

B737-300

# AVIONICS

(波音 737-300 型飞机电子系统)

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上册

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PDG

## 内容简介

本书全面介绍了波音 737-300 型飞机上的通信、导航、仪表、飞行管理和自动驾驶等机载电子系统。主要包括各系统的功用、组件的连接、工作程序和测试程序。

本书图文并茂,适用于飞机电子设备维修专业的学生学习使用。

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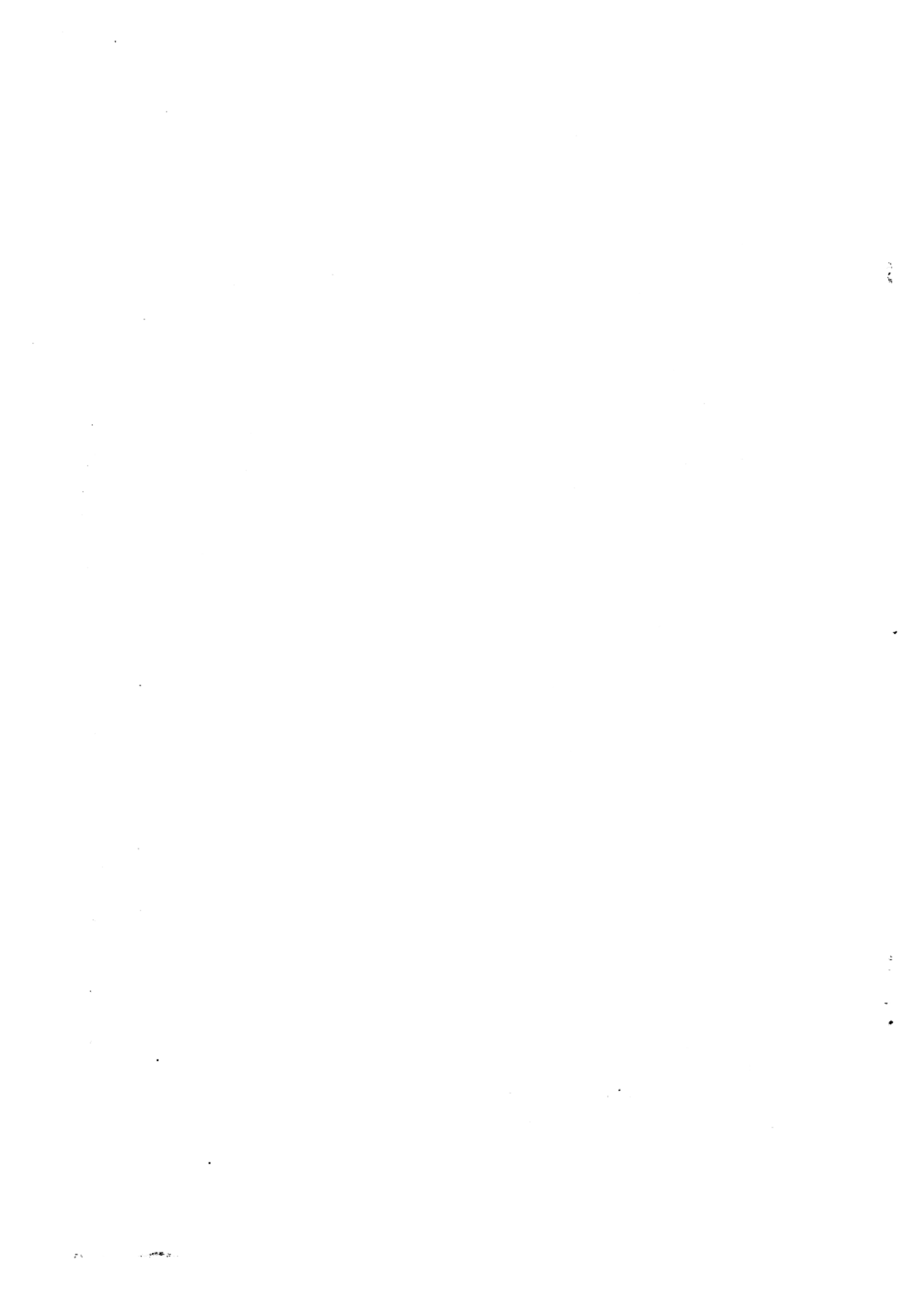
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# 1. AIRPLANE GENERAL DESCRIPTION

波音 737-300 型飞机适用于中短程航线的飞行。

**飞机舱门:** 机身左侧有前、后登机门, 机身右侧有前、后厨房门和货舱门, 机身下部有前设备舱和电子设备舱接近门, 这些舱门都是由人工操作的塞式密封门。如果这些舱门中有一个没关或没有完全锁好, P5 板上琥珀色灯会燃亮, 向机组发出警告。

**机身站位:** 波音系列飞机通常用“站位”来确定飞机的某一具体位置。

**仪表板:** 飞行仪表及其通告器装在正驾驶仪表板、副驾驶仪表板和中央仪表板上; 各控制器和通告器灯装在前电子控制板、后电子控制板、遮光板和侧壁上。

**跳开关板:** 装在正副驾驶座位后面。

**主警告灯和系统警告器:** 装在遮光罩(P7)上, 主警告灯燃亮时告知飞行员发动机或 APU 系统失效, 系统通告器燃亮则告知飞行员有关系统失效。

**电源系统:** 由互不相连的 115V/400 周 AC 汇流条、28V/AC 汇流条和 28V/DC 汇流条组成。115VAC 汇流条由主发电机、外接 115VAC 汇流条电源或机载辅助动力装置 (APU) 供电。28VAC 汇流条由连接在 115VAC 汇流条上的变压整流组件供电, 或者在 AC 汇流条无电时, 由飞机蓄电池提供 28VDC。

**辅助动力装置 (APU):** 是一台燃气涡轮发动机, 位于飞机尾部 APU 舱内, 不论在地面和空中都能提供 45 千伏安的三相 400 周 115 伏电压给电源系统, 并为主发动机的起动和系统提供压力空气。

电子设备舱位于客舱下面, 前轮舱后方的一个舱中。电子设备舱可以从地面上经机身下方的设备舱门接近, 必要时可从客舱前部地板上的一块盖板接近电子设备舱。设备舱中有三个设备架, 前方为 E1 架, 左侧为 E2 架, 右侧为 E3 架。

静电放电敏感标志为黄底黑字, 这种标志贴在设备架、组件外壳或线路板上。在拆装静电放电敏感组件时, 必须首先切断该组件的电源, 并连接搭铁带, 用防护罩把插头 (座) 盖好。禁止用手触摸插头 (座), 拆下的组件应放入专门的导电容器中。

设备冷却系统主要冷却电子舱内设备架上的设备, 主要部件位于电子舱后部下面。

发动机危险区域会产生高速和高温气流, 造成人员伤亡和器材的损坏。

静电放电器安装在大翼、尾翼上, 用来泄放操纵面上的静电荷, 以防静电耦合到无线电接收机天线回路中。

通信系统包括无线电联络设备、话音记录器、机组内话、服务内话和旅客广播系统。

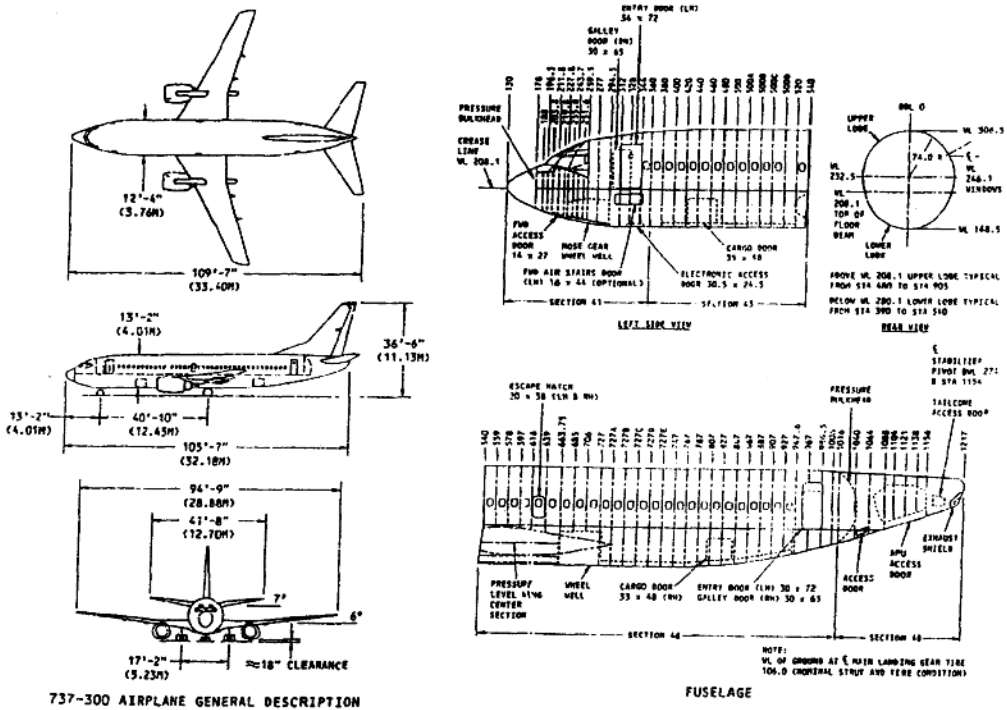
导航系统计算和显示飞机在地球表面上的运动状态和位置, 并能提供高度、温度、空速、航向和姿态等飞行参数的显示, 在遇到危险状态时发出警告信号。

飞行管理系统提供姿态和航向数据, 用作导航计算, 并提供自动飞行控制和推力控制。

维护手册包含了机务人员对装在波音 737 飞机上的所有系统和设备进行维护、排故、性能检查和修理所必须的资料。手册中每个标题编码分为三段, 表示章、节和标题号。

## 1.1. INTRODUCTION

The Boeing 737-300 twin engine airplane is designed for short to medium range operation. It will have the capacity to carry 148 tourist class passengers. The airplane principle dimensions are shown on the graphic.



737-300 AIRPLANE GENERAL DESCRIPTION

FUSELAGE

## I. FUSELAGE

The fuselage is a semi-monocoque structure consisting of skin reinforced by circumferential frames and longitudinal stringers.

The fuselage is divided into reference planes measured in inches. This provides a means of identifying the location of components or particular points. Three reference planes are used for the fuselage.

**Body station.** The plane perpendicular and measured parallel to the body centerline from B STA 0.00, a point 130 inches forward of the nose.

**Body buttock line.** The plane measured perpendicular to the body vertical centerline panel, BBL 0.00.

**Body waterline.** The plane measured perpendicular to a horizontal plane located 148.5 inches below the body. BWL 0.00.

The fuselage is manufactured in four body sections, connected by production breaks



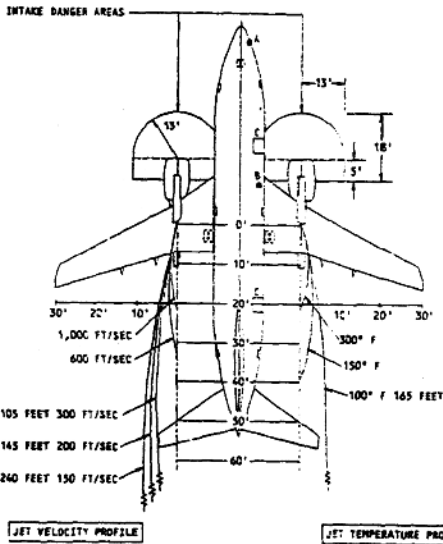
or manufacturing breaks to form a complete integral structure. The forward three sections form the pressurized shell of the fuselage, and enclose all the passenger, crew, and cargo accommodations.

Section 43 is that part of the fuselage between body stations 360 and 540. Above the floor it encloses the forward half of the passenger cabin. Below the floor it encloses the forward cargo compartment.

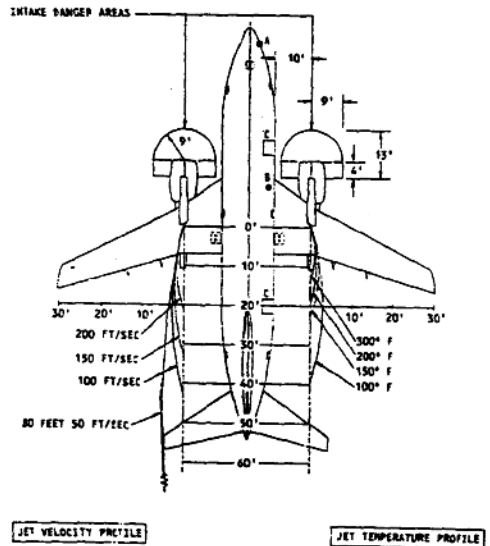
Section 48 is that part of the fuselage between body station 540 and the rear pressure bulkhead at station 1016. Above the floor, section 48 encloses the aft half of the passenger cabin. Below the floor it includes the cavity for the center wing box. The main landing gear wheel well and the aft cargo compartment.

Section 48 is not pressurized and extends aft from the rear pressure bulkhead at body station 1016. A tail cone extends aft from station 1156. A compartment with fireproof walls in the lower part of the section, below the horizontal stabilizer, allows installation of the APU.

## II. POWERPLANT DANGER AREAS



TAKE-OFF THRUST



IDLE THRUST

METRIC CONVERSIONS:  
 M = FT X .3048  
 °C = (°F - 32) / 5.9  
 M/SEC = FT/SEC X .3048

NOTES:  
 1. STANDARD DAY  
 2. SEA LEVEL  
 3. NO WIND  
 4. STATIC AIRPLANE

A. ELECTRICAL GROUND POWER RECEPTACLE  
 B. PNEUMATIC GROUND POWER RECEPTACLE  
 C. CARGO COMPARTMENT DOORS

POWERPLANT DANGER AREAS

The wing-mounted engines require that ground personnel be aware of the danger areas. The characteristic of the jet engine operation require extreme care to prevent injury to personnel and/or damage to equipment. An operating engine consumes large quantities of air and is capable of sucking large objects into the inlet, including men. The exhaust of an operating engine has a velocity capable of overturning work stands, carts and at high engine power can easily pick up a man, also the noise of the operating engine can be harmful to the human hearing system.

Numerous incidents have been reported including injury to personnel by jet engines. One incident has resulted in a fatality.

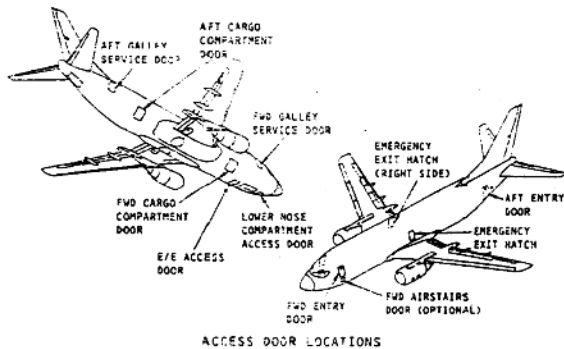
The powerplant danger areas are the air inlet and exhaust from the fan and core sections of the engine. All these sections provide hazards due to high air velocity, temperature and generated noise.

## 1. 2. GENERAL DESCRIPTION

### 1. ACCESS

Doors allow access to the passenger cabin, airstrips to cargo and service areas.

There are two entry doors on the left side of the airplane, one forward and one aft. There are two galley service doors on the right side, one forward and one aft. All the doors operate the same way.



Emergency exit hatches are located one on each side of the fuselage over the wing area.

There are two cargo compartment doors on the lower right side of the fuselage, one serving each cargo compartment.

The lower nose compartment access door is located forward of the nose wheel well.

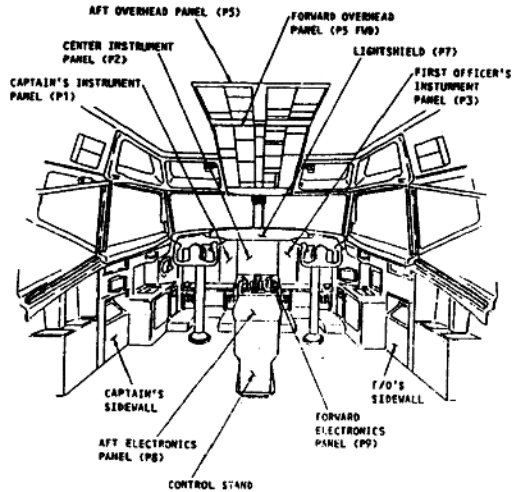
The electronic equipment compartment access door is located in the lower fuselage, aft of the nose wheel well.

## II. INSTRUMENT PANEL

### 1. INSTRUMENT PANEL LOCATIONS

Flight instruments and avionics system controls and indicators are located on panels in the flight compartment.

Flight instruments and annunciator lights are located on the captain's, first officer's, and center instrument panels. Control panels and annunciator lights are located on the fwd and aft overhead panel, light shield and sidewalls.



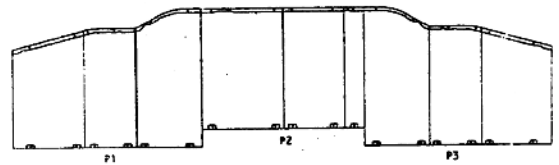
INSTRUMENT PANEL LOCATION

### 2. INSTRUMENT PANEL INSTALLATION

The instrument panels are modularized for easy removal to allow access to instrument connectors.

Modular section of the instrument panels are removed by releasing the DZUS fasteners at the top and bottom of the panel section. The panel section is then slid out on tracks to gain access to wiring and connectors. The panel section may be lifted up to release it from its tracks for complete removal.

For re-installation, the panel section is slid forward on its tracks and secured in place with the DZUS fasteners.



• INDICATES DZUS FASTENERS

INSTRUMENT PANEL INSTALLATION

### 3. PANEL INSTRUMENT INSTALLATION

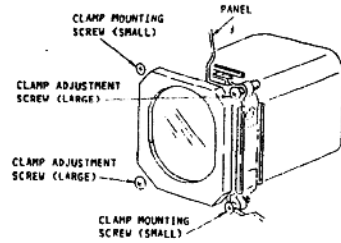
Most of the airplane's instruments are secured to panel by clamps. The clamps are fastened to the back of the panel face and surround the instrument case. Loosening a clamp facilitates instrument removal; tightening a clamp holds the instrument firmly in its panel mounted position.

The clamps are fastened to the panels by clamp mounting screws which can be identified by noticing that they are smaller than the other screw positioned around the perimeter of the instrument. Limited counterclockwise rotation of the clamp mounting screws facilitates instrument removal after the clamp has been slackened. The clamp mounting screws should be removed only when it is necessary to detach the clamp from the panel.

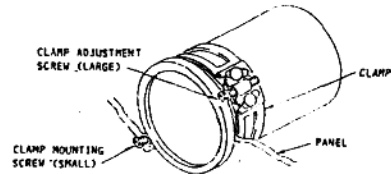
On rectangular instrument installations, there are two clamp mounting screws located diagonally opposite each other. On cylindrical instrument installations, there is one clamp mounting screw.

A clamp may be loosened or tightened by turning the clamp adjustment screws which can be identified by noticing that they are larger than the clamp mounting screws.

Counterclockwise rotation of the adjustment screws extends the clamp to permit removal or re-orientation of the instrument; clockwise rotation contracts the clamp around the instrument case. On rectangular instrument installations, there are two clamp adjustment screws located diagonally opposite each other. On cylindrical instrument installations, there is one clamp adjustment screw.



RECTANGULAR INSTRUMENT INSTALLATION

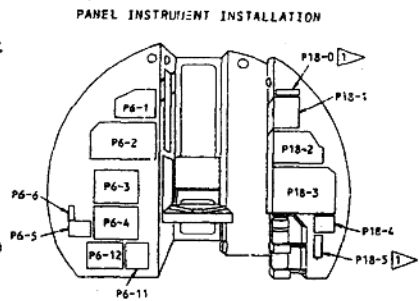


ROUND INSTRUMENT INSTALLATION

#### 4. LOAD CONTROL CENTER LOCATION

The load control center panels, right (P6) and left (P18), contain the contractors, relays, and the circuit breakers which control and distribute electrical power to airplane systems. Hinged panels allow access to the wires and components behind the circuit breakers.

The P6 load control center is located behind the first officer's seat. The P18 is behind the captain's seat.



FLIGHT COMPARTMENT LOOKING AFT

LOAD CONTROL CENTER LOCATION

### III. FLIGHT COMPARTMENT LIGHTS

Flight compartment lighting provides general illumination of the control cabin and local illumination of control panels, instruments, and controls.

Power for lighting is supplied through circuit breakers in the P6 and P18 panels. Flight compartment lights are powered by 28 volts ac except for the compass light, 28 volts dc, and the pilots' fluorescent background lights, 115 volt ac. The flight compartment instrument panels use white lighting.

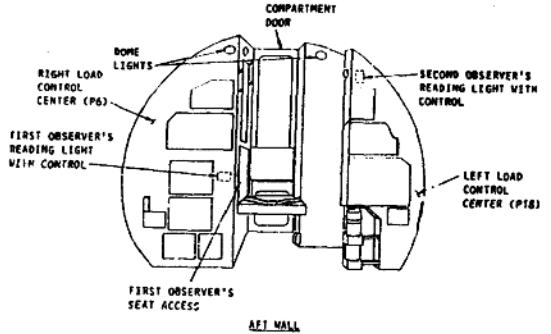
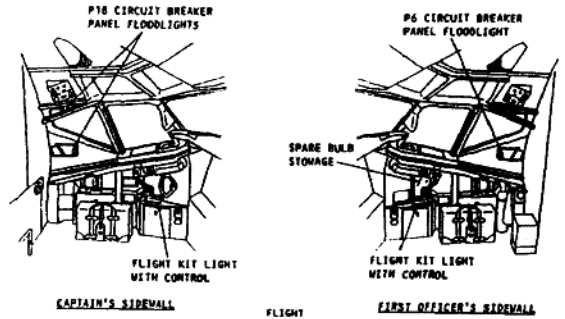
The dome lights are intensity controlled by a three-position (DIM-OFF-ON) toggle switch on the aft overhead panel. The captain's and first officer's white map lights are in the upper center window cavities. Controls for these lights are on the captain's and first officer's panels.

Flood lights for the circuit breaker panels and flight kit lights and controls, are located on the captain's and first officer's sidewalls.

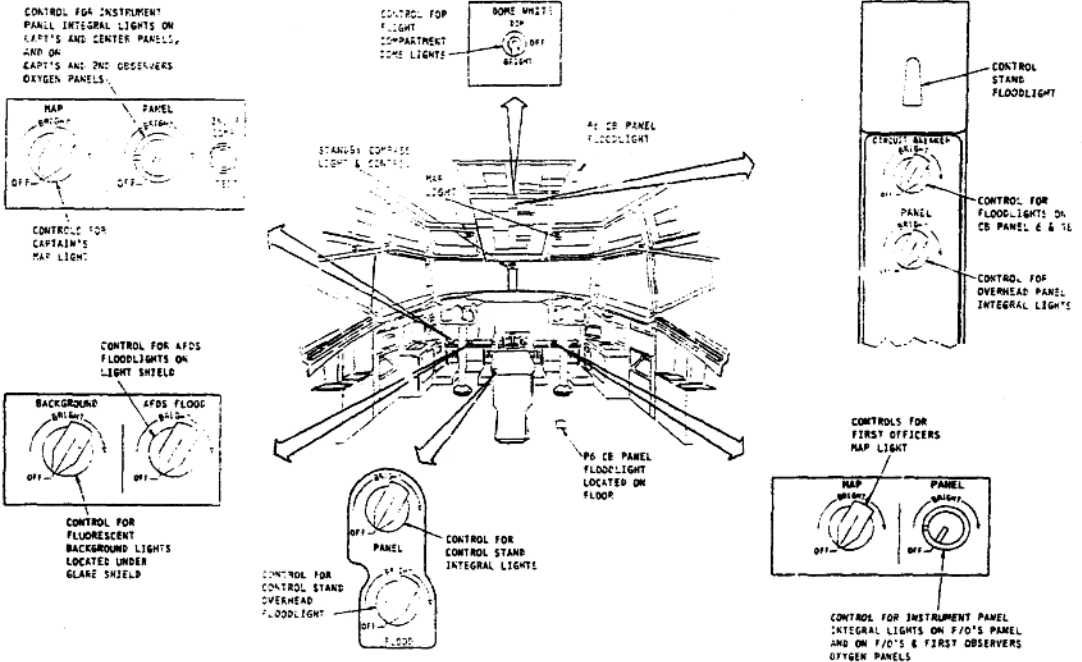
Flood lights illuminate the circuit breaker panels and the control stand. The controls are located on the overhead panel and control stand. Dome lights locate on the aft portion of the control cabin provide general area illumination.

The first observer's reading light is mounted in the entryway to the right of the first observer's seat. The second observer's reading light, when installed, is mounted to the left of the second observer's seat and above the circuit breaker panel. The light controls are part of each light assembly.

Spare lamp bodes are on the captain's and first officer's sidewall.



FLIGHT COMPARTMENT LIGHTS - AFT AND SIDEWALLS



FLIGHT COMPARTMENT LIGHTS - FORWARD SECTION

The captain's and first officer's stations are illuminated by fluorescent lights in the lightshield, above the main instrument panels, and by integral lights in the panel lightplates and instruments. The control for these lights are located on the captain's and first officer's instrument panels, overhead panel and control stand. The standby compass face is illuminated by a small white light inside the compass. The light is controlled by an adjacent three position (DIM-BRIGHT-OFF) compass light switch. The auto flight director system flood lights are located on the lightshield and the control is located on the P1 panel.

#### IV. MASTER WARNING AND CAUTION ANNUNCIATORS

The master caution lights inform the pilots that a system fault indicator light has illuminated on overhead panel or the engine and APU protection panel. The system caution annunciator informs the pilots which system has a fault. The master caution lights and system annunciators are located on the lightshield.

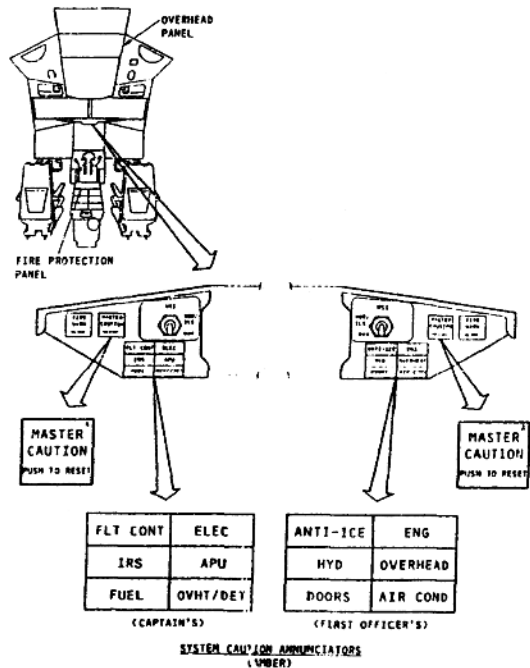
Power for the lights is either from a system circuit breaker or from the DIM and TEST circuit breaker.

The master caution light consists of an amber light cap labeled MASTER CAUTION-PUSH TO RESET.

Each system caution annunciator is composed of an amber light cap divided into six sections. The light cap sections on the captain's side are labeled FLT CONT, ELEC, IRS, APU, fuel and OVHT/DET. The light cap sections on the first officer's side are labeled ANTI-ICE, ENG, HYD, OVERHEAD, DOORS, and AIR COND.

Pressing either the captain's or first officer's master caution light extinguishes the master caution lights and the system caution annunciators. The system fault indicator light remains illuminated until the fault is corrected. The pilot may recall system fault indications on the system caution annunciators by pressing either annunciator. All annunciator lights will illuminate while the annunciator is pressed. When released, only those system with illuminated fault indicators will cause the corresponding system caution annunciator to remain illuminated.

The lamps for the warning lights and annunciators are replaced by pulling off the light cap.



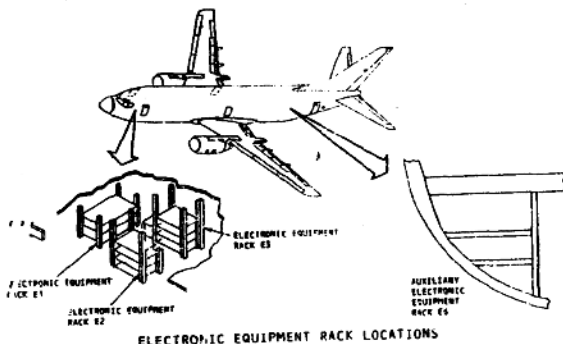
MASTER WARNING LIGHTS AND CAUTION ANNUNCIATORS

# 1.3. ELECTRONIC EQUIPMENT COMPARTMENT

## 1. ELECTRONIC EQUIPMENT RACK LOCATIONS

The majority of avionics system line replaceable units (LRUs) are located on the equipment racks in the electronic equipment (E & E) compartment, and the aft cargo compartment.

The E & E compartment is located in the lower 41 section. Aft of the nose wheel well. The auxiliary rack is located in the aft end of the section 48.



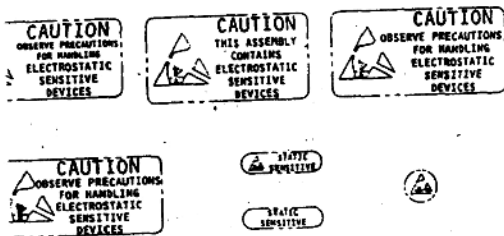
There are 3 equipment racks

located in the E&E compartment. The external access door is located between the 3 racks. Access from the forward cargo compartment is through a removable panel located between the E2 and E3 racks. Additional access to the forward cargo compartment from the passenger cabin is located between the seat tracks on the right side of the airplane by the third window from the front. This is not a normal access since there are two panels, one must be removed from below and one from above. Access to the auxiliary equipment rack is through the aft cargo door.

## 1. ELECTROSTATIC DISCHARGE SENSITIVITY

Static electricity is generated and stored on the surface of non-conductive materials and discharges to the first available ground source. Items such as human hands, air, and glass store high positive charges, whereas plastics store large charges of negative electricity.

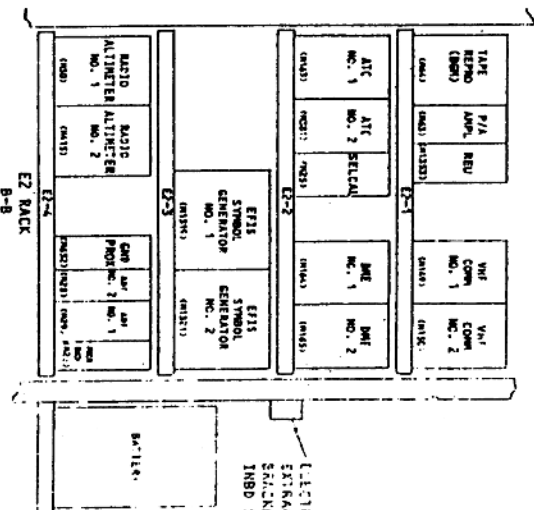
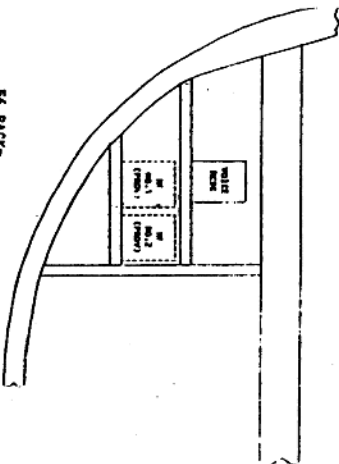
If static discharge can be seen or felt, then it may be assumed that the potential difference prior to discharge can be measured in thousands of volts. However, the voltage necessary to damage microcircuitry can be thirty volts or less. Therefore, electrostatic discharge damage can occur even though the discharge is of insufficient strength to be felt or seen. The low energy



TYPICAL BOEING ESDS DECALS

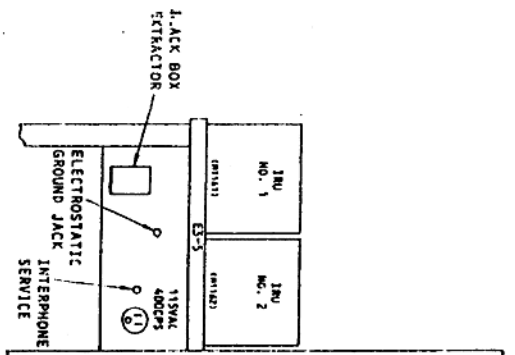
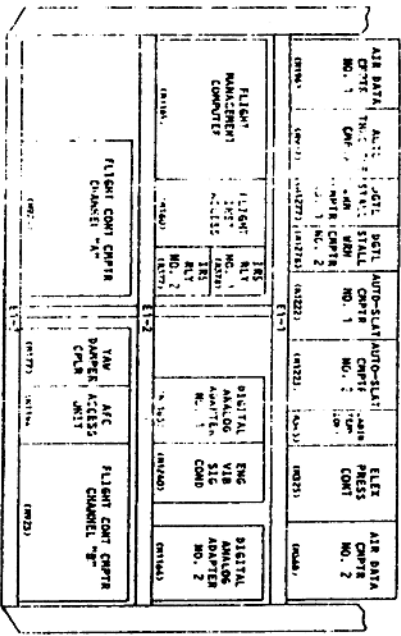
STATIC DISCHARGE SENSITIVE DEVICES IDENTIFIERS

E6 BACK-  
STA 887-STA 907, AFT CARGO COMP.

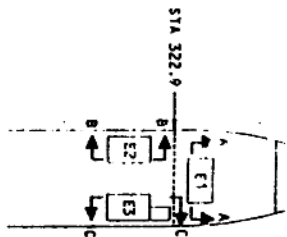


ELECTRONIC EQUIPMENT RACKS

E7 BACK



E3 RACK



STA 322-9



source that most commonly destroys ESDS devices is the human body which, in conjunction with nonconductive garments and floor coverings, generates and retains static electricity. In order to adequately protect ESDS devices, the device and everything that contacts it must be brought to ground potential by providing a conductive surface and discharge paths.

LRU's/instruments - do not touch connector pins of other exposed conductors. Install dust caps whenever a unit is removed.

Circuit cards - use a wrist strap assembly when handling circuit cards. Wrap card in a conductive plastic bag and place in a container for transport.

Racks and shelves containing ESD sensitive equipment are identified.

LRU's and instruments containing ESD sensitive circuitry are labeled.

Circuit assemblies containing ESD sensitive equipment are labeled accordingly on the extractor lever.

## 2. ELECTRONIC EQUIPMENT RACKS

Electronic components are installed on racks in the electronic equipment compartment. The views shown on the graphic are of the front of each rack as viewed from the electronic equipment compartment access. The auxiliary electronic equipment rack is in the aft cargo compartment. The view shown is the front of the rack as viewed facing aft from the aft cargo door.

The E1 rack is located at the forward end of the compartment. The E2 rack is located on the left side of the compartment and the E3 on the right side. The battery is installed beside the forward end of the E2 rack. The E3-5 shelf, on the forward side of the E3 rack, accommodates the inertial reference units. An LRU extractor is located on the forward inboard stanchion of the E2 rack.

The E6 rack is located on the right rear wall of the aft cargo compartment and contains the voice recorder.

## 11. LRU INSTALLATION

LRU retaining devices provide the means of pushing the LRU connector into its mating rack connector, securing the LRU on the shelf, and extracting the unit for removal. There are 3 types of LRU hold downs; 2 are thumbscrew types the other is a lever-latch.

The cam-lock lever is a force limiting lever which also serves as a carrying handle for the LRU after removal. Press the latch to release the lever from the handle. Move the lever downward to release the LRU from the connector. To install an LRU, slide the unit into the shelf with the lever open until the lever engages the shelf-mounted fork. Then move the lever upward to its latched position.