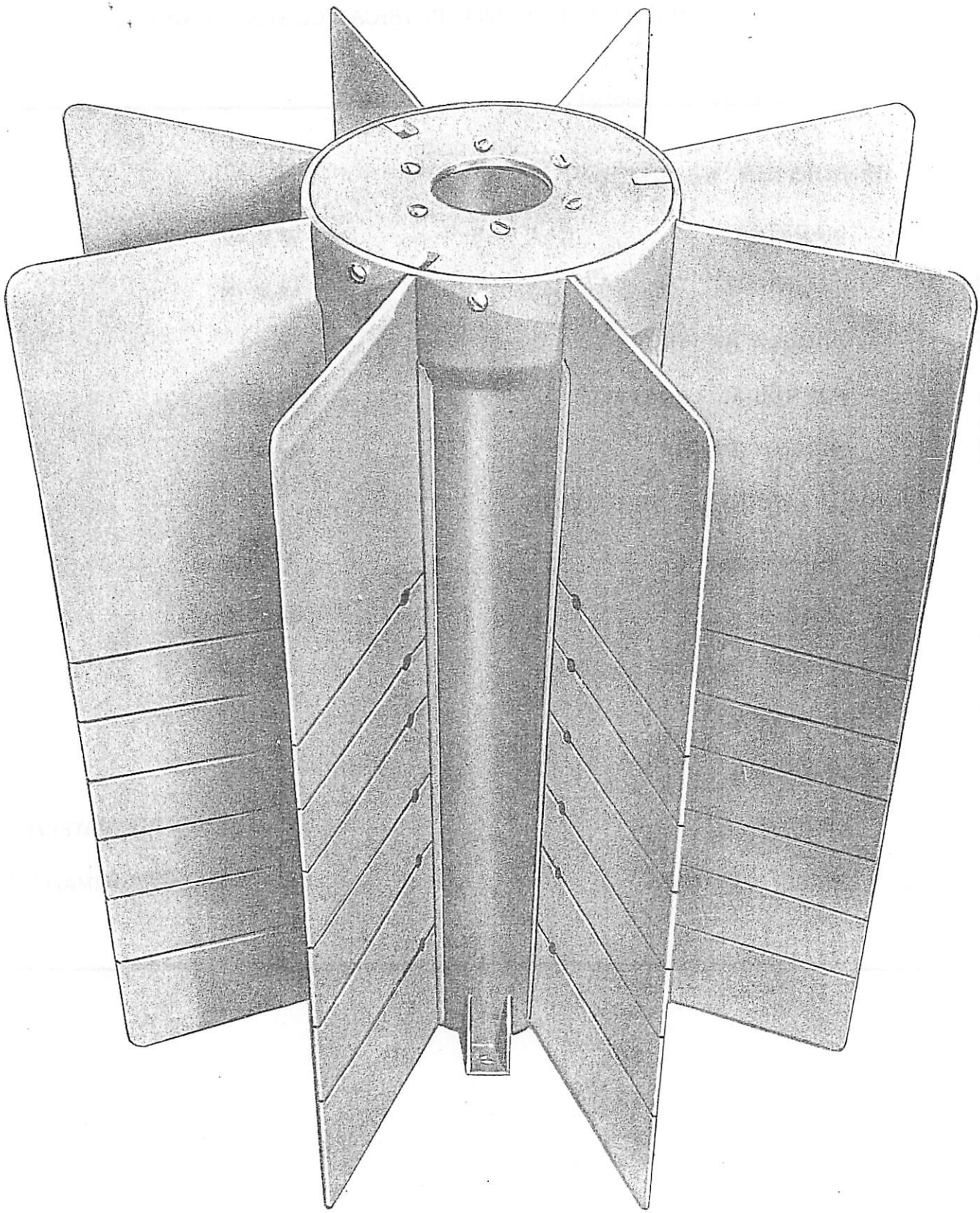

Figure 1-2. Generator Assembly (GA)

18 inches high and 16 inches in diameter. These dimensions include eight fin radiators for heat rejection. The GA, during translunar flight, is stored in the unfueled condition in the ALSEP compartment of the Lunar Module (LM) directly beside the Apollo Lunar Geological Equipment (ALGE). Figure 1-3 shows the location of the GA on the LM vehicle.

FUEL CAPSULE ASSEMBLY

The Fuel Capsule Assembly (FCA), shown in Figure 1-4, contains the radioisotope fuel (Pu-238) encapsulated to meet nuclear safety criteria. The FCA thermal output (radiated and conducted) will not exceed 1550 watts. The FCA is a thin walled cylindrical shaped structure with an end plate assembly required for integration into the GA. Total earth weight of the FCA is approximately 13.5 pounds. The FCA is approximately 16.5 inches in length and 2.5 inches in diameter.

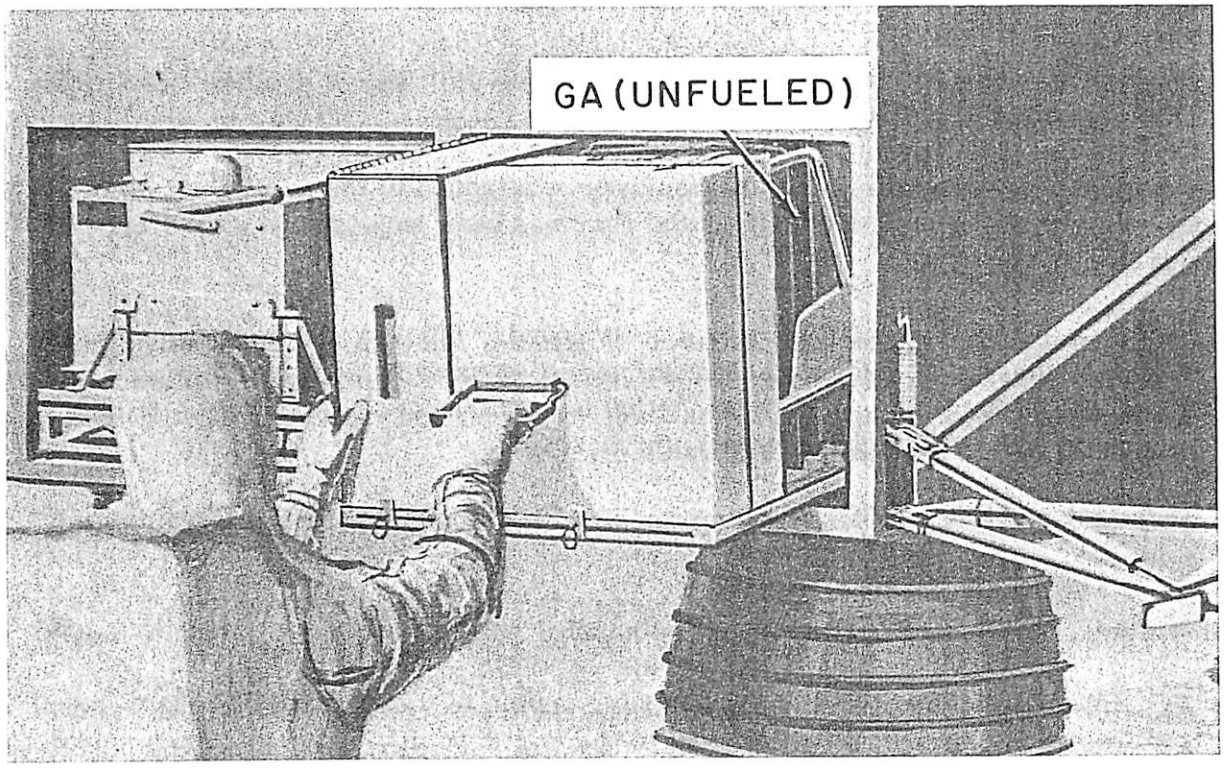

Figure 1-3. Location of the GA on the LM Vehicle

LM FUEL CASK

The LM Fuel Cask (LFC), shown in Figure 1-5, with the FCA in place, contains the FCA during translunar flight and provides re-entry protection to the FCA in case of orbital abort. Total earth weight of the cask, without the fuel capsule in place, is approximately 20 pounds. The cask provides a free radiation surface for rejection of fuel capsule heat during all operating phases. The fuel cask is mounted on the exterior surface of the LM vehicle adjacent to the ALSEP compartment near the landing gear struts. Figure 1-6 shows the location of the fuel cask.

FLIGHT HANDLING TOOL

The Flight Handling Tool (FHT), shown in Figure 1-7, is used by the astronaut to remove the Fuel Capsule Assembly from the fuel cask mounted to the LM and insert it into the GA while on the lunar surface. The FHT has the following performance characteristics:

a. Engagement force is less than 10 pounds (earth).

b. Torque required to lock and unlock the tool from the FCA is less than 10 pound inches.

c. Number of complete turns (360°) of FHT between full unlock position to full lock position is $2 \pm 1/4$ turns.

d. Temperature of the threaded interface where attached to the ALSEP supplied handle will not exceed 300°F after the FHT has been supporting an FCA for 15 minutes in vacuum.

e. FHT is capable of supporting a load of 30 pounds, the c.g. of which is applied at 7.80 inches from the latch mechanism jaw on an axial axis, for a minimum of 5 minutes without damage or degradation in performance. Application of load may be in either vertical or horizontal directions.

f. FHT is capable of performing a minimum of 100 complete fueling and defueling cycles.

g. Weight of FHT, less ALSEP supplied handle, will not exceed 0.8 pounds (earth).

h. ALSEP supplied handle includes a locking device to lock the FHT in the engaged position ensuring secure attachment to the fuel capsule during astronaut handling.

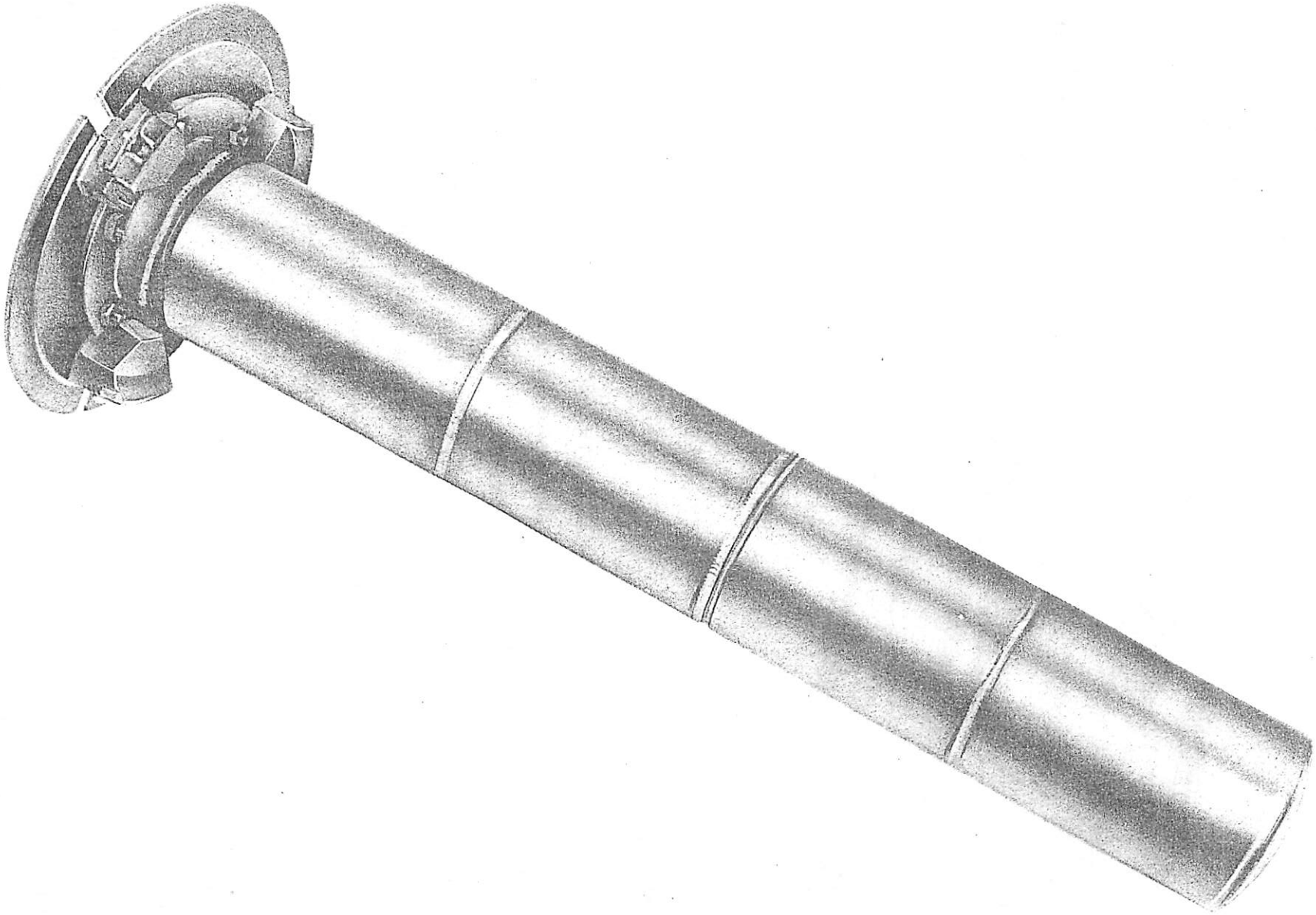

Figure 1-4. Fuel Capsule Assembly (FCA)

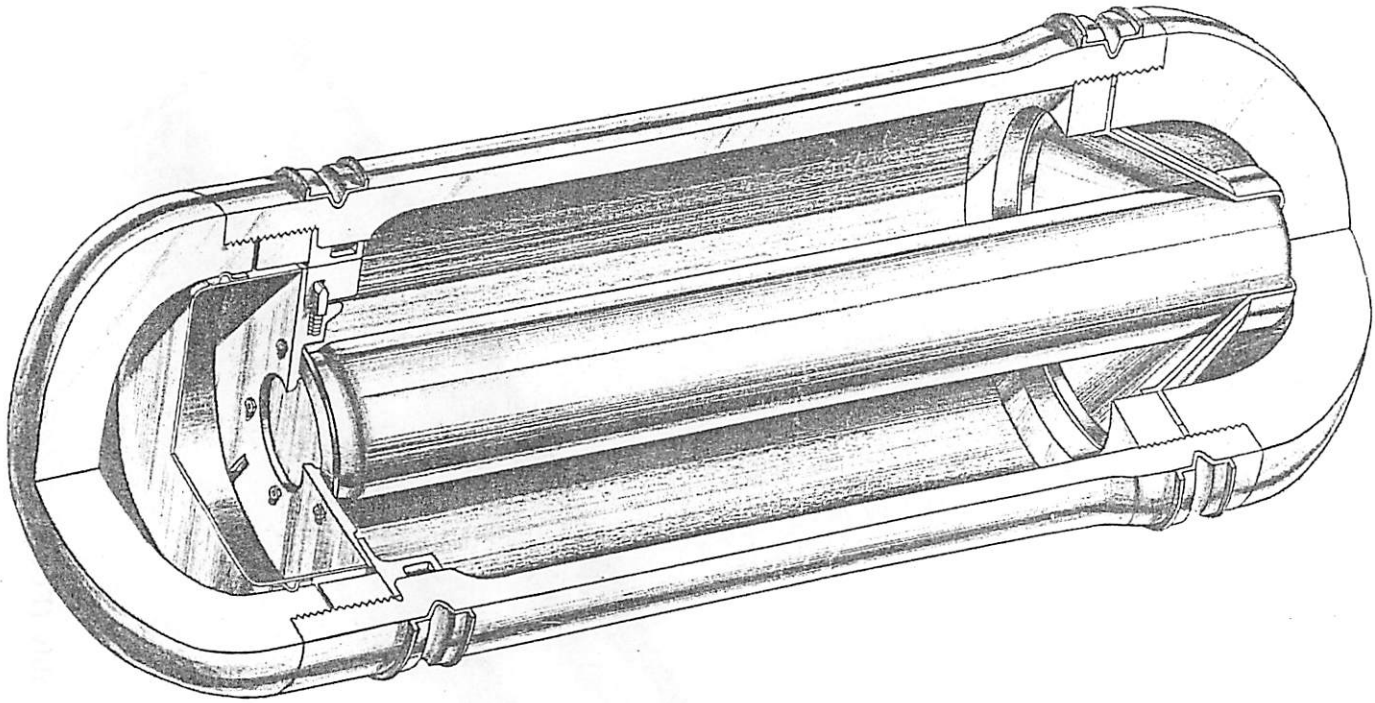

Figure 1-5. LM Fuel Cask

GROUND HANDLING TOOL

The Ground Handling Tool (GHT), shown in Figure 1-8, is used to insert and remove the FCA or Electric Fuel Capsule Simulator used as the GA heat source during tests to and from the LFC, Ground Shipping Cask (G8C) and the GA.

The GHT has operational characteristics similar to the FHT. The GHT, however, is designed to fulfill ground handling requirements where the FHT is designed with major considerations based on astronaut handling needs and mission weight requirements. The GHT incorporates a handle which is an integral part of the unit. The FHT handle is a separate item.

GROUND TEST EQUIPMENT

The Ground Test Equipment (GTE) includes Electric Fuel Capsule Simulators (EFCS) and Integrated Power Unit Test Panels, which provide the means to operate and checkout a GA. The EFCS's as shown in Figure 1-9, are used as a subsititute heat source for the GA during tests. The test panel, shown in Figure 1-10, is comprised of a performance map panel and an EFCS control panel. The cabinet is approximately 75 inches high.

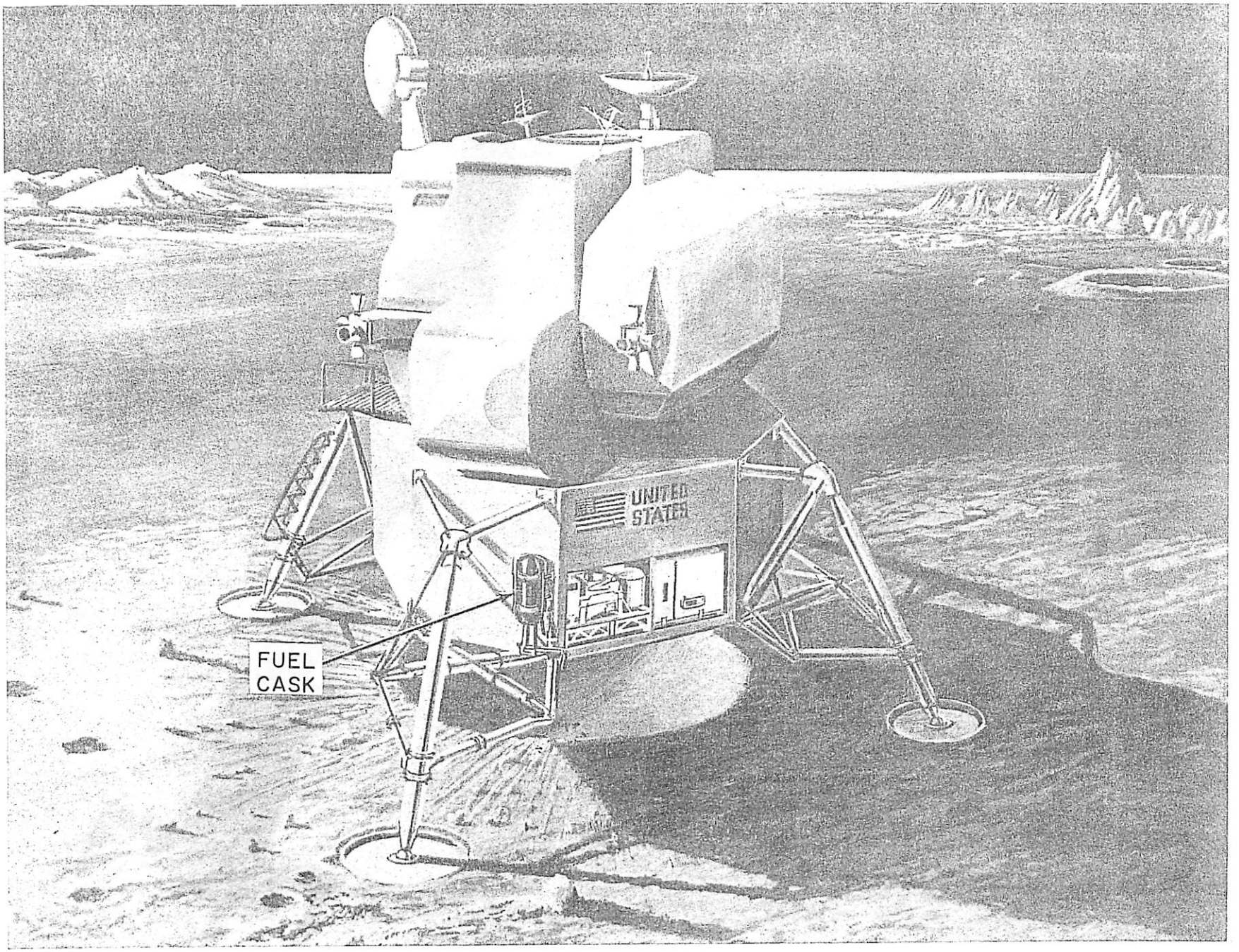

Figure 1-6. Location of the Fuel Cask on the LM Vehicle

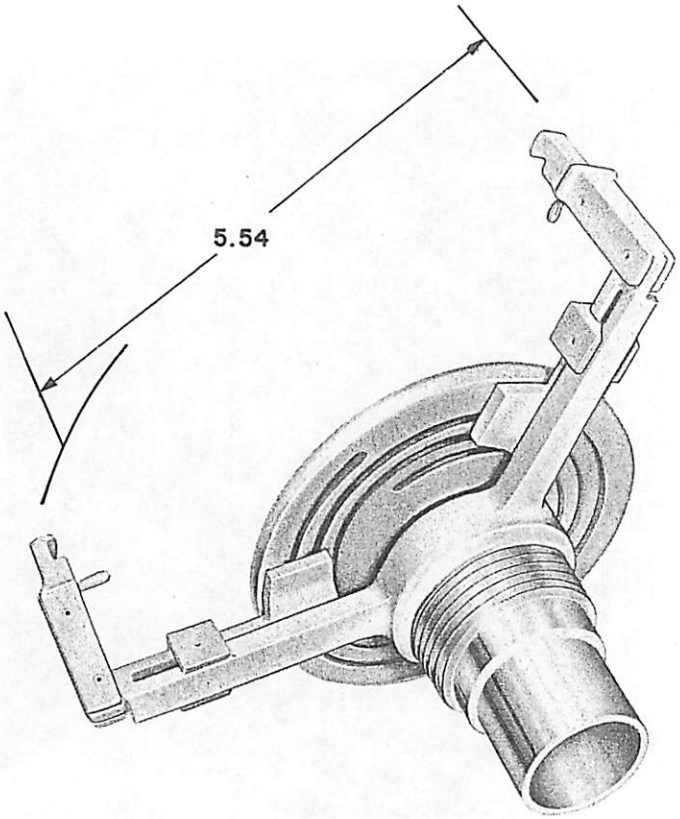

Figure 1-7. Flight Handling Tool

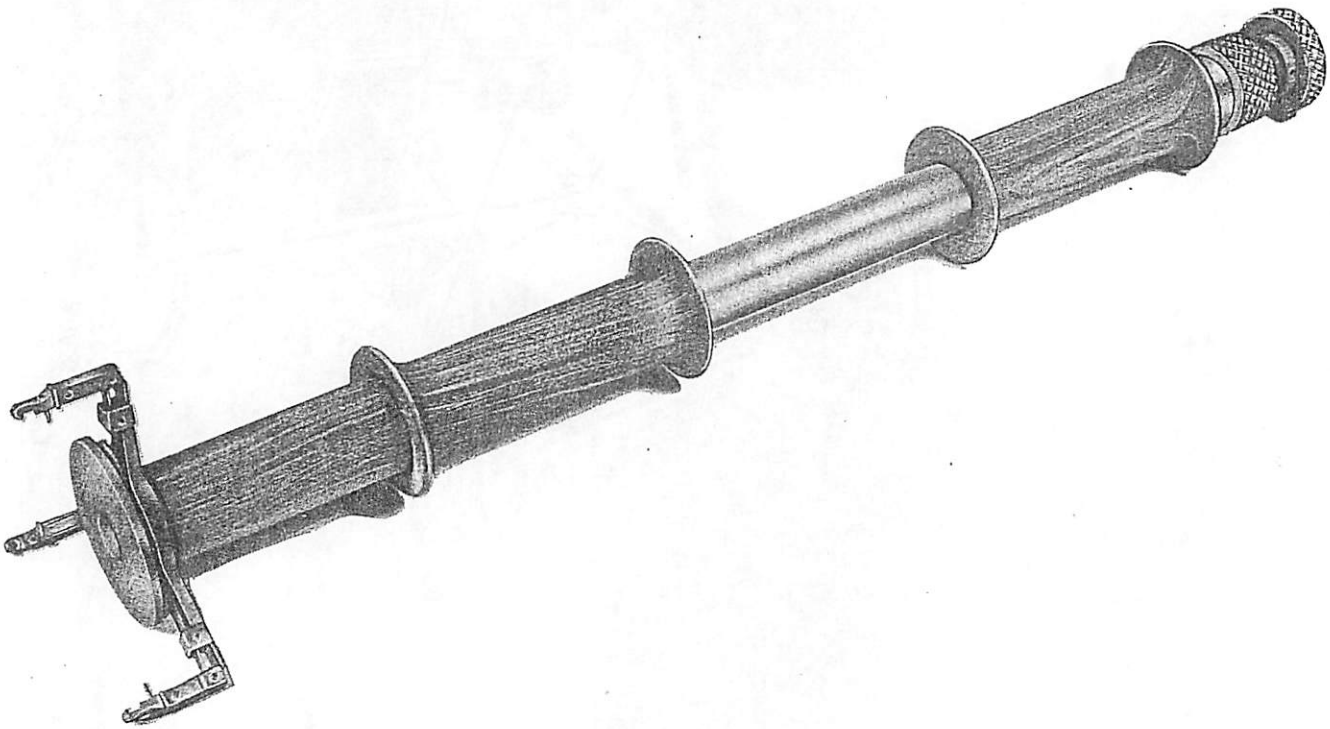

Figure 1-8. Ground Handling Tool

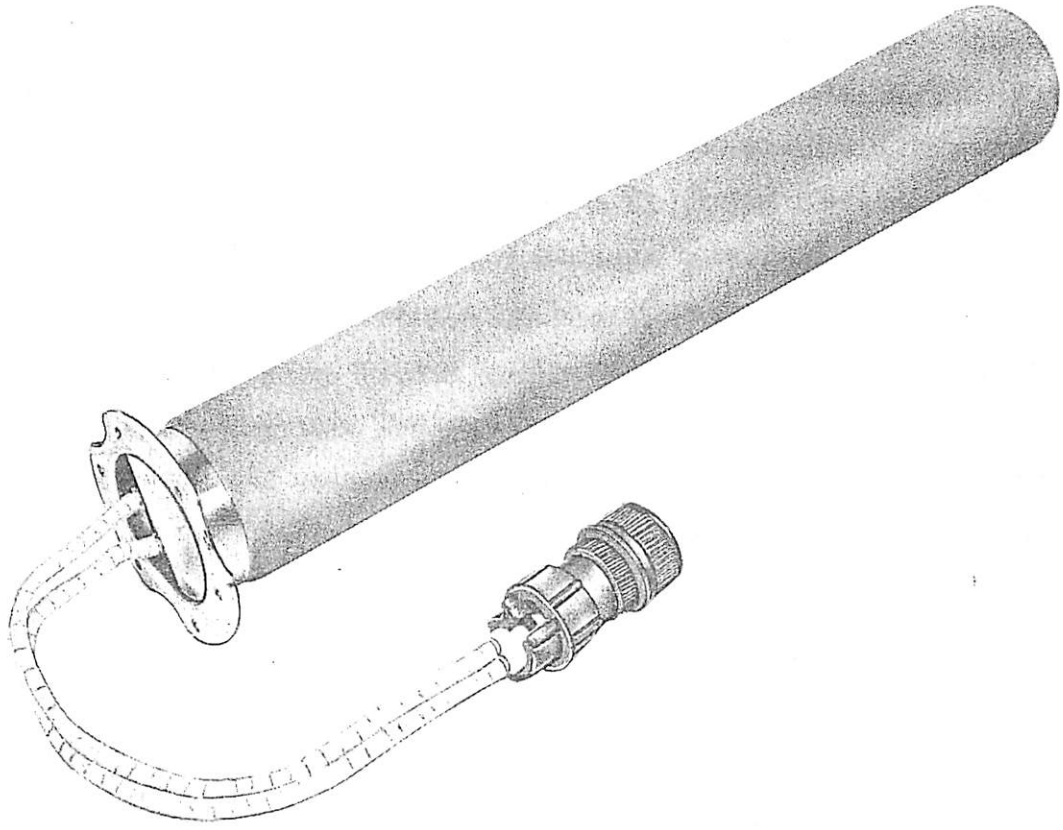

Figure 1-9. Electric Fuel Capsule Simulator (EFCS)

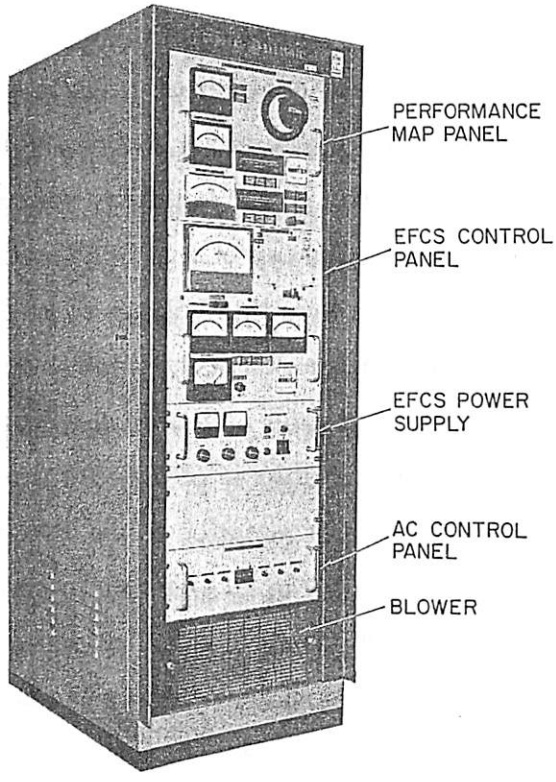

Figure 1-10. Integrated Power Unit Test Console

The performance map panel consists of a resistance thermometer read-out section and a performance map section. The resistance thermometer read-out section provides the means for manual selection and analog display of three GA hot junction (T_H) and three GA cold junction (T_C) temperature sensors in degrees Fahrenheit. These sensors have a T_H range of 600° to 1200^oF and T_C range of 0° to 600^oF. The performance map section provides the means for monitoring and visually displaying the potential in volts dc, current in amperes, power in watts, variable load resistances in ohms, and also measures the elapsed time of the monitored functions. The voltage monitor and display will monitor dc voltage over the ranges of 0 to 40 vdc in two ranges and will provide analog display of the voltage to an accuracy of ± 1% of full scale. The current monitor and display will monitor direct current over the range of 0 to 10 amperes and will provide analog display of the current to an accuracy of ± 1% of full scale. The power monitor and display will monitor dc power in watts, over the range of 0 to 100 watts and will provide analog display of the power to an accuracy of ± 2 watts. A load resistor with a variable resistance between 0 and 20 ohms with a step to open circuit is provided. The elapsed time indicator and display will measure elapsed time of monitored functions and will provide a digital display of elapsed time in hours and tenths of hours.

The EFCS power control panel provides the means for controlling, monitoring and visually displaying the EFCS output. The power controller, utilizes power sensing techniques, which is adjustable from 1200 to 1700 watts and maintains a particular power setting in this range to an accuracy of ± 1%. The power indicator senses EFCS power and provides display of this power in watts to an accuracy of ± 1%. The ac line voltage indicator senses a potential of 208 vac, 60 cps and displays this voltage to an accuracy of ± 1%. The dc power supply for the EFCS heaters has a remotely programmable output from 85 to 115 vdc, 20 amps maximum. The elapsed time indicator and display measure elapsed time of monitored functions and provide digital display of elapsed time in hours and tenths of hours. The current indicator senses the current supplied to the EFCS and provides display of the current in amperes over a range of 0 to 20 amps dc to an accuracy of ± 1%. The voltage indicator senses the potential across the EFCS lead pigtail and provides display over a range of 0 to 150 volts to an accuracy of ± 1% in the 25 to 115 volt range. The safety monitor, monitors one selected T_H sensor and de-energizes the EFCS power

source when a predetermined T_H level is exceeded. The level set is variable from 1100 to 1175°F.

CAPE KENNEDY SUPPORT EQUIPMENT

The Cape Kennedy Support Equipment, shown in Figure 1-11, includes a transfer cask, a handling tool, a port entry trough, an inspection tool and a torque tool. This equipment is utilized at the launch pad and in the Spacecraft LM Adapter (SLA) area of the spacecraft to remove, handle, transport and insert the FCA into the LFC just before launch.

- TRANSFER CASK

The transfer cask is used to transport the FCA from a van on the launch pad to the SLA platform area of the Apollo Spacecraft. How much does this weigh? Can it be handled as shown in fig. 4-2?

- SLA HANDLING TOOL

The SLA Handling Tool is used at the launch area for insertion and removal of the FCA. It is used in conjunction with the transfer cask and the LFC.

- PORT ENTRY TROUGH

The Port Entry Trough is used to transfer the FCA, with SLA handling tool attached, through a ten inch access port in the spacecraft structure at the level of LM fuel cask attachment.

- INSPECTION TOOL

The Inspection Tool is used to verify proper engagement of the FCA in the LFC.

- TORQUE TOOL

The Torque Tool is used to remove and replace the LFC lid during FCA loading operations in the SLA area of the Apollo Spacecraft.

SHIPPING CONTAINERS

All components of the IPU system are shipped to Cape Kennedy in separate shipping containers to preserve the quality of the equipment and to ensure that damage, deterioration, loss and substitution are prevented. Each shipping container contains a 3-axis shock indicator. This instrumentation is of sufficient accuracy and resolution to assure that

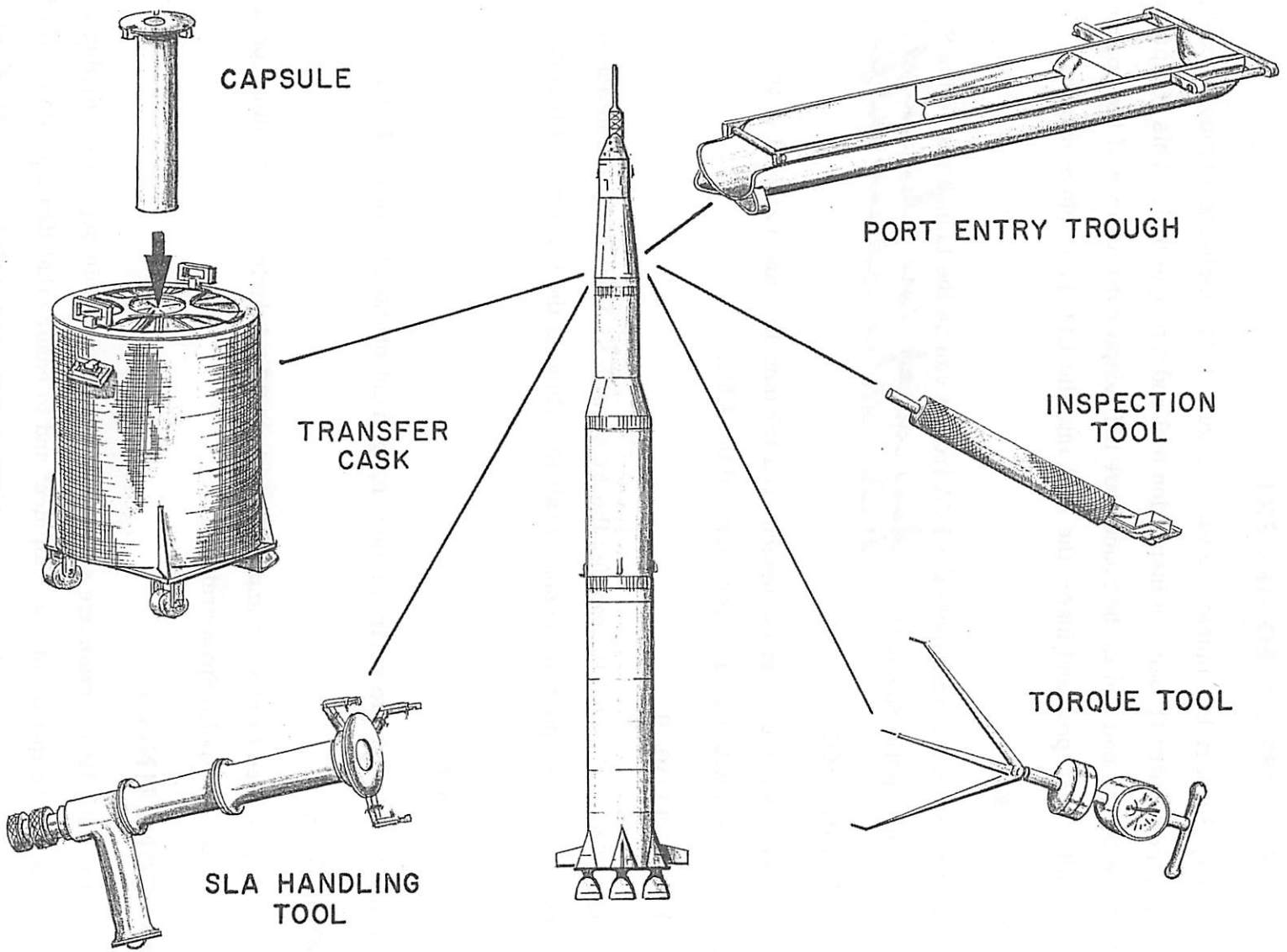

Figure 1-11. Cape Kennedy Support Equipment

any excessive acceleration environments experienced during shipping are detected. The shipping container for the GA provides a means for direct readout of internal container pressure. In addition, the Ground Shipping Cask in which the FCA is transported, is designed to provide radiation protection to operating personnel and to the general public during shipping, handling and storage (Figure 1-12). The Ground Shipping Cask attenuates the neutron and gamma radiation from a plutonium-238 fuel capsule of approximately 1500 thermal watts, so that the maximum x-ray equivalent dose to man (RBE corrected) at one meter from any exterior surface will not exceed ten milliroentgens per hour. The procedures used in the storage, transportation and ground handling of the shipping cask with fuel capsule installed comply with the applicable AEC, state and local regulations covering such operations (in particular, AEC Regulations 10CFR71 and 10CFR72 and Interstate Commerce Commission Regulations 47CFR71-78). All IPU system shipping containers are capable of being transported by common carrier (truck or plane) and protecting the equipment during storage under sheltered conditions for a minimum of two years. Marking of the containers is in accordance with the requirements of MIL-STD-129.

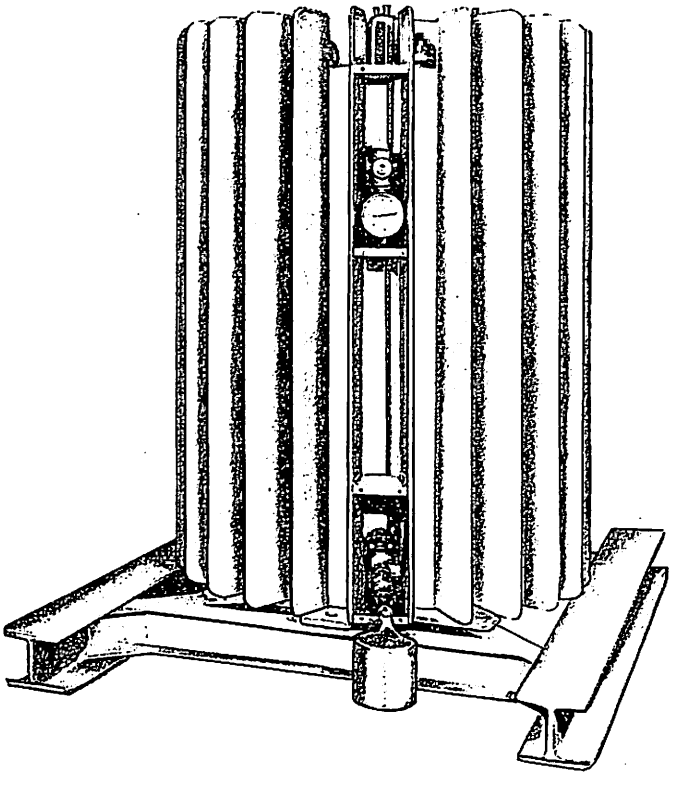

Figure 1-12. Ground Shipping Cask

SECTION 2

IPU FUNCTIONAL DESCRIPTION

SECTION 2

IPU FUNCTIONAL DESCRIPTION

GENERATOR ASSEMBLY

The Integrated Power Unit (IPU) includes the generator assembly and the fuel capsule assembly. Figure 2-1 shows a cutaway view of the IPU. The GA consists of the following assemblies:

a. Thermopile Assembly

b. Hermetic Seal System

c. Structural and Heat Rejection System

d. Wiring System

e. Instrumentation System

Table 2-1 lists the IPU Electrical and Thermal Characteristics.

TABLE 2-1. IPU ELECTRICAL AND THERMAL CHARACTERISTICS

OUTPUT POWER	56.2 WATTS (FOR A PERIOD OF AT LEAST ONE YEAR)
OUTPUT VOLTAGE	16 VOLTS DC (NOMINAL)
CURRENT	2 AMPS (IN EACH OF 2 STRINGS)
OVERALL EFFICIENCY (NOMINAL)	4 PERCENT
HOT JUNCTION TEMP. (MAX.)	1100°F (LUNAR DAY)
COLD JUNCTION TEMP. (MAX.)	525°F (LUNAR DAY)
FUEL CAPSULE THERMAL OUTPUT	1430 TO 1520 WATTS
FUEL CLAD TEMP. (MAX.)	1390°F

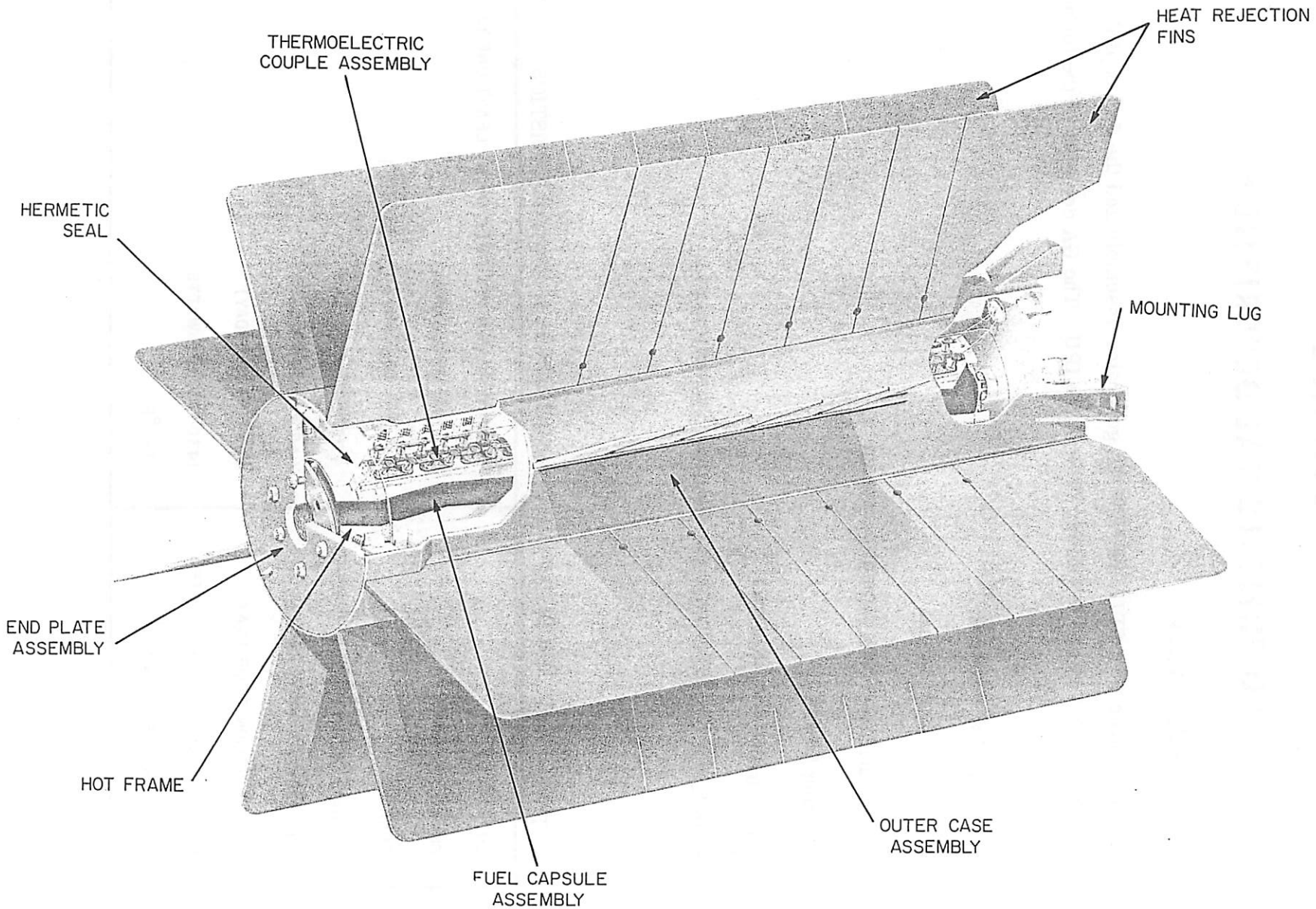

Figure 2-1. Integrated Power Unit (IPU) Cutaway View

- THERMO PILE ASSEMBLY

The thermopile assembly, made up of the couple assembly, hot shoes assembly, N-leg button, P-leg button, spacer strip and boron nitride insert, is sandwiched between the cold side (couple assembly cold caps to followers) and hot side (boron nitride to hot frame) of the structural assembly. The followers are spring loaded to keep the thermoelectric elements in compressive loading. The thermopile assembly provides direct energy conversion within the GA.

- HERMETIC SEAL SYSTEM

The hermetic seal assembly for the GA includes, both the forward and aft hermetic seals. The forward seal secures the hot frame to the outer case assembly, and the aft seal provides an end cover to the outer case assembly. Penetration for the power leads are made through the aft seal.

- STRUCTURAL AND HEAT REJECTION SYSTEM

The structural and heat rejection system of the GA provides the elements necessary to contain and support the thermopile assembly. These elements receive thermal energy from the fuel capsule assembly and provide the proper distribution of energy to the thermopile assembly before rejecting waste energy to the natural thermal environment.

- WIRING SYSTEM

The wiring system is comprised of two series-parallel strings of thermopile attached to end-of-row cold strap assemblies; the aft hermetic seal connectors; degaussing loops at each end; the internal wiring to connect the header with the degaussing loops; and the wiring harness which terminates in an output connector. Dipole degaussing loops (bucking coils) are incorporated into the generator (one coil at each end of the thermopile assembly) to limit the current induced magnetic field intensity to 0.24 gammas at a distance of one meter from the generator along the GA axial centerline.

- INSTRUMENTATION SYSTEM

The instrumentation system monitors the thermal performance of the Integrated Power Unit (IPU) and transmits this data to a bridge circuit in the ALSEP equipment. The 6 RTD (resistance thermometer) system indicates the temperature at the interior of the hot frame (3 places) and the temperature of the outer case (3 places).

FUEL CAPSULE ASSEMBLY

The fuel capsule assembly is an encapsulated Plutonium 238 system. The fuel capsule, capable of providing 1520 watts thermal output, is inserted into the cylindrical hot frame of the GA through the forward hermetic seal.

IPU OPERATION

Figure 2-2 illustrates a functional block diagram of IPU operation. Heat generated by the natural decay of the plutonium 238 isotope fuel is transferred by thermal radiation to the hot frame, then to the spring loaded lead telluride thermoelectric elements mounted radially around the hot frame. Heat is converted directly to electrical power by heating the junction of two dissimilar metals (the Seebeck effect). Power from the thermoelectric couples is fed to the power header, and then to the power conditioning unit in the ALSEP package. Figures 2-3 and 2-4 show the power distribution to the ALSEP equipment. Reject waste heat is transferred to a heat sink. The heat sink includes a cold frame, outer case and eight fins. Heat from the cold junction of the thermoelectric couple is transferred to the cold frame and then to the outer case and fins. Heat from the outer case and fins is dissipated to the lunar environment by thermal radiation.

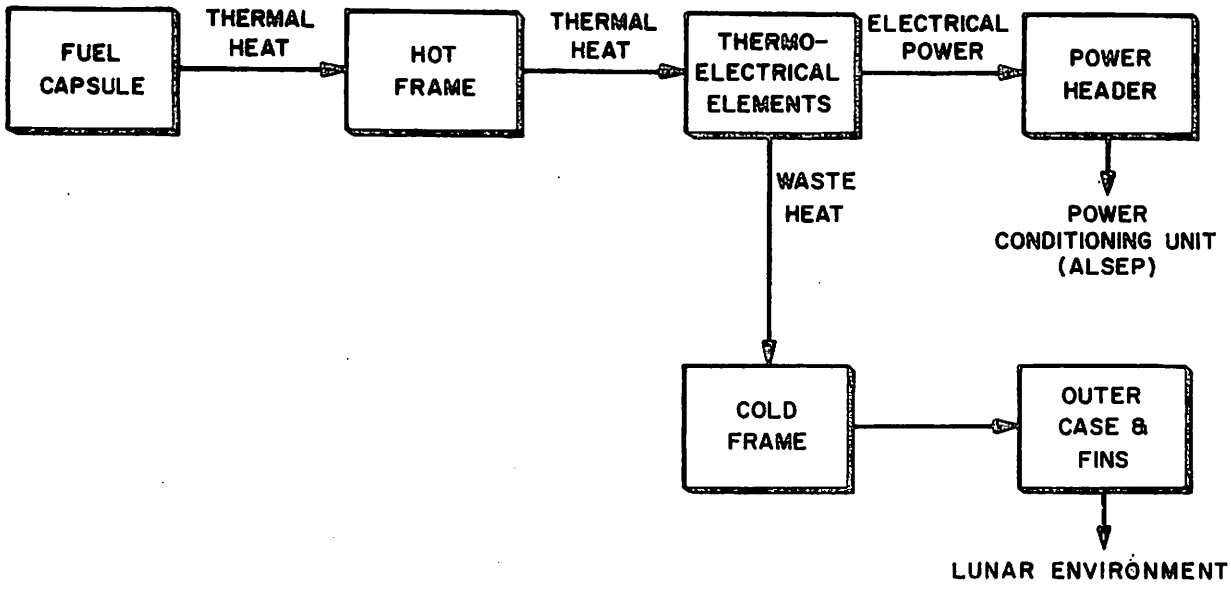

Figure 2-2. Functional Block Diagram, IPU

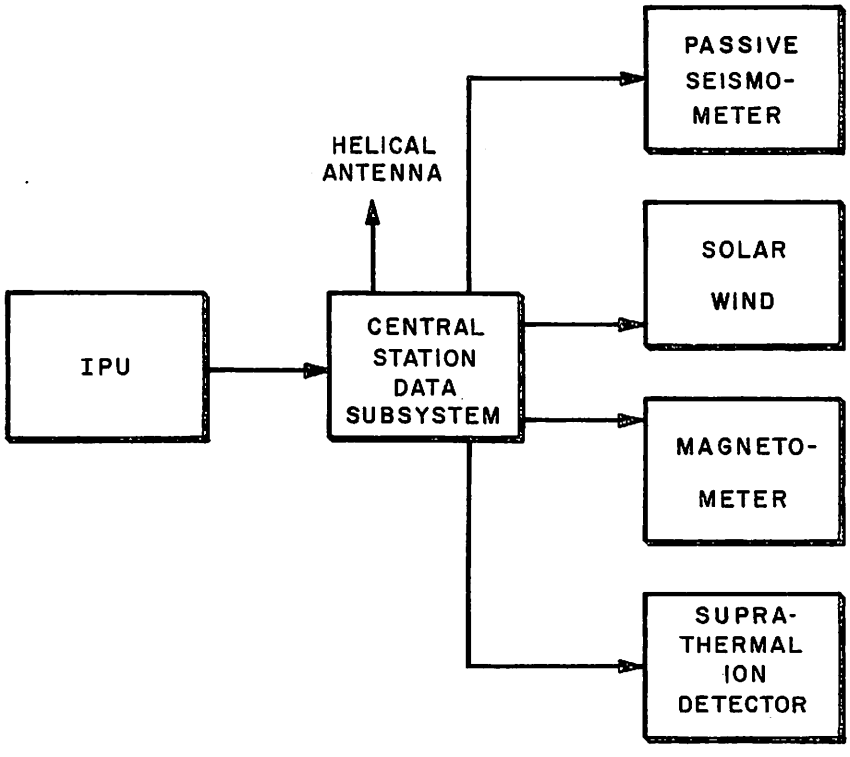

Figure 2-3. Power Distribution, ALSEP Equipment, Array A

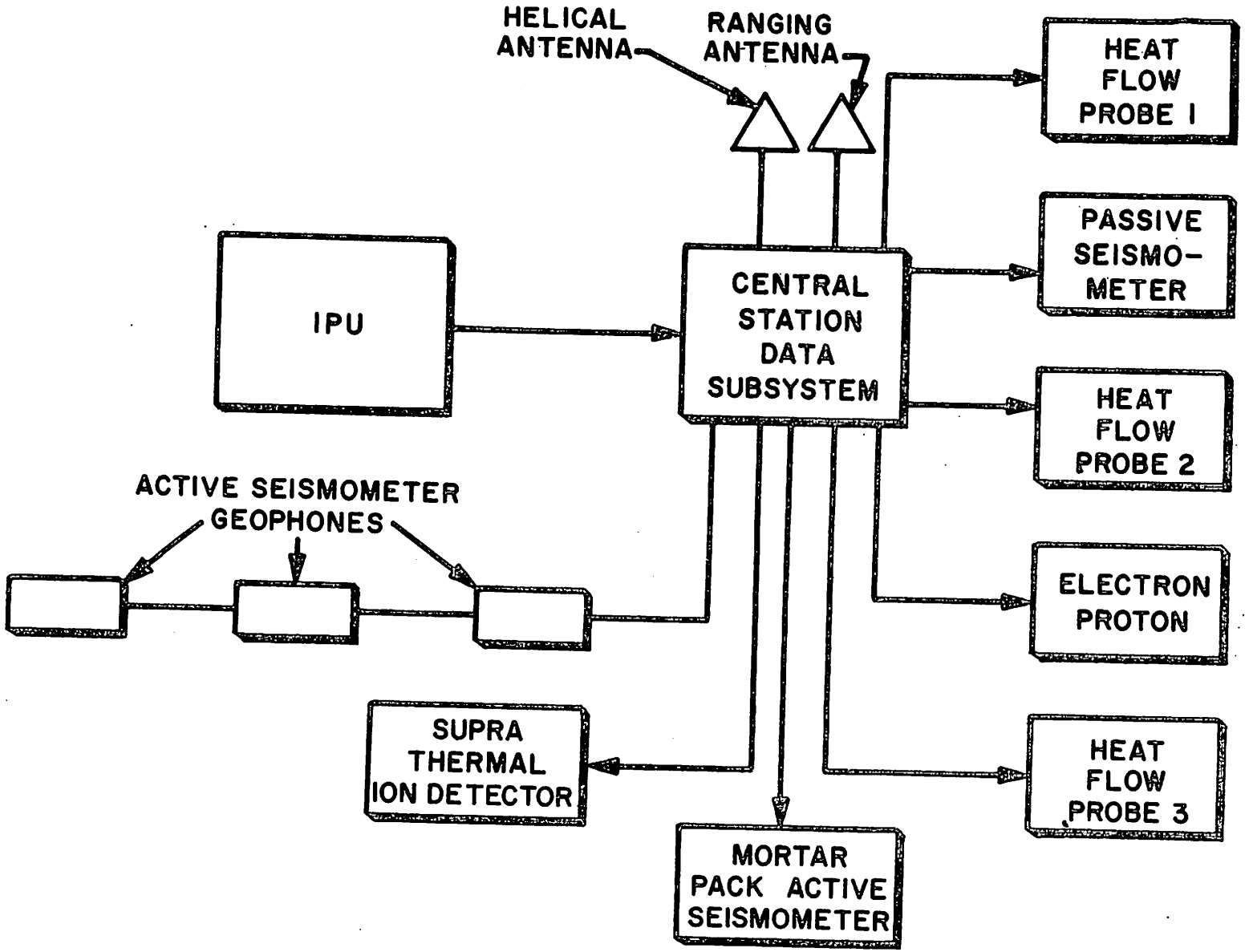

Figure 2-4. Power Distribution, ALSEP Equipment, Array B

SECTION 3

RECEIPT AND PRELAUNCH CHECKOUT REQUIREMENTS

SECTION 3

RECEIPT AND PRELAUNCH CHECKOUT REQUIREMENTS

This section describes the requirements for SNAP-27 flight items in preparation for subsequent mounting on the LM vehicle at Cape Kennedy.

Initial tests are performed by GE/MSD quality assurance personnel to verify that no degradation in performance or structural changes occurred as a result of the shipping environment. For final testing the IPU must be cabled to the Bendix assembled ALSEP system. An integrated ALSEP system test is performed to demonstrate compatibility and satisfactory performance of the complete ALSEP system. Performance of the IPU will be monitored while it supplies power to the central station.

Five equipment packages will be delivered to Cape Kennedy during the course of the program. The following items are included in each equipment package:

a. 1 Generator Assembly with cable and connector

b. 1 LM Fuel Cask

c. 1 Fuel Capsule Assembly

d. 1 Ground Handling Tool

e. 1 Flight Handling Tool

f. Shipping Containers

The initial shipment will, in addition to one each of the above, include two Type A Electrical Fuel Capsule Simulators, two test panels, and Cape Kennedy Support Equipment. While one IPU is being prepared for installation into the flight vehicle, a second unit will be continuously maintained as a backup unit in the event of flight unit component malfunction. The two Type A Electric Fuel Capsule Simulators and the two test panels will be used to support all of the IPU's that are shipped to Cape Kennedy.

Each component of the IPU system will be inspected to insure that no damage occurred during shipment. Maximum g values experienced by each of the components in their shipping containers (as indicated on the shipping container dynamic instrumentation) and the

internal pressure of the generator assembly container (as indicated on the pressure gauge) will be recorded (Figure 3-1).

Mechanical compatibility between the various IPU components will be verified by inserting and latching the fuel capsule assembly, using ground and flight handling tools, in both the GA and the LFC. Since two IPU packages will be shipped for the initial flight, (one prime, one backup), interchangeability of corresponding components will also be verified. In addition, a check will be made between the LFC and the LM struts to verify mechanical compatibility.

The GA will be checked for dc resistance and continuity and then subjected to E-I mapping (Figure 3-2) for eight thermal equilibrium points. Mapping will be performed in a thermal vacuum test chamber using an electric fuel capsule simulator and the IPU test panel. The data will be recorded on an X-Y recorder or, if a computer is available, on a digital print-out. During E-I mapping, the generator will also be checked for internal leakage. A single point check of IPU performance will then be made using the fuel capsule assembly (Figure 3-3).

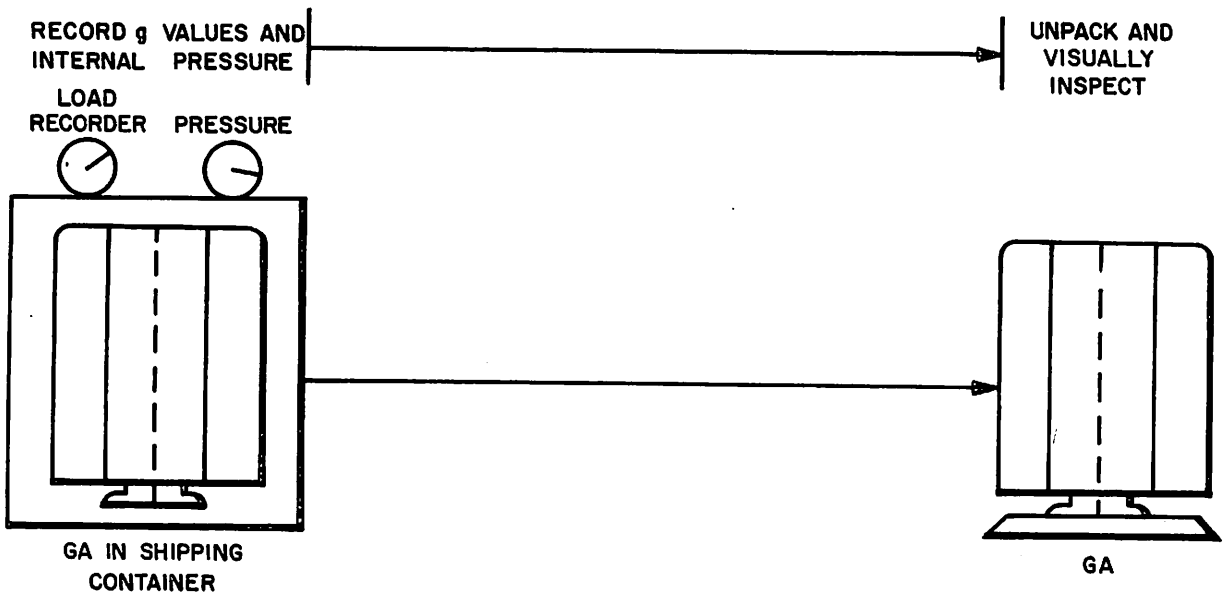

Figure 3-1. Generator Assembly, Receiving Inspection

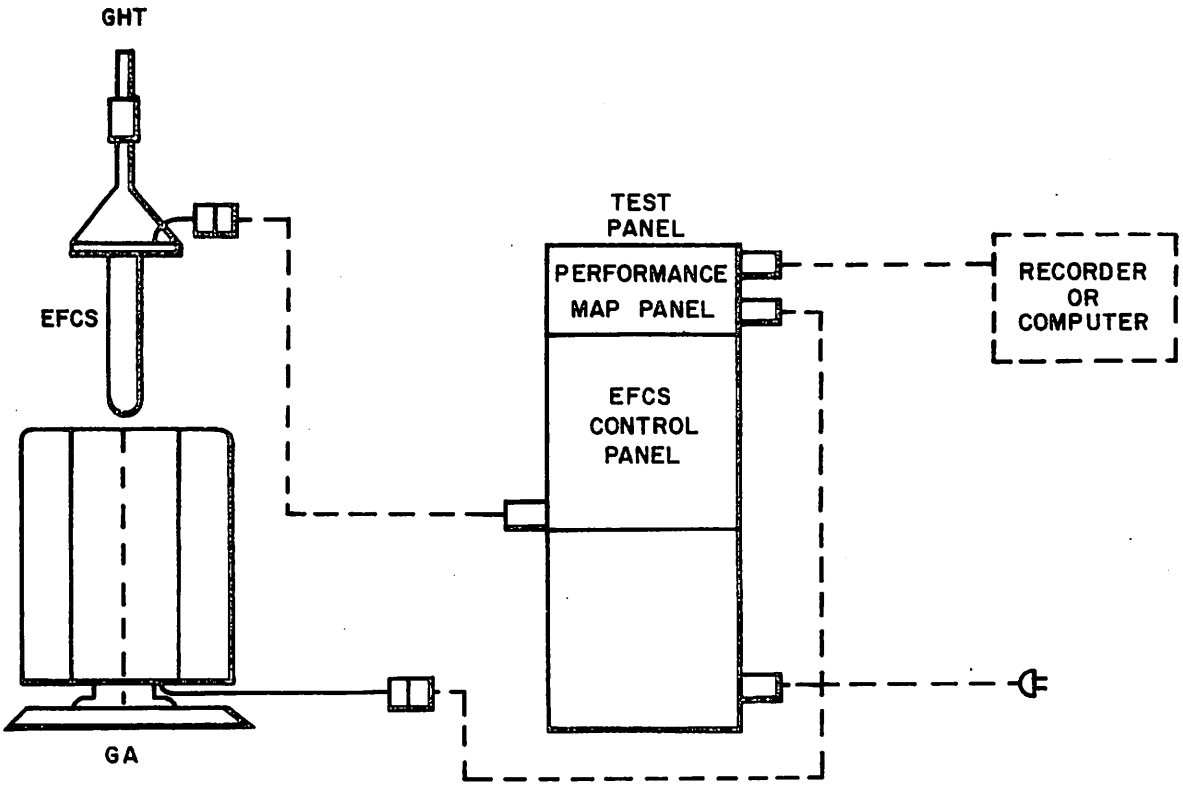

Figure 3-2. Generator Assembly, Performance Test (with EFCS)

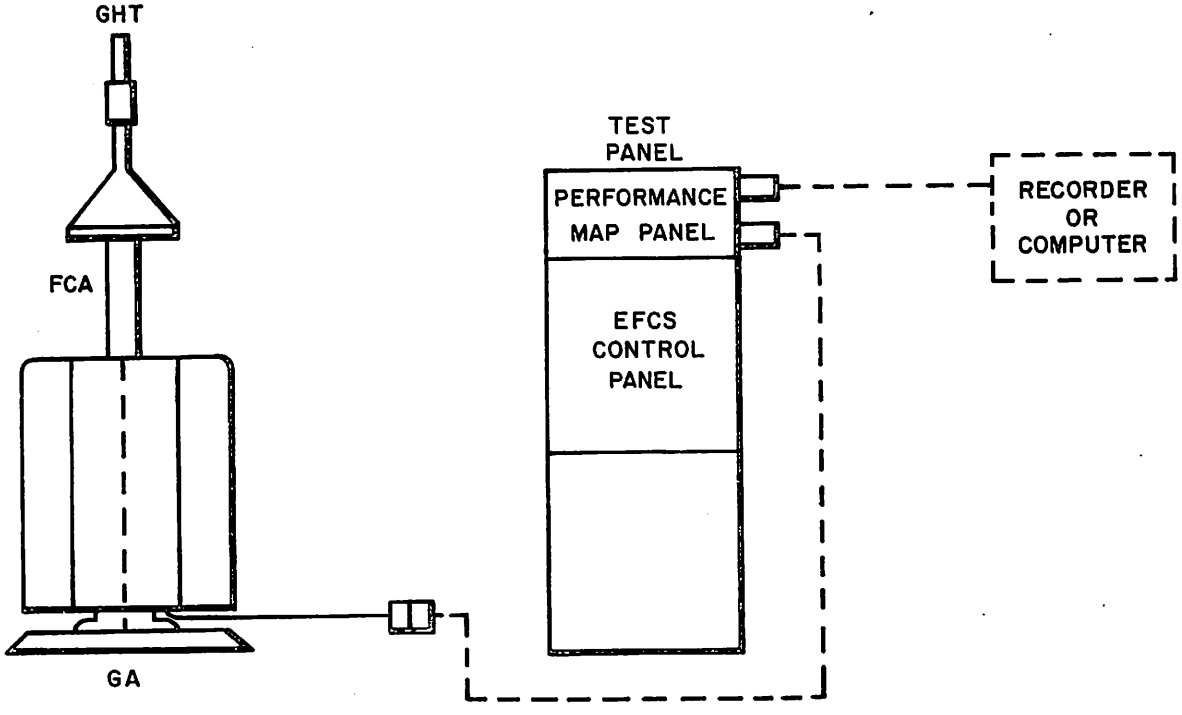

Figure 3-3. Generator Assembly, Performance Test (with FCA)

The integrated ALSEP systems test brings together the particular IPU and ALSEP flight equipment that will be associated in lunar deployment. Mechanical and electrical compatibility, and performance verification is performed. The IPU is mated to the ALSEP central station and the Performance Map Panel on the IPU test console through a special switchbox and auxiliary cables (Figure 3-4). The switchbox connects the GA output to the IPU test console for hard-line IPU performance measurements. Performance of the IPU when power is switched to the central station is obtained through the ALSEP telemetry in a form representative of lunar mission operation. The ALSEP system testing will be performed using the FCA and the IPU bolted to ALSEP Pallet Number 2.

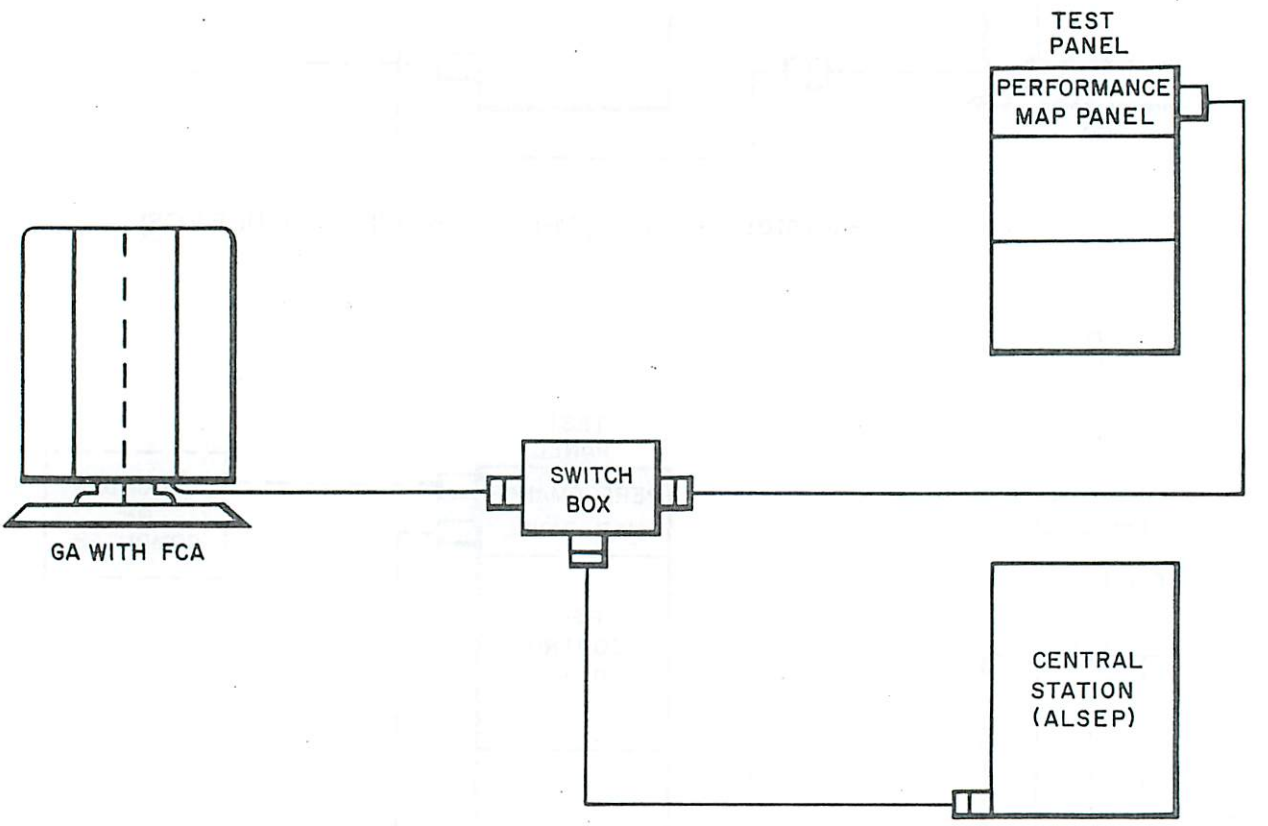

Figure 3-4. Integrated System Checkout

SECTION 4

PRELAUNCH INSTALLATION

SECTION 4
PRELAUNCH INSTALLATION

This section gives a general description of the prelaunch installation procedures necessary at Cape Kennedy for SNAP-27 flight items. The Generator Assembly, flight handling tool and power cable assembly will be secured to Pallet No. 2 along with the Apollo Lunar Geological Equipment (ALGE). This pallet with all equipment mounted, is defined as subpackage No. 2 and is placed in the ALSEP compartment of the LM vehicle. The remaining components of the ALSEP system (subpackage No. 1) are also placed in the ALSEP compartment. The covering and thermal blankets are placed over the ALSEP compartment.

The LM fuel cask is attached directly to the LM structure adjacent to the ALSEP compartment. When these equipment installations are completed, the LM is transferred to the Vehicle Assembly Building (VAB) where the LM is secured inside the Spacecraft LM Adapter (SLA) on the Apollo Vehicle. After the Apollo vehicle is assembled, it is transferred to the launch pad by the crawler-transporter. SNAP-27 Radioisotope Fuel Capsule loading is performed at the launch site using one of two loading philosophies.

PRIME METHOD (See Figure 4-1)

The Ground Shipping Cask (GSC), with the FCA installed, is located in a van at the base of the mobile service structure. The FCA is transferred from the GSC to the transfer cask using the SLA handling tool. The transfer cask is lowered from the van and rolled into an elevator on the mobile service structure where it is taken to the SLA platform level. On the SLA platform, the FCA is removed from the transfer cask, using the SLA handling tool, and placed on the port entry trough with the SLA handling tool attached. The port entry trough is passed, SLA handling tool first, into the SLA/LM area of the spacecraft through a ten inch access port. The SLA handling tool with the FCA attached is lifted from the port entry trough, hand-carried to the LFC and inserted. The SLA handling tool is removed and proper engagement of the FCA to the LFC is checked with the inspection tool. The LFC lid is then installed using the torque tool.

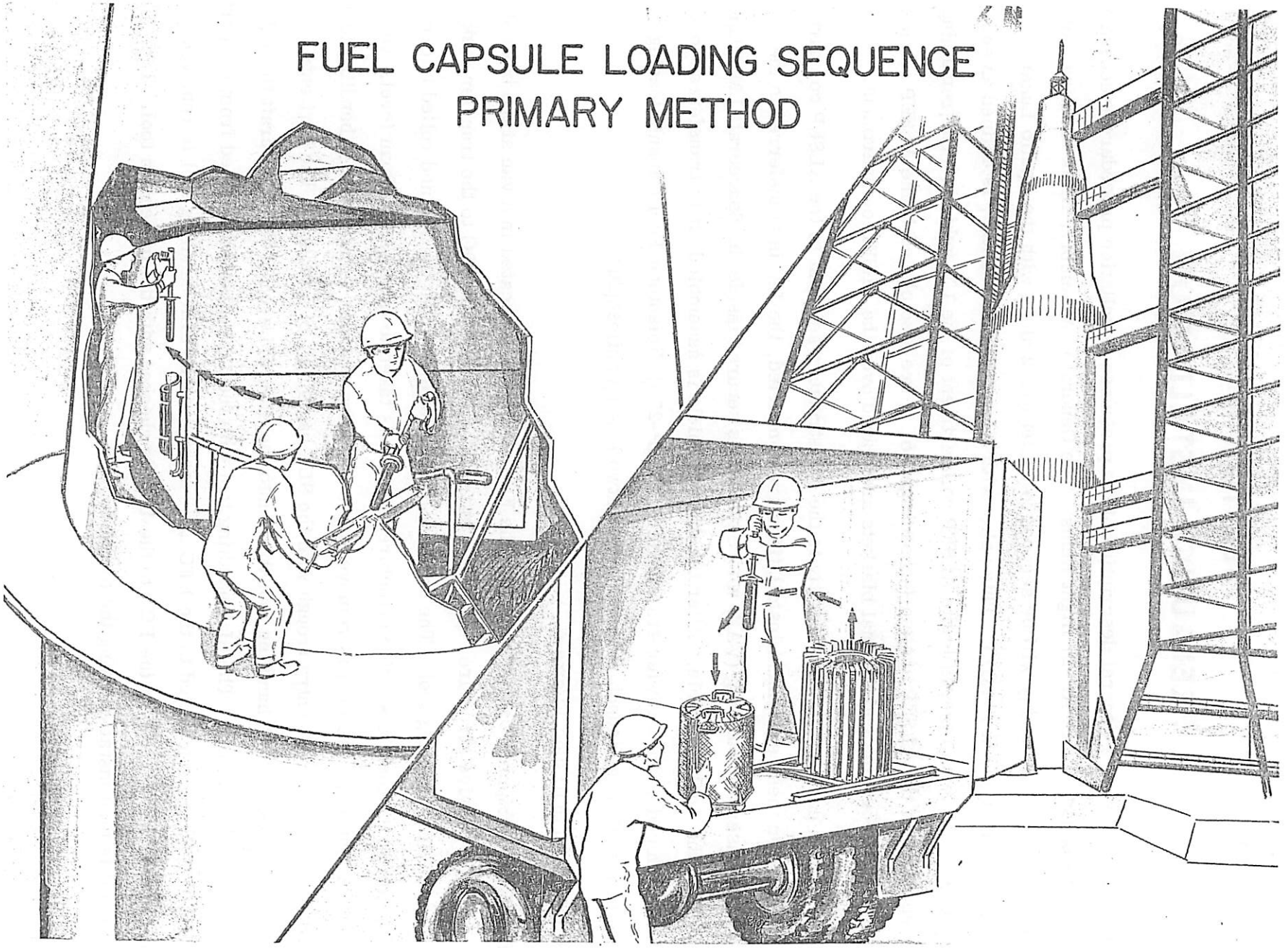

Figure 4-1. Fuel Capsule Loading Sequence, Primary Method

ALTERNATE METHOD (See Figure 4-2)

The GSC, with the FCA installed, is located in a van at the base of the umbilical tower. The FCA is transferred from the GSC to the transfer cask using the SLA handling tool. The transfer cask is lowered from the van and rolled into an elevator on the umbilical tower where it is taken to the SLA platform level. The transfer cask is passed into the spacecraft through an access door and lifted to the LM level. The FCA is removed from the transfer cask and inserted into the LFC using the SLA handling tool. The SLA handling tool is removed and proper engagement of the FCA is checked with the inspection tool. The LFC lid is then installed using the torque tool.

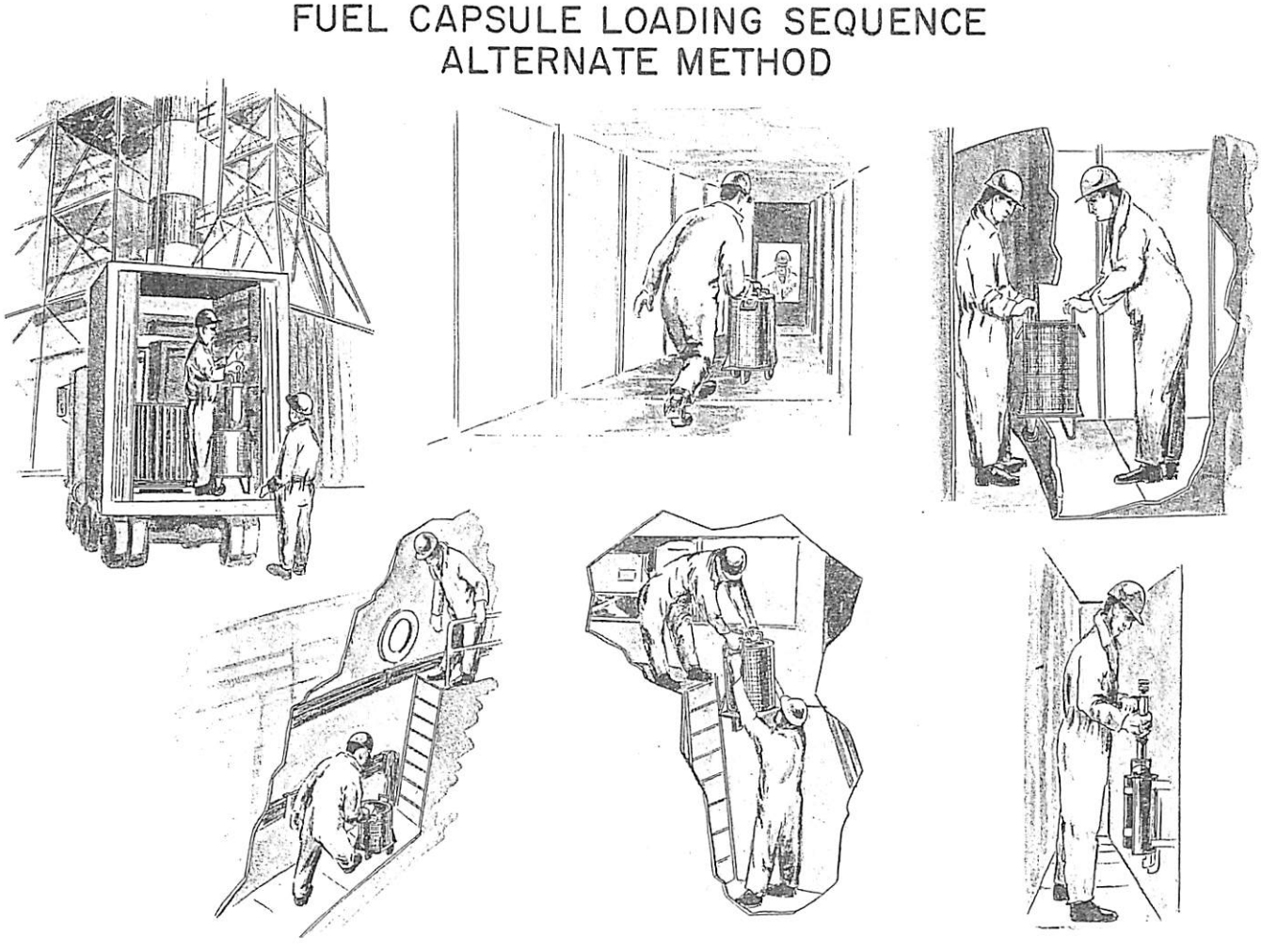

Figure 4-2. Fuel Capsule Loading Sequence, Alternate Method

SECTION 5
LUNAR DEPLOYMENT

SECTION 5

LUNAR DEPLOYMENT

The IPU is deployed on the lunar surface according to ALSEP system deployment procedures, detailed in Bendix document "ALSEP Flight System and Ground System Familiarization Manual" ALSEP-MT-03 (not available at the time of this printing). Fuel Capsule transfer on the lunar surface is executed by the astronaut just before the IPU is positioned for lunar surface operation to insure that the IPU is relatively cool during the time it is carried by the astronaut. To safely transfer the FCA from the LFC to the GA, the following handling philosophy will be followed:

a. Subpackage No. 2 (Figure 5-1) is removed by releasing the pip pins and grasping the suitcase type handle which is attached to the ALSEP subpackage. The package is pulled out to the edge of the compartment and using a second handle on the side or appropriate handholes in the structure, it is placed on the lunar surface with the GA axis vertical (Figure 5-2).

b. Subpackage No. 1 (Figure 5-2) is removed (following the same procedure described for Subpackage No. 2) and lowered to the lunar surface.

c. The flight handling tool with Bendix handle installed is released from Subpackage No. 2 and in its non-extended position is used to tilt the fuel cask to the desired angle for fuel capsule removal.

d. The flight handling tool is extended to full length.

e. The flight handling tool is engaged with the FCA (Figure 5-3). The FCA is extracted from the cask and lowered into the GA. (Figure 5-4). The FHT is disengaged locking the FCA in the GA.

f. The two ALSEP subpackages can be transported in either of two carrying modes; suitcase carry mode or barbell carry mode. The astronaut can select the one best suited to the local lunar surface conditions. If suitcase carry is elected, the antenna mast is attached to Subpackage No. 1 for transport. If barbell carry mode is elected, the antenna mast is connected between subpackages 1 and 2 for transport. Figure 5-5 shows the barbell carry mode.

g. Subpackages 1 and 2 are carried to their selected operating site on the lunar surface. The experiment packages are deployed to their respective positions and electrically connected to the central station. The IPU should be placed approximately ten feet from the central station or nearest experiment package to ensure an adequate thermal radiation path from the IPU to the lunar environment. Figure 5-6 shows the ASLEP equipment deployed on the lunar surface.

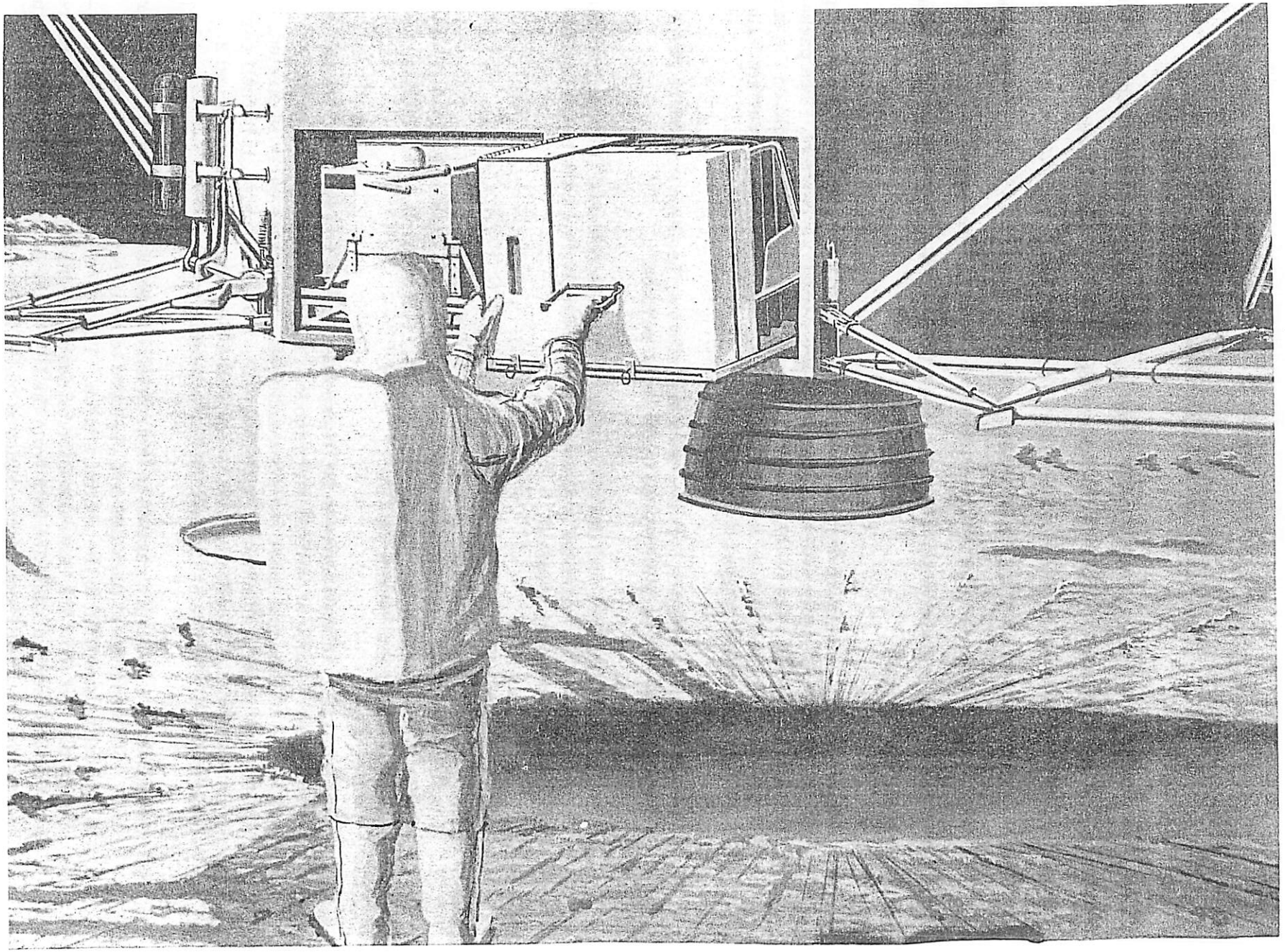

Figure 5-1. Removing Subpackage No. 2 from the LM

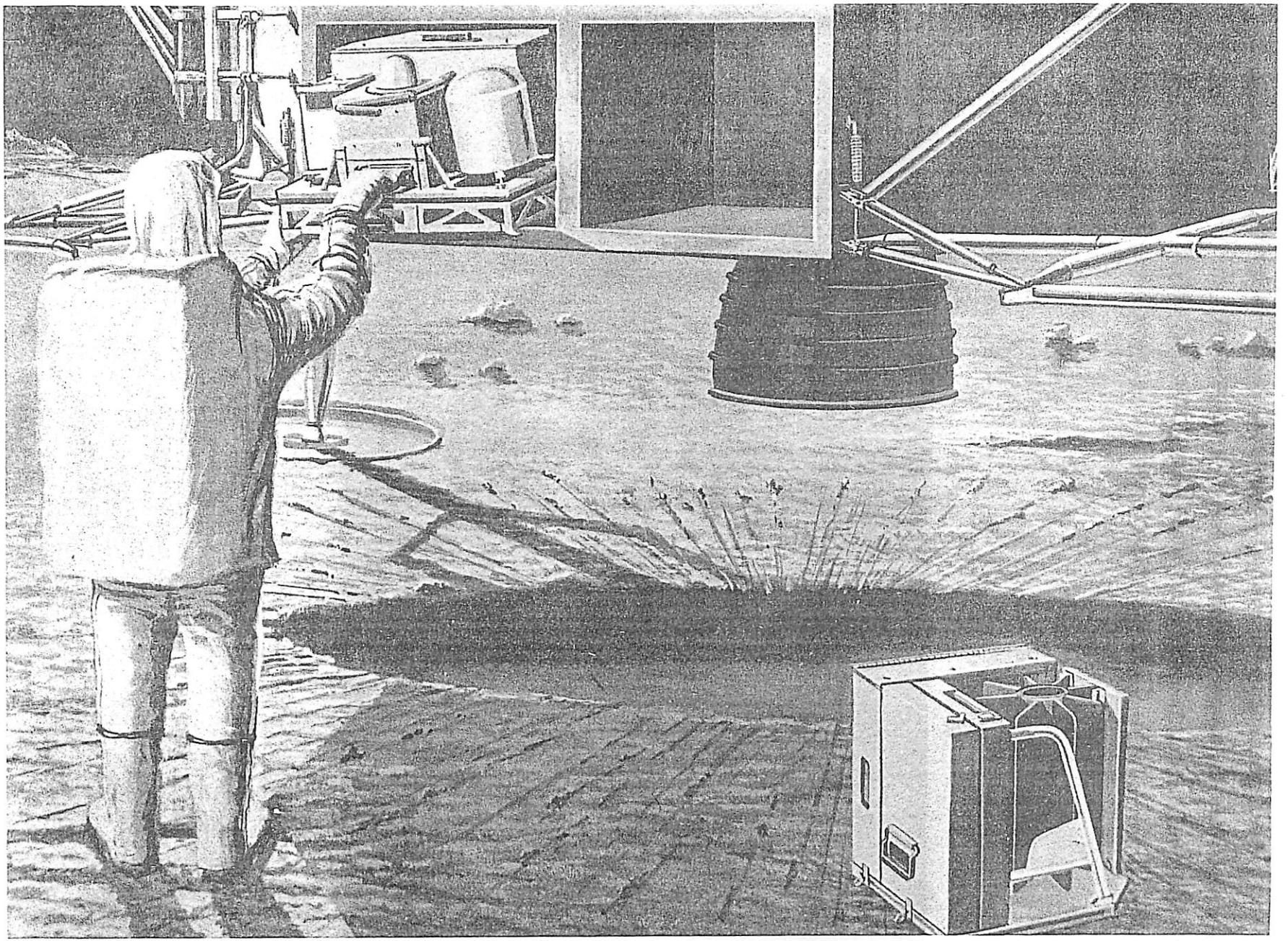

Figure 5-2. Removing Subpackage No. 1 from the LM

The IPU will start heating up on the lunar surface as soon as the astronaut inserts the fuel capsule into the GA, however, a waiting period of approximately 90 minutes is required before IPU output is at the prescribed power level. After the waiting period, the IPU will provide 56.2 watts minimum to the ALSEP equipment for at least one year.

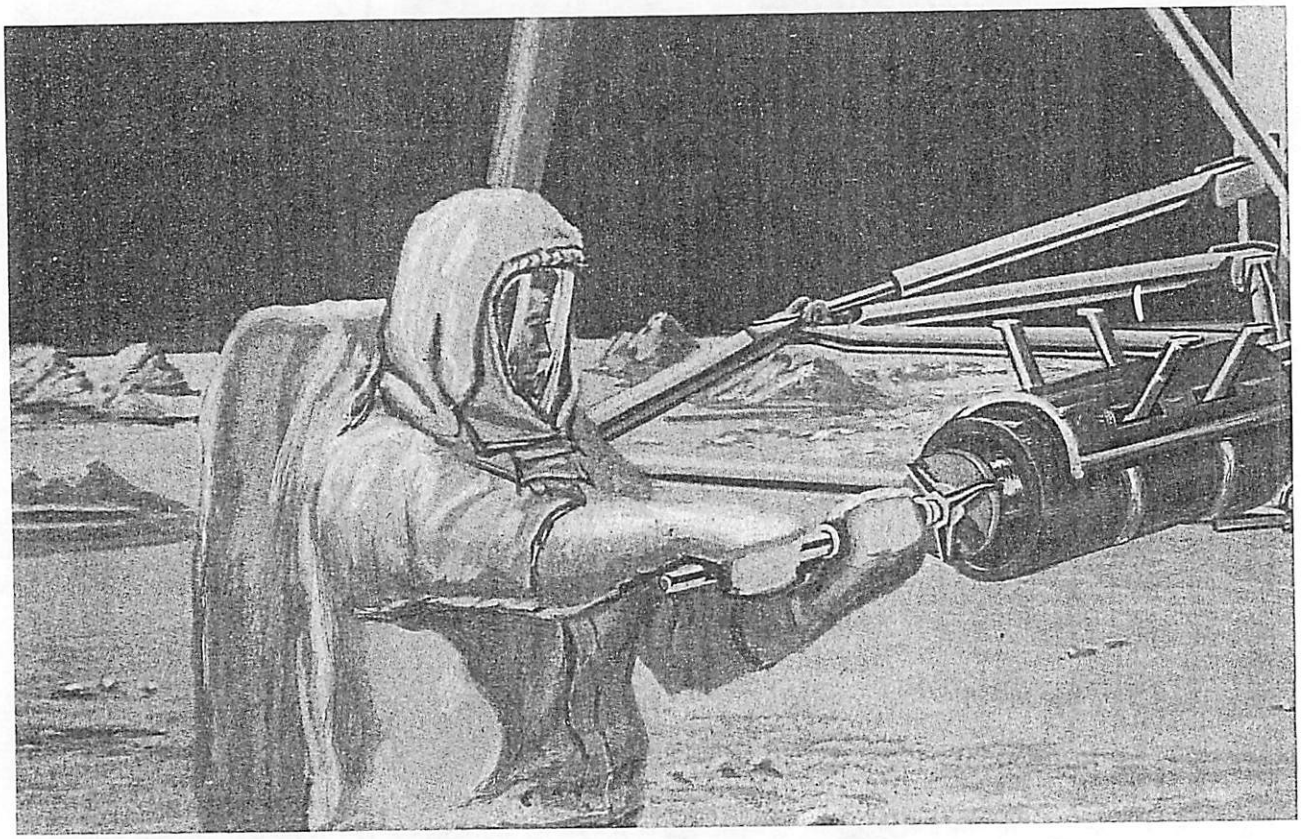

Figure 5-3. Engaging the FHT with the FCA

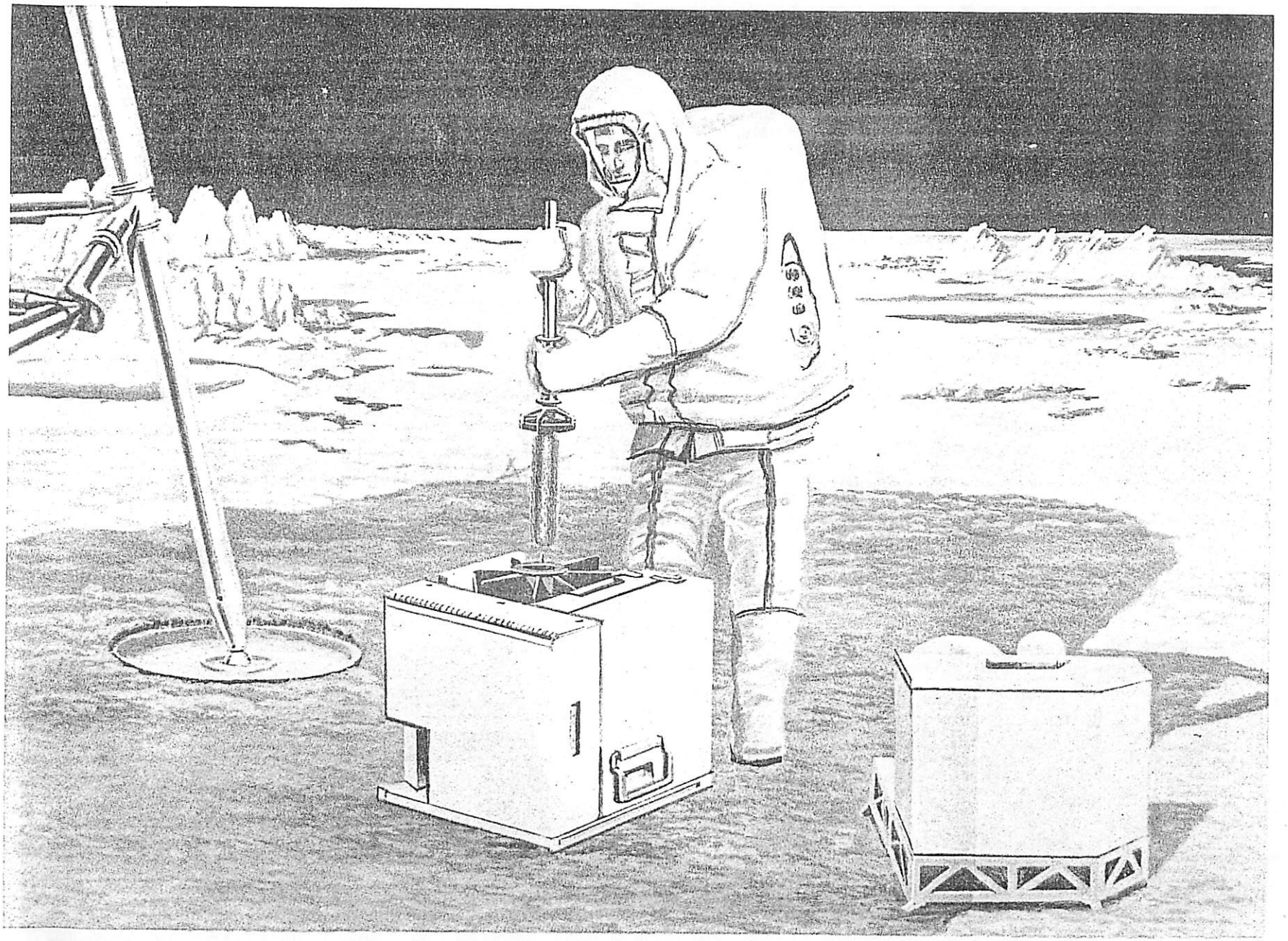

Figure 5-4. Inserting the FCA into the GA

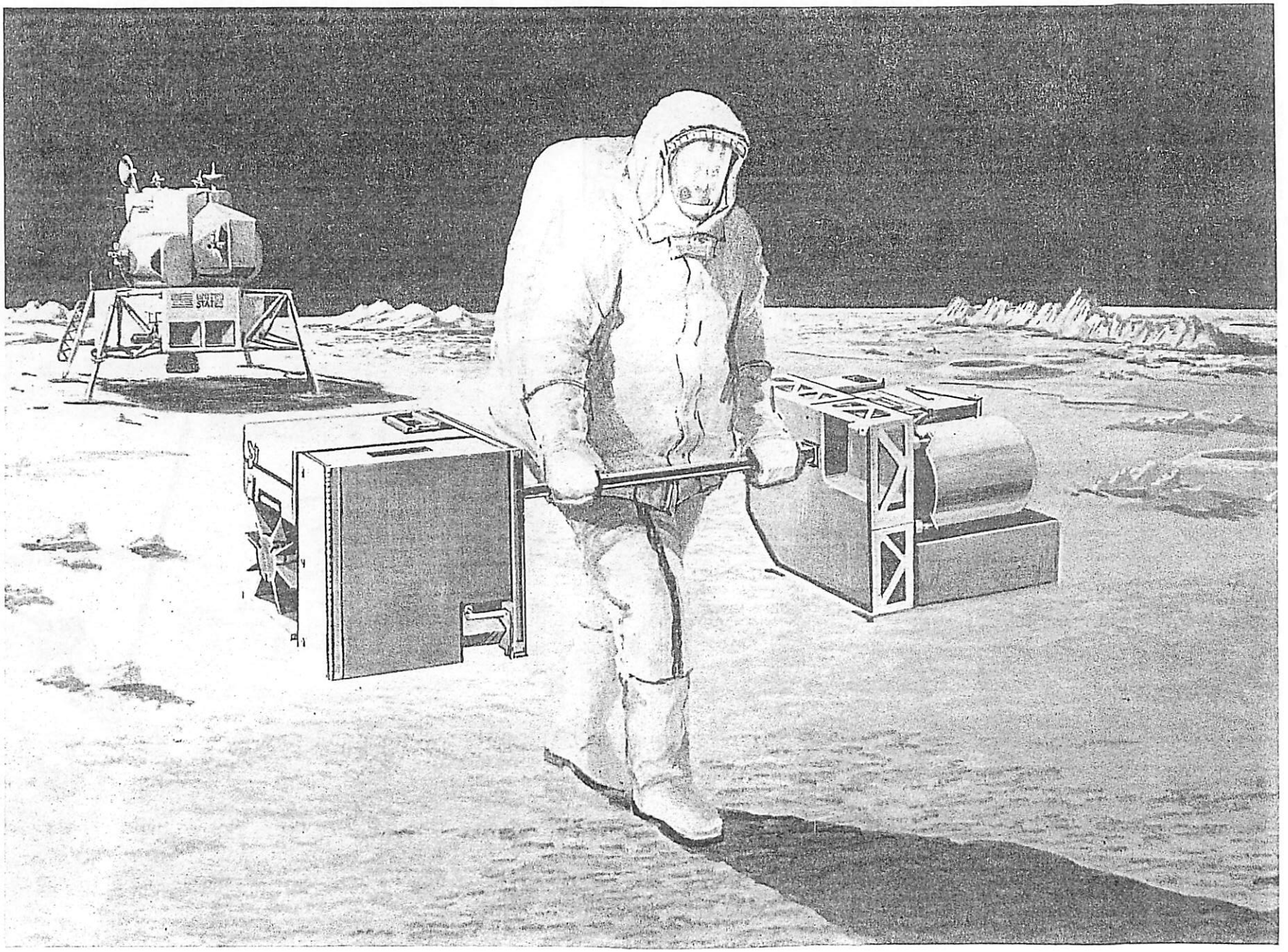

Figure 5-5. Barbell Carry Mode

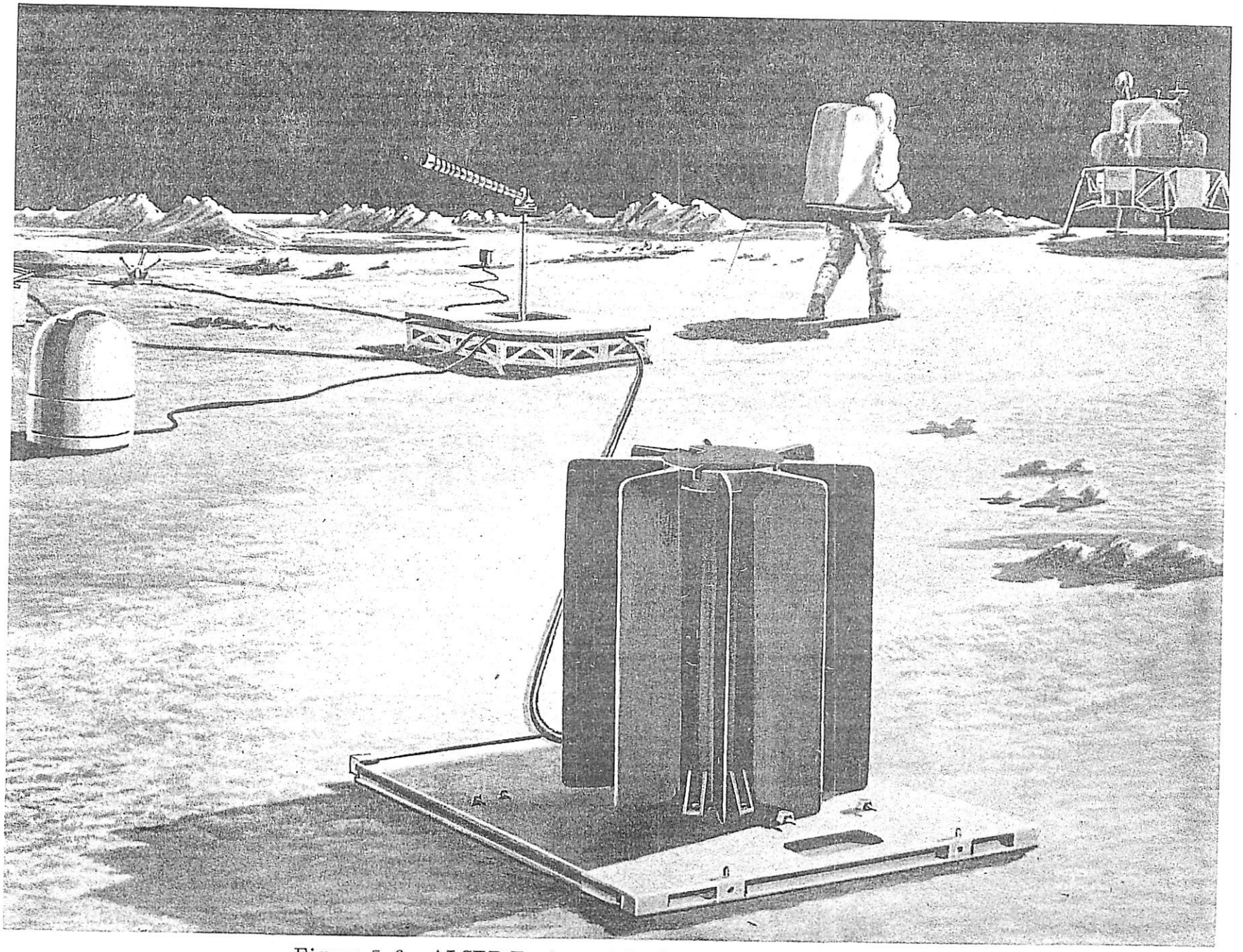

Figure 5-6. ALSEP Equipment Deployed on the Lunar Surface

GENERAL ELECTRIC