CREW PERSONAL EQUIPMENT

Crew personal equipment includes a variety of mission-oriented equipment required for life support and astronaut safety and accessories related to successful completion of the mission.

These equipments range from astronaut space suits and docking aids to personal items stored throughout the cabin. The Modularized Equipment Stowage Assembly (MESA), Apollo lunar scientific experiments payload (ALSEP), Quad 3 pallet assembly, and the Lunar Roving Vehicle (LRV) are stored in the descent stage.

This equipment is used for sample and data collecting and scientific experimenting. The resultant data will be used to derive information on the atmosphere and distance between earth and moon.

The portable life support system (PLSS) interfaces with the Environmental Control Subsystem (ECS) for refills of oxygen and water. The pressure garment assembly (PGA) interfaces with the ECS for conditioned oxygen, through oxygen umbilicals, and with the Communications and Instrumentation Subsystems for communications and bioinstrumentation, through the electrical umbilical.

EXTRAVEHICULAR MOBILITY UNIT

The extravehicular mobility unit (EMU) provides life support in a pressurized or unpressurized cabin, and up to 7 hours of extravehicular life support (depending on astronaut's metabolic rate).

In its extravehicular configuration, the EMU is a closed-circuit pressure vessel that envelops the astronaut. The environment inside the pressure vessel consists of 100% oxygen at a nominal pressure of 3.75 psia. The oxygen is provided at a flow rate of 6 cfm. The extravehicular life support equipment configuration includes the following:

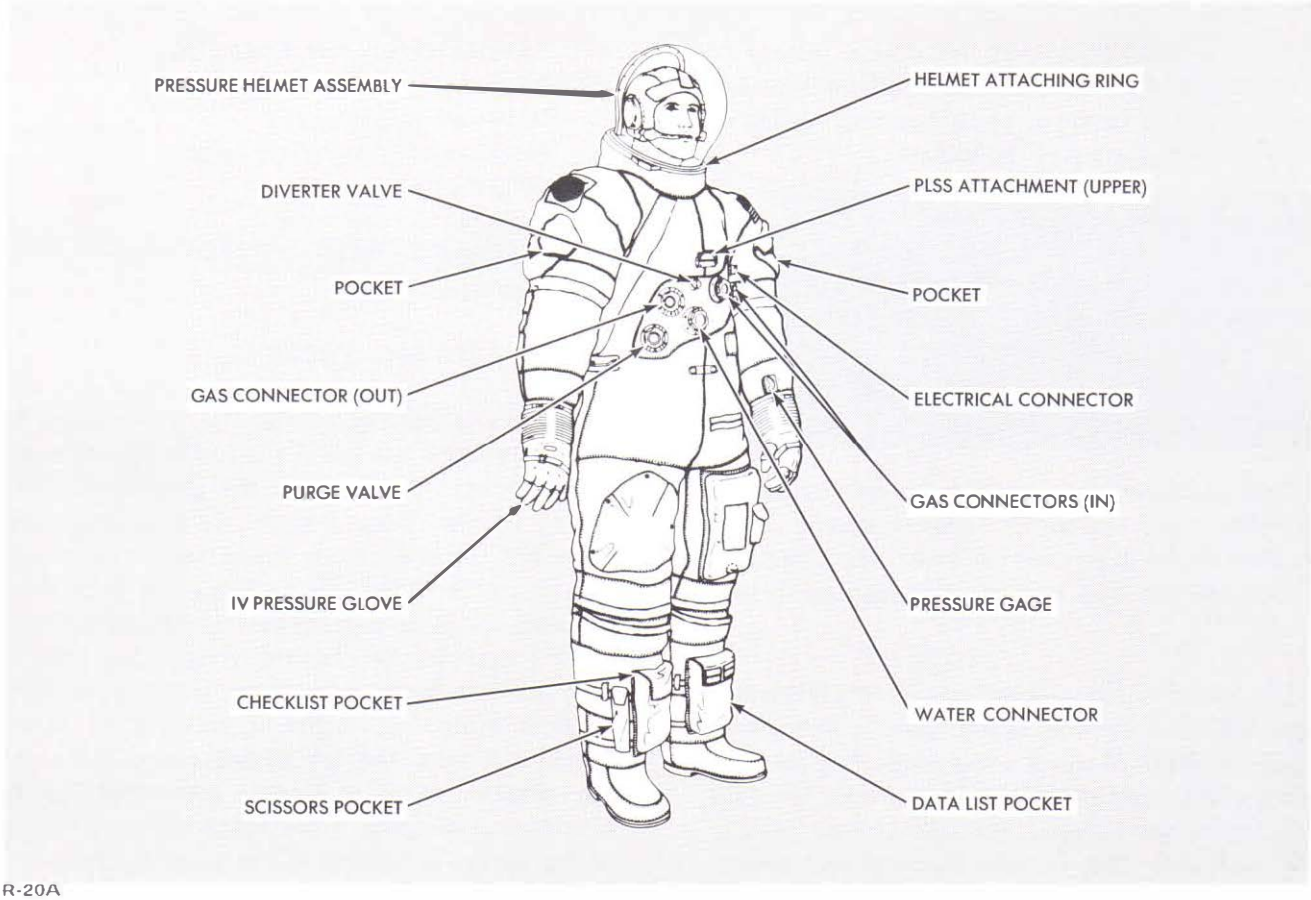
Liquid cooling garment (LCG)
Pressure garment assembly (PGA)
Integrated thermal micrometeoroid garment (ITMG)
Portable life support system (PLSS)
Oxygen purge system (OPS)
Communications carrier
EMU waste management system
EMU maintenance kit
PLSS remote control unit
Lunar extravehicular visor assembly (LEVA)
Biomedical belt

LIQUID COOLING GARMENT

The liquid cooling garment (LCG) is worn by the astronauts while in the LM and during all extravehicular activity. It cools the astronaut's body during extravehicular activity by absorbing body heat and transferring excessive heat to the sublimator in the PLSS. The LCG is a one-piece, long-sleeved, integrated-stocking undergarment of netting material. It consists of an inner liner of Beta cloth, to facilitate donning, and an outer layer of Beta cloth into which a network of Tygon tubing is woven. The tubing does not pass through the stocking area. A double connector for incoming and outgoing water is located on the front of the garment. Cooled water, supplied from the PLSS, is pumped through the tubing. Pockets for bioinstrumentation signal conditioners are located around the waist. A zipper that runs up the front is used for donning and doffing the LCG; an opening at the crotch is used for urinating. Dosimeter pockets and snaps for attaching a biomedical belt are part of the LCG.

PRESSURE GARMENT ASSEMBLY

The pressure garment assembly (PGA) is the basic pressure vessel of the EMU. It provides a mobile life-support chamber if cabin pressure is lost due to leaks or puncture of the vehicle. The PGA consists of a helmet, torso and limb suit, intravehicular gloves, and various controls and instrumentation to provide the crewman with a controlled environment. The PGA is designed to be worn for 115 hours, in an emergency, at a regulated pressure of 3.75± 0.25 psig, in conjunction with the LCG.



R-20A

Pressure Garment Assembly

The torso and limb suit is a flexible pressure garment that encompasses the entire body, except the head and hands. It has four gas connectors, a PGA multiple water receptacle, a PGA electrical connector, and a PGA urine transfer connector for the PLSS/PGA and ECS/PGA interface. The PGA connectors have positive locking devices and can be connected and disconnected without assistance. The gas connectors comprise an oxygen inlet and outlet connector, on each side of the suit front torso. Each oxygen inlet connector has an integral ventilation diverter valve. The PGA multiple water receptacle, mounted on the suit torso, serves as the interface between the LCG multiple water connector and PLSS multiple water connector. A protective external cover provides PGA pressure integrity when the LCG multiple water connector is removed from the PGA water receptacle. The PGA electrical connector, provides a communications, instrumentation, and power interface to the PGA. The PGA urine transfer connector on the suit right leg is used to transfer urine from the urine collection transfer assembly (UCTA) to the waste management system.

The urine transfer connector, permits dumping the urine collection bag without depressurizing the PGA. A pressure relief valve on the right-leg thigh vents the suit in the event of overpressurization. If the valve does not open, it can be manually overridden. A pressure gage on the left sleeve indicates suit pressure.

The helmet is a Lexan (polycarbonate) shell with a bubble-type visor, a vent-pad assembly, and a helmet attaching ring. The vent-pad assembly permits a constant flow of oxygen over the inner front surface of the helmet. The astronaut can turn his head within the helmet neck-ring area. The helmet does not turn independently of

the torso and limb suit. The helmet has provisions on each side for mounting a lunar extravehicular visor assembly (LEVA). When the LM is unoccupied, the helmet protective bags are stowed on the cabin floor at the crew flight stations. Each bag has a hollow-shell plastic base with a circular channel for the helmet and the LEVA, two recessed holes for glove connector rings, and a slot for the EMU maintenance kit. The bag is made of Beta cloth, with a circumferential zipper; it folds toward the plastic base when empty.

The intravehicular gloves are worn during operations in the LM cabin. The gloves are secured to the wrist rings of the torso and limb suit with a slide lock; they rotate by means of a ball-bearing race. Freedom of rotation, along with convoluted bladders at the wrists and adjustable anti-ballooning restraints on the knuckle areas, permits manual operations while wearing the gloves.

All PGA controls are accessible to the crewman during intravehicular and extravehicular operations. The PGA controls comprise two ventilation diverter valves, a pressure relief valve with manual override, and a manual purge valve. For intravehicular operations, the ventilation diverter valves are open, dividing the PGA inlet oxygen flow equally between the torso and helmet of the PGA. During extravehicular operation, the ventilation diverter valves are closed and the entire oxygen flow enters the helmet. The pressure relief valve accommodates flow from a failed-open primary oxygen pressure regulator. If the pressure relief valve fails open, it may be manually closed. The purge valve interfaces with the PGA through the PGA oxygen outlet connector. Manual operation of this valve initiates an 8 pound/hour purge flow, providing CO_2 washout and minimum cooling during contingency or emergency operations.

A pressure transducer on the right cuff indicates pressure within the PGA. Biomedical instrumentation comprises an EKG (heart) sensor, ZPN (respiration rate) sensor, dc-to-dc converter, and wiring harness. A personal radiation dosimeter (active) is attached to the integrated thermal micrometeoroid garment for continuous accumulative radiation readout. A chronograph wristwatch (elapsed-time indicator) is readily accessible to the crewman for monitoring.

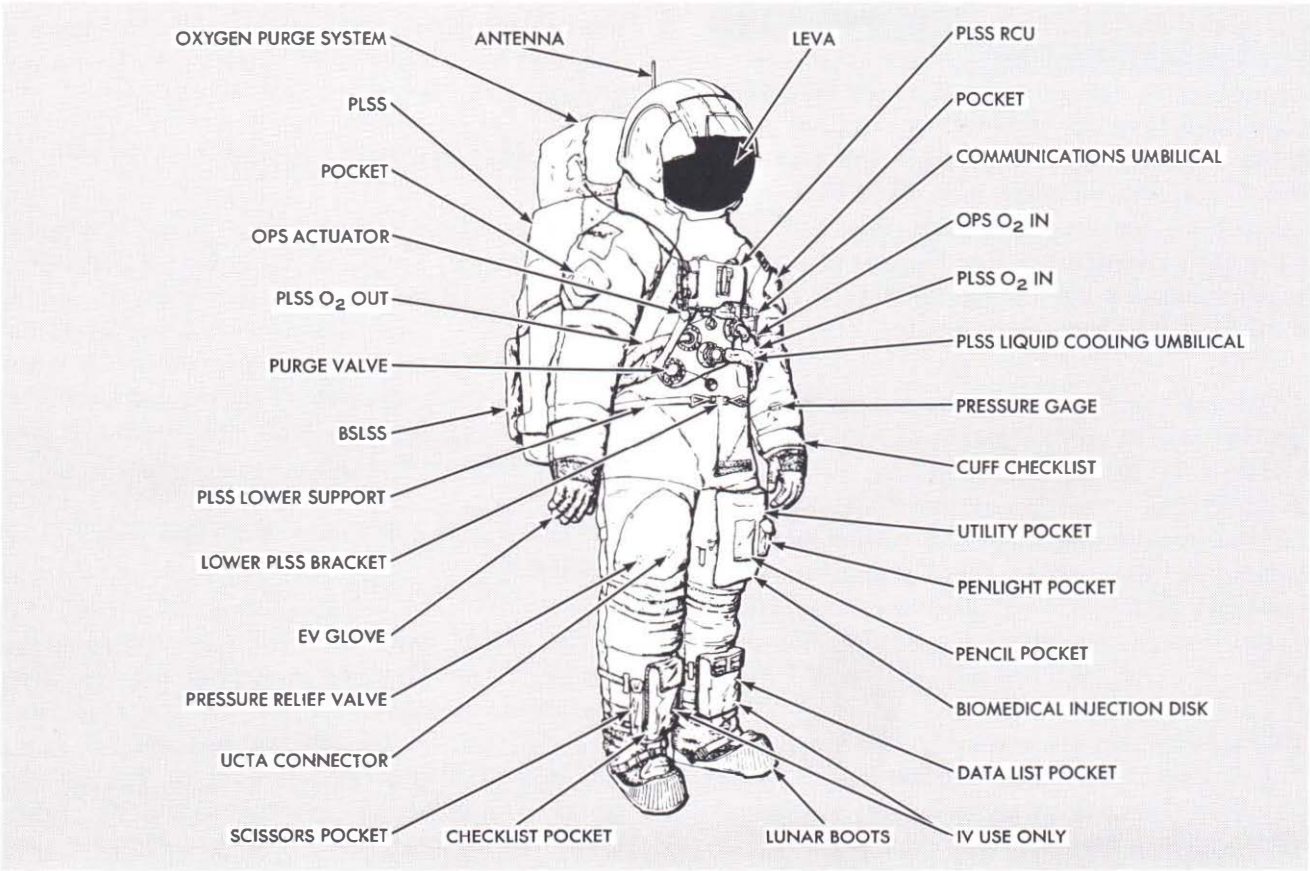
COMMUNICATIONS CARRIER

The communications carrier (cap) is a polyurethane-foam headpiece with two independent earphones and microphones, which are connected to the suit 21-pin communications electrical connector. The communications carrier is worn with or without the helmet during intravehicular operations. It is worn with the helmet during extravehicular operations.

INTEGRATED THERMAL MICROMETEOROID GARMENT

The ITMG, worn over the PGA, protects the astronaut from harmful radiation, heat transfer, and micrometeoroid activity. It is a one-piece, form-fitting, multilayered garment that is laced over the PGA and remains with it. The LEVA, gloves, and boots are donned separately. From the outer layer in, the ITMG is made of a protective cover, a micrometeoroid-shielding layer, a thermal-barrier blanket (multiple layers of aluminized mylar), and a protective liner. A zipper on the ITMG permits connecting or disconnecting umbilical hoses. For extravehicular activity, the PGA gloves are replaced with the extravehicular gloves. The extravehicular gloves are made of the same material as the ITMG to permit handling intensely hot or cold objects outside the cabin and for protection against lunar temperatures. The extravehicular boots (lunar overshoes) are worn over the PGA boots for extravehicular activity. They are made of the same material as the ITMG. The soles have additional insulation for protection against intense temperatures.

The LEVA, which fits over the clamps around the base of the helmet; provides added protection against solar heat, space particles, solar glare, ultraviolet rays, and accidental damage to the helmet. The LEVA is comprised of a plastic shell, cover, hinge assemblies, three eyeshades, and two visors (protective and sun visors). The protective visor



R-21A

Integrated Thermal Micrometeoroid Garment

provides impact, infrared, and ultra-violet ray protection. The sun visor has a gold coating which provides protection against light and reduces heat gain within the helmet. The eyeshades, two located on each side and one in the center, reduces low-angle solar glare by preventing light penetration at the sides and overhead viewing area. When the LM is occupied, the LEVA's are stowed in helmet stowage bags and secured on the ascent engine cover.

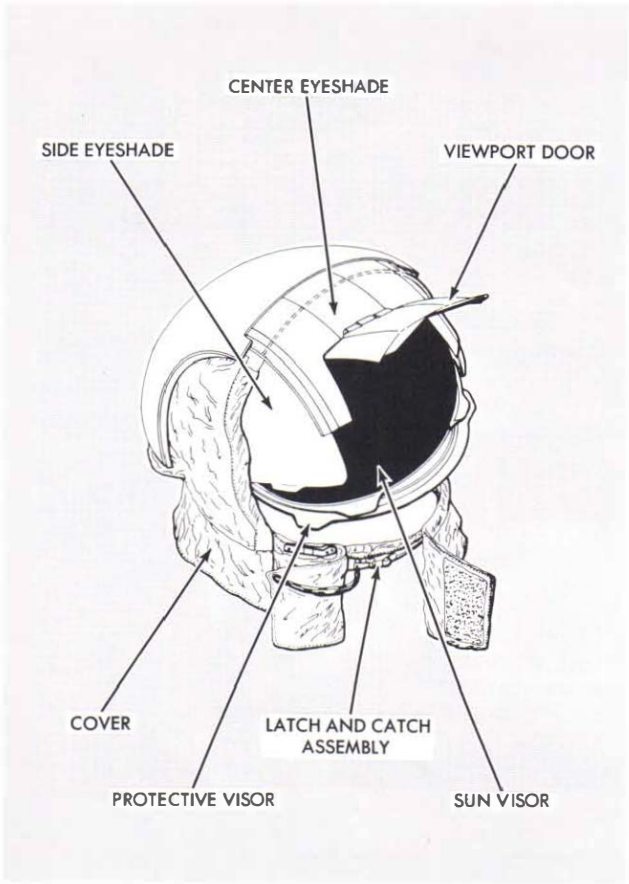
PORTABLE LIFE SUPPORT SYSTEM

The PLSS is a self-contained, self-powered, rechargeable environmental control system. In the extravehicular configuration of the EMU, the PLSS is worn on the astronaut's back. The PLSS supplies pressurized oxygen to the PGA, cleans and cools the expired gas, circulates cool liquid in the LCG through the liquid transport loop, transmits astronaut biomedical data, and functions as a duel VHF transceiver for communication.

The PLSS has a contoured fiberglass shell to fit the back, and a thermal micrometeoroid protective cover. It has three control valves, and, on a separate remote control unit, two control switches, a volume control, and a five-position switch for the dual VHF transceiver. The remote control unit is set on the chest.

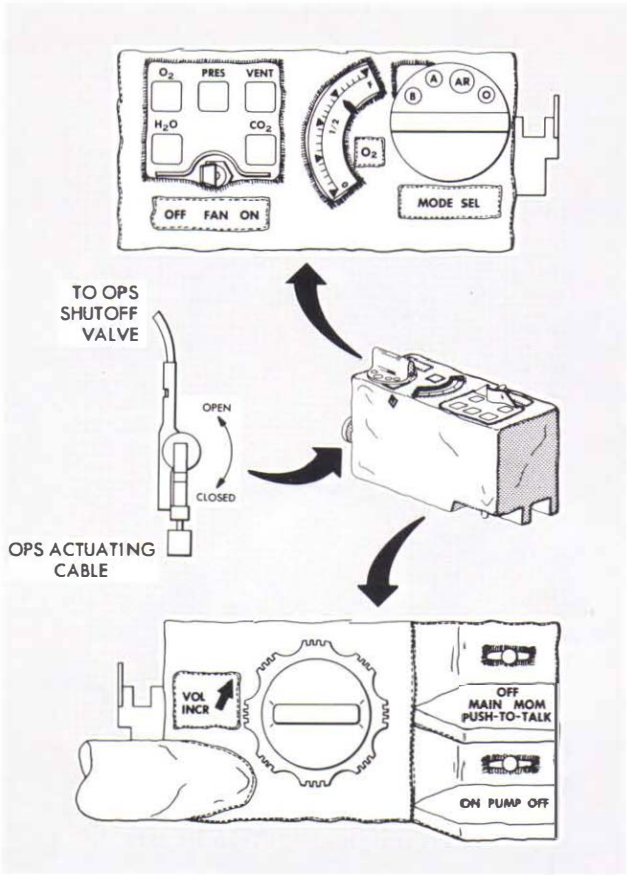
The PLSS attaches to the astronaut's back, over the ITMG; it is connected by a shoulder harness assembly. When not in use, it is stowed on the floor or in the left-hand midsection. To don the PLSS, it is first hooked to the overhead attachments in the left-hand midsection ceiling. The astronaut backs against the pack, makes PGA and harness connections, and unhooks the PLSS straps from the overhead attachment.

The PLSS can operate for 7 hours, depending upon the astronauts metabolic rate, before oxygen and feedwater must be replenished and the battery



R-22A

Lunar Extravehicular Visor Assembly



R-23A

PLSS Remote Control Unit

replaced. The basic systems and loops of the PLSS are primary oxygen subsystem, oxygen ventilation loop, feedwater loop, liquid transport loop, and electrical system.

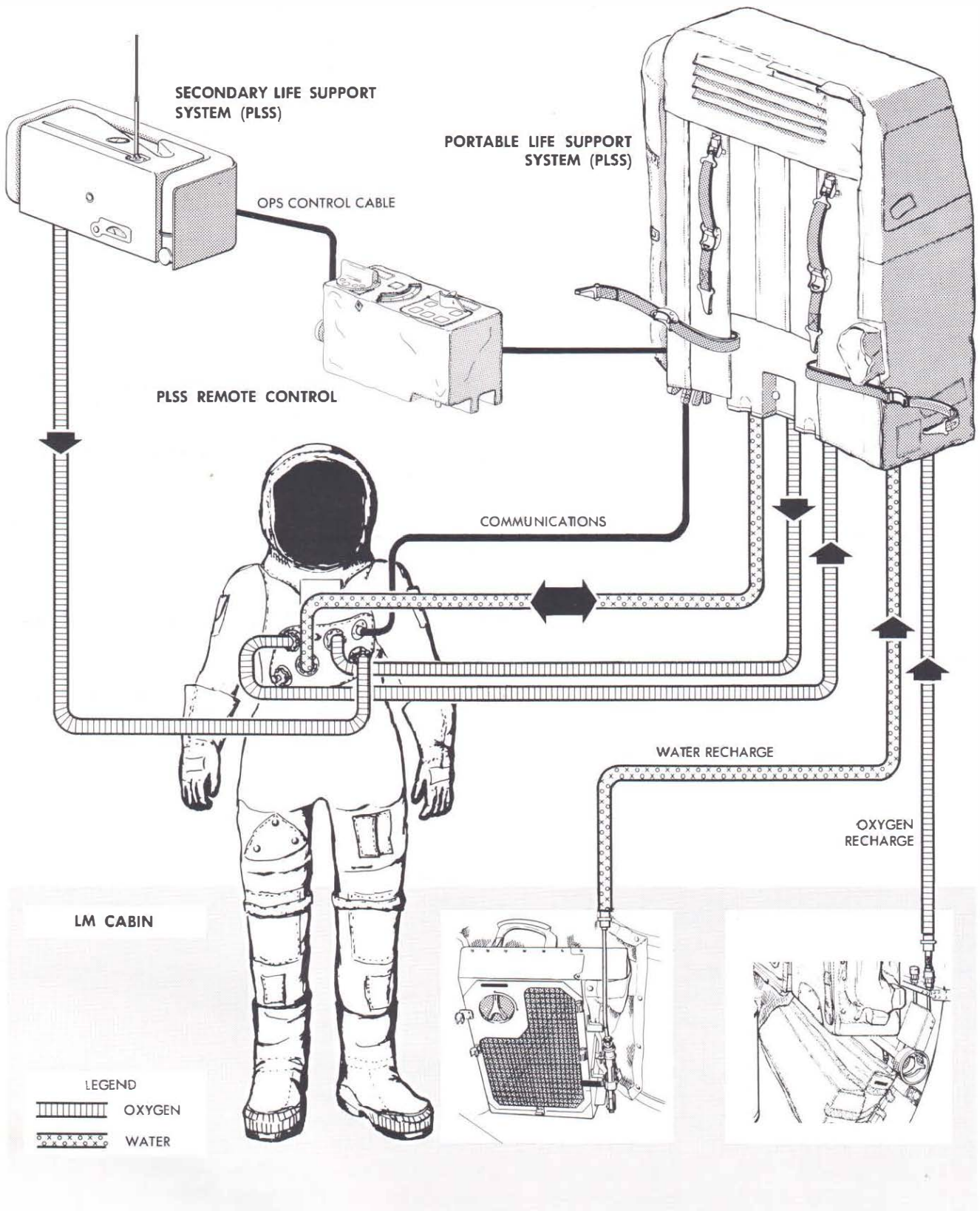
The space suit communicator (SSC) in the PLSS provides primary and secondary duplex voice communication and physiological and environmental telemetry. All EMU data and voice must be relayed through the LM and CM and transmitted to MSFN via S-band. The VHF antenna is permanently mounted on the oxygen purge system (OPS). Two tone generators in the SSC generate audible 3- and 1.5-kHz warning tones to the communications cap receivers. The generators are automatically turned on by high oxygen flow, low vent flow, or low PGA pressure. Both tones are readily distinguishable.

PLSS REMOTE CONTROL UNIT

The PLSS remote control unit is a chest-mounted instrumentation and control unit. It has a fan switch, pump switch, SSC mode selector switch, volume control, PLSS oxygen quantity indicator, five status indicators, and an interface for the OPS actuator.

OXYGEN PURGE SYSTEM

The OPS is a self-contained, independently powered, high-pressure, nonrechargeable emergency oxygen system that provides 30 minutes of regulated purge flow. The OPS consists of two interconnected spherical high-pressure oxygen bottles, an automatic temperature control module, an oxygen pressure regulator assembly, a



R-24A

Diagram of the Portable Life Support System

battery, an oxygen connector, and checkout instrumentation. In the normal extravehicular configuration, the OPS is mounted on top of the PLSS and is used with PLSS systems during emergency operations. In the contingency extravehicular configuration, the OPS is attached to the PGA front lower torso and functions independently of the PLSS. The OPS has no communications capability, but provides a hard mount for the SSC VHF antenna. Two OPS's are stowed in the LM.

UMBILICAL ASSEMBLY

The umbilical assembly consists of hoses and connectors for securing the PGA to the ECS, Communications Subsystem (CS), and Instrumentation Subsystem (IS). Separate oxygen and electrical umbilicals connect to each astronaut.

The oxygen umbilical consists of Flourel hoses (1.25-inch inside diameter) with wire reinforcement. The connectors are of the quick-disconnect type, with a 1.24-inch, 90° elbow at the PGA end. Each assembly is made up of two hoses and a dual-passage connector at the ECS end and two separate hoses (supply and exhaust) at the PGA end. When not connected to the PGA, the ECS connector end remains attached and the hoses stowed.

The electrical umbilical carries voice communications and biomedical data, and electrical power for warning-tone impulses.

CREW LIFE SUPPORT

The crew life support equipment includes food and water, a waste management system, personal hygiene items, and pills for in-flight emergencies. A potable-water unit and food packages contain sufficient life-sustaining supply for completion of the LM mission.

CREW WATER SYSTEM

The water dispenser assembly consists of a mounting bracket, a coiled hose, and a trigger-actuated water dispenser. The hose and dispenser extend approximately 72 inches to dispense water from the ECS water feed control assembly. The ECS water feed control valve is opened to permit water flow. The dispenser assembly supplies water at +50° to +90° for drinking or food preparation and fire extinguishing. The water for drinking and food preparation is filtered through a bacteria filter. The water dispenser is inserted directly into the mouth for drinking. Pressing the trigger-type control supplies a thin stream of water for drinking and food preparation. For firefighting, a valve on the dispenser is opened. The valve provides a greater volume of water than that required for drinking and food preparation.

FOOD PREPARATION AND CONSUMPTION

The astronaut's food supply (approximately 3,500 calories per man per day) includes liquids and solids with adequate nutritional value and low waste content. Food packages are stowed in the LM midsection, on the shelf above PLSS No. 1 and the right-hand stowage compartment and the MESA.

The food is vacuum packed in plastic bags that have one-way poppet valves into which the water dispenser can be inserted. Another valve allows food passage for eating. The food bags are packaged in aluminum-foil-backed plastic bags for stowage and are color coded: red (breakfast), white (lunch), and blue (snacks).

Food preparation involves reconstituting the food with water. The food bag poppet-valve cover is cut with scissors and pushed over the water dispenser nozzle after its protective cover is removed. Pressing the water dispenser trigger releases water. The desired consistency of the food determines the quantity of water added. After withdrawing the water dispenser nozzle, the protective cover is replaced and the dispenser returned to its stowage position. The food bag is kneaded for approximately 3 minutes, after which the food is considered reconstituted. After cutting off the neck of the food bag, food can be squeezed into the mouth through the food-passage valve. A germicide tablet, attached to the outside of the food bag, is inserted into the bag after food consumption, to prevent fermentation

and gas formation. The bag is rolled to its smallest size, banded, and placed in the waste disposal compartment.

EMU WASTE MANAGEMENT SYSTEM

The EMU waste management system provides for the disposal of body waste through use of a fecal containment system and a urine collection and transfer assembly, and for neutralizing odors. Personal hygiene items are stowed in the left-hand stowage compartment.

Waste fluids are transferred to a waste fluid collector assembly by a controlled difference in pressures between the PGA and cabin (ambient). The primary waste fluid collector consists of a long transfer hose, control valve, short transfer hose, and a 8,900-cc multilaminate bag. The long transfer hose is stowed on a connector plate when not in use. To empty his in-suit urine container, the astronaut attaches the hose to the PGA quick-disconnect, which has a visual flow indicator. Rotating the handle of the spring-loaded waste control valve controls passage of urine to the assembly. The 8,900-cc bag is in the PLSS LiOH storage unit, the short transfer hose is connected between the waste control valve and the bag.

With cabin pressure normal (4.8 psia), the long transfer hose is removed from the connector stowage plate and attached to the PGA male disconnect. The PGA is overpressurized by 0.8 ± 0.2 psia and the waste control valve is opened. Urine flows from the PGA to the collector assembly at a rate of approximately 200 cc per minute. When bubbles appear in flow indicator, the valve indicator is released and allowed to close.

A secondary waste fluid collector system provides 900-cc waste fluid containers, which attach directly to the PGA. Urine is transferred directly from the PGA, through the connectors, to the bags. These bags can then be emptied into the 8,900-cc collector assembly.

FECAL DEVICE

The fecal containment system consists of an outer fecal/emesis bag (one layer of Aclar) and a smaller inner bag. The inner bag has waxed tissue on its inner surface. Polyethylene-backed toilet tissue and a disinfectant package are stored in the inner bag.

To use, the astronaut removes the inner bag from the outer bag. After unfastening the PGA and removing undergarments, the waxed tissue is peeled off the bag's inner surface and the bag is placed securely on the buttocks. After use, the used toilet tissue is deposited in the used bag and the disinfectant package is pinched and broken inside the bag. The bag is then closed, kneaded, and inserted in the outer bag. The wax paper is removed from the adhesive on the fecal/emesis bag and the bag is sealed then placed in the waste disposal compartment.

PERSONAL HYGIENE ITEMS

Personal hygiene items consist of wet and dry cleaning cloths, chemically treated and sealed in plastic covers. The cloths measure 4 by 4 inches and are folded into 2-inch squares. They are stored in the food package container.

MEDICAL EQUIPMENT

The medical equipment consists of biomedical sensors, personal radiation dosimeters, and emergency medical equipment.

Biomedical sensors gather physiological data for telemetry. Impedance pneumographs continuously record heart beat (EKG) and respiration rate. Each assembly (one for each astronaut) has four electrodes which contain electrolyte paste; they are attached with tape to the astronaut's body.

Six personal radiation dosimeters are provided for each astronaut. They contain thermoluminescent powder, nuclear emulsions, and film that is sensitive to beta, gamma, and neutron

radiation. They are placed on the forehead or right temple, chest, wrist, thigh, and ankle to detect radiation to eyes, bone marrow, and skin. Serious, perhaps critical, damage results if radiation dosage exceeds a predetermined level. For quick, easy reference each astronaut has a dosimeter mounted on his EMU.

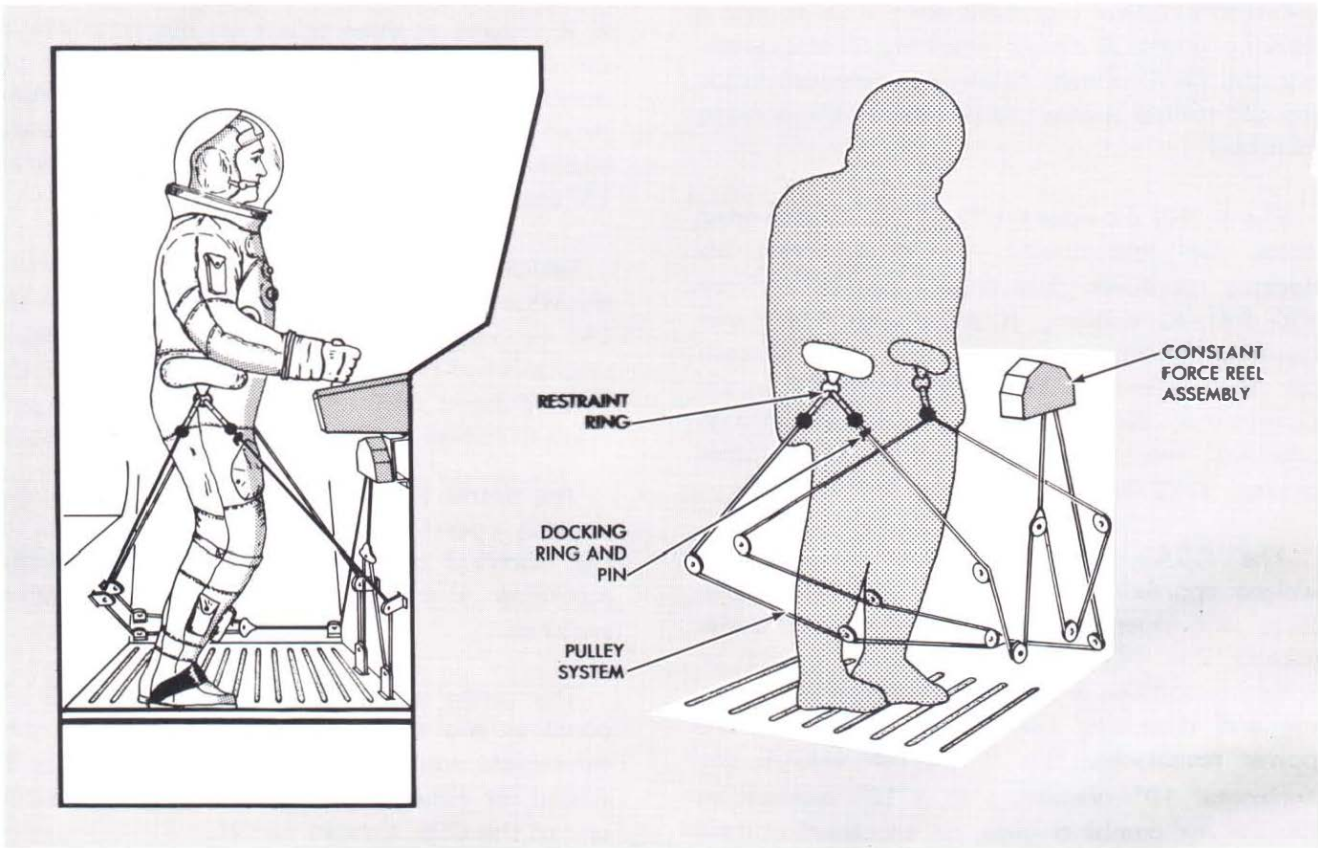
The emergency medical equipment consists of a kit of six capsules: four are pain killers (Darvon) and two are pep pills (Dexedrine). The kit is attached to the interior of the flight data file, readily accessible to both astronauts.

CREW SUPPORT AND RESTRAINT EQUIPMENT

The crew support and restraint equipment includes armrests, handholds (grips), Velcro on the floor to interface with the boots, and a restraint assembly operated by a rope-and-pulley arrangement that secures the astronauts in an upright position under zero-g conditions.

The armrests, at each astronaut position, provide stability for operation of the thrust/translation controller assembly and the attitude controller assembly, and restrain the astronaut laterally. They are adjustable (four positions) to accommodate the astronaut; they also have stowed (fully up) and docking (fully down) positions. The armrests, held in position by spring-loaded detents, can be moved from the stowed position by grasping them and applying downward force. Other positions are selected by pressing latch buttons on the armrest forward area. Shock attenuators are built into the armrests for protection against positive-g forces (lunar landing). The maximum energy absorption of the armrest assembly is a 300-pound force, which will cause a 4-inch armrest deflection.

The handholds, at each astronaut station and at various locations around the cabin, provide support for the upper torso when activity involves turning, reaching, or bending; they attenuate movement in any direction. The forward



R-25

Restraint Equipment

panel handholds are single upright, peg-type, metal grips. They are fitted into the forward bulkhead, directly ahead of the astronauts, and can be grasped with the left or right hand.

The restraint assembly consists of cables, restraint rings, and a constant-force reel system. The cables attach to D-rings on the PGA sides, waist high. The constant-force reel provides a downward force of approximately 30 pounds, it is locked during landing or docking operations. When the constant-force reel is locked, the cables are free to reel in. A ratchet stop prevents paying out of the cables and thus provides zero-g restraint. During docking maneuvers, the Commander uses pin adjustments to enable him to use the crewmen optical alignment sight (COAS) at the overhead (docking) window.

DOCKING AIDS AND TUNNEL HARDWARE

Docking operations require special equipment and tunnel hardware to effect linkup of the LM with the CSM. Docking equipment includes the crewman's optical alignment sight (COAS) and a docking target. A drogue assembly, probe assembly; the CSM forward hatch, and hardware inside the LM tunnel enable completion of the docking maneuver.

The COAS provides the Commander with gross range cues and closing rate cues during the docking maneuver. The closing operation, from 150 feet to contact, is an ocular, kinesthetic coordination that requires control with minimal use of fuel and time. The COAS provides the Commander with a fixed line-of-sight attitude reference image, which appears to be the same distance away as the target.

The COAS is a collimating instrument. It weighs approximately 1.5 pounds, is 8 inches long, and operates from a 28-volt d-c power source. The COAS consists of a lamp with an intensity control, a reticle, a barrel-shaped housing and mounting track, and a combiner and power receptacle. The reticle has vertical and horizontal 10° gradations in a 10° segment of the circular combiner glass, on an elevation scale (right side) of -10° to +31.5°. The COAS is capped and secured to its mount above the left window (position No. 1).

To use the COAS, it is moved from position No. 1 to its mount on the overhead docking window frame (position No. 2) and the panel switch is set from OFF to OVHD. The intensity control is turned clockwise until the reticle appears on the combiner glass; it is adjusted for required brightness.

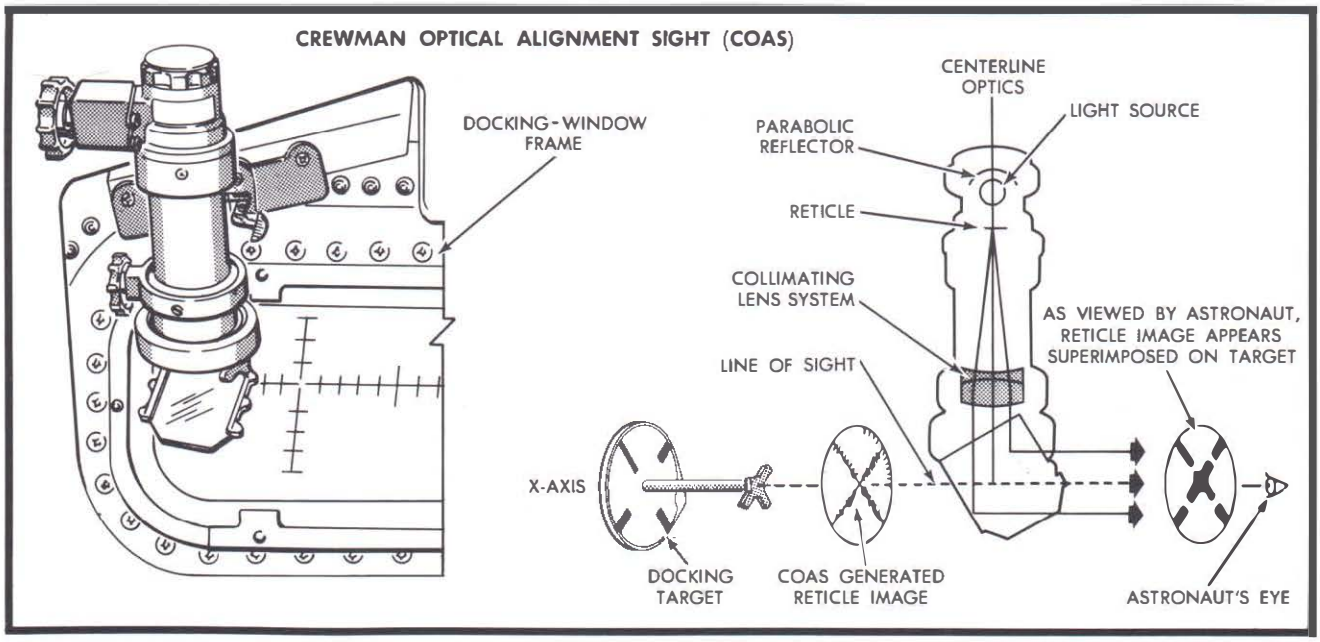
The docking target permits docking to be accomplished on a three-dimensional alignment basis. The target consists of an inner circle and a standoff cross of black with self-illuminating disks within an outer circumference of white. The target-base diameter is 17.68 inches. The standoff cross is centered 15 inches higher than the base and, as seen at the intercept, is parallel to the X-axis and perpendicular to the Y-axis and the Z-axis.

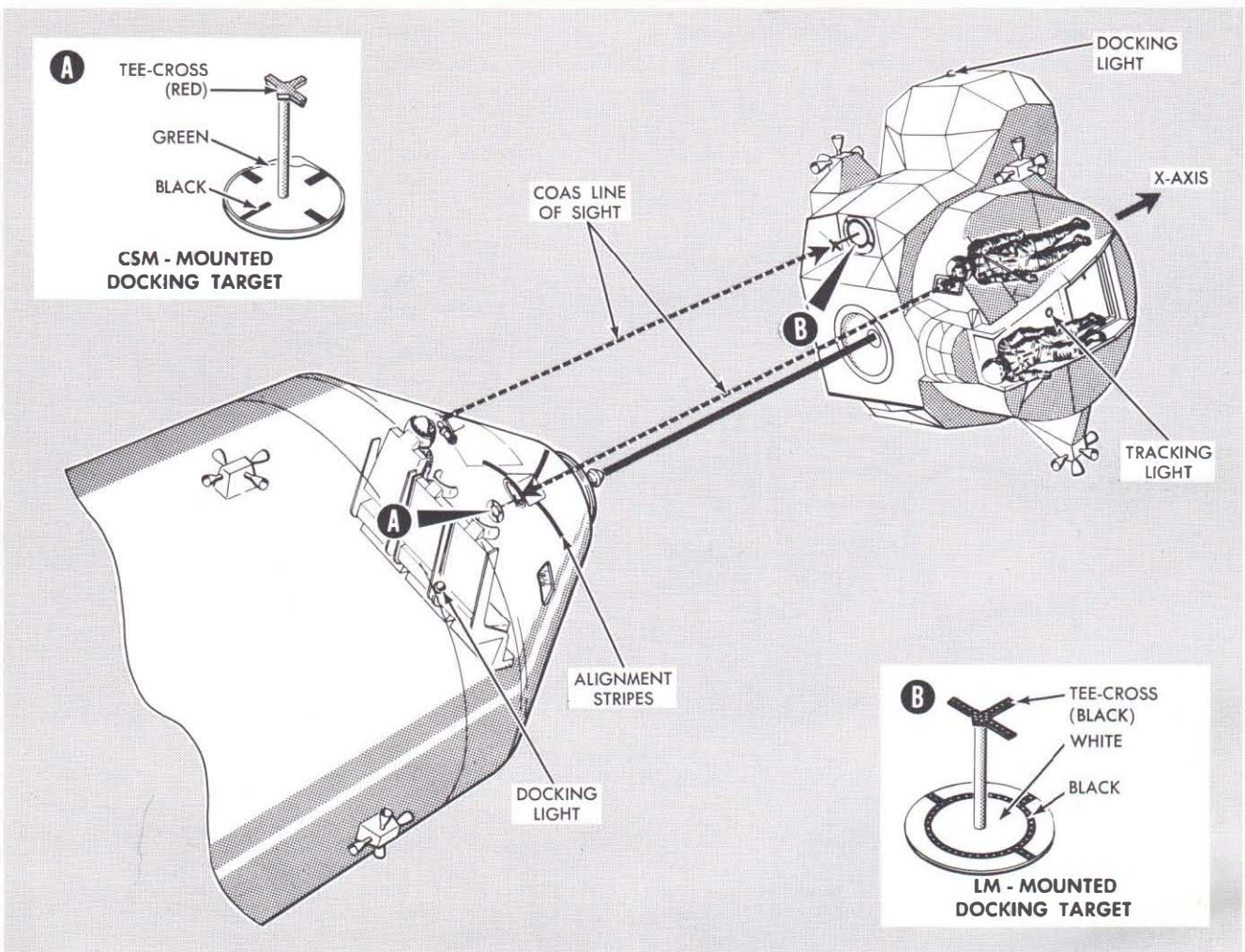
The drogue assembly consists of a conical structure mounted within the LM docking tunnel. It is secured at three points on the periphery of the tunnel, below the LM docking ring. The LM docking ring is part of the LM midsection outer structure, concentric with the X-axis. The drogue assembly can be removed from the CSM end or LM end of the tunnel.

Basically, the assembly is a three-section aluminum cone secured with mounting lugs to the LM tunnel ring structure. A lock and release mechanism on the probe, controls capture of the CSM probe at CSM-LM contact. Handles are provided to release the drogue from its tunnel mounts.

The tunnel contains hardware essential to final docking operations. This includes connectors for the electrical umbilicals, docking latches, probe-mounting lugs, tunnel lights, and deadfacing switches.

The probe assembly provides initial CSM-LM coupling and attenuates impact energy imposed by vehicle contact. The probe assembly may be folded for removal and for stowage within either end of the CSM transfer tunnel.





R-26

Docking Aids

CREW MISCELLANEOUS EQUIPMENT

Miscellaneous equipment required for completion of crew operations consists of in-flight data with checklists, emergency tool B, and window shades.

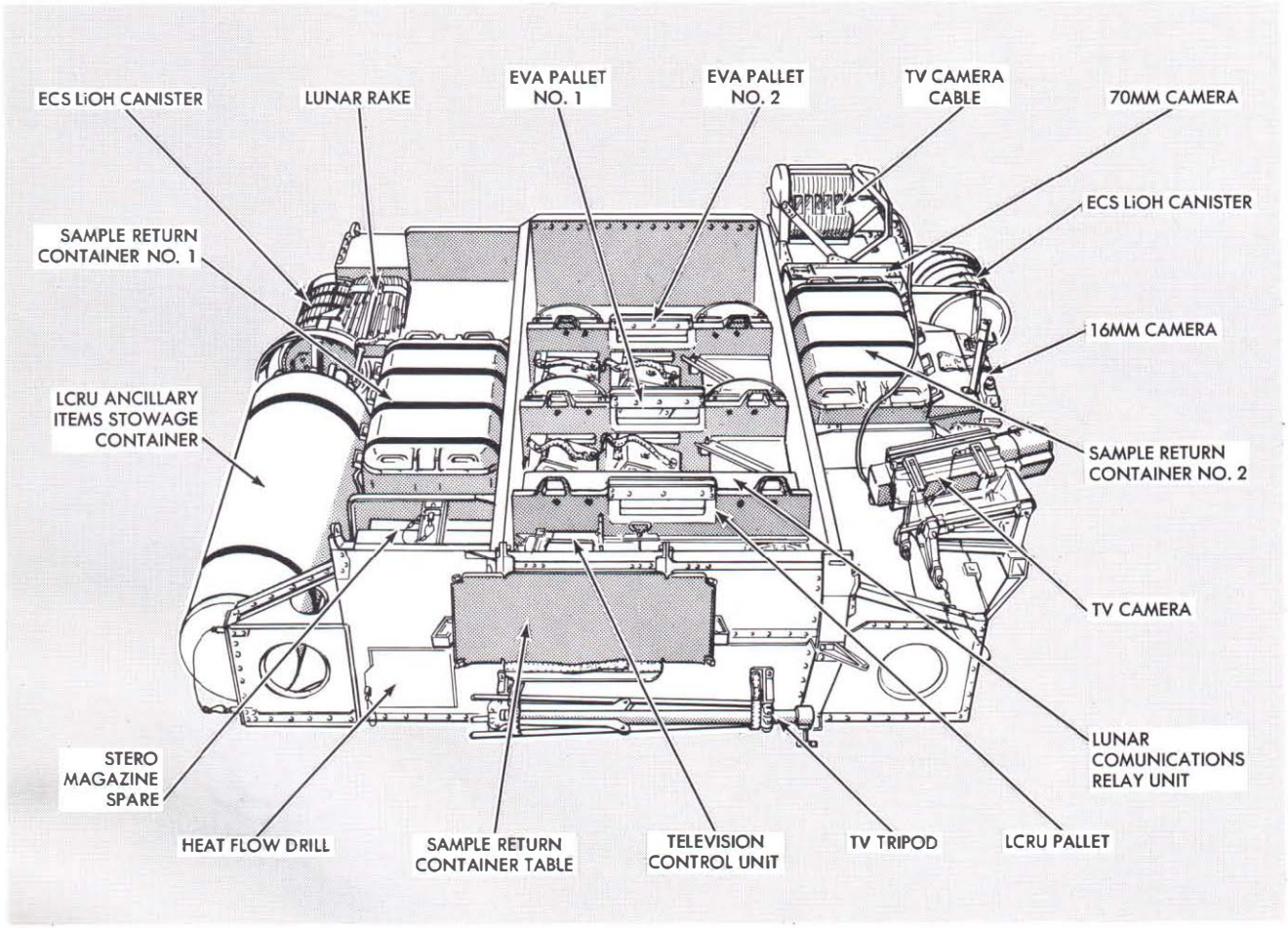
The in-flight data are provided in a container in the left-hand midsection. The Commander's checklist is stowed at his station. The in-flight data kit is stowed in a stowage compartment. The packages include the flight plan, experiments data and checklist, mission log and data book, systems data book and star charts.

Tool B (emergency wrench) is a modified Allen-head L-wrench. It is 6.25 inches long and has a 4.250-inch drive shaft with a 7/16-inch drive. The wrench can apply a torque of 4,175 inch-pounds; it has a ball-lock device to lock the head of the drive shaft. The wrench is stowed on the right side stowage area inside the cabin. It is a contingency tool for use with the probe and drogue, and for opening the CM hatch from outside.

Window shades are used for the overhead (docking) window and forward windows. The window shade material is Aclar. The surface facing outside the cabin has a highly reflective metallic coating. The shade is secured at the bottom (rolled position). To cover the window, the shade is unrolled, flattened against the frame area and secured with snap fasteners.

MODULARIZED EQUIPMENT STOWAGE ASSEMBLY

The MESA pallet is located in quad 4 of the descent stage. The pallet is deployed by the extravehicular astronaut when the LM is on the lunar surface. It contains fresh PLSS batteries and LiOH



R-27A

Modularized Equipment Stowage Assembly

cartridges, a TV camera and cable, still camera, tools for obtaining lunar geological samples, food, film, and containers in which to store the samples. It also has a folding table on which to place the sample return containers. Pallets are provided and are used to transfer the PLSS batteries and the cartridges to the cabin.

QUAD 3 PALLET ASSEMBLY

The quad 3 pallet assembly contains two pallets, a Lunar Roving Vehicle (LRV) pallet, and a pallet holding the Lunar Retro-Ranging Reflector. The LRV pallet contains a lunar geological exploration tool carrier, a lunar dust brush, a gnomen, a recording penetrometer, tongs, a trenching tool, collection bags, and other items needed during lunar exploration.

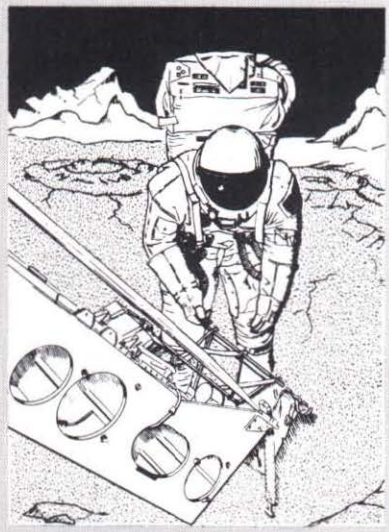
APOLLO LUNAR SURFACE EXPERIMENT PACKAGE

The Apollo Lunar Surface Experiment Package (ALSEP) consists of two packages of scientific instruments and supporting subsystems capable of transmitting scientific data to earth for one year. These data will be used to derive information regarding the composition and structure of the lunar body, its magnetic field, atmosphere and solar wind. Two packages are stowed in quad 2 of the descent stage. The packages are deployed on the lunar surface by the extravehicular astronaut.

ALSEP power is supplied by a radioisotope thermoelectric generator (RTG). Electrical energy is developed through thermoelectric action. The RTG provides a minimum of 16 volts at 56.2 watts to a power-conditioning unit. The radioisotopes fuel capsule emits nuclear radiation and approximately 1,500 thermal watts continuously. The surface temperature of the fuel capsule is approximately 1,400° F. The capsule is stowed in a graphite cask, which is externally mounted on the descent stage. The capsule is removed from the cask and installed in the RTG.

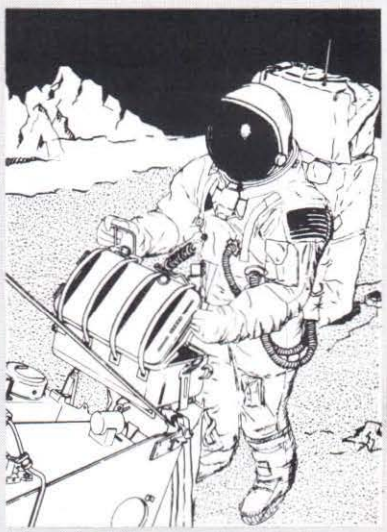
LASER RANGING RETRO-REFLECTOR

The laser ranging retro-reflector is a passive experiment with an array of optical reflectors that serve as targets for laser-pointing systems on earth. The experiment is designed to accurately measure the distance between earth and the moon.



ASTRONAUT PLACING EQUIPMENT TRANSFER BAG ON MESA TABLE

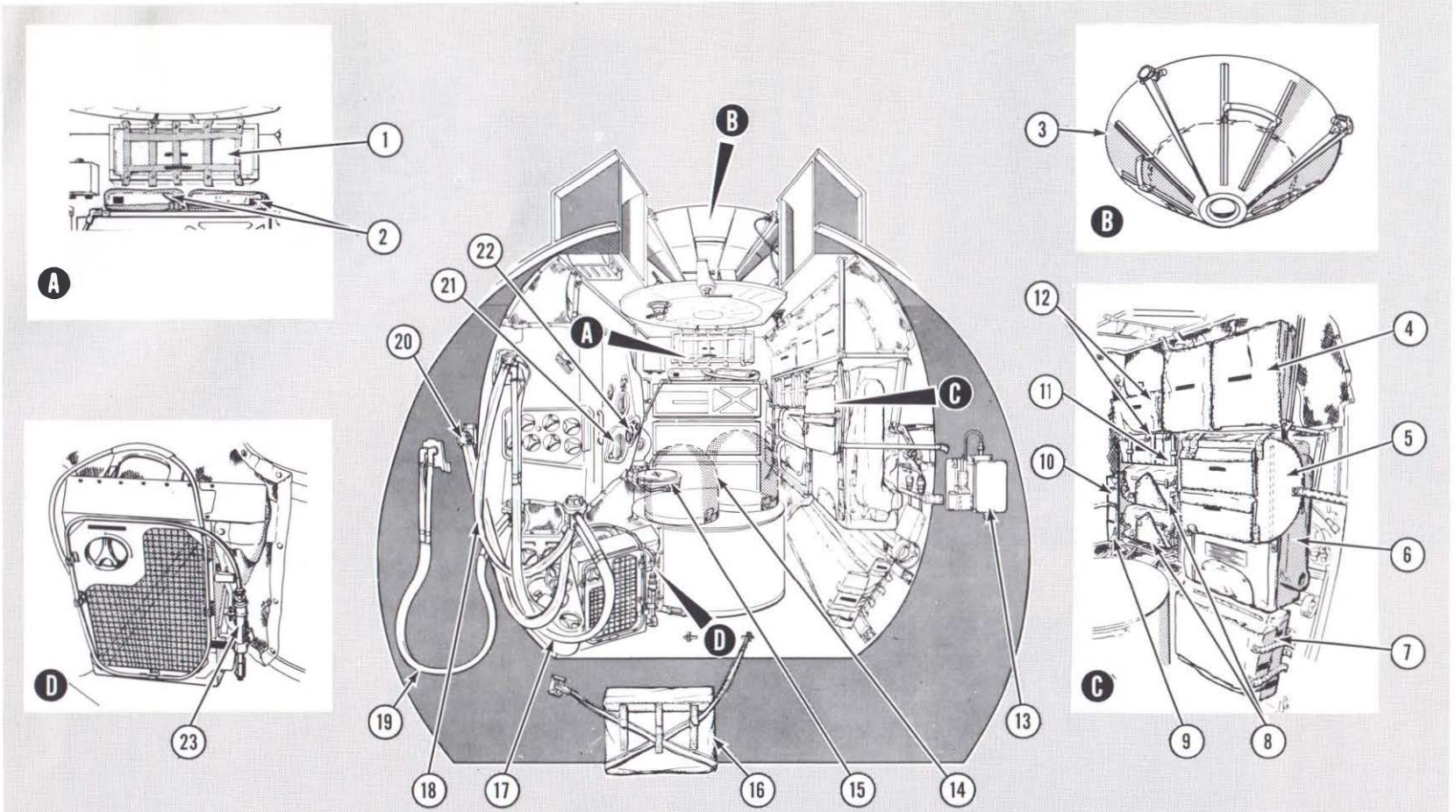
ASTRONAUT STOWING LiOH CARTRIDGE IN EQUIPMENT TRANSFER BAG



ASTRONAUT PLACING LUNAR SAMPLE IN SAMPLE RETURN CONTAINER

R-28

Application of MESA on Lunar Surface

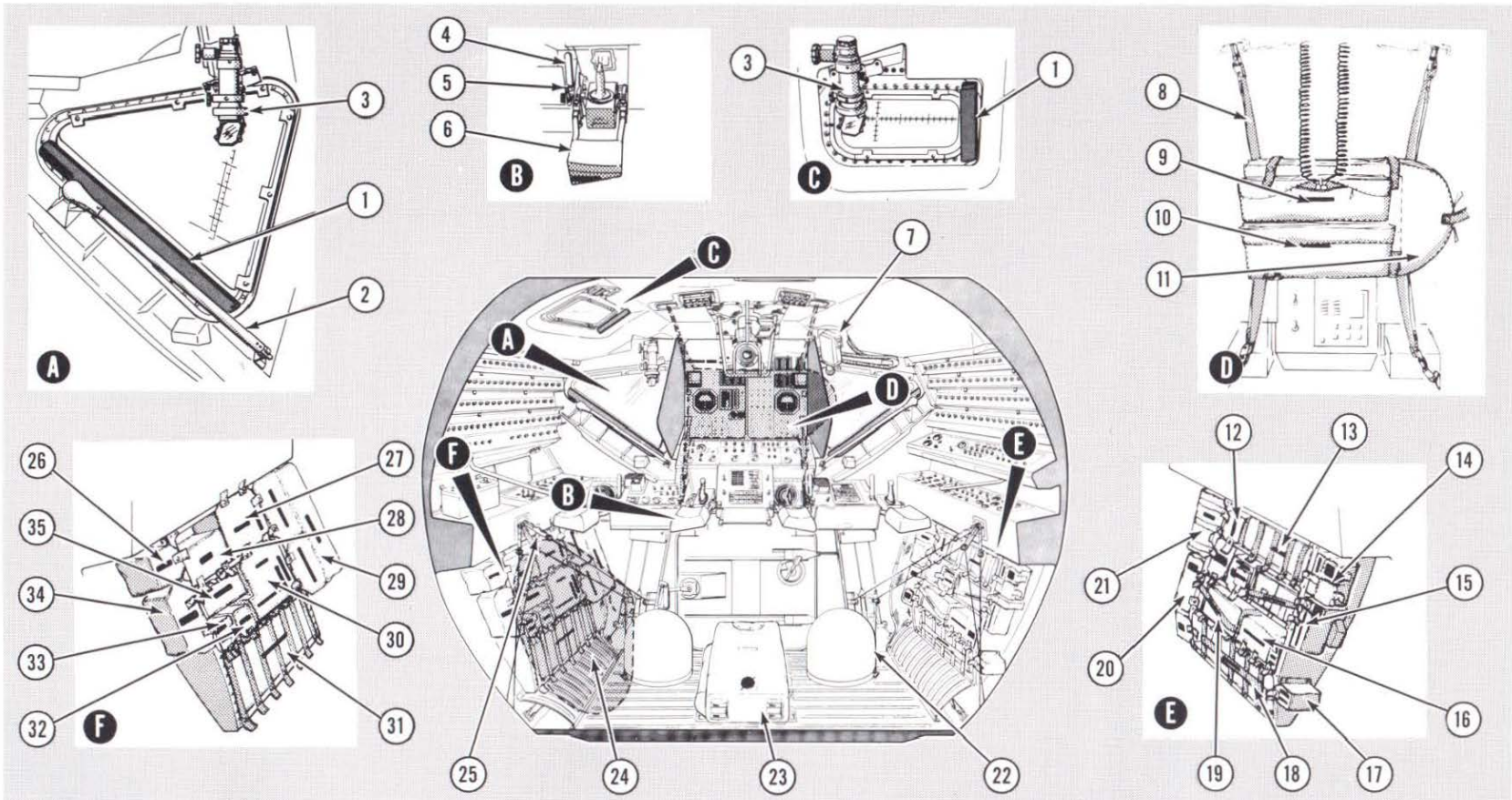


ITEM	NOMENCLATURE	LOCATION
1.	LM FOOD ASSEMBLY	CENTER – Z 27 BULKHEAD
2.	PLSS REMOTE CONTROL UNIT (2)	CENTER – Z 27 BULKHEAD
3.	DOCKING DROGUE	INSIDE DOCKING TUNNEL (LAUNCH POSITION)
4.	FLIGHT DATA FILE DATA CARD KIT	ONBOARD DATAFILE
5.	INTERIM STOWAGE ASSEMBLY (IN-FLIGHT)	IN FRONT OF PLSS (POSITION NO. 2)
6.	PLSS/EVCS ASSEMBLY WAIST HARNESS ADJUSTABLE WAIST HARNESS EVA RETRACTABLE TETHER	RECHARGE STATION
7.	LIQUID COOLING GARMENT	BELOW PLSS

ITEM	NOMENCLATURE	LOCATION
8.	OXYGEN PURGE SYSTEM (2)	EARTH LAUNCH POSITION
9.	CONTINGENCY LUNAR SAMPLE RETURN CONTAINER JETTISON STOWAGE BAG	LH MIDSECTION
10.	STANDARD FLAG KIT PILOT'S REFERENCE KIT	LH MIDSECTION
11.	LM MEDICAL PACKAGE	LH MIDSECTION
12.	LUNAR BOOTS (2 PAIR)	LH MIDSECTION
13.	DATA STORAGE ELECTRONIC ASSEMBLY	+ Z 27 BULKHEAD
14.	CDR'S AND LMP'S HELMET STOWAGE BAGS, LEVA, EV GLOVES	ASCENT ENGINE COVER (POSITION NO. 2)

ITEM	NOMENCLATURE	LOCATION
15.	ECS LIOH CANISTER	AFT OF ASCENT COVER
16.	BUDDY SLSS ASSEMBLY	+ Z 27 BULKHEAD
17.	O_2 UMBILICAL ASSEMBLY (CDR)	RH MIDSECTION
18.	H_2O UMBILICAL ASSEMBLY (CDR)	RH MIDSECTION
19.	O_2 UMBILICAL ASSEMBLY (LMP)	RH SIDE
20.	H_2O UMBILICAL ASSEMBLY (LMP)	RH SIDE
21.	ECS LIOH CANISTER	RH AFT MIDSECTION
22.	PLSS LIOH CANISTER	RH AFT MIDSECTION
23.	WATER DISPENSER/ FIRE EXTINGUISHING ASSEMBLY	FORWARD OF ENGINE COVER

Crew Miscellaneous Equipment (Sheet 1)



ITEM	NOMENCLATURE	LOCATION
1.	WINDOW SHADE (3)	FORWARD AND OVERHEAD WINDOWS
2.	CRASH BAR (2)	FORWARD WINDOWS
3.	COAS	LEFT WINDOW (POSITION NO. 1) OVERHEAD WINDOW (POSITION NO. 2)
4.	HANDGRIP (4)	FORWARD OF CDR'S AND LMP'S STATIONS
5.	RESTRAINT REEL CONTROLS (2)	LOWER RIGHT PANEL 5, LOWER LEFT PANEL 6
6.	ARMRESTS (4)	CDR'S AND LMP'S STATIONS
7.	16-MM DATA ACQUISITION CAMERA 18-MM LENS, 16-MM MAGAZINE, POWER CABLE	ABOVE RIGHT WINDOW
8.	INTERIM STOWAGE ASSEMBLY	EARTH LAUNCH POSITION (NO. 1)
9.	UTILITY LIGHT ASSEMBLY (2)	INTERIM STOWAGE ASSEMBLY
10.	LENS BRUSH	INTERIM STOWAGE ASSEMBLY
11.	INSUIT DRINKING DEVICE (2)	INTERIM STOWAGE ASSEMBLY
12.	MONOCULAR	RHSSC
13.	HASSELBLAD CAMERA, 60-MM LENS, PROTECTIVE COVER, TRIGGER, HANDLE	RHSSC CAMERA COMPARTMENT

ITEM	NOMENCLATURE	LOCATION
14.	LGC ADAPTER	RHSSC
15.	EMERGENCY TOOL B CAMERA MOUNT BRACKET	RHSSC
16.	NEEDLE NOSE PLIERS TIEDOWN WEBBING ACA SHORTING PLUG	RHSSC
17.	AOT EYEGUARD ASSEMBLY AOT HIGH DENSITY FILTER EYEPATCH	RHS
18.	SAMPLE SCALE	RHSSC
19.	PASSIVE RADIATION DOSIMETER 16-MM DATA ACQUISITION CAMER MAGAZINE MAGAZINE TRANSFER BAG	RHSSC
20.	LEC-WAIST TETHER KIT	RHSSC
21.	70-MM MAGAZINE TRANSFER BAG (3) HASSELBLAD MAGAZINE (3)	RHS
22.	HELMET STOWAGE BAG (2)	CDR'S AND LMP'S STATIONS (LAUNCH)
23.	PLSS	BETWEEN CREW STATIONS

ITEM	NOMENCLATURE	LOC TION
24.	DROGUE	LEFT OF CDR'S STATION (ABANDON LM POSITION)
25.	RESTRAINT CABLES	CDR'S AND LMP'S STATIONS
26.	FACIAL WIPES (WET)	LHSSC
27.	LM UTILITY TOWEL ASSEMBLY (3)	LHSSC
28.	URINE RECEPTACLE SYSTEM	LHSSC
29.	CWG ELECTRICAL HARNESS (2) TISSUE DISPENSER (2)	LHSSC
30.	SMALL URINE COLLECTION ASSEMBLY (2) EMESIS BAG (6) DEFECATION COLLECTION DEVICE (6)	LHSSC
31.	LM UTILITY TOWELS (2 RED - 2 BLUE) HAMMOCK ASSEMBLIES (2)	LHSSC
32.	COAS LIGHT BULB ASSEMBLY COAS SNAP ON FILTER	LHSSC
33.	URINE COLLECTION TUBE ASSEMBLY CLAMP (2)	LHSSC
34.	WET FACIAL WIPES (9)	LHSSC
35.	LIGHTWEIGHT HEADSET (2)	LHSSC

Crew Miscellaneous Equipment (Sheet 2)