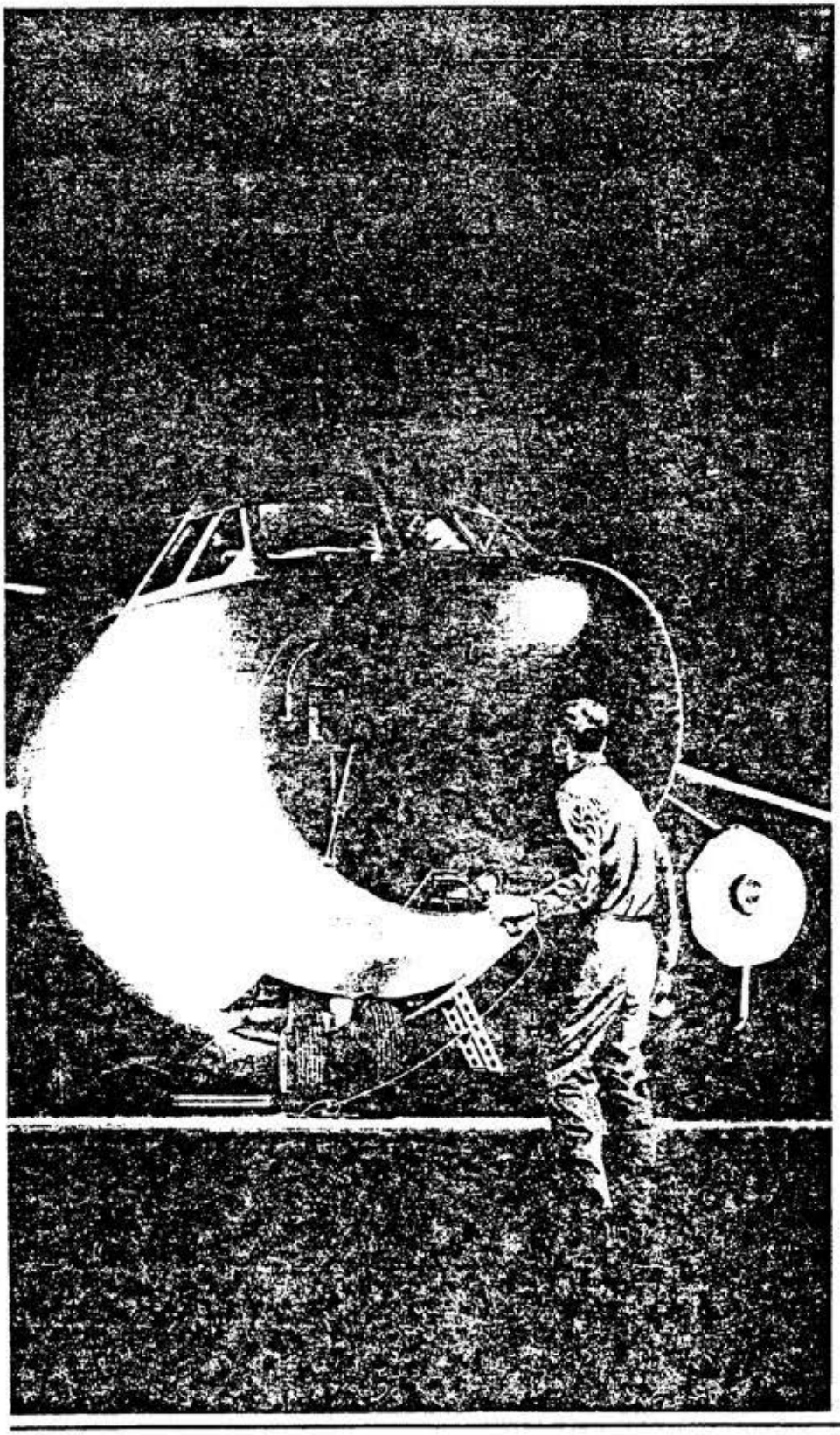
STARLIFTER TRAINING MANUAL • VOLUME VI



AVIONICS

Customer Training Department • Lockheed - Georgia Company • Marietta, Georgia 3006(

STARLIFTER TRAINING MANUAL

VOLUME VI

AVIONICS

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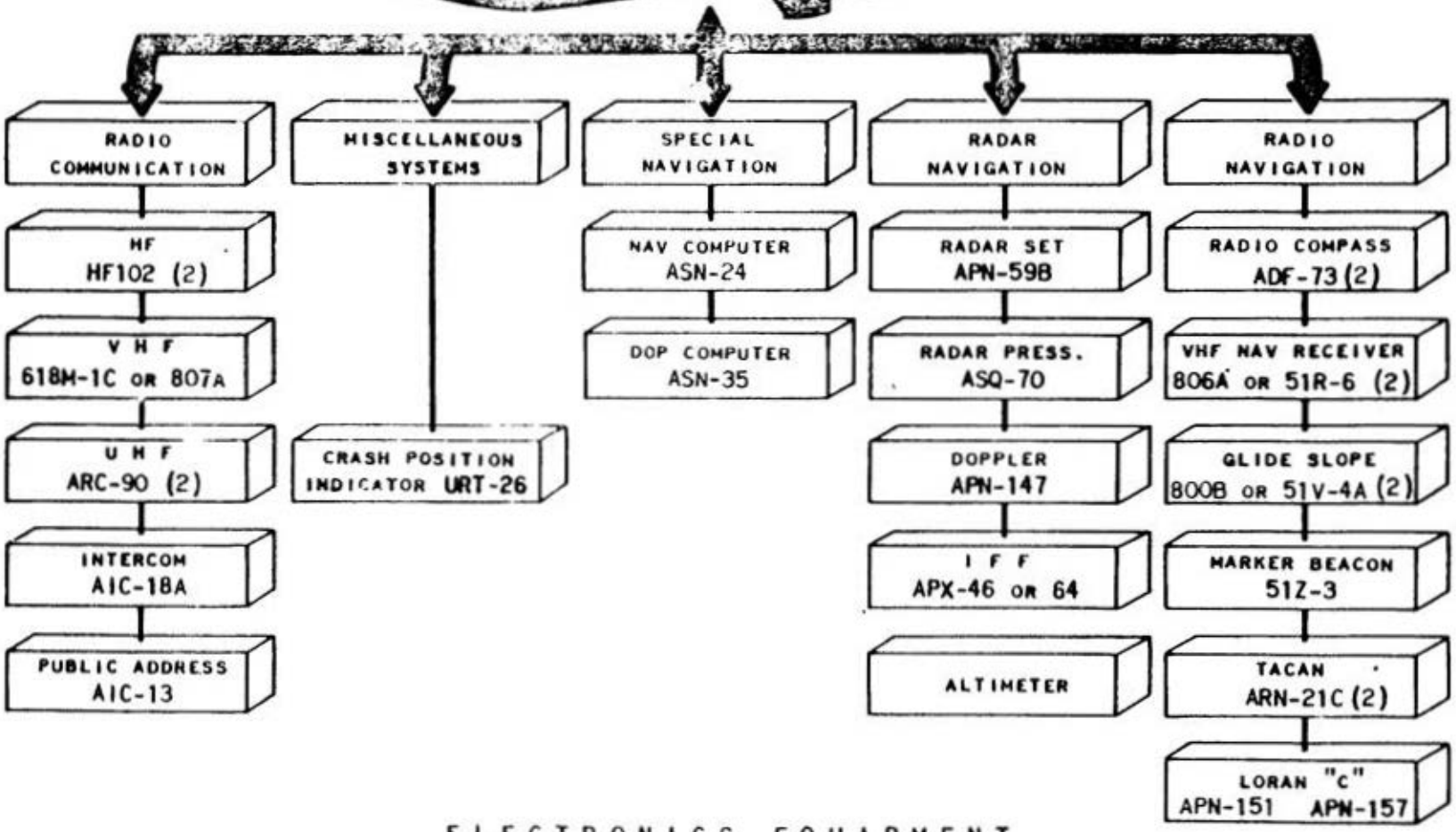


ELECTRONICS EQUIPMENT

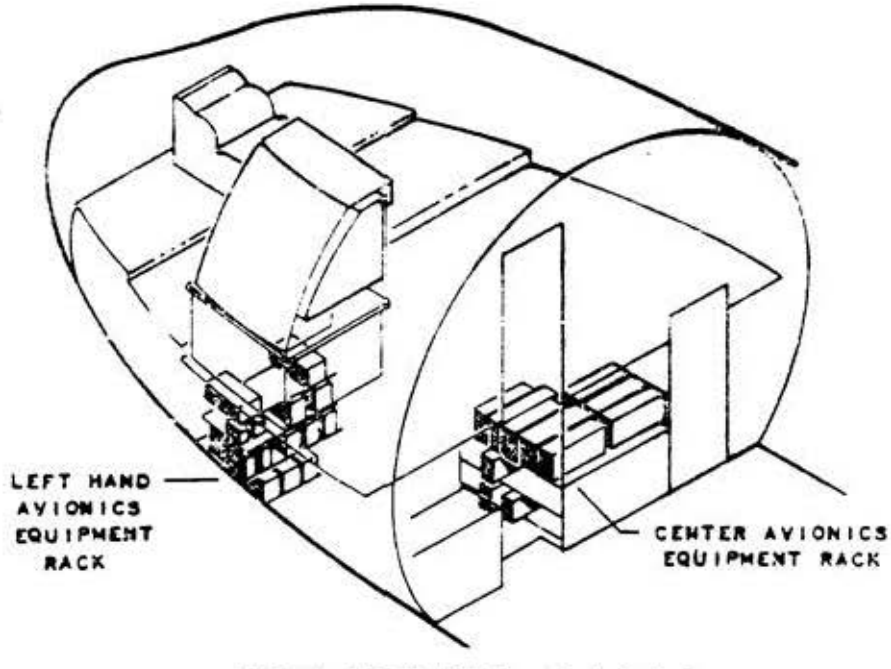
GENERAL INFORMATION

INTRODUCTION

Since high-speed, long range operations of modern aircraft require highly specialized and dependable equipment, a wide variety of avionics systems is provided on the StarLifter. This avionics equipment, for the most part, represents the newer generation of solid state electronics equipment developed for the aircraft industry. Use of this equipment has resulted in higher reliability, lighter weight, and reduced electrical power requirements.

GENERAL

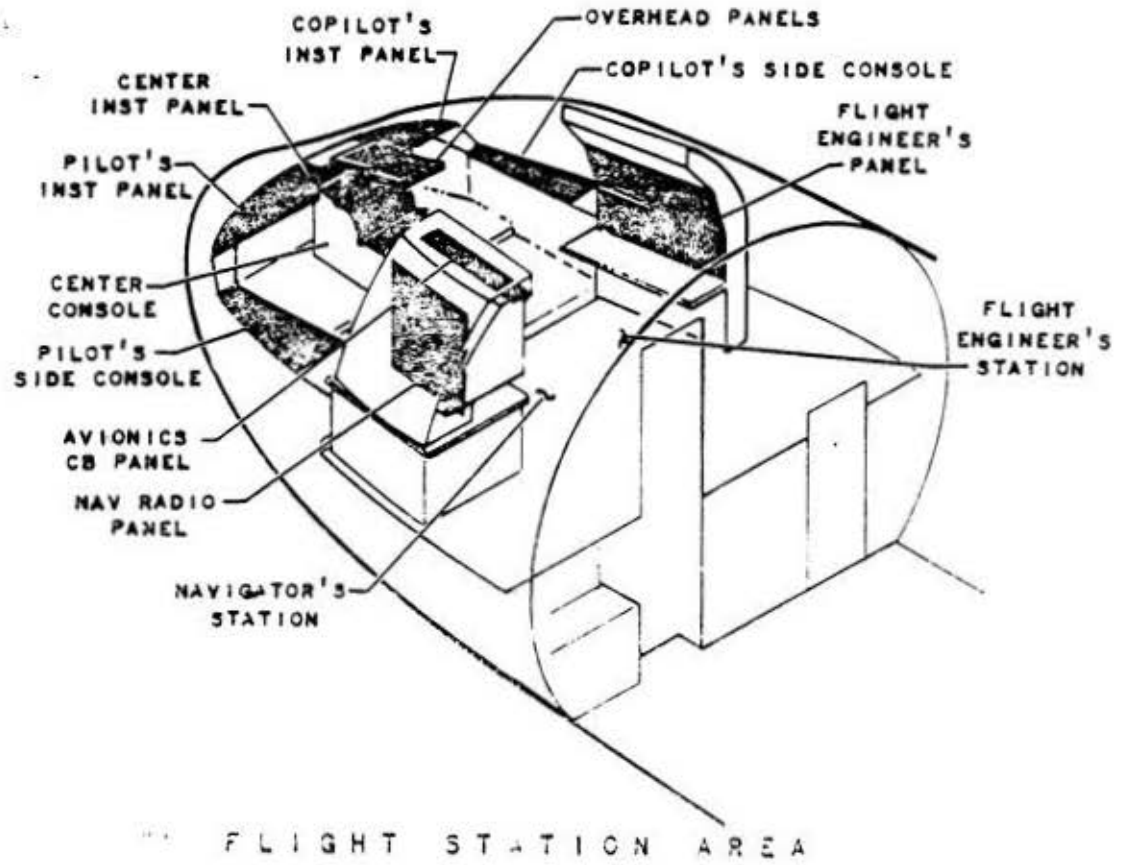
Equipment location, excluding antennas, is generally confined to the for-



EQUIPMENT RACKS

ward sections of the aircraft. Equipment racks are provided under the crew deck area where the majority of the black boxes are located.

Circuit breakers, control panels, and some boxes are located in the flight station area where they are readily accessible to crew members.



FLIGHT STATION AREA

The avionics systems can be divided into five basic groups:

- Radio Communications
- Radio Navigation
- Radar Navigation
- Special Navigation
- Miscellaneous Systems

RADIO COMMUNICATION SYSTEMS

The intercommunications (intercom) system provides communication among the various crew members. It also permits certain crew members to monitor all communication and navigation receivers. Transmission over the radio communication systems is accomplished through the intercom system. It can also be used in conjunction with the Public Address (PA) system to make announcements to crew members and passengers.

The PA system is provided so that instructions or announcements can be heard in the cargo compartment without the use of headphones. The PA system is used during loading and unloading of the aircraft and it can also be used to monitor some of the radio receivers to provide entertainment for passengers during flight.

Two High Frequency (HF) communication systems are installed. These systems provide long-range, Amplitude-Modulated (AM) or Single Sideband (SSB) communication. The SSB mode is limited to Upper Sideband (USB) operation. The HF systems are especially useful in long-range, over-water flights where other communication systems do not provide sufficient range.

For short-range radio contacts, two Very High Frequency (VHF) communication systems are provided. Because of the straight-line radiation characteristics at these frequencies, communication is restricted to line-of-sight distances.

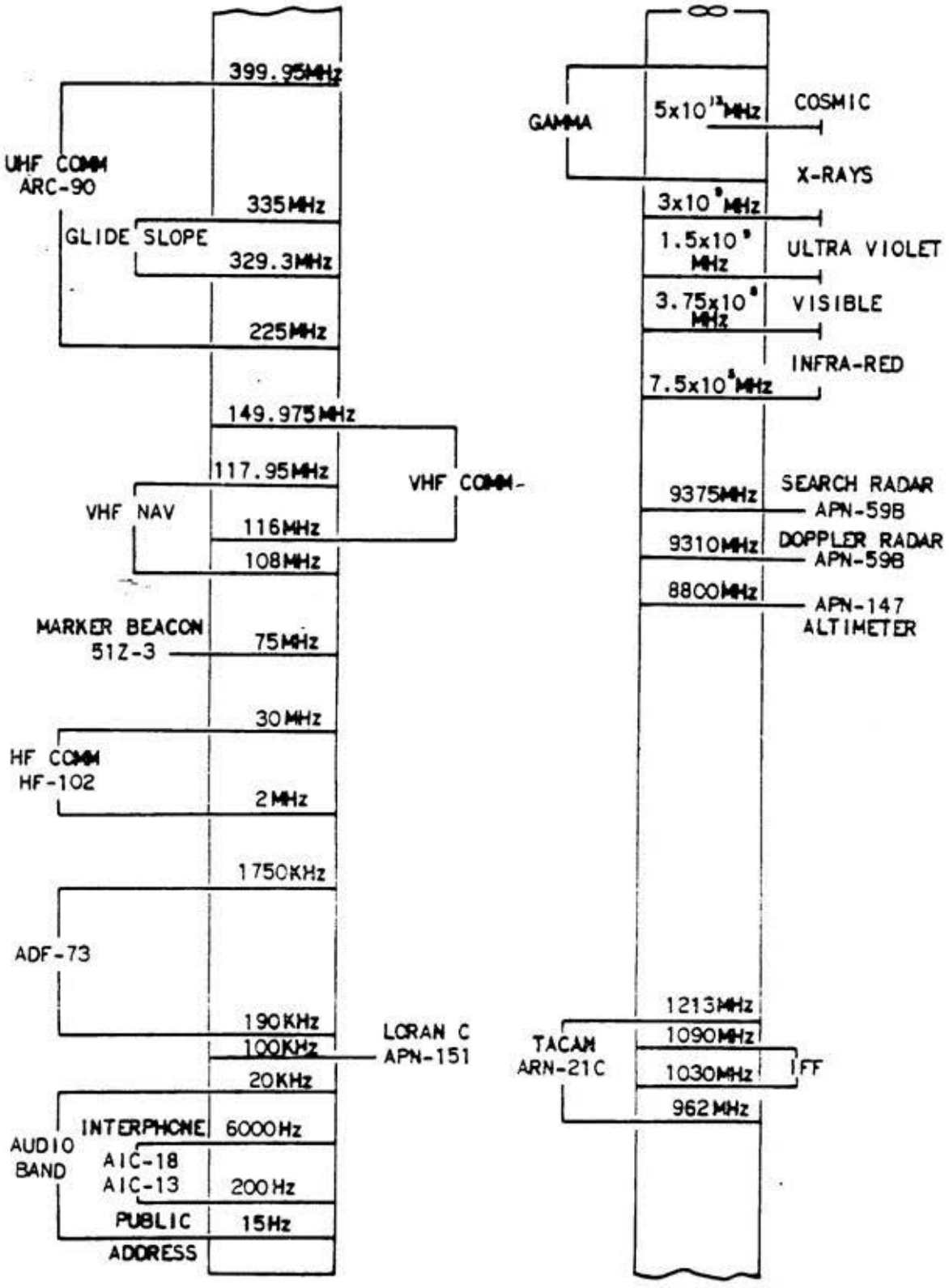
Two Ultra-High Frequency (UHF) communication systems, like the VHF systems, provide short-range communications in air-to-air and air-to-ground operations. Range of these systems is also limited to line-of-sight distances. The range of both the VHF and UHF systems increases as the aircraft altitude increases.

RADIO NAVIGATION SYSTEMS

The most modern radio navigation aids are installed in the StarLifter. These systems provide aural information for identification to the crew, information for visual display by instruments, and guidance information to the Automatic Flight Control System (AFCS).

Two Automatic Direction Finder (ADF) systems are installed. These systems are used to take bearings on either standard broadcast or low-frequency radio range stations.

Two VHF navigation receivers are provided which may be used for VHF Omnidirectional Range (VOR) or Instrument Landing System (ILS) operation. VOR operation provides visual bearing display to any selected VOR ground station within range of the equipment. ILS operation provides lateral guidance from a runway localizer beam during instrument approaches or landings. Either operation can be coupled into the AFCS to provide automatic radio guidance.



FREQUENCY SPECTRUM

Two glideslope receivers are installed to provide vertical guidance during ILS approaches and landings. The information is visually displayed and can also be coupled to the AFCS for automatic vertical aircraft control during ILS operation.

A single marker beacon receiver provides an indication when the aircraft is directly over any airway or runway marker beacon station.

Two Tactical Air Navigation (TACAN) systems provide indications of bearing and distance to TACAN ground stations. The bearing information can be supplied to the AFCS to fly a selected TACAN course. Bearing and range data are also furnished to the navigation computer.

A Long Range Navigation System (LORAN C) provides all-weather navigation information which enables the navigator to determine a position "fix" at great distances from LORAN ground stations. The LORAN is especially useful during long, over-water flights where other navigation aids are not within range of the aircraft. Data is also supplied to the navigation computer.

RADAR NAVIGATION SYSTEMS

A search radar system is installed to provide radar display to the pilot and navigator for weather avoidance, terrain mapping, and ground radar beacon station identification and position. Aircraft position data may be inserted into the navigation computer.

A pressurization system provides needed atmospheric pressure to the search radar to prevent high voltage arcing at high altitudes.

An identification system (IFF) is installed to provide coded replies to interrogations from other stations. The IFF transponder may be used to transmit encoded barometric altitude information as well as selected identification codes.

The installed doppler radar system will provide the navigator with visual indications of aircraft drift angle and ground speed. This radar navigation system operates accurately under varying wind conditions without need for ground stations. Electrical outputs for the doppler computer navigation computer and compass systems are also provided.

The radar altimeter (low-range) system provides the pilots with an indication of the aircrafts true altitude above the ground. This system also provides altitude data to the All Weather Landing System (AWLS).

SPECIAL NAVIGATION SYSTEMS

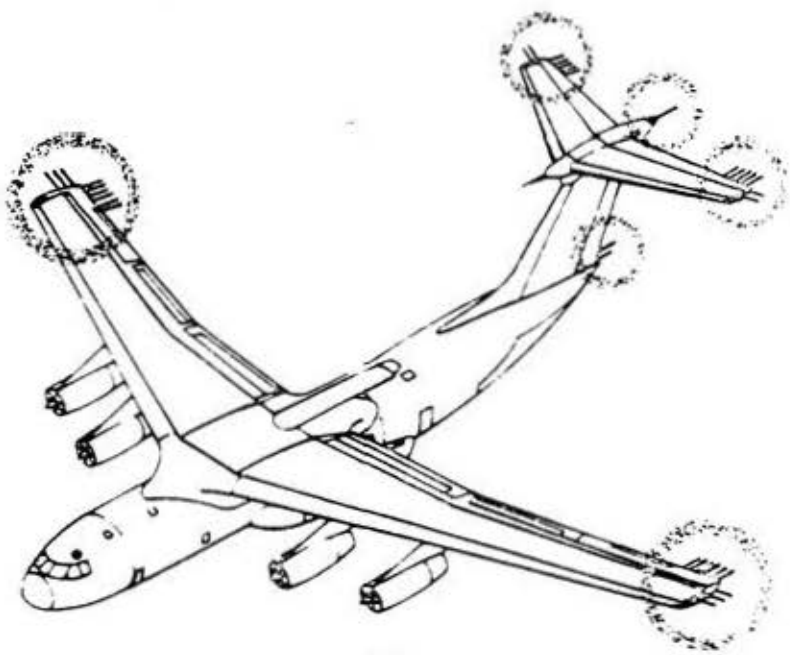
The doppler computer provides present position indications to the air crew such as distance to go along the selected flight path and cross track deviation away

from the selected path. The doppler computer receives the aircrafts actual path and ground speed information from the doppler radar system. Outputs from the doppler computer may be selected as an input to the AFCS for aircraft guidance.

A light-weight, high-speed navigational computer (ASN-24) is installed to assist the navigator and pilot in determining such navigation parameters as distance to a selected destination, present latitude and longitude, ground speed, winds, cross track and along track to selected destinations and celestial navigation data. The outputs are provided from continuously updated dead reckoning computations. Positional accuracy is improved by inputs from various navigational sensors including search radar, TACAN, LORAN C, Doppler radar, gyro compass, and central air data computer. High precision outputs are available for terminal navigation at drop zones. Outputs are also selectable by the pilot's and copilot's flight direction systems.

STATIC DISCHARGERS

As the airplane moves through the air, a static charge tends to accumulate along the trailing edges of the wind and of the vertical and horizontal stabilizers. This



NOTE:

THIRTY FIVE STATIC DISCHARGERS DISSIPATE STATIC ELECTRICITY FROM THE AIRCRAFT INTO THE ATMOSPHERE REDUCING INTERFERENCE TO RADIO RECEPTION.

STATIC DISCHARGER LOCATIONS

static charge builds up until it discharges into the air. As the discharge occurs, Radio Frequency (RF) waves are generated which are picked up by the radio receivers as static interference. The amount of interference depends upon the amount of static charge at the time of discharge. If the static charge can be concentrated on small areas, the discharge will occur before the charge becomes very high. As a result, radio interference will be greatly decreased. To accomplish this, static dischargers are provided as shown in the illustration.

MISCELLANEOUS SYSTEMS

A crash position indicator (CPI), transmitting on an emergency radio frequency, will guide search and rescue aircraft to locate the ditching area. CPI transmission begins with manual or automatic deployment from the Star Lifter.

The airborne flight data recorder make a nondestructive record of aircraft altitude, airspeed, heading and vertical velocity. This system provides a precrash history of flight parameters beneficial to accident investigations.

POWER SOURCES

The power required by the Star Lifter is normally supplied by four main engine-driven A-C generators.

Auxiliary power is supplied by a fifth generator driven by an Auxiliary Power Unit (APU). This generator is used for ground checkout of the aircraft systems.

External A-C power can be used for ground checkout of the aircraft systems.

A-C power for the avionics systems is supplied by the main tie bus to the No. 1 and 2 avionics buses, and the isolated A-C avionics bus. Avionics bus No. 1 supplies phase "a" nav. bus 1. Phase "a" nav. bus 2 is supplied by the No. 2 avionics bus.

D-C power is supplied by two T/R units to the No. 1 main D-C avionics bus and No. 2 main D-C avionics bus. The isolated D-C avionics bus can be supplied power in flight from the emergency generator or the battery.

CONTROL PANELS

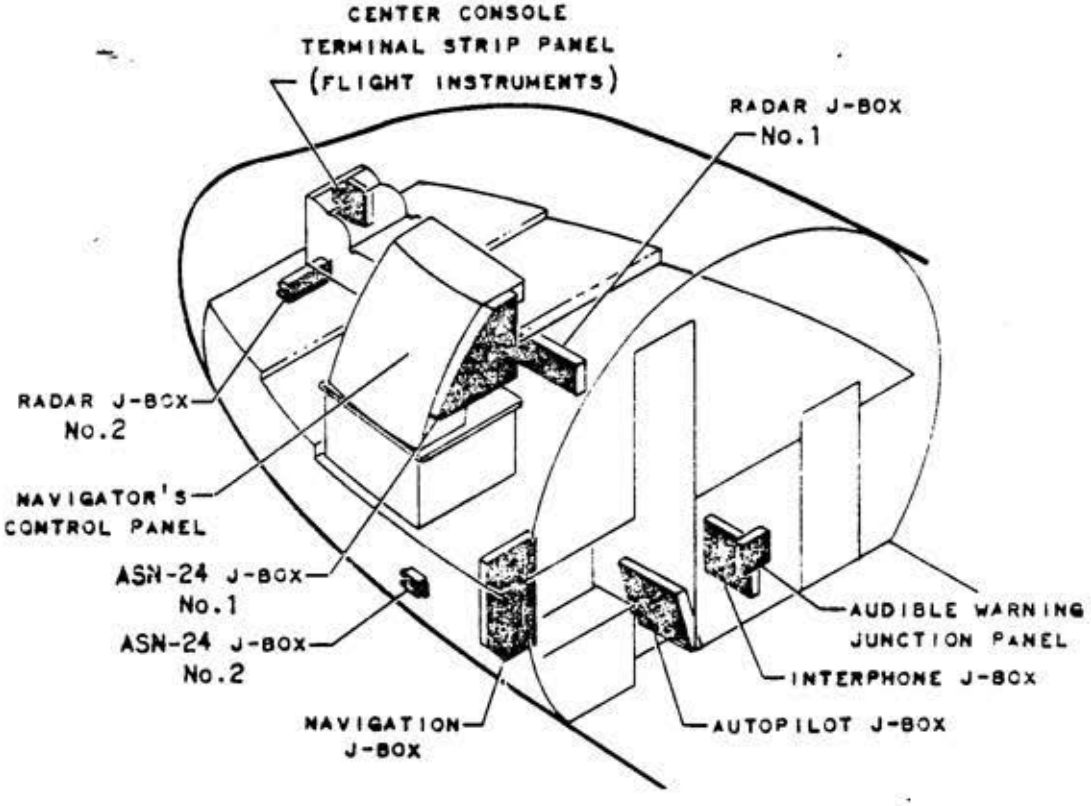
The pilot's and copilot's control panels for the communication and navigation equipment are located on the center console. Each control panel is edgelighted, engroved plastic panel. Only the markings and controls are illuminated. The navigator's and flight engineer's stations have the same style illuminated panels.

EQUIPMENT RACKS

The major avionics equipment is located under the flight deck floor on racks. These racks are the left hand avionics equipment rack and the center avionics equipment rack. The left hand avionics equipment rack is approached by entering the left underdeck passageway. The center avionics equipment rack is located between the two underdeck passages.

JUNCTION BOXES

There are seven major Junction (J) boxes on the airplane. These J boxes serve as interconnection points among the radar, communication, and navigation equipment. The seven J boxes are the autopilot, interphone, navigation, two ASN-24, and two radar. These locations are shown on the illustration.



AVIONICS JUNCTION (J) BOXES

AVIONICS TEST RECEPTACLES

Three avionics test receptacles are installed in the forward area of the aircraft. They are intended to supply D-C and single-phase A-C power to ground support test equipment used in checkout and troubleshooting of various avionics systems. One receptacle is located in the nose wheel well under the radar receiver-transmitter. The other two are located on either side of the avionics underdeck rack, slightly aft of the forward wheelwell box.

ANTENNAS

The majority of the electronics systems' antennas are of the following types: flush-mounted (cavity), blade (stub), or long-wire.

TECHNICAL ORDERS

A complete series of Air Force technical orders is available. Several of these manuals contain information which directly concerns the avionics systems. These manuals are as follows:

T.O. 1C-141A-1 Flight Manual:

The Flight Manual contains information for safe and efficient operation of the airplane. The manual includes a section on the location of components with operating procedures for the electrical and avionic systems, and includes range and limitations due to installation.

T.O. 1C-141A-2-7 Electrical Systems:

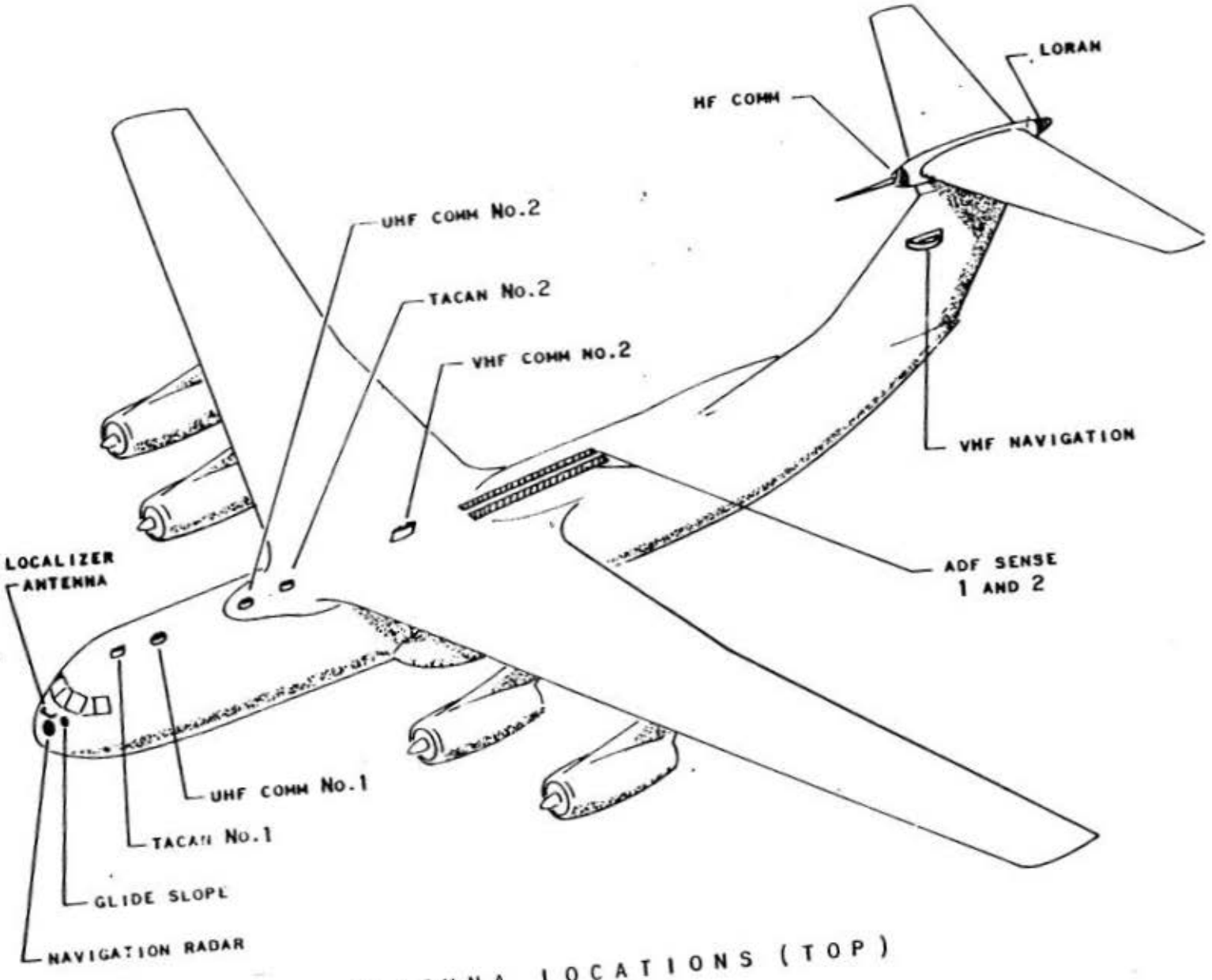
This Manual covers the description, operation, checkout, troubleshooting, removal and replacement of components, and adjustment procedures for the entire electrical systems of the C-141A airplane.

T.O. 1C-141A-2-8 Radio/Communications and Navigation Systems:

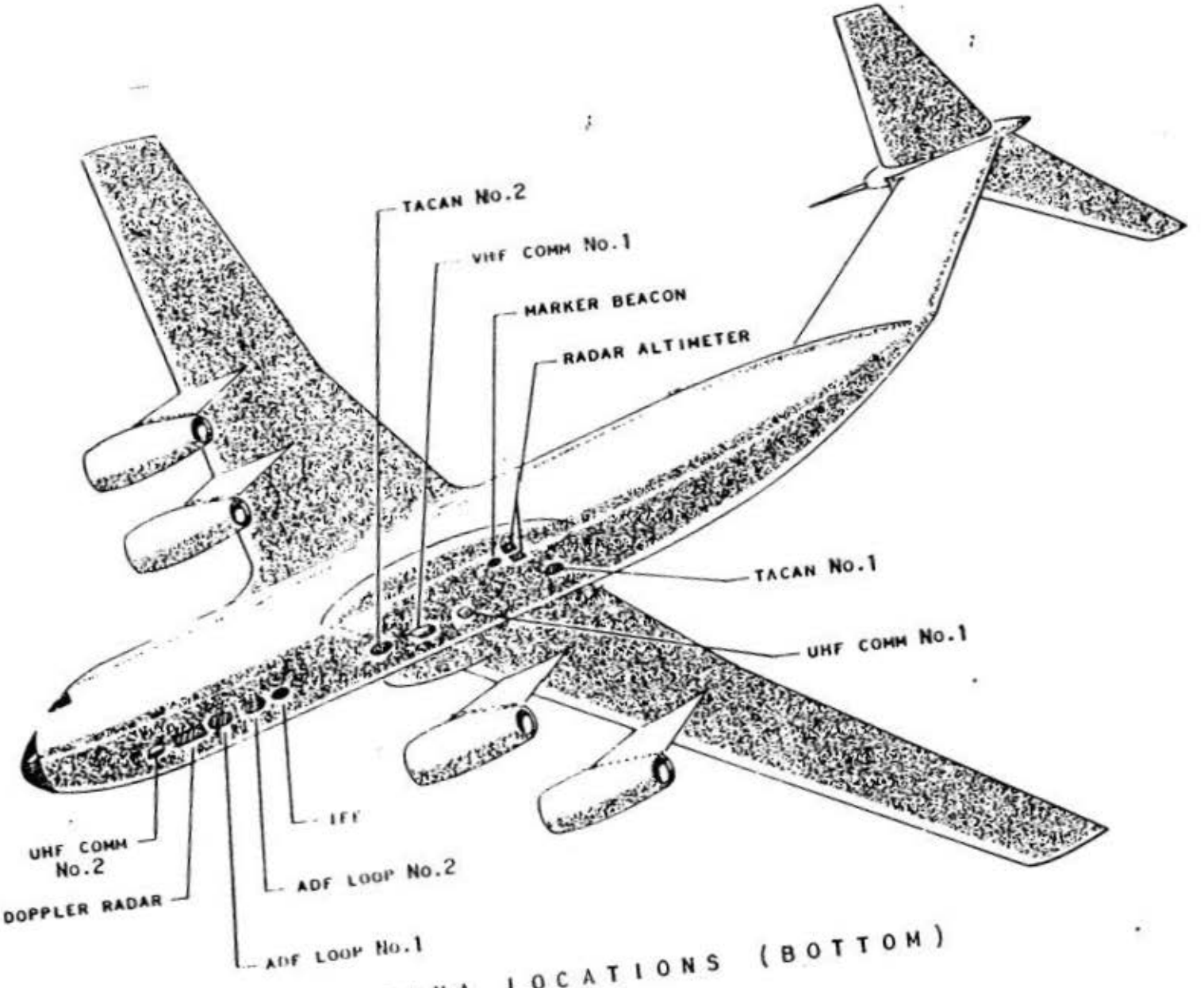
This manual covers the operation, checkout, troubleshooting, removal and replacement of components, and adjustments of the components of the avionic system of the C-141A airplane. Included are wiring diagrams of all the systems, and an item list of all the systems components by name and part number.

T.O. 1C-141A-2-11 Airplane Wiring Diagrams:

This manual contains an item list of the electrical system components and wiring diagrams of the electrical systems of the airplanes. For detailed information on a specific system, refer to the Air Force Systems Technical Order or manufacturer's handbook on the specific system or unit. T.O. 1C-141A-01 is a T.O. index of applicable T.O.'s used with the C-141A airplanes.



ANTENNA LOCATIONS (TOP)



ANTENNA LOCATIONS (BOTTOM)