T.O. 1C-130 (A) H-1

FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

F41608-78-G-0053

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AIR FORCE PERSONNEL CLEARED FOR OPERATION OF SUBJECT AIRCRAFT.

SEE TECHNICAL ORDER INDEX T.O. 0-1-1-3 AND ITS SUPPLEMENTS FOR CURRENT STATUS OF FLIGHT MANUALS, SAFETY SUPPLEMENTS, OPERATIONAL SUPPLEMENTS AND FLIGHT CREW CHECKLISTS.

THIS PUBLICATION IS INCOMPLETE WITHOUT T.O. 1C-130(A)A-1-3 AND T.O. 1C-130(A)H-1-2.

THIS PUBLICATION INCORPORATES OPERATIONAL SUPPLEMENTS TO 1C-130(AH)-1S-50, 1S-52, 1S-53 and 1S-54.

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29 FEBRUARY 1980

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SCOPE.

This manual contains the necessary information for safe and efficient operation of the AC-130H. These instructions provide you with a general knowledge of the airplane, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized; therefore, basic flight principles are avoided.

SOUND JUDGEMENT.

Instructions in this manual are for a crew inexperienced in the operation of this airplane. This manual provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgement. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

PERMISSIBLE OPERATIONS.

The flight manual takes a positive approach and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from the flight manual manager before any questionable operation is attempted which is not specifically permitted in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA.

Refer to basic T.O. 0-1-1-3, and its monthly supplement, which lists all current flight manuals, safety supplements, and checklists. Its frequency of issue and brevity assure an accurate, up-to-date listing of these publications.

STANDARDIZATION AND ARRANGEMENT.

Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into nine fairly independent sections to simplify reading straight through or using it as a reference manual.

SAFETY SUPPLEMENTS.

Information involving safety will be promptly forwarded to you by safety supplements. Supplements covering loss of life will get to you in 48 hours by TWX, and those concerning serious damage to equipment within 10 days by mail. The title page of the flight manual and the title block of each safety supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with, but there is no point in restricting your operation by complying with a replaced or rescinded supplement.

OPERATIONAL SUPPLEMENTS.

Information involving operations will be promptly forwarded to you by operational supplements. Supplements covering urgent operational information will get to you in 48 hours by TWX, and those concerning essential information, but a less urgent nature will get to you within 10 days by mail. The title page of the flight manual and the title block of each operational supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with but there is no point in restricting your operation with a replaced or rescinded supplement.

CHECKLISTS.

The flight manual contains only amplified checklists. Condensed (abbreviated) checklists have been issued as separate technical orders. Line items in the flight manual and checklists are identical with respect to arrangement and item number. Whenever a safety supplement affects the condensed (abbreviated) checklists/ write in the applicable change on the affected checklist page. As soon as possible, a new checklist page incorporating the supplement will be issued. This will keep handwritten entries of safety supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES.

Each flight crew member is entitled to personal copies of the flight manual, safety supplements, operational supplements and checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel. It is their job to fulfill your technical order requests. Basically, you must order the required quantities on the Publications Requirements Table (T.O. 0-1-1-3). Technical Orders 00-5-1 and 00-5-2 give detailed information for properly ordering these publications. Make sure a system is established at your base to deliver these publications to the flight crews immediately upon receipt.

FLIGHT MANUAL AND CHECKLIST BINDERS.

Loose leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your condensed (abbreviated) checklist. These binders contain plastic envelopes into which individual checklist pages are inserted. They are available in two capacities and are obtained through normal Air Force supply under the following stock list numbers: 7510-766-4269, and 4270 for 25 and 40 envelope binders respectively. Check with your supply personnel for assistance in securing these items.

WARNINGS, CAUTIONS, AND NOTES.

The following definitions apply to warnings, cautions, and notes found throughout the manual:

WARNING	- Operating procedures, techniques, etc., which may result in personal injury or loss of life if not carefully followed.
CAUTION	- Operating procedures, techniques, etc., which may result in damage to equipment if not carefully followed.
Note	- An operating procedure, technique, etc., which is considered essential to emphasize.

USE OF WORDS SHALL, WILL, AND MAY.

The following definitions apply to words "shall," "will," and "may" found throughout the manual:

Shall and Will	- Used to indicate a mandatory requirement.
May	- Indicates an acceptable or suggested means of accomplishment.

YOUR RESPONSIBILITY — TO LET US KNOW.

Every effort is made to keep the flight manual current. Review conference with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the flight manual program are welcomed. These should be forwarded through your Command Headquarters to Warner Robins ALC, Robins AFB, Ga. 31098, Attn: MMSRDD.

TIME COMPLIANCE TECHNICAL ORDERS

The following Time Compliance Technical Orders have been incorporated in this manual or in outstanding Safety Supplements.

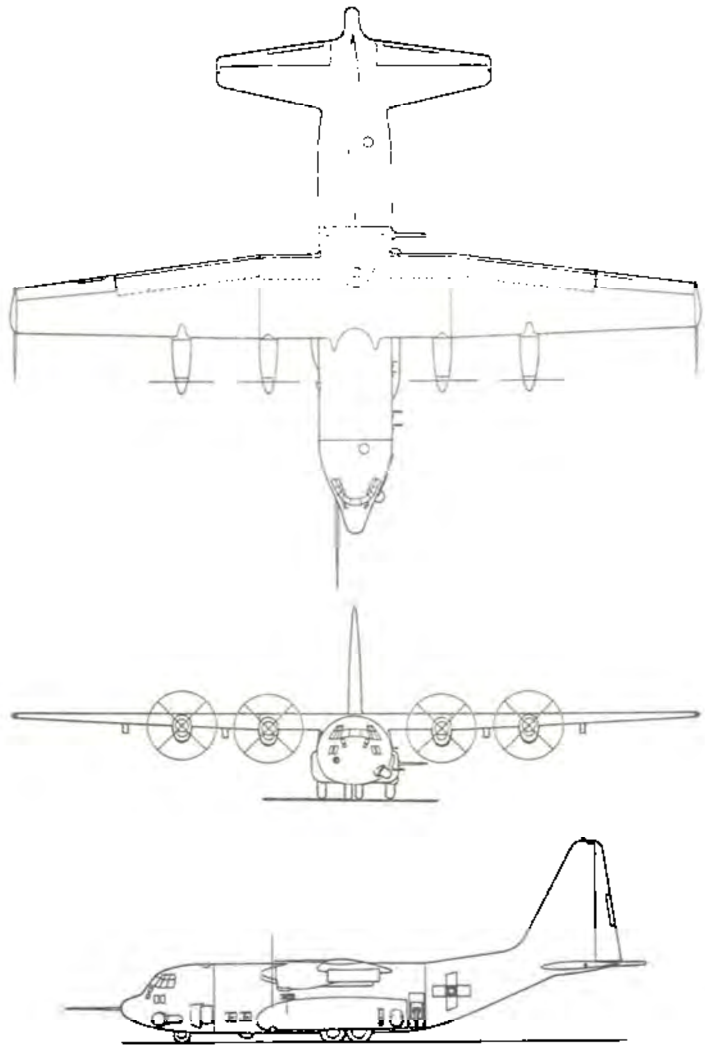
NUMBER	TITLE
T.O. 1C-130-636	Modification of Propeller Synchrophaser Panels
T.O. 1C-130-696	Installation of Redesigned Hydraulic Ground Checkout Valve
T.O. 1C-130-702	Permanent Closure of Forward Cargo Door Opening
T.O. 1C-130-720	Relocation of VHF Antenna
T.O. 1C-130-740	Retrofit Replacement of NLG Drag Strut and Retraction Mechanism
T.O. 1C-130-743	Installation of Hytrol Mk. II Anti-Skid Brake System
T.O. 1C-130-759	Removable Panel for Emergency Extension of Nose Gear
T.O. 1C-130-762	Installation of Engine Ground Start Interlock
T.O. 1C-130-764	Incorporation of Provisions for Emergency Extension and Rigging of MLG
T.O. 1C-130-778	Replacement of Brakes and Wheels
T.O. 1C-130-794	Installation of Hydraulic Check Valve in Brake Return Line
T.O. 1C-130-819	Modification to Improve Center Wing Fatigue Life
T.O. 1C-130-824	Retrofit Anti-Collision Light on Lower Surface of C-130 Aircraft
T.O. 1C-130-831	Installation of Fuel Cell Explosive Suppression in Fuel Cell
T.O. 1C-130-838	Installation of AIMS Equipment
T.O. 1C-130-889	Removal of Control C8765/AJQ-24 P/N 1205-0408 and AJQ-24 BMU
T.O. 1C-130-891	Life History Recording System
T.O. 1C-130-894	Retrofit Installation of Improved Bleed Air Warning System
T.O. 1C-130-931	Replacement of AN/ARN-21 TACAN Systems with AN/ARN-118 TACAN.
T.O. 1C-130-941	Modification of Isolation DC Bus Off Indicator Circuit, C-130 Aircraft
T.O. 1C-130-945	Installation of AN/ARC-164(V) UHF Radio
T.O. 1C-130-949	Installation of Aerial Refueling System
T.O. 1C-130-974	Engine Starting
T.O. 1C-130(A)-501	Install Chaff Control
T.O. 1C-130(A)-502	Install AN/ALE-20 Dispenser
T.O. 1C-130(A)-504	AN/AHX-2 Recorder Set, Signal Data, Mount Relocation

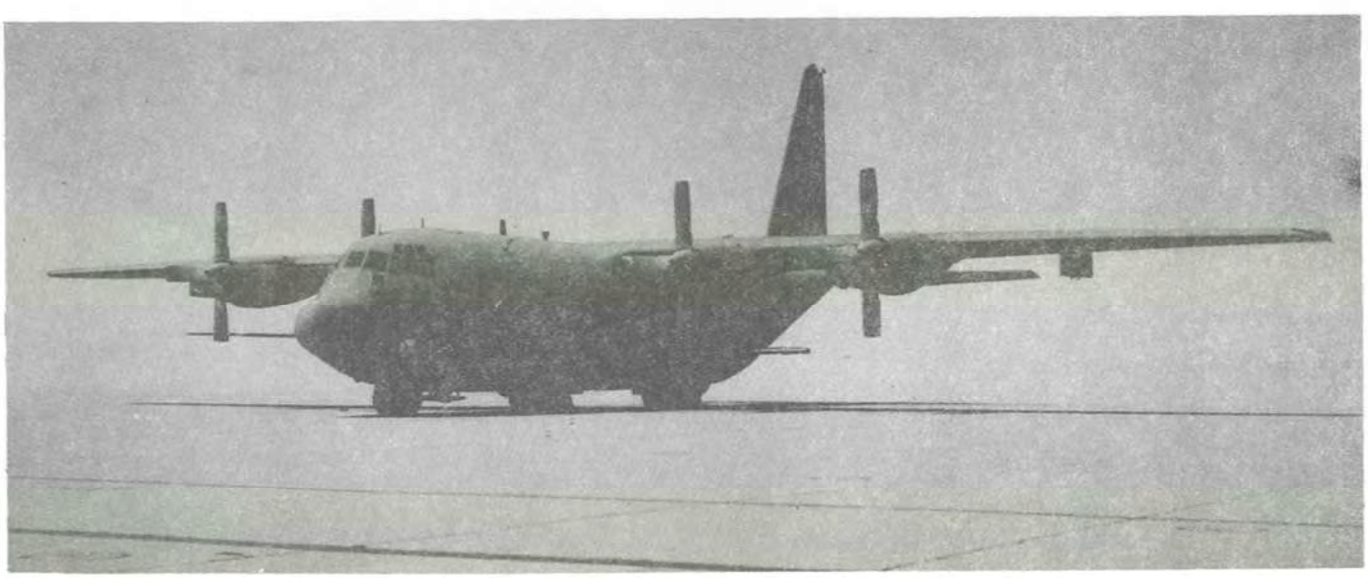
TIME COMPLIANCE TECHNICAL ORDERS (Cont)

NUMBER	TITLE
T.O. 1C-130(A)E-502	Install Pave Spectre Equipment
T.O. 1C-130(A)E-503	Install AN/ARN-92 Computer Power Filter
T.O. 1C-130(A)E-504	Install Gunport Closures
T.O. 1C-130(A)E-505	Install Autopilot Pitch Reference Switching Unit
T.O. 1C-130(A)E-506	Install Pave Aegis System and Relocate RT 1031/APQ-150
T.O. 1C-130(A)E-507	Install Enclosure for the Low Light Level Television Pedestal
T.O. 1C-130(A)E-508	Install Oxygen Regulator for Instructor Navigator
T.O. 1C-130(A)E-509	Install Upper AN/APR-37 Antenna
T.O. 1C-130(A)E-510	Relocate AN/AAD-7 Infrared System Water Separator
T.O. 1C-130(A)E-511	Install Lighting for Emergency Egress System Instruction Placard
T.O. 1C-130(A)E-512	Install New IO Position SUU-42A/A Dispensers, Scanner Blister, and Very Pistols
T.O. 1C-130(A)E-513	Install Active Television
T.O. 1C-130(A)E-514	Install Interphone Provisions for Instructor Navigator and add "Remote Call" function at Right Scanner position
T.O. 1C-130(A)E-515	Addition of Flexible Fuel Drain and Vent Lines
T.O. 1C-130(A)E-516	Modification of Armor System
T.O. 1C-130(A)E-517	Install Trainable 40MM Gun Mount
T.O. 1C-130(A)E-518	Install Infrared Shielding
T.O. 1C-130(A)E-519	Install Overhead Rail System
T.O. 1C-130(A)E-520	Install T56A-15 Engines
T.O. 1C-130(A)E-521	Add Forced Air Cooling and Failure Indicator to PP-6827/A Power Supply Inverter P/N 6720-29004-1
T.O. 1C-130(A)E-522	AN/APQ-150 Fairing Installation
T.O. 1C-130(A)H-502	Correction of TACAN and Other EMI Problems, AC-130H Aircraft
T.O. 1C-130(A)H-503	Installation of Improved Radar Warning Capability, AC-130H Aircraft
T.O. 1C-130(S)B-503	Installation of AN/APN-59B Search Radar in Lieu of AN/APS-31 Search Radar and Redesign of Radio Operator's Station
T.O. 1C-130(S)B-504	Installation of AN/APN-147(V) Doppler and AN/ASN-35 Computer

AC-130H

HERCULES





SECTION I

description

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THE AIRPLANE.

The Lockheed AC-130H is an all-metal, high-wing, long-range, land-based monoplane. The fuselage is divided into the cargo compartment and the flight station. It can be fully pressurized and air conditioned, both in flight and on the ground. The mission of the airplane is to operate as an aerial gunship. The AC-130H can land and take-off on short runways, and it can be used on landing strips such as those usually found in advance base operations.

PROPULSION.

Power is supplied by four Allison T56-A-15 turboprop constant-speed engines (figure 1-11). Each engine drives a 4-blade Hamilton Standard Hydromatic, constant-speed, full-feathering, reversible-pitch propeller.

AIRPLANE DIMENSIONS.

The principal dimensions of the airplane are:

Wing Span	132 feet 7 inches
Length	97 feet 9 inches
Height	38 feet 6 inches
Stabilizer Span	52 feet 8 inches
Cargo Compartment	
Length	41 feet
Width (Minimum)	10 feet 3 inches
Height (Minimum)	9 feet
Maximum Gross Weight	155,000 pounds

(For complete weight information, see Section V.)

See Section II for ground clearance and turning radius. See Section V for ground flotation characteristics.

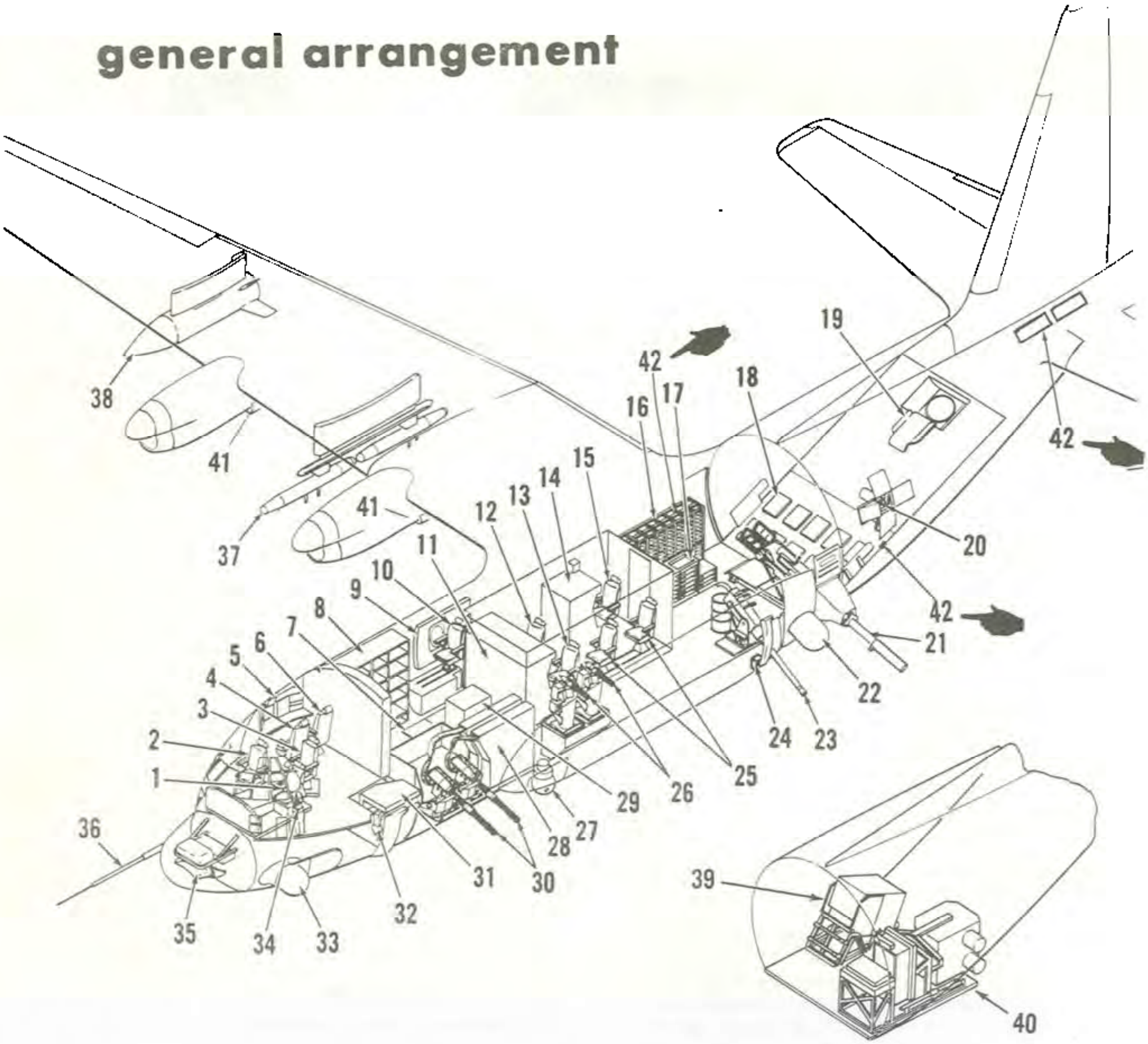
CREW.

The flight deck and cargo compartment provide for a crew of fourteen. Five crew members are located on the flight deck and nine in the cargo compartment.

The five flight deck crew members include the pilot, copilot, navigator, fire control officer and flight engineer. The fire control officer's station is located adjacent and aft of the navigator's station.

The nine cargo compartment crew members include an infrared (IR) operator, an electronic warfare officer (EWO), TV operator, a scanner observer, four airborne gunners (AG), and an illuminator operator (IO).

general arrangement



1. PILOT'S SEAT
2. COPILOT'S SEAT
3. FLIGHT ENGINEER
4. NAVIGATOR'S SEAT
5. NAVIGATOR AND FCO CONSOLE
6. FIRE CONTROL OFFICER'S SEAT
7. CRASH SEATS
8. CARGO COMP. ELECTRONICS EQUIPMENT RACK
9. SCANNER/OBSERVER WINDOW (EGRESS)
10. SCANNER/OBSERVER'S SEAT
11. IR AND EWO CONSOLE
12. EWO'S SEAT
13. IR OPERATOR'S SEAT
14. TV CONSOLE
15. TV OPERATOR'S SEAT
16. 40MM AMMO RACK
17. 105MM AMMO RACK (AFT)
18. CRASH SEATS
19. ILLUMINATOR OPERATOR BENCH
20. 2KW ILLUMINATOR
21. 105MM GUN
22. BEACON TRACKING RADAR
23. 40MM AUTOMATIC GUN
24. ALE-20 DISPENSER (2 PLACES)
25. CREW REST SEATS
26. 7.62 MINIGUNS
27. INFRARED RECONNAISSANCE SET
28. 20MM AMMO RACK
29. 105MM AMMO RACK (FWD)
30. 20 MM GUNS
31. FLIGHT DECK EXTENSION
32. MULTI-SENSOR PLATFORM (TV/LASER PLATFORM)
33. BLACK CROW RADOME
34. PILOT'S GUNSIGHT
35. APN-59B RADAR
36. PITOT STATIC BOOM
37. ECM PODS
38. SUU-42A/A DISPENSER
39. FLARE LAUNCHER LAU-74/A
40. 40KVA ILLUMINATOR LIGHT SET
41. INFRARED SHIELD
42. AN/ALE-40(V) DISPENSERS

Figure 1-1.

An operator's booth, installed on the right side of the cargo compartment, houses the IR operator, EWO, and TV operator. The booth also has two rest stations.

The scanner/observer is stationed on a platform immediately forward of the booth on the right side of the cargo compartment. The illuminator operator is stationed on the cargo ramp door as an aft scanner. The IO is positioned on an armored bench (for lying down) and scans through a bubble installed in the cargo door. Four airborne gunners man the gun stations (20MM, 7.62MM, 40MM and 105MM guns). The illuminator operator (IO) operates the 40 KW illuminator and the LAU-74/A flare launcher (when installed).

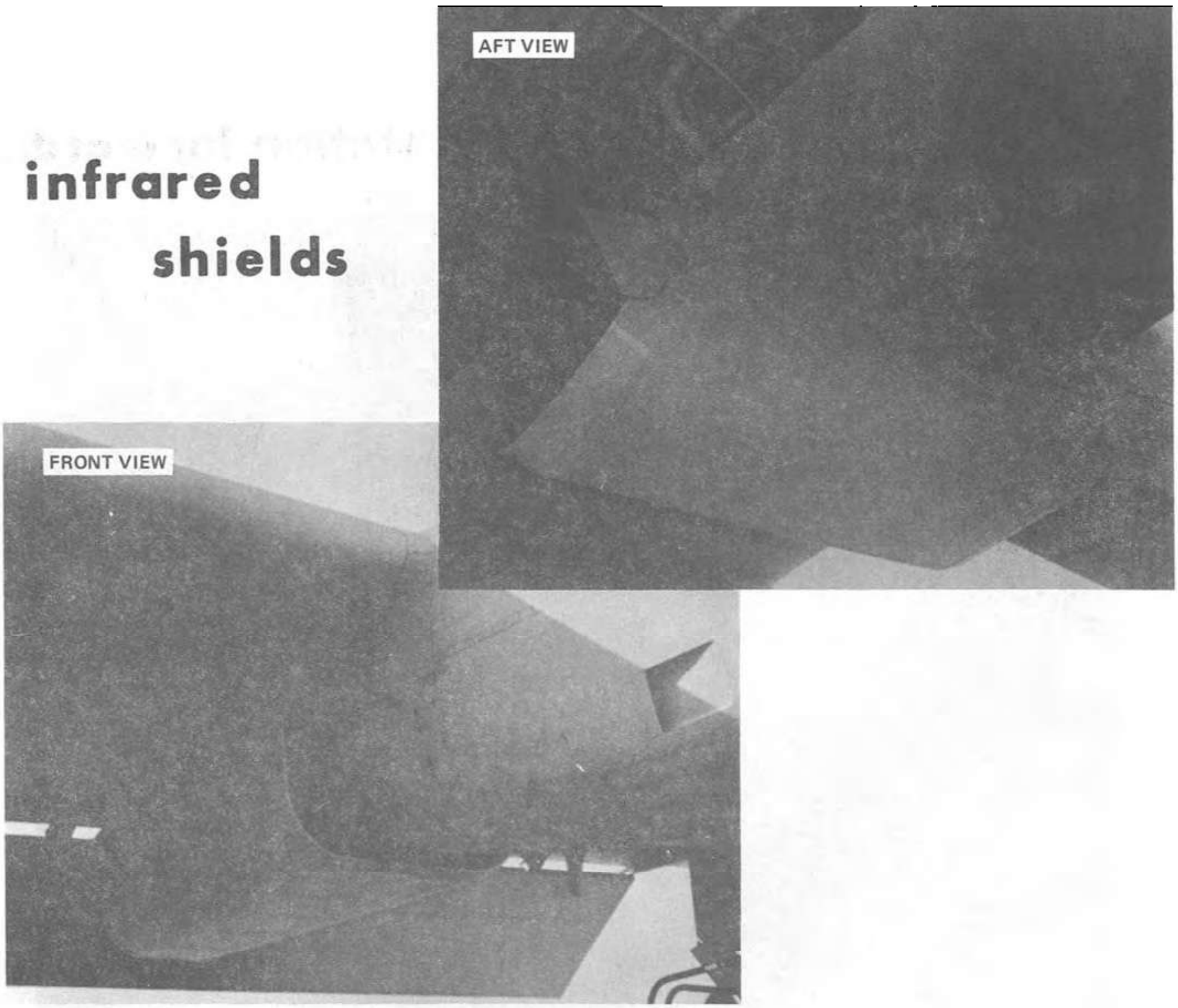


Figure 1-2.

ENGINES

The airplane is powered by four T56-A-15 engines. The static, standard-day, sea level, take-off rating of the engine at 100 percent rpm (13, 820) is 4, 910 equivalent propeller SHP; 4, 591 propeller SHP plus 319 ESHP resulting from jet thrust. The maximum allowable torquemeter indicated power is 19, 600 inch-pounds. This is equivalent to 4, 200 SHP plus 100 SHP allowance for gearbox and accessory losses, or a total of 4, 300 SHP. Each engine is fitted with a removable infrared shielding device.

INFRARED SHIELDS.

The wing structure has been modified to accomodate mounting a removable infrared shield to cover the aft portion of each engine nacelle (figure 1-2). These shields, each weighing 300 pounds, are designed to reduce engine infrared emissions in flight.

POWER SECTION.

The power section of the engine has a single-entry, 14-stage, axial-flow compressor; a set of 6 combus-

flight station forward

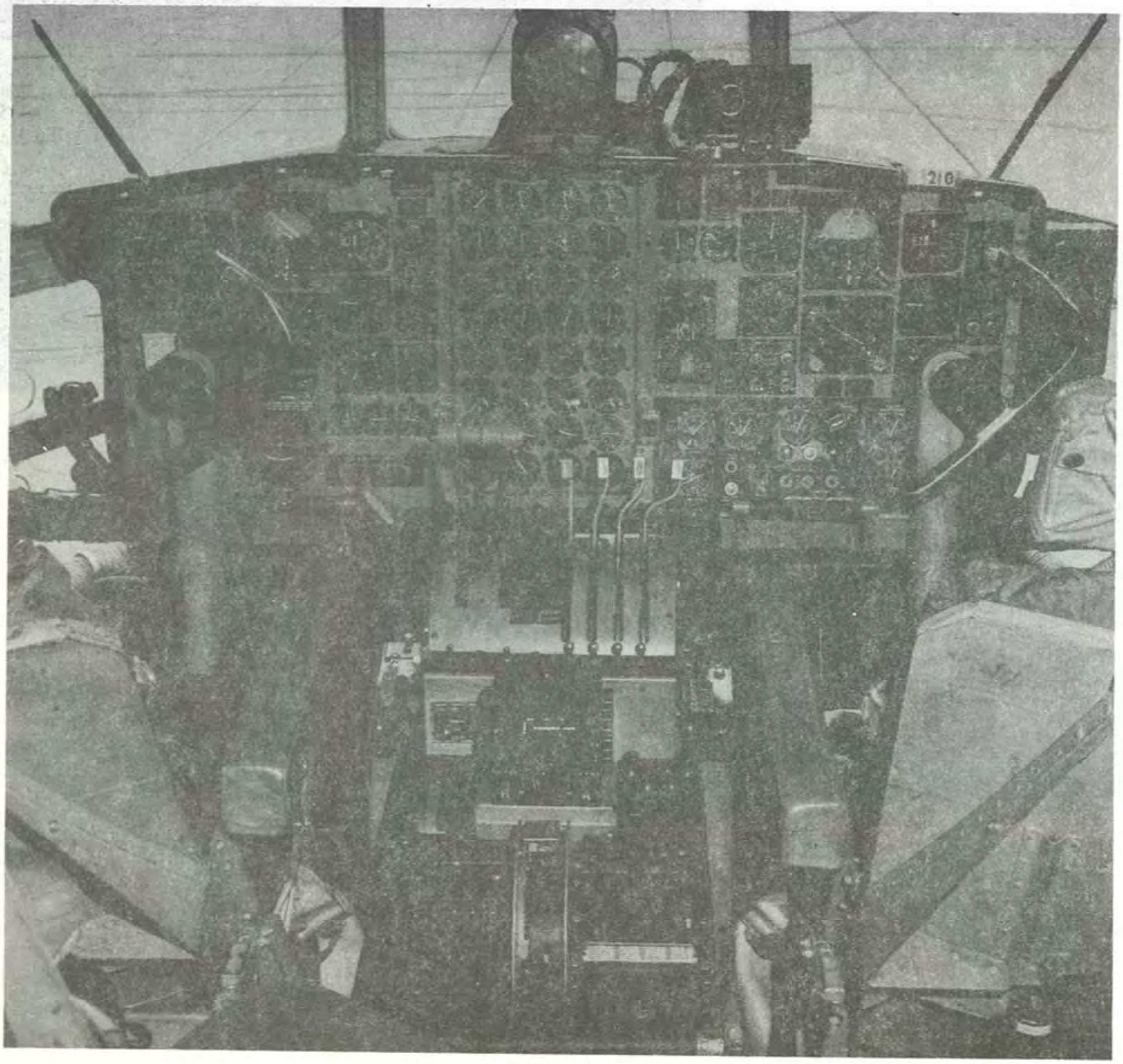


Figure 1-3.

tion chambers of the through-flow type; and a 4-stage turbine. Mounted on the power section are an accessories drive assembly and components of the engine fuel, ignition, and control systems. Acceleration bleed valves are installed at the 5th and 10th compressor stages. A manifold at the diffuser bleeds air from the compressor for airplane pneumatic systems. Anti-icing systems prevent accumulation of ice in the engine inlet air duct and the oil cooler scoop. Inlet air enters the compressor through a scoop and duct below the compressor and is progressively compressed through the 14 stages of the compressor. The compressed air (at approximately 125 psi, 600°F) flows through a diffuser into the combustion section. Fuel flows into the combustion chambers and burns, increasing the temperature and thereby the energy of the gases. The gases pass through the turbine, causing it to rotate and drive the compressor, propeller, and accessories. The gases, after expanding through the turbine, flow out a tailpipe.

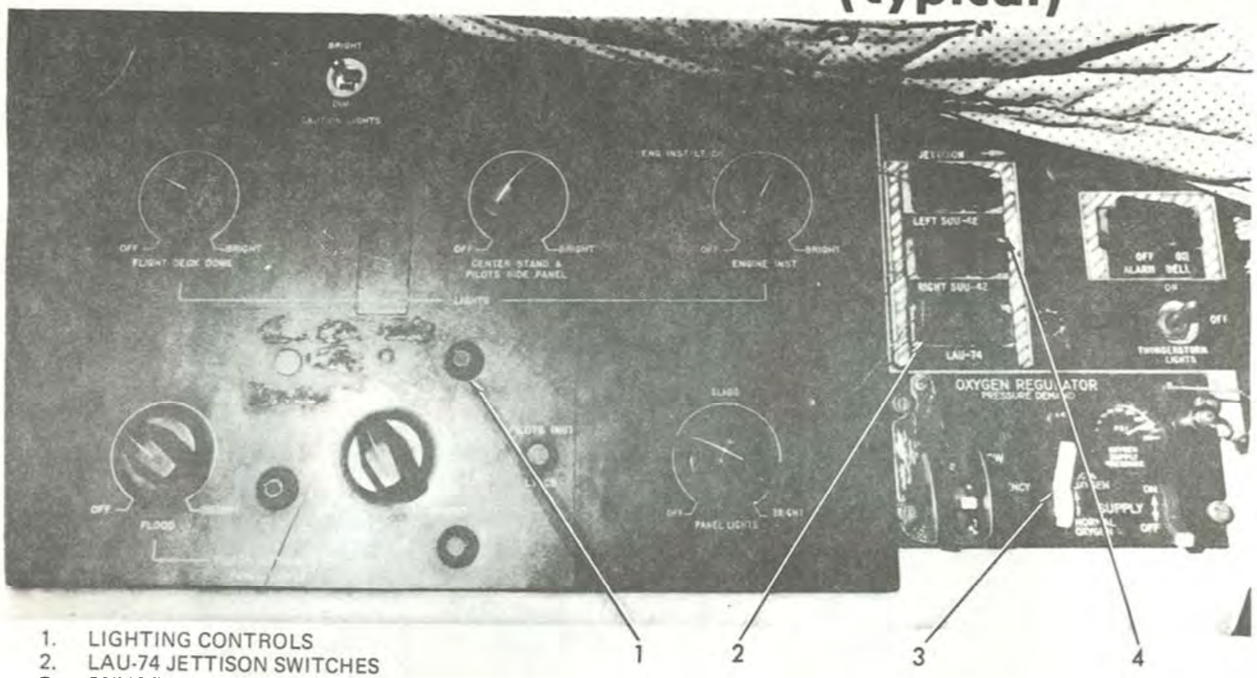
pilot's station

Figure 1-4.

copilot's station

Figure 1-5.

pilot's side shelf (typical)



1. LIGHTING CONTROLS
2. LAU-74 JETTISON SWITCHES
3. OXYGEN REGULATOR
4. SUU-42A/A JETTISON SWITCHES

Figure 1-6.

copilot's side shelf

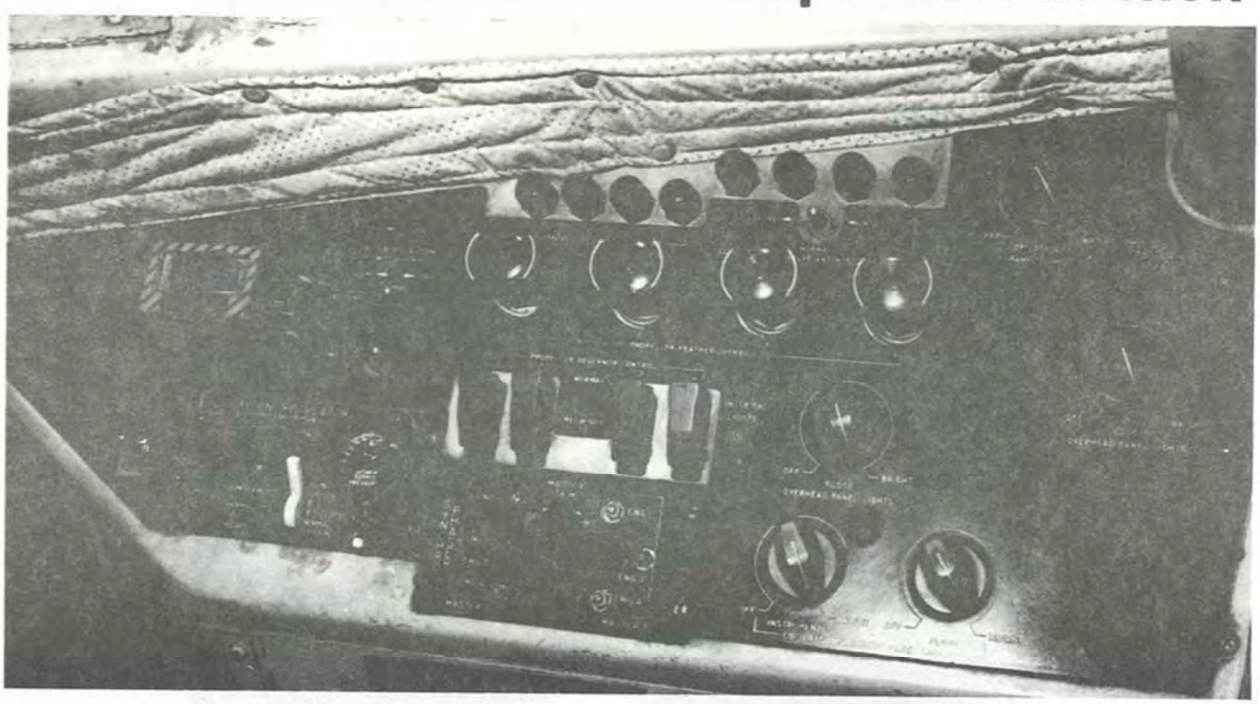
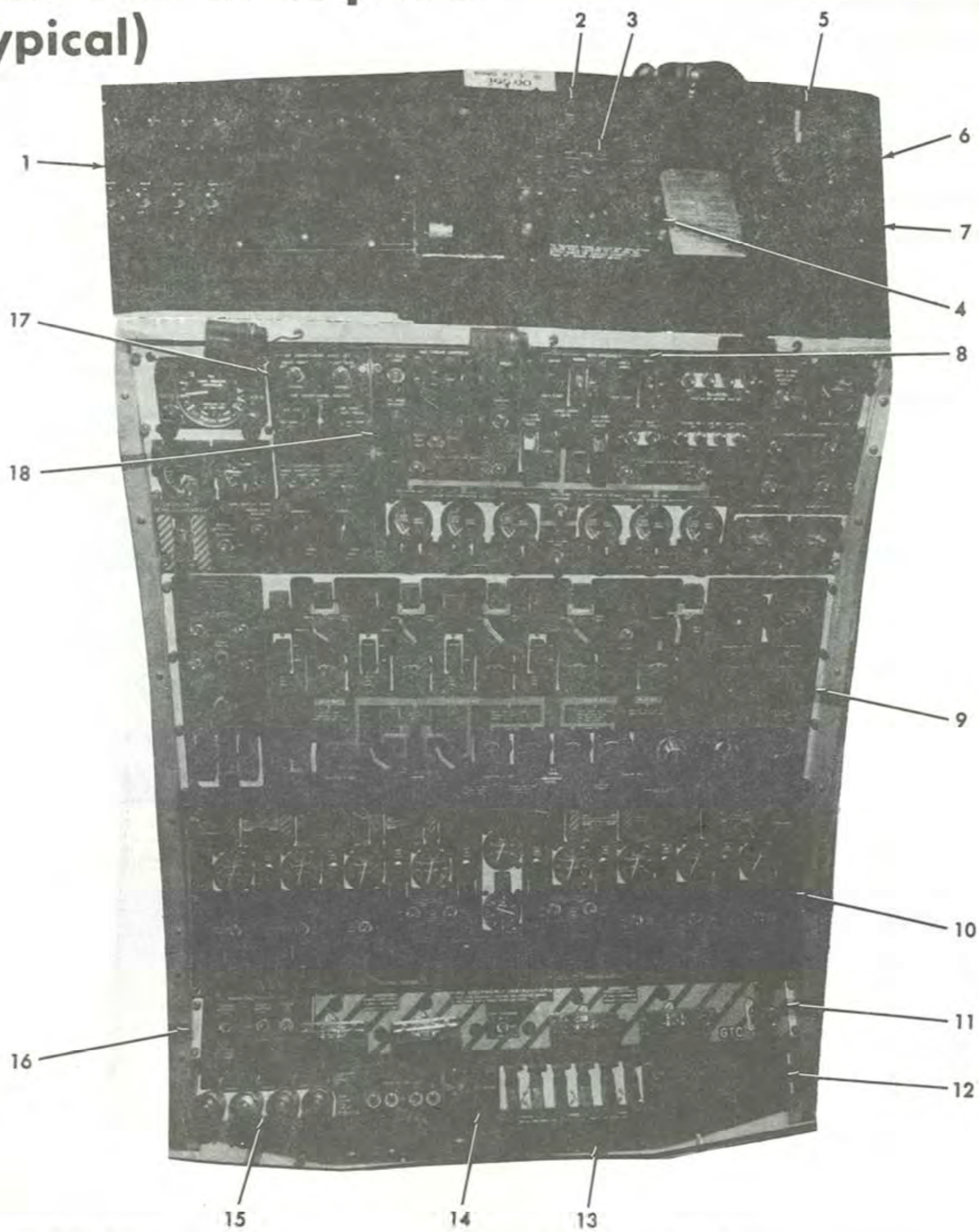


Figure 1-7.

overhead control panel (typical)

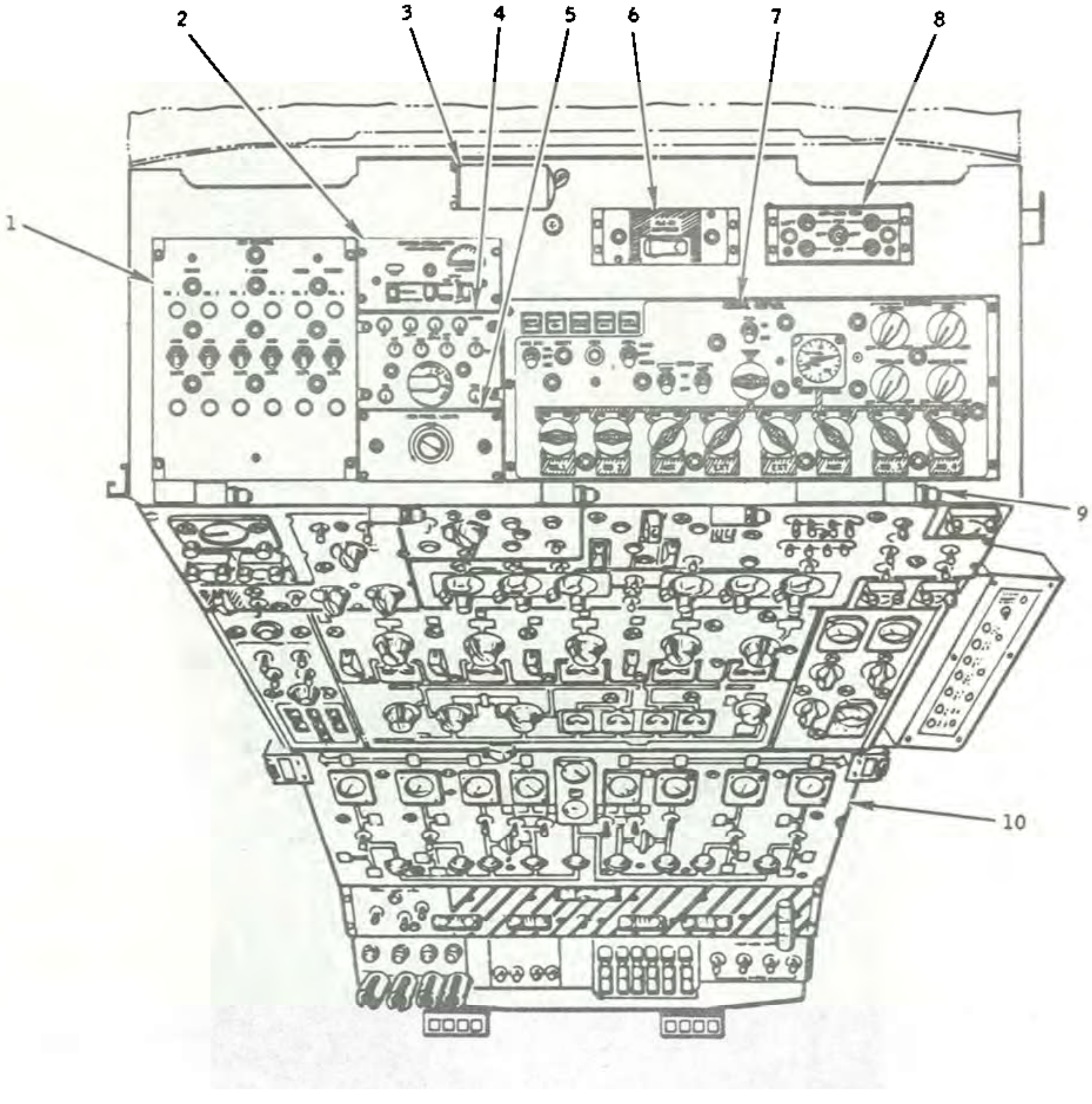


1. GUN CONTROL PANEL
2. FUEL GOVERNING CONTROL PANEL
3. ANTI-SKID TEST PANEL
4. GUN PANEL LIGHTS CONTROL PANEL
5. OXYGEN REGULATOR
6. ALE-20 SAFE/ARM CONTROL PANEL
7. INTERCOMMUNICATION CONTROL PANEL
8. ANTI-ICING SYSTEMS CONTROL PANEL
9. ELECTRICAL CONTROL PANEL
10. FUEL CONTROL PANEL
11. FIRE EMERGENCY CONTROL PANEL
12. OIL COOLER FLAPS CONTROL PANEL
13. CONTROL BOOST SWITCH PANEL
14. ICE DETECTION PANEL
15. ENGINE STARTING CONTROL PANEL
16. FIRE WARNING SYSTEM TEST PANEL
17. AIR CONDITIONING AND PRESSURIZATION PANEL
18. GTC CONTROL PANEL

Figure 1-8.

overhead control panel (typical)

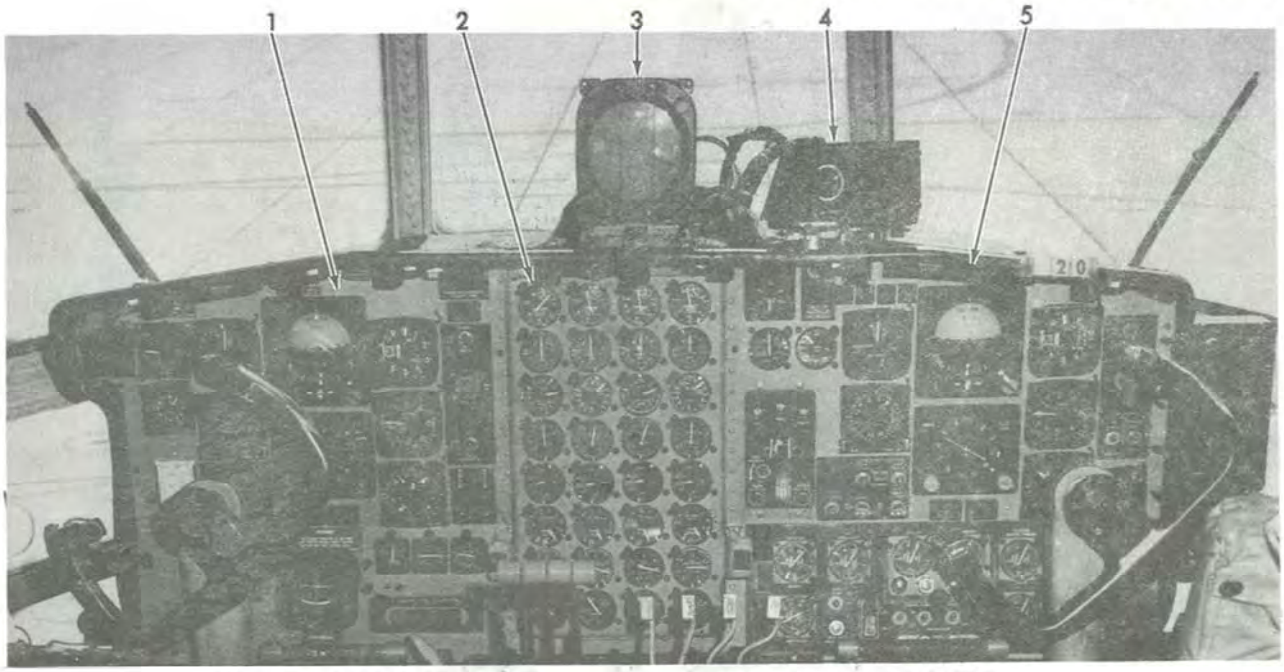
(AIRPLANES MODIFIED BY T.O. 1C-130-949)



1. GUN CONTROL PANEL
2. OXYGEN REGULATOR
3. LIGHT ASSEMBLY - C4A
4. INTERCOMMUNICATIONS CONTROL PANEL
5. GUN PANEL LIGHTS CONTROL PANEL
6. ALE-20 SAFE/ARM CONTROL PANEL
7. AERIAL REFUELING CONTROL PANEL
8. ANTI-SKID TEST PANEL
9. LIGHT ASSEMBLY (5)
10. FUEL CONTROL PANEL (MODIFIED)

Figure 1-9.

main instrument panel



1. PILOT'S INSTRUMENT PANEL
2. ENGINE INSTRUMENT PANEL
3. PILOT'S RADAR INDICATOR
4. OFF NOMINAL INDICATOR
5. COPILOT'S INSTRUMENT PANEL

Figure 1-10.

EXTENSION SHAFT ASSEMBLY.

The extension shaft assembly consists of two concentric shafts and torquemeter components. The inner shaft transmits power from the power section to the reduction gear. The outer shaft serves as a reference so the torsional deflection of the loaded inner shaft can be detected by the magnetic pickups of the torque indicating system.

REDUCTION GEAR ASSEMBLY.

The reduction gear assembly contains a reduction gear train, a propeller brake, an engine negative torque control system, and a safety coupling. Mounted on the accessory drive pads are the engine starter, an ac generator, a hydraulic pump, an oil pump, and a tachometer generator. The reduction gear has an independent dry-sump oil system supplied from the engine oil tank. The reduction gear train is in two stages, providing an overall reduction of 13.54 to 1 between engine speed (13,820 rpm) and propeller shaft speed (1,021 rpm). The propeller brake, engine negative torque control system, and safety coupling are described in the following paragraphs.

Propeller Brake.

The cone-type propeller brake acts on the first stage of reduction gearing. During engine operation, it is held disengaged by gearbox oil pressure when rpm exceeds 23 percent, and is engaged below this speed. As engine speed is reduced and oil pressure drops, the braking surfaces are brought into contact by spring force to help slow the propeller to a stop. Helical splines are provided between the starter shaft and the starter gear on the outer brake member causing the brake to disengage when starting torque is applied during starting. The brake also engages to stop reverse rotation of the propeller.

Safety Coupling.

The safety coupling is provided to decouple the power section from the reduction gear if negative torque applied to the reduction gear exceeds approximately 6,000 inch-pounds, a value much higher than that required to operate the NTS system. Because of its higher setting, the safety coupling backs up the NTS system to reduce drag until the propeller can be feathered. The safety coupling connects the engine extension shaft to the pinion of the first stage of reduction gears. It consists of three members. An outer member is attached to the extension shaft; an inner member is attached to the pinion; and an intermediate member is engaged to the outer member by straight teeth and to the inner member by helical teeth. Reaction of the helical teeth tends to force the intermediate member aft out of engagement when negative torque is applied; and the members disengage if approximately 6,000 inch-pounds negative torque is reached. While disengaged, the two members are forced together by springs so that the teeth ratchet. The teeth can thus be damaged; therefore, the engine should not be continued in operation after a decoupling. Before restarting the engine, the coupling must be replaced.

T56-A-15 engine

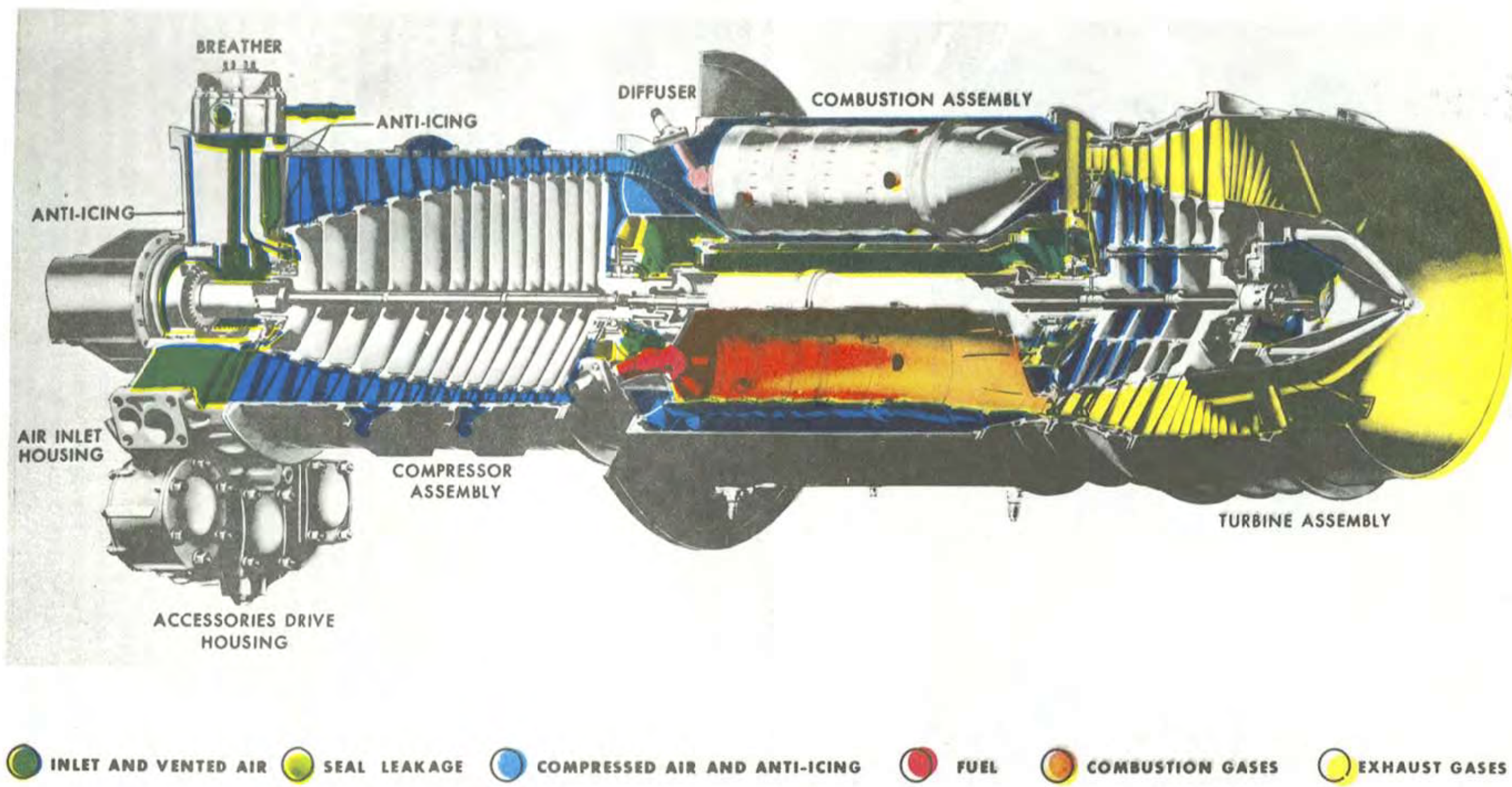


Figure 1-11.

ENGINE FUEL AND CONTROL SYSTEM.

The turboprop engine consists of the same components as the turbojet engine except that a propeller and a reduction gear are added. A turboprop engine turbine extracts more energy from the gas stream than a turbojet engine. This is necessary to drive not only the compressor and the accessories but also the propeller. Since most of the gas stream energy is absorbed by the turbine, the jet action, while still effective, is reduced considerably. A reduction gear is used because the turning speed of the power unit is too high for use with a propeller. In flight the engine operates at a constant speed which is maintained by the governing action of the propeller. Power changes are made by changing fuel flow and propeller blade angle rather than engine speed. An increase in fuel flow causes an increase in turbine inlet temperature and a corresponding increase in energy available at the turbine. The turbine absorbs more energy and transmits it to the propeller in the form of torque. The propeller, in order to maintain governing speed, increases blade angle to absorb the increased torque. Turbine inlet temperature is a very important factor in the control of the engine. It is directly related to fuel flow and consequently to power produced. It is also limited because of the strength and durability of the combustion and turbine section materials. The control system schedules fuel flow to produce specific turbine inlet temperatures and to limit those temperatures so that the temperature tolerances of combustion and turbine section materials are not exceeded. The fuel system (figure 1-12) consists of fuel filters, a fuel pump, a hydromechanical fuel control in series with an electronic temperature datum control system, and six fuel nozzles. Operating with the fuel system is the ignition system, the starting fuel enrichment system, the bleed air system, and the propeller. Changes in power settings are effected by the throttle which is connected to the fuel control and the propeller through a mechanical coordinator. During ground operation, changes in throttle position mechanically affect both the fuel flow and the propeller blade angle. In flight, changes in throttle position mechanically affect fuel flow and the propeller governor regulates blade angle, maintaining constant engine speed. The hydromechanical fuel control, which is part of the basic fuel system, senses engine inlet air temperature and pressure, rpm, and throttle position and varies fuel flow accordingly. The electronic temperature datum (TD) control system senses turbine inlet temperature and throttle position and makes any necessary changes in the fuel flow from the fuel control before it reaches the fuel nozzles. The TD system compensates for minor variables not sensed by the hydromechanical fuel control and for mechanical tolerances within the fuel control itself. By means of switches the TD system can be turned off or locked and the engine will operate on the basic hydromechanical system alone. With the TD system in AUTO, temperature protection is provided through the entire throttle range, and automatic temperature scheduling is provided when the throttle is in the range of 65 to 90 degrees. When the TD system is in NULL, the automatic functions of temperature limiting and temperature scheduling must be accomplished manually by adjustment of the throttle.

BASIC HYDROMECHANICAL FUEL SYSTEM.

The basic hydromechanical fuel system consists of a throttle, a coordinator, a low-pressure fuel filter, a high-pressure fuel filter, a dual-element fuel pump, a hydromechanical fuel control, and six fuel nozzles.

Throttle, Coordinator, and Propeller Control Linkage.

The coordinator is a mechanical discriminating device which coordinates the throttle, the propeller, the fuel control, and the electronic temperature datum (TD) system. Movements of the throttle are transmitted to the coordinator by cables and, in turn, to the fuel control and the propeller by a series of levers and rods. A potentiometer in the coordinator provides signals to the TD system. Propeller blade angle is scheduled by throttle position from MAXIMUM REVERSE to FLIGHT IDLE. For throttle settings between FLIGHT IDLE and TAKE-OFF, the propeller is governing. Throttle movement in this range serves primarily to change fuel flow.

Fuel Control and Fuel Nozzles.

Fuel flows from the fuel pump to the hydromechanical fuel control. The control is sensitive to throttle position, air temperature and pressure at the engine inlet, and engine speed. The engine speed function of the fuel control maintains engine speed in the taxi range and limits engine speed in the flight range if the propeller governor fails. Governor action is controlled by flyweights that respond to engine rpm. The control will start to reduce fuel to the engine at approximately 103.5 percent rpm. The fuel flow schedule maintained by the fuel control provides satisfactory operation of the engine throughout its entire range. Fuel metered by the control is equal to engine requirements plus an additional 20 percent, which is for the use of the temperature datum valve, a part of the TD system. The required fuel flow passes on through the temperature datum valve to the fuel nozzles and into the combustion liners, where it is burned.

Electronic Temperature Datum Control System.

The temperature datum control together with the coordinator potentiometer, temperature adjustment network, a turbine inlet temperature measurement system, and the temperature datum valve make up the electronic temperature datum system. The system compensates for variations in fuel heat value and density, engines, and control system characteristics.

The temperature datum control is furnished actual turbine inlet temperature signals from a set of thermocouples and desired turbine inlet temperature signals by the throttle through the coordinator potentiometer and the temperature adjustment network. The control compares the actual and the desired turbine inlet temperature signals. In the temperature controlling range 65 - 90 degrees), if there is a difference, the temperature datum control signals the temperature datum valve to increase or decrease fuel flow to bring the temperature back on schedule. In the temperature limiting range (0 - 65 degrees) the temperature datum control acts only when the limiting temperature is exceeded at which time it signals the temperature datum valve to decrease fuel flow. The temperature datum valve is located between the fuel control and the fuel nozzles. It is a motor-operated, bypass valve which responds to signals received from the temperature datum control. In throttle positions between 0 and 65 degrees the valve remains in a 20 percent bypass or null position and the engine operates on the fuel flow scheduled by the fuel control. The valve remains in the null position unless it is signaled by the temperature datum control to limit turbine inlet temperature. The valve then reduces the fuel flow (up to 50 percent during starting, 20 percent above 94 percent rpm) to the nozzles by returning the excess to the fuel pump. When the turbine inlet temperature lowers to the desired level, the temperature datum control signals the valve to return to the null position. In throttle positions between 0 and 65 degrees the control system is in the temperature limiting range. In throttle positions between 65 and 90 degrees the temperature datum valve acts to control turbine inlet temperature to preselected schedule corresponding to throttle position/ this is the temperature controlling range. In this range the valve may be signaled by the temperature datum control to allow more (higher temperature desired) or allow less (lower temperature desired) of the fuel to flow to the fuel nozzles. Any specific fuel flow trim correction applied in the 65 - 90 degrees throttle range can be locked into the temperature datum valve while above 65 degrees and will be maintained in the 0 - 65 degrees range by the use of the TD control switch located at the flight station. Also, the TD system can be returned to null at any time by the use of the temperature datum control switch. When the switch is in null, automatic temperature limiting circuits are inoperative, the temperature datum valve remains in the null (20 percent bypass) position, and all fuel metering is then accomplished by the fuel control. Temperature limiting then must be accomplished by throttle adjustment.

Acceleration Bleed Air Valves.

The bleed air valves on the fifth and tenth stages of the compressor are provided for compressor unloading during starting and while the engine is operating in the low-speed ground idle range. These bleed valves remain open only when engine speed is below 94 percent rpm. The fifth and tenth stage bleed air valves are automatic in operation and are actuated by 14th stage compressor air pressure through an engine-driven speed sensitive valve assembly.

Starting Fuel Enrichment System.

The enrichment system consists of a bypass line in which is mounted a solenoid valve controlled by the speed-sensitive control and a pressure switch. The valve is opened by the speed-sensitive control through the ignition relay when engine speed reaches 16 percent rpm during starting. While open, it allows pump discharge fuel to flow around the metering section of the fuel control to add to the metered flow from the fuel control. After fuel pressure in the manifold reaches approximately 50 psi (gage), the manifold pressure switch opens to de-energize the valve, which then closes.

STARTING SYSTEM.

An air turbine starter unit drives the engine for ground starts. This starter unit consists of an air-driven turbine section, a clutch, and a reduction gear section that is splined to the reduction gear section of the engine. Air for driving the starter can be supplied by the gas turbine compressor, by an operating engine, or by an external air source. The air is routed through the bleed air system and the engine bleed air valves. When the respective bleed air valve is opened, air is supplied to the starter regulator valve. The starter regulator valve opens when its solenoid is energized, and it allows airflow into the starter turbine section. The starter regulator valve closes when its solenoid is de-energized. This closes off the air supply to the starter turbine and causes the clutch to disengage the starter from the engine reduction gearing, and the starter button pops out. (Refer to Section V for starter limits.)

IGNITION SYSTEM.

The ignition system is a high-voltage, condenser-discharge type, consisting of an exciter, two igniters, and control components. The system is controlled by the speed-sensitive control through the ignition relay which turns it on at 16 percent engine rpm and off at 65 percent engine rpm during starting.

ENGINE CONTROLS.

Engine control in the flight range of operation is based on regulation of engine speed by propeller constant-speed governing and control of torque through regulation of fuel flow. Note that the throttle acts only as a fuel control. It exercises no direct control over the propeller, which is controlled entirely by the propeller regulator to regulate engine speed and to limit the low blade angle. The throttle does select the rate of fuel flow. The fuel control regulates the

engine fuel flow
engine starting (parallel operation)

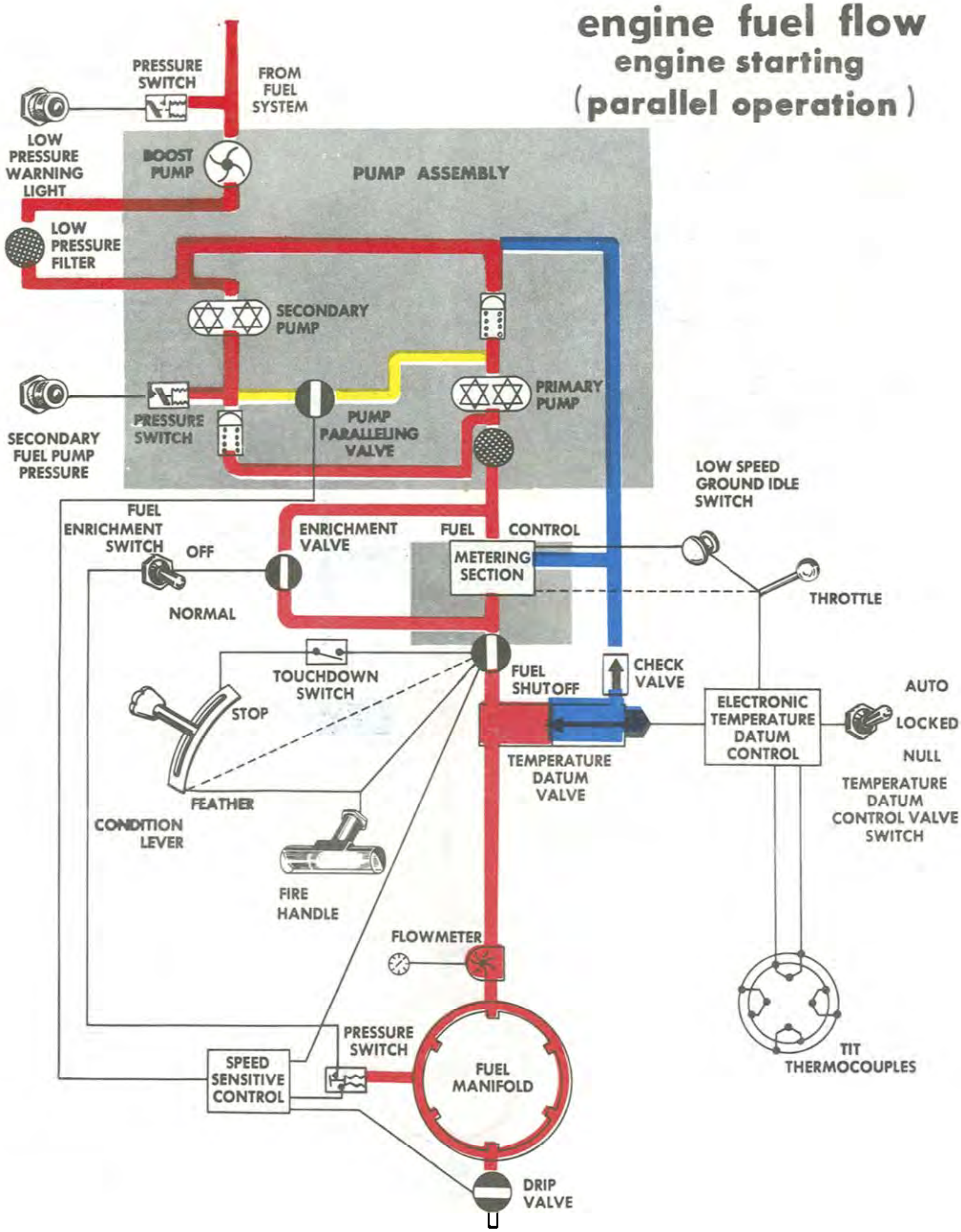


Figure 1-12. (Sheet 1 of 2)

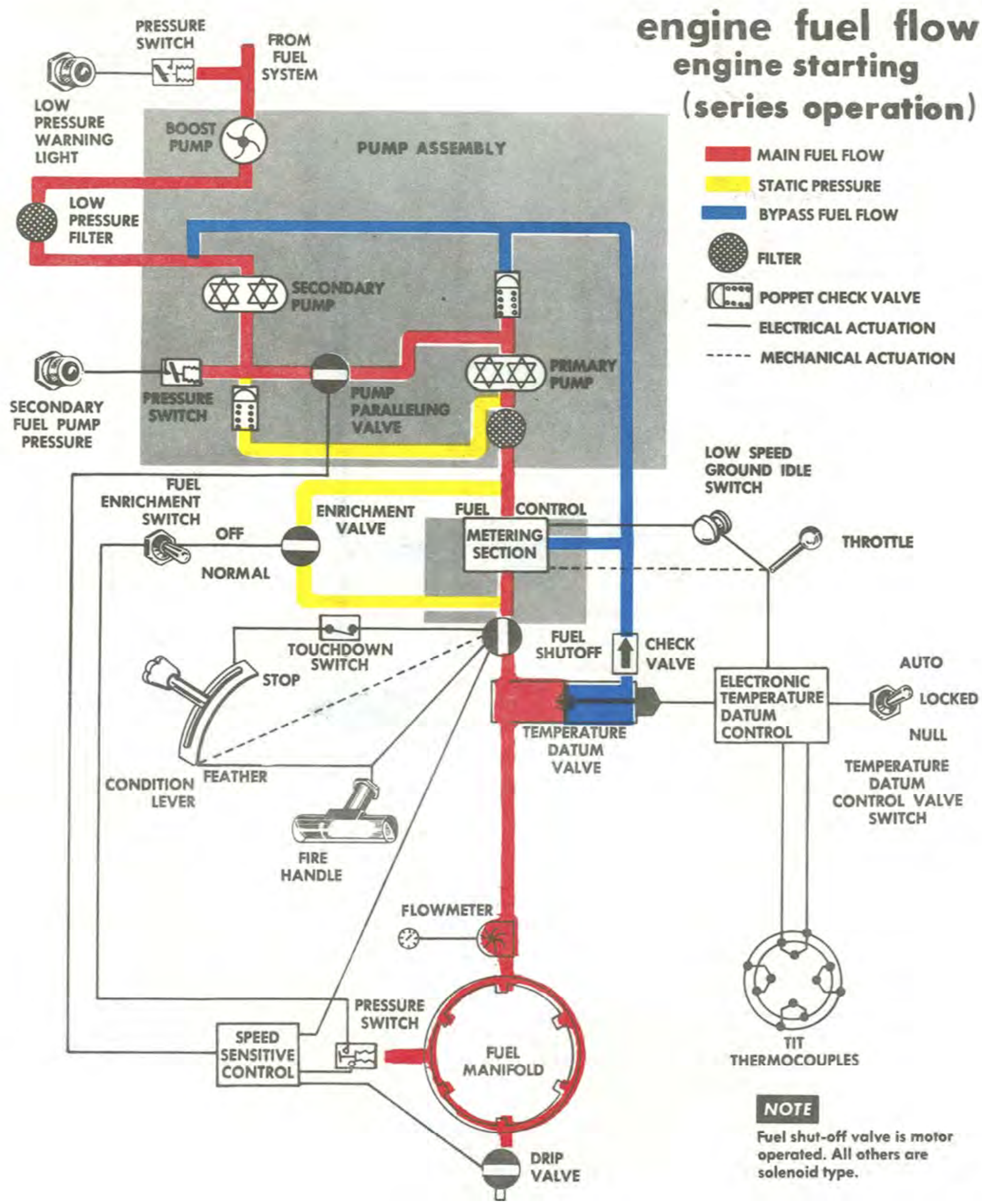
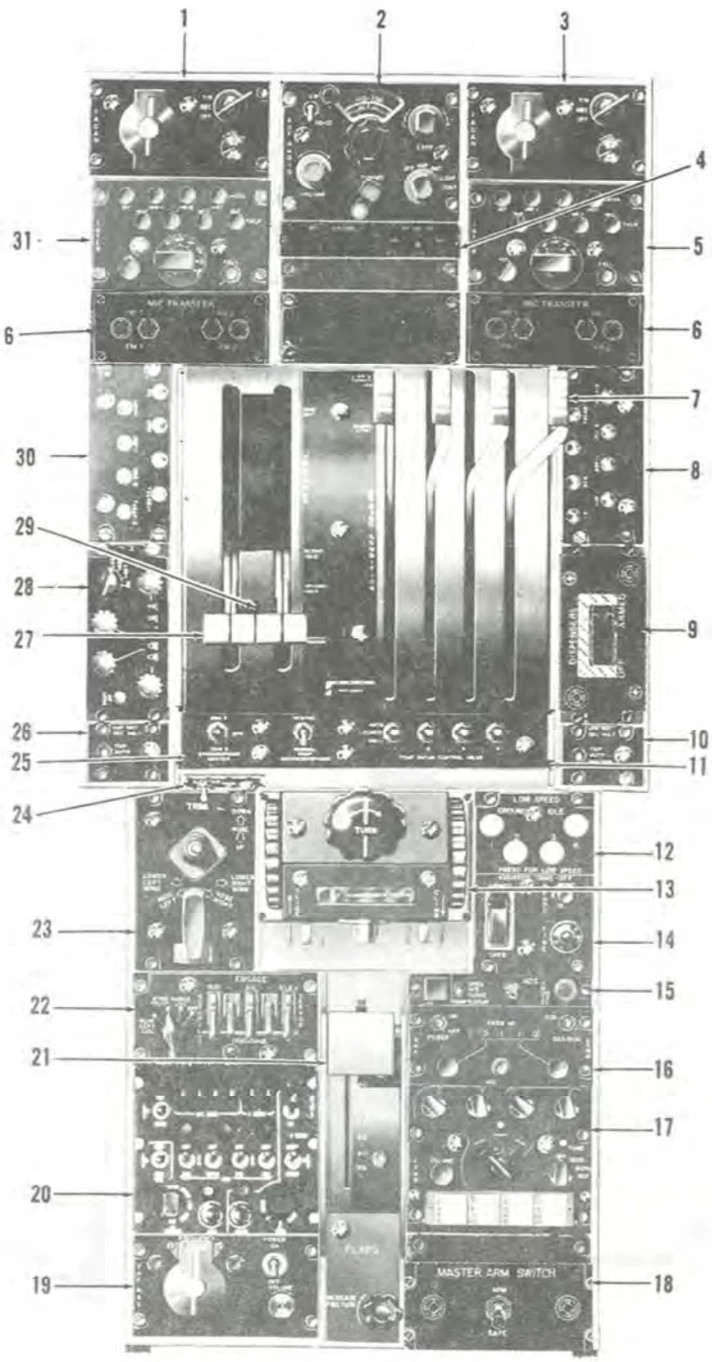


Figure 1-12. (Sheet 2 of 2)

flight control pedestal



1. NO. 1 TACAN CONTROL PANEL
2. RADIO COMPASS CONTROL PANEL
3. NO. 2 TACAN CONTROL PANEL
4. IFF ANTENNA SWITCH AND CAUTION LIGHT PANEL
5. COPILOT'S INTERCOM CONTROL PANEL
6. MIC TRANSFER PANEL
7. ENGINE CONDITION LEVERS
8. COPILOT'S INTERCOM MONITOR PANEL
9. FLARE MASTER ARM SWITCH PANEL
10. NO. 2 UHF ANTENNA SELECTOR
11. TEMP. DATUM CONTROL VALVE SWITCH PANEL
12. LOW SPEED GROUND IDLE PANEL
13. AUTOPILOT CONTROLLER
14. ASSISTED TAKE-OFF CONTROL PANEL
15. ADS (AIR DROP SYSTEM) CONTROL PANEL
16. VHF COMMAND CONTROL PANEL
17. UHF COMMAND CONTROL PANEL
18. MASTER ARM SWITCH PANEL
19. NO. 1 VHF NAVIGATION PANEL
20. IFF TRANSPONDER CONTROL PANEL
21. FLAP LEVER
22. AUTOPILOT CONTROL PANEL
23. TRIM TAB CONTROL PANEL
24. ELEVATOR TAB POWER SWITCH
25. PROPELLER SYNCHROPHASER CONTROL PANEL
26. NO. 1 UHF ANTENNA SELECTOR
27. THROTTLES
28. LIAISON RADIO CONTROL PANEL
29. THROTTLE FRICTION KNOB
30. PILOT'S INTERCOM MONITOR PANEL
31. PILOT'S INTERCOM CONTROL PANEL

Figure 1-13.

rate of increase and decrease of fuel metering for acceleration and deceleration.

Throttles.

The throttles (see figure 1-13) are quadrant-mounted on the flight control pedestal. Throttle movement controls engine operation by positioning propeller controls and by positioning controls to select the rate of engine fuel flow. Throttle movements are transmitted through mechanical linkage to an engine-mounted coordinator. The coordinator transmits the movements through mechanical linkage to the propeller and to the engine fuel control, and it also actuates switches and a potentiometer which affect electronic temperature datum control system operation. Each throttle has two distinct ranges of movement, taxi and flight, which are separated by a stop. (See figure 1-14.) Both ranges are used for ground operation, but the taxi range must not be used in flight. In the taxi range, the throttle position selects a propeller blade angle and a corresponding rate of fuel flow. In the flight (governing) range, throttle position selects a rate of fuel flow to produce a scheduled turbine inlet temperature; and the propeller governor controls propeller blade angle. The throttles have the following four placarded positions (figure 1-14):

MAXIMUM REVERSE - (0 degrees travel) gives maximum reverse thrust with engine power approximately 80 percent of maximum power.

GROUND IDLE - (Approximately 18 degrees travel) is a detent position. This is the ground starting position at which blade angle is set for minimum thrust.

FLIGHT IDLE - (34 degrees travel) is the transition point between the taxi and flight (governing) ranges. A stop in the quadrant limits aft travel of the throttle at this position until the throttle is lifted.

TAKE-OFF - (90 degrees travel) is the maximum power position.

The throttle quadrant is also divided into two unmarked ranges with respect to control of the electronic temperature datum control system. The crossover point is at 65 degrees throttle travel, at which point the switches in the coordinator are actuated. Below this point, the electronic temperature datum control system can limit turbine inlet temperature. Above this point, it is controlling turbine inlet temperature.

throttle quadrant

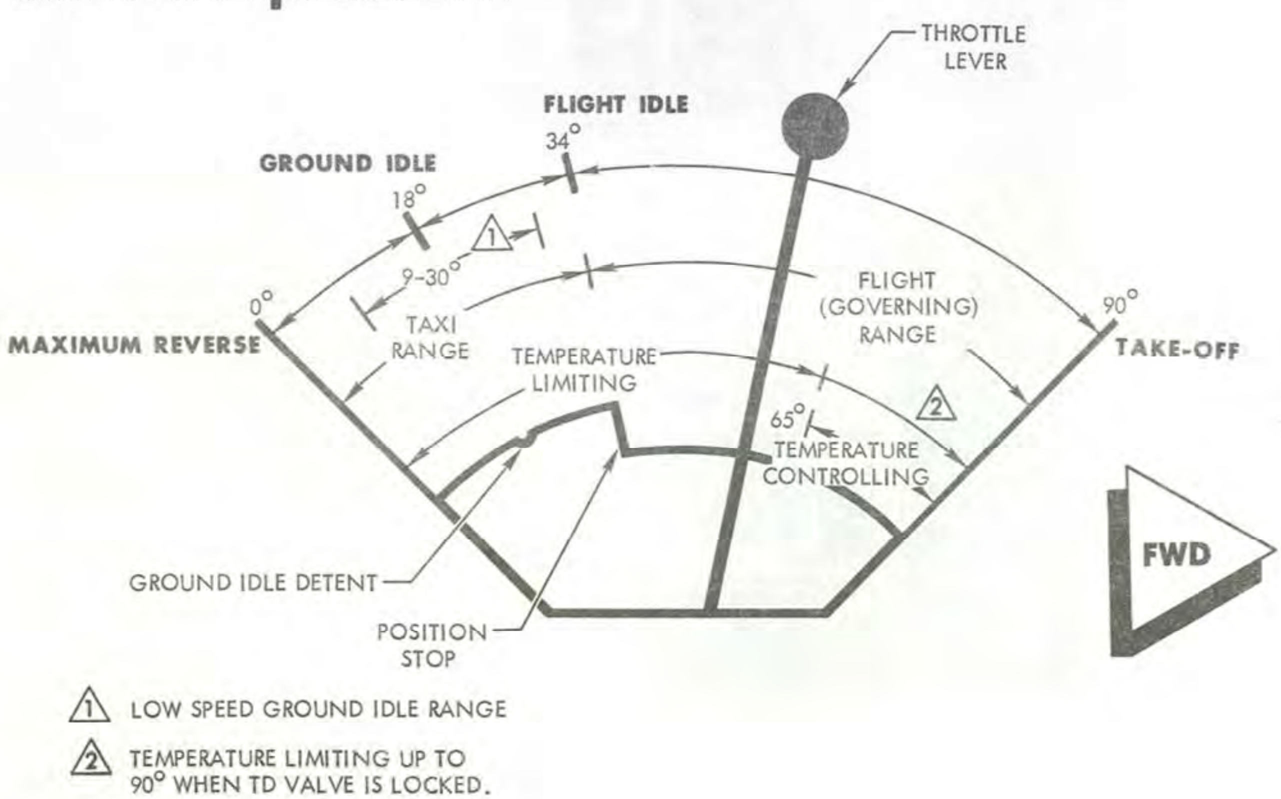


Figure 1-14.

low speed ground idle panel

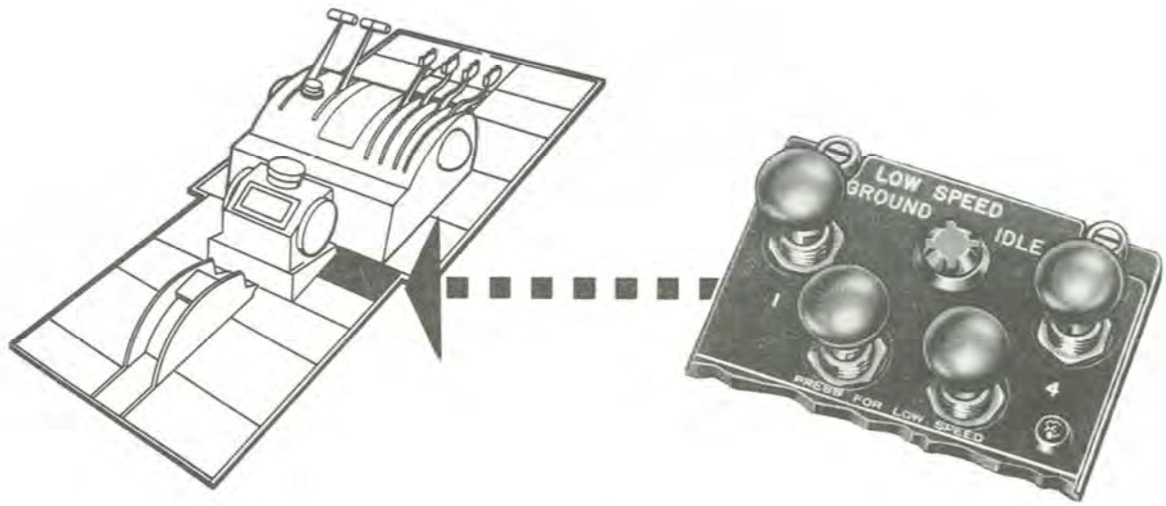


Figure 1-15.

Low-Speed Ground Idle Control.

Four low-speed ground idle control buttons (figure 1-15) located on the control pedestal may be pushed in to reduce fuel flow from the fuel control, thus causing engine rpm to drop to approximately 72 percent at any time the throttles are in the range between 9 degrees and 30 degrees. Moving the throttles out of this range will automatically disengage the low-speed ground idle buttons. Power is supplied from the 28-volt essential dc bus through the low-speed ground idle circuit breakers on the copilot's side circuit breaker panel.

Throttle Friction Knob.

A friction knob (see figure 1-13) on the throttle quadrant adjusts the amount of friction applied to the throttles to prevent creeping or accidental movement.

Engine Condition Levers.

Four pedestal-mounted condition levers (see figure 1-13) are primarily controls for engine starting and stopping and propeller feathering and unfeathering.

They actuate both mechanical linkages and switches which provide electrical control. Each lever has four placarded positions:

RUN is a detent position. At this position, the lever closes a switch which places engine fuel and ignition systems under control of the speed-sensitive control. For engines No. 2 and No. 3, the ice detection system is energized.

AIR START is a position attained by holding the lever forward against spring tension. In this position, the lever closes the same switch closed by placing the lever at RUN, and in addition closes a switch which causes the propeller auxiliary pump to operate, thus providing pressure to unfeather the propeller.

GROUND STOP is a detent position. In this position, the lever actuates a switch which causes the electrical fuel shutoff valve on the engine fuel control to close, if the airplane is on the ground and the landing gear touchdown switches are closed. The switch also energizes the nacelle preheat control circuit.

FEATHER is a detent position. When the lever is pulled toward this position, mechanical linkages transmit the motion to the engine-mounted coordinator and from the coordinator to the propeller and to the shutoff valve on the engine fuel control. Switches are also actuated by the lever as it is pulled aft. The results of moving the lever to FEATHER are the following:

The propeller receives a feather signal mechanically and electrically energizes the feather solenoid valve.

The fuel shutoff valve on the engine fuel control is closed both mechanically and electrically.

The propeller auxiliary pump is turned on, providing pressure to feather the propeller.

temperature datum control valve switch panel

Figure 1-16.

The nacelle preheat system remains operable only when the airplane is on the ground.

Temp Datum Control Valve Switches.

Four temperature datum control valve switches (figure 1-16) are mounted on a control panel at the aft end of the flight control pedestal. Each switch has AUTO, LOCKED, and NULL position. The switch positions are used as follows:

The AUTO position permits normal operation of the electronic temperature datum control system by applying single-phase, ac power to the amplifier from the ac instrument and engine fuel control bus through an engine fuel and temperature control circuit breaker on the pilot's lower circuit breaker panel.

The LOCKED position may be set when the throttles are in temperature-controlling range, to provide a fixed percentage correction on the metered fuel flow throughout the engine operating range to maintain a symmetrical shaft horsepower. If the TD control valve switch is then positioned at LOCKED, the TD valve is locked at whatever position it is in at the time. The TD valves remain locked and the fuel correction lights remain out through all throttle movements, unless an overtemperature condition is sensed by the amplifier. When the switch is in the LOCKED position, the TD valve for an engine is unlocked and moves toward a take position if turbine inlet temperature for the engine exceeds normal temperature limiting. If a valve is unlocked by its control system to correct an overtemperature condition, the fuel correction light for that engine illuminates to indicate that the valve has unlocked to correct for the overtemperature. Overtemperature protection is still available. Resetting the system for locked operation will extinguish the light.

Note

The switches lock a fuel correction only when they are positioned at LOCKED while the throttle is in temperature controlling range and the fuel correction light is out. If the switches have not been placed in the LOCKED position and the throttles are moved out of the temperature controlling range, the TD valves return to the NULL position.

The NULL position removes ac power from the control system amplifier; and the TD valve, receiving no control signals, returns to its null position so that it does not correct the fuel flow according to turbine inlet temperature. The TD valve brake is released by 28-volt dc power supplied from the essential dc bus through the engine fuel control circuit breakers located on the copilot's side circuit breaker panel.

The NULL position of these switches is used to deactivate the electronic temperature datum control systems when erratic fuel scheduling is suspected or when the engines are not operating.

Electronic Fuel Correction Lights.

The electronic fuel correction amber lights (figure 1-17) are located on the pilot's instrument panel.

electronic fuel correction panel

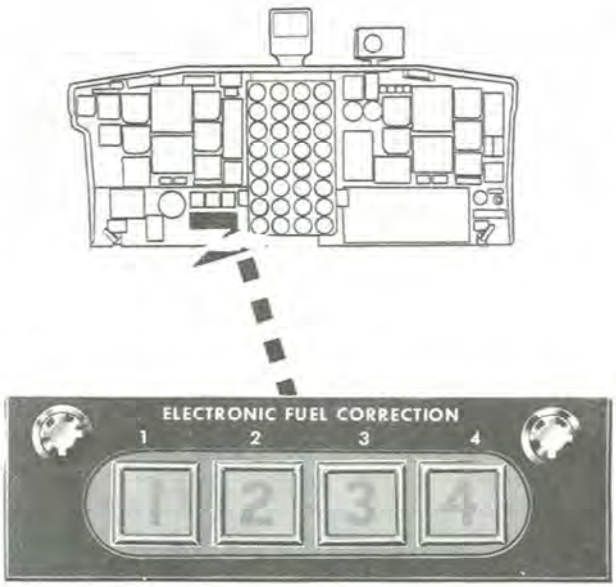


Figure 1-17.

The lights are on while the throttles are in temperature-limiting range (below 65 degrees) and go out when the throttles are advanced to the temperature-controlling range (above 65 degrees).

Starting Control System.

The starting control system automatically controls fuel flow and ignition during ground and air starts. Electric power for the control circuits is supplied from the essential dc bus through engine start control circuit breakers and the ignition control circuit breakers on the copilot's side circuit breaker panel. Provisions are made for using the battery to energize these circuits when all the air output of the gas turbine compressor is required to drive the starter. The automatic control of the starting control system has a speed-sensitive control and a speed-sensitive valve, which are engine-driven. The speed-sensitive control performs the following functions:

On acceleration to 16 percent rpm, the fuel shutoff valve in the engine fuel control is opened, the ignition relay is energized completing circuits to the ignition exciter, the engine fuel pump paralleling valve closes, the fuel enrichment valve opens, and the manifold drip valve closes.

On acceleration to 65 percent rpm - ignition system is de-energized, fuel pump paralleling valve is opened to return pumps to series operation, manifold drip valve is de-energized (it is then held closed by pressure).

On acceleration to 94 percent rpm - electronic temperature datum control system is switched from start limiting to normal limiting, and the speed-sensitive valve opens to allow 14th stage bleed air to force the 5th and 10th stage acceleration bleed valves closed. The TD valve take capability changes from 50 percent to 20 percent.

Engine Ground Start Switches.

The engine ground start switches are located on the engine starting panel on the overhead control panel. Each switch is used to open the starter air regulator valve to permit operation of the starter. The switch button is pushed in manually and held until the starter out rpm (60 percent) is attained. The button can be released at any time to discontinue starter operation. A red light in the button glows as long as the starter button is held in.

Each engine starting circuit is electrically interlocked with the corresponding engine oil fire shutoff valve control circuit. This renders the starting circuit inoperative unless the fire handle is pushed in and the oil fire shutoff valve circuit breaker is engaged.

Engine Fuel Enrichment Switches.

The engine fuel enrichment switches (figure 1-18) are located on the engine starting panel. They are toggle switches with NORMAL and OFF positions. In NORMAL, each switch allows the engine fuel enrichment valve to be controlled by the speed-sensitive control and manifold pressure switch during starting. The OFF position is provided to permit deactivating the fuel enrichment system for any engine.

Engine Bleed Air Valve Switches

The engine bleed air valve switches are located on the anti-icing systems control panel on the overhead panel. They are toggle switches with OPEN and CLOSE positions. Each switch controls a motor-driven bleed air valve in the aft section of the engine nacelle, just forward of the wing beam. When the valve

engine starting panel

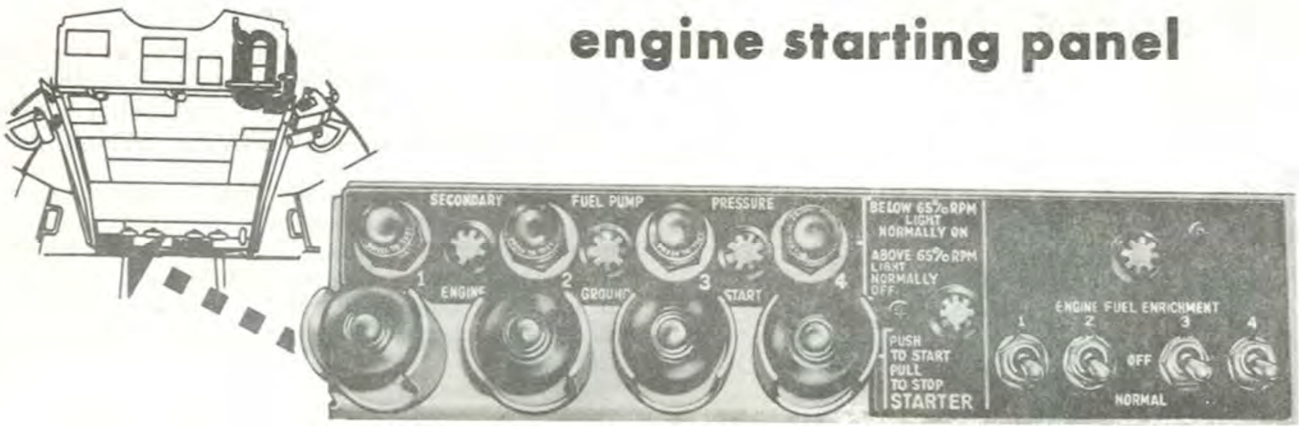


Figure 1-18.

is opened, it allows bleed air to flow from the bleed air system manifold to the starter valve, the nacelle preheat valve, and the inlet air scoop anti-icing valve; or, if the engine is running, it allows air to flow from the bleed air manifold of the engine to the bleed air system. The valve is closed when necessary to prevent air flow from the engine to the bleed air system or from the bleed air system to the nacelle ducts. A check valve is provided to prevent back flow into the engine diffuser. The bleed air valves receive 28-volt dc power from the essential dc bus through the bleed air fire shutoff valve circuit breakers on the copilot's side circuit breaker panel.

Feather Valve and NTS Test Switch and Lights.

The feather valve and negative torque signal check system (figure 1-20) consist of a feather valve and NTS check switch, four indicator lights (one for each engine), four NTS check relays (one for each engine), and a feather valve switch and an NTS switch in each propeller control assembly. When the feather valve and NTS check switch is in the VALVE position, it completes the light circuits from the essential dc bus through the lights and contacts of each NTS check relay to the feather valve switch in each propeller control assembly. If the feather valve is manually positioned for feathering the propeller, it completes a circuit to ground for the corresponding indicator light. The light will come on to indicate that the feather valve is in position to feather the propeller. When the feather valve and NTS check switch is in the NTS position, it completes two circuits. One circuit is completed from the essential dc bus through each indicator light to a set of contacts in each NTS check relay. The other circuit is completed from the essential dc bus through the coil of each NTS check relay to the NTS check switch in the propeller control assembly. When a negative torque condition exists, the engine NTS plunger actuates a linkage which closes the NTS switch. The NTS switch completes a circuit to ground for the NTS check relay coil and energizes the relay. The relay actuates to provide a ground path for the light circuit and the relay coil. The relay will remain energized, and the indicator light will glow as long as the feather valve and NTS check switch is in the NTS position.

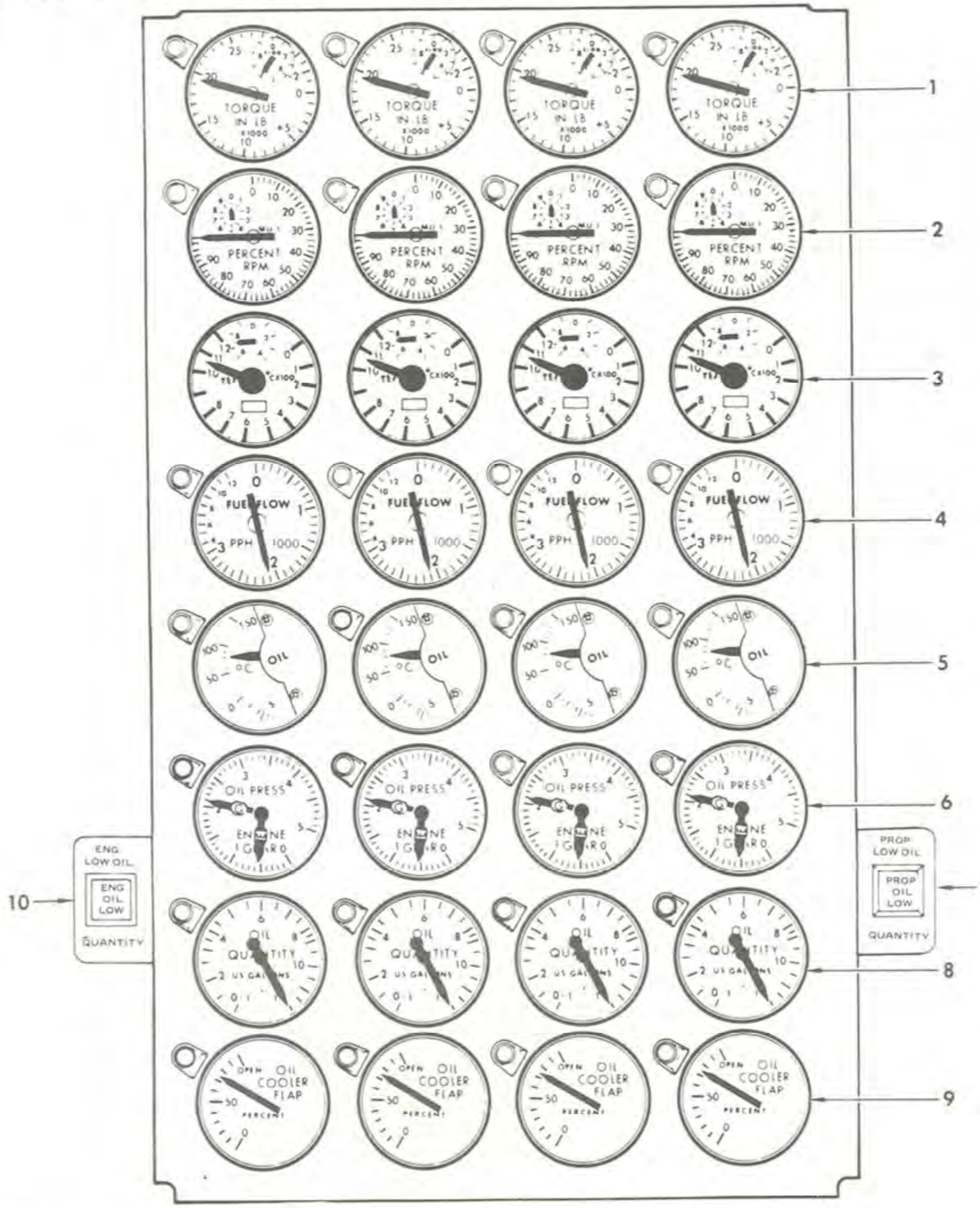
Engine Fire Handles.

The fire handles (figure 1-65) are located on the overhead control panel. Each handle contains turbine overheat warning lights and fire detection warning lights. Normal position of the handles is in. When a handle is pulled out, switches actuated by the handle cause the following electrical operations:

The shutoff valve on the engine fuel control is closed.
The engine oil shutoff valve is closed.
The firewall fuel shutoff valve is closed.
The firewall hydraulic shutoff valves are closed.
The engine bleed air valve is closed.
Engine starting control circuits are de-energized.
The propeller is feathered.
The fire extinguisher system control valves are positioned.
The extinguishing agent discharge switch is armed.

Refer to Fire Extinguisher System in this section for additional information on the fire handles.

Engine Instrument Panel



1. TORQUEMETER
2. TACHOMETER
3. TURBINE INLET TEMPERATURE
4. FUEL FLOW
5. OIL TEMPERATURE
6. OIL PRESSURE
7. PROP LOW OIL QUANTITY MASTER WARNING LIGHT
8. OIL QUANTITY
9. OIL COOLER FLAP POSITION
10. ENGINE LOW OIL QUANTITY WARNING LIGHT

Figure 1-19.

ENGINE INSTRUMENTS.

Torquemeters.

Each of the four torquemeters (figure 1-19) indicates torque in inch-pounds, and can indicate either positive or negative torque. The indicated torque is detected at the extension shaft between the engine power section and reduction gear assembly. The torquemeters receive 115-volt, single-phase ac power from the ac instrument and engine fuel control bus through the engine torquemeter circuit breakers on the pilot's lower circuit breaker panel.

Tachometers.

Each of the four tachometers (figure 1-19) indicates engine speed in percent of normal engine rpm. Normal rpm (100 percent) equals 13,820 engine rpm. A vernier dial on each indicator makes it possible to read to the nearest percent. The tachometer system has a separate engine-driven tachometer generator mounted on each engine that is not dependent upon the airplane electrical system for operation.

Turbine Inlet Temperature Indicators.

Each of the turbine inlet temperature indicators (figure 1-19) indicates temperature sensed by thermocouples in the engine turbine inlet casing. Each indicator registers temperature in degrees Centigrade and contains a vernier scale graduated in degrees. Single-phase, 115-volt power for the indicator systems is supplied from the ac instrument and engine fuel control bus through the turbine inlet temperature circuit breakers on the pilot's lower circuit breaker panel.

Fuel Flow Gages.

Each of the four fuel flow gages (figure 1-19) indicates flow in pounds per hour. Flow is measured at the point where it enters the manifold on the engine. Single-phase, 115-volt ac power is supplied to the indicator systems from the ac instrument and engine fuel control bus through the fuel flow circuit breaker on the pilot's lower circuit breaker panel. A single fuel flow power supply unit, which powers all fuel flow transmitters, receives 28-volt dc power from the essential dc bus through the fuel flow circuit breaker on the copilot's lower circuit breaker panel.

Note

For additional information on fuel indicators and pressure warning lights see Fuel System Indicators in this section.

Secondary Fuel Pump Pressure Lights.

Four secondary fuel pump pressure lights (figure 1-18) are located on the overhead engine starting control panel. Each light is controlled by a pressure switch on the engine fuel pump and filter assembly. The light is normally illuminated while the two gear pumps in the assembly are operating in parallel during engine starting (prior to 65 percent rpm). The light also illuminates at any other time if the pump paralleling valve is not open or if the primary gear pump fails. If the light does not illuminate during starting, it may indicate either the pump paralleling valve has not closed or the secondary pump has failed. The four lights receive 28-volt dc power from the essential dc bus through the fuel management secondary pump indicator lights circuit breaker on the copilot's side circuit breaker panel.

Oil Temperature Gages.

The four oil temperature gages (figure 1-19) indicate oil temperature in the oil inlet lines. The electrical-resistance type indicators receive 28-volt dc power from the essential dc bus through the engine oil temperature indicator circuit breaker on the copilot's side circuit breaker panel.

Oil Pressure Gages.

Four dual oil pressure gages (figure 1-19) register oil pressure for both the engine power sections and reduction gears. The rear needle marked G on each indicator shows reduction gear oil pressure; and the front needle marked E indicates power section oil pressure. The oil pressure gages receive 26-volt ac power from the instrument transformer through the gearbox indicator oil pressure and indicator engine oil pressure fuses on the pilot's lower circuit breaker panel.

PROPELLERS.

Each engine is equipped with a Hamilton Standard, four-blade, electro-hydromatic, full-feathering, reversible-pitch propeller. The propeller operates as a controllable-pitch propeller for throttle settings below FLIGHT IDLE and as a constant-speed propeller for throttle setting of FLIGHT IDLE or above. The major components of the propeller system are the propeller assembly, the synchrophasing system, the control system, and the anti-icing and deicing systems. The oil capacity of the pressurized sump is 6.5 quarts. The capacity of the complete system fully serviced including the pressurized sump is 26 quarts.

PROPELLER BLADES.

The propeller blades are of solid aluminum alloy with shanks which are partially hollow for weight reduction. The blade incorporates a fairing made of plastic foam (Lockfoam) covered with a nylon reinforced rubber material to direct the airflow into the engine. The blade gear segments, thrust bearings, oil seal, and deicing rings are located on the mounting end of the blades.

BARREL ASSEMBLY.

The principal functions of the barrel assembly are to retain the blades within the propeller assembly, to provide the means of attaching the propeller to the engine shaft, and to transmit engine torque to the blades. The barrel assembly is made in two sections which are bolted together to retain the propeller blades. The rear half of the assembly has an extension which is machined to fit over the splined engine shaft.

PITCH LOCK ASSEMBLY.

The pitch lock regulator assembly is located within the barrel assembly. Components of the pitch lock mechanism are a stationary pitch lock ratchet which is splined to the barrel, and a rotating pitch lock ratchet which is splined to the rotating cam within the dome assembly. The pitch lock mechanism prevents the blades from decreasing pitch if overspeeding of approximately 103 percent rpm occurs or if hydraulic pressure is lost. The stationary and rotating pitch lock ratchet rings are held disengaged by propeller oil pressure under control of the pitch lock regulator; they are spring-loaded to engage when the pressure is lost. However, when the ratchet rings are engaged, the propeller can still increase pitch to allow feathering. When an overspeed condition is sensed by the flyweight within the pitch lock regulator assembly, oil pressure is removed to allow the pitch lock ratchets to engage and prevent a decrease in blade angle. To release the pitch lock, the overspeed must be corrected to restore oil pressure, and the blade must increase a few degrees to disengage the ratchets. In order that pitch lock action will not interfere with normal reversing of the propeller the pitch lock ratchet rings are mechanically held apart by cam action throughout a blade angle range of a few degrees above the low pitch stop to full reverse. However, a propeller which has once locked pitch cannot be reversed, as its blade angle cannot be reduced. In case of inadvertent pitch lock see propeller failures in Section III.

DOME ASSEMBLY.

The dome assembly is mounted on the forward section of the barrel assembly. It contains the pitch changing mechanism and the low-pitch stop assembly. The pitch changing mechanism converts hydraulic pressure into mechanical torque. Its main parts are a piston assembly, a stationary cam, a rotating cam, and the dome shell. The piston is a double-walled assembly which fits over the two cams and inside the dome shell. The piston is held in place by rollers which ride in the cam tracks of both cams. The re of the rotating cam is connected to the propeller blades by beveled gears. As hydraulic pressure is applied to the piston, causing it to move, the rollers riding in the cam tracks turn the rotating cam, changing the blade angle. The low-pitch stop is located in the dome and mechanically stops the piston from decreasing blade angle below approximately 23 degrees in flight. The low-pitch stop is retracted to allow lower blade angles during ground operation.

CONTROL ASSEMBLY.

The propeller control assembly is mounted in the aft extension of the propeller barrel but does not rotate. It contains the oil reservoir, pumps, valves, and control components which supply the pitch changing mechanism with hydraulic pressure of the proper magnitude and direction to vary the propeller blade angle as required for the selected operating condition. The main components contained within the valve housing assembly section of the control assembly are the flyweight speed sensing pilot valve, feather valve, feather solenoid valve, and feather actuating valve. The pump housing assembly contains a scavenge, main, standby, and an electric-driven, double-element, auxiliary pump. The flow of fluid from these pumps is controlled by the valves in the valve housing assembly to accomplish the desired propeller operation. All mechanical and electrical connections necessary for propeller operation are made through the control assembly. The mechanical connections are linkages from the engine control system and the NTS (negative torque signal) system. The electrical connections are for oil level indication, pulse generator coil, auxiliary pump motor, synchrophasing system, NTS and feather switches, anti-icing and deicing systems, and the electric feathering system.

SPINNER ASSEMBLY.

The spinner assembly improves the aerodynamic characteristics of the propeller assembly. It encloses the dome, barrel, and control assemblies. It consists of a front section, rear section, and a non-rotating afterbody assembly. Cooling air is admitted through an air inlet at the front of the spinner and passes over the dome assembly, barrel assembly, and control assembly fins and exhausts through vents in the engine nacelle.

ANTI-ICING AND DE-ICING ASSEMBLY.

The anti-icing and de-icing assembly (figure 4-16) is made up of resistance-type heating elements which are incorporated on the leading edge and fairing of each blade and the entire spinner assembly for anti-icing and de-icing. Continuous anti-icing heaters cover the front portion of the spinner assembly and the entire afterbody assembly. Cyclic deicing heaters cover the remainder of the spinner front section, the spinner rear rotating section, the spinner plateaus, and the blade leading edge and fairing. Power from the air-

copilot's side shelf propeller controls

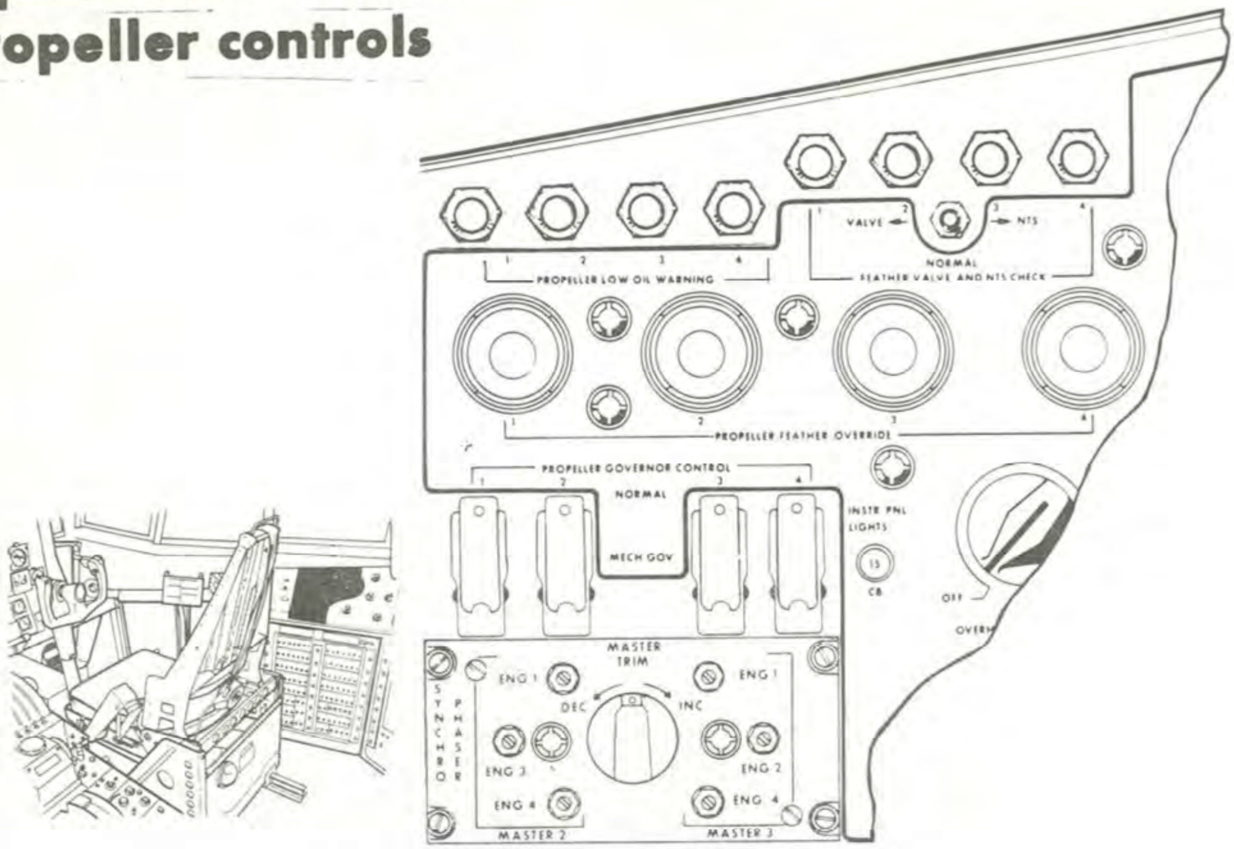


Figure 1-20.

plane electrical system is transmitted through the brush housing assembly, mounted on the stationary control assembly, through the rotating sliprings on the contact ring holder assembly, mounted on the aft end of the barrel, to the anti-icing and de-icing elements. Power to the blade heaters is transmitted through four brush housings mounted on the contact ring holder assembly to the blade sliprings.

PROPELLER LOW OIL WARNING LIGHTS.

A propeller low oil warning light for each propeller is located on the copilot's side shelf (figure 1-20): a propeller low oil quantity light, which acts as a master warning light, is located on the engine instrument panel (figure 1-19). The propeller low oil warning system is controlled by a float-actuated switch in each propeller control assembly. When the oil quantity for any propeller drops approximately 2 quarts below normal in the pressurized sump, the float-actuated switch closes and illuminates the propeller low oil warning light for that engine and the propeller low oil quantity light. If another propeller experiences a low oil quantity, the only indication will be from the propeller low oil warning light for that engine. The low oil warning lights receive 28-volt dc power from the essential dc bus through the propeller low oil level circuit breaker on the copilot's side circuit breaker panel.

PROPELLER SPEED CONTROL SYSTEM.

The speed of the propeller is controlled by the propeller governing system within the flight range of the throttle lever so as to maintain a constant rpm. Within the ground range, the propeller blade angle is a function of throttle lever position. The propeller does not govern the rpm within the ground range.

Propeller Governing System.

The principal function of the propeller governing system is to maintain a constant engine operating rpm. Propeller governing is accomplished by the action of the flyweight speed-sensing pilot valve. This valve is controlled by the mechanical action of the flyweights opposing the force of the speeder spring. When the propeller is in an on-speed condition, the pilot valve meters sufficient fluid to the increase pitch or forward side of the dome assembly piston to overcome the centrifugal twisting moment and maintain the required blade angle. When an overspeed condition occurs, the flyweight force overcomes the speeder spring force, and the pilot valve moves to increase the flow to the increase pitch side of the piston to increase blade angle and cause the propeller to slow down. If the propeller slows below governed speed, the force of the speeder spring overcomes the force exerted by the flyweights, and the pilot valve meters fluid to the aft side of the dome assembly piston to decrease blade angle and allow the propeller to increase speed. The low-pitch stop prevents the propellers from decreasing blade angle below approximately 23 degrees while the throttles are in the flight range.

Electronic Propeller Governing.

The synchrophaser electronic unit provides circuits for the following governing functions: speed stabilization (derivative), throttle anticipation, and synchrophasing. The propeller mechanical governor will hold a constant speed in the flight range, but throttle changes will cause the governor to overspeed or underspeed while trying to compensate for the change in power. A stabilization circuit stabilizes the mechanical governor during these changes when the propeller governor control switch is in the NORMAL position by sending a signal to the speed bias servo control motor to change the speeder spring compression. The throttle anticipation circuit stabilizes the propeller speed during rapid movement of the throttle when the propeller governor control switch is in the NORMAL position. Throttle movement rotates the anticipation potentiometer in the propeller control assembly sending a signal to the anticipation circuit which sends an amplified signal to the speed bias servo control motor to change the speeder spring compression. The synchrophasing system acts to keep all the propellers turning at the same speed, and it maintains a constant rotational position relationship between the blades to decrease vibration and to lower the noise level. The system uses either No. 2 or No. 3 engine as the master engine, and it relates the blade position of the other three engines to the master. The blade position of a slave engine is changed by moving the pilot valve to increase or decrease the speed of that engine. The synchrophasing circuit determines blade position by comparing an electrical pulse generated by each slave propeller to a modified pulse from the master propeller. If the blades are in the correct position, the resultant voltage of the slave and master pulse will be zero. Any deviation in blade position will produce a positive or negative voltage from the two compared pulses. This voltage drives the speed bias servo control motor to change the speeder spring compression, correcting the blade position. If propeller operation is erratic, see Propeller Failures in Section III.

NTS (NEGATIVE TORQUE SIGNAL) SYSTEM.

The NTS (negative torque signal) system provides a mechanical signal to limit negative torque. Negative torque is encountered when the propeller attempts to drive the engine. If not relieved, this condition creates a great amount of drag, causing the airplane to yaw. The NTS system consists of an actuating mechanism housed partly within the reduction gear assembly and partly in a signal assembly in the propeller valve housing. It operates when negative torque applied to the reduction gear exceeds a predetermined value of -1260 (±600) inch-pounds. A ring gear is then moved forward against springs as a result of a torque reaction generated through helical splines. In moving forward, the ring gear pushes a plunger through the nose of the gearbox. The plunger pushes against a cam in the signal assembly to actuate control linkage connected to the propeller valve housing. When a negative torque signal is transmitted to the propeller, the propeller increases blade angle to relieve the condition, except when the throttles are below the FLIGHT IDLE position. When the throttles are below FLIGHT IDLE, a cam moves the actuator away from the NTS plunger and renders the system inoperative. This is necessary to prevent a propeller from receiving a possible negative torque signal at high landing speeds when the throttles are moved toward reverse. If the negative torque is sufficiently reduced, the signal mechanism returns to normal by springs acting on the ring gear.

Note

> The NTS does not normally commit the propeller to feather. However, a malfunctioning NTS system may completely feather the propeller or cause engine to stall/flame out on landing or descent.

PROPELLER CONTROLS.

Propeller controls include the throttles, condition levers, fire handles, synchrophaser master switch, prop resynchrophase switch, synchrophaser trim controls, propeller governor control switches, fuel governor check switches, feather override buttons, and feather valve and NTS check switch.

Throttles.

Each throttle (figure 1-13) is mechanically linked through the engine coordinator to an input shaft on the propeller control assembly. When the throttle is in the governing range, between FLIGHT IDLE and TAKE-OFF positions, the input shaft rotates with throttle movement, but it has no effect on propeller speed except normal throttle anticipation and speed stabilization action. When the throttle is in the range below FLIGHT IDLE, movement of the throttle is transmitted to the speed-sensing pilot valve to increase or decrease blade angle. The maximum negative blade angle is obtained when the throttle is at MAXIMUM REVERSE. Approximate minimum thrust angle is obtained when the throttle is at GROUND IDLE. When the throttle is moved below FLIGHT IDLE, a cam locks out the NTS system and a switch interrupts synchrophaser signals to the propeller.

Engine Condition Levers.

The engine condition levers (figure 1-13) serve as feathering and unfeathering controls. Each lever is mechanically linked to the engine coordinator, which transmits the motion of the lever to the propeller linkage only when it is moved to the FEATHER position. When the condition lever is moved to the FEATHER position the pilot valve is ported to increase pitch, and the feather valve moves to the feather position. The condition lever also actuates a switch in the control pedestal, completing a circuit to the holding coil of a propeller feather override button on the copilot's side shelf. The propeller feather override button pulls in and completes circuits to energize a feather solenoid and the auxiliary pump motor. The feather actuating valve and feather solenoid valve route fluid to position the feather valve and pilot valve for propeller feathering. When the feather valve reaches the position to feather the propeller, the feather valve and NTS check light illuminates if the cockpit switch is in the VALVE position. When the propeller blades reach feather angle, a pressure buildup occurs and actuates a pressure cutout switch in the control assembly, which opens the holding circuit for the propeller feather override button. For unfeathering, the engine condition lever is held in the AIR START position. A switch is actuated to turn on the auxiliary pump, and the pump continues to operate as long as the lever is held in this position. When the engine condition lever is in the AIR START position and the auxiliary pump is operating, fluid is routed to the aft side of the dome assembly piston through the propeller governor to move the blades toward low pitch angle. When the condition lever is in GROUND STOP or RUN positions it has no effect on the propeller controls.

Fire Handles.

When the engine fire handle (figure 1-65) is pulled it closes the circuit to stop the engine and to energize the propeller feather override button, which in turn energizes the auxiliary pump motor and the feathering solenoid valve. The feathering solenoid valve routes fluid to position the feather valve and pilot valve to feather the propeller.

Synchrophase Master Switch.

The synchrophase master switch (figure 1-21) is located on the flight control pedestal. This three-position (ENG 2, OFF, ENG 3) toggle switch controls the operation of the synchrophasing system and selects the engine to be used as the master. When the switch is in the ENG 2 position, the number 2 engine is selected as the master and the other propeller rotational speeds and blade phase angles are referenced to this engine. When the switch is in the OFF position, there is no synchrophasing and the propellers operate in normal governing. When the switch is in the ENG 3 position, the No. 3 engine is the master and the other propellers are referenced to this engine.

Prop Resynchrophase Switch

The propeller resynchrophase switch (figure 1-21) is a two-position (NORMAL, RESYNC) toggle switch located on the flight control pedestal. The switch is spring-loaded to the NORMAL position. When the switch is placed in the RESYNC position, the speed bias servo motors of the slave propellers are repositioned to the midpoint of their travel range, and speeds of the propellers remain the same until the switch is released to the NORMAL position. Each time the switch is placed in RESYNC and released, the speed of the slave propellers can change approximately 2 percent to a maximum of approximately ±5 percent from the optimum 100 percent. When the switch is held in the RESYNC position for 1 to 2 seconds and then released to NORMAL, it takes the synchrophasing system as long as 1 minute to correct the phase angle and speed of the propellers.

Synchrophaser Trim Controls

The synchrophaser master trim knob is located on the copilot's side shelf (figure 1-20). It positions a potentiometer for altering the speed of the master engine. Full travel of the master trim knob will change the speed of the master engine plus or minus one percent. The six screwdriver adjustments located around the master trim knob are for maintenance adjustment only.

Propeller Governor Control Switches.

The four propeller governor control switches are two-position (NORMAL, MECH GOV) guarded toggle switches located on the copilot's side shelf (figure 1-20). When the switches are in the NORMAL position the throttle anticipation and speed stabilization (derivative) circuits are operative, and if the synchrophaser master switch is positioned to either master engine the blade rotational position of the slave engines is related to the master by the synchrophasing system. Placing a switch in the MECH GOV position disconnects the electrical speed control to that propeller, and the speed of the propeller is controlled by basic mechanical governing.

Fuel Governing Check Switches.

The four fuel governing check switches located on the aft end of the overhead control panel (located on the left-hand side of the overhead panel of the fire control officer's console on airplanes modified by T.O. 1C-130-949) are safety wired and are not to be used in flight.

Feather Override Buttons.

Four feather override buttons are located on the copilot's side shelf (figure 1-20). They provide a means for manually stopping the auxiliary pump at completion of the feather cycle. When the condition lever is moved to FEATHER or the fire handle is pulled, a circuit is completed to a holding coil of the propeller feather override button. The propeller feather override button pulls in and completes circuits to energize the auxiliary pump and feather

synchronization control switch panel

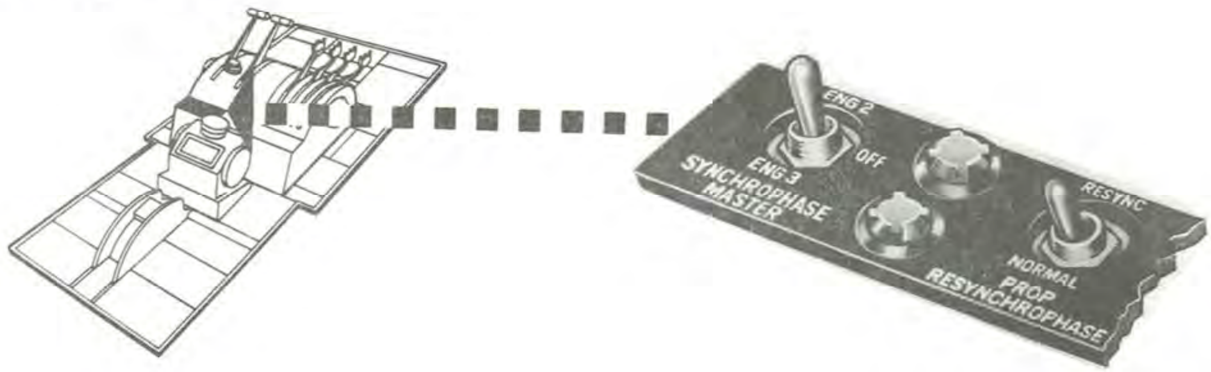


Figure 1-21.

solenoid. Normally, a pressure switch at the propeller opens the holding solenoid circuit when the blades reach feather and the button pops out. If the button fails to pop out after the feather cycle is completed, the button should be pulled out manually to turn off the auxiliary pump. The holding coil of the override button receives 28-volt dc power from the essential dc bus through the feather and air start or emergency feather circuit breakers on the copilot's side circuit breaker panel.

OIL SYSTEMS.

Independent oil systems, one for each engine, supply lubrication to the engine gearboxes and power sections. An oil tank is located in each nacelle above the engine and has a 12-gallon oil capacity and a 7.5-gallon expansion space. The oil feeds from the tank into the gearbox and power section of the engine, where it is picked up by scavenge pumps and driven through a heat exchanger and oil cooler back into the oil tank. Hot oil passing through the heat exchanger heats the engine fuel and prevents ice from forming in the fuel filter. Air flowing through an oil cooler duct and over the coils of the oil cooler absorbs excess heat from the oil. A thermostatic element, located in the oil tank return line, controls the oil temperature by regulating the amount of air flowing through the oil cooler duct. Four motor-operated valves provide an emergency means of shutting off oil flow to the engines when the fire handles are pulled. The valves receive 28-volt dc power from the essential dc bus through the oil fire shutoff valves circuit breakers on the copilot's side circuit breaker panel.

Each valve control circuit is eletrically interlocked with the corresponding engine starting circuit, so that the engine can be started only when the fire handle has been pushed in and the valve circuit breaker has been closed.

Oil used in this airplane must conform to the specification and grade listed in the servicing diagram, figure 1-72.

OIL SYSTEM CONTROLS.

Oil Cooler Flap Switches.

Airflow through the oil cooler is governed by a controllable oil cooler flap which restricts the opening of the oil cooler air exit duct. Four four-position (AUTOMATIC, OPEN, CLOSE, FIXED) toggle switches are located on the oil cooler flaps switch panel (figure 1-22) of the flight control overhead panel. These switches control the electrical circuits of the oil cooler flap actuators. When any of the four switches is in AUTOMATIC position, the position of the oil cooler flap is regulated by a thermostatic unit to cool the oil to approximately 80°C (176°F). In the OPEN or CLOSE positions (spring-loaded), the thermostat is excluded from the circuit, and the actuator is directly energized to open or close the oil cooler flap. When the switch is moved to the FIXED position, the flap actuator is de-energized and the flap will remain in the position it was in prior to moving the switch. Moving the switch to the AUTOMATIC position provides for all normal operations. OPEN, CLOSE, and FIXED positions are used to control the oil cooler flap actuator manually if the thermostatic control unit fails. The oil cooler flap actuators are energized through the oil cooler flap switches by 28-volt dc power from the essential dc bus through the oil cooler flaps circuit breaker on the copilot's side circuit breaker panel.

Engine Fire Handles.

Motor-operated shutoff valves, energized by 28-volt dc power and controlled by the fire handles on the en-

oil cooler flaps switch panel

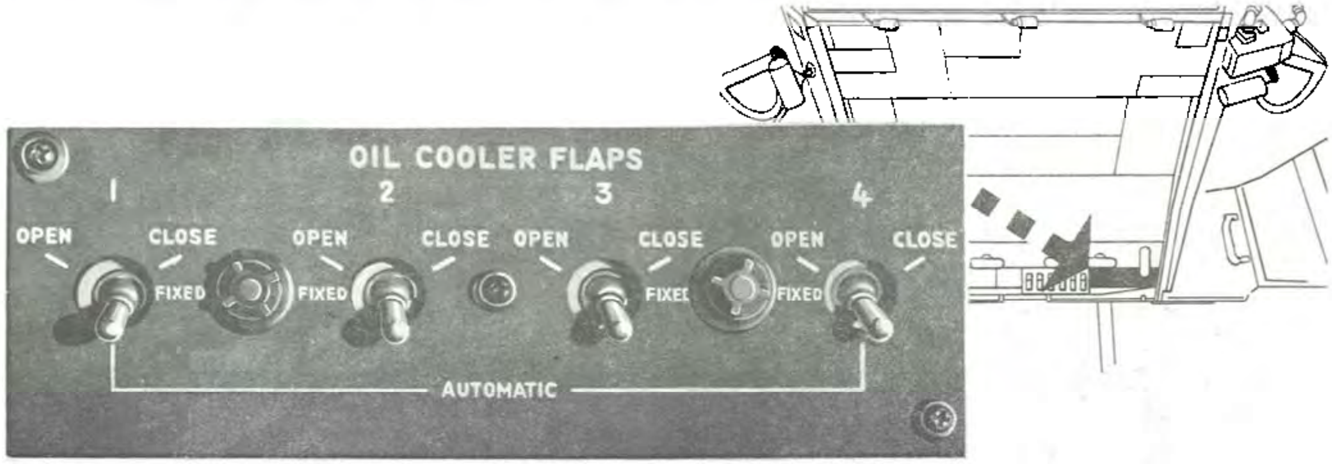


Figure 1-22.

gine fire panel, are installed in the engine oil systems to shut off the flow of oil at the bottom of the tank during an emergency. See Fire Extinguishing System in this section for other functions of engine fire handles.

OIL SYSTEM INDICATORS.

The oil system indicators are located on the engine instrument panel. Each engine has individual indicators on this panel.

Oil Quantity Gages.

Four oil quantity gages (figure 1-19), one for each engine oil system, are located on the engine instrument panel. Each instrument is calibrated from 0 (empty) to F (full) in increments of 2 quarts and numbered in gallons. The indicators are energized by 28-volt dc power from the essential dc bus through the oil quantity indicator circuit breaker on the copilot's side circuit breaker panel.

Low Oil Quantity Warning Lights.

A low oil quantity warning light (figure 1-19) is located on the engine instrument panel, left of the oil quantity indicators. The light is electrically connected to each oil quantity indicator transmitter, and illuminates when an oil tank quantity level drops to approximately 4.0 gallons. The light will be energized only on the first engine to have a low oil quantity. The warning light is energized by 28-volt dc power from the essential dc bus through the engine oil quantity light circuit breaker on the copilot's side circuit breaker panel.

Oil Cooler Flap Position Indicators.

Four oil cooler flap position indicators (figure 1-19), one for each engine oil system, are located on the engine instrument panel. The indicators are electrically connected to position transmitters that are geared to the oil cooler flap actuators. The indicator dials, calibrated from 0 to OPEN in increments of 10 percent, indicate the percent of opening of cooler flap doors. The indicators are energized by 28-volt dc power from the essential dc bus through the oil cooler flaps circuit breaker on the copilot's side circuit breaker panel.

FUEL SYSTEM.

The fuel system is a modified manifold-flow type, incorporating a fuel crossfeed system, a single point refueling and defueling system, and a fuel dump system. The system provides fuel supply for the four engines and the gas turbine compressor. It is adaptable to a number of flow arrangements (figure 1-23). Fuel specifications and grades are listed in the servicing diagram (figure 1-72). Nominal values for fully serviced and total usable capacities of the fuel tanks are shown in figures 1-25 and 1-26. A rectangular structure of polyurethane foam is installed in the internal tanks, external tanks, and all wing dry bays except the wing center dry bay. This provides the airplane with an explosion suppression capability which alleviates the possibility of airplane and personnel loss due to projectiles striking and penetrating

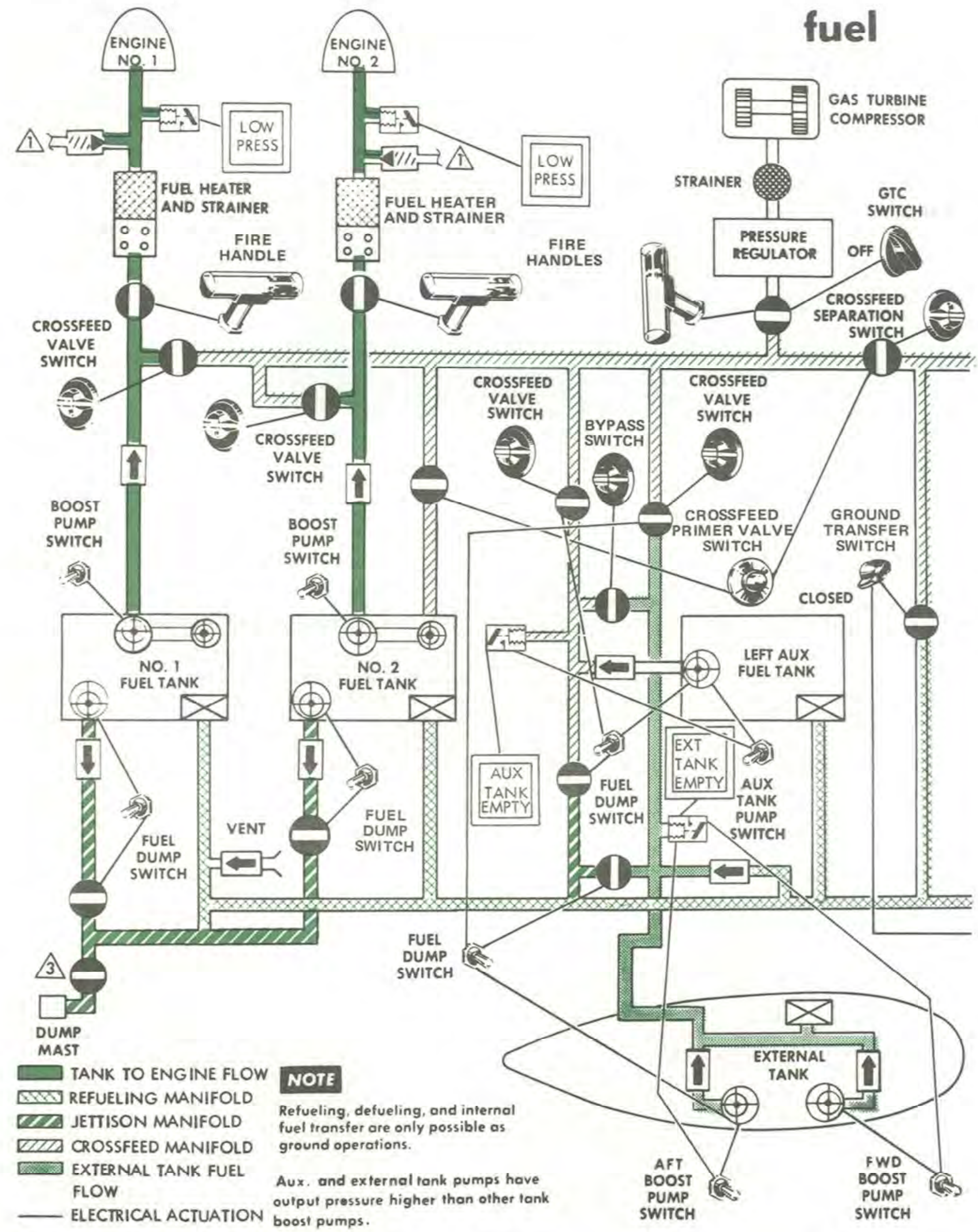


Figure 1-23. (Sheet 1 of 2)

system

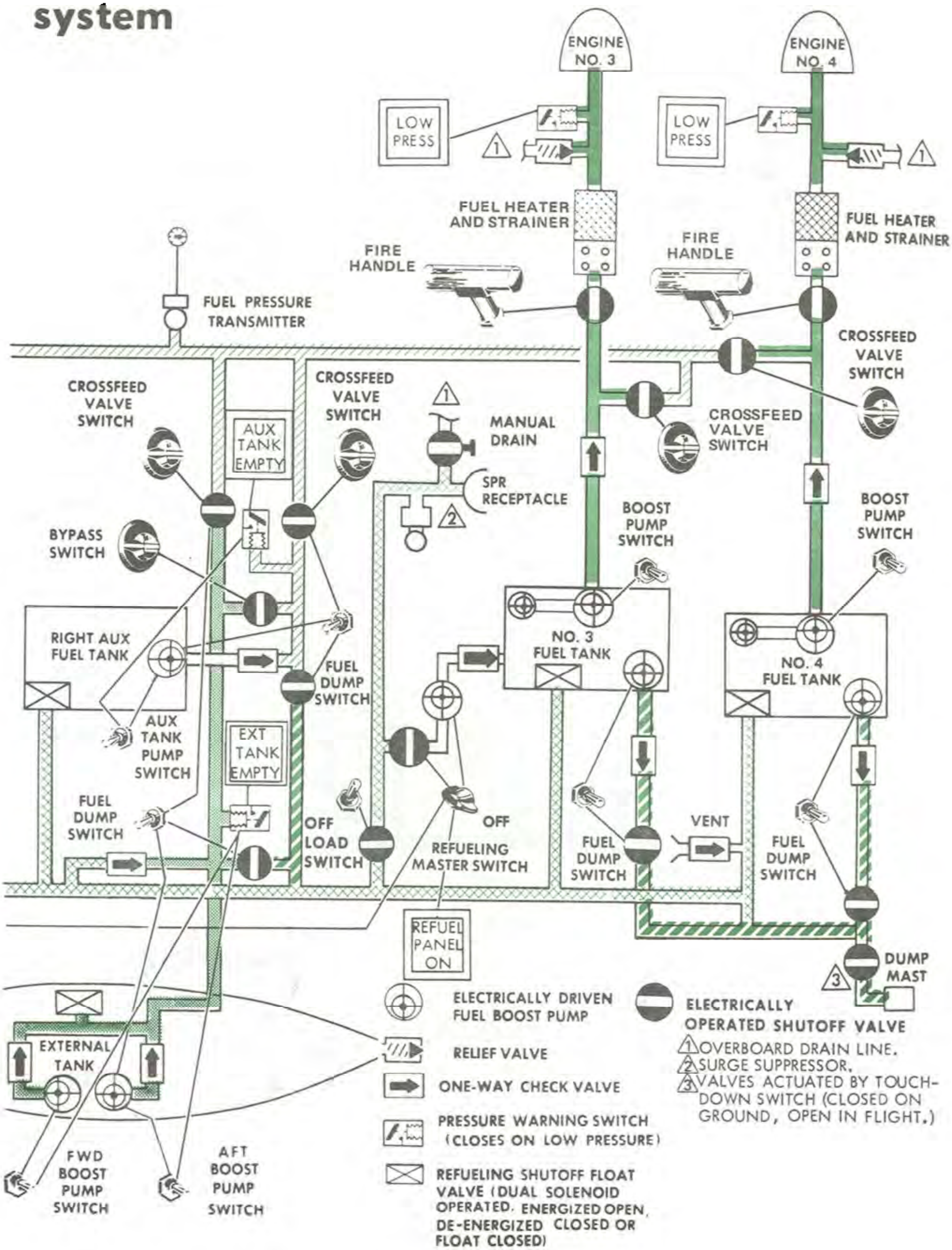


Figure 1-23. (Sheet 2 of 2)

fuel

(AIRPLANES MODIFIED BY T.O. 1C-130-949)

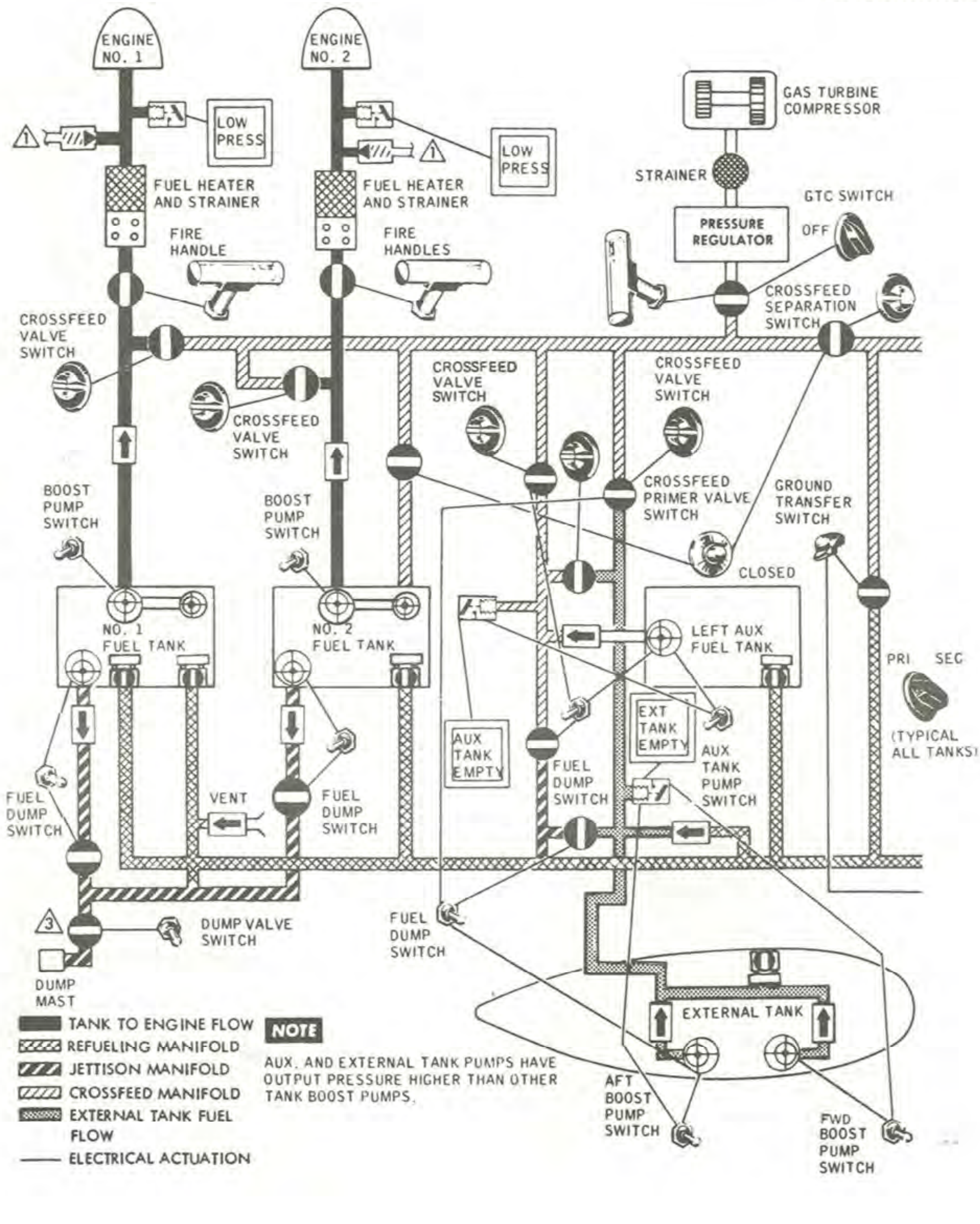


Figure 1-24. (Sheet 1 of 2)

system

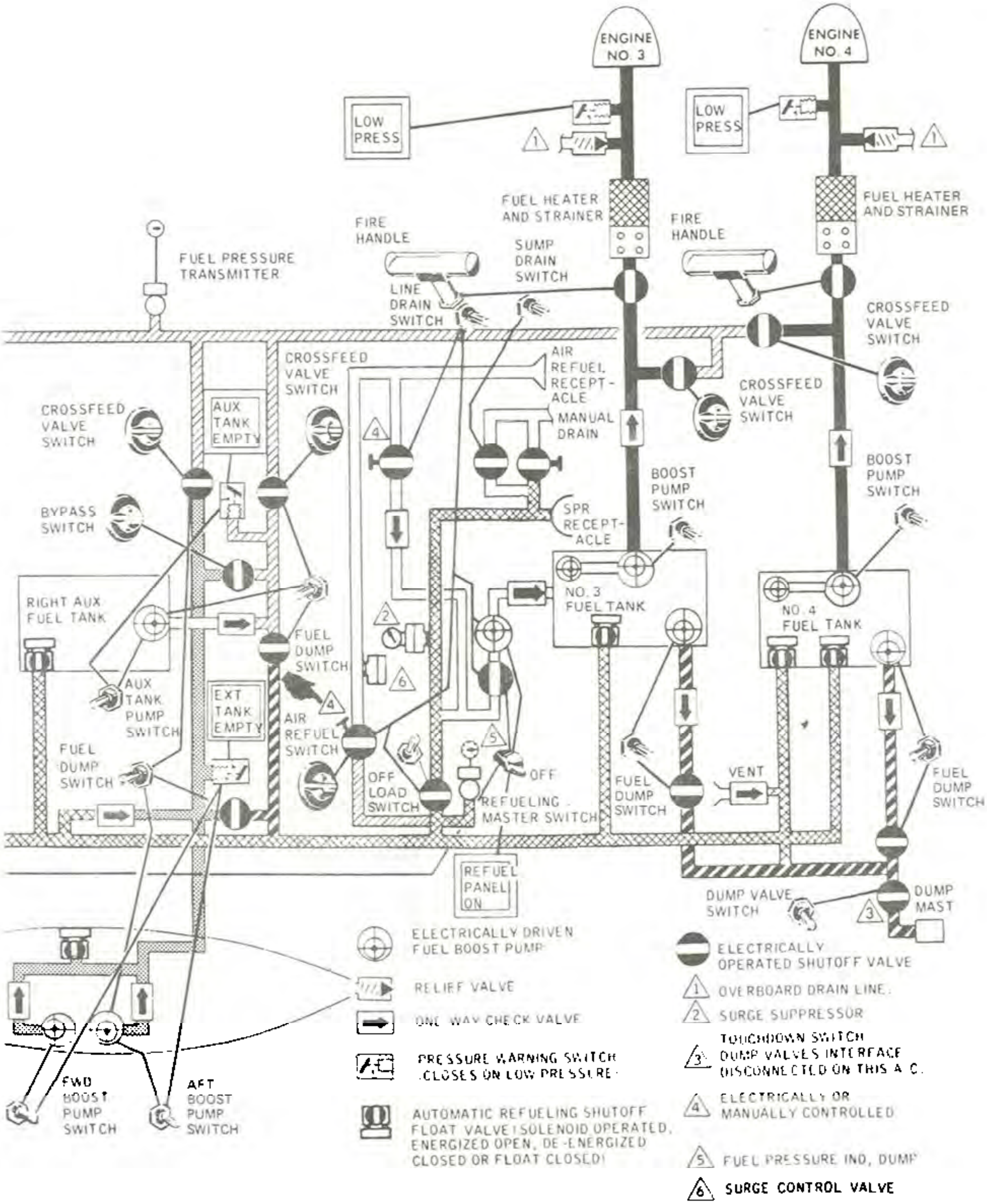


Figure 1-24. (Sheet 2 of 2)

the airplane. For system management, see Section VII. Airplane limitations resulting from use of alternate fuel are discussed in Section V.

FUEL FLOW.

Each engine may be supplied fuel either directly from the main respective fuel tank or through the crossfeed manifold system from any tank. Fuel for the GTC is supplied through the crossfeed manifold system also, and may come from any tank.

REFUELING AND DEFUELING.

All fuel tanks may be refueled or defueled from a single point ground refueling and defueling receptacle located in the right aft landing gear fairing. Fuel is routed from the single point receptacle through the refueling manifold. Each tank has a separate supply line from the manifold and each supply line has a float type shutoff valve. Refueling is controlled at the single point refueling control panel, located above the refueling receptacle. As an alternate method, tanks may be fueled separately through a filler opening in the top of each tank. (See Single Point Refueling and Defueling in Section IV.)

In-flight refueling is possible on airplanes modified by T.O. 1C-130-949.

Note

The auxiliary fuel tanks do not have filler openings in the wing.

INTERNAL TANKS.

There are six fuel tanks located within the wing. The number one, two, three, and four tanks are integral and use sealed wing structure for tank walls. The left and right auxiliary fuel tanks are each comprised of units of three bladder type cells. The three cells are interconnected to form one assembly and laced within the center wing section. Each of the six tanks has a three-phase, ac powered boost pump to assure fuel flow.

Fuel level around the boost pump is maintained through use of a jet-pump-ejector located in the inboard forward corner of each main tank. An additional pump is located in each main tank for fuel dumping.

EXTERNAL TANKS.

Two all-metal external fuel tanks are mounted under the wings on pylons between the inboard and outboard engines. The tanks are partially compartmented for center-of-gravity control. All fuel flows into the center compartment through check valves. A surge box in the tank center compartment contains a forward and an aft boost pump, providing dual reliability and an increased fuel dumping rate if both pumps are operated during fuel dumping. Both pumps have overriding output pressures which, under normal operation, assure depletion of fuel from the external tanks before the main tanks are affected.

VENT SYSTEM.

All of the fuel tanks are vented to the atmosphere to equalize pressure at all times. Tanks No. 2 and No. 3 and the left and right auxiliary have a wrap-around vent system. The wrap-around system permits venting for the above tanks even though the airplane is not in a wing-level attitude. Vent air leaving the tank passes through a vent tank on its way overboard. Any fuel entering the vent lines because of a change of attitude of the airplane collects in the vent tank and is returned to the tank continuously by a jet eductor pump operated by fuel flow taken from the booster pump discharge line. Boost pump pressure is necessary for the vent eductor system to operate. The extreme outboard tanks, No. 1 and No. 4 are vented by float-controlled valves to prevent fuel loss overboard on the ground when the airplane is not in a wing-level attitude and inflight when the wings deflect upward.

Note

The external tanks are vented through the spaces at the top of the bulkheads separating the tank compartments, and through the fuel vent line. The vent line runs from the forward compartment of the tank through the pylon and up into the wing trailing edge, where it vents to the atmosphere. Fuel will not fill the vent line because the tank is separated by compartments, and the line is at the top of the tank and runs upward to the wing.

FUEL STRAINER AND HEATER UNIT.

A combination fuel strainer and heater is located in the right side of each nacelle. Heat is transferred from engine oil to the fuel in the heater unit, and the temperature is thermostatically controlled.

CROSSFEED PRIMER SYSTEM.

A press-to-actuate crossfeed fuel primer valve switch is located on the fuel control panel (figure 1-32). This switch when depressed moves the motor-operated crossfeed fuel primer valve to the open position and opens the motor-driven crossfeed separation valve. This allows fuel to flow through the manifold into the No. 2 fuel tank to remove any trapped air. Normally, fuel from the No. 4 tank is used to prime the manifold. This requires that the No. 4 tank crossfeed valve be

fuel quantity data table

AIRPLANES NOT MODIFIED BY T.O. 1C-130-831

TANK	FULLY SERVICED SINGLE POINT REFUELING OR THROUGH INDIVIDUAL FILLER PORTS		USABLE FUEL △ LEVEL FLIGHT	
	GALS	LBS	GALS	LBS
TANK NO. 1	1350	8775	1340	8710
TANK NO. 2	1240	8060	1230	7995
TANK NO. 3	1240	8060	1230	7995
TANK NO. 4	1350	8775	1340	8710
LEFT AUXILIARY	910	5915	910	5915
RIGHT AUXILIARY	910	5915	910	5915
	TOTAL USABLE		6960	45240
LEFT EXTERNAL	1400	9100	1360	8840
RIGHT EXTERNAL	1400	9100	1360	8840
	TOTAL USABLE		9680	62920

DATA BASIS: CALCULATED, BASED ON 6.5 POUNDS PER GALLON OF JP-4 FUEL FOR INTERNATIONAL STANDARD DAY.

△ LEVEL FLIGHT = 4° NOSE UP ATTITUDE

NOTE ALL VALUES PRESENTED IN THE TABLE ARE NOMINAL

Figure 1-25.

open and No. 4 tank boost pump be on. Releasing the switch actuates the primer valve to the closed position and closes the crossfeed separation valve. The crossfeed fuel primer valve receives 28-volt dc power from the essential dc bus through the engine crossfeed valves prime circuit breaker on the copilot's side circuit breaker panel.

TANK SHUTOFF FLOAT VALVES (AIRPLANES MODIFIED BY T.O. 1C-130-949).

Solenoid operated refueling shutoff float valves (energized open, de-energized closed, or float closed) have been installed in each fuel tank on airplanes modified by T.O. 1C-130-949 in place of the dual solenoid valve. An additional shutoff valve of the same type has been installed in the outboard area of fuel tanks No. 1 and No. 4. The float valves in the outboard area of each outboard tank (No. 1 and No. 4) allow the tanks to receive a full load before automatic shutoff occurs while airborne when the wings are in the higher in-flight attitude, compared to the more nearly level attitude for ground servicing. Each tank shutoff valve contains a piston operated shutoff mechanism controlled by dual floats. The dual floats and associated solenoids are designated primary (PRI) and secondary (SEC), and are controlled by the single point refueling panel or the individual tank switches on the aerial refuel panel. On the single point refuel panel, when the master switch is in REFUEL & GND TRANS position and the tank switches are in OPEN position, both primary and secondary float valves are energized. The tank selector switches on the aerial refuel panel provides for energizing either the primary or secondary float valves individually, but not both simultaneously. All solenoids in all tanks must be operating properly when an air refuel operation is scheduled for the flight. Refer to Single Point Refueling and Defueling system and Air Refueling System paragraphs for additional details. The primary solenoids are energized by 28 vdc from the essential dc bus through PRIMARY TANK SOLENOID MAINS and PRIMARY TANK SOLENOID AUXILIARY AND EXTERNAL 5-ampere circuit breakers on the copilot's lower circuit breaker panel. The secondary solenoids receive 28 vdc power from the isolated dc bus through SECONDARY TANK SOLENOID MAINS and, AUXILIARY AND EXTERNAL 5-ampere circuit breakers on the pilot's side circuit breaker panel.

Surge Control Valve (Airplanes Modified by T.O. 1C-130-949).

A surge control valve is located in the air refueling line between the UARRSI receptacle and the air refueling valve to regulate in-flight fuel pressure to 45 to 60 psi.

Air Refueling Valve (Airplanes Modified by T.O. 1C-130-949).

The air refueling valve, located at approximately FS 508 overhead, is a 28-volt dc motor operated valve. Valve operating power is obtained from the essential dc bus through an air valve circuit breaker panel. The valve is relay controlled by the air refueling valve relay located overheat at FS 448. The relay is controlled from the aerial refueling amplifier switch on the air refuel panel. A secondary source of relay control is obtained when the line drain switch on the air refuel panel is placed to ON, which causes the valve to open if it is not already open. In the event of valve motor failure, the valve can be opened or closed manually by a red handle on the valve. When the handle is in horizontal position, the valve is closed, and when near vertical, the valve is open.

DRAIN SYSTEM (AIRPLANES MODFIED BY T.O. 1C-130-949).

The Air refueling system utilizes the single point refueling system drain transfer pump and valve in conjunction with the air refueling system line drain valve to pump residual fuel from the UARRSI fuel line after a refueling operation. When the line drain switch on the air refuel panel is placed to ON, the off load valve, air refueling valve, line drain valve, and the drain shutoff valve open and the drain pump activates to pump residual fuel into No. 3 tank. The drain operation requires approximately 8 minutes. After completion of the drain operation, the line drain switch is placed to OFF, the open valve close, and the drain pump deactivates. The drain pump and valve receive 28-volt dc power from the essential dc bus through a drain power circuit breaker on the copilot's lower circuit breaker panel. They are relay controlled by the drain switches on the aerial refuel panel and the off load switch on the single point refuel (SPR) panel.

Sump Drain Valve (Airplanes Modified by T.O. 1C-130-949).

The sump drain valve is provided to drain residual fuel from the sump. The sump drain valve, located in a parallel line to the single point refueling system manual drain valve, is solenoid operated by actuation of the sump drain switch on the air refuel panel. Operating power of 28-volt dc is obtained through the aerial refuel panel power switch.

Dump Valve Switches (Airplanes Modified by T.O. 1C-130-949).

The dump mast valves are controlled by two dump valve switches. The switches, mounted at the left and right ends of the fuel control panel, are shown in figure 1-28. The switch on the left operates the left-hand mast dump valve and the one on the right, the right-hand mast dump valve. The two-position (NORMAL/OPEN) switches are guarded in the NORMAL position and, in this position, the dump mast valves are closed to allow fuel to flow through the refuel manifold and portions of the dump mast during aerial refueling operations. When the switches are positioned to OPEN, the valves open to allow fuel to jettison through the refuel manifold and dump masts. The valves operate on 28-volt dc power from the essential dc bus through the fuel dump valves shutoff circuit breaker.

FUEL DUMPING SYSTEM.

A fuel dump system is provided to enable all fuel, except 1,600 pounds in each of the main tanks and approximately 65 pounds in the external tanks, to be dumped overboard. Eight two-position (OFF, DUMP) toggle switches are located on the fuel control panel (figure 1-27). The switches are safety wired to the OFF position. (For dumping rate refer to figure 3-4). If the external tanks forward boost pumps are switched on manually, the rate increases to approximately 3,900 pounds per minute.

Actuation of any switch will initiate the dumping overboard of the fuel in its respective tank. The No. 1, No. 2, and the left auxiliary and external tanks feed into a common dumping manifold in the left wing which has its outlet in the left wingtip. The right auxiliary and external tanks, No. 3 tank, and No. 4 tank feed into a manifold in the right wing which has its outlet in the right wingtip. Check valves at each tank dump outlet prevent any reverse flow. The No. 1, No. 2, No. 3, and No. 4 tanks have individual integral pumps specifically for dumping. The left auxiliary tank and right auxiliary tank use the same pump for dumping and normal boost pumping. The aft boost pump in the external tanks is used for normal dumping, and the forward boost pump can be switched on manually to increase the dumping rate. All pumps are powered by three-phase, 115/200-volt, 400-cycle ac. Actuation of a dump switch will open the 28-volt dc motor-operated jettison valve and simultaneously turn on the pump for the selected tank. The crossfeed valve will close when the dump switch for the auxiliary or external tanks is placed in the DUMP position. The 28-volt dc motor operated dump valves are all powered from the essential dc bus through

fuel quantity data table

AIRPLANES MODIFIED BY T.O. 1C-130-831

TANK	FULLY SERVICED SINGLE POINT REFUELING OR THROUGH INDIVIDUAL FILLER PORTS		USABLE FUEL △ LEVEL FLIGHT	
	GALS	LBS	GALS	LBS
TANK NO. 1	1305	8482	1295	8418
TANK NO. 2	1163	7560	1153	7494
TANK NO. 3	1163	7560	1153	7494
TANK NO. 4	1305	8482	1295	8418
LEFT AUXILIARY	883	5740	883	5740
RIGHT AUXILIARY	883	5740	883	5740
	TOTAL USABLE		6662	43304
LEFT EXTERNAL	1336	8684	1282	8333
RIGHT EXTERNAL	1336	8684	1282	8333
	TOTAL USABLE		9226	59970

DATA BASIS: ACTUAL MEASUREMENT, BASED 6.5 POUNDS PER GALLON OF JP-4 FUEL FOR INTERNATIONAL STANDARD DAY.

△ AMOUNT THAT CAN BE PUMPED OUT - AVERAGE

NOTE ALL VALUES PRESENTED IN THE TABLE ARE NOMINAL

Figure 1-26.

the copilot's side circuit breaker panel. The No. 1, No. 2, No. 3 and No. 4 dump pumps are powered from the main ac bus through the copilot's upper circuit breaker panel. The boost/dump pumps for the left and right auxiliary tanks are powered from the main ac bus through the auxiliary tank circuit breakers on the copilot's upper circuit breaker panel. The boost/dump pumps for the left and right external tanks receive power through the external tank pump aft circuit breakers on the copilot's upper circuit breaker panel and the external tank pump forward circuit breakers on the pilot's upper circuit breaker panel.

Dump Mast Shutoff Valves.

A fuel dump shutoff valve is located in the line going to each of the two dump masts. The refueling manifold and dump lines are connected together to permit rapid offloading of fuel through the SPR receptacle using the dump pumps. The dump mast shutoff valves prevent fuel from coming out the dump mast during ground defueling operation. The valves are actuated by the touchdown switch to close on the ground and open in flight except on airplanes modified by T.O. 1C-130-949. Refer to Dump Valve Switches for details on modified airplanes. Electrical power is supplied from the essential dc bus through the fuel dump valves shutoff circuit breaker on the copilot's side circuit breaker panel.

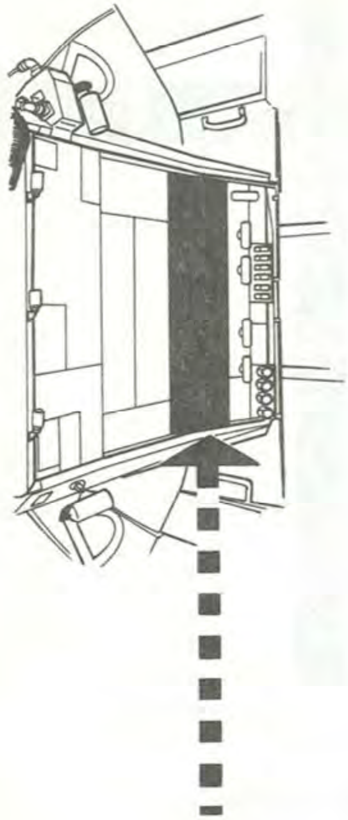
FUEL SYSTEM CONTROLS.

All controls for inflight management of the fuel system are located on the fuel control panel (figure 1-27).

Boost Pump Switches.

Ten boost pump switches are located on the fuel control panel. The No. 1, 2, 3, and 4 fuel tank boost pump switches control the internal boost pumps for their respective tanks. The left and right auxiliary fuel tank pump switches control the pump in each of the auxiliary tanks. The two pump switches for each external tank control the forward and aft boost pumps in the external tanks. All of the boost pumps are pow-

fuel control panel



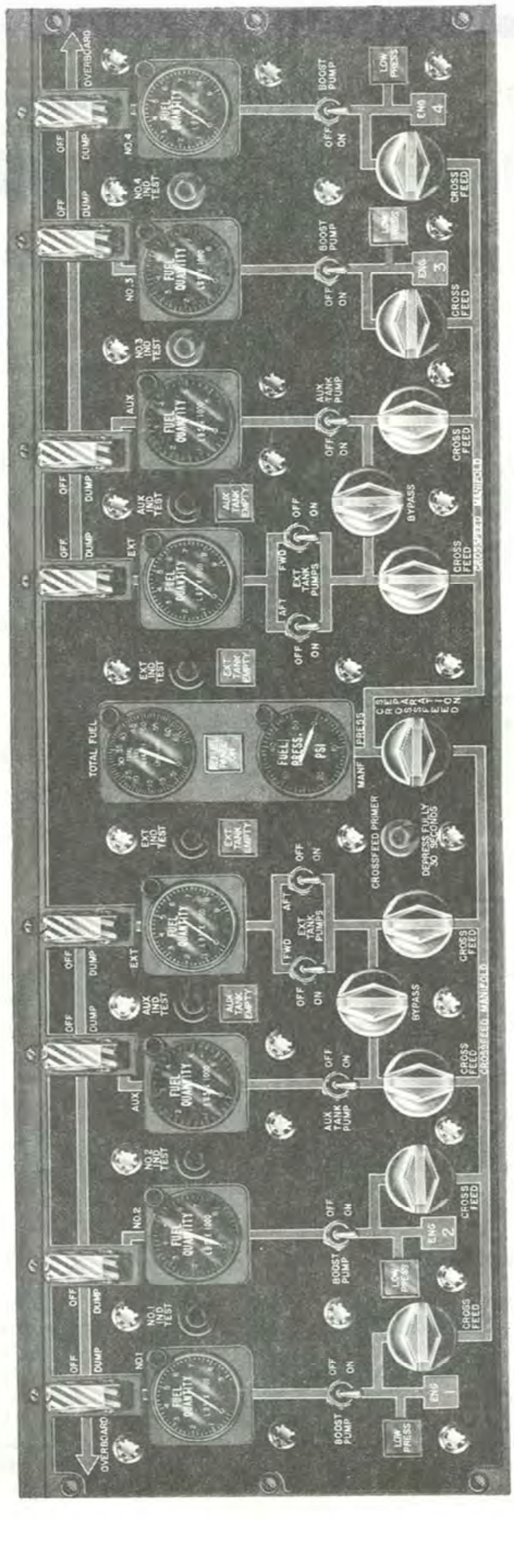


Figure 1-27.

fuel control panel

(AIRPLANES MODIFIED BY T.O. 1C-130-949)

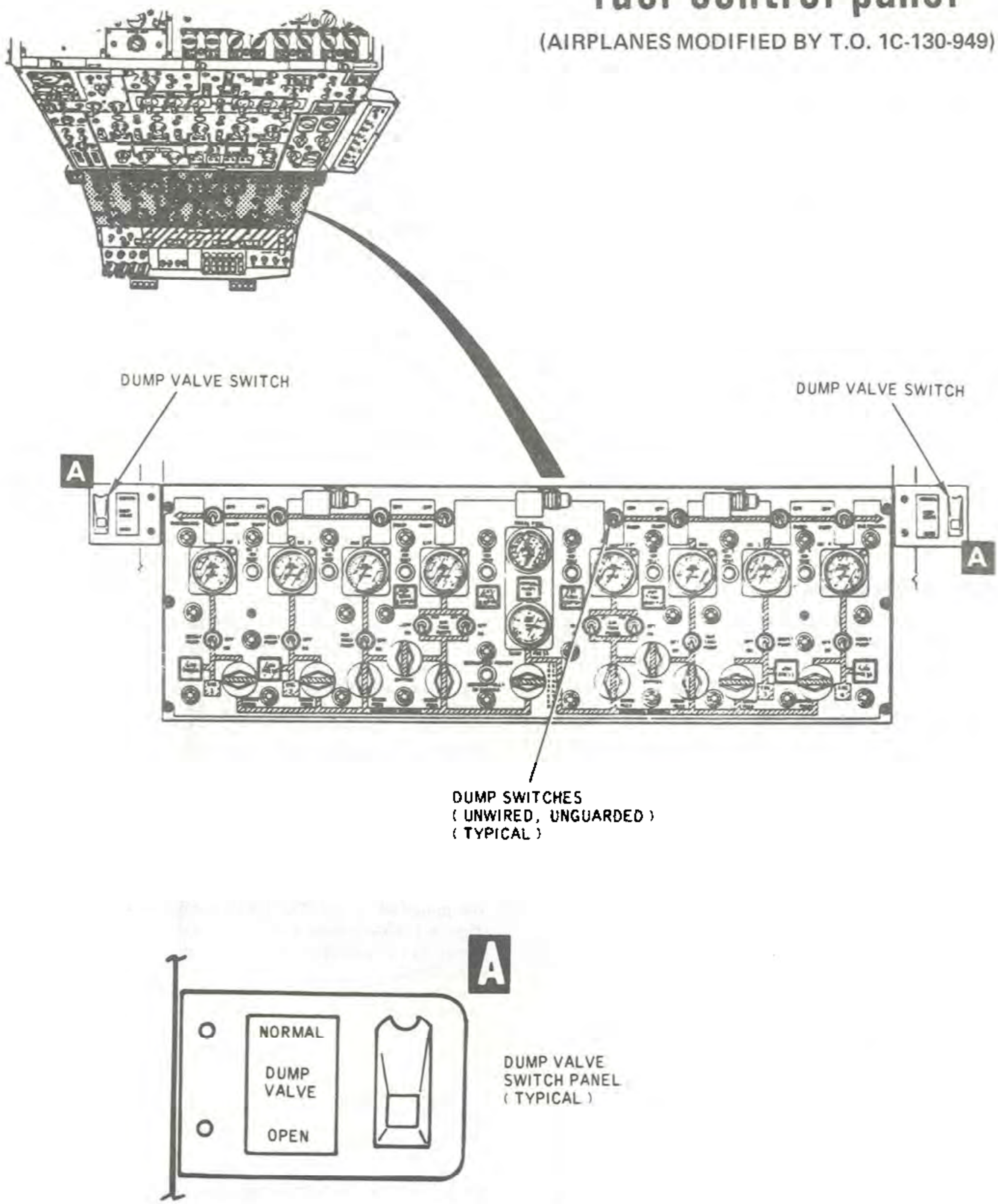


Figure 1-28.

ered by three-phase, 115/200-volt, 400-cycle ac. The No. 1 tank pumps are supplied power from the left ac bus through the fuel boost pump tank No. 1 circuit breaker on the pilot's upper circuit breaker panel. The No. 2 tank pumps are supplied power from the essential ac bus through the fuel boost pump tank 2 circuit breaker on the pilot's side circuit breaker panel. The No. 3 tank pumps are supplied power from the main ac bus through the fuel boost pump tank 3 circuit breaker on the copilot's upper circuit breaker panel. The No. 4 tank pumps are supplied power from the right ac bus through the fuel boost pump tank No. 4 circuit breaker on the pilot's upper circuit breaker panel. The left and right auxiliary fuel tank boost pumps are supplied power from the main ac bus through the auxiliary tank circuit breakers on the copilot's upper circuit breaker panel. The aft boost pumps for the right and left external tanks receive power from the main ac bus through the external tank pump aft circuit breakers on the copilot's upper circuit breaker panel. The forward boost pump for the right external tank receives power from the right ac bus through the external tank pump forward circuit breaker on the pilot's upper circuit breaker panel. The forward boost pump for the left external tank receives power from the left ac bus through the external tank pump forward circuit breaker on the pilot's upper circuit breaker panel.

Crossfeed Valve Switches.

Crossfeed valve switches (figure 1-27) are located on the fuel control panel. These two-position rotary switches route 28-volt dc power from the essential dc bus through the engine crossfeed valves circuit breakers on the copilot's side circuit breaker panel to the motor-operated crossfeed valves. When the switches are placed in the CROSSFEED position (switch markings aligned with the fuel control panel markings), the valve motors are energized to open the valves. When the switches are placed in the OFF position (switch markings at right angles to the panel markings), the valve motors are energized to close the valves. In case of power failure, the valves hold the last energized position.

Bypass Valve Switches.

Note

> Bypass valve switches are inoperative when external tanks are removed. Bypass valves will be wired to remain open if external tanks are removed.

Two bypass valve switches (figure 1-27) are located on the fuel control panel to permit an alternate path for fuel from the left and right auxiliary and external fuel tanks if crossfeed valves fail to open. These two-position rotary switches route 28-volt dc power from the essential dc bus through the engine crossfeed valves 1 and 4 circuit breaker (left valve) and 2 and 3 circuit breaker (right valve) on the copilot's side circuit breaker panel to motor-operated bypass valves. The left bypass valve receives power from the essential dc bus through the 1 and 4 engine crossfeed valves circuit breaker, and the right bypass valve receives power from the essential dc bus through the 2 and 3 engine crossfeed valves circuit breaker on the copilot's side circuit breaker panel. When switces are placed in BY-PASS position (switch markings aligned with fuel control panel markings), valve motors are energized to open the valves and allow external tank fuel to be crossfed or jettisoned through the auxiliary tank crossfeed or jettison valves, and vice versa. The bypass valves may be used to jettison main tank fuel in the event of main tank dump valve failure. When switches are placed in the OFF position (switch markings at right angles to panel markings), valve motors are energized to close the valves. In case of power failure, the valves hold the last energized position.

Crossfeed Separation Valve Switch.

The crossfeed separation switch (figure 1-27) is located on the fuel control panel. The crossfeed separation valve is provided in the crossfeed manifold system to permit additional control on fuel routing. The crossfeed separation valve provides for directing fuel from tanks located in the left section of the wing to engines No. 1 and No. 2 while engines No. 3 and No. 4 operate on fuel from the tanks located in the right section of the wing. This procedure insures a more even fuel consumption when operating from the auxiliary or external tanks through the crossfeed manifold. Since there may be a slight variation in boost pump pressure, and if both pumps were supplying the manifold, the pump operating at the highest pressure would feed the manifold if not prevented by the separation valve. When the crossfeed separation switch is placed in the open (vertical) position, the crossfeed separation valve is electrically actuated by 28-volt dc power from the essential dc bus through the engine crossfeed valves prime circuit breaker located on the copilot's side circuit breaker panel.

Fire Handles.

Five fire handles, one for each engine and one for each engine and one for the gas turbine compressor, are mounted on the fire emergency control panel (figure 1-65). These fire handles route 28-volt dc power to the motor-operated, engine fire wall fuel shutoff valves and to the motor-operated, gas turbine compressor fuel supply shutoff valve. In case of power failure, valves hold the last energized position. Circuit protection is provided by the engine fire shutoff valve circuit breakers on the copilot's side circuit breaker panel and the GTC control circuit breaker the pilot's side circuit breaker panel. Other functions of the handles are described under Fire Extinguishing System in this section.

FUEL SYSTEM INDICATORS.

Quantity gages and warning lights are located on the fuel control panel to give the crew a continuous, visual indication of the status of the fuel system. For additional information on the fuel indicators, see Engine Instruments in this section.

Total Fuel Quantity Indicator.

A total fuel quantity indicator (figure 1-27) is located in the center of the fuel control panel. The indicator is electrically connected to each of the fuel tank quantity gages, through a ratio assembly and power unit, and continuously shows the total fuel quantity (in pounds) in the fuel tanks, when the single point refueling master switch is in the OFF position. When the master switch is in any position other than OFF, the total fuel quantity indicator is de-energized. The total fuel quantity indicator receives single-phase, 115-volt ac power from the ac instrument and engine fuel control bus through fuel quantity totalizer circuit breaker on the pilot's lower circuit breaker panel.

Fuel Quantity Indicators and Test Switches.

Fuel quantity indicators (figure 1-27) are located on the fuel control panel. Each tank indicator is connected to capacitance probes in one of the respective fuel tanks, and gives a continuous visual indication of the pounds of fuel contained in that tank. Single-phase, 115-volt ac power to operate the quantity indicators is taken from the ac instrument and engine fuel control bus. Circuit protection is provided by the fuel quantity circuit breakers on the pilot's lower circuit breaker panel. Quantity indicator test switches (figure 1-27) are provided to test the quantity indicating system. When depressed, a press-to-test switch provides a ground and the indicator pointer moves toward zero. Failure of any pointer to move toward (but not necessarily to) zero indicates a malfunction in that quantity indicator. If a power failure is encountered the indicators will remain at the last indication before power failure. If a power failure is encountered on one indicator, the individual indicator will remain at the last indication before power failure and the total fuel quantity indicator will subtract the amount of fuel indicated on the inoperative indicator.

Auxiliary Fuel Tank Magnetic Sight Gage

An auxiliary fuel tank magnetic sight gage is located on the underside of the wing center section for each auxiliary fuel tank. The magnetic sight gage consists of three components: a mounting base and outer tube, a float, and a gage stick. The mounting base is attached to the lower surface of the auxiliary fuel tank with the outer tube secured to the mounting base. The float rides on the outside of the tube and has magnets in its inner diameter. The gage stick is contained within the outer tube, has magnets on its upper end, markings to indicate fuel quantity, and latches on the lower end into the mounting base. The gage stick markings indicate fuel quantity and is marked from 5 to 59 in 500 pound increments.

Auxiliary and External Tank Empty Lights.

Two auxiliary tank empty lights and two external tank empty lights (figure 1-27) are located on the fuel control panel in the flight station. If the boost pump switch associated with a given auxiliary or external tank is positioned at ON and the crossfeed separation valve is closed, the associated tank empty light will be illuminated whenever output flow pressure is below approximately 23 psi. Illumination of the light indicates either depleted tank quantity or an inoperative boost pump or (in the case of the external tanks only) failure of the fuel level control valve. The tank empty lights receive 28-volt dc power from the essential dc bus through the dump valves circuit breakers on the copilot's side circuit breaker panel.

Refueling Panel on Light.

A refueling panel on light (figure 1-27) is located on the fuel control panel. The circuit to this light is completed when the single point refueling master switch is not in the OFF position. The refueling panel on light receives 28-volt dc power from the main dc bus through the ground transfer valve circuit breaker on the copilot's lower circuit breaker panel.

Fuel Pressure Ground Test Indicator.

A fuel pressure indicator (figure 1-27) located on the fuel control panel is used to check out the fuel boost pumps before flight. This indicator is electrically connected to a fuel pressure transmitter. The transmitter measures the pressure of the crossfeed manifold. Thus, when the fuel boost pumps are turned on individually, the pressure supplied the crossfeed system by any pump is measured by the transmitter and shown by the indicator. Single-phase, 26-volt, 400-cycle ac to operate the pressure indication system is supplied by the No. 1 instrument power transformer. Circuit protection is provided by the fuel pressure indicator fuse on the pilot's lower circuit breaker panel.

Note

> The markings on this instrument are for preflight reference only. Inflight low-pressure warning is supplied by the pressure warning lights on the fuel control panel. However, boost pump pressure may be checked with this instrument at any time.

Fuel Low-Pressure Warning Lights.

Four fuel low-pressure warning lights (figure 1-27) are located on the fuel control panel. Each light is turned on when fuel supply pressure at the point where fuel enters the engine pump falls below approximately 8.5 psi. When illuminated, a light indicates a possible booster pump failure, valve failure, fuel line failure, or a malfunctioning pressure switch. The lights receive 28-volt dc power from the essential dc bus through the fuel management low-pressure lights circuit breaker on the copilot's side circuit breaker panel.

ELECTRICAL POWER SUPPLY SYSTEM.

All internal electrical power for aircraft use comes basically from five ac generators or the battery. Each engine drives one 40-kva, ac generator, and the air turbine motor drives one 20-kva, ac generator. (The air turbine motor-driven generator is basically rated at 20 kva. However, because the air turbine motor fan provides sufficient cooling air, the generator is rated in this installation at 30 kva for continuous operation.) Power from these ac generators is used to provide electrical power for airplane use: 28-volt dc; 200/115-volt, 400-cycle, three-phase primary ac; and 115-volt, 400-cycle, single-phase, secondary and primary ac. The four engine-driven ac generators are connected through a series of relays to four ac buses; the left-hand ac bus, the essential ac bus, the main ac bus, and the right-hand ac bus. The relay system operates in such a manner that any combination of two or more of the engine-driven ac generators will power all four of the buses. If only one generator is operating, it will power only the essential ac bus and the main ac bus. Placing the ATM generator control switch in the ATM GENERATOR position energizes the ATM generator contactor relay which connects the ATM generator to the essential ac bus. The air turbine motor-driven ac generator will power only the essential ac bus at any time. The ATM generator under-frequency control circuit is deactivated during engine start. This is necessary to prevent the ATM generator from dropping off the line due to an under-frequency condition caused by slowing of the ATM during engine starting. (See Section IV for additional information on the ATM.) Combinations of operating generators and buses which they power are shown on the ac bus power sources (figure 1-33). All inflight controls for operation of the electrical system are located on the electrical control panel on the overhead panel in the flight station. Circuit breakers are shown in figures 1-30 through 1-37.

EXTERNAL POWER PROVISIONS.

Note

The 200/115-volt, 3-phase, 400-cycle ac external source should have a capacity of 40 kva; its phase rotation must be A-B-C. The 28-volt dc external source should have a capacity of 400 amperes.

Both dc and ac external power receptacles are located on the left side of the fuselage just aft of the battery compartment. DC power from the external source is supplied through two current limiters to the main dc bus and two current limiters to the left hand and right hand dc bus, one on each bus. Any dc electrically operated equipment on the airplane, except equipment connected to the battery bus, can be supplied from an external dc power source. The battery is disconnected from all dc buses except the battery bus when external dc power is being used. When an external ac power source is connected to the airplane, power is supplied to all ac buses, to the dc buses through transformer-rectifier units, and to the battery bus to charge the battery if the dc power switch is in the BATTERY position.

Note

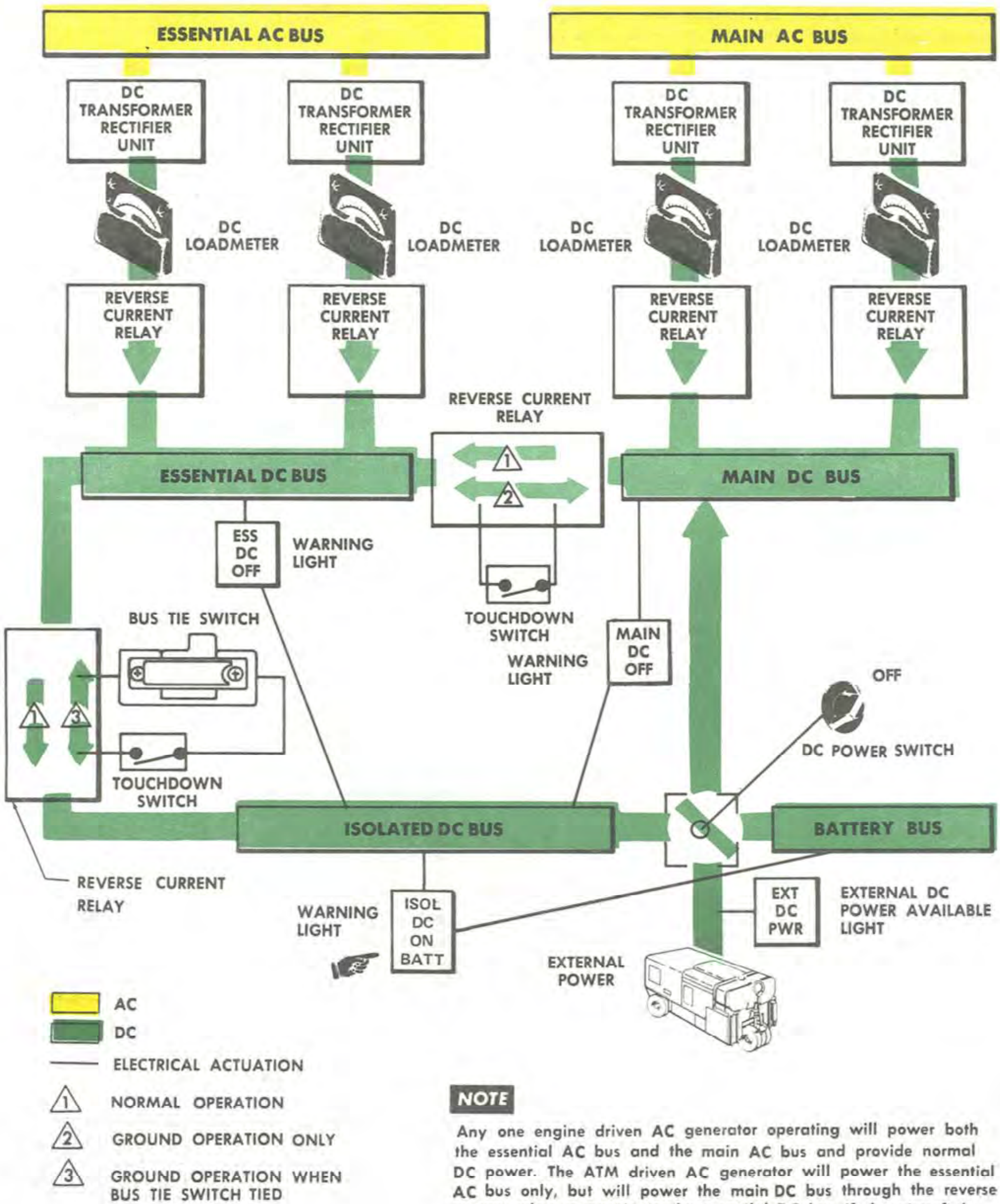
The ATM generator switch must be in the OFF position before external ac power can be fed into the airplane system.

DC POWER SYSTEM.

Power from the essential ac bus and the main ac bus operates four transformer-rectifier units (two from each ac bus) to provide dc power for the airplane (figure 1-29). The four transformer-rectifier units, mounted on the electronic control and supply rack, convert the power from the ac buses to 28-volt dc.

Both the essential ac bus and the main ac bus may be powered by any of the engine-driven generators. (Refer to figure 1-33 ac bus power sources.) The essential ac bus is powered from the air turbine motor generator also, so it may be used as a source of dc power for ground operation. The transformer-rectifier units feed current through reverse current relays to the main dc bus and the essential dc bus. Power from the left-hand ac bus and the right-hand ac bus operate two additional transformer-rectifier units (one from each bus) to provide dc power for the added equipment. The transformer-rectifier units are located on the lower shelf of the cargo compartment electronics equipment rack and supply 28 vdc power to left and right-hand dc buses. The units are powered directly from the ac electrical system and receive power any time the left-hand and right-hand ac buses are powered.

dc power supply



NOTE

Any one engine driven AC generator operating will power both the essential AC bus and the main AC bus and provide normal DC power. The ATM driven AC generator will power the essential AC bus only, but will power the main DC bus through the reverse current relay connected to the essential DC bus if the aircraft is on the ground.

See DC Power Distribution Figure 1-30.

Figure 1-29.

DC System Buses.

There are six buses in the dc power system: the main bus, the essential bus, the isolated bus, the battery bus and the LH and RH buses (figure 1-30). The main and essential buses are connected through a reverse-current relay, which in flight allows current to flow from the main bus to the essential bus, but limits current flow in the opposite direction. When the airplane is on the ground, a touchdown switch is actuated to complete a circuit which overrides the current limiting features of the reverse-current relay and permits current flow in either direction between the main and essential buses. The essential and isolated buses are similarly connected through another reverse-current relay which limits current flow from the isolated bus to the essential bus in flight. When the airplane is on the ground, the touchdown switch completes a circuit so that manual positioning of the bus tie switch overrides the current limiting features of the reverse-current relay and permits current flow in either direction between the isolated and essential buses.

Note

> The bus tie switch is only effective if the touchdown switch is actuated by the aircraft being on the ground.

The isolated bus is connected to the battery bus by the dc power switch. During ground operation with no engines operating, all of the dc buses except the LH and RH may be connected and powered through either the battery, or the essential dc bus, which can utilize air turbine motor ac generator output to the essential ac bus as a power supply. External dc power will supply all dc buses, except the battery, when the dc bus power switch is in the EXT DC PWR position.

The LH dc bus and RH dc bus are connected to the left and right-hand transformer rectifier units through reverse current relays. The buses are located on the right side of the cargo compartment forward bulkhead inside the LH and RH dc lower distribution box (figure 1-30). A reverse current relay connects the buses together and allows current flow from the RH bus to the LH bus in the event of power loss on the LH bus.

Battery.

A 24-volt, 31 (at 1 hour discharge rate) or 36 (at 5 hour discharge rate) ampere-hour battery is located in a fuselage compartment forward of the crew entrance door. The battery supplies power to the battery bus and to the isolated bus. A reverse current cutout is connected between the isolated bus and the essential and main dc buses. It normally prevents the battery from powering equipment connected to the essential and main dc buses and permits power from the essential and main dc buses to be used to power equipment connected to the isolated bus, and to charge the battery. During gas turbine compressor starting the battery powers the GTC starter and control circuits through the GTC control circuit breaker on the pilot's side circuit breaker panel.

An additional 24-volt, 24 ampere hour battery is located in the battery compartment for the fire control system.

Note

> See Section IV of this manual for description of Fire Control System power supply.

DC System Controls.

The dc electrical system is powered directly by the ac electrical system, therefore only two dc system controls are necessary to operate the system. They are the bus tie switch and the dc power switch. They are both located on the electrical control panel on the overhead control panel in the flight station.

The bus tie switch is a two-position (NORMAL, TIED) guarded toggle switch which functions in conjunction with the touchdown switch. When the airplane is on the ground the bus tie switch can connect the isolated dc bus and the essential dc bus for current flow in either direction. This allows battery power to feed all dc buses and circuits but the LH and RH bus circuits when the dc power switch is in the BATTERY position.

DC POWER SWITCH.

The dc power switch is a three-position, rotary-type switch located on the overhead electrical control panel (figure 1-31). When the switch is in the EXT DC PWR position, the external power relays will close when external power is applied in the correct polarity, to connect the external power receptacle to the main dc bus. When the switch is in the BATTERY position, the battery relay is closed and the battery is connected to the isolated bus. This position of the switch permits power to flow from the main dc bus or the essential dc bus through the reverse current relay to the isolated bus to charge the battery. When the switch is in the OFF position, the external power relay is open, the external power receptacle is disconnected from the main dc bus, and the battery is disconnected from the isolated bus.

DC System Indicators.

The dc system indicators are all located on the electrical control panel on the overhead control panel in the flight station and include four loadmeters, two bus off indicators, an isolated dc bus on battery indicator, an external dc power available light, and a voltmeter with a bus selector switch. In addition, two loadmeters, one for the LH and one for the RH bus are located on the cover of the LH and RH dc lower distribution box.

dc power distribution

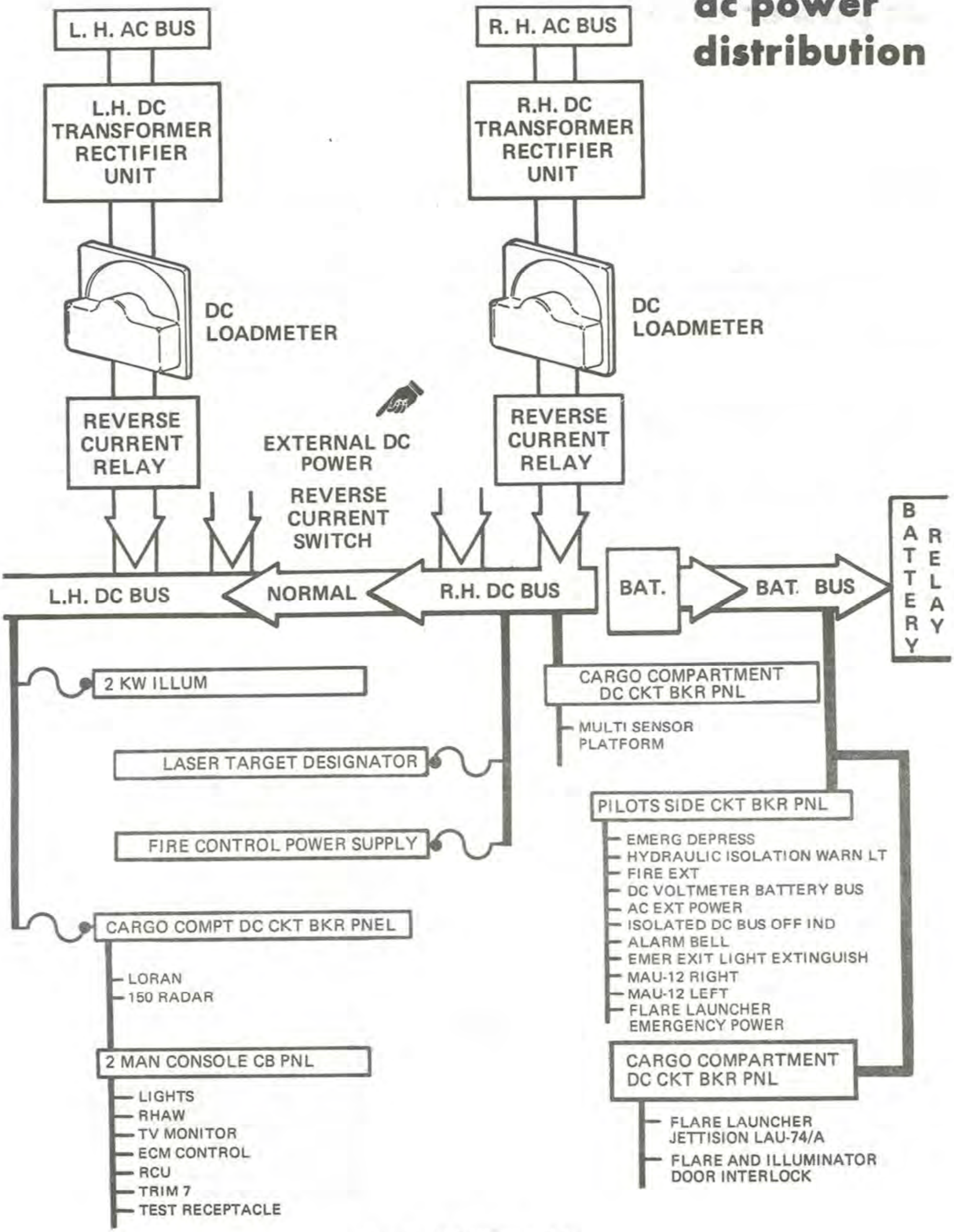


Figure 1-30. (Sheet 1 of 4)

dc power distribution

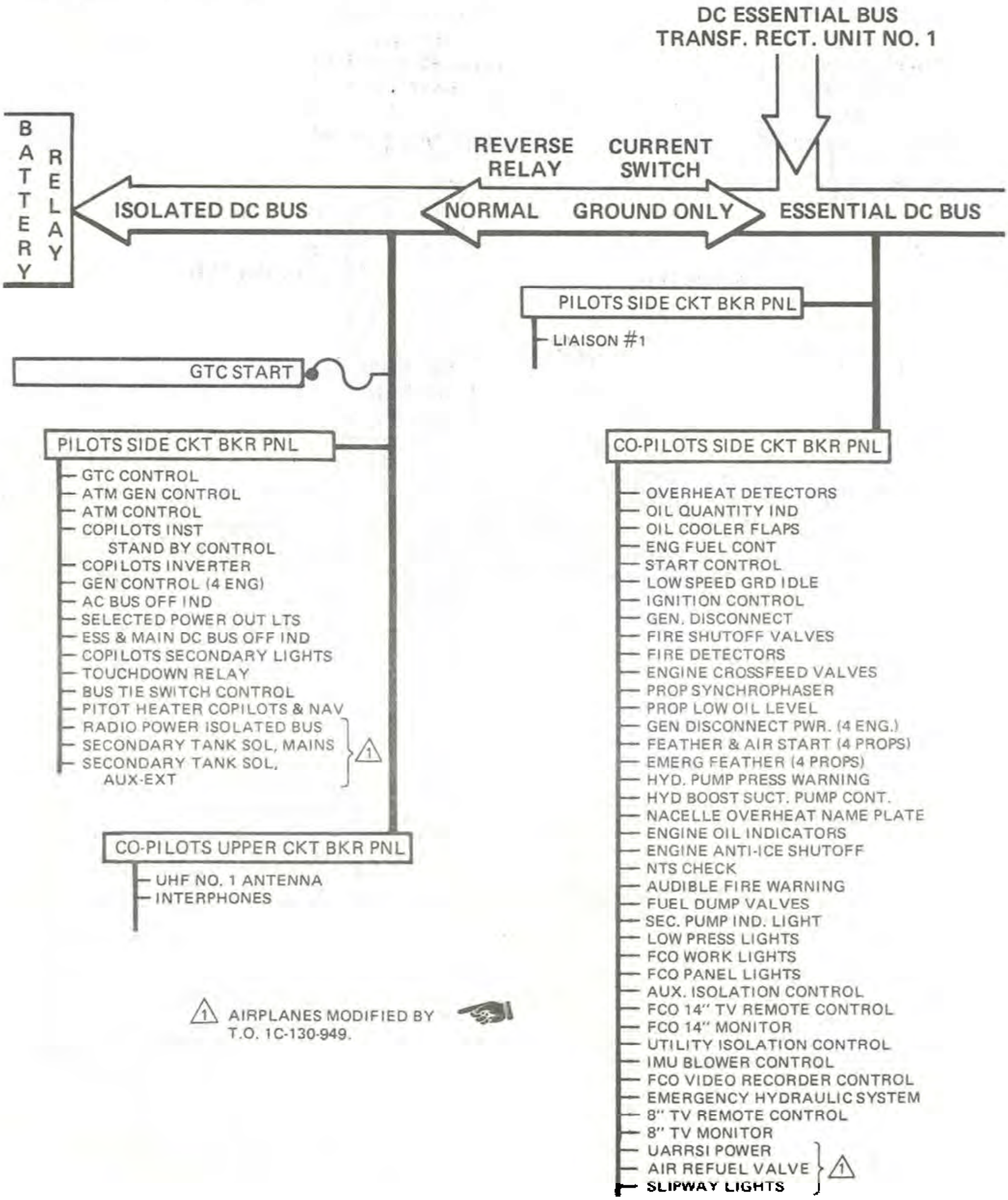


Figure 1-30. (Sheet 2 of 4)

dc power distribution

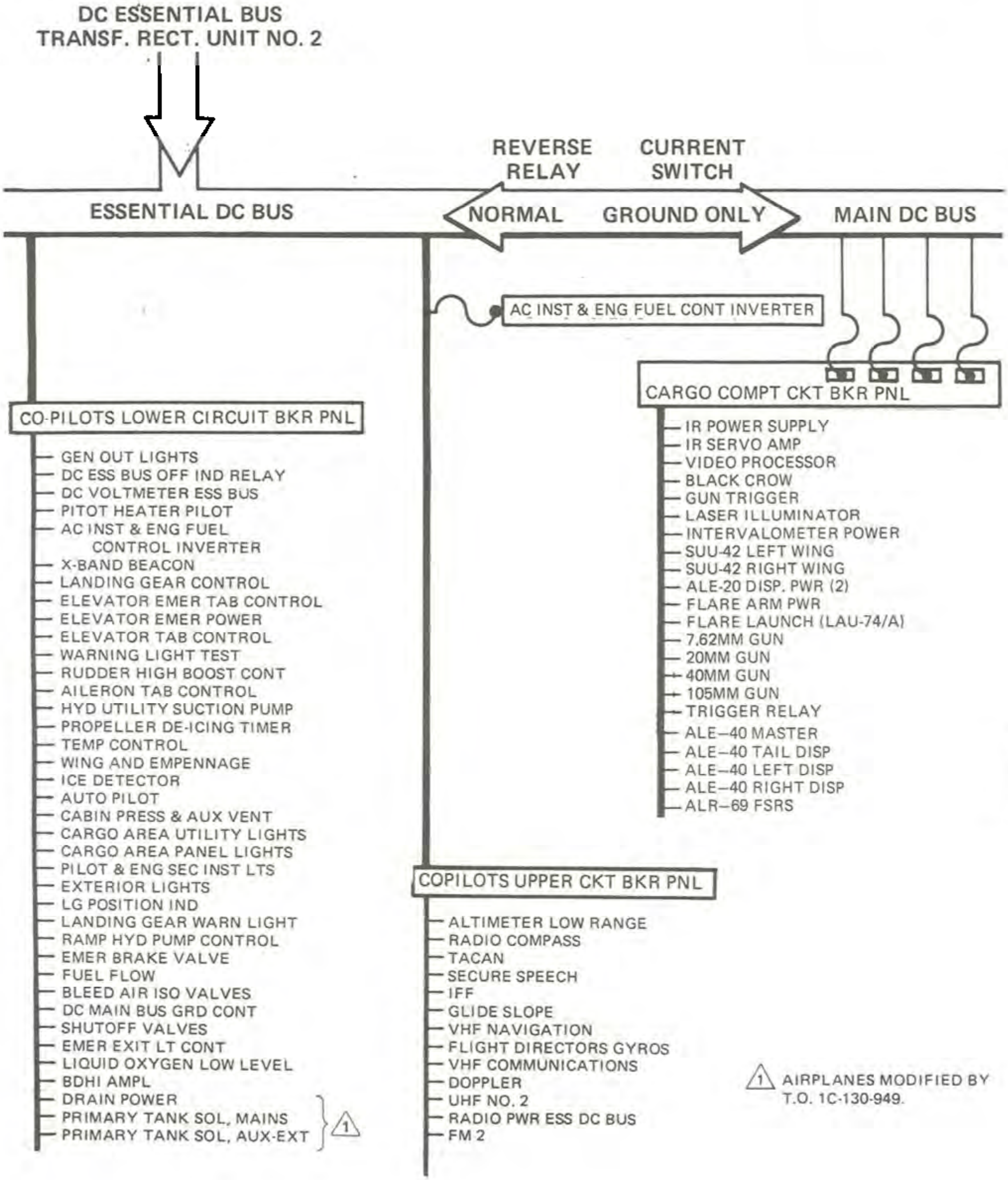


Figure 1-30. (Sheet 3 of 4)

dc power distribution

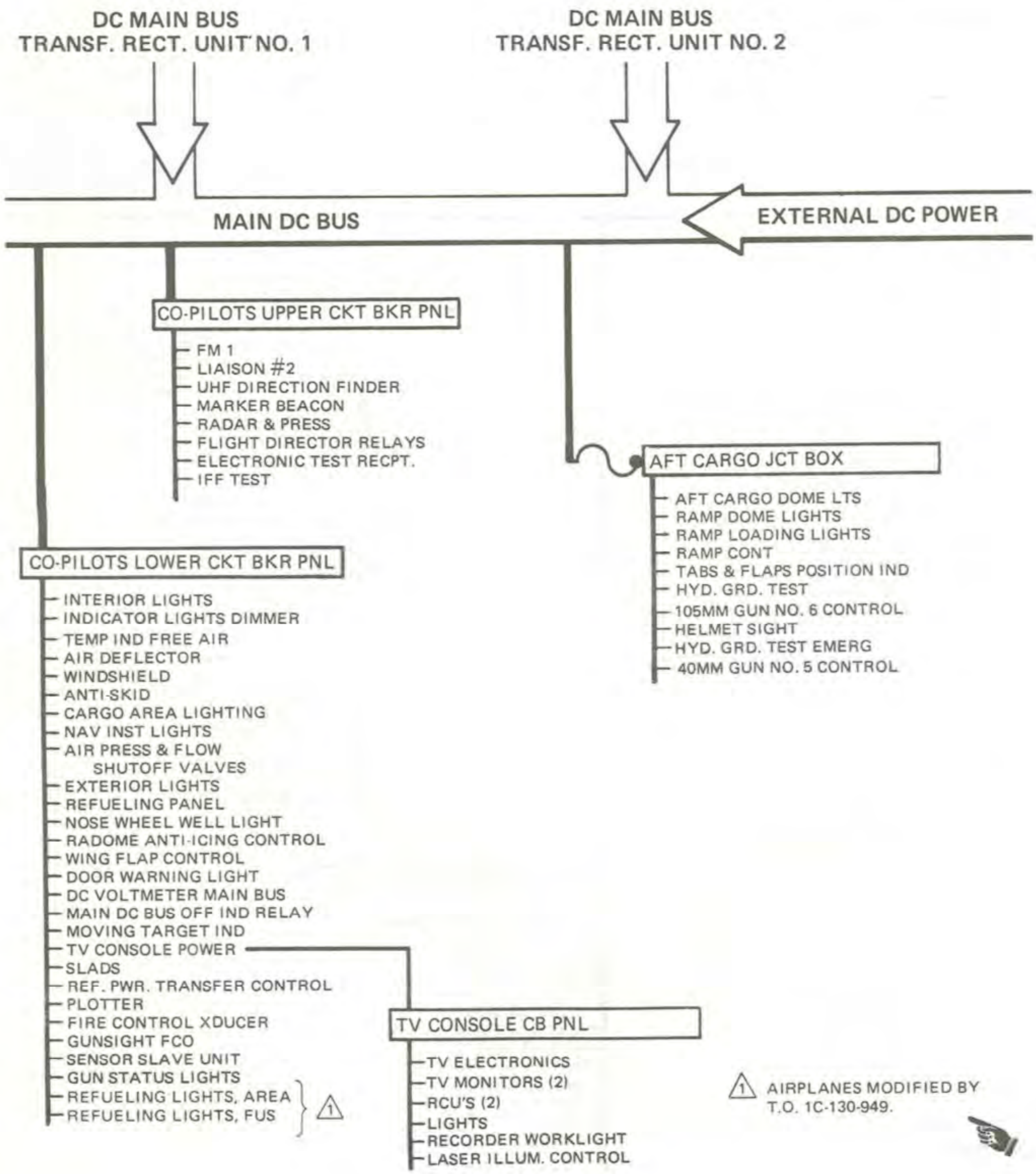


Figure 1-30. (Sheet 4 of 4)

overhead electrical control panel

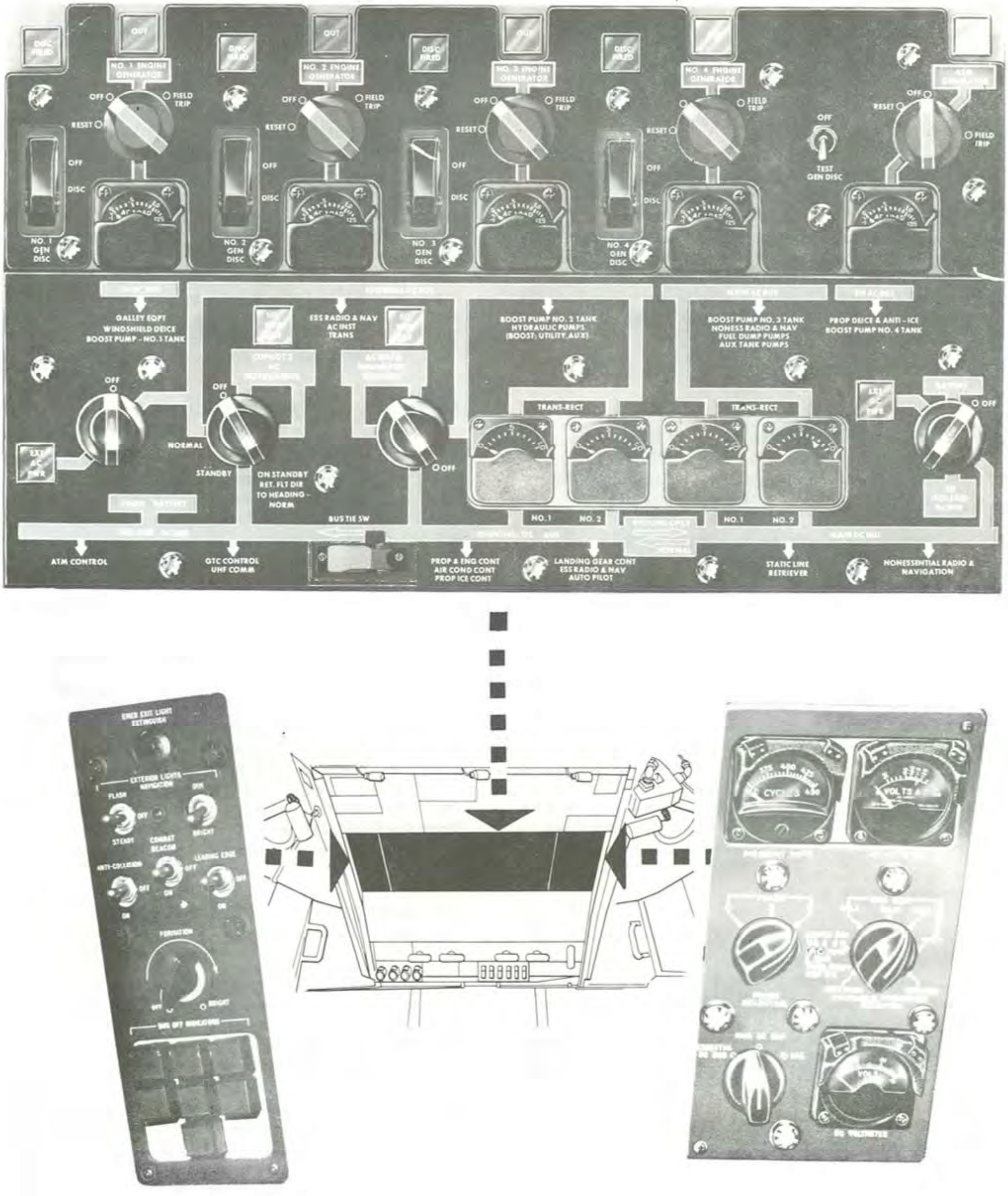


Figure 1-31.

LOADMETERS.

Six loadmeters, one for each transformer rectifier unit, indicate percent of rated current load flowing from each unit.

BUS OFF INDICATOR LIGHTS. Two bus off indicator lights, one each for the main dc bus and essential dc bus, give a visual indication of power off condition of the buses. The main and essential dc bus lights are powered from the isolated dc bus.

ISOLATED DC BUS ON BATTERY INDICATOR LIGHT. The isolated bus on battery light, marked ISOL DC ON BAT, gives a visual indication that the bus has become disconnected from the essential dc bus and is being powered by the battery only. The isolated bus on battery light is powered from the battery bus and controlled by the indicator circuit of the reverse current relay which connects the isolated dc bus to the essential dc bus.

Note

> The ISOL DC ON BAT indicator light will illuminate for a malfunction, or if the dc power switch is placed in the EXT DC PWR position when no external power is connected and no internal AC generator power is powering the DC system. Momentary illumination of the light is normal when items with high electrical starting load are placed on the essential AC or DC bus.

VOLTMETER AND BUS SELECTOR SWITCH. The voltmeter is located on the overhead electrical control panel (figure 1-28) and is connected to the main dc bus, essential dc bus, or battery by means of the voltmeter selector switch adjacent to the voltmeter. Selected bus voltage will be indicated on the voltmeter.

EXTERNAL DC POWER INDICATION. The external dc power available light will be illuminated whenever external dc power is connected to the external dc power receptacle in the correct polarity.

SECONDARY AC SYSTEM.

The secondary ac power is comprised of two systems, the copilot's ac instrument system and the ac instrument and engine fuel control system (figure 1-32). A 3-phase power supply system, phase-locked to phase C aircraft power, is added to provide a transient-free source of power for the fire control system. Circuit breakers for distribution of the system are located on the pilot's lower circuit breaker panel.

Note

> Refer to Section IV for fire control power system.

Copilot's AC Instrument Power System.

A single 250-volt-ampere inverter supplies 115-volt, 400-cycle, three phase power. The inverter draws dc power from the isolated bus; therefore, it can be operated from the battery during emergency conditions of flight. During normal operation power is supplied from the essential ac bus through a power transformer which converts three phase 200/115-volt, 400 cycle power to three phase 115-volt, 400 cycle power to operate the pilot's and copilot's ac instruments.

AC Instruments and Engine Fuel Control System.

The ac instruments and engine fuel control system is powered by a 115-volt, 400-cycle, single-phase, ac bus. The source of power is a 2500-volt-ampere single-phase inverter powered through the ac instrument and engine fuel control inverter circuit breaker on the copilot's lower circuit breaker panel from the essential dc bus. Normal power is supplied from phase A of the essential ac bus through the ac instrument and engine fuel control power circuit breaker. Two instrument transformers are powered from the 115-volt, 400-cycle, single-phase bus, and provide 26-volt, single-phase, ac power for instrument use.

Secondary AC System Controls.

Controls for the secondary ac power system are located on the overhead electrical control panel in the flight station. The controls consist of four rotary-type switches, two of which act as inverter controls and power source selectors, with the remaining two serving to permit measuring the frequency and voltage of the output power of the inverters.

COPILOT'S AC INSTRUMENT SWITCH.

The copilot's ac instrument switch is a three-position (ISOLATED DC BUS, OFF, ESSENTIAL AC BUS) rotary switch. In the ISOLATED DC BUS position power is routed from the isolated dc bus to operate the copilot's instrument inverter for the copilot's instrument power supply system. In the ESSENTIAL AC BUS position the inverter is turned off, and power for the copilot's instrument power system is taken from the essential ac bus through a transformer. In the OFF position no power is supplied to the system.

AC INSTRUMENT AND ENGINE FUEL CONTROL SWITCH.

The ac instrument and engine fuel control switch is a three-position (ESSENTIAL AC BUS, OFF, ESSENTIAL DC BUS) rotary switch. In the ESSENTIAL AC BUS position power is supplied to the 115-volt, 400-cycle, single-phase bus from phase A of the essential ac bus. In the ESSENTIAL DC BUS position power is supplied to the ac instruments and engine fuel control invertor which will then power the system. If the inverter voltage is insufficient, the power supply is automatically switched from the essential dc bus to the essential ac bus. This occurs when the inverter output voltage drops to 25 (+20) volts. In the OFF position no power is supplied to the system.

VOLTAGE AND FREQUENCY SELECTOR SWITCH.

A voltage and frequency selector switch, located on the overhead control panel (figure 1-31), has seven positions for selecting the output voltage and frequency of the ac power supply sources to be measured. If the switch is at the inverter position and a bus source of power is being used in place of the inverter, the frequency meter and the ac voltmeter will not indicate.

PHASE SELECTOR SWITCH.

A three-position phase selector switch, located on the overhead electrical control panel (figure 1-31), permits selection of the appropriate phase of electrical power when measuring the output voltage and frequency of either of the inverters.

Secondary AC System Indicators.

Indicators for the secondary ac power system are a voltmeter, a frequency meter, and selected power out lights located on the overhead electrical control panel in the flight station.

VOLTMETER AND FREQUENCY METER.

A voltmeter, a frequency meter, and a selector switch (figure 1-31) provide for reading the voltage and frequency of power supplied by any of the ac power sources. The meters are connected to the selected ac power source by the switch. If the switch is at an inverter position and a bus source of power is being used in place of the inverter, the meters will not indicate.

SELECTED POWER OUT LIGHTS.

Two selected power out lights (figure 1-31) are located on the electrical control panel. If the copilot's instrument selected power out light comes on, it indicates that no power is being supplied to the copilot's ac instrument bus. When the ac instrument and engihe fuel control switch is in the ESSENTIAL DC BUS position and its selector power out light glows, an inverter has failed; however, the 115-volt ac instrument and engine fuel control bus is then automatically connected to the essential ac bus. A light does not glow when the corresponding selector switch is at OFF.

PRIMARY AC SYSTEM.

Primary AC System Controls.

The ac system controls, with the exception of a manual reset lever on each generator control panel, are located on the overhead electrical control panel in the flight station. The generator control panels are located in racks under the flight station and are accessible from the cargo compartment.

GENERATOR SWITCHES.

The generator switches consist of five 4-position rotary-type switches located on the overhead electrical control panel (figure 1-31) in the flight station. When a switch is in the ON position (knob stripe aligned with panel stripe), a relay closes contacts to connect the generator to the buses if the generator is operating normally. The distribution of generated power to the various buses under all conditions of generator operation is shown in figure 1-33. All engine generators are off the line when the low-speed ground idle buttons are engaged; therefore, the ATM generator must be used to provide power to the essential ac bus which is the only bus it supplies. When the switch is placed in the OFF position, the relay disconnects the generator from the system. If the switch is turned to FIELD TRIP, the field circuit of the generator is opened by a field relay to remove generator excitation. No voltage is then produced by the generator. The RESET position of the switch is used to operate the field relay to its reset position after it has been tripped. The relay then closes the generator field circuit to allow the generator to build up voltage. The RESET position of the generator switch knob is spring-loaded. The generator switch knob must be pulled out to move it to the FIELD TRIP positon.

AC EXTERNAL POWER SWITCH.

A two-position, ac external power switch is located immediately below the LH ac bus loadmeter on the overhead electrical control panel (figure 1-31). The OFF position of the switch disconnects external power from the ac distribution system. The EXT AC PWR position (stripe on knob aligned with stripe on panel) connects external power to the ac distribution system.

Note

An override solenoid in the system is powered from the battery and will turn the switch off if the ATM generator control switch is on, if the ac power is not in the correct phase sequence, if any engine generator is on the line, or if the external power plug is not in the receptacle.

AC VOLTMETER, FREQUENCY METER, PHASE SELECTOR, AND FREQUENCY AND VOLTAGE SELECTOR SWITCH.

An ac voltmeter and frequency meter indicate voltage and frequency of the source selected by the voltage and frequency selector switch (figure 1-31). The phase selector switch works in conjunction with the voltage and frequency selector switch and selects the phase of power for indication.

ac secondary power system

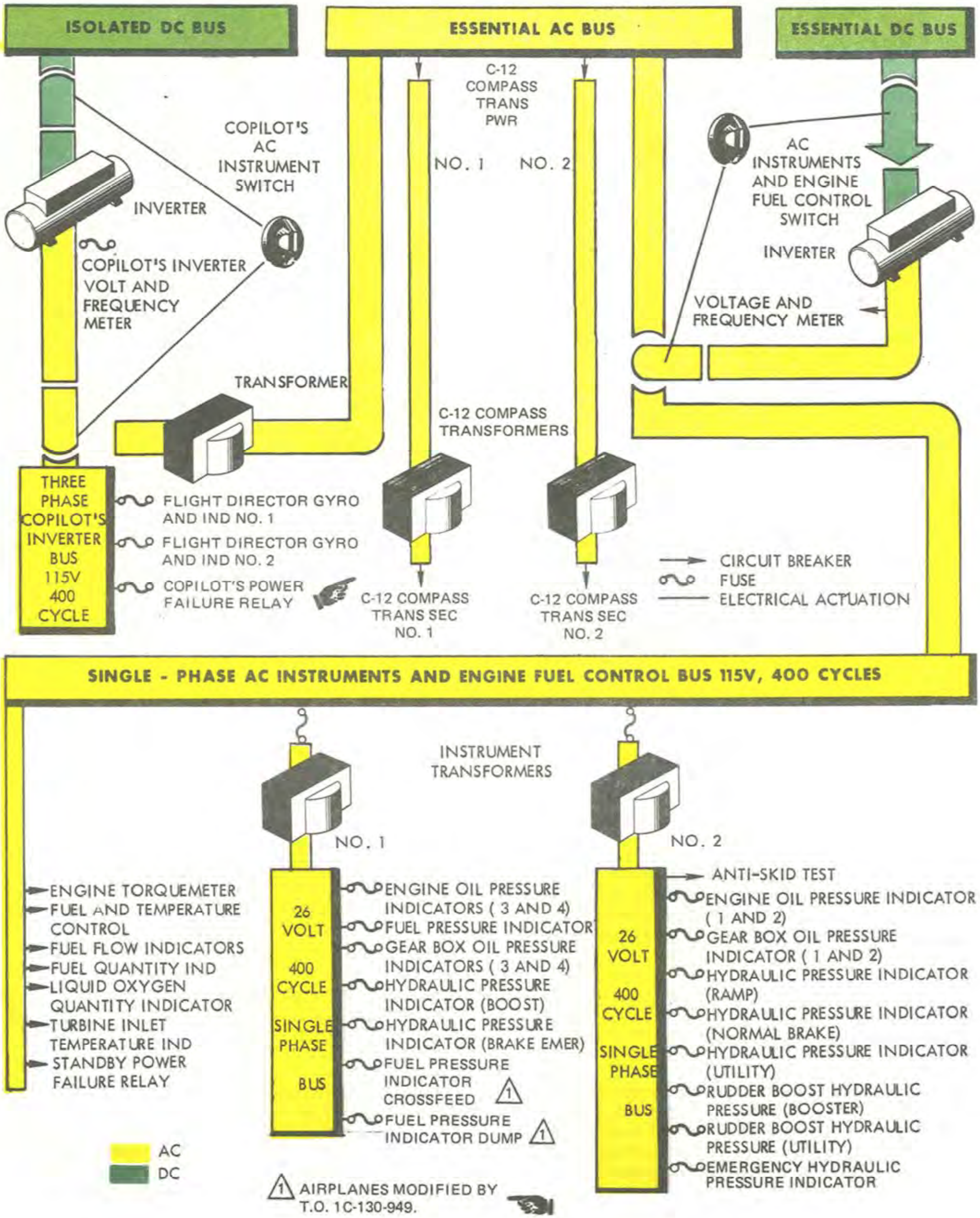


Figure 1-32.

ac bus power sources

ENGINE DRIVEN GENERATORS				AC GENERATOR POWER SOURCE			
NO. 1	NO. 2	NO. 3	NO. 4	L H AC BUS	ESSENTIAL AC BUS	MAIN AC BUS	R H AC BUS
ON	ON	ON	ON	1	2	3	4
OUT	ON	ON	ON	2	2	3	4
ON	OUT	ON	ON	1	1	3	4
ON	ON	OUT	ON	1	2	4	4
ON	ON	ON	OUT	1	2	3	3
OUT	OUT	ON	ON	4	3	3	4
ON	OUT	OUT	ON	1	1	4	4
ON	ON	OUT	OUT	1	2	2	1
OUT	ON	ON	OUT	2	2	3	3
OUT	ON	OUT	ON	2	2	4	4
ON	OUT	ON	OUT	1	1	3	3
OUT	OUT	OUT	ON		4	4	
OUT	OUT	ON	OUT		3	3	
OUT	ON	OUT	OUT		2	2	
ON	OUT	OUT	OUT		1	1	
OUT	OUT	OUT	OUT		ATM GEN.		

GENERATOR OUT   GENERATOR ON

EXAMPLE: NO. 2 AND NO. 3 ENGINE DRIVEN GENERATORS OUT.
LH AC BUS SUPPLIED BY NO. 1 GENERATOR.
ESSENTIAL AC BUS SUPPLIED BY NO. 1 GENERATOR.
MAIN AC BUS SUPPLIED BY NO. 4 GENERATOR.
RH AC BUS SUPPLIED BY NO. 4 GENERATOR.

Figure 1-33.

GENERATOR DISCONNECT SWITCHES.

Each generator is provided with a spring-loaded two-position (OFF, DISC) guarded switch. When the switch is held in the DISC position (approximately 2 seconds), a direct short in the firing mechanism causes the fused portion of the plunger to burn through and be actuated by spring tension. Plunger movement actuates a generator disconnect fired switch. The generator disconnect fired light will illuminate, indicating the firing mechanism has been fired. The plunger then engages a wing on the generator stub shaft causing it to shear. The generator cannot be reconnected in flight since a new stub shaft must be installed. Power to the switches is supplied from the essential dc bus through the generator disconnect power circuit breaker on copilot's side circuit breaker panel.

GENERATOR DISCONNECT TEST SWITCH.

A spring loaded, two-position (OFF, TEST GEN DISC) switch is provided to check the continuity of the firing mechanism. If the continuity check is good, the generator disconnect fired lights (4) will iluminate.

ac power distribution

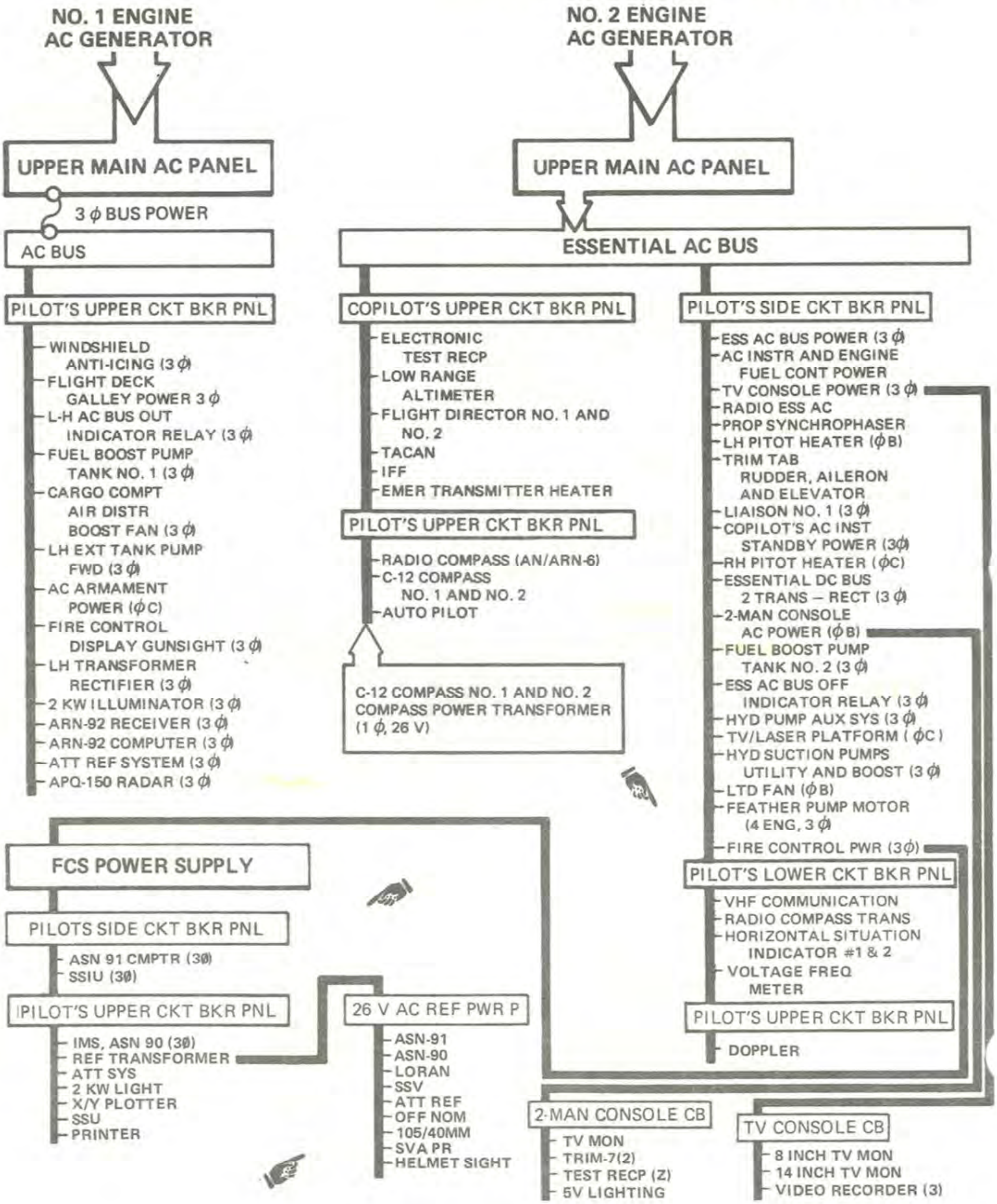


Figure 1-34. (Sheet 1 of 2)

ac power distribution

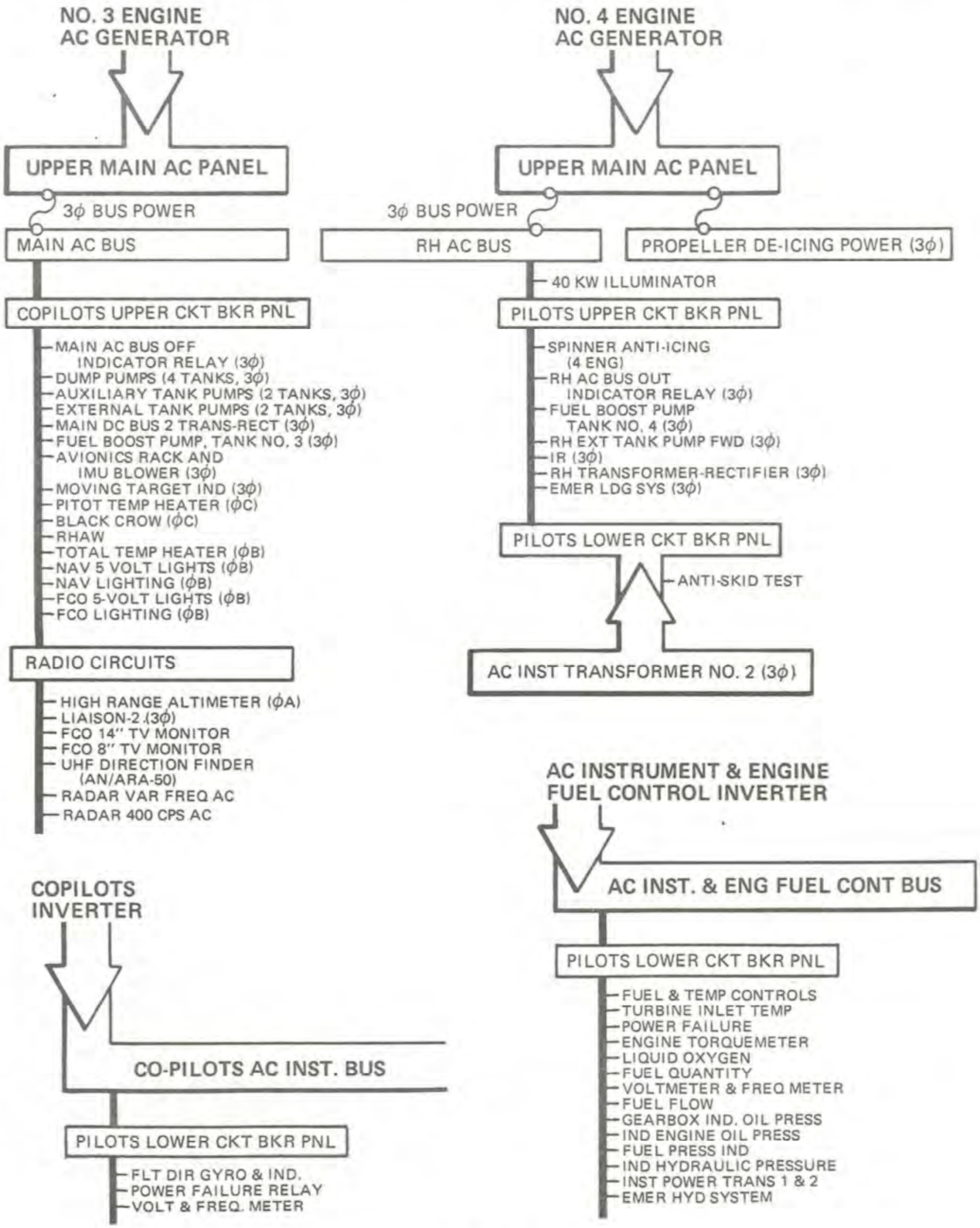


Figure 1-34. (Sheet 2 of 2)

upper main ac distribution panel

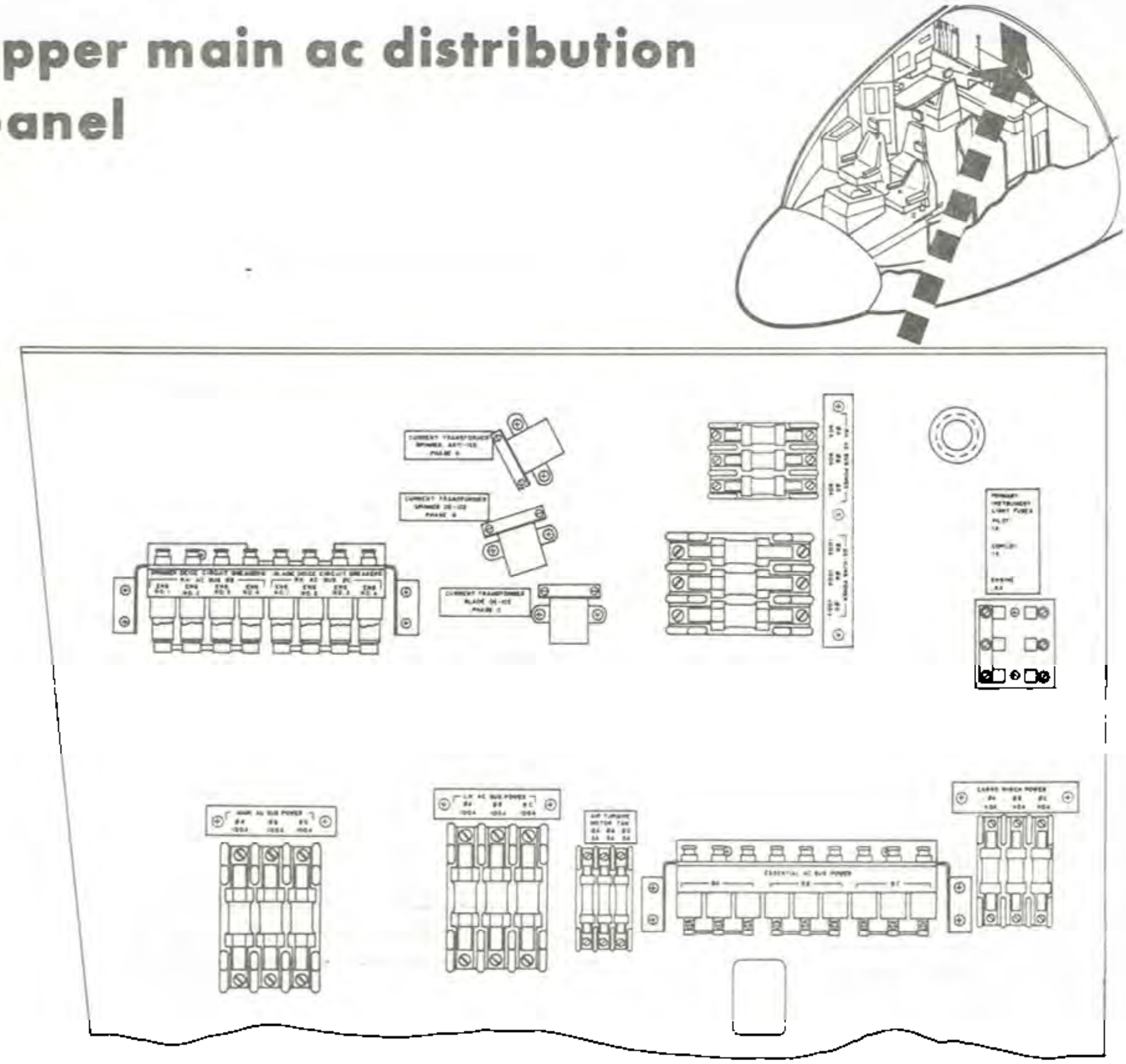


Figure 1-35.

Power to the switch is supplied from the essential dc bus through the generator disconnect power circuit breaker on the copilot's side circuit breaker panel.

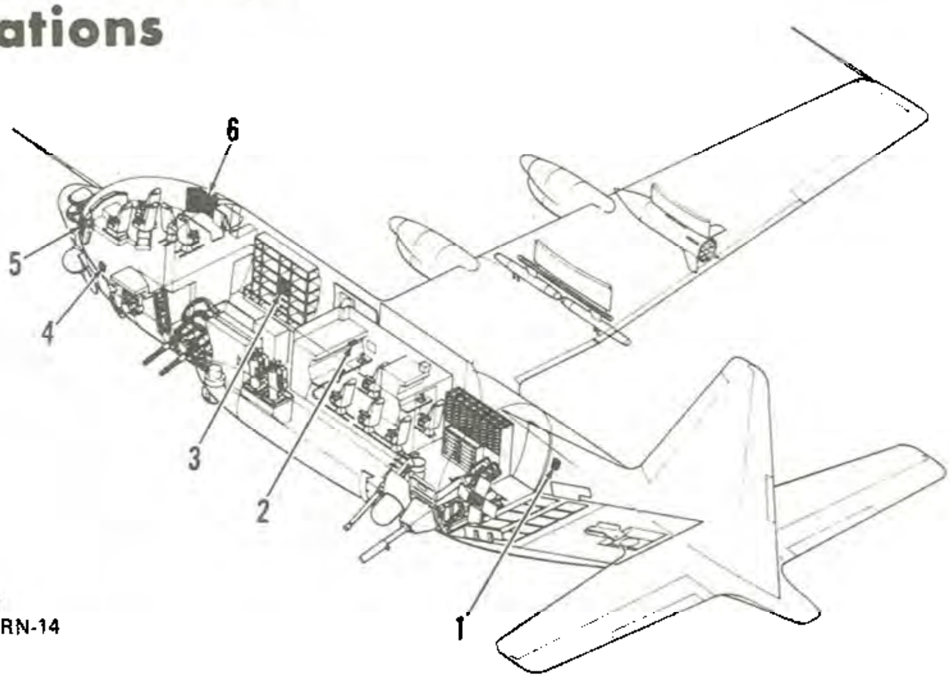
Primary AC System Indicators.

Indicators for the primary ac power system are located in the overhead electrical control panel in the flight station. They consist of five generator-out indicator lights, five ac loadmeters, four bus off indicators, an ac voltmeter and a frequency meter for test-measuring the sources of ac power, and an ac external power on indicator light.

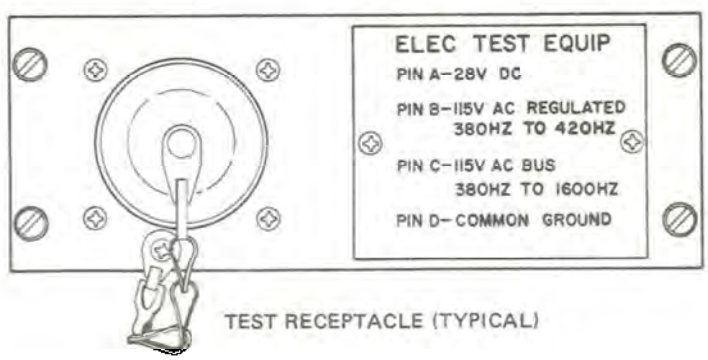
GENERATOR-OUT INDICATOR LIGHTS.

Each generator is provided with a generator-out indicator light on the overhead electrical control panel (figure 1-31). This light will illuminate when the generator control switch is in the ON position and one or more of the following conditions exist: the generator is not developing sufficient voltage (approximately 70 volts), the generator output is below approximately 368 cps (engine rpm is too low), or the field-trip relay has opened the field circuit of the generator. The field relay will trip when the generator switch is turned to the FIELD TRIP position, the generator output voltage is too high, or a fault exists in the generator output circuit.

electronic equipment test receptacle locations



1. VHF NAVIGATION RECEIVER TEST RECEPTACLE (ON AN/ARN-14 EQUIPMENT RACK)
2. IR/EWO CONSOLE TEST RECEPTACLE
3. CARGO COMP. ELECTRONICS RACK
4. TEST RECEPTACLE (RIGHT-HAND UNDER DECK RACK)
5. SEARCH RADAR TEST RECEPTACLE (RIGHT-HAND NOSE WHEELWELL)
6. NAVIGATOR'S STATION TEST RECEPTACLE.



TEST RECEPTACLE (TYPICAL)

Figure 1-36.

AC LOADMETERS.

Five ac loadmeters, one for each generator, are located on the overhead electrical control panel (figure 1-31) and give a continuous indication of the percent of rated current flow from their respective generators.

BUS OFF INDICATORS.

Four warning lights, one for each ac bus, are located on the overhead electrical control panel (figure 1-31). The lights are operated by a relay supplying dc power to the lights when the respective ac bus is not energized. The lights receive 28-volt dc power from the isolated dc bus through the ac bus off ind circuit breaker on the pilot's side circuit breaker panel.

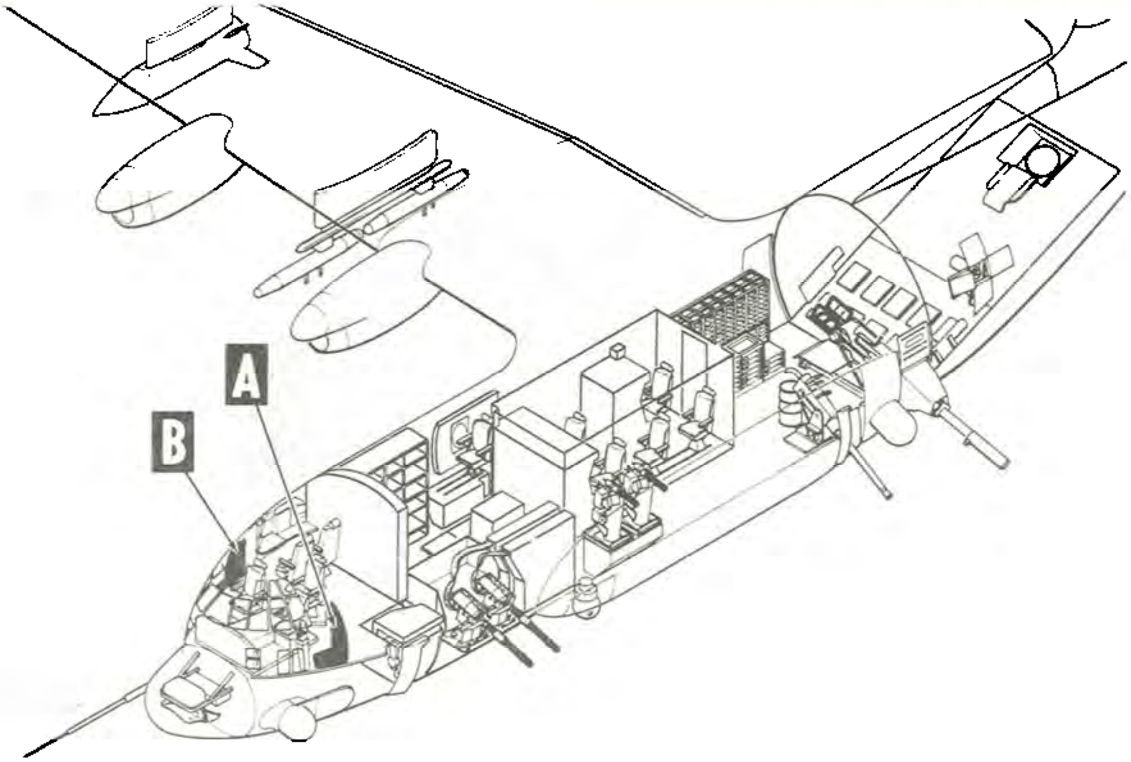
AC VOLTMETER.

An ac voltmeter, mounted on the overhead electrical control panel (figure 1-31), can be used to measure the output voltage of that generator or inverter which has been selected with the voltage and frequency selector switch. Each of the three phases of generator output, or the appropriate phase of inverter output, can be measured by selectively positioning the phase selector switch.

FREQUENCY METER.

A frequency meter mounted on the overhead electrical control panel (figure 1-31) permits measuring the frequency of the output power of that generator selected with the voltage and frequency selector switch.

circuit breaker locations



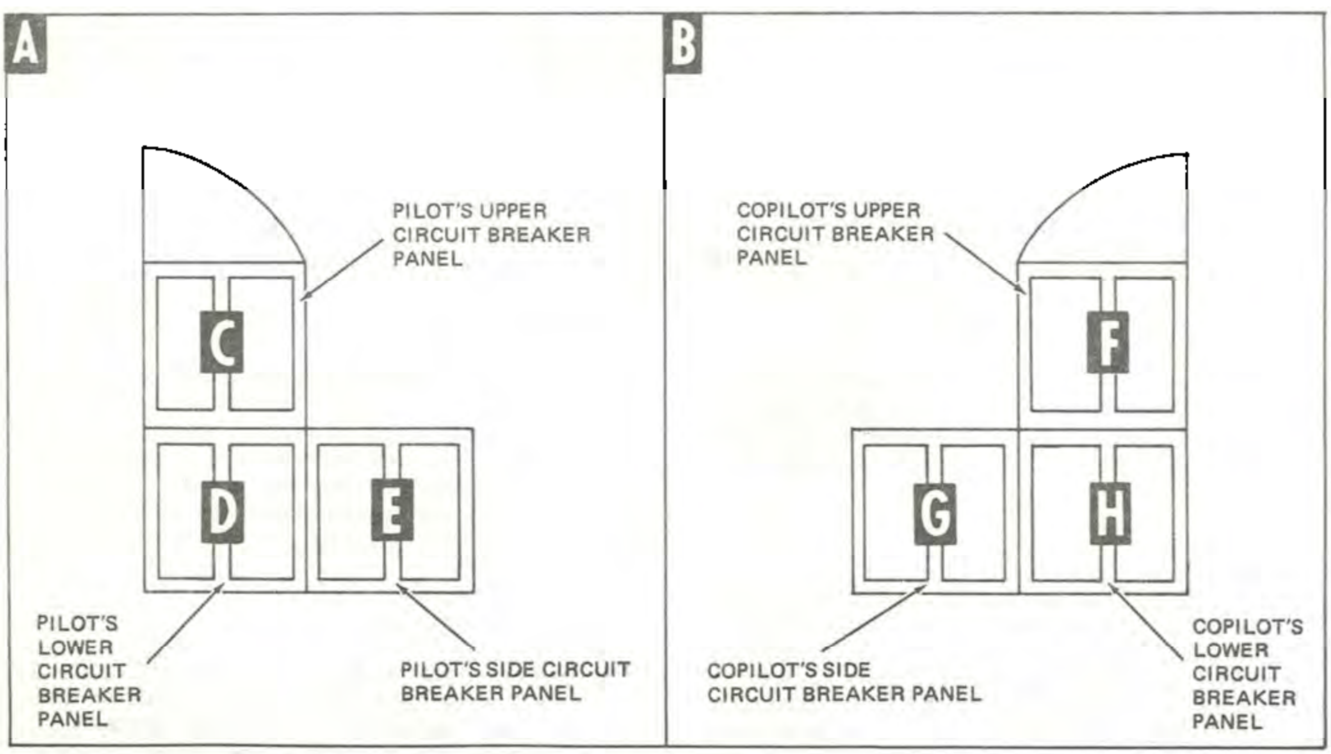
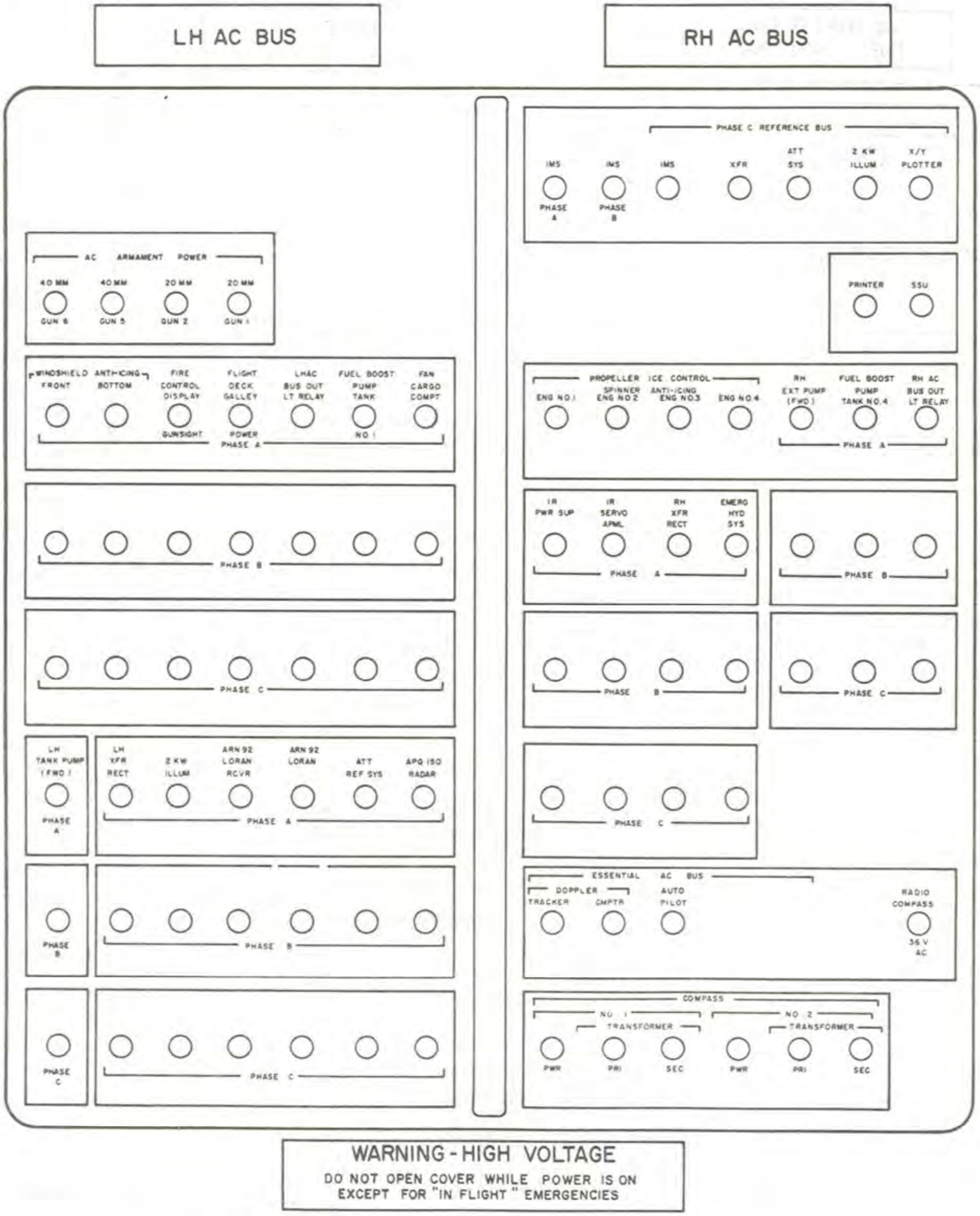


Figure 1-37. (Sheet 1 of 12)

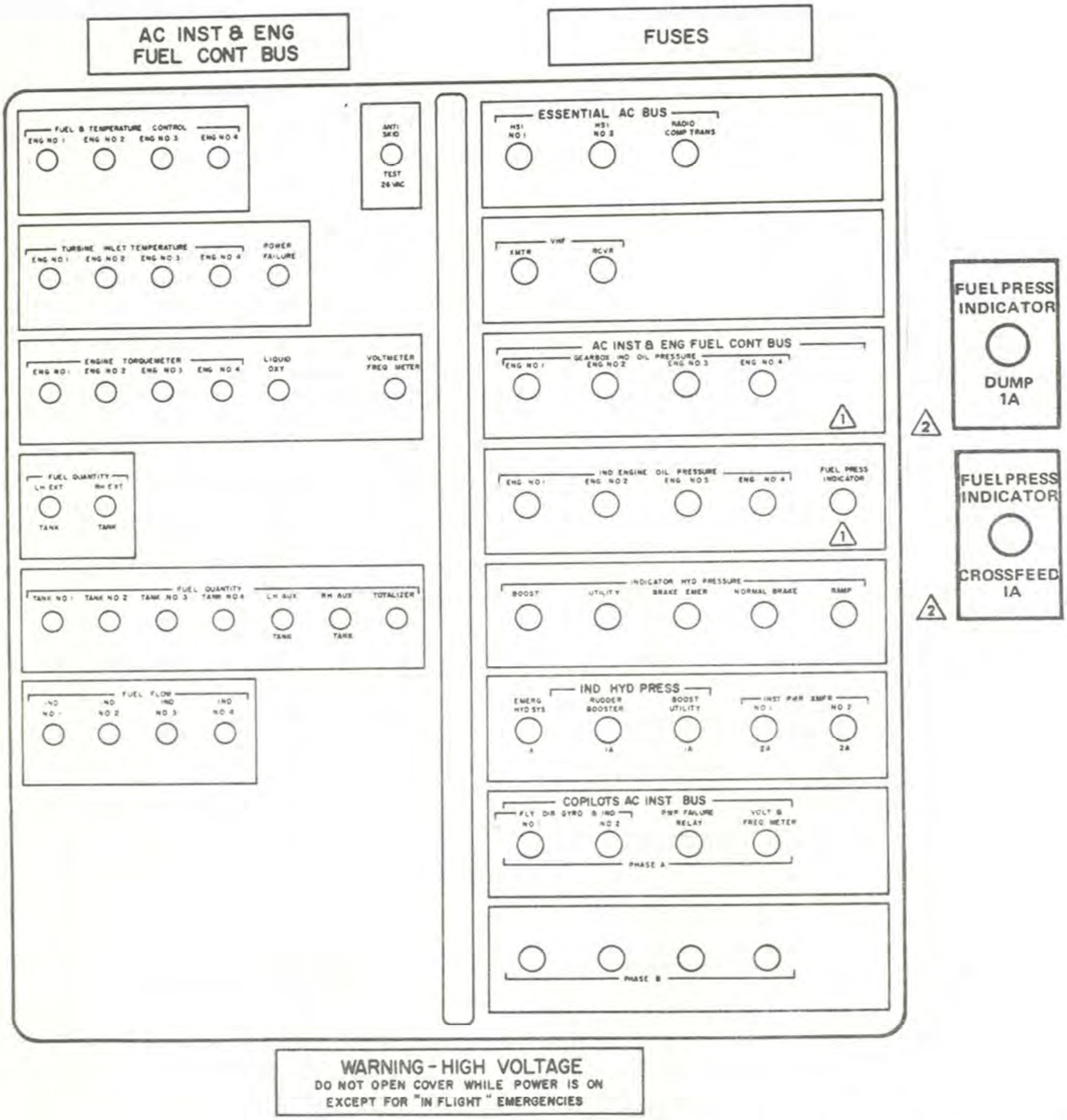
circuit breaker locations



C PILOT'S UPPER CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 2 of 12)

circuit breaker locations



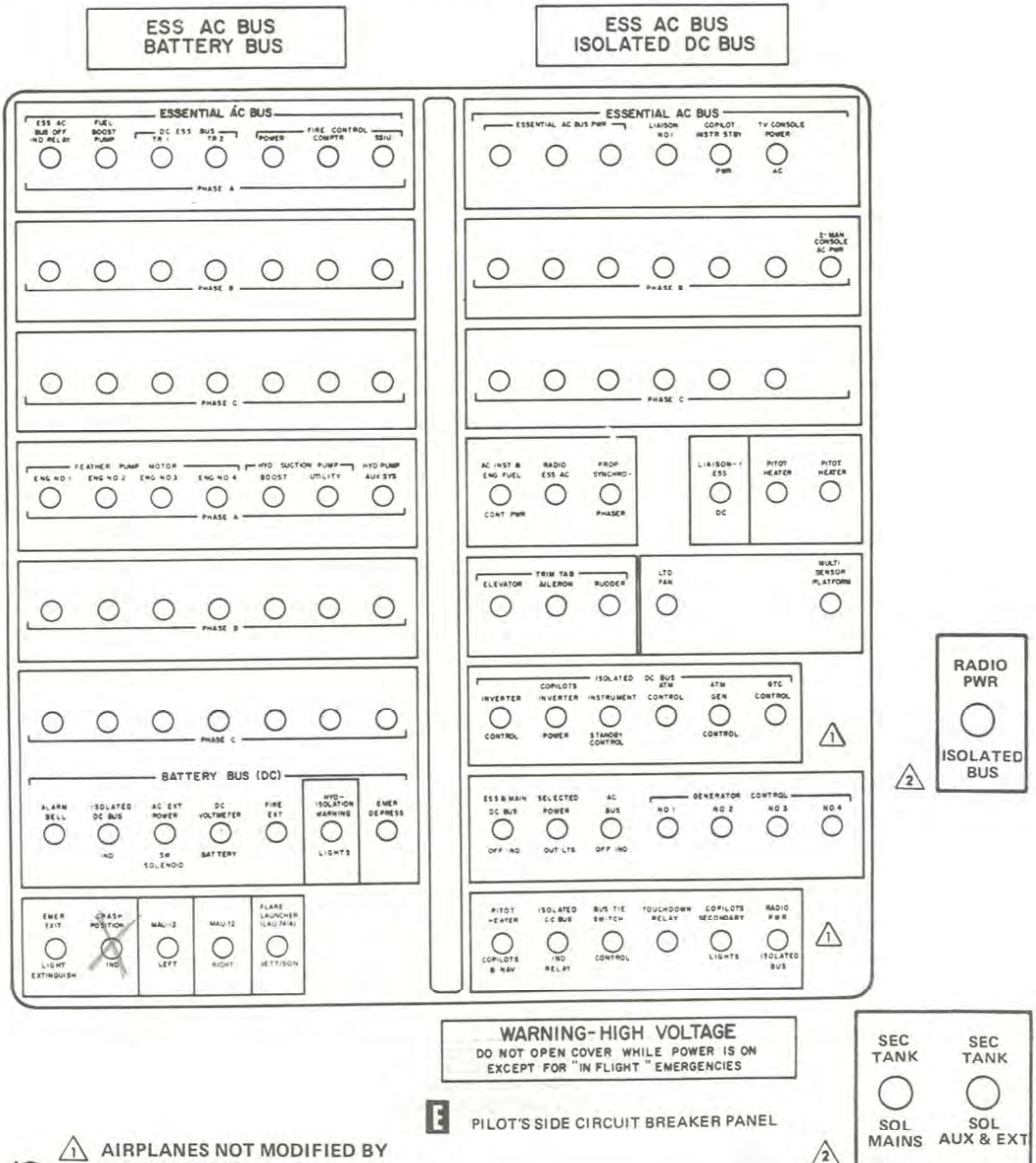
D PILOT'S LOWER CIRCUIT BREAKER PANEL

1 AIRPLANES NOT MODIFIED BY T.O. 1C-130-949

2 AIRPLANES MODIFIEDY BY T.O. 1C-130-949

Figure 1-37. (Sheet 3 of 12)

circuit breaker locations



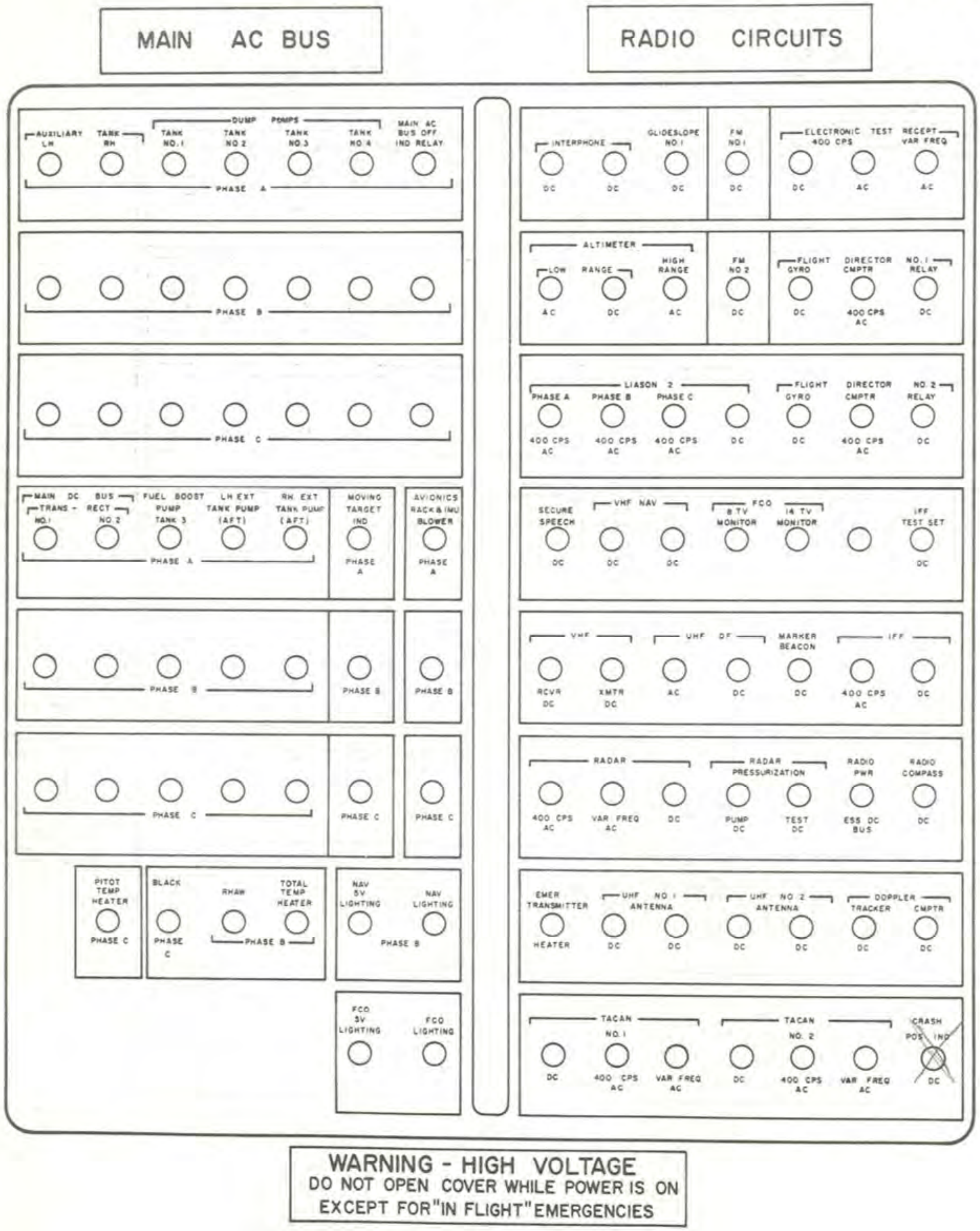
E PILOT'S SIDE CIRCUIT BREAKER PANEL

⚠1 AIRPLANES NOT MODIFIED BY T.O. 1C-130-949

⚠2 AIRPLANES MODIFIED BY T.O. 1C-130-949

Figure 1-37. (Sheet 4 of 12)

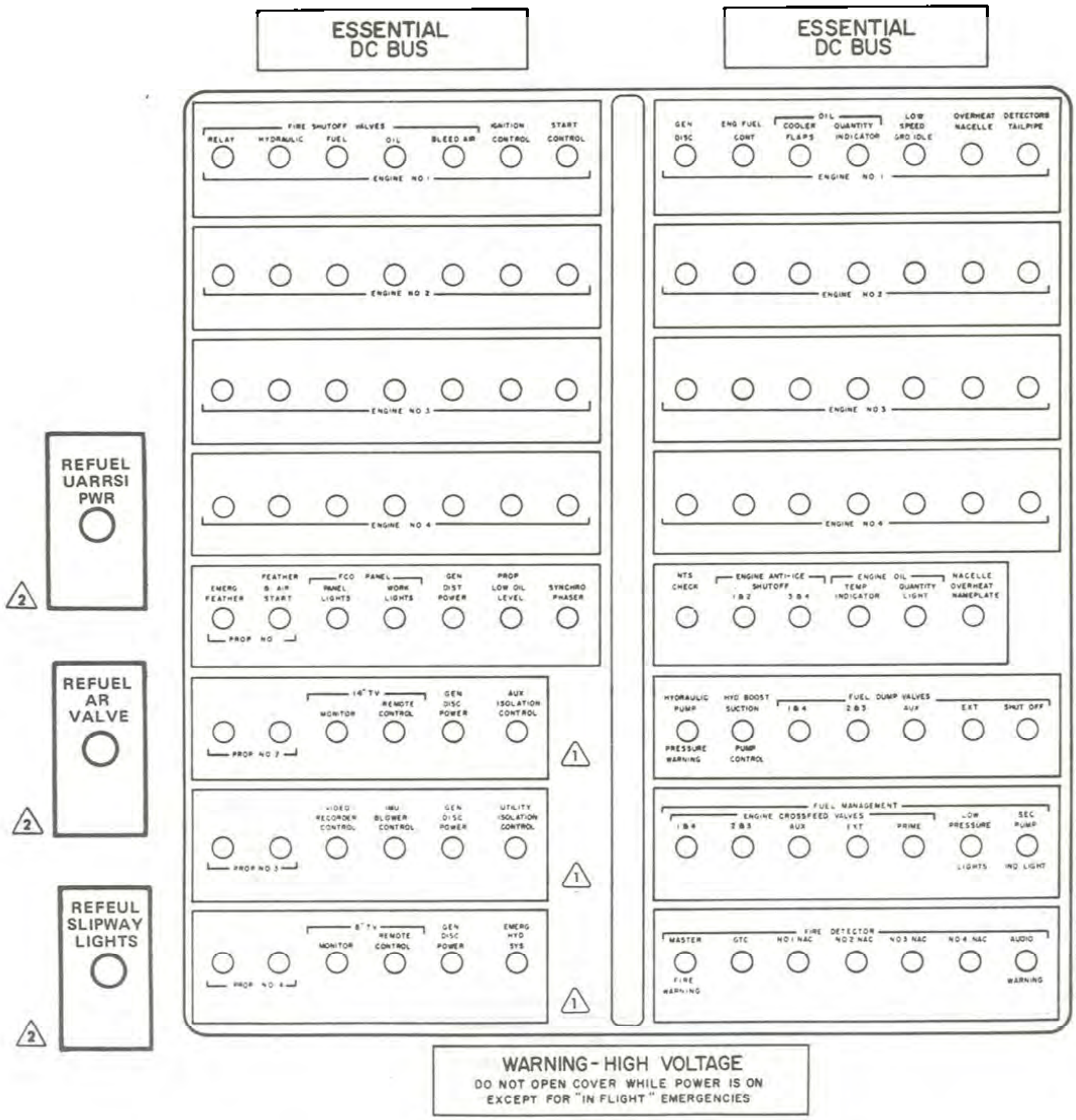
circuit breaker locations



F COPILOT'S UPPER CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 5 of 12)

circuit breaker locations



G COPILOT'S SIDE CIRCUIT BREAKER PANEL

⚠1 AIRPLANES NOT MODIFIED BY T.O. 1C-130-949

⚠2 AIRPLANES MODIFIED BY T.O. 1C-130-949

Figure 1-37. (Sheet 6 of 12)

circuit breaker locations

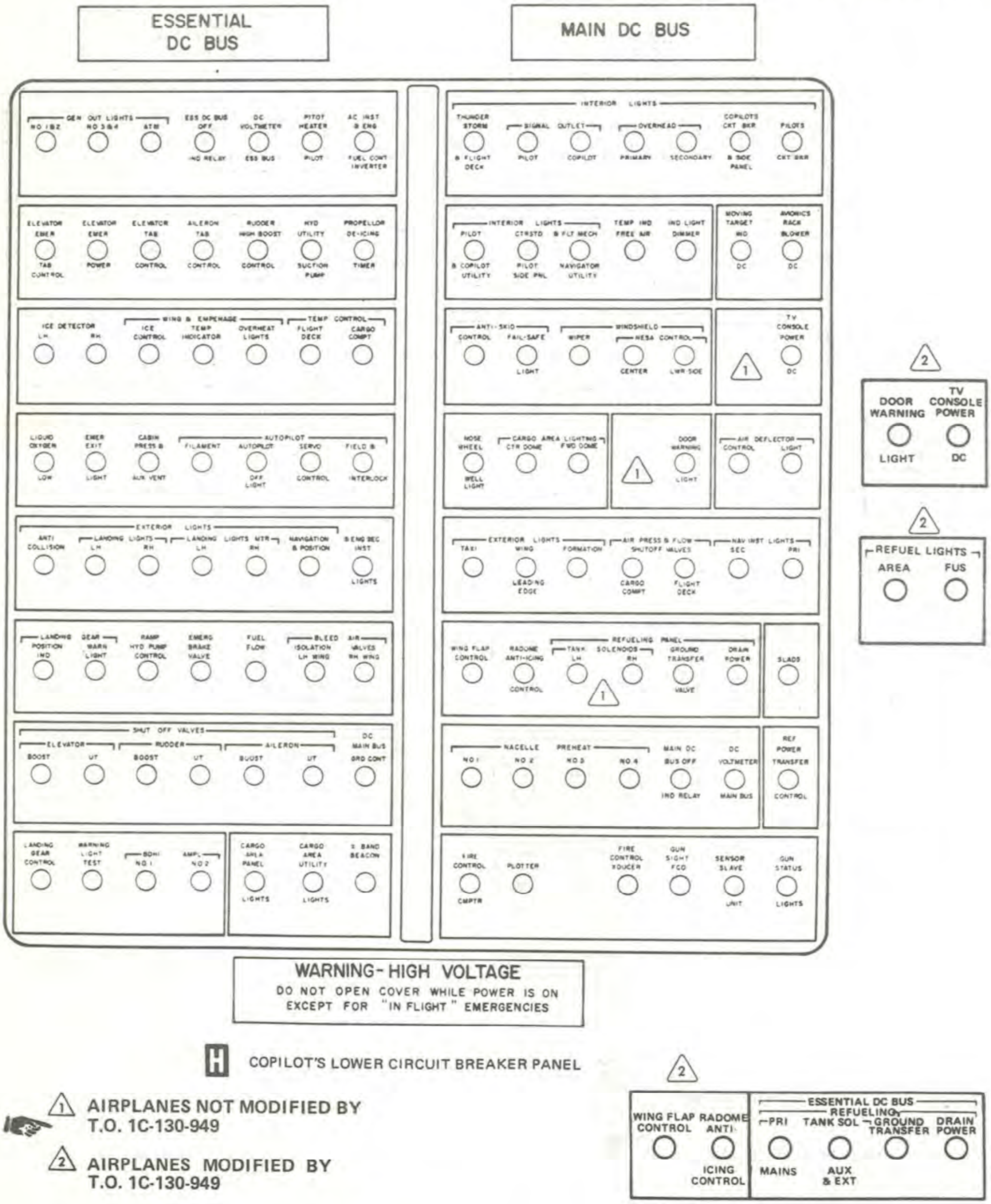
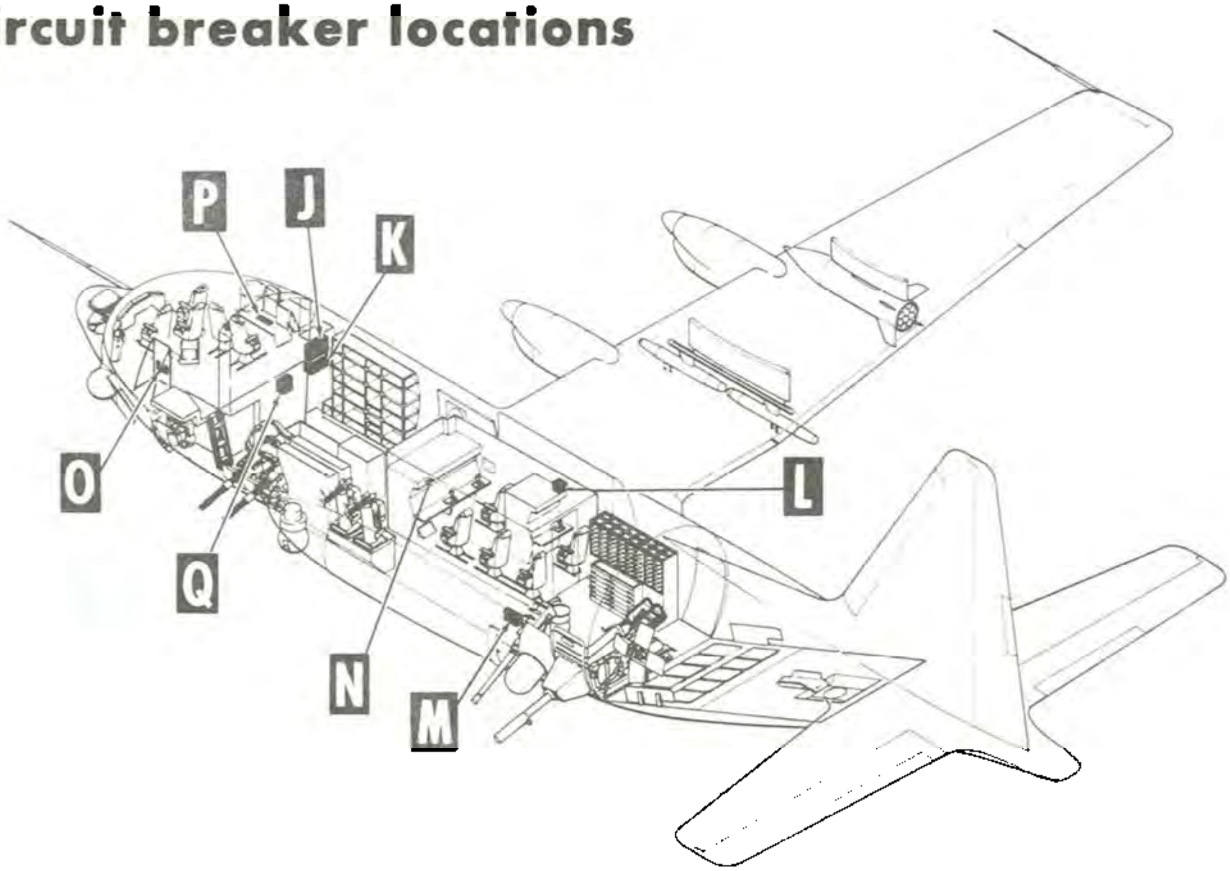
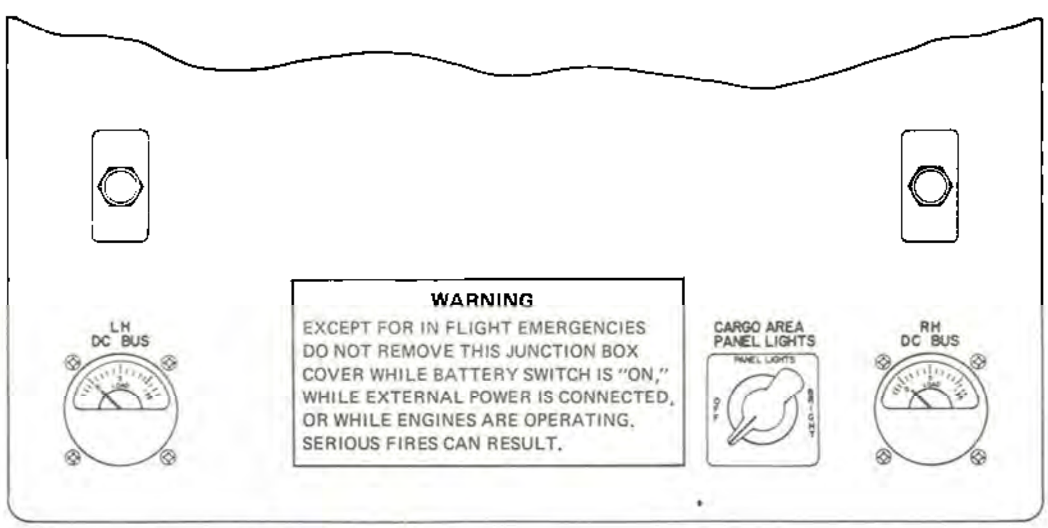


Figure 1-37. (Sheet 7 of 12)

circuit breaker locations

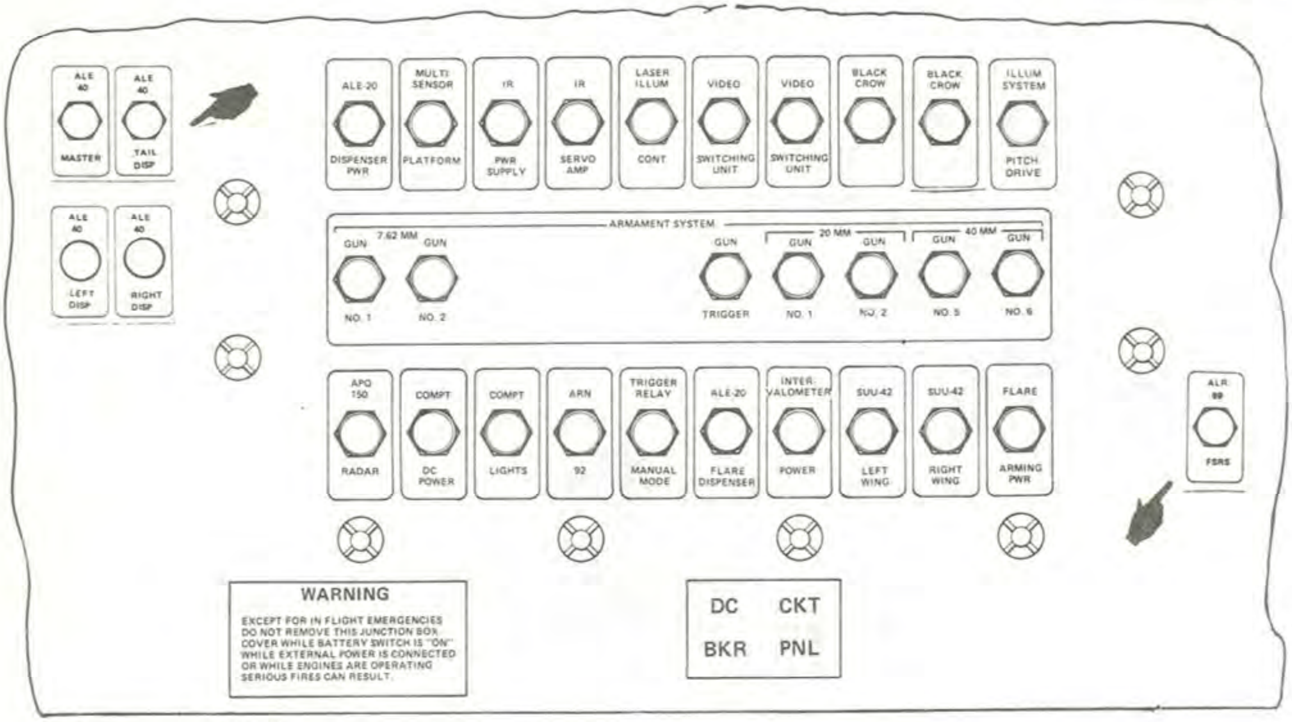




J LH AND RH DC LOWER DISTRIBUTION BOX

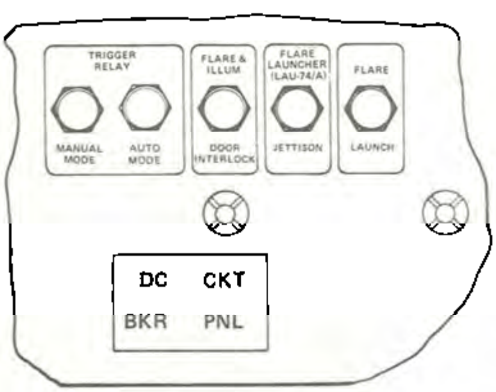
Figure 1-37. (Sheet 8 of 12)

circuit breaker locations



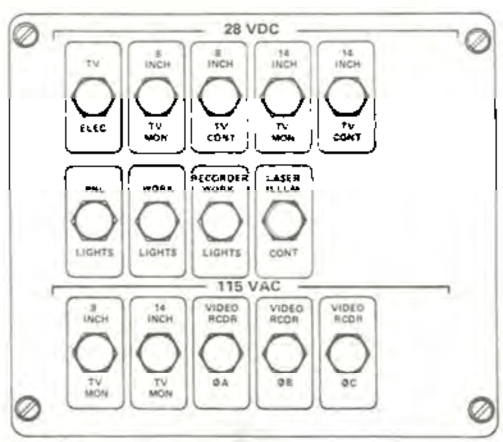
K CARGO COMPARTMENT DC CIRCUIT BREAKER PANEL

(APPLICABLE TO AIRCRAFT WITH SERIAL NUMBERS 69-6569 THRU 69-6577)



K CARGO COMPARTMENT DC CIRCUIT BREAKER PANEL

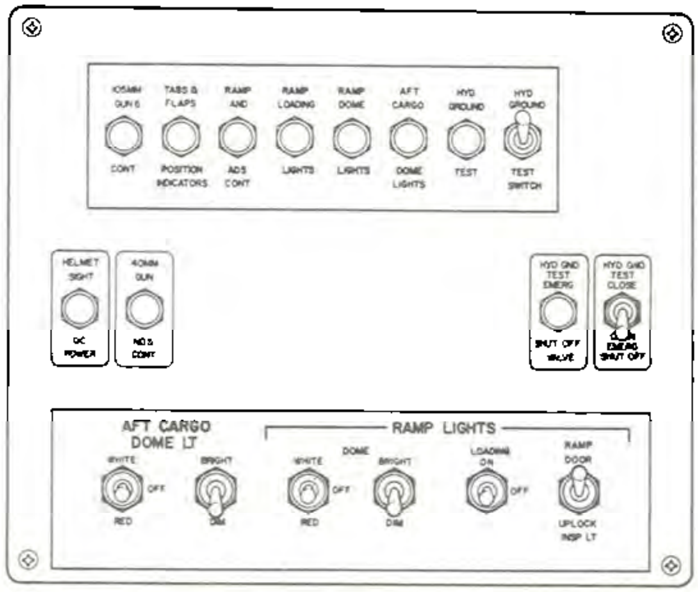
(APPLICABLE TO AIRCRAFT WITH SERIAL NUMBERS 69-6567 THRU 69-6568)



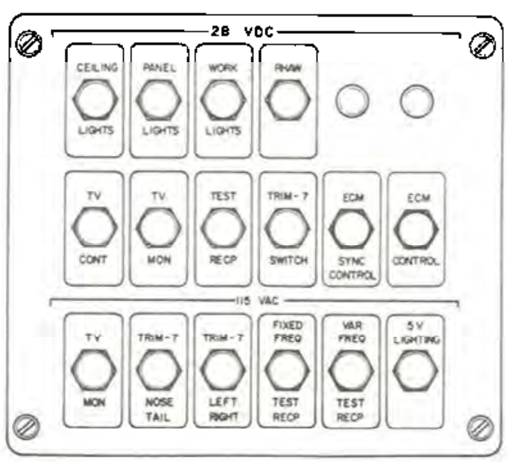
L TV CONSOLE CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 9 of 12)

circuit breaker locations



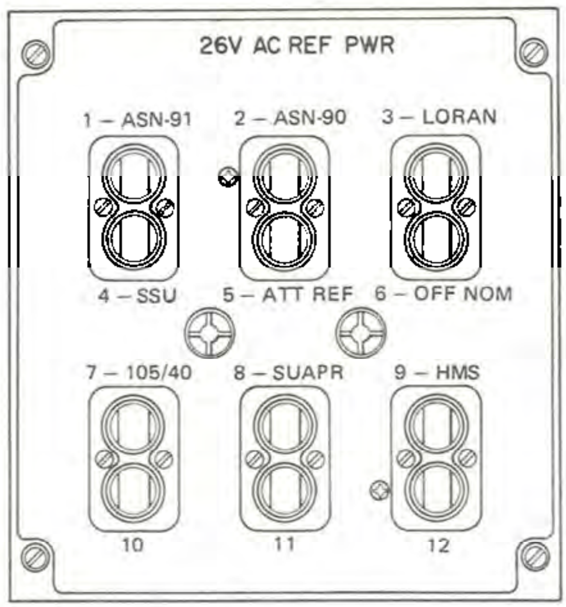
M AFT FUSELAGE JUNCTION BOX



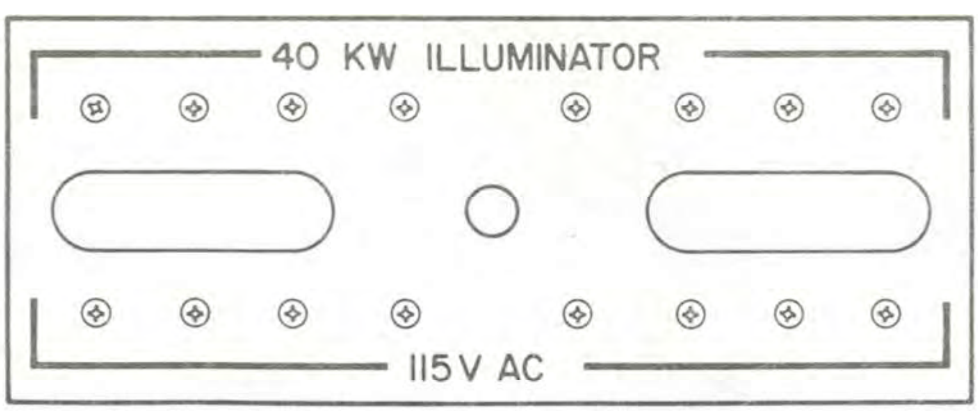
N TWO-MAN CONSOLE CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 10 of 12)

circuit breaker locations



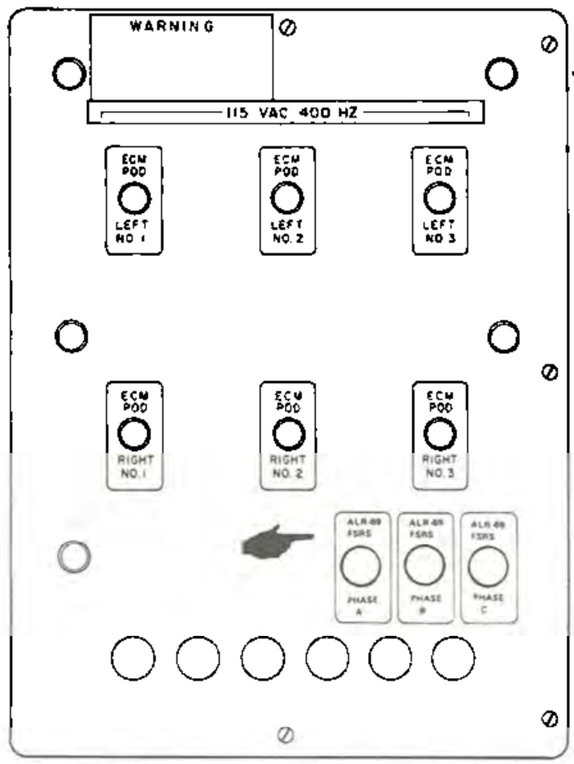
O 26 VAC REFERENCE POWER PANEL



P 40 KW ILLUMINATOR CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 11 of 12)

circuit breaker locations



Q ECM WING POD CIRCUIT BREAKER PANEL

Figure 1-37. (Sheet 12 of 12)

Each of the three phases of the generator output power can be measured by selecting the appropriate position on the phase selector switch.

Note

> A & M Frequency meters (identified by the word "HERTZ" on the face) are only accurate in the engine operating range above 90 percent rpm (ground idle).

AC EXTERNAL POWER ON INDICATOR LIGHT.

An ac external power on (EXT AC PWR) indicator light is mounted next to the ac external power switch on the overhead electrical control panel (figure 1-31). The light is energized by dc power through small pins in the ac external power receptacle and through the closed contacts of a phase sequence relay on the lower main ac distribution panel when the relay is energized. The phase sequence relay is energized when three-phase external ac power with correct phase sequence and no open phases is connected to the airplane. Test power is supplied to the power on indicator light by pressing against the lens.

GENERATOR DISCONNECT FIRED INDICATOR LIGHT.

Each generator is provided with a generator disconnect fired (DISC FIRED) indicator light that will illuminate when one of the following conditions exist: a generator disconnect switch is held in the DISC position and the firing mechanism is fired, or when the generator disconnect test switch is held in the TEST GEN DISC position. Power to the lights is supplied from the essential dc bus through the gen disconnect circuit breaker on the copilot's side circuit breaker panel.

AERIAL REFUEL MODIFICATION (T.O. 1C-130-949).

On airplanes equipped with the aerial refueling system, added electrically operated components receive operating power from the main, essential, and isolated dc busses, and the ac secondary system. These components, listed below, are provided circuit breakers installed on the flight deck circuit breaker panels indicated.

MAIN DC BUS - COPILOT'S LOWER CB PANEL
- Aerial Refuel Area Lights
- Aerial Refuel Fuselage Lights

ESSENTIAL DC BUS - COPILOT'S SIDE OR LOWER CB PANEL
- Air Refuel Valve
- Drain Power
- Dump Shutoff Valve (Modified)
- Primary Tank Solenoids - Auxiliary and External
- Primary Tank Solenoids - Mains
- Refuel Slipway Lights
- UARRSI Power

ISOLATED DC BUS - PILOT'S SIDE CB PANEL
- Secondary Tank Solenoids - Auxiliary and External
- Secondary Tank Solenoids - Mains

AC SECONDARY - PILOT'S LOWER CB PANEL
- Fuel Pressure Indicator, Crossfeed (Modified)
- Fuel Pressure Indicator, Dump

ELECTRONIC TEST RECEPTACLES.

There are six test receptacles (figure 1-36) in the airplane. They are located as follows: navigator's station, electronics equipment rack, IR/EWO console, aft cargo compartment (AN/ARN-14 equipment rack), below the flight deck extension, and in the nose wheel well.

HYDRAULIC POWER SUPPLY SYSTEMS.

A booster hydraulic system, a utility hydraulic system, and an auxiliary hydraulic system comprise power supply sources for all hydraulic components operation on the airplane. The booster system furnishes hydraulic power to a portion of the surface control boost system only. The utility system normally operates the landing gear, wing flaps, brakes, nose wheel steering, and a portion of the surface control boost system. The auxiliary system normally operates the ramp system and provides emergency pressure for brake operation. The auxiliary system also provides pressure for emergency extension of the nose landing gear.

An emergency hydraulic system provides emergency operation of the landing gear and steering if a failure occurs in the utility system. Figure 1-38 presents a block diagram for hydraulic system distribution.

UTILITY HYDRAULIC SYSTEM.

The utility hydraulic system (figure 1-40) operates from the output of number one and number two engine-driven hydraulic pumps and supplies hydraulic power to the wing flap hydraulic motor, the main landing gear hydraulic motors, the nose landing gear hydraulic system, the main landing gear brakes, nose wheel steering, UARRSI door mechanism (airplanes modified by T.O. 1C-130-949), and to a portion of the aileron, rudder, elevator control boost system and trainable gun mounts thru a priority valve. The engine-driven variable displacement pumps are supplied hydraulic fluid under electric suction boost pump pressure from a 3.2-gallon reservoir mounted on the left side of the cargo compartment. The engine-driven pumps are provided with internal control mechanisms to vary their output volume with system demand and control pressure to maintain approximately 3,000 psi output pressure. If the pump is not operating, the low pressure warning light will glow. The pressurized output fluid of each pump passes through a filter, an electrically operated shutoff valve, and a one-way check valve before merging as system pressure. The one way check valves provide individual pump failure warning by preventing the operating pump pressure from actuating the pressure warning switch for the failed pump. Fluid supply and output of the engine-driven pumps can be cut off by actuation of the fire emergency handle or engine pump switch for that particular engine. The supply fluid and output is cut off by the closing of electrically actuated shutoff valves. External connections are provided so an external supply of pressure may be used for ground maintenance operation of the system. Ground test valves are incorporated in the system so that system pressure from the auxiliary hydraulic system may be used if desired in ground maintenance operations.

A single nine-port ground test valve provides supply, return, and case drain functions. Four filters are used in the system to provide protection from foreign material contamination.

A pressure relief valve provides protection against system overpressures. An accumulator is installed in the utility hydraulic system pressure line to provide reserve pressure and a damping effect during demand and pressure fluctuations. A sight level gage mounted on the reservoir gives a visual indication of the reservoir fluid quantity. Provisions for control and monitoring of the utility hydraulic system are all located on the hydraulic control panel (figure 1-39) on the copilot's instrument panel. A secondary hydraulic panel (figure 1-39) provides switching for isolation valves in the utility and auxiliary systems. This panel also contains a hydraulic pressure indicator and switch to turn on the emergency hydraulic system.

Hydraulic lines to the left main wheel well and the nose wheel well have been protected where possible by armor plating.

Ground Test Emergency Hydraulic Shut-Off Valve.

A shut-off valve (de-energized closed) in the utility system ground test return line and a check valve in

hydraulic distribution block diagram

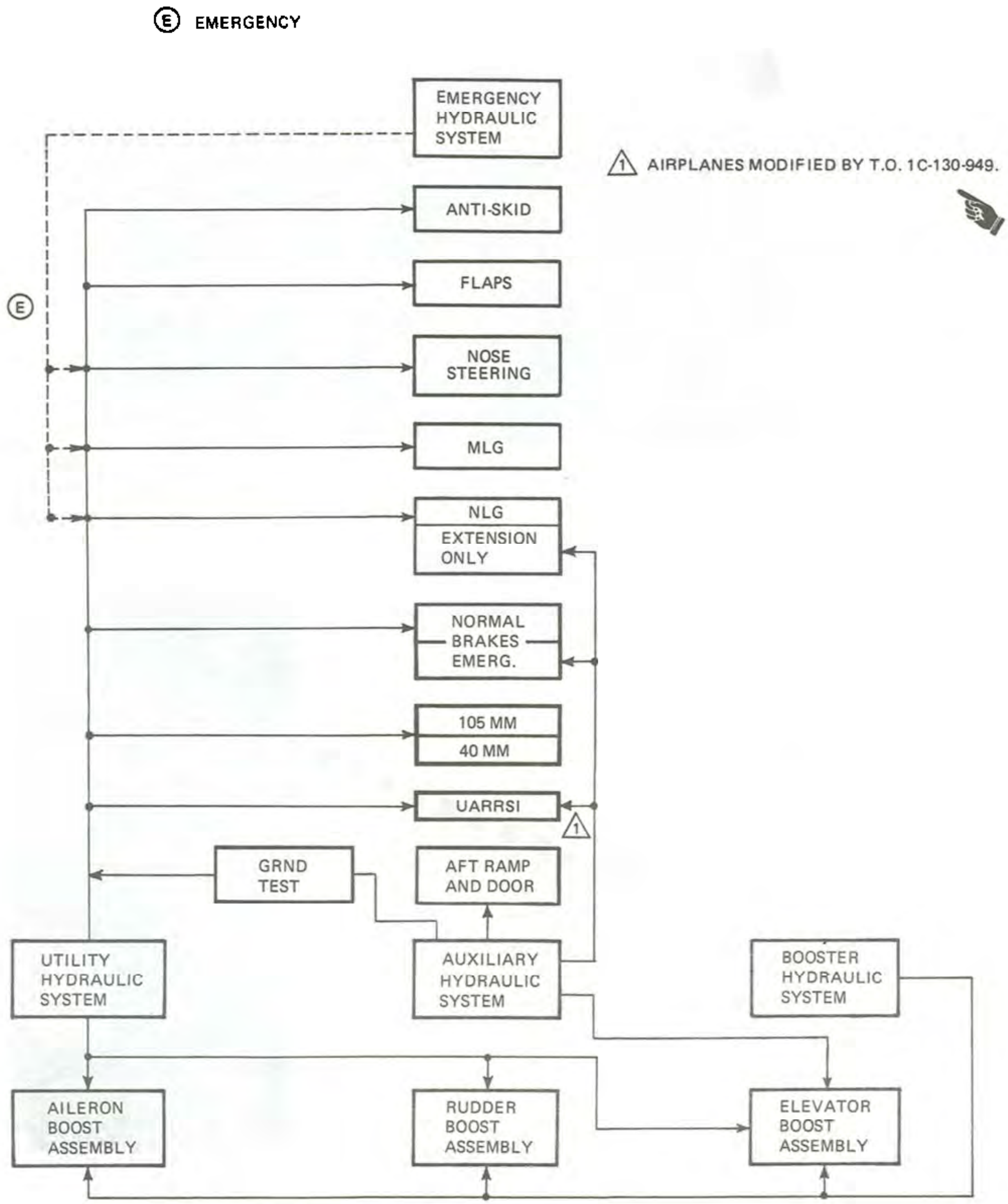


Figure 1-38.

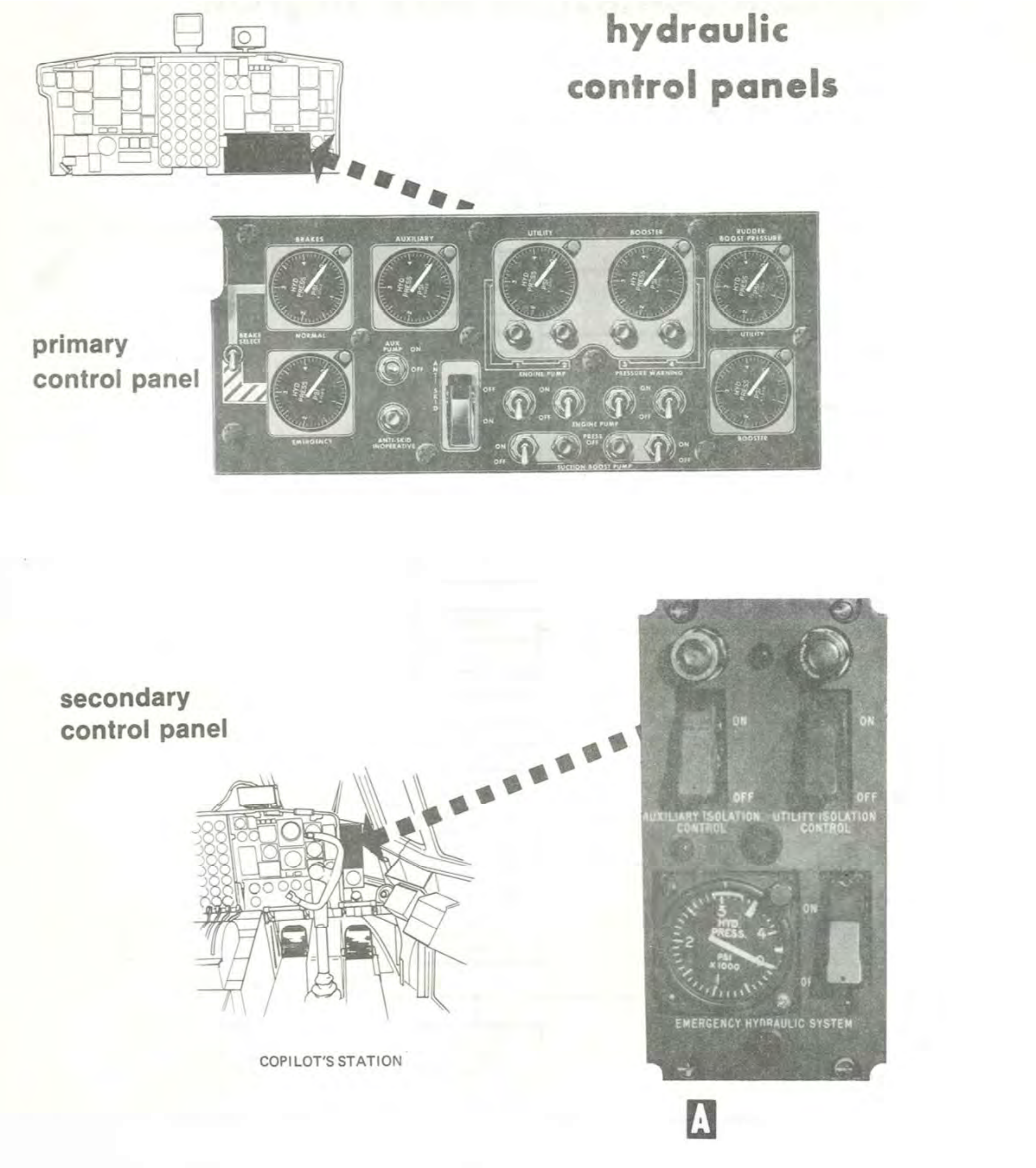

hydraulic
control panels
primary
control panel
BRAKES
AUXILIARY
UTILITY
BOOSTER
RUDDER
BOOST PRESSURE
NORMAL
EMERGENCY
BRAKE
SELECT
AUX
PUMP
ON
OFF
ANTI-SKID
ANTI-SKID
INOPERATIVE
ENGINE PUMP
PRESSURE WARNING
SUCTION BOOST PUMP
secondary
control panel
ON
OFF
AUXILIARY ISOLATION
CONTROL
UTILITY ISOLATION
CONTROL
HYD
PRESS.
PSI
X1000
EMERGENCY HYDRAULIC SYSTEM
COPILOT'S STATION
A

Figure 1-39.

utility hydraulic system

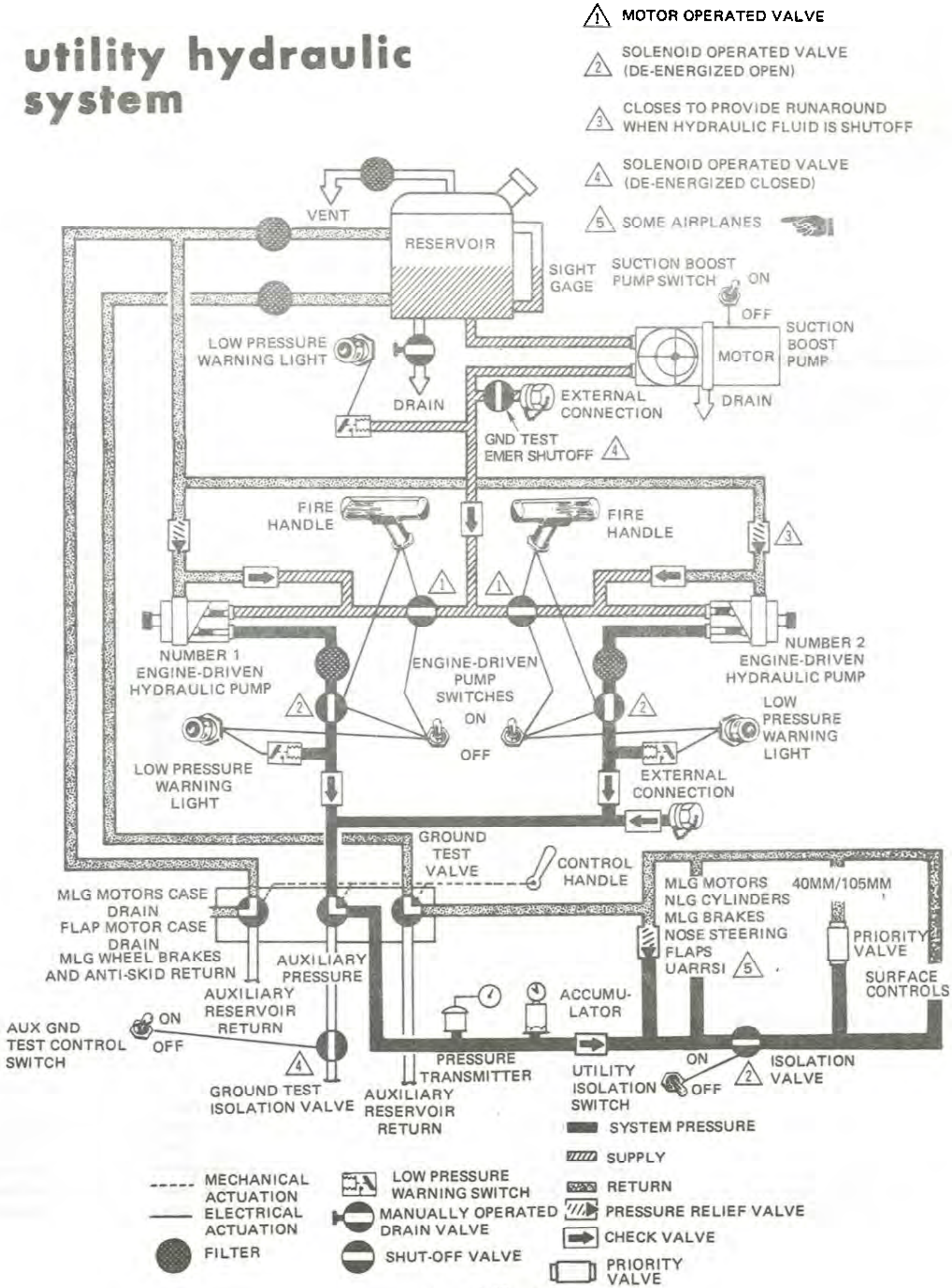


Figure 1-40.

the pressure return line provide emergency shutoff in the event of an ALE-20 flare fire.

The shutoff valve is located in the main landing gear wheel well. A close/open switch and circuit breaker are located on the aft cargo compartment circuit breaker panel. It can be operated manually with access through the left main wheel well. Power for this valve is obtained from the 28-volt main dc circuit breaker located on the aft fuselage junction box.

Note

Whenever an external hydraulic cart is used for system checkout, the ground test hydraulic emergency shutoff switch must be in the OPEN position.

Utility Isolation Valve.

An isolation valve has been installed to isolate the booster branch of the utility system from the utility branch, in the event of line rupture in the aft section of the aircraft. The switch for this isolation valve is located on the secondary hydraulic panel. When the utility isolation control switch is turned on, an indicator lamp on the panel will light to show that power has been applied to the valve. When the valve actuates, hydraulic pressure is cut off from the booster branch (aileron, elevator, rudder, and trainable weapons). The landing gear (both main and nose wheel), nose wheel steering, brakes and wing flaps will remain functional when the utility isolation control valve is actuated. Power is obtained from 28 vdc from the essential dc bus on the copilot's side circuit breaker panel.

Pressure Transfer Valve.

A pressure transfer valve in the utility system is located near the landing gear selector valve. The pressure transfer valve normally provides a pressure and return line path from the utility system lines to the landing gear system, but when the emergency hydraulic system is turned on, the hydraulic pressure from the emergency hydraulic system causes the pressure transfer valve to switch automatically and provide pressure and return line paths from the emergency system to the landing gear system. This provides an emergency back-up for the landing gear if the utility system should fail or lose hydraulic pressure.

Power Switching Valve.

A power switching valve in the utility system is located in the aft portion of the cargo ramp area near the elevator booster assembly. The power switching valve normally provides pressure and return line paths from the utility system to the elevator booster assembly. If pressure in the utility system fails (450-750 psi), and the auxiliary system has been turned on, the hydraulic pressure from the auxiliary system will cause the power switching valve to switch automatically to provide pressure and return line paths from the auxiliary system to the elevator booster assembly. Figure 1-44 shows the power switching valve located in the flight control system.

Priority Valve.

The airplane's utility system provides hydraulic power to the trainable gun mounts. A filter and a priority valve, located above and aft of the left paratroop door, have been added to protect the system. The priority valve will close to isolate pressure in the utility system when pressure in the system drops below 2,250 psi.

Utility Suction Boost Pump Switch.

The utility system suction boost pump switch is a two-position (OFF, ON) toggle switch which furnishes 28-volt dc power from the essential dc bus through the hyd utility suction pump circuit breaker on the copilot's lower circuit breaker panel to operate a relay which controls three-phase essential ac bus power to the suction boost pump motor.

Suction Boost Pump Pressure Warning Light.

The suction boost pump low pressure warning light is an amber warning light controlled by a pressure sensitive switch. The warning light will illuminate if pressure output of the suction boost pump drops below approximately 20 psi. The suction boost pump motor is protected by thermal circuit breakers which open and stop the motor if the current exceeds approximately 11 amperes. When this occurs, the low-pressure warning light will illuminate. As the circuit breakers cool, the circuits will close to restore power to the pump motor, and the light will go off. The light receives 28-volt dc power from the essential dc bus through the hyd utility suction pump circuit breaker on the copilot's lower circuit breaker panel.

Engine Pump Switch.

Engine pump off-on switch is a two-position toggle switch which controls two hydraulic shutoff valves. One of these valves shuts off supply flow to the engine-driven pump, and the other shuts off pump output. These are the same valves operated by the fire emergency handle. Since the engine pump continues to turn after both the supply and output valves are closed, normal flow from the pump case drain passes through a check valve back into the suction port of the pump to form a run-around circuit. This feature is provided to prevent damage to the engine-driven pumps that would otherwise result from lack of hydraulic fluid and overheating. The valves receive 28-volt dc power from the essential dc bus through the fire shutoff valves hydraulic circuit breaker on the copilot's side circuit breaker panel.

Engine Pump Pressure Warning Light.

The engine pump pressure amber warning lights are controlled by pressure actuated switches which sense the engine-driven pump output pressures. Whenever either engine pump output pressure drops below approximately 1,000 psi its light will illuminate. The pressure warning light will also illuminate when the engine pump switch is placed in the OFF position. The lights receive 28-volt dc power from the essential dc bus through the hydraulic pump pressure warning circuit breaker on the copilot's side circuit breaker panel.

Utility Hydraulic Pressure Gage.

The utility system hydraulic pressure gage is controlled by a remote transmitter and indicates utility system pressure. The gage receives 26-volt ac power from the No. 2 instrument transformer through the indicator hyd pressure utility fuse on the pilot's lower circuit breaker panel.

BOOSTER HYDRAULIC SYSTEM.

The booster hydraulic system (figure 1-41) operates from the output of number three and number four engine-driven hydraulic pumps and supplies hydraulic power to a portion of the elevator, rudder, and aileron control boost system. The engine-driven variable displacement pumps are supplied hydraulic fluid under electric suction boost pump pressure from a 2-gallon reservoir mounted on the right side of the cargo compartment. The engine-driven pumps are provided with internal control mechanisms to vary their output volume with system demand and control pressure to maintain approximately 3,000-psi output pressure. If the pump is not operating, the low pressure warning light will glow. The pressurized output fluid of each pump passes through a filter, an electrically operated shutoff valve, and a one-way check valve before merging as system pressure. The one-way check valve provides individual pump failure warning by preventing system pressure from actuating the pressure warning switch of the failed pump. Fluid supply and output of the engine-driven pumps can be cut off by actuation of the fire handle or engine pump switch for that particular engine. The supply fluid and output is cut off by the closing of electrically actuated shutoff valves. Provisions are included in the system for manual overboard draining of the system fluid. External connections are also provided so an external supply of pressure may be used for ground maintenance operation of the system. Four filters are incorporated in the system to provide protection from foreign material contamination. A pressure relief valve provides protection against system overpressures. An accumulator in the system provides reserve pressure and a damping effect during demand and pressure fluctuations.

A sight level gage mounted on the reservoir gives a visual indication of the reservoir fluid quantity. Provisions for control and monitoring of the booster hydraulic system are all located on the hydraulic control panel (figure 1-39) on the copilot's instrument panel.

Booster Suction Boost Pump Switch.

The booster system suction boost pump switch is a two-position OFF-ON toggle switch which furnishes 28-volt dc power from the essential dc bus through the hyd boost suction pump control circuit breaker on the copilot's side circuit breaker panel, and controls three-phase essential ac bus power to the suction boost pump motor.

Suction Boost Pump Pressure Warning Light.

The suction boost pump low pressure warning light is an amber warning light controlled by a pressure-sensitive switch. The warning light will glow, if pressure output of the suction boost pump drops below approximately 20 psi. The suction boost pump motor is protected by thermal circuit breakers which open and stop the motor if the current exceeds approximately 11 amperes. When this occurs, the low pressure warning light will illuminate. As the circuit breakers cool the circuit will close to restore power to the pump motor and the light will go off. The light receives 28-volt dc power from the essential dc bus through the hydraulic boost suction pump control circuit breaker on the copilot's side circuit breaker panel.

Engine Pump Switch.

The engine pump OFF-ON switch is a two-position toggle switch which controls two hydraulic shutoff valves. One of these valves shuts off supply flow to the engine-driven pump, and the other shuts off pump output. These are the same valves operated by the fire handle. Since the engine-driven pump continues to turn after both the supply and output valves are closed, normal flow from the pump case drain passes through a check valve back into the suction port to form a run-around circuit. This feature is provided to prevent damage to the engine-driven pumps that would otherwise result from lack of hydraulic fluid and overheating. The valves receive 28-volt dc power from the essential dc bus through the fire shutoff valves hydraulic circuit breaker on the copilot's side circuit breaker panel.

Engine Pump Pressure Warning Lights.

The engine pump pressure amber warning lights are controlled by pressure actuated switches which sense the engine-driven pump output pressure. Whenever either engine pump output pressure drops below ap-

booster hydraulic system

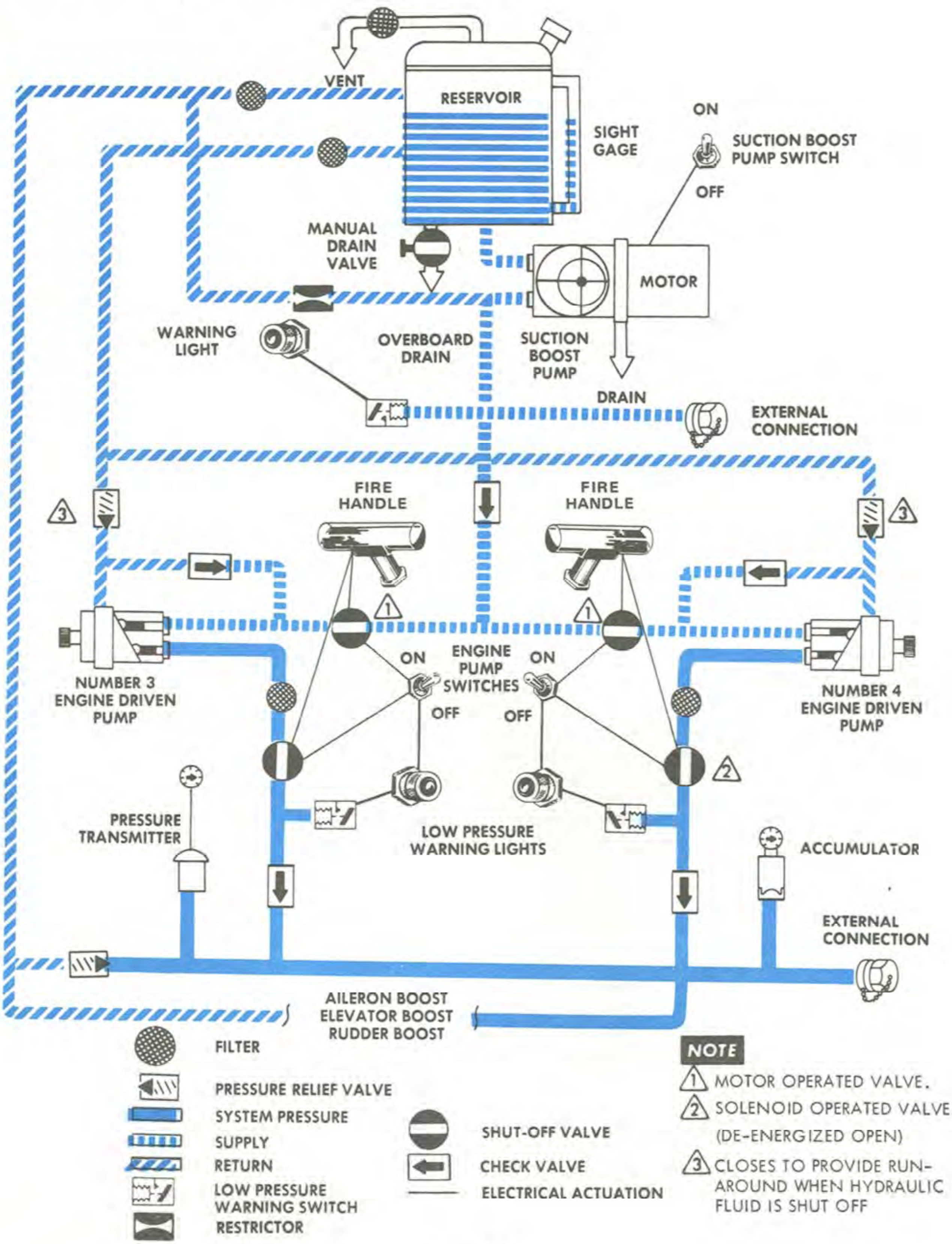


Figure 1-41.

auxiliary hydraulic system

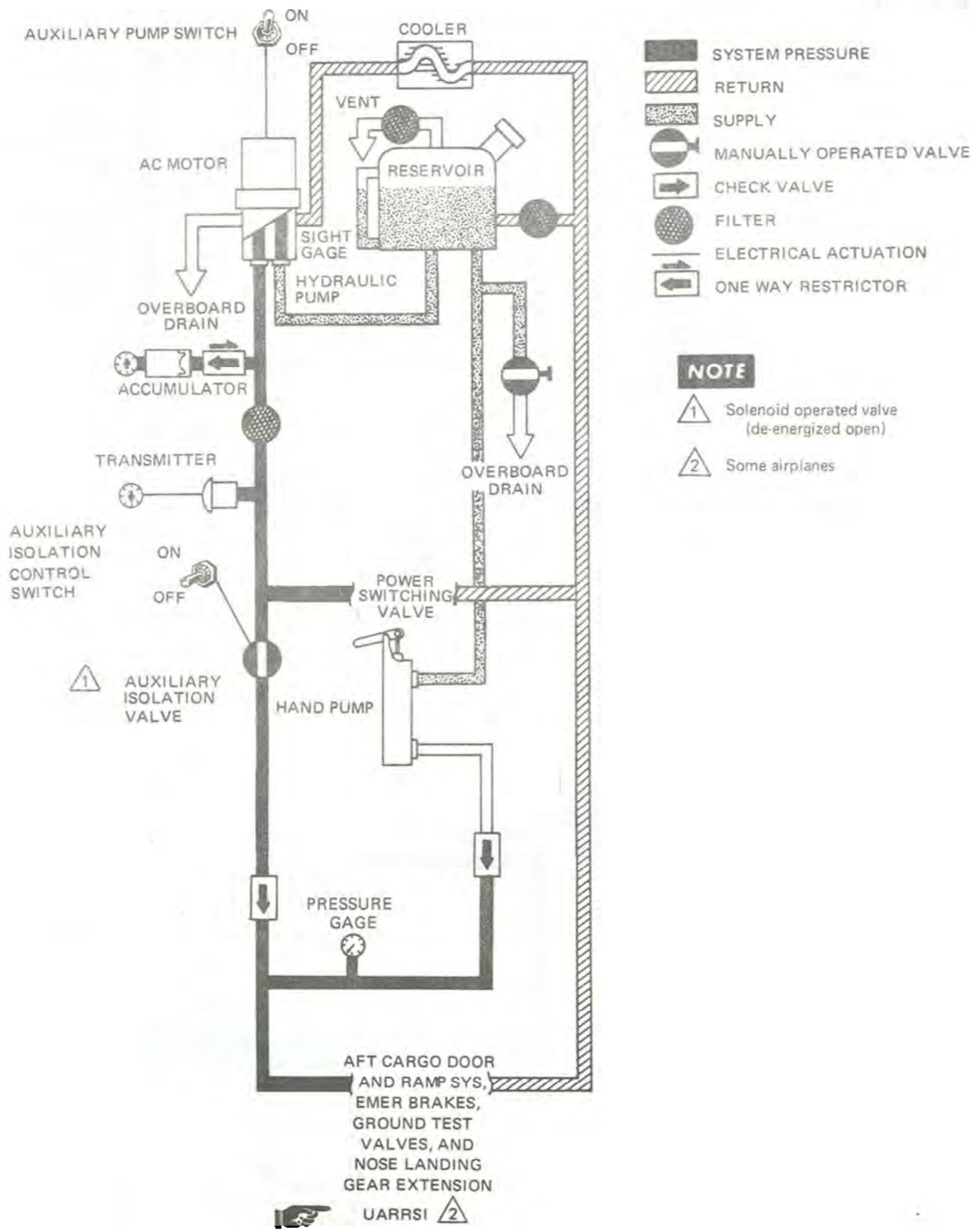


Figure 1-42.

emergency hydraulic system

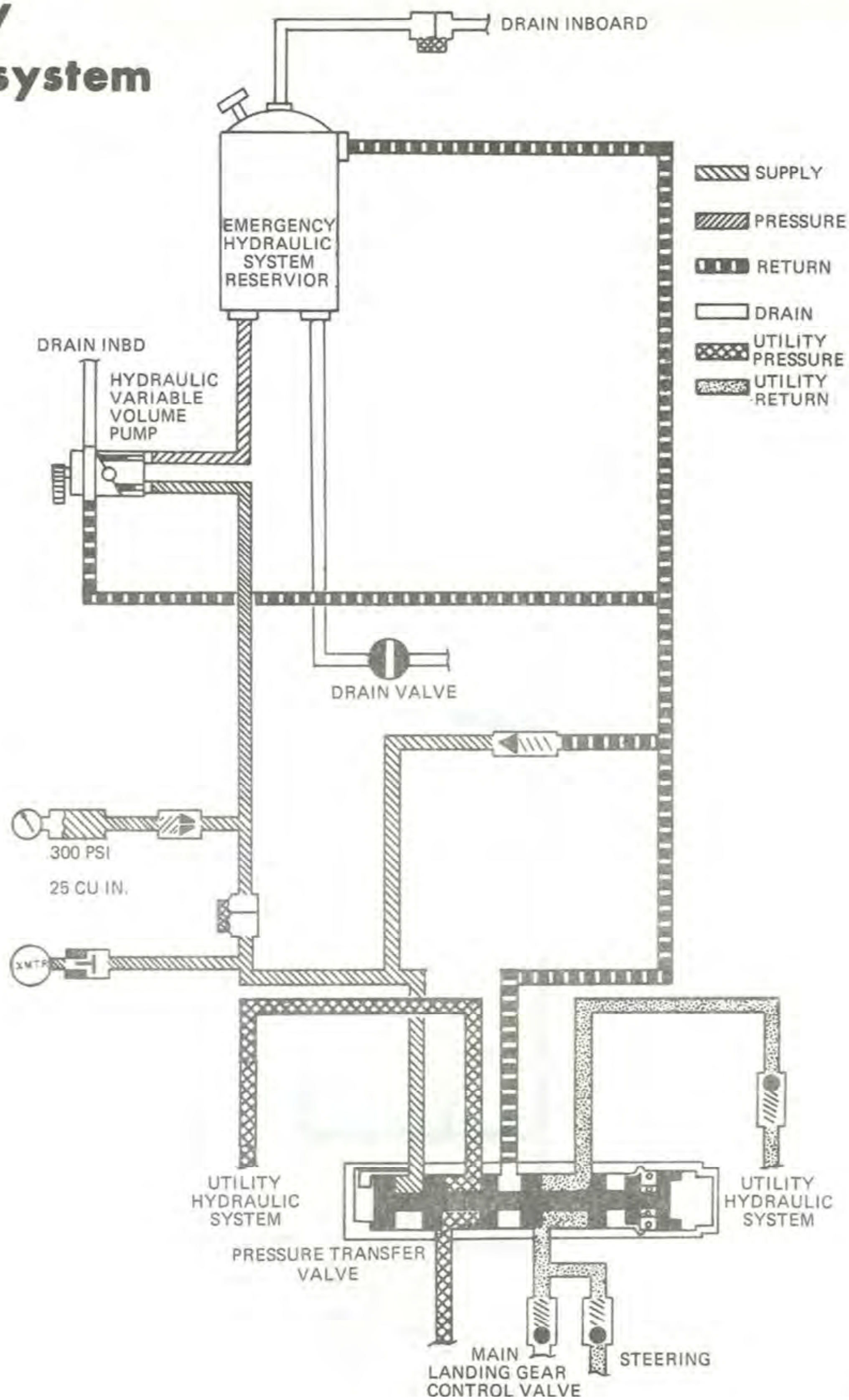


Figure 1-43.

proximately 1,000 psi its light will illuminate. The pressure warning light will also illuminate when the engine pump switch is placed in the OFF position. The lights receive 28-volt dc power from the essential dc bus through the hydraulic pump pressure warning circuit breaker on the copilot's side circuit breaker panel.

Booster Hydraulic Pressure Gage.

The booster system hydraulic pressure gage is controlled by a remote transmitter and indicates booster system pressure. The gage receives 26-volt ac power from the No. 1 instrument transformer through the indicator hydraulic pressure boost fuse on the pilot's lower circuit breaker panel.

AUXILIARY HYDRAULIC SYSTEM.

The auxiliary hydraulic system (figure 1-42) operates from a three-phase, ac, electrically driven hydraulic pump, it powers the aft cargo door and ramp system; provides an alternate source of hydraulic power to operate the UARRSI door mechanism (airplanes modified by T.O. 1C-130-949), provides emergency pressure for the main landing gear brakes, provides pressure for nose gear emergency extension, and an alternate method of powering the utility side of the elevator boost package through the power switching valve.

The system is mounted in the cargo compartment and may be manually or electrically operated from the ramp control panel (figure 4-146), or electrically operated from the hydraulic control panel (figure 1-39). A handpump (figure 4-146) in the system provides an optional source of system pressure for ground or inflight operation of the aft cargo door and ramp system, emergency brakes, and emergency nose gear extension, but is isolated from the power switching valve by a check valve. A direct measuring pressure gage located near the handpump shows system pressure. A remotely controlled pressure gage located on the hydraulic control panel also indicates system pressure. The electrically driven system pump, supplied hydraulic fluid from a 3.4-gallon reservoir, is a variable-volume output type which will maintain approximately 3000 psi output pressure. Check valve allow handpump pressure to operate the system when the handpump is operated and the electric pump is off. A manually operated shutoff valve is provided to furnish overboard drain provisions. A manually operated nose landing gear emergency extension valve connects the system to the nose landing gear system, allowing auxiliary system pressure to be transferred to the nose landing gear uplock and to the down actuating cylinder for emergency extension of the nose gear. Two filters provide protection from foreign material contamination within the system. An accumulator is provided in the auxiliary hydraulic system. The accumulator takes some of the starting load off the auxiliary hydraulic pump and, in turn, helps to prevent surge loads on the essential ac bus. A cooler assembly in the system permits continuous pump operation.

Auxiliary Hydraulic Pump Switches.

The auxiliary hydraulic pump may be controlled by either of two ON-OFF toggle switches, located on the hydraulic control panel and the ramp control panel. When either switch is placed in the ON position, 28-volt dc power is supplied from the essential dc bus through the ramp hydraulic pump control circuit breaker, located on the copilot's lower circuit breaker panel, to energize the auxiliary hydraulic pump relay. When the relay is energized, 115/200-volt, three-phase, ac power is supplied from the essential ac bus through the hydraulic pump auxiliary system circuit breakers, located on the pilot's side circuit breaker panel, to drive the auxiliary hydraulic pump motor. When both switches are placed in the OFF position, the relay is de-energized and power is removed from the auxiliary hydraulic pump motor.

Auxiliary Hydraulic Pressure Gages.

The auxiliary hydraulic system pressure is indicated by the gage located on the hydraulic control panel and the gage located in the cargo compartment near the handpump. The gage located in the cargo compartment is a direct-reading instrument and shows system pressure at all times, whether from the handpump or from the electric pump. The gage located on the hydraulic control panel is controlled by a remote transmitter; it receives 26-volt ac power from the No. 2 instrument transformer through the ramp indicator hydraulic pressure fuse located on the pilot's lower circuit breaker panel.

Note

> Pressure build up from the auxiliary hydraulic hand pump will not be indicated on any pressure gage located on the hydraulic control panel.

Ground Test Valves.

Ground test valves are provided for pressurizing the utility hydraulic system with auxiliary system pressure without running the engines in order to check equipment operated by the utility system.

A single nine-port ground test valve is used in lieu of the two three-port valves. This valve provides supply, returns and case drain functions. Four filters are used in the system to provide protection from foreign material contamination. The valve is provided for maintenance purposes only and cannot be used for checking systems when airborne since the manual ground test valve is located in the left aft wheel well fairing.

Ground Test Isolation Valve.

A ground test isolation valve is installed in the auxiliary pressure line to the ground test check-out valve. The switch for this valve is located in the aft cargo compartment circuit breaker box just forward of the left paratroop door. This valve is normally closed to isolate the auxiliary system from the ground test check-out valve. Power for this valve is obtained from the 28-volt main dc circuit breaker located on the aft fuselage junction box.

Auxiliary Isolation Valve.

An auxiliary isolation valve has been added to isolate the power switching valve from other auxiliary functions. The control switch for this valve is located on the secondary hydraulic panel. When the auxiliary isolation control valve switch is turned on, an indicator lamp on the panel lights shows that power has been applied to the isolation valve. With switch ON, auxiliary pressure from the electrically driven pump is not available for aft cargo door and ramp, emergency brakes, emergency nose gear extension, and UARRSI system (some airplanes), but is available from auxiliary system hand pump. The valve is powered by 28 vdc from the essential dc bus on the copilot's side circuit breaker panel.

EMERGENCY HYDRAULIC SYSTEM.

The emergency hydraulic system (figure 1-43) is located on the right side of the aircraft just forward of the auxiliary hydraulic system. It provides emergency hydraulic power to the landing gear and nose wheel steering. It is connected to the landing gear through a pressure transfer valve which is actuated when the emergency hydraulic system is turned on. The pressure in the emergency hydraulic pressure line causes the valve to switch automatically to provide hydraulic power for the landing gear and steering functions. The emergency hydraulic system control switch and pressure indicator are located on the secondary hydraulic panel. When the switch is placed in the ON position, the hydraulic motor pump is turned on and hydraulic pressure is built up in the system. The pressure transmitter relays the hydraulic pressure to the pressure indicator on the secondary hydraulic panel and thus shows that the system is on. The landing gear lever can be utilized to operate the landing gear.

Pump receives 115 volts 3 phase power from the right hand ac bus on the upper circuit breaker panel. Switch control power is 28 volt from the essential dc bus on the copilot's side circuit breaker panel.

CAUTION

> The emergency hydraulic system should not be operated at full load for more than 1 minute or operated at no load for more than 30 minutes.

If the emergency hydraulic system is to be used for landing gear extension and nose wheel steering, the system should be turned on just long enough to extend and lock the landing gear in the down position. Then, the system should be turned off until a time just prior to landing, when the system can be turned on again. This will avoid overheating of the hydraulic motorpump between the time of landing gear extension and touch-down of the aircraft when nose wheel steering is required.

FLIGHT CONTROLS.

The flight controls include the main surface control systems, which are aileron, rudder, and elevator systems, and tab control systems. The main surfaces are controlled by mechanical systems with hydraulic boost. The trim tabs are controlled by electrical control systems. The autopilot, when operating, controls the main surfaces and elevator trim tabs.

MAIN SURFACE CONTROL SYSTEMS.

The main surfaces (ailerons, rudder, and elevators) are controlled by mechanical control systems, consisting of cables, pushrods, bellcranks, and torque tubes. Hydraulically driven booster units provide most of the force required to move the surfaces. The booster units are driven by hydraulic pressure supplied simultaneously by the booster and utility hydraulic system (figure 1-44), each of which serves to power one portion of the booster units. System operation is such that failure or malfunction of any component of either system in any booster unit will allow normal function of the other system powering the same unit. A loss of hydraulic pressure in either hydraulic system results in a corresponding loss in the booster unit, and a proportionate loss of power to operate the unit. The airplane may be controlled with complete loss of booster unit power by the use of trim tabs and engine power, plus coordinated increased efforts of the pilot and copilot. Solenoid-operated shutoff valves in each surface control system can be actuated by switches on the control boost switch panel (figure 1-45) at the flight station to shut off supply pressure to either portion of the systems. The valves are spring-loaded and will open when de-energized (control boost switches in the ON position). A booster off warning light for each switch is also powered by the solenoid shutoff valve switch and will illuminate when the switch is in the OFF position. An autopilot servomotor is cable-rigged to each booster unit to substitute for manual control during autopilot operation. Electrical power for operation of the booster shutoff valves is supplied from the essential dc bus through the aileron, elevator, and rudder shutoff valves circuit breakers on the copilot's lower circuit breaker panel.

Rudder Booster Assembly.

Note

> Snubber action may be detected on rudder booster assemblies containing Ronson actuators when moving from travel extremes with only one hydraulic system pressurized. This snubbing action is not binding or sticking. With both hydraulic systems pressurized, there should be no perceptible snubbing action when actuating from travel extremes toward center.

The rudder booster assembly is a single tandem-type hydraulic actuating cylinder which furnishes most of the force to actuate the rudder. During normal operation, fluid supplied at approximately 3,000 psi pressure is routed by solenoid-controlled, normally de-energized diverter valves through pressure reducer valves in each of the systems; and from there at a pressure of approximately 1,300 psi, to the rudder

surface control system

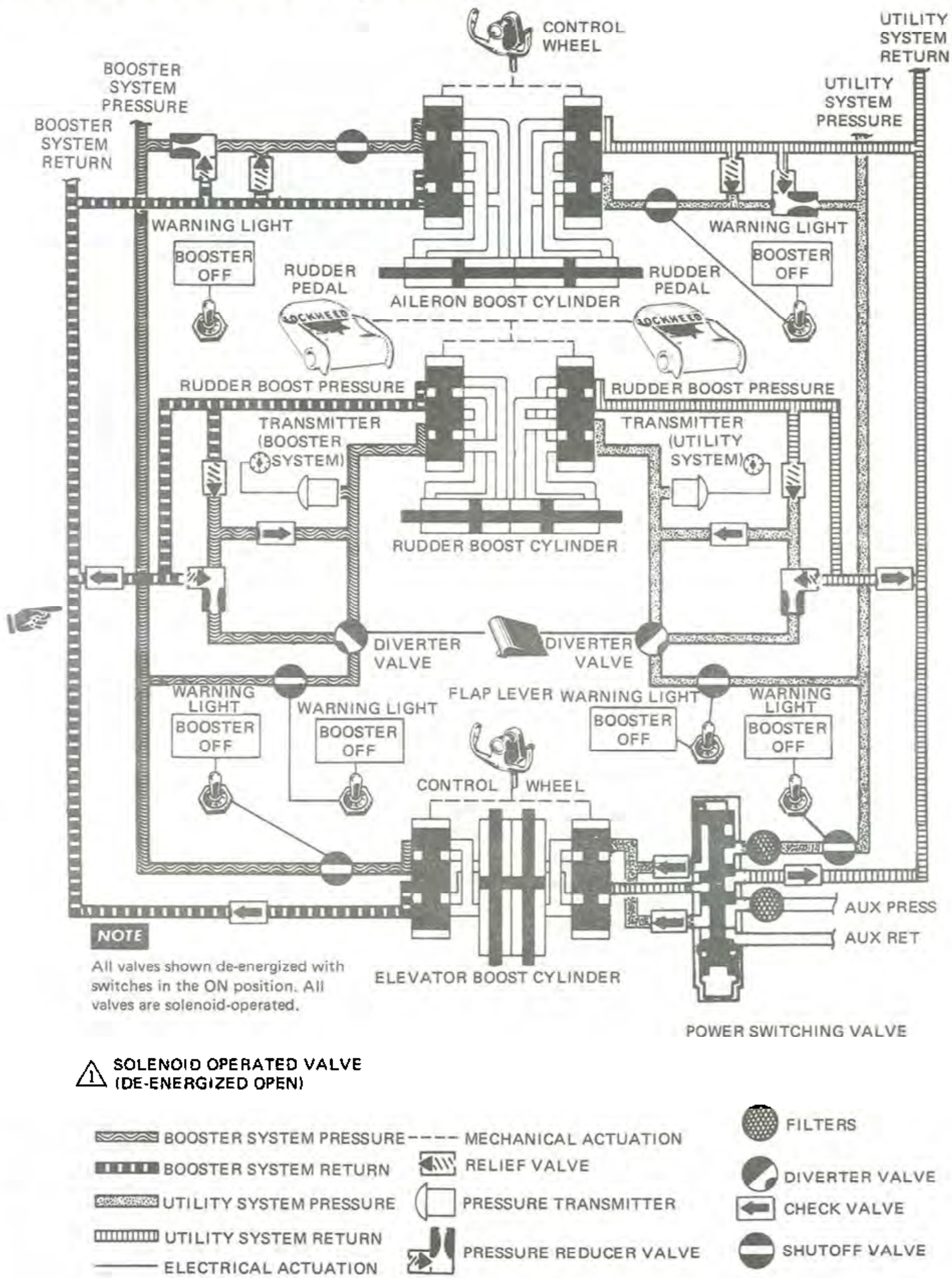


Figure 1-44.

control boost switch panel

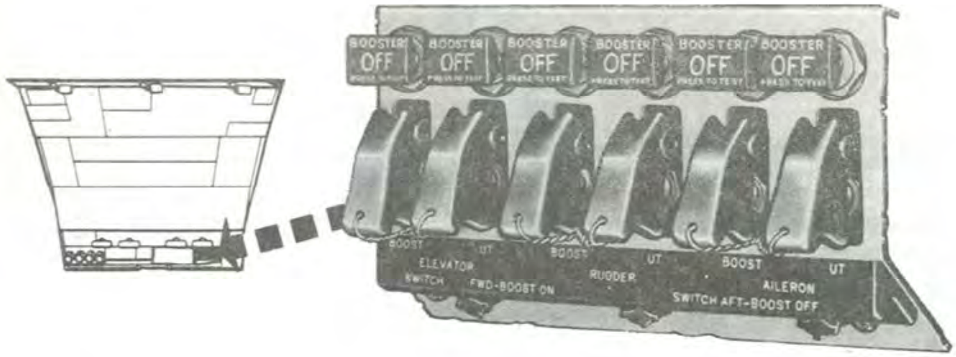


Figure 1-45.

booster assembly. This system pressure produces desirable characteristics of sensitivity and surface travel for normal inflight operation. Movement of the flap lever from the retracted (UP) position to approximately the 15 percent position or beyond will energize the solenoids of the diverter valves, actuating the valves in such a manner that the pressure reducers are bypassed thereby permitting supply fluid at approximately 3,000 psi pressure to reach the booster assembly. This doubles the available actuating force and gives desirable characteristics of sensitivity and surface travel at low airspeeds such as are encountered in take-off, landing, flying traffic patterns, troop drops, and cargo drops where flaps are used. The diverter valves are powered from the essential dc bus through the rudder high boost circuit breaker located on the copilot's lower circuit breaker panel. The amount of pressure actuating the rudder booster assembly (both the booster and utility portion of the system) is indicated on pressure gages located on the hydraulic panel (figure 1-40) of the copilot's instrument panel. Transmitters for these indicators are located downstream of the diverter valve and therefore will show high or low pressure operation.

Aileron Booster Assembly.

The aileron booster assembly is a single tandem-type hydraulic actuating cylinder which furnishes most of the force to actuate the ailerons.

During normal operation, the booster assembly is furnished fluid through pressure-reducers at approximately 2, 050 psi from both the booster and utility hydraulic systems.

Elevator Booster Assembly.

The elevator booster assembly has dual actuating cylinders connected to the booster assembly output power lever that operates the elevator control surfaces. The actuating cylinders operate simultaneously by 3,000 psi pressure supplied by the booster and utility hydraulic systems, each of which powers one actuating cylinder.

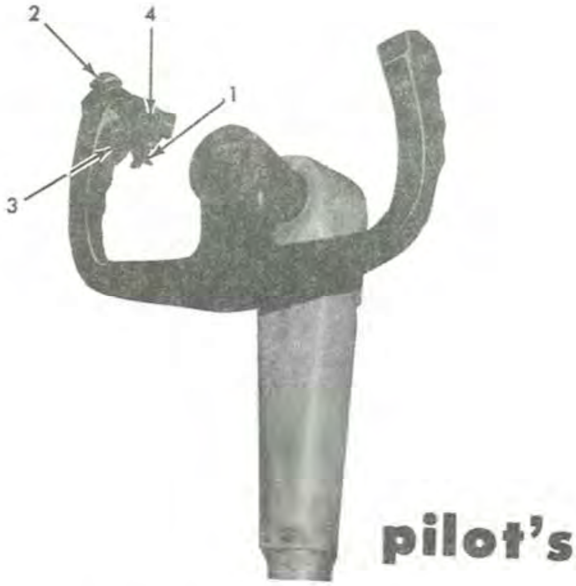
Also, an alternate method is provided to the utility side of the boost package by the auxiliary hydraulic system through the power switching valve.

Surface Control System Controls.

CONTROL COLUMNS AND WHEELS.

Control columns and wheels (figure 1-46) installed at the pilot's and copilot's stations to operate the aileron and elevator surface controls are of the conventional type. Mechanical linkage actuates the hydraulically powered booster unit control valves and servomotors for each of these surface controls. Push rods (elevator) and a chain and cable arrangement (ailerons) connect the control column to bell cranks on torque tubes which are mounted under the flight station beneath the pilot's and copilot's seats. From there, dual sets of steel cables continue the elevator linkage as far as the pressure bulkhead at the extreme rear of the cargo compartment and the aileron linkage to the rear face of the center section wing rear beam web. From these points push rods and bell cranks pick up the motion and transmit it to the booster unit control valves and servo units.

control wheels



1. MICROPHONE BUTTON
2. ELEVATOR TAB SWITCH
3. AUTO-PILOT RELEASE BUTTON
4. TRIGGER (PILOT ONLY)

Figure 1-46.

rudder pedal adjustment control

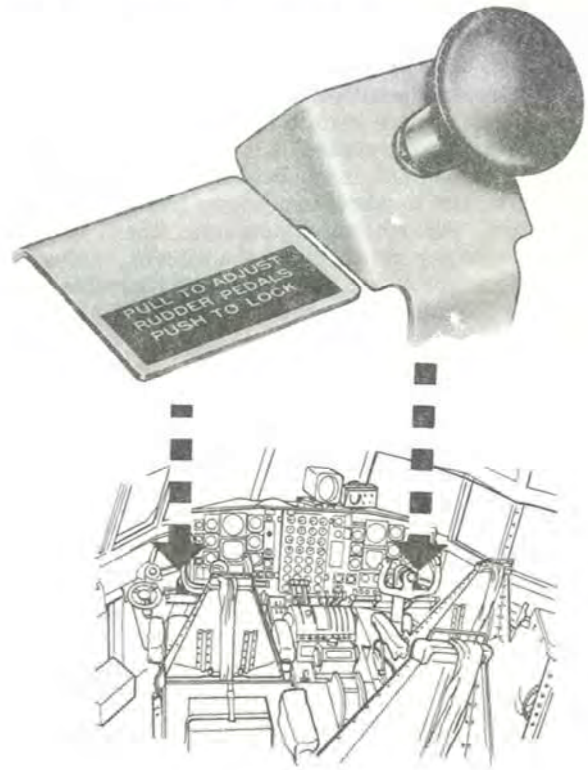


Figure 1-47.

RUDDER PEDALS AND ADJUSTMENT LEVERS.

Rudder pedals are of the conventional type. Each pair of rudder pedals can be adjusted individually by unlocking the rudder adjustment lever (figure 1-47) and pushing or releasing the spring-loaded pedals to the desired position. The rudder pedals are used to operate the rudder booster when hydraulic power is available, and to operate the rudder manually when hydraulic power is not available. Toe pressure on the rudder pedals actuates the brake during either normal or emergency braking.

CONTROL BOOST SWITCHES AND WARNING LIGHTS.

The control booster unit shutoff valve actuating switches (figure 1-45) are located on the control boost switch panel on the overhead control panel. There are six guarded two-position toggle switches (ON with cover down, de-energized) which will actuate the shutoff valves to isolate the corresponding booster package and energize six hooded warning lights which illuminate BOOSTER OFF when their respective switch is placed in the OFF position. The panel switches supply power to the warning lights directly through the copilot's lower circuit breaker panel when in the OFF position and therefore the lights furnish no independent indication directly of boost unit failure or that the shutoff valves are closed. The warning light only indicates that the switch is in the OFF position and dc power is routed to the solenoid shutoff valve. Individual pressure control from both the booster and utility system is available to each boost package. Twenty-eight volt dc power for the lights and valves is supplied from the essential dc bus through the shutoff valves circuit breakers on the copilot's lower circuit breaker panel. A utility isolation control valve switch is located on the secondary hydraulic control panel (figure 1-39). When this switch is turned ON, an indicator lamp on the panel will illuminate to show that power has been applied to the valve. When the valve actuates, utility hydraulic pressure is cut off from the aileron, elevator, rudder, control boost packages and trainable weapons. (See Flight Control Systems Failure in Section III for emergency procedures.)

TRIM TAB CONTROL SYSTEMS.

Trim tabs are provided on the control surfaces to aid in trimming the airplane during flight. Lateral trim is obtained through operation of a trim tab on the left aileron. A ground adjustable tab is located on the right aileron to compensate for any inherent unbalance about the longitudinal axis of the airplane. Nose-up and nose-down trim is obtained through operation of the trim tabs on the elevators, one trim tab on each elevator control surface. Minor directional control for yaw conditions is obtained by operation of the rudder trim tab. The elevator trim tab normal system is inoperative for manual control when the autopilot is engaged. The autopilot elevator servo will function only when the elevator tab switch is placed in the NORMAL position. All trim tab actuators are driven by 115-volt, single-phase, ac motors, except during emergency operation when the elevator trim tab actuator is driven by a 28-volt dc motor.

Trim Tab Systems Controls.

Trim tab controls consist of switches for control of the tab actuators and a power selector switch to select emergency operation of the elevator tabs.

AILERON AND ELEVATOR TRIM TAB SWITCH.

An aileron and elevator trim tab switch is located on the trim tab control panel of the flight control pedestal (figure 1-48). It is a recessed, five-position (NOSE UP, NOSE DOWN, OFF, LOWER LEFT WING, LOWER RIGHT WING) toggle switch, with all switch positions other then the OFF (center) position spring-loaded to return to the center position upon release of the switch. When the switch is held in the LOWER LEFT WING or LOWER RIGHT WING position, the trim tab on the left aileron control surface is actuated by a tab motor to trim the airplane laterally. When the switch is held in the NOSE UP or NOSE DOWN position, the elevator trim tabs are actuated by a tab motor to drive the tabs down or up. The elevator tabs can only be operated from the aileron and elevator trim tab switch when the elevator tab power selector switch is positioned to EMER. When the switch is in the OFF (center) position, the electric motors that actuate the trim tabs are de-energized.

The aileron tab motors receive 115-volt ac power from the essential ac bus through the aileron trim tab circuit breaker on the pilot's side circuit breaker panel. The elevator tab motor receives 28-volt dc power from the essential dc bus through the elevator emer power circuit breaker located on the copilot's lower circuit breaker panel.

Two control relays in the aileron trim tab power circuit are energized by the trim tab control switch. The relays eliminate the necessity to route the 115-volt, ac power required to operate the aileron trim tab actuator through the trim tab control switch. When the switch is placed in the LOWER LEFT WING position, it will energize the tab down relay which connects 115-volt ac power to the aileron trim tab actuator and drives the tab down. When the switch is placed in the LOWER RIGHT WING position, it will energize the tab up relay which connects 115-volt, ac power to the aileron trim tab actuator and drives the tab up. The relays are actuated by 28-volt, dc power from the essential dc bus through the aileron tab control circuit breaker on the copilot's lower circuit breaker panel.

ELEVATOR TAB SWITCHES.

An elevator tab switch (figure 1-46) is located on the outboard hand grip of each control wheel. It is a slide-type switch with NOSE UP, NOSE DOWN, and center off positions. These switches are connected in parallel and either switch can control the tabs. A runaway tab condition may be corrected by opposite movement of either switch. When either of these switches is in NOSE UP or NOSE DOWN position, and the elevator tab power selector switch is in NORMAL, a pair of dual relays are actuated and 115-volt ac power from the essential ac bus through the elevator trim tab circuit breaker is applied to the actuator. The elevator tabs con only be operated from the elevator tab switches when the elevator tab power selector switch is positioned to NORMAL.

ELEVATOR TAB POWER SELECTOR SWITCH.

An elevator tab power selector switch (figure 1-48) is located on the flight control pedestal. It is three-position (NORMAL, OFF, EMERGENCY) toggle switch used to select the source of electrical power for operation of the elevator trim tabs. When the switch is in the NORMAL position, 115-volt, ac power is supplied from the essential ac bus through the elevator trim tab circuit breaker on the pilot's side circuit breaker panel to a trim tab actuating motor

trim tab system controls & indicators

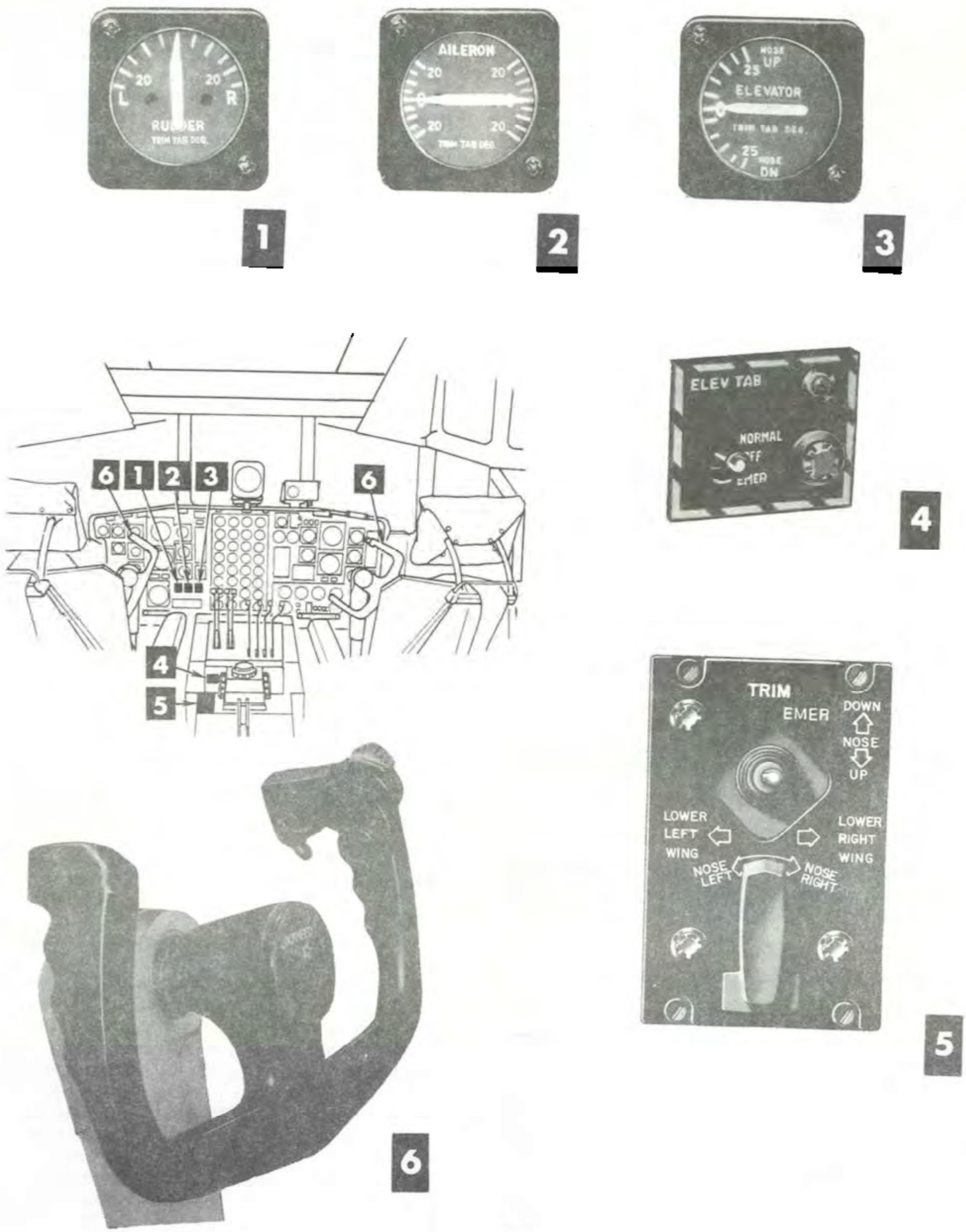


Figure 1-48.

relay for autopilot or manual operation of the elevator trim tabs. In the NORMAL position, the elevator trim tabs can be controlled from the control wheels. When in the EMERGENCY position, the elevator trim tabs can be controlled only from the elevator trim tab switch located on the pedestal. During emergency operation, 28-volt dc power is supplied from the essential dc bus through the elevator emergency power circuit breaker, located on the copilot's lower circuit breaker panel to a trim tab actuating motor that will drive the elevator trim tabs either up or down when the respective elevator trim tab control relay is energized by actuation of the trim tab control switch on the pedestal. When the elevator tab power selector switch is in the NORMAL position, the elevator trim tab control relays are powered by 28-volt dc, from the essential dc bus through the elevator tab control circuit breaker, located on the copilot's lower circuit breaker panel. When the elevator tab power selector switch is in the EMERGENCY position, the elevator trim tab tab control relays are powered by 28-volt dc, from the essential dc bus, through the elevator emer tab control circuit breaker located on the copilot's lower circuit breaker panel. When the elevator tab power selector switch is placed in the OFF position, all circuits to the elevator trim tabs are de-energized. (See Flight Control Systems Failure in Section III for emergency operation.)

RUDDER TRIM TAB SWITCH.

A rudder trim tab switch is located on the trim tab control panel of the flight control pedestal (figure 1-48). It is a three-position (NOSE LEFT, OFF, NOSE RIGHT) switch that controls operation of the rudder trim tab motor. The NOSE LEFT and NOSE RIGHT positions are spring-loaded to return to the OFF (center) position upon release of the control switch. When the switch is in NOSE LEFT or NOSE RIGHT position, 115-volt ac power from the essential ac bus through the rudder trim tab circuit breaker on the pilot's side circuit breaker panel energizes the rudder trim tab motor to position the rudder trim tab and trim the airplane.

Tab Position Indicators.

Tab position indicators show the pilot the exact angle formed by any trim tab with its corresponding control surface and the direction in which the trim will act.

RUDDER TRIM TAB POSITION INDICATOR.

A rudder trim tab position indicator is located on the pilot's instrument panel (figure 1-48). The indicator is connected to a transmitter mounted on the rudder trim tab actuator housing and indicates to the pilot the degree of rudder trim tab positioning relative to the rudder control surface. This indicator is energized by 28-volt dc power from the main dc bus through the tabs and flap position indicators circuit breaker in the aft fuselage junction box. The indicator dial face is calibrated from 0 to L and 0 to R in increments of 5 degrees of rudder trim tab travel from the neutral 0 marking. The needle on the indicator shows the exact angle between the rudder trim tab and rudder surface and the direction in which the trim will act.

AILERON TRIM TAB POSITION INDICATOR.

An aileron trim tab position indicator is located on the pilot's instrument panel (figure 1-48). This indicator is connected to a transmitter mounted on the left aileron trim tab actuator and indicates to the pilot the degree of left aileron trim tab positioning relative to the aileron control surface. This indicator is energized by 28-volt dc power from the main dc bus through the tabs and flaps position indicators circuit breaker in the aft fuselage junction box. The indicator dial face if calibrated from the neutral position of 0 to 20 up and 0 to 20 down in 5-degree increments of left aileron trim tab travel. The needle on the indicator shows the exact angle between the aileron trim tab and the left aileron surface and the direction in which the trim will act.

ELEVATOR TRIM TAB POSITION INDICATOR.

An elevator trim tab position indicator is located on the pilot's instrument panel (figure 1-48). The indicator is connected to a transmitter mounted on the elevator trim tab rotary actuator housing and indidicates to the pilot the degree of elevator trim tab positioning relative to the elevator control surface. This indicator is energized by 28-volt dc power from the main dc bus through the tabs and flaps position indicators circuit breaker in the aft fuselage junction box. The indicator dial face is calibrated from the neutral position 0 to 25 up or 25 down, in 5-degree increment of elevator trim tab travel. The needle on the indicator shows the exact angle between the elevator trim tabs and the corresponding elevator surface and the direction in which the trim will act.

Note

Trim tab travel is controlled by limit switches set at 6 degrees nose down and 25 degrees nose up, and by mechanical stops set at 8 degrees nose down and 27 degrees nose up.

FLAP SYSTEM.

The airplane is equipped with four flaps, consisting of an outboard and an inboard flap in each wing. The flaps are of the Lockheed-Fowler, high-lift type in which the flap motion is a combination of an aft movement to increase wing area and a downward tilting movement to alter the airfoil section to increase lift and drag. The time required for full extension or retraction of the flaps in between 10 to 13 seconds. When 100 percent extended, the flaps form an angle of approximately 35 degrees with the wings. The flaps are operated by a reversible hydraulic motor, a cam-actuated microswitch followup mechanism, torque tubes, gearbox, and drive screw assemblies. Hydraulic pressure is directed through a check valve to the

flap system

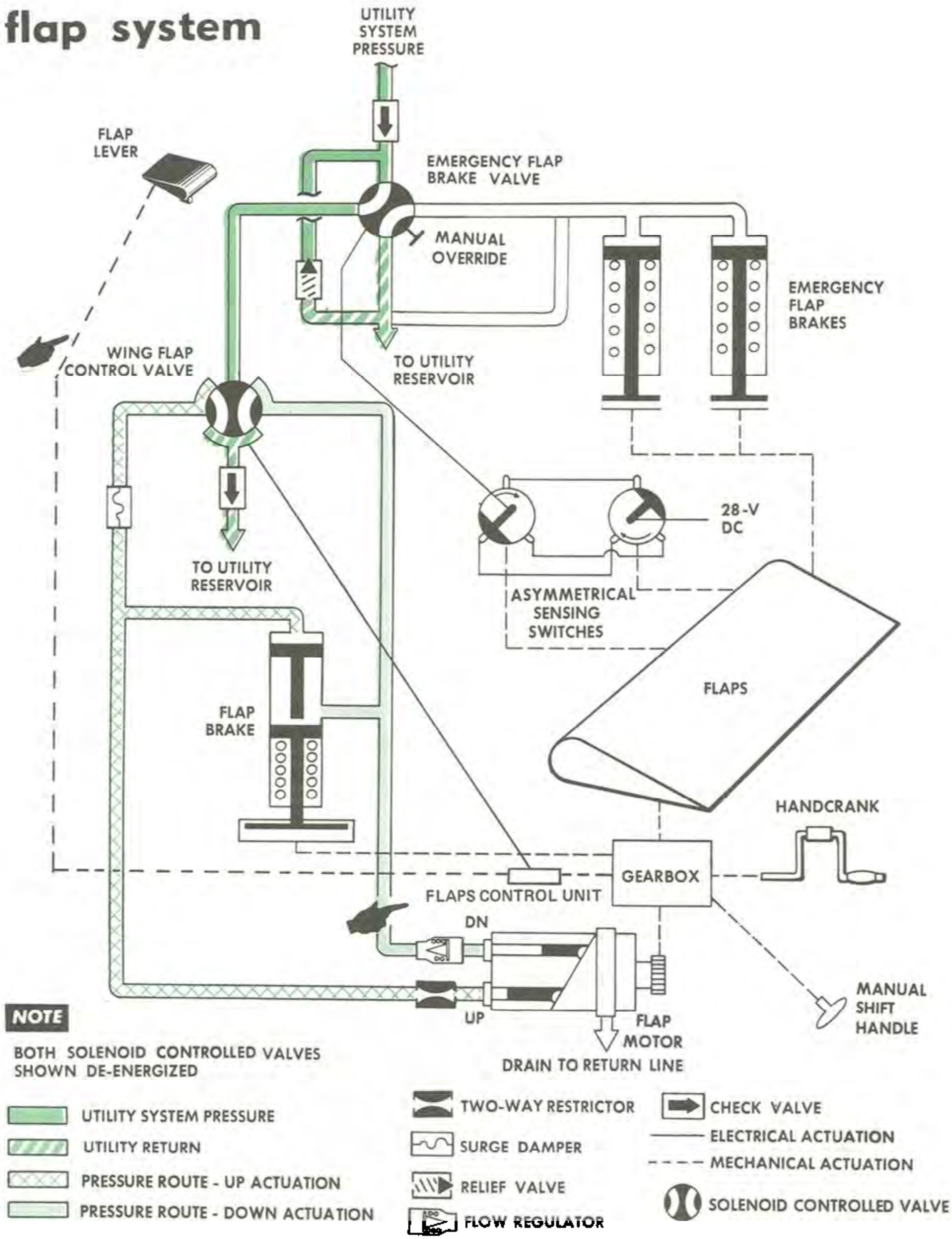


Figure 1-49.

emergency flap brake valve, and wing flap control valve, where pressure is directed to the up or down system. The hydraulic motor operates the torque shaft section extending outboard to the gearbox, which rotates ball bearing drive screws for actuation of the flaps. The flaps may be operated manually with a handcrank. A disk-type, spring-loaded flap brake holds the flaps in the selected position and prevent movement by aerodynamic loads. The brake is released by fluid pressure supplied to the system for operation of the flap drive motor. Emergency flap brakes are splined to the outer ends of the flap drive torque shaft to prevent unequal actuation of the flaps during normal extension and retraction of the flaps. Utility hydraulic system pressure is used for operation of the flap system (figure 1-49).

FLAP SYSTEM CONTROLS.

Flap system controls are provided for normal operation of the flaps. Provisions exist for manual operation of the flaps if the normal operating system fails to function.

Flap Lever.

A flap lever (figure 1-50) is located on the aft end of the flight control pedestal. It is a manually actuated control lever with the lever range calibrated from UP to DOWN in increments of 10 percent. There is a detent at approximately the 50 percent position but the flaps can be extended to any desired position by placing the lever at the selected percent of flap extension. The lever is attached by cables to a movable cam inside a flap control unit mounted on the center section wing rear beam in the cargo compartment. Movement of this cam closes microswitches which close a 28-volt dc control circuit for the wing flap selector valve. The actuated valve directs a flow of hydraulic fluid to drive the flap motor in the selected direction. A rudder pressure diverter valve, electrically actuated by a switch on the flap control lever mechanism, controls the pressure available for operation of the rudder. Pressure available for rudder operation at flap settings from 0 to 15 percent is approximately 1,300 psi as compared to approximately 3,000 psi for flap settings from 15 to 100 percent. The pressure control system is provided to prevent excessive loads at high speeds. When the selected position of the flaps is reached, the microswitches open, the selector valve shuts off hydraulic flow, and a spring-loaded hydraulic brake locks the flaps in the selected position. The wing flap selector valve receives 28-volt dc power from the main dc bus through the wing flap control circuit breaker on the copilot's lower circuit breaker panel.

Note

The landing gear warning horn is interconnected with the flap system. When the flap lever is set at approximately 70 percent or more with the landing gear up, the landing gear warning horn will sound; it cannot be silenced until the landing gear is down and locked or the flap lever is retracted above 70 percent.

Flap Lever Friction Knob.

A flap lever friction knob (figure 1-50) is located on the flap control panel. Turning the knob clockwise mechanically tightens the friction on the flap cables, preventing the flap lever from vibrating out of its set position.

Wing Flap Selector Valve.

A wing flap selector valve (figure 3-6) is mounted on the left-hand hydraulic panel, forward of the left-hand wheel well. It is a solenoid-operated valve, directing the flow of utility hydraulic fluid to either the up or down side of the flap motor for normal raising and lowering of the flaps, depending on the position of the flap lever. Override controls, consisting of two buttons marked RAISE and LOWER, are located on the selector valve for use in case of electrical failure. Pushing the button marked LOWER routes hydraulic fluid to release the flap brakes and to the gearbox drive motor to lower the flaps. Pushing the button marked RAISE routes hydraulic fluid to release the brakes and to the gearbox drive motor to raise the flaps. In normal operation, the valve is energized by 28-volt dc power from the main dc bus through the wing flap control circuit breaker on the copilot's lower circuit breaker panel.

Emergency Flap Brake Valve.

The emergency flap brake valve is a solenoid-operated hydraulic valve, located on the left-hand hydraulic panel forward of the left wheel well. In its de-energized position, hydraulic pressure passes through it to the flap selector valve. It is equipped with a manual override that unlocks the emergency flap brakes. In the event that a torque tube in the system breaks or a coupling comes apart, the asymmetric sensing switches located at the ends of the torque tubing will sense the resulting out of phase condition. This sensing is immediately translated to the emergency flap brake valve by 28-volt dc power through the wing flap control valve circuit breaker on the copilot's lower circuit breaker panel to energize the brake valve and lock the flap brakes before further motion of the flaps can occur. The flap cannot then be raised or lowered by any means until the manual override is moved, resetting the valve to release the emergency brakes. The manual override is for ground use only. (See Asymmetrical Flap Positioning in Section III.)

Flap Position Indicator.

A flap position indicator is located on the copilot's instrument panel (figure 1-63). The indicator is connected to a transmitter that is mounted on the

flap control panel

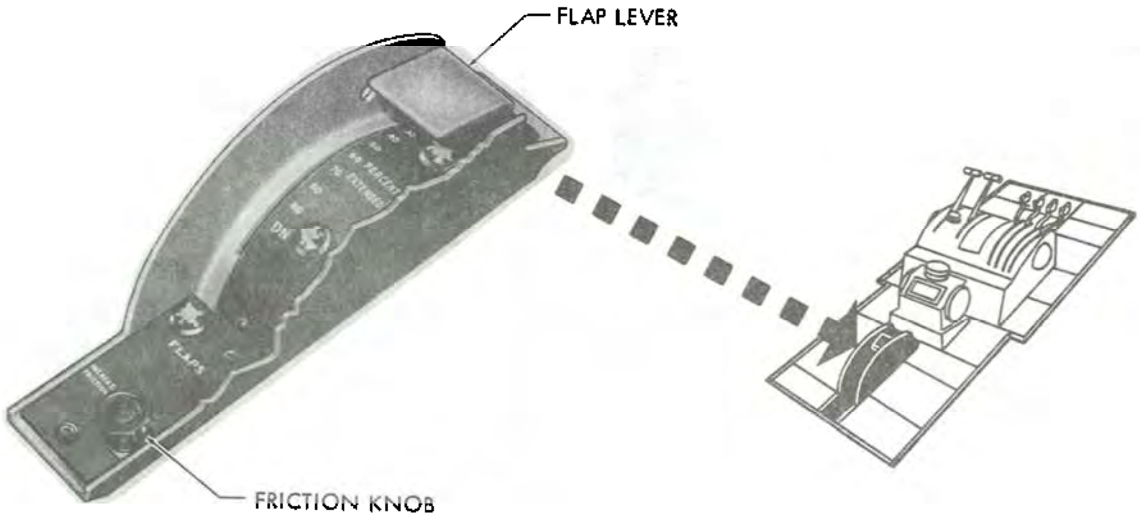


Figure 1-50.

flap drive control unit located on the aft face of the wing rear beam. The indicator dial is calibrated from UP to DOWN in increments of 10 percent. The indicating system is energized by 28-volt dc power from the main dc bus through the tabs and flaps position indicators circuit breaker in the aft fuselage junction box.

Manual Operation.

An emergency method of operating the flaps mechanically is provided by an extension stub shaft connected through a universal joint to the torque shaft which drives the flap screwjacks. An emergency engaging handle shifts between the hydraulic and manual drive. The extension stub shaft and the handcrank are located on the forward wall of the left-hand main landing gear wheel well. (See Flap System Failure in Section III for manual operation.)

LANDING GEAR SYSTEM.

The landing gear system includes a dual-wheel, steerable nose gear and two tandem-mounted main landing gears. Normal operation of the system is through the utility hydraulic system. The nose gear retracts forward into the nose section of the fuselage; the main landing gears retract vertically into the left and right wheel well on either side of the fuselage. In the retracted position, all landing gears are enclosed by mechanically operated flush doors. A landing gear position-indicating system gives a visual indication of the position of each gear and a visual and audible indication of an unlocked condition of the landing gear. Under normal operation, the time required for the nose and main landing gears to retract or extend is 19 seconds or less. An alternate method of operating the landing gear is provided by the emergency hydraulic system through the pressure transfer valve.

MAIN LANDING GEAR.

The main landing gear system (figure 1-51) consists of four strut-wheel assemblies paired in tandem configuration and connected by a drag strut. Normal landing gear actuation is supplied by utility system pressure with hydraulic flow directed through pressure transfer valve and a landing gear control valve to each of the two main landing gear reversible hydraulic motors. Each pair of struts are raised and lowered in vertical tracks by means of screwjacks, connected by torque shafts which are driven by their respective hydraulic motor through a gear box. Mechanically actuated controllable restrictor valves are located in the up lines reducing hydraulic flow to the landing gear motors thus slowing the retracting speed of the strut assemblies prior to contacting the upper bumper stop on their respective screwjacks. This controllable restrictable valve plunger is mechanically actuated during the final inches of each forward strut travel by a bracket. After contacting the up-limit switch the landing gear selector valve is deenergized to its centered position. As system pressure decreases the main landing gear

main landing gear system

NOTE

All Valves Are Shown De-energized. After Gear Down Has Been Selected, The Landing Gear Control Valve Will Remain In Down Position Until Gear Up Solenoid Is Energized.

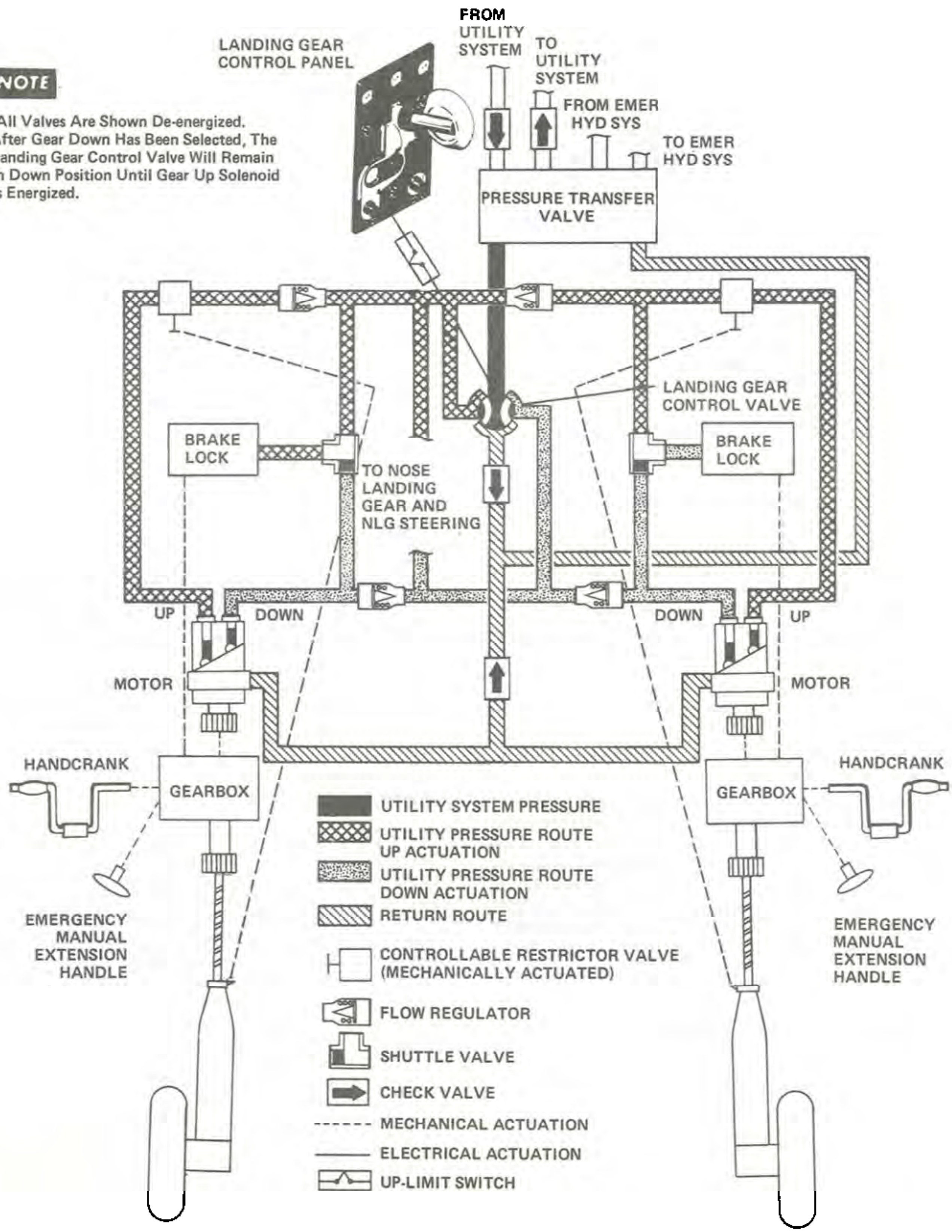


Figure 1-51.

spring-loaded brake engages and holds its respective gear in the up position until released by hydraulic pressure or by mechanical means.

Manual Operation Provisions.

Emergency methods of actuating the main landing gear mechanically or manually are provided by means of emergency engaging handles, two extension stub shafts, two handcranks, a main landing gear emergency extension wrench and easily removed pressure-sealed doors. One emergency engaging handle is provided for each main landing gear. One handle is located on the forward side of each wheel well bulkhead. The emergency engaging handles are connected by cables to their respective gearbox assembly. Pulling an emergency engaging handle disengages the main landing gear spring-loaded brake and the drive motor and engages the manual extension and retraction gears. Either handcrank (one is located on each side of the fuselage near the wheel well bulkheads) can then be used to operate the appropriate extension stub shaft. The shaft is connected by mechanical linkage to the gearbox assembly which drives the retraction screwjacks. One extension stub shaft is mounted on the forward wall of each main landing gear wheel well. The emergency extension wrench is provided for manually extending the main landing gear after both the normal and emergency extension systems have failed. Use of the wrench requires removal of the pressure-sealed doors in the wheel well. The upper pressure-sealed doors provide access to the main landing gear hydraulic gearboxes, permitting manual release of the respective hydraulic brake mechanism in the event of manual release cable jamming or failure. Release of the hydraulic brake mechanism will be accompanied by a shift of the gearbox mechanism from power to hand drive. The lower doors provide access to the respective vertical torque shafts, permitting limited maintenance on some of the components of the torque shaft. The bolts retaining each of the pressure-sealed doors can be removed with a handcrank. Two glass panels are located on each of the right- and left-hand wheel well walls. These panels are used for visual inspection to determine whether or not the main landing gear is fully extended when the manual emergency system is used. The landing gear down-and-locked indicators remain operative during manual operation.

NOSE LANDING GEAR. SEE 15-61

The nose landing gear is a swinging-type gear, extending down and aft, actuated by a hydraulic cylinder, and secured in the up and down positions by locks. The gear is normally supplied with hydraulic fluid under pressure by the utility supply system; however, during an emergency it can be supplied by the auxiliary hydraulic system (for extension only). Hydraulic fluid from either the up or down side of the landing gear control valve flows to the landing gear uplocks, downlocks and to the nose landing gear actuating cylinder (figure 1-52). Fluid for the nose landing gear steering control valve is supplied from the landing gear control valve in the down position only. A two-way flow regulator in the up actuation line upstream of the nose landing gear actuating cylinder, restricts the flow of hydraulic fluid to and from the cylinder in order to modulate landing gear actuation.

An emergency nose gear extension valve is located forward of the booster hydraulic system reservoir on the right side of the cargo compartment. Moving the valve handle to the NLG EMER EXT position directs auxiliary hydraulic pressure to the down line of the nose landing gear. A shuttle valve connects the utility pressure down line to the auxiliary system pressure line, permitting the respective pressure to be used to place the nose landing gear in the down-and-locked position when the utility system is inoperative. The manual release handle at the flight station provides a mechanical means of unlocking the nose gear uplock. The auxiliary system motor-driven pump or handpump may be used to pump the nose landing gear into the down-and-locked position.

The nose gear can be visually checked through a nose landing gear inspection window on the aft bulkhead of the nose wheel well under the flight deck. A removable access panel, which also includes the inspection window, is provided for emergency nose landing gear extension. There are no provisions for emergency retraction of the nose landing gear.

LANDING GEAR SYSTEM CONTROLS.

The landing gear system requires several types of controls, to lower and retract the landing gears hydraulically and manually, to hold the landing gear in the down-and-locked position, and to silence the warning horn.

Landing Gear Lever.

A landing gear lever (figure 1-53) is located on the left side of the copilot's instrument panel. It is a two-position (UP, DOWN) lever which directs the gear actuating mechanism to raise or lower the nose and main landing gears. When the lever is moved to UP position, a solenoid-operated selector valve directs pressure from the utility hydraulic system to release the nose gear downlock and the landing gears retract. When the lever is moved to the DOWN position, the nose landing gear uplock is released, the main landing gear brake locks which hold the gear in the up position are released, and the landing gear extends. The valve circuit is powered by 28-volt dc from the essential dc bus through the landing gear control circuit breaker on the copilot's lower circuit breaker panel. When the landing gear lever is moved to the down position, it enters a detent which holds the gear lever down. After landing, the touchdown switch deenergizes the landing gear lever release solenoid, engaging a mechanical locking device to hold the gear lever down. During take-off or in flight, the touchdown switch energizes the landing gear lever release solenoid and retracts the mechanical locking device. If the touchdown switch or touchdown circuit fails, the lock release finger latch must be pulled down before the landing gear lever can be moved to the up position.

nose landing gear system

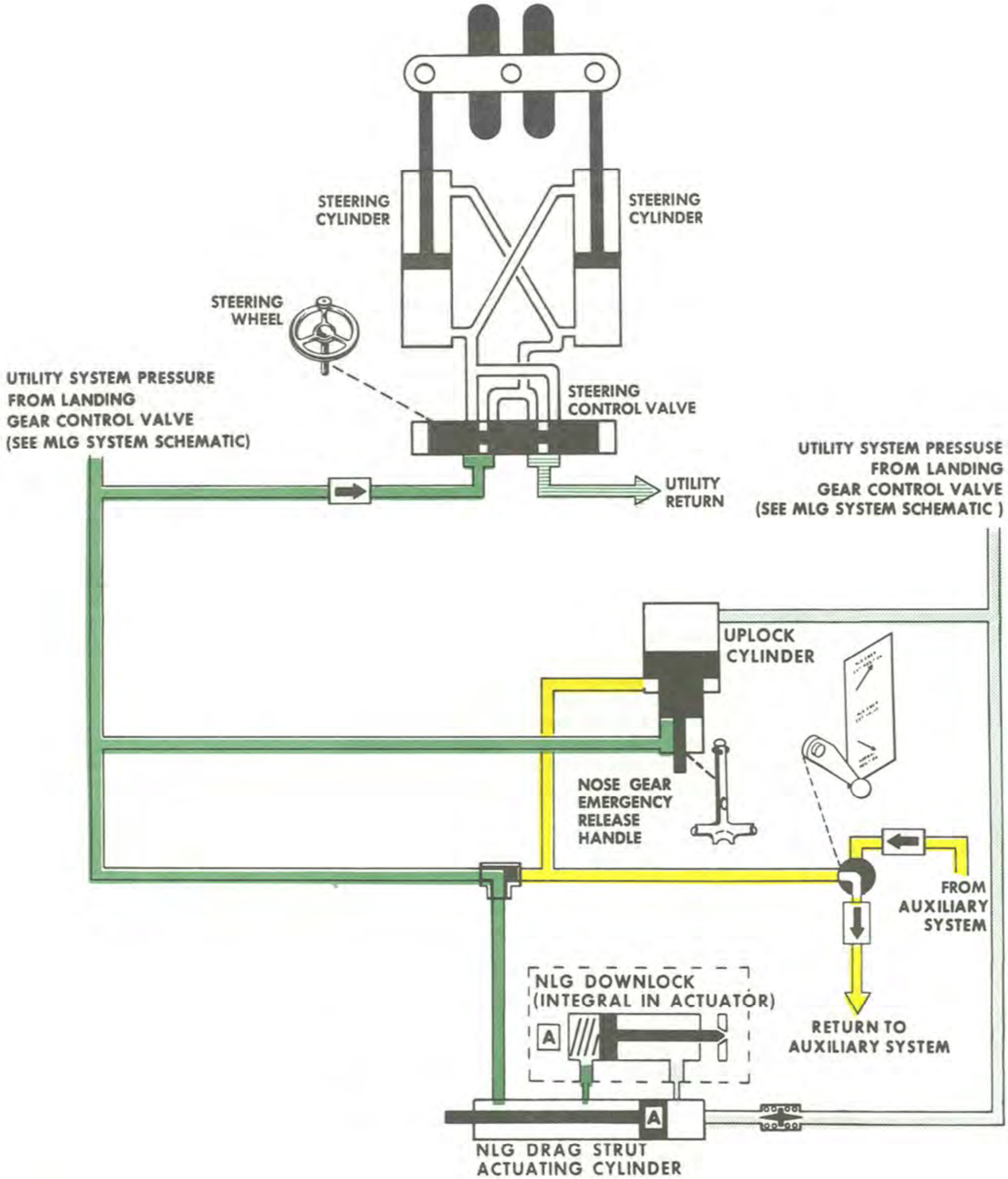


Figure 1-52.

landing gear control panel

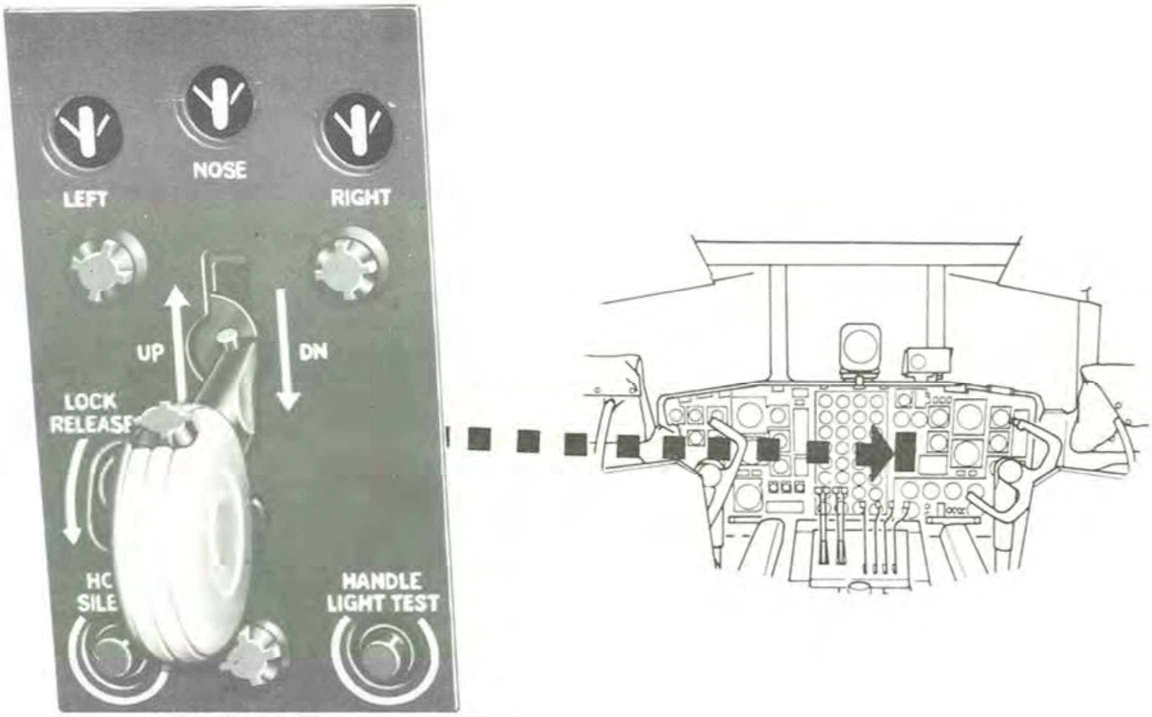


Figure 1-53.

Main Landing Gear Selector Valve.

A landing gear selector valve (figure 3-8) is mounted on the left-hand hydraulic panel, forward of the left wheel well. It is a solenoid operated valve, directing the flow of utility hydraulic fluid to either the up or down side of the landing gear hydraulic motor for normal extension and retraction of the landing gear, as selected by the gear lever. Override controls consisting of two buttons marked up and down, are located on the selector valve for use in case of electrical failure. Pushing the button marked down routes hydraulic fluid to release the landing gear spring-loaded brakes and drives the hydraulic motor gear boxes extending the gear to the down position. A detent holds the landing gear control valve in the down position for nose wheel steering fluid routing. Depressing and holding the up button will retract the landing gear. In normal operation, the valve is energized by 28 volt dc power from the essential dc bus through the landing gear control circuit breaker on the copilot's lower circuit breaker panel.

Main Landing Gear Touchdown Switch.

A touchdown switch is installed on the lower aft side of each forward main gear strut. The switches are safety devices which either prevent some airplane system from operating or permit it to operate when the airplane is on the ground or in flight. The weight of the airplane on the gear operates these switches. Some systems are wired directly through the touchdown switches and others operate through relays which are controlled by the touchdown switches. Systems that are affected by the touchdown switches and relays are as follows:

1. Touchdown switch

   a. Engine ground stop (inop in flight)

   b. Nacelle preheat (inop in flight)

   c. Dump mast shutoff valves (closed on ground, open inflight) (airplanes not modified by T.O. 1C-130-949) Airplanes modified by T.O. 1C-130-949, refer to Dump Valve Switches.

2. Touchdown relay

   a. Landing gear control handle lock (unlocked in flight)

   b. Wheel brakes (anti-skid) (brakes inop in flight)

   c. Cockpit controls for ramp and aft cargo door (inop on the ground)

d. Airdrop release (inop on the ground) (deactivated)

e. SUU-42A A dispensers (inop on ground)

f. ALE 20 dispensers (inop on ground)

g. Airborne signal to INS (inflight)

3. Auxiliary touchdown relay

a. GTC control power (inop in flight)

b. DC bus tie control (inop in flight)

Emergency Engaging Handle.

A yellow emergency engaging handle is located on the forward wall of each wheel well, just below the extension shaft of the landing gear manual operation stub shaft. The handle operates a cable which disengages the main landing gear hydraulic brake and the drive motor, and simultaneously engages the mechanical linkage which connects the stub shaft to the gearbox, thereby permitting manual raising or lowering of the main landing gear. The yellow handles must be pulled outward and locked before the landing gear can be extended or retracted manually. After each manual extension or retraction of the main landing gear, the handle must be turned one-quarter turn clockwise to unlock, and then be released to the normal position. Proper shifting of the mechanism can be verified by rotating the handcrank in both directions. If the handle is in the normal position, the handcrank will rotate freely.

Landing Gear Handcrank.

Two landing gear handcranks are provided for the manual operation of the main landing gears. One handcrank is stored in retaining clips on the forward face of the left wheel well, and the other is stored on the top right hand corner of the booth. One end of each crank is made to fit over the protruding end of the extension stub shaft. An extension stub shaft is located on each wheel well forward wall, just above the emergency engaging handles.

Main Landing Gear Emergency Extension Wrench.

The emergency extension wrench is provided for manual extension of the main landing gear after both the normal and emergency extension systems fail to extend the gear. The wrench has a fixed socket on one end and a ratchet and socket on the other end. The wrench is used to manually rotate the landing gear ballscrews to lower the struts. The wrench is stowed on the fuselage wall below the NLG emergency extension valve.

Main Landing Gear Ground Lock.

Two main landing gear ground locks are provided for use while performing maintenance on the gear, to prevent accidental retraction of the main landing gears. The locks are installed on the hexagonal ends of the main landing gear screw assemblies, one lock on each side of the airplane. The locks are stowed in the miscellaneous equipment box aft of the right paratroop door.

Nose Landing Gear Ground Lock

A nose landing gear ground lock (figure 1-54) is provided to prevent accidental retraction of the nose landing gear while the airplane is parked. The ground lock consists of a ball-lock pin which is inserted in a hole in the actuator rod-end and prevents release of the internal downlock of the actuator.

Nose Gear Emergency Release Handle.

A nose gear emergency release handle (figure 1-55) is located below the floor of the flight station under a hinged panel between the copilot's seat and the control pedestal. The handle operates a cable system which releases the nose landing gear uplock and allows the nose gear to fall free.

nose landing gear ground lock

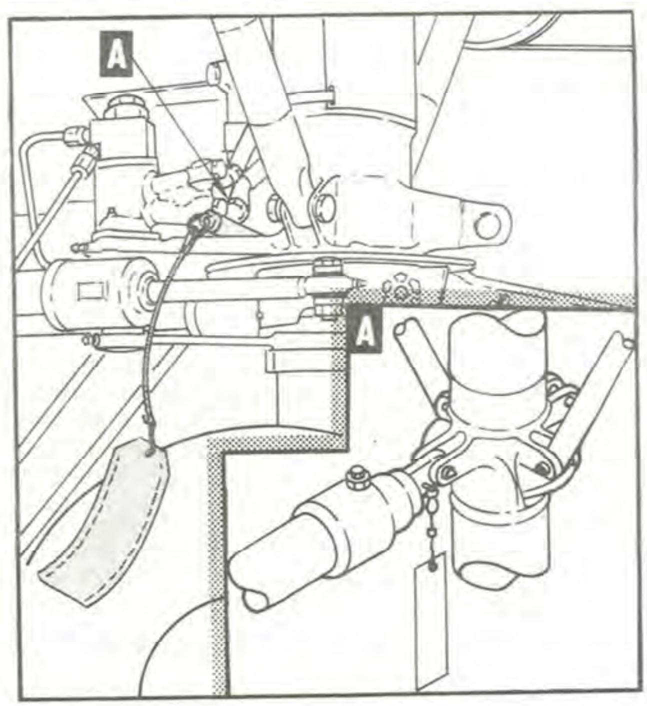


Figure 1-54.

Note

Dropping the nose gear by pulling the emergency release handle may allow air to enter the hydraulic system and may require bleeding before normal operation will be restored. Also, use of this method of lowering the nose landing gear can cause a small amount (approximately one quart) of hydraulic fluid to be transferred from the utility supply system to the auxiliary system reservoir, each time the release handle is operated. As a result, practice use of this method of lowering the nose landing gear is not recommended and should be avoided.

LANDING GEAR SYSTEM INDICATORS.

Landing gear warning signals are presented by a horn and a light. Landing gear positions are indicated by three indicators.

Note

The landing gear warning horn and light operate from the same circuit. Failure of either individual landing gear warning circuits will cause the horn to remain silent and the light to remain out.

Landing Gear Warning Horn and Silence Switch.

The landing gear warning horn is located above and to the left of the pilot's seat. Two things will cause the landing gear warning horn to sound: retarding a throttle to a position within 5 degrees forward of the FLIGHT IDLE position with the landing gear up, and extending the flaps more than approximately 70 percent with the landing gear up. A warning horn silence switch (figure 1-53) is located on the landing gear control panel. It is a press-type switch used to silence the landing gear warning horn when a throttle is retarded. It will not silence the horn when flaps are extended more than 70 percent with landing gear up. When the switch is pressed, the horn-silencing relay is actuated, and the warning horn electrical circuit is broken. Cycling of the landing gears or advancement of an engine throttle will reset the horn-silencing relay, so that the horn can sound again. The landing gear warning horn circuit is energized by 28-volt dc power from the essential dc bus through the landing gear warn light circuit breaker on the copilot's lower circuit breaker panel.

Landing Gear Warning Light and Warning Light Test Switch.

The landing gear warning light is connected to the landing gear retraction system and the throttle warning switches; it will illuminate whenever the landing gear is not in a locked position, or when an engine throttle is retarded to within 5 degrees of FLIGHT IDLE position and the landing gear is not fully extended. A warning light test switch (figure 1-53) is located on the landing gear control panel. It is a press-type switch, used to test the continuity of the landing gear warning lights electrical circuit. When the switch is pressed, the landing gear warning light bulbs in the landing gear lever handle will illuminate. Failure of the bulbs to illuminate shows a defective circuit. The landing gear warning lights are energized by 28-volt dc power from the essential dc bus through the

nose gear uplock emergency release handle

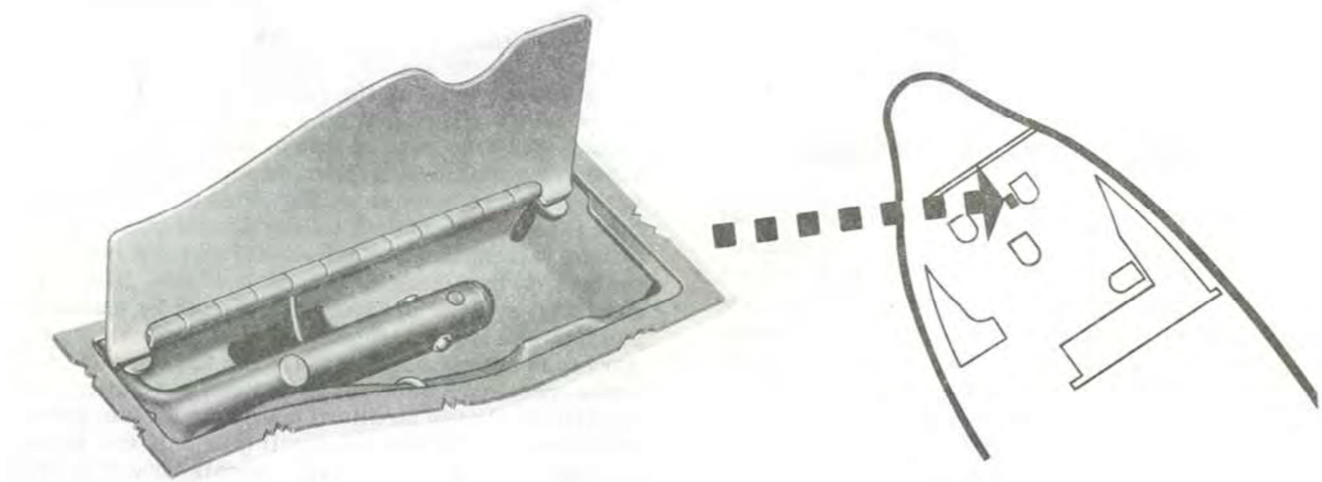


Figure 1-55.

Figure 1-56.

landing gear warn light circuit breaker on the copilot's lower circuit breaker panel.

Landing Gear Position Indicators.

A left main gear position indicator, a nose gear position indicator, and a right main gear position indicator (figure 1-53) are located on the landing gear control panel. These indicators give a visual indication of position of the landing gear. When the letters UP appear on the face of an indicator, it means that the gear represented by that indicator is retracted and locked. When the picture of a landing gear wheel appears on the face of an indicator, it means that the landing gear represented by that picture is extended and locked. Diagonal stripes on the face of an indicator mean that the landing gear represented by that indicator is somewhere between the extended and retracted positions or that the indicator is inoperative. The landing gear position indicators are energized by 28-volt dc power from the essential dc bus through the landing gear position ind circuit breaker on the copilot's lower circuit breaker panel.

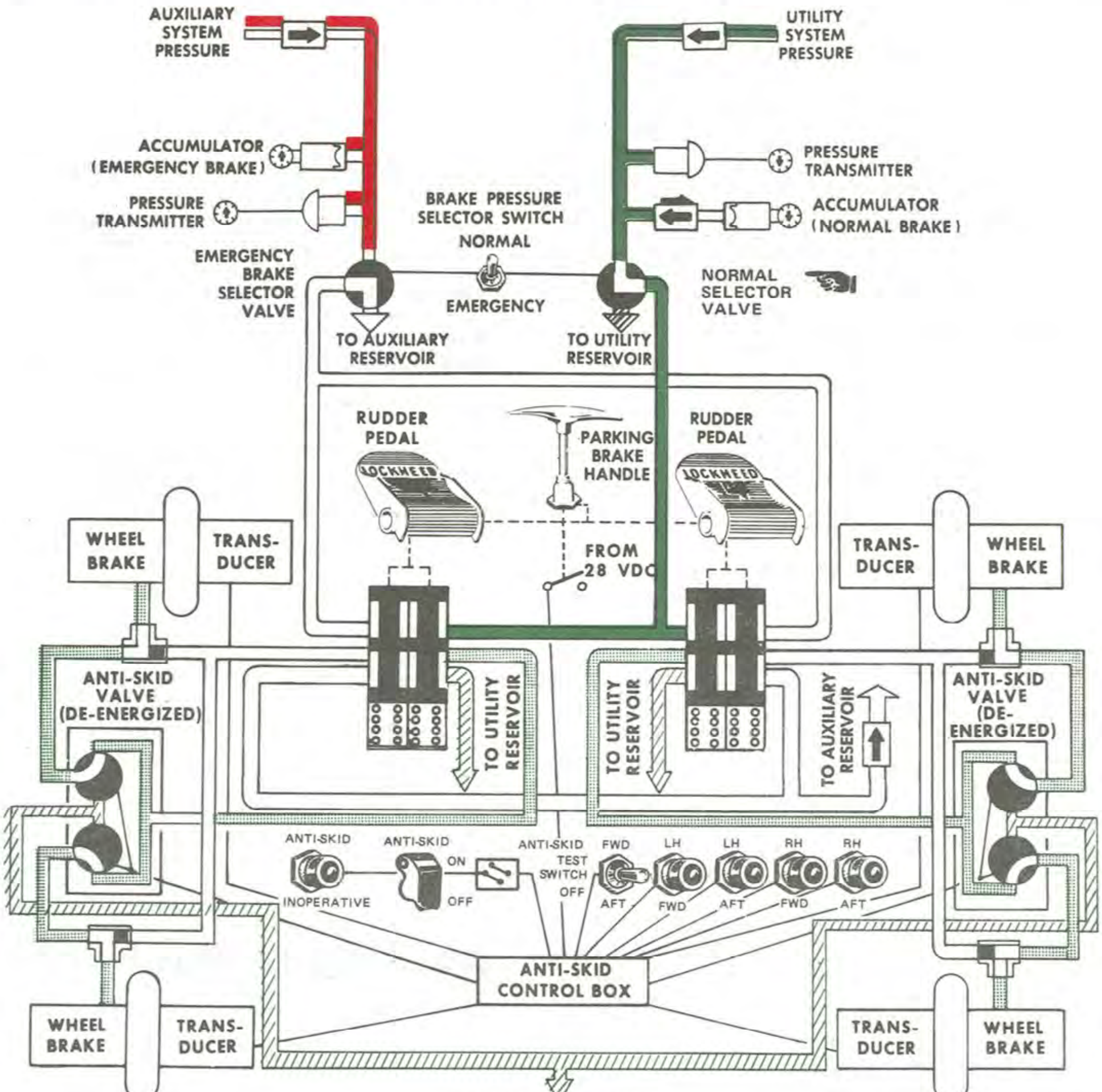
NOSE WHEEL STEERING SYSTEM.

The airplane is steered during taxiing by directional control of the nose wheel. The nose wheel is hydraulically actuated and governed by a steering control valve in the utility hydraulic system. The steering control valve is connected by a cable to a manually operated nose steering wheel (figure 1-56) located in the flight station at the left of the pilot's control column. Direction control of the nose wheel is limited by means of mechanical stops to 60 degrees right and left of center. One and one-quarter turns from center position of the nose steering wheel will turn the steering wheel to the full-left or the full-right position. Orifices in the steering cylinders provide snubbing action to dampen oscillations of the nose wheel and to prevent shimmy. Centering cams on the nose gear strut return the nose wheel to a centered position whenever the weight of the airplane is removed from the nose gear.

BRAKE SYSTEM.

A hydraulically operated, multiple disk brake is installed on each of the four main landing gear wheels. The nose landing gear wheels do not have brakes. The brakes normally operate from utility hydraulic system (figure 1-57) pressure with an alternate supply available through the auxiliary hydraulic system. If electrical power is off, both systems are available to supply pressure to operate the brakes. The system with the higher pressure will cause the shuttle valve to shift as necessary to provide pressure. Fluid flows through a brake pressure selector valve to the right- and left-hand brake control valves. When the fluid leaves the brake control valves, it flows through the anti-skid valves and shuttle valves to the brakes. Each of the two halves (left and right) of the brake system contains a brake control valve, an anti-skid valve, and two brake shuttle valves. The auxiliary system supply flows through the emergency brake pressure selector valve. When the emergency brake system is actuated, fluid is directed to the brake control valves, then through shuttle valves directly to the brakes, bypassing the anti-skid valves. Utility or auxiliary system pressure is selected by manually positioning a brake pressure selector switch. Auxiliary system handpump pressure can also be used for brake operation for towing operations when utility or electrically driven auxiliary hydraulic system pressure is not available. This will give only one brake application, therefore the brake pedals should be depressed firmly and held when braking is required.

main landing gear brake system



- NORMAL BRAKE PRESSURE LINE
- UTILITY SYSTEM PRESSURE
- UTILITY SYSTEM RETURN LINE
- AUXILIARY SYSTEM PRESSURE
- CHECK VALVE
- ONE-WAY RESTRICTOR
- SHUTTLE VALVE

——— ELECTRICAL ACTUATION

– – – – MECHANICAL ACTUATION

NOTE

Brake pressure selector switch shown in NORMAL (up) position, with brake selector valve de-energized and emergency brake selector valve energized. In EMERGENCY position (switch down) the normal brake selector valve is energized (to return) and the emergency brake selector valve is de-energized, connecting auxiliary pressure. Complete power failure leaves both valves open to supply pressure from their respective systems. Upper two valves are solenoid controlled. Lower two valves are solenoid-operated.

Figure 1-57.

System pressure will not build up when the brake pedals are pumped on and off while the auxiliary system handpump is being operated.

BRAKE SYSTEM ACCUMULATORS.

Air-charged accumulators are used in both the normal brake and the emergency brake hydraulic systems to increase the supply of hydraulic pressure in case of a pressure failure. The accumulator in the normal brake system, when fully charged with hydraulic fluid, is capable of supplying pressure for about two brake applications. The accumulator in the emergency brake system, having one-half the capacity of the normal brake system accumulator, is capable of supplying pressure for about one additional brake application.

BRAKE ANTI-SKID PROVISIONS.

Skidding due to excess brake application during normal brake operation is controlled by an anti-skid system, which is actuated as skidding commences and releases brake pressure until the skid condition is corrected. (See Anti-Skid System in this section.)

BRAKE SYSTEM CONTROLS

Mechanical and electrical brake system controls are furnished to operate the brakes by hydraulic power.

Brake Pedals.

Actuation of the brakes is through application of toe pressure on the rudder pedals at either the pilot's or copilot's station. The amount of braking force is proportional to the force applied to the brake pedals. The right pedals actuate the right brakes, and the left pedals actuate the left brakes. This arrangement allows directional control of the airplane through differential braking. Application of normal brake pressure before touchdown is prevented when the anti-skid system is energized.

Brake Pressure Selector Switch.

A two-position (NORMAL, EMERGENCY) brake selector toggle switch (figure 1-38) located on the hydraulic control panel provides selection of either normal or auxiliary hydraulic pressure for applying the brakes. The NORMAL position will supply utility hydraulic pressure to the brakes, and the EMERGENCY position will supply auxiliary hydraulic pressure to the brakes. With the brake selector switch in the NORMAL position and the landing gear lever in the UP position, the normal brake selector valve is energized closed by 28-volt dc power from the essential dc bus through the landing gear control circuit breaker on the copilot's lower circuit breaker panel. When the landing gear lever is placed to DN, the normal brake selector is de-energized to open. With the brake selector switch in the EMERGENCY position, the normal brake selector valve is energized closed by 28-volt dc power from the main dc bus through the anti-skid control circuit breaker on the copilot's lower circuit breaker panel. The emergency brake selector valve is energized by 28-volt dc power from the essential dc bus received through the emergency brake valve circuit breaker located on the copilot's lower circuit breaker panel. Both the normal brake selector valve and the emergency brake selector valve are de-energized open.

Note

> In case of dc electrical power failure, the de-energized valves can admit either utility or auxiliary hydraulic system pressures to the brake system. The shuttle valve is positioned by the system supplying the greater pressure.

Parking Brake Control Handle.

A parking brake control handle (figure 1-58) is located in front of the pilot's seat, to the right of the pilot's right foot rest. The control handle is mounted on a

parking brake handle

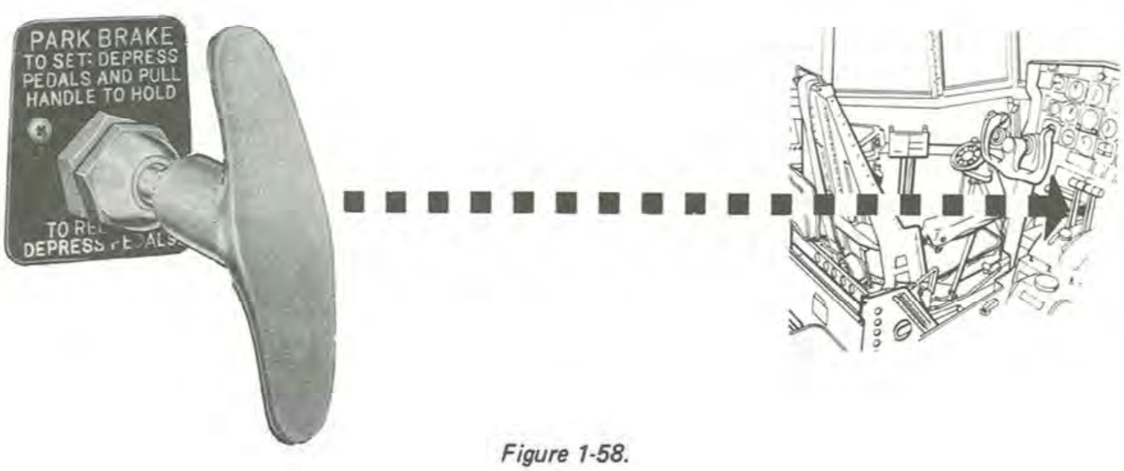


Figure 1-58.

anti-skid test panel

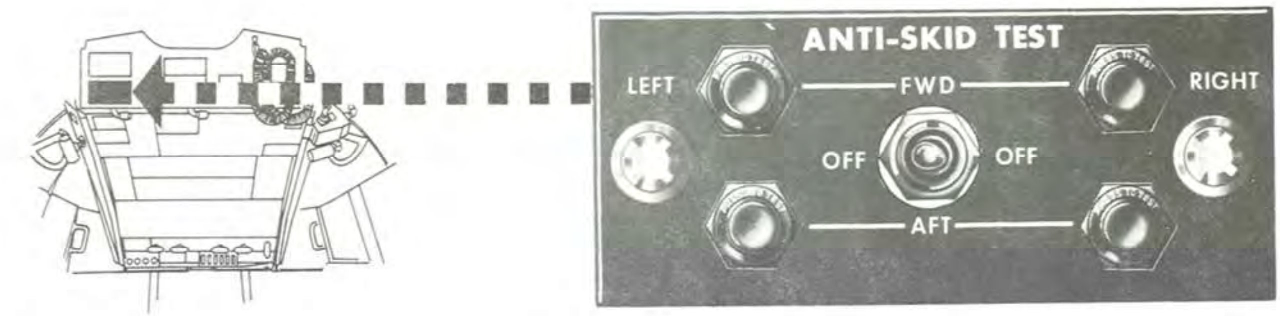


Figure 1-59.

panel support and is attached to a flexible cable. This cable pulls a pawl into position so that it locks the brakes into the depressed position as set by the action of the rudder pedals. The brakes are set for parking by first depressing the toe section of the rudder pedals and then pulling out the parking brake control handle, holding force on the handle as the pedals are released. The brakes are released by again depressing the toe section of the rudder pedals. Setting the parking brake while the anti-skid switch is in the ON position de-energizes the anti-skid system and illuminates the anti-skid inoperative light.

BRAKE PRESSURE INDICATORS.

Two brake pressure indicators (figure 1-38) are located on the hydraulic control panel at the bottom of the copilot's instrument panel. The indicators are connected to pressure transmitters in the pressure lines of the brake control system and register the hydraulic pressure available in the brake sections of both the utility and auxiliary hydraulic systems. The indicators are energized by 26-volt ac power from the instrument transformers through the brake emergency and normal brake fuses on the pilot's lower circuit breaker panel.

ANTI-SKID SYSTEM

The anti-skid system consists of four wheel-speed transducers, an electrical control box, and two dual electro-hydraulic servo brake pressure control valves.

ANTI-SKID SYSTEM OPERATION.

The system prevents skidding of wheels when too much brake pressure is applied during airplane decelerations. This is done through a brake-releasing system, controlled by signals from wheel-speed transducers.

SKID-DETECTOR OPERATION.

The wheel-speed transducer unit mounted in the axle of each main landing gear wheel applies control to the braking operation through the anti-skid valves when the landing gear wheel begins to approach a skid condition. One dual anti-skid valve is located above the booster hydraulic reservoir on the right forward wheel well wall, and the other is on the left-hand hydraulic panel forward of the utility hydraulic reservoir. Each wheel-speed transducer unit contains a frequency generator which senses wheel rotational speed and wheel speed change. The transducers form part of an electrical circuit which prevents landing with brakes on, and which releases brakes in case of a locked condition. Should the wheel speed decrease rapidly, indicating approach of a skid condition, the control box sends an electric impulse to an anti-skid valve which reduces pressure to the affected brake below the pressure which caused sensing of the skid. As subsequent skids are sensed, they are electronically compared with the amount the hydraulic pressure had to be reduced to eliminate earlier skids detected. This comparison results in a more accurate determination of the minimum reduction in brake pressure required to eliminate the skid. The skid detection and control function is independent on each wheel. The skid control system will not function when the brake system is operating from the auxiliary hydraulic system or when the parking brakes are set.

ANTI-SKID SYSTEM CONTROLS AND INDICATORS.

Anti-Skid Switch.

An anti-skid two-position (OFF, ON) guarded toggle switch (figure 1-39) is located on the hydraulic control panel. It is energized by 28-volt dc power from the main dc bus, through the anti-skid control circuit breaker on the copilot's lower circuit breaker panel. When the switch is in the ON position, the anti-skid system is operative and becomes an integral part of the wheel brake system. When the switch is in the OFF position the landing gear brake system operates as a standard brake system.

Anti-Skid Inoperative Light.

An anti-skid inoperative light (figure 1-39), located on the hydraulic control panel, illuminates whenever the anti-skid system is not operating as an integral part of the landing gear brake system. It warns the pilot that skid protection has been lost on all wheels. This light will also illuminate when the parking brake is set. This system is energized by 28-volt dc power from the main dc bus, through the anti-skid fail-safe light circuit breaker on the copilot's lower circuit breaker panel. A functional test of the light circuit is made by pressing on the light bulb cover. Failure of the light to illuminate shows a defective circuit.

Anti-Skid Test Switch and Indicator Lights.

An anti-skid test panel (figure 1-59) is located on the aft end of the overhead control panel. The test panel contains a three-position (FWD, OFF, and AFT) anti-skid test switch and four green indicator lights identified as LEFT FWD, RIGHT FWD, LEFT AFT, and RIGHT AFT. When the test switch is placed in the FWD position, 26-volt, 400-cycle power obtained from the ac instrument and engine fuel control bus (through the anti-skid test circuit breaker, located on the pilot's lower circuit breaker panel) is applied to the anti-skid control box to simulate a skid condition. When the switch is released to the OFF position, the FWD indicator lights should illuminate momentarily. Illumination of the lights indicates that the anti-skid control box would have properly responded to an actual skid. When the test switch is placed in the AFT position and released, the AFT indicator lights should illuminate momentarily.

UARRSI UNIT HYDRAULIC POWER REQUIREMENT (AIRPLANES MODIFIED BY T.O. 1C-130-949).

Hydraulic pressure and return lines lead from a hydraulically operated shuttle valve on the UARRSI shuttle valve panel assembly at FS 257 to the UARRSI unit. Pressure and return lines connect the shuttle valve to the UARRSI utility selector valve and the UARRSI auxiliary selector valve located in the same area. The selector valves are solenoid operated, selectable by a three-position (UTL-OFF-AUX) hydraulic system toggle switch on the aerial refuel panel. The selector valve solenoids operate on 28-volt dc power provided through the hydraulic system switch when the amplifier switch on the aerial refuel panel is positioned to either NORM or OVRD. A diagram of the UARRSI hydraulic system is provided in figure 1-60.

INSTRUMENTS.

Only those instruments which are not part of a complete system are covered under this heading. For the description of instruments that are part of a complete system, see the paragraph covering that system. The flight director system is covered in Section IV.

PITOT-STATIC INSTRUMENTS.

Ram air pressure and atmospheric pressure to operate the vertical velocity indicators, airspeed indicators, and altimeters are supplied by the pitot-static system (figure 1-61). Two pitot tubes furnish the ram pressure for the airspeed indicators, and two wing tip mounted static ports furnish static pressure for the airspeed and vertical velocity indicators and altimeters. The left wing tip mounted static boom serves the pilot's instruments; the right-hand wing tip mounted static boom serves the copilot's, navigator's and booth instruments.

Vertical Velocity Indicators.

The two vertical velocity indicators, one mounted on the pilot's instrument panel (figure 1-62) and the other mounted on the copilot's instrument panel (figure 1-63), are differential pressure measuring instruments that indicate the rate of change in altitude of the airplane.

Airspeed Indicators.

The five airspeed indicators, one mounted on the pilot's instrument panel (figure 1-62), one on the copilot's instrument panel (figure 1-63), a true airspeed indicator on the navigator's instrument panel (figure 4-54), one on the two-man console (figure 4-117) in the booth and one on the TV operator's console (figure 4-105) in the booth are instruments which use differential air pressure to determine airspeed. The banded pointer on the airspeed indicators constantly indicates the structural speed limit at sea level and does not provide an accurate indication of airspeed limitation. The method of obtaining accurate information regarding airspeed limitation versus altitude is contained in Section V.

Altimeters.

Three altimeters, one mounted on the pilot's instrument panel (figure 1-62), one on the copilot's instrument panel (figure 1-63), and one on the navigator's instrument panel (figure 4-54), are barometric-type instruments measuring variation in pressure by means of aneroid units. Two additional barometric type altimeters are installed, one on the TV console (figure 4-105) and one on the IR/EWO console (figure 4-117).

The pilot's (AAU-21/A) altimeter combines a conventional barometer altimeter and an altitude-reporting encoder in one self-contained unit. 10,000-

UARRSI hydraulic system

(AIRPLANES MODIFIED BY T.O. 1C-130-949)

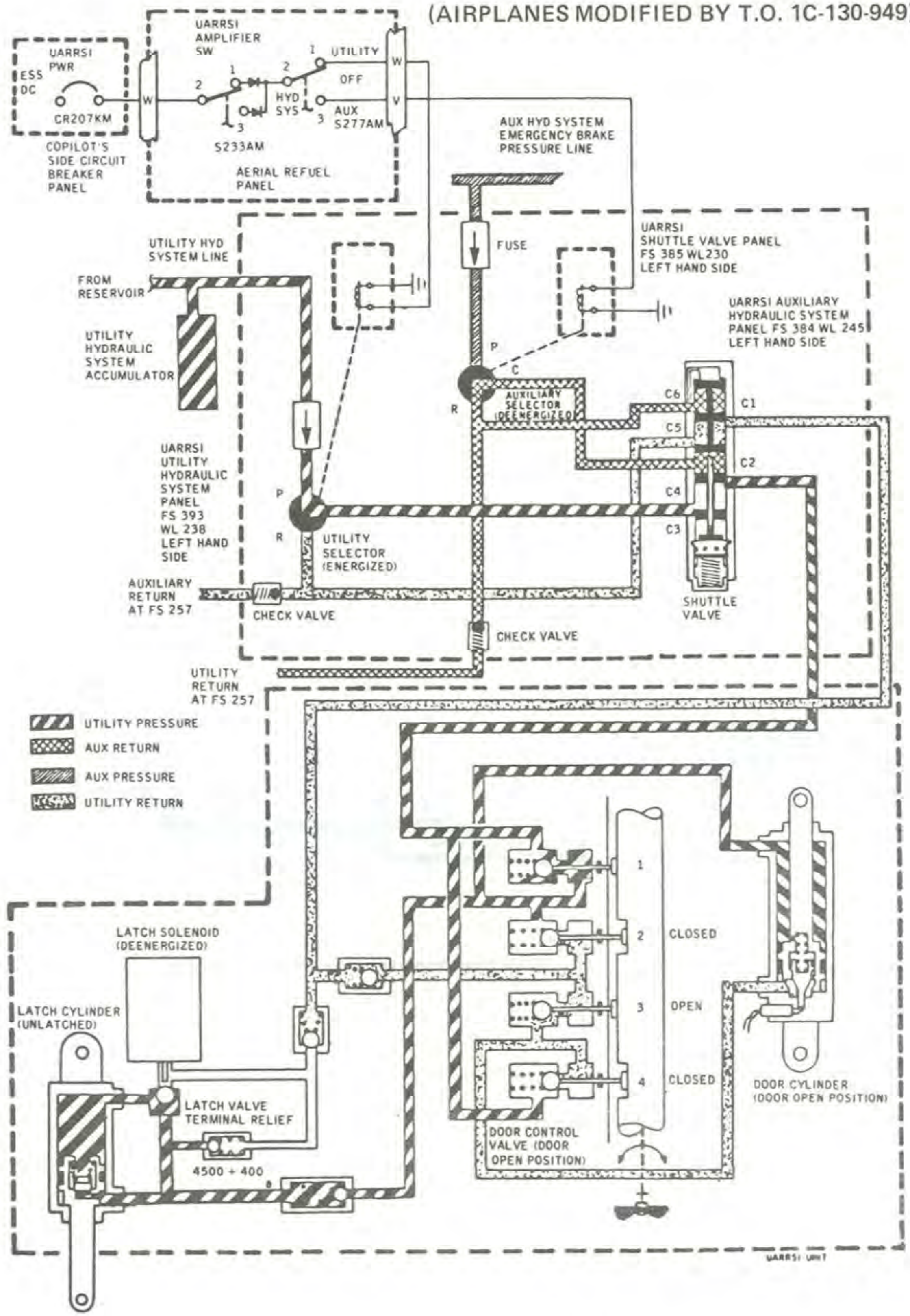
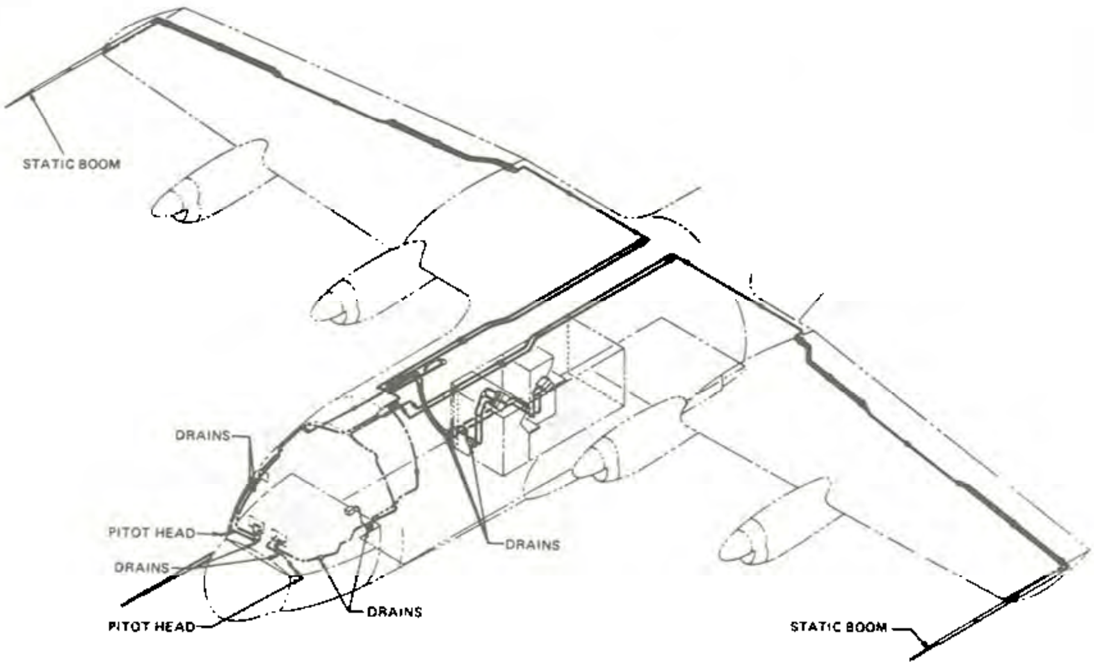


Figure 1-60.

pitot - static system



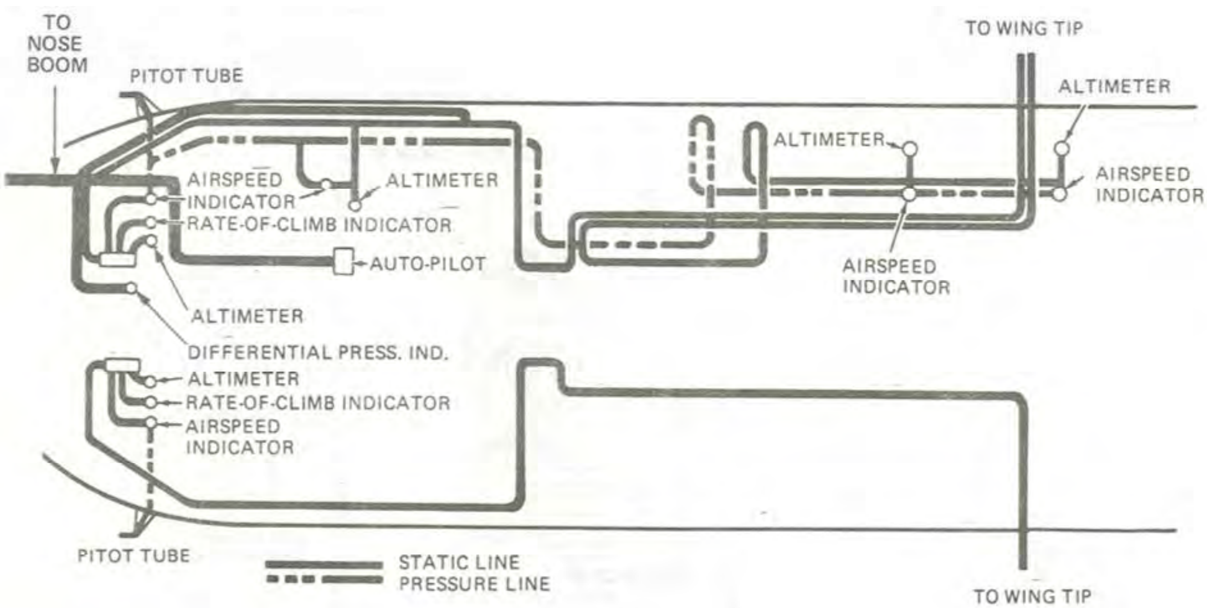
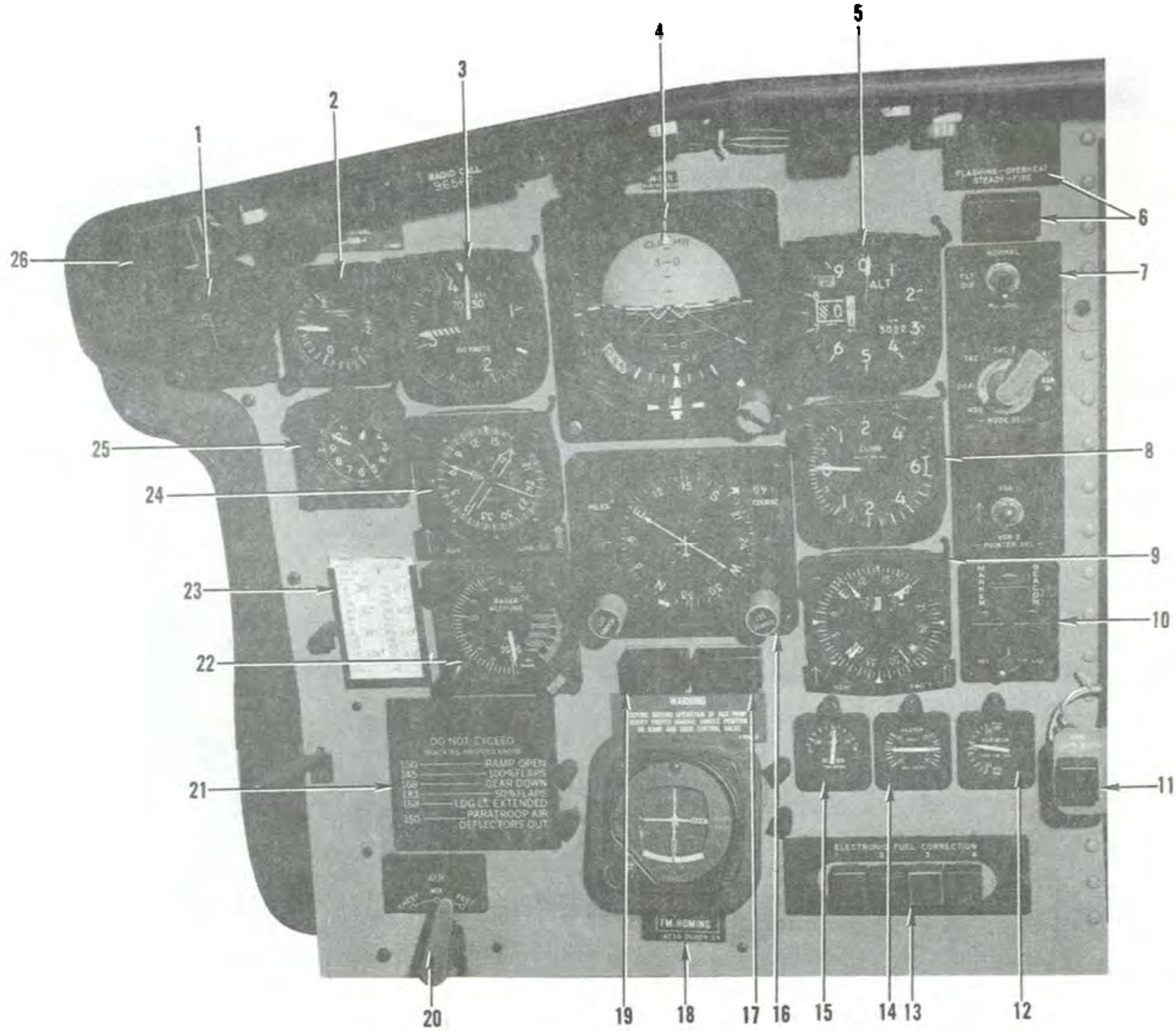


Figure 1-61.

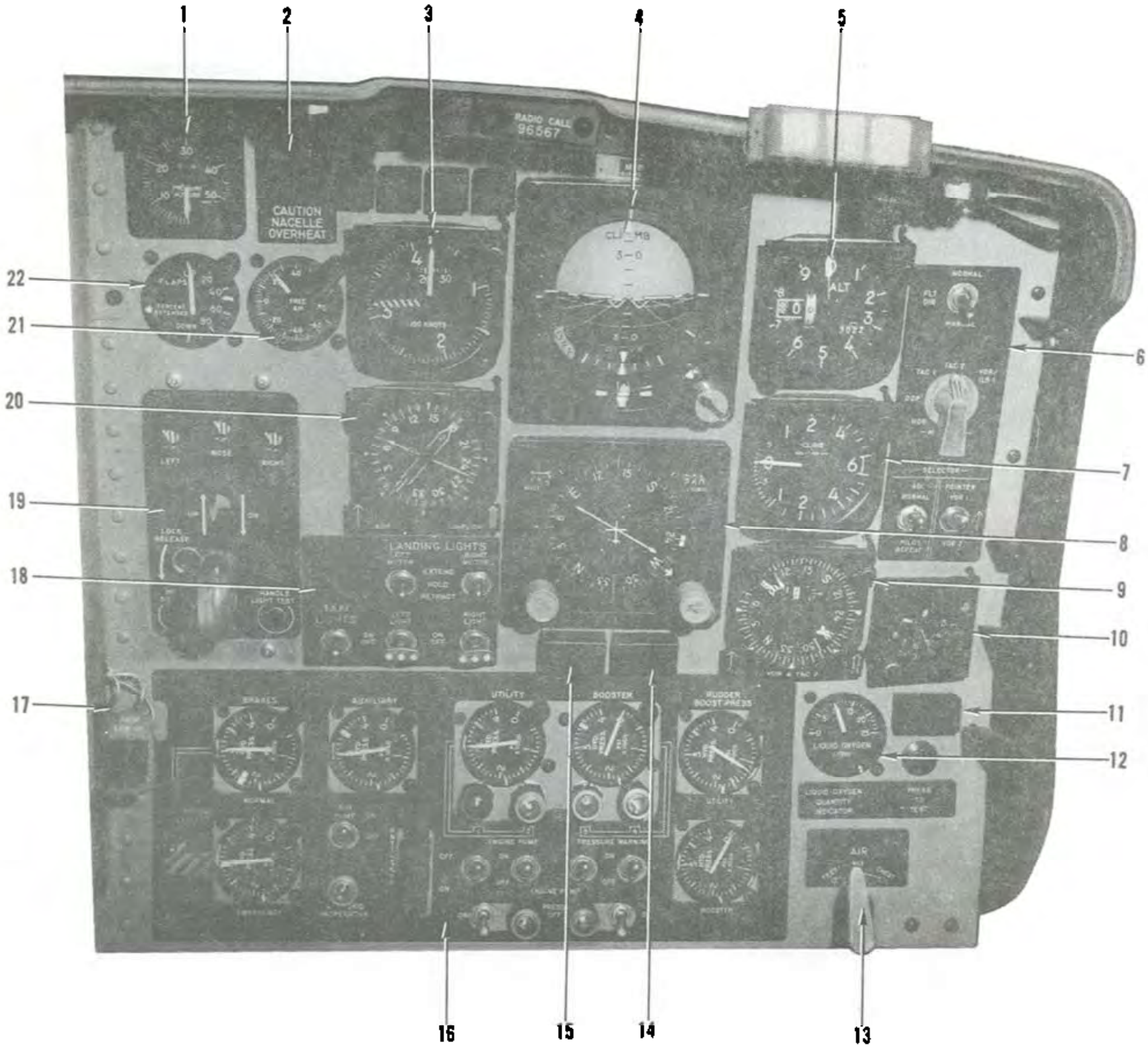
pilot's instrument panel



1. MAGNETIC COMPASS
2. ACCELEROMETER
3. AIRSPEED INDICATOR
4. ATTITUDE DIRECTOR INDICATOR
5. ALTIMETER-ENCODER
6. MASTER FIRE WARNING LIGHT
7. RADIO INSTRUMENTS SELECTOR PANEL
8. VERTICAL VELOCITY INDICATOR
9. BEARING DISTANCE HEADING INDICATOR (BDHI)
10. MARKER BEACON CONTROL PANEL
11. ENGINE LOW OIL QUANTITY WARNING LIGHT
12. ELEVATOR TAB POSITION INDICATOR
13. ELECTRONIC FUEL CORRECTION PANEL
14. AILERON TAB POSITION INDICATOR
15. RUDDER TAB POSITION INDICATOR
16. HORIZONTAL SITUATION INDICATOR
17. BEAM COUPLER OFF LIGHT
18. INSTRUMENT APPROACH INDICATOR
19. AUTOPILOT OFF LIGHT
20. AIR DIVERTER HANDLE
21. AIRSPEED LIMITATIONS PLACARD
22. RADAR ALTIMETER
23. MAGNETIC COMPASS CORRECTION CARD HOLDER
24. RADIO MAGNETIC INDICATOR
25. CLOCK
26. MASTER DOOR WARNING LIGHT

Figure 1-62.

copilot's instrument panel



1. CABIN ALTIMETER
2. NACELLE OVERHEAT WARNING PANEL
3. AIRSPEED INDICATOR
4. ATTITUDE DIRECTOR INDICATOR
5. ALTIMETER
6. RADIO INSTRUMENTS SELECTOR PANEL
7. VERTICAL VELOCITY INDICATOR
8. HORIZONTAL SITUATION INDICATOR
9. BEARING-DISTANCE-HEADING INDICATOR
10. CLOCK
11. LIQUID OXYGEN LOW QUANTITY WARNING LIGHT
12. LIQUID OXYGEN QUANTITY INDICATOR
13. AIR DIVERTER HANDLE
14. COPILOT'S ADI REPEAT LIGHT
15. SELECTED NAV SYSTEM OFF LIGHT
16. HYDRAULIC CONTROL PANEL
17. PROP LOW OIL QUANTITY MASTER WARNING LIGHT
18. LANDING AND TAXI LIGHTS CONTROL PANEL
19. LANDING GEAR CONTROL PANEL
20. RADIO MAGNETIC INDICATOR
21. FREE AIR TEMPERATURE INDICATOR
22. WING FLAP POSITION INDICATOR

Figure 1-63.

and 1000-foot counter indicators and a 100-foot drum indicator provide a direct digital output and readout of altitude in increments of 100 feet, from —1000 to 38,000 feet. The digital output is referenced to 29.92 inches of mercury and is not affected by changes in barometric setting. A pointer repeats the indications of 100-foot drum, and serves both as a vernier for the drum and as a quick indication of the rate and sense of altitude changes. Two methods may be used to read indicated altitude on the counter-drum pointer altimeter: (1) read the counter-drum window, without reference to the pointer, as a direct digital readout in thousands and hundreds of feet, or (2) read the thousands of feet on the two counter indicators, without referring to the drum, and then add the 100-foot pointer indication.

The pilot's (AAU-21/A) altimeter indicates pneumatic altitude referenced to barometric pressure and provides coded altitude information (mode C) to the IFF transponder via the altitude encoder. The code off flag monitors only the encoder function of the altimeter. It does not indicate transponder condition. The AIMS altitude reporting function may be inoperative without the code off flag showing, in case of transponder failure or improper control settings. It is also possible to get a good mode C test on the transponder control with the code off flag showing. Display of the code off flag indicates an encoder power failure or a code off flag failure. In this event, check that ac power is available and that the circuit breakers are in. If the flag is still visible, radio contact should be made with a ground radar site to determine whether the AIMS altitude reporting function is operative and the remainder of the flight should be conducted accordingly.

The altimeter setting is entered by use of a normally operated barometric set knob in the lower left front of the instrument case. The altimeter setting appears on counters in the window in the lower right of the display and has a range of settings from 28.1 to 31.0 inches of mercury.

An internal vibrator operates continuously whenever aircraft dc power is turned on. The vibrator minimizes internal mechanical friction, enabling the instrument to provide a smoother display during changing altitude conditions. Should vibrator failure occur, the altimeter will continue to function pneumatically, but a less-smooth movement of the instrument display will be evident with changes in altitude.

WARNING

If the altimeter's internal vibrator is inoperative due to either internal failure or dc power failure, the 100-foot pointer may momentarily hang up when passing through 0 (12 o'clock position). If the vibrator has failed, the 100-foot pointer hang up can be minimized by tapping the case of the altimeter. Pilots should be especially watchful for this failure when their minimum approach altitude lies within the 800 - 1000 foot part of the scale (1800 - 2000 feet, 2000 - 3000 feet, etc), and should use any appropriate altitude back-up information available.

Note

The AAU-21/A and AAU-27/A altimeter employs a unique operating feature. The 10,000-foot and 1000-foot counters remain in a fixed position during altitude changes while the 100-foot drum and pointer rotate continuously. When each 1000-foot increment is nearly completed, the counter(s) abruptly index to the next correct digit making readings simpler to observe. However, the altimeter mechanism which provided this feature also causes a characteristic behavior of the pointer. This is a noticeable pause or hesitation of the pointer caused by the additional intermittent friction and inertia loads applied to the mechanism in order to turn over the counter wheel at thousand-foot intervals as the pointer completes each revolution. This momentary pause is followed by a noticeable acceleration as the altimeter mechanism overcomes the counter wheel loads and rolls the dial over to the next thousand-foot digit. This effect will be more pronounced at ten thousand-foot intervals where both counters are turned over simultaneously. The pause occurs during the nine to one portion of the scale. The pause and accelerate behavior is more pronounced at high altitudes and high rates of ascent and descent. During normal rates of descent at low altitudes the effect will be minimal.

The copilot's (AAU 27/A) altimeter is read in the same manner as the pilot's altimeter. However, the copilot's altimeter does not contain an altitude reporting encoder and hence, no code-off window.

AIR DATA MEASUREMENT SYSTEM.

A pitot static boom, extending approximately 10 feet forward of the nose section, measures temperature, impact pressure, static pressure, side-slip angle, normalized impact pressure, and angle-of-attack for use by the fire control computer. The computer processes these parameters to determine the true airspeed, altitude, and attitude of the aircraft. The pitot boom static port supplies static pressure to the autopilot.

MISCELLANEOUS INSTRUMENTS.

Free Air Temperature Indicators.

Two free air temperature indicators, one on the copilot's instrument panel (figure 1-61) and the other on the navigator's instrument panel (figure 4-76), indicate ambient outside air temperature. This temperature must be corrected for compressibility for true air temperature during and 1000-foot counter indicators and a 100-foot drum indicator provide a direct digital output and readout of altitude in increments of 100 feet, from —1000 to 38,000 feet. The digital output is referenced to 29.92 inches of mercury and is not affected by changes in barometric setting. A pointer repeats the indications of 100-foot drum, and serves both as a vernier for the drum and as a quick indication of the rate and sense of altitude changes. Two methods may be used to read indicated altitude on the counter-drum pointer altimeter: (1) read the counter-drum window, without reference to the pointer, as a direct digital readout in thousands and hundreds of feet, or (2) read the thousands of feet on the two counter indicators, without referring to the drum, and then add the 100-foot pointer indication.

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AIR DATA MEASUREMENT SYSTEM.

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MISCELLANEOUS INSTRUMENTS.

Free Air Temperature Indicators.

Two free air temperature indicators, one on the copilot's instrument panel (figure 1-61) and the other on the navigator's instrument panel (figure 4-76), indicate ambient outside air temperature. This temperature must be corrected for compressibility for true air temperature during flight. The indicators are electrically connected to resistance bulbs mounted on each side of the airplane. The free air temperature indicators receive 28-volt dc power from the main dc bus through the temp ind free air circuit breaker on the copilot's lower circuit breaker panel.

Note

> The navigator's indicator will read slightly higher than the copilot's when the radome anti-icing or radar is on.

Magnetic Compass.

A magnetic compass (figure 1-62) is mounted on the pilot's instrument panel. This is a standard floating card type compass that indicates the direction the plane is headed with respect to magnetic north.

Accelerometer.

A Type MA-1 accelerometer is located on the pilot's nstrument panel (figure 1-62) and gives instantaneous as well as maximum and minimum readings of the g forces exerted on the airplane. The gage scale indicates readings of from plus 4 g's to minus 2 g's. The maximum and minimum indication needles will remain at highest readings until the PUSH TO SET button on the gage case is pushed, then they will both return to plus one g and will again register maximum or minimum readings of g forces until again reset. The accelerometer is designed for inflight use only and does not accurately measure g forces during landing. This instrument is to be used in conjunction with the information on structural limitations in Section V.

Clocks.

There are six clocks mounted in the airplane: one on the pilot's, copilot's, and navigator's instrument panel; two on the two-man operator's console; and one on the TV operator's console.

EMERGENCY EQUIPMENT.

Various types of emergency equipment are furnished to minimize hazards to the airplane and to personnel in case of fire or accident.

FIRE EXTINGUISHING SYSTEM.

A two-shot bromochloromethane (CB) fire extinguishing system (figure 1-64) is connected through a series of directional flow valves to each of four engine nacelles and to the gas turbine compressor compartment. (Dibromodifluoromethane (DB) may be used when CB is not available.) Each bottle contains approximately 19 pounds of agent. One bottle is discharged each time the system is actuated. A check valve prevents the agent from entering a bottle which has previously been discharged. Each bottle is charged to approximately 600 psi, with nitrogen acting as a propellant for the CB. Individual pressure gages on each bottle show charged pressure.

Fire Extinguishing System Controls.

The fire extinguishing system controls are located on the fire emergency control panel forward of the overhead electrical control panel. The fire extinguishing system control circuits use dc power supplied from the battery bus through the fire extinguishing circuit breaker on the pilot's side circuit breaker panel.

AGENT DISCHARGE SWITCH.

A three-position (NO. 1,OFF, NO. 2) toggle switch located on the fire emergency control panel (figure 1-61) controls the discharge of the bottles. The agent discharge switch is spring-loaded to the OFF position. This circuit is not effective however until one fire handle is pulled. The fire handle circuit powers the correct sequence of solenoid directional control valves in the system to direct flow of agent to the selected engine when one of the bottles is fired. The control valves move in the same order as the handles are pulled. If two fire handles are pulled, the agent will be routed to the engine for the last handle pulled. In order to route agent to the engine for the first handle pulled, the first handle must be pushed in and pulled again.

FIRE HANDLES

The five plastic fire handles (figure 1-65) are mounted on the fire emergency control panel. They operate emergency shutdown switches for the gas turbine compressor and the four engines. When fire handle is pulled out, it closes dc circuits to operate valves which isolate the engine as follows:

The shutoff valve on the engine fuel control is closed.
The engine oil shutoff valve is closed.
The firewall fuel shutoff valve is closed.
The firewall hydraulic shutoff valves are closed.
The engine bleed air valve is closed.
Engine starting control circuits are de-energized.
The propeller is feathered.
Positions the fire extinguisher system control valves.
Arms the extinguishing agent discharge switch.

When the GTC handle is pulled, the GTC is isolated as follows:

The GTC fuel shutoff valve is closed.
The GTC oil shutoff valve is closed.
The GTC bleed air valve is closed.
Positions the fire extinguisher system control valve.
Arms the extinguisher agent discharge switch.

ENGINE TURBINE OVERHEAT WARNING SYSTEM.

An overheat warning system is provided for each engine hot section. Each system consists of four thermal-switch detector units mounted in the hot section of the nacelle aft of the fire wall, a flasher, and indicator lights. These components are interconnected so that an overheat condition sensed by any

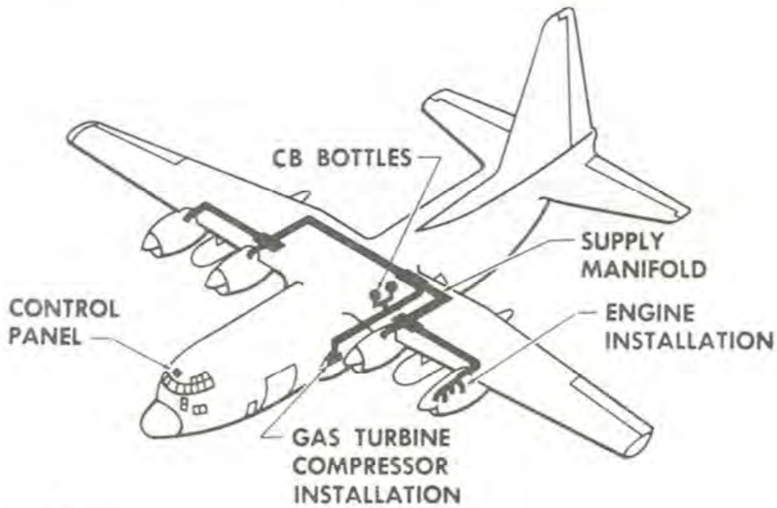
fire extinguishing system

NOTE

Electrically operated valves are solenoid operated, shown in the normal de-energized position. After discharging agent, open valves are held open as long as the fire handle is out providing another fire handle is not pulled.

CYLINDER DETONATOR

2-WAY CHECK VALVE



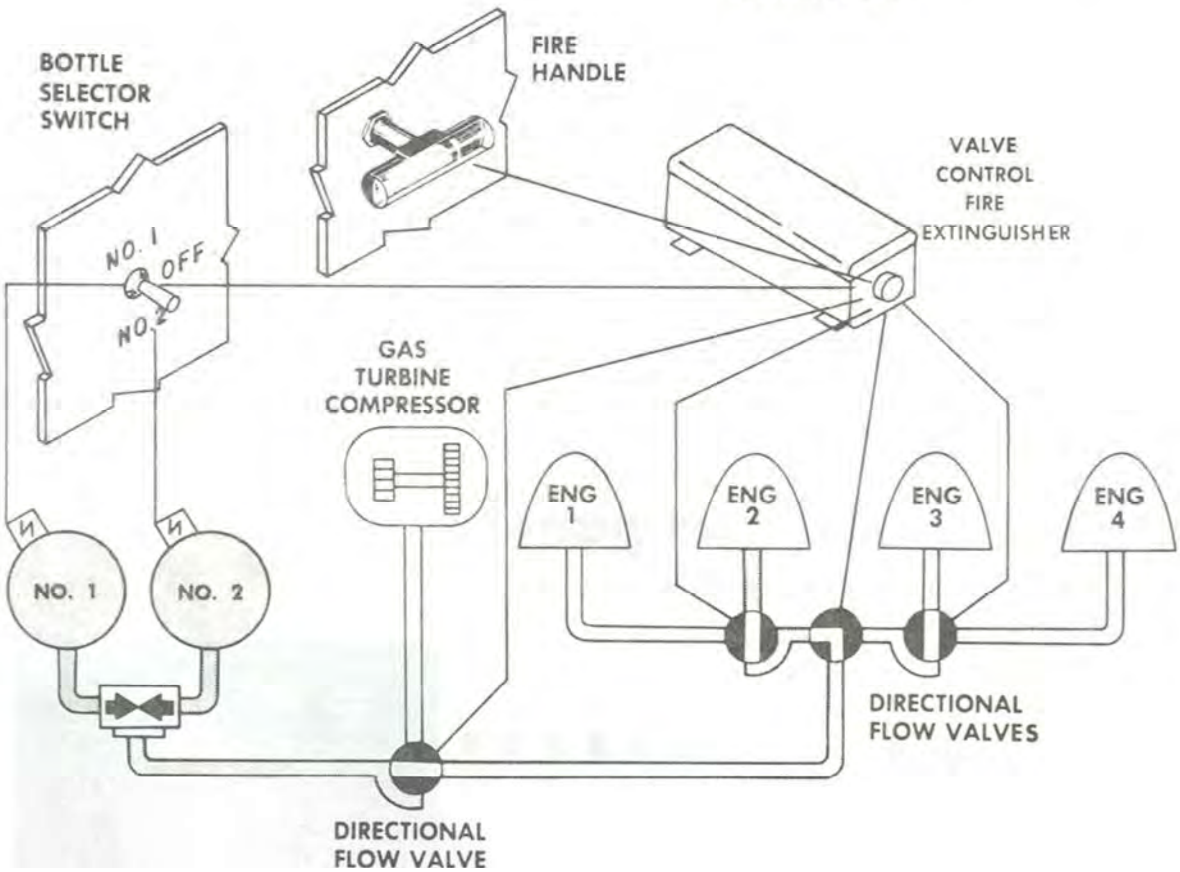


Figure 1-64.

fire emergency control panel

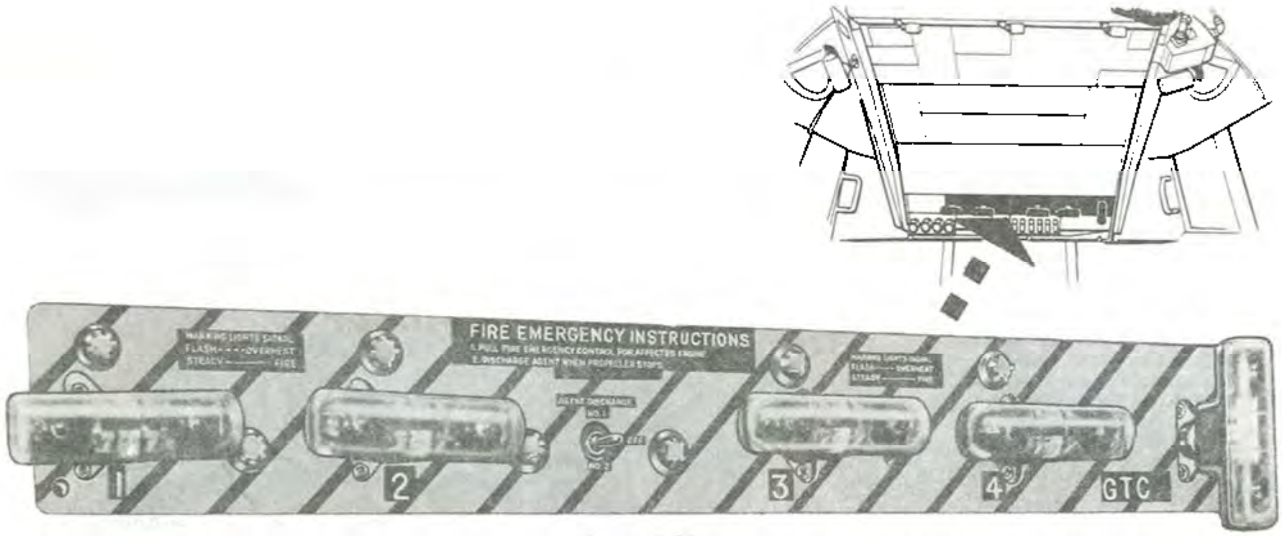


Figure 1-65.

one of the detectors causes the lights to flash. The detectors are connected in parallel to a loop; and if part of the detectors are inoperable, the remaining detectors can still close the circuit to turn on the lights. A test switch permits testing all four systems at the same time. The fenwal setting at which the detector lights will give an overheat warning is approximately 371°C (700°F). Twenty-eight-volt dc power for energizing the system is supplied from the essential dc bus through overheat detectors tailpipe circuit breakers on the copilot's side circuit breaker panel.

Indicator Lights.

Two red lights in each of the engine fire handles (figure 1-65) are flashed to indicate an engine overheat condition.

Master Fire Warning Panel.

The master fire warning panel (figure 1-68) is located on the pilot's instrument panel. The panel lights are flashed whenever any one of the engine overheat warning systems senses an overheat condition. When the lights flash, the lights in the engine fire handle flash also, and those lights indicate in which nacelle the overheat condition has been sensed. The master panel contains a master light and a panel light, both of which flash to indicate engine overheat.

Turbine Overheat Detector Test Switch.

The overheat detectors test switch (figure 1-66) is located on the warning system test panel on the overhead control panel. The switch has NORMAL and TEST positions. When positioned at TEST, it closes all four of the overheat warning system circuits in the same manner as if they were closed by detectors sensing an overheat condition. If the indicator lights flash when the switch is operated, circuit continuity and flasher operation are satisfactory.

Note

The test switch will only check circuit continuity and that the switch is functioning

warning system test panel

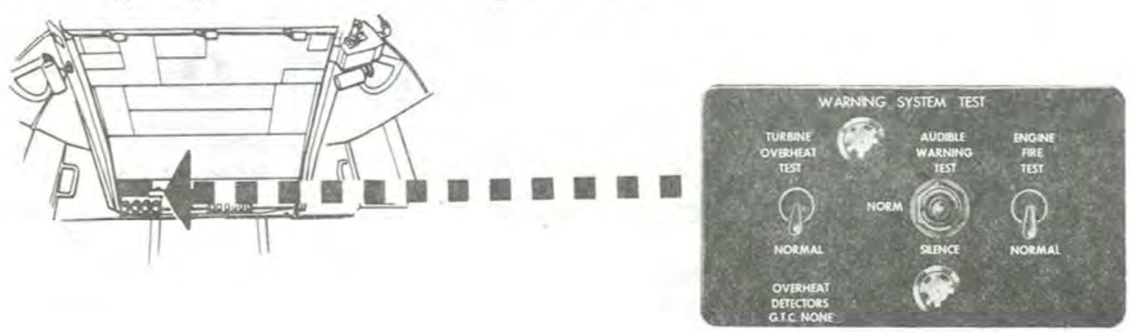


Figure 1-66.

properly. Even though all indicator lights illuminate and flash, this does not indicate the detectors are properly set or even operating.

NACELLE OVERHEAT WARNING SYSTEMS.

A nacelle overheat warning system is provided for each nacelle. Each system consists of thermal-switch detector units, mounted in the nacelle area forward of the fire wall, and a warning light on the copilot's instrument panel. A test switch is provided for testing all four warning systems simultaneously. The purpose of each system is to warn of an overheat condition in the area around the engine compressor section. Overheat in this area can result from the nacelle preheat valve being opened, or a rupture occurring in the bleed air system ducts. The overheat condition could also result from fire. The overheat condition can be detected by any one of the six detectors, which are connected in parallel to a loop. The fenwal setting at which the detector lights will give an overheat warning approximately 149°C (300°F). Twenty-eight-volt dc power for the detector units is supplied from the essential dc bus through overheat detectors nacelle circuit breakers on the copilot's side circuit breaker panel.

Indicator Lights.

Four numbered nacelle overheat warning lights are located on a panel (figure 1-67) on the copilot's instrument panel. If overheat is detected in any nacelle, the corresponding light on the panel glows steadily. The panel itself is also lighted simultaneously. When the test switch is operated, all four nacelle warning lights and the panel lights are illuminated. Twenty-eight-volt dc power is supplied from the essential dc bus through the nacelle overheat nameplate and overheat detectors nacelle circuit breakers on the copilot's side circuit breaker panel.

Nacelle Overheat Test Switch.

A test switch is located on the nacelle overheat warning panel (figure 1-67) next to the lights. Operation of the test switch closes all four nacelle overheat warning circuits, causing all four warning lights and the panel lights to glow as long as the switch is held in TEST. Failure of a light to come on indicates a break in continuity in the warning circuit.

Note

The test switch will only check circuit continuity and that the switch is functioning properly. Even though all indicator lights illuminate, this does not indicate the detectors are properly set or even operating.

FIRE DETECTION AND WARNING SYSTEMS.

A fire detection and visual warning system is provided for each engine and gas turbine compressor. Each engine system consists of a continuous loop detector, amplifier, and indicator lights located in the flight station. The gas turbine compressor system is the same. Each system is sensitive to high temperature and, when detected, the amplifier unit initiates a signal to the indicator lights. These lights give a steady red glow when activated. A test system is provided to test operation of each detector and system. The test switch is located on the warning system test panel and when actuated will illuminate all fire warning lights simultaneously. The test switch and the warning lights are powered by the essential dc bus through the fire detector circuit breaker on the copilot's side circuit breaker panel.

nacelle overheat control panel

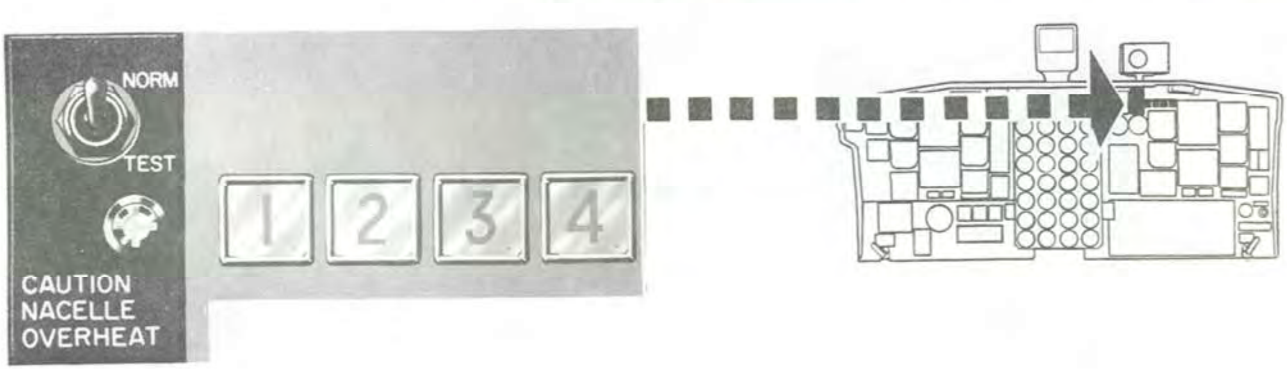


Figure 1-67.

Visual warning of the detection of a fire is supplemented by an audible warning. Detection of a fire is transmitted simultaneously to the appropriate indicator lights and to a speaker located aft of the overhead control panel. The result is a steady red glow from the indicator lights and a loud blaring noise from the speaker.

Note

Audible fire warning is deactivated.

Momentary selection of the SILENCE position of a three-position (TEST, NORM, SILENCE) spring-loaded, toggle switch, located on the warning system test panel (figure 1-66), will silence the speaker. The indicator lights will continue to glow until the fire is extinguished. The TEST and SILENCE positions of the switch are both test positions. Holding the switch to TEST while visually monitoring the master fire warning light, No. 1 fire handle light, and audibly monitoring the speaker, provides a check of the continuity of the audible fire warning system. A blast from the speaker should be accompanied by a steady red glow at the master fire warning light panel, and the No. 1 fire handle light. When the switch is released, it should return to NORM. Holding the switch to SILENCE while simultaneously holding the engine fire test switch to TEST and repeating both monitoring operations, provides a check on the current operational status of a holding relay in the system. If the speaker remains silent and the master fire warning light and all fire handle lights glow, the relay is functioning as desired. If the speaker continues to sound, the relay is defective. Releasing the switch from the SILENCE position should cause it to return to NORM. Electrical power for the system is furnished from the essential dc bus through an audio warning circuit breaker located on the copilot's side circuit breaker panel.

Fire Detection Systems Indicator Lights.

Two lamps in each of the fire handles provide fire indication. The red lamps in a handle glow whenever fire is detected in the corresponding nacelle. The lamps glow steadily to distinguish the indication from the flashing overheat warning indication.

Master Fire Warning Panel.

The master fire warning panel (figure 1-68) is located on the pilot's instrument panel. The panel contains a warning light and a panel light. If fire is detected by any one of the detection systems, the panel and warning light will glow steadily. The steady light distinguishes the signal from an overheat warning indication, which is a flashing of the same lights. When the master panel indicates fire, the lamps in one of the fire handles will illuminate also to indicate the location of the fire. The master fire-warning light receives 28-volt dc power from the essential dc bus through the master fire warning circuit breaker on the copilot's side circuit breaker panel.

HAND OPERATED FIRE EXTINGUISHERS.

CAUTION

Bromochloromethane is highly corrosive to aircraft metal, paint, and plexiglas. In the event the fire extinguisher starts to leak, the extinguisher should be inverted and the control valve depressed (cover the nozzle with a cloth or aim into a can etc. to catch any liquid which may be discharged). This will release the stored charge of pressurizing gas with a minimum discharge of fluid and render the extinguisher harmless. The extinguisher should be returned to its bracket and be reported for replacement in Form 781.

Note

High pressure water type fire extinguishers are installed when flares are transported within the cargo compartment.

master fire warning light panel

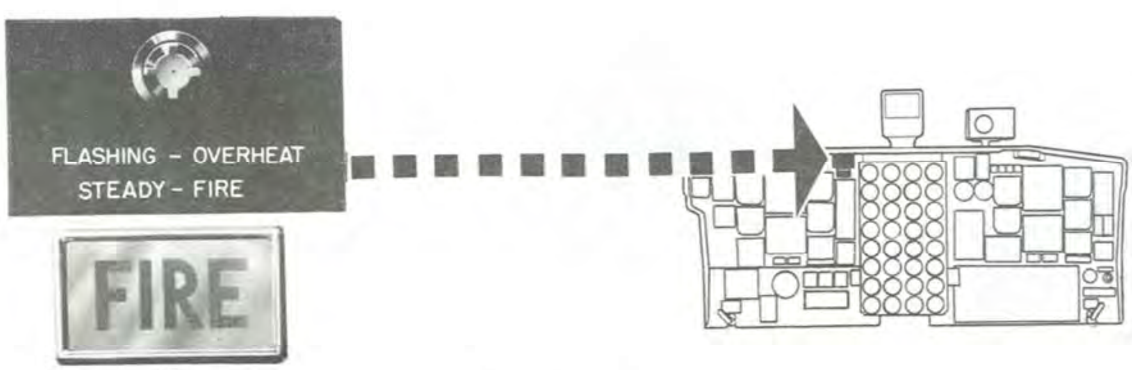


Figure 1-68.

Six bromochloromethane fire extinguishers are provided for fighting interior fires, one in the flight station on the flight station aft bulkhead and five in the cargo compartment. A trigger-type handle located at the top of the extinguisher permits it to be operated with one hand. An additional chemical type extinguisher is provided in the cargo compartment just forward of the right hand paratroop door (figure 3-1).

ALARM SYSTEM.

Five warning bells and a warning light are installed in the airplane: four warning bells are located in the cargo compartment, and one is located in the booth which is connected to the booth warning light. Power for operation of the bells and light is supplied from the battery bus through the alarm bell circuit breaker on the pilot's side circuit breaker panel. When the alarm bells and lights are actuated the emergency egress panel instruction placard will illuminate and if the main dc bus is powered, the cargo compartment lights will illuminate.

DOOR WARNING SYSTEM.

The door warning system consists of a master door warning light on the pilot's side of the glare shield (figure 1-62), a light, and master light shutoff switch at each door and door warning switches on each door. The door warning system is supplied 28-volt dc power from the main dc bus through the door warning light circuit breaker on the copilot's lower circuit breaker panel.

Door Warning Lights.

The master door warning light is located on the pilot's side of the glare shield. It illuminates whenever any one of the door warning switches is closed. The switches are closed when the doors are not closed and latched. It can be turned off by the master light shutoff switch for the affected door, and then will be turned on again if a warning switch on another door closes.

The left paratroop door light is located on a panel next to the door. The right paratroop door, ramp, and aft cargo door lights are located on a panel aft of the right paratroop door. The crew door warning light is located forward of the crew entrance door. Any one of these lights will be turned on when the corresponding door is not securely locked, and these individual lights cannot be turned off except by securing the door.

Master Light Shutoff Switches.

The master light shutoff switches are located on the door warning light panels in the cargo compartment next to the individual door warning lights. One switch is provided for each door. The purpose of the switches is to permit turning off the master warning light on the pilot's instrument panel, thus rearming the light so that it can give a second warning if another door becomes insecure.

FIRST AID KITS.

Seven small first aid kits and two battle first aid kits are installed in the airplane. The small kits are located as follows: two are located on the flight deck, two are located in the booth, two are located on the outside forward wall of the booth, one on the outside aft wall of the booth. The locations of the two battle first aid kits are: one on the aft inside wall of the booth, and one on the outside forward wall of the booth (figure 3-1).

HAND AXES.

Three hand axes are provided on the aircraft. They are mounted forward, inside and aft of the booth (figure 3-1).

FLASHLIGHTS.

Provisions for nine flashlights (figure 3-1) are made in the airplane, one above and forward of each paratroop door, one adjacent to the aft escape hatch, one adjacent to the side emergency exit, one adjacent to the center escape hatch, one below the forward escape hatch, and one at the galley.

EMERGENCY LIGHTS.

Seven portable, battery-operated emergency lights (figure 3-1) are installed on stationary terminal blocks located near each normal or emergency exit. One light is installed aft of the flight deck extension, one near each of the two paratroop doors, one near the right side emergency exit, and one near each of the three overhead emergency escape hatches. When installed, the lights can be either individually controlled by the three-position (ON, OFF, ARMED) switch on each light assembly or collectively extinguished by the emergency exit light extinguish push button on the overhead electrical control panel (figure 1-31). In order for the emergency exit light extinguish push button to be able to extinguish a light; however, the associated light assembly switch must be positioned to ARMED. An inertia switch in each of the light assemblies actuates the light when the airplane is subjected to a decelerating force exceeding 2-1/2 g's. The lights will also illuminate if power on the essential dc bus fails. An individual light assembly can be removed for emergency portable use by pulling the release handle on the light assembly. The control system for the installed system is supplied 28-volt dc power from the essential dc bus through the emergency exit light control circuit breaker on the copilot's lower circuit breaker panel, and from the battery bus through the emergency exit light extinguish circuit breaker on the pilot's side circuit breaker panel.

LIFERAFTS.

There are provisions for four 20-man liferafts in the top center wing trailing edge area. Liferaft release handles (figure 3-14) are located as follows: two on the flight station bulkhead below the escape hatch, two on the fuselage structure aft of the right paratroop door, and two on the wing upper surface inboard of their respective liferaft compartments. The release handles on the wing upper surface can be reached by removing the protective fabric covering over the handle openings. The rafts are automatically inflated upon actuation of the release handles and are secured to the airplane by lanyards.

EMERGENCY RADIO.

A PRC-90 emergency radio or equivalent will be installed in an accessory kit stowed with each liferaft. The PRC-90 is capable of transmitting voice or distress signal and receiving on 243.0 mHz. One additional frequency is available for voice transmission/reception.

ACCESSORY KITS.

An accessory kit is stowed with each liferaft. Each kit contains an emergency radio, four distres signals, five survival food packets, and one distress marker light.

PARACHUTE AND SURVIVAL KIT STORAGE.

Storage provisions are provided for chest-type parachutes. The storage racks are located at the forward end of the booth and on the left side of the booth.

PYROTECHNIC PISTOL.

There are provisions for mounting a pyrotechnic pistol at the right scanner's station and two at the IO station, and one at the navigator station. The pyrotechnic flares are located at the bottom of the galley equipment rack.

CAUTION

To avoid firing the pyrotechnic pistol with the pressure port closed, do not touch the trigger of the pistol until the trigger guard is in the fully extended position.

WARNING

Failure to handle the pyrotechnic pistol safely when removing pistol from the pistol mount could result in an accidental discharge inside the airplane.

EMERGENCY ESCAPE EXITS.

Three overhead emergency escape hatches and a side emergency exit panel are provided on the airplane. The overhead emergency escape hatches are located forward of the flight station aft bulkhead, aft of the center wing section, and above the loading ramp. The side emergency exit panel is located forward of the right wheel well. An emergency escape lever is mounted on the fuselage adjacent to each emergency escape exit. Moving this lever releases the locking latches, and allows the hatch or exit panel to be pulled into the airplane. The hatches and side exit panel may be released from outside of the airplane by means of flush-type finger handles mounted in the fuselage skin. Pulling these handles releases the hatches and side emergency exit panel in the same manner as do the emergency escape levers. An explosive emergency egress panel and operating controls are added near the scanner/observer position (figure 1-69). The emergency egress system is installed as an integral structural part of the airframe. A linear shaped explosive charge is permanently mounted on the skin and framed in a shielded backblast retainer. When the linear shaped charge is fired, a predesigned opening is instantaneously cut in the fuselage of the aircraft. Exterior chopping locations are marked in yellow (figure 3-2) as painted on each side of the fuselage above the paratroop jump doors. The locations are marked on the inside and outside of the fuselage.

The mechanical safe/arm actuator provided is foolproof against any spurious inputs which may be encountered during normal aircraft operation or emergency conditions.

A fireman-type exit pole, located directly aft of the flight deck entrance, provides emergency exit from the flight deck (figure 3-1).

ALTERNATE EXITS.

See Section III for air, ground, and water emergency exits.

EMERGENCY ESCAPE ROPES.

An emergency escape rope is installed aft of each cargo compartment overhead emergency escape hatch. The flight deck emergency escape rope is located on the cargo compartment side of fuselage station 245. One end of each rope is fastened to the fuselage structure. The ropes are looped into a bundle and are secured near the hatches in snap-fastened straps (figure 3-1).

CREW ENTRANCE DOOR.

The crew entrance door (figure 2-1) used during ferry flight only, is located on the forward left side of the airplane. The door is opened from the outside by rotating the door handle downward. A hand lanyard on the aft side of the inside face of the door is provided for pulling the door closed preparatory to flight.

emergency egress panel

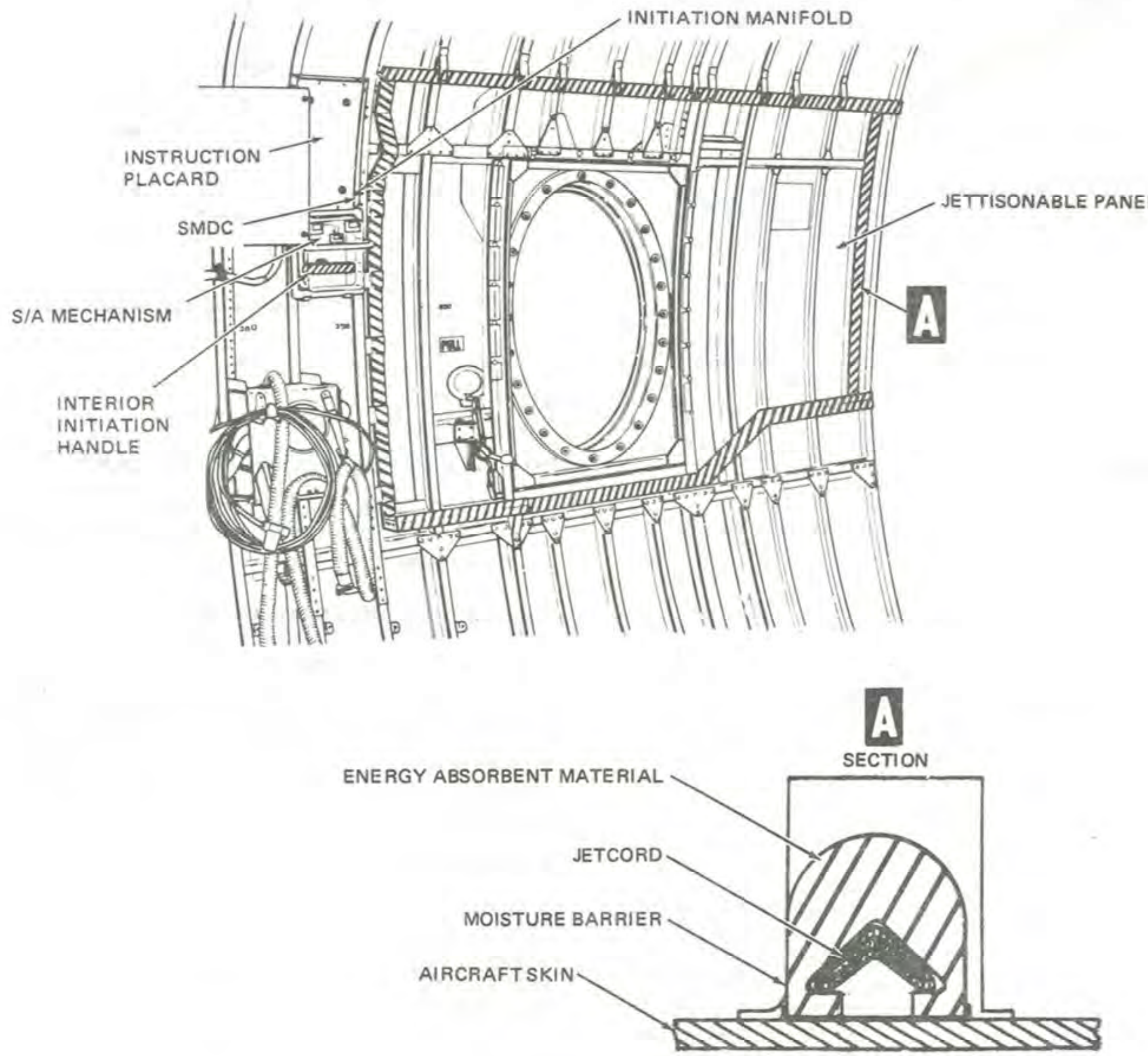


Figure 1-69.

To open the door from the inside, turn the inside handle in a counterclockwise direction.

Crew Entrance Door Jettison Handle.

The crew entrance door jettison handle (figure 1-70) is a yellow handle located on the ceiling of the flight station, 3 feet to the left of the center line of the airplane and slightly aft of the pilot's seat. Pulling the handle down actuates a cable through a bellcrank assembly to pull the locking pins from the top of the door at the same time that the hinge pins drop from the bottom hinge and the telescoping counterbalance is released.

crew door jettison handle

Figure 1-70.

SEATS.

A maximum of 23 crash stations, all with crash seats, are provided in the airplane (figure 1-1): five crash stations (pilot, copilot, navigator, fire control officer and engineer) are located on the flight deck; five crash stations (IR operator, TV operator, EWO and the two rest stations) are located in the booth; two are located just forward of the booth in the cargo compartment; one is located at the scanner/observer position; ten crash stations (two rows of five seats) are provided on the cargo ramp floor.

The crew is provided with tapered-back seats (figure 1-71) designed for use with back-style parachutes. The engineer's, navigator's, booth and right scanner seats, on a swivel base, are adjustable both fore and aft and up and down. Headrests may be stowed when not in use at the rear of the pilot's or copilot's seats. Raising the vertical adjustment lever on the right side of each seat releases vertical locking pins and permits the seats to be raised by spring pressure or lowered by the weight of the occupant. A horizontal adjustment lever on the left side of the seat, when raised, releases horizontal locking pins and permits the seat to be moved forward or aft. Raising swivel release levers, located forward of the vertical adjustment levers on the right side of the engineer's, navigator's, booth and right scanner's seat releases a locking device and permits these seats to be swiveled. The pilot's, copilot's, engineer's and navigator's seats are provided with protective armor plating. The armor plating is described in Section IV.

SEAT CONTROLS.

Seat controls are designed to adjust the seat position to the physical build of the individual crew member. They are easily adjusted to the comfort of the crew member and may be locked in any desired position.

Pilot's and Copilot's Seat Tilt Lever.

A seat tilt lever, located on the right side of the pilot's and copilot's seats, is a manual control which allows the seat to tilt forward or aft.

Horizontal Adjustment Lever.

A horizontal adjustment lever, located on the left side of the seats, locks and unlocks the seat adjustment mechanism, allowing the seat to be adjusted from an aft to a forward position. Placing the lever in the FORWARD detent locks the adjustment mechanism. Placing the lever in the AFT detent unlocks the adjustment mechanism.

Swivel Release Lever.

A swivel release lever, located on the right side of the engineer's, navigator's, booth and right scanner seats, controls the rotational movement of this seat. When the swivel release lever is raised, the seat-locking device is released and the seat can be rotated to any desired position. When the lever is released, the locking device engages to prevent rotation of the seat.

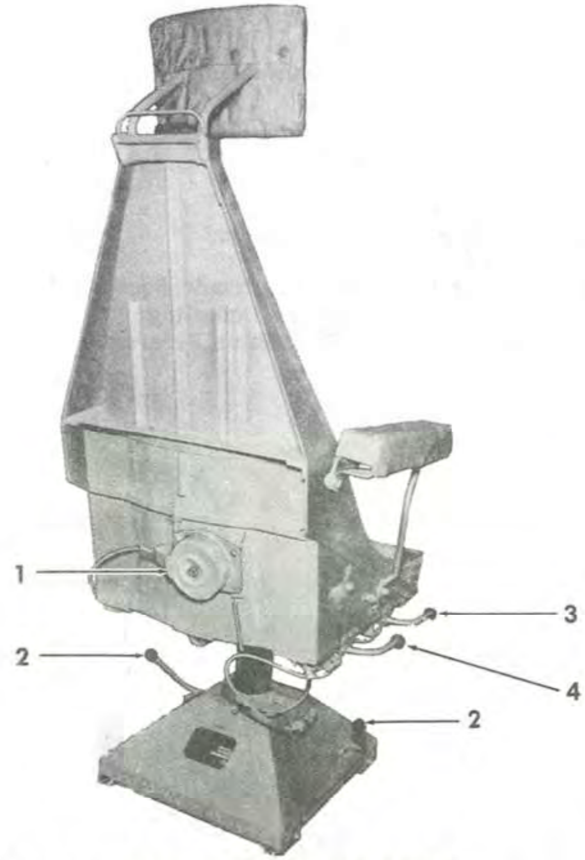
Vertical Adjustment Lever.

A vertical adjustment lever, which is spring-loaded to the lock position, is located at the right side of each seat. The seat itself is spring-loaded to its upper-most position. To adjust the seat for height, sit down in the seat, at the same time pulling up on the vertical adjustment lever. The seat will tend to move up or down, depending on the weight applied to it. When the desired height is attained, release the lever, which will lock the seat in the desired position.

SAFETY BELTS AND SHOULDER HARNESS.

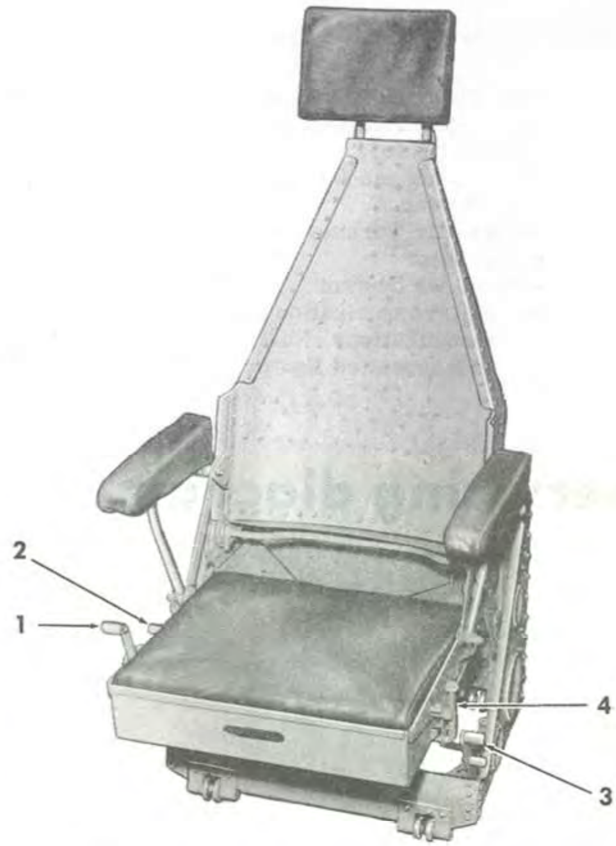
All crew seats are provided with a conventional seat safety belt and shoulder harness.

crew seats typical



ENGINEER'S, NAVIGATOR'S, BOOTH AND RIGHT SCANNER

1 INERTIA REEL
2 HORIZONTAL ADJUSTMENT LEVER
3 SWIVEL RELEASE LEVER
4 VERTICAL ADJUSTMENT LEVER



PILOT'S AND COPILOT'S SEAT

1 SEAT TILT LEVER
2 VERTICAL ADJUSTMENT LEVER
3 HORIZONTAL ADJUSTMENT LEVER
4 INERTIA REEL LEVER

NOTE

ON PILOT'S AND COPILOT'S SEATS, VERTICAL AND HORIZONTAL ADJUSTMENT LEVERS HAVE EXTENSIONS TO FACILITATE OPERATION WITH ARMOR PLATE INSTALLED.

Figure 1-71.

SHOULDER HARNESS INERTIA REEL LOCK CONTROL HANDLE.

A two-position (LOCK, UNLOCKED) shoulder harness inertia reel lock control handle (figure 1-71) is located on the left of the pilot's, copilot's, navigator's booth and right scanner seats. A latch is provided for retaining the control handle securely at either position. By pressing in on the top of the control handle, the latch is released and the handle may be moved freely from one position to another. When the control is in the UNLOCKED position, the reel harness cable will extend to allow a crew member to lean forward in his seat; however, the reel harness cable will automatically lock when an impact force of 2 to 3 g's on the airplane is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to LOCKED and then returned to the UNLOCKED position. When the handle is in the LOCKED position, the reel harness cable is manually locked so that the seat occupant is prevented from moving forward. The LOCKED position is used only when a crash landing is anticipated. This position provides a safety precaution in addition to automatic safety lock. The navigator's and engineer's inertia reel will not function automatically nor will the shoulder harness provide restraint if the seats are facing sideways. This is due to the plane of the inertia weight and spring.

AUXILIARY EQUIPMENT.

The following equipment is described in Section IV of this manual:

- Aft Cargo Door and Ramp System
- Air Conditioning System
- Air Deflectors
- Anti-icing and De-icing System
- Armament
- ATM (Air Turbine Motor)
- Auto Pilot
- Bleed Air System
- Cabin Pressurization System
- Communications, Navigation, Fire Control and Associated Equipment
- GTC (Gas Turbine Compressor)
- Life History Recorder
- Lighting System
- Miscellaneous Equipment
- Nacelle Preheat System
- Oxygen System
- Radio Beam Coupler Equipment
- Paratroop Door
- Sensor and Associated Electronic Equipment
- Single Point Refueling and Defueling
- Switching Unit Auto Pilot Pitch Reference

servicing diagram

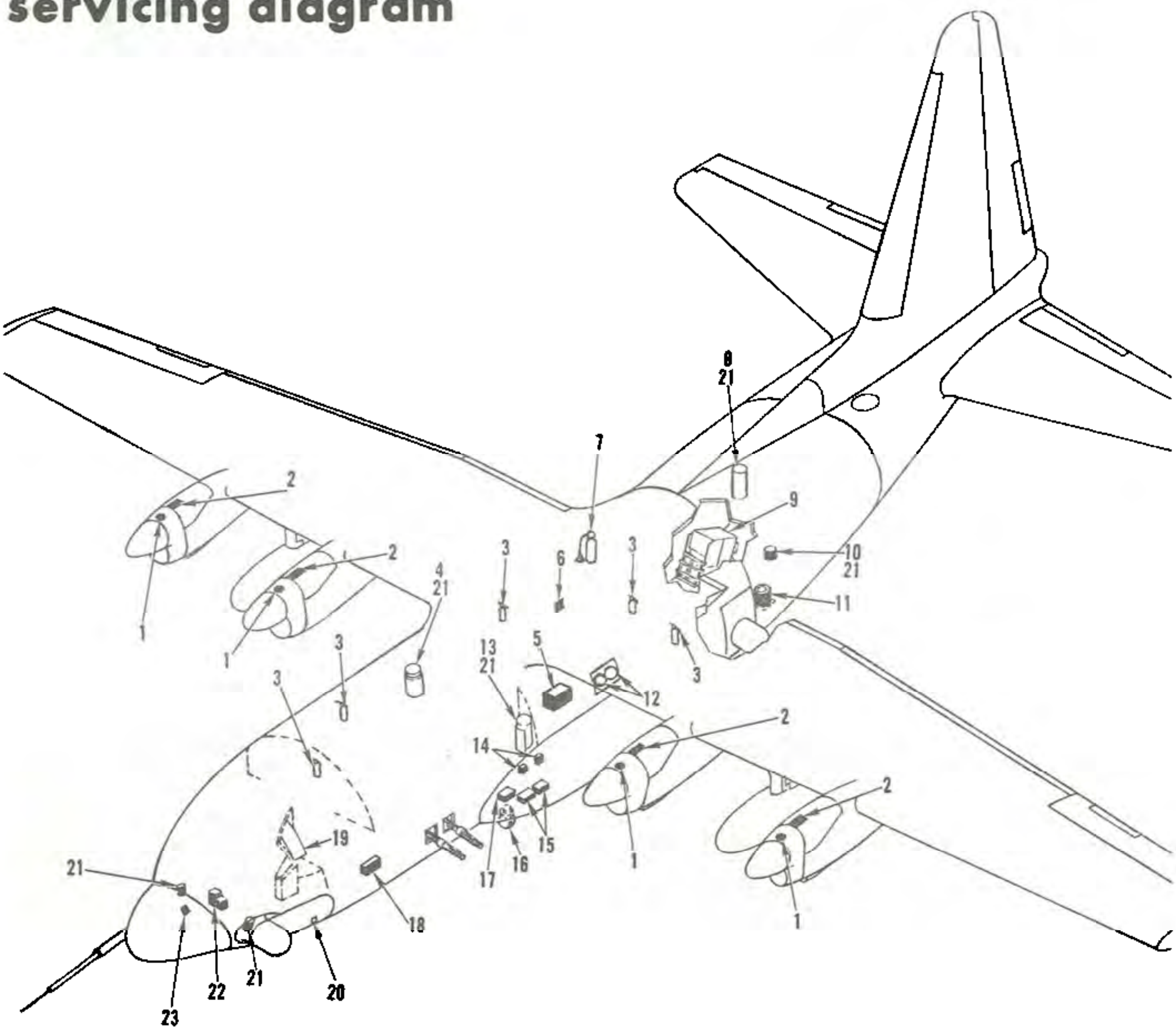


Figure 1-72. (Sheet 1 of 2)

servicing diagram

ITEM NO.	UNIT	AGENT	SPECIFICATION	NATO SYMBOL
1	PROPELLER RESERVOIR (4 PLACES)	HYDRAULIC FLUID	MIL-H-6083 TYPE I OR MIL-H-5606 [1]	C-635
2	ENGINE OIL AND STARTER OIL FILLER (4 PLACES)	LUBRICATING OIL	MIL-L-7808 OR MIL-L-23699 [2]	0-148 OR 0-156
3	HAND FIRE EXTINGUISHER (5 PLACES)	BROMOCHLOROMETHANE	MIL-B-4394	
4	BOOSTER HYDRAULIC SYSTEM RESERVOIR	HYDRAULIC FLUID	MIL-H-5606	H-515
5	AIR TURBINE MOTOR	LUBRICATING OIL	MIL-L-7808 OR MIL-L-23699 [2]	
6	FUEL TANKS - SINGLE POINT REFUELING RECEPTACLE	TURBINE FUEL	MIL-J-5624, JP-4 AND JP-5 [3]	F-40 AND F-44
7	HAND FIRE EXTINGUISHER	DRY CHEMICAL	—	
8	EMERGENCY HYDRAULIC SYSTEM RESERVOIR	HYDRAULIC FLUID	MIL-H-5606	H-515
9	FLARE LAUNCHER LAU-74/A	DEHYDRATED AIR	—	
10	AUXILIARY HYDRAULIC SYSTEM RESERVOIR	HYDRAULIC FLUID	MIL-H-5606	H-515
11	TOILET	DISINFECTANT TABLET WATER	AF8500-415000 CLASS 24 CLEAN, WARM	
12	FIRE EXTINGUISHER SYSTEM BOTTLES	DIBROMODIFLUOR-METHANE	MIL-D-4540 OR MIL-B-4394	
13	UTILITY HYDRAULIC SYSTEM RESERVOIR	HYDRAULIC FLUID	MIL-H-5606	H-515
14	7.62 MM GUN BATTERY (2 PLACES)	DISTILLED WATER	—	
15	20 MM GUN BATTERY (2 PLACES)	DISTILLED WATER	—	
16	AN/AAD-7 DETECTING SET COMPRESSOR	HELIUM	BB-H-1168	
17	GAS TURBINE COMPRESSOR OIL RESERVOIR	LUBRICATING OIL	MIL-L-7808 OR MIL-23699 [2]	
18	LTD/R TRANSMITTER	NITROGEN	BB-N-411	
19	GALLEY WATER TANK	DRINKING WATER	—	
20	EXTERNAL POWER RECEPTACLE	—	—	
21	ACCUMULATORS (6 PLACES)	DEHYDRATED AIR	—	
22	AIRCRAFT AND F.C. SYSTEM BATTERIES	DISTILLED WATER	—	
23	LIQUID OXYGEN FILLER	LIQUID OXYGEN	MIL-O-27210, TYPE II	

— NOTES —

[1] THESE FLUIDS ARE THE ONLY TYPES AUTHORIZED AND MAY BE MIXED IN ANY QUANTITIES DESIRED.

[2] IN EMERGENCIES MIL-L-7808 AND MIL-L-23699 MAY BE MIXED. THE AMOUNT OF EMERGENCY OIL ADDED SHOULD NOT EXCEED ONE HALF TANK CAPACITY. AT FIRST OPPORTUNITY, THE OIL WILL BE DRAINED AND ENGINE SERVICED WITH PROPER OIL.

[3] REFER TO SECTION V FOR ALTERNATE FUELS.

Figure 1-72. (Sheet 2 of 2)

SECTION II

normal procedures

TABLE OF CONTENTS

PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

Refer to Section V for information concerning the restrictions imposed on the airplane in flight.

FLIGHT PLANNING.

The wide range of speeds and altitudes possible with the airplane requires that careful attention be given to mission planning and cruise control. Remember that turbo-prop-powered airplanes use considerable more fuel at low altitudes than similar reciprocating engine airplanes. Use the performance charts in T.O. 1C-130(A)H-1-2 to find required fuel quantities, take-off distances, airspeeds and power settings.

TAKE-OFF AND LANDING DATA CARD.

A take-off and landing data (TOLD) card is provided in the engineer's abbreviated flight crew checklist. The engineer will complete the TOLD card prior to each take-off and landing. Maximum effort, zero flap, and reduced power data need only be computed when performing these operations. Take-off and landing data may be obtained from the performance charts in T.O. 1C-130(A)H-1-2.

WEIGHT AND BALANCE.

Check the airplane weight and balance, and make sure that the weight and balance clearance (Form 365F) is complete and correct. Refer to Section V for weight limitations of the airplane, and check the take-off and anticipated landing gross weights.

CHECKLISTS.

The flight manual contains only amplified procedures. Individual flight crew checklists are issued as separate technical orders.

Flight crew checklists are designed for use with binders having plastic envelopes into which the individual pages are inserted. Checklist binders are available through normal Air Force supply channels.

Line (numbered) items in the flight manual and flight crew checklists are identifcal as pertains to arrangement and item number.

Checklist items followed by "As required" are items requiring varying procedures due to varying conditions. "As required" or "State setting" will not be used as a response; instead, the actual position or setting of the unit or system will be stated.

Each flight crew member is required to use and refer directly to the appropriate checklist for all phases of operation in which they participate except during visual inspection, starting engines, taxi, takeoff, touch-and-go landings, emergencies, or when specifically allowed by the amplified portion of the checklist. In these instances, direct reference to checklist items will be made before performing them or afterward as a cleanup reference.

The engineer may accomplish all checklists from BEFORE STARTING ENGINES through ENGINE SHUTDOWN without direct reference to the applicable checklist. All engineer system checks/items not requiring crew coordination may be accomplished as practical on these checklists except that he must review all items on each checklist for completion prior to responding checks "complete" for any phase of operation.

For simplification, this section will include only normal procedures applicable to the pilots and engineer. Procedures for other crewmembers are included only when their coordination is required. For duties of other crewmembers, refer to Section VIII. The following crew identifying codes are used throughout all checklists:

P	Pilot	FCO	Fire Control Officer
CP	Copilot	E	Engineer
N	Navigator	AG	Airborne Gunner
EWO	Electronic Warfare Officer	TV	TV Operator
IR	Infrared Operator	GC	Ground Controller
IO	Illuminator Operator	RS	Right Scanner

Note

Any crewmember performing scanner/ground controller duties will use illuminator operator's checklist.

Note

A comma between crew positions or responses indicates that both will be applicable. A virgule (/) between positions or responses indicates either one or the other will apply.

The preflight and cockpit checklists are provided for the purpose of preparing the airplane for flight and are performed by the engineer. The engineer will ensure that all access panels, escape hatches, and landing gear doors are closed/secure after completion of the preflight. The engineer will inform the pilot of any checks or checklists not complete. The remaining checklists are performed on each flight with all necessary crewmembers in their respective duty positions. Each checklist for a phase of operation will be initiated by the pilot except as indicated in the narrative introduction to that checklist. The copilot will be responsible for reading the pilot's checklist. Only the response items need be read aloud. The copilot will accomplish all non-response items prior to proceeding to the next item. When a checklist item is followed by a crew position (i.e., P, CP, E, etc.), that crewmember takes the action and, if the action is in quotes, responds aloud to the person reading the checklist. When more than one crewmember has the same response to the same item, all subsequent to the initial crewmember responding need respond only with his crew position. (Exception: When altimeters appear as a checklist item, each crewmember will state the altimeter setting.) When the TV operator responds for all crewmembers in the booth, the response will be "TV." When the navigator is responding for himself and the FCO, the response will be "NAV." Sequence of response will be in the order as shown on the checklist. At the completion of each phase of operation (checklist), the copilot response indicates that the applicable checklist is complete.

Note

Before answering a challenge that indicates a panel or system, the responsible crewmember will ensure that all switches/controls on that panel/system are as indicated by the subitems (letters) in the amplified checklist. When landing gear, flaps, engine shutdown, or ground idle appear on a checklist, the action will be coordinated with the pilot prior to accomplishment if the airplane is moving. Checklist items not applicable to the airplane/mission being flown (i.e., illuminator, UARRSI) need not be challenged or responded to.

In the event the airplane is flown without a full crew (i.e., ferry mission), responses of the missing crewmembers will be as designated by the pilot. Crewmember system checks or items not requiring crew coordination may be accomplished prior to the challenge and as soon as practical beginning with the Before Starting Engines checklist through the After Landing checklist. This does not preclude response to the checklist when item is called by the copilot.

entrance to airplane

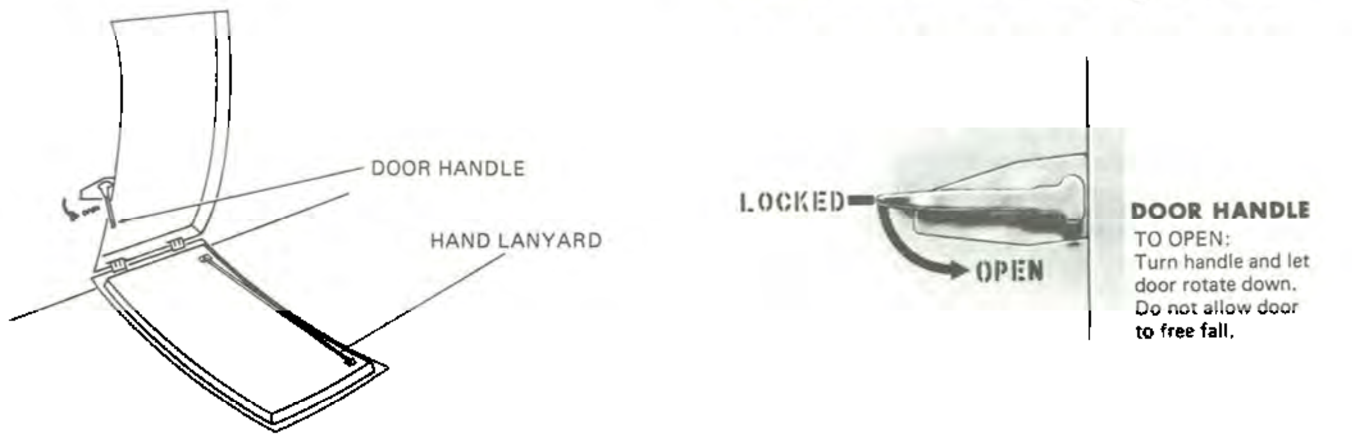


Figure 2-1.

THROUGH FLIGHT OPERATION.

After the first flight of the day, if the airplane is flown on the same type mission and no maintenance or servicing is required, it is unnecessary for preflight checks to be performed. When maintenance or servicing is required, only the items or systems affected need be checked prior to the next flight. The checklists have been designed so, for through flight operation, the flight crew may begin with the cockpit checklist to assure safe operation.

ENTRANCE.

Normal entrance to the airplane will be through the right paratroop door or ramp.

CAUTION

Do not enter through the crew entrance door because of possible damage to the multi-sensor platform. If equipment is not installed, the crew entrance door may be utilized. See figure 2-1 for instruction for opening the door.

WARNING

When operating the handle, stand clear of the door. This will prevent injury to personnel, should the door fall free.

CAUTION

When opening the door from the inside, use the hand lanyard to restrain the door if it should fall free.

PREFLIGHT CHECK.

Enter the airplane flight station. Consult Form 781 to find the status of the airplane. Check that the airplane is serviced with the proper amounts of fuel, oil, and oxygen. It is the responsibility of the pilot to ensure that a preflight inspection, as required by T.O. 1C-130B-6 and T.O. 1C-130(A)H-6, is performed. Preflight checks are normally performed by the engineer; however, the pilot may designate other personnel to assist him.

Note

The flight crew inspection procedures are based on the assumption that maintenance personnel have completed all the requirements of preflight/through flight inspection in T.O. 1C-130B-6 and 1C-130(A)H-6. Therefore, duplicate inspections and operational checks of systems by flight crew members are eliminated, except for certain items required in the interest of flying safety.

BEFORE EXTERIOR INSPECTION.

WARNING

All guns will be electrically and mechanically safe and the loading sectors installed in the 7.62MM guns before power is applied to the airplane.

1.	Prior to entrance	Checked
a.	Chocks	In place
b.	Static ground	Connected
c.	AC or dc external power	Standing by
d.	Nose gear pin	In place
e.	Dust excluders and duct plugs	Removed

Note

Intakes, exhausts, and items requiring the use of a ladder or maintenance stand may be checked at this time.

f.	Fire extinguisher	In place
g.	Airplane location (for emergency notification purposes)	Noted
h.	Flare dispensers ground safety pins	In place
i.	Form 781 and applicable publications	Checked
2.	Flare dispensers junction box, AN/ALE 40(V)	Checked
a.	Right SUU-42 A/A switch	NORMAL
b.	Left SUU-42 A/A switch	NORMAL
c.	Right ALE-20 switch	NORMAL
d.	Left ALE-20 switch	NORMAL
e.	ALE-40	Checked
	(1) Switches - Reset	
	(2) Pins - Installed	
3.	Flare launcher (LAU-74/A)	SAFE
a.	Power lead connector	Disconnected, Stowed
b.	Shorting plug	Installed
c.	Main selector valve	OFF
d.	Air bottles	OFF

e.	Manual jettison handle	Down/Safetied
f.	Jettison safety pin	Installed

WARNING

Aft cargo door will be open anytime flares are stored in the LAU-74/A, if the pneumatic valves are open or the electrical cables connected.

4. Aft fuselage area — Checked
   - a. Aft cargo door and ramp controls — NEUTRAL
   - b. Auxiliary hydraulic pump switch — OFF
   - c. Aft hydraulic reservoir fluid levels — Checked
   - d. ALE-20 dispenser switch — SAFE
   - e. Pyrotechnic pistols and mounts — Checked
   - f. ALE-40 — Checked
     - (1) Switches - Reset
     - (2) Pins - Installed
5. 40 KVA illuminator power switch — OFF
6. 105MM gun — Checked
   - a. Hydraulic control valves — OFF
   - b. Breech — Clear
   - c. Arm switch — SAFE
   - d. LWCP — OFF
7. 40MM gun — Checked
   - a. Arm switch — SAFE
   - b. LWCP — OFF
   - c. Breech — Clear
   - d. Firing selector lever — STOP FIRE
   - e. Hydraulic control valves — OFF
8. Booth — Checked
   - a. Aircraft publications — Checked

b.	IR 8-inch monitor controls	CCW, OFF
c.	IR mode select switch	OFF
d.	IR 14-inch monitor controls	CCW, OFF
e.	IR gimbal position control	OFF, Stow
f.	ECM pod controls	OFF
g.	TRIM-7A	OFF
h.	ALR-69	OFF
i.	RHAW intensity and audio (some airplanes)	CCW
j.	BC power switch	OFF
k.	APQ-150	OFF
l.	BC mount power switch	OFF
m.	Chaff control launch switch	OFF

Note

For ferry or crew training flights during which the EW's position will not be occupied by a qualified equipment operator, isolate the audio management unit by pulling the RHAW circuit breaker on the two-man console circuit breaker panel.

n.	Right main landing gear inspection windows	Checked
o.	TV 8-inch monitor	CCW, OFF
p.	Searchlight controls	OFF
q.	Right wing SUU-42A/A	SAFE
r.	TV 14-inch monitor	CCW, OFF
s.	TV/laser control panel	OFF
t.	TV mount power switch	OFF

9. Left bleed air isolation valve — Open
10. Utility hydraulic reservoir fluid level — Checked
11. 7.62MM guns — Checked

a.	Arm switches	SAFE
b.	Drive motor and clearing solenoid electrical connectors	Disconnected

c.	Loading sectors and safing bars	Installed
d.	Rate switch (IFR airplanes)	LO RATE
12.	Spare fluids	Checked

13. Right bleed air isolation valve — Open
14. Booster hydraulic fluid level — Checked
15. Right scanner station — Checked
    a. Egress panel
        (1) Safety pin — Installed
        (2) Safety cover — Installed
        (3) Arm/Safe switch — SAFE
        (4) T-handle — In
    b. ALE-20 dispenser switch — SAFE
    c. Pyrotechnic pistol and mount — Checked
16. 20MM guns
    a. Arm switches — SAFE
    b. Firing lead — Disconnected
17. Liquid nitrogen dewar — Checked

Note

Fifty per cent (50%) service minimum for one mission.

18. Galley switches — OFF
19. Feather valve and NTS check switch — VALVE
20. Alarm bell — Checked

Note

Alarm bells will be checked with battery power only. Check battery for a minimum of 21 volts.

21. ALR-69 intensity — CCW
22. Copilot's circuit breaker panels — Checked
23. Navigator's station — Checked
    a. Equipment power — OFF
    b. Attitude reference control — OFF
    c. ADF control — OFF
    d. HF control — OFF
    e. FM control — OFF

f.	Radome anti-icing	OFF
g.	Doppler power switch	OFF
h.	Radar switches	OFF
i.	LORAN mode switch	OFF
j.	INS computer power	OFF
k.	IMS mode switch	OFF
l.	FC power supply switches (IFR airplanes)	OFF, INV
m.	Radio altimeter	OFF
n.	Flight deck refrigeration shut-off valve override handle	Neutral
o.	Aldis lamp and lens	Checked
p.	Pyrotechnic pistol and pistol mount	Checked (pistol safetied in mount)
q.	Periscopic sextant mount	Checked, closed

24. Fire control officer's station — Checked

a.	IMU blower switch	OFF
b.	FC power supply switches (non-IFR modified airplanes)	OFF, INV
c.	Gun mode select switch	AUTO
d.	8-inch monitor	CCW, OFF
e.	Fire control display	OFF
f.	Line printer	OFF
g.	Computer/gun indicator	Fixed
h.	Video recorder	OFF, Stop
i.	14-inch monitor	CCW, OFF
j.	Fuel governing check switches (IFR airplanes)	NORMAL, SAFETIED

25. Upper main ac distribution panel — Checked
26. Liferaft release handles — IN, Safetied
27. Miscellaneous and emergency equipment — Checked

a.	Escape rope	Checked

	b.	Emergency exit light	Checked, ARMED
	c.	First aid kits	Checked
	d.	Fire extinguisher	Checked
	e.	Restraining harness or parachute	Checked

Note

A restraining harness or parachutes will be required on the flight deck for pressurized flight. If a parachute is used on overwater flights, a one-man liferaft is required.

	f.	Pyrotechnic pistol flares	Checked
28.		Crew entrance door jettison handle	Safetied
29.		Portable oxygen bottles (all)	Checked
30.		ALE-20 dispenser switch	SAFE
31.		Aerial refuel panel (some airplanes)	Set
	a.	All switches set to OFF or closed	
32.		Engineer's oxygen panel	OFF, 100%
33.		Fuel governing check switches (non-IFR modified airplanes)	NORMAL, Safetied
34.		Weapons control panel	SAFE
35.		Pressurization test valves	OPEN, Safetied
36.		Emergency depressurization handle	IN, Safetied
37.		Pilot's circuit breaker panel	Checked
38.		Flare dispenser jettison switches	SAFE
39.		HUD	OFF
40.		Air-conditioning control panel	Set
	a.	Cargo compartment and flight deck shutoff switches	NORMAL
	b.	Air-conditioning master switch	OFF
	c.	Cargo compartment and flight deck temperature controls	OFF, NORMAL, FLT DECK
	d.	Cargo underfloor heating switch	OFF
	e.	Emergency depressurization switch	NORMAL
41.		GTC control panel	Set
	a.	GTC control switch	OFF

b.	Bleed air valve switch	CLOSED
c.	Air turbine motor switch	STOP

42. Anti-icing control panel — Set

a.	Nesa windshield switches	OFF
b.	Nacelle preheat switches	OFF
c.	Prop and engine anti-icing master switch	AUTO
d.	Pitot heat switches	OFF
e.	Engine inlet duct anti-icing switches	OFF
f.	Propeller ice control switches	OFF
g.	Wing and empennage anti-icing switches	OFF

43. Wing isolation and engine bleed air valve switches — Set

a.	Wing isolation valve switches	NORMAL
b.	Engine bleed air valve switches	CLOSE

44. Fuel control panel — Set

a.	Dump switches	OFF, Safetied (except IFR airplanes)
b.	Fuel boost pump switches	OFF
c.	Crossfeed valve switches	NO. 2 OPEN/Others closed
d.	Dump mast shutoff switches (IFR airplanes)	OFF, Safetied

45. Landing gear lever — DN

46. Hydraulic control panels — Set

a.	Brake select switch	EMERGENCY
b.	Anti-skid switch	ON
c.	Auxiliary pump switch	OFF
d.	Engine pump switches	ON
e.	Suction boost pump switches	OFF
f.	Emergency hydraulic system switch	OFF
g.	Utility isolation switch	OFF
h.	Auxiliary isolation switch	OFF

47. IFF — OFF, IDENT OUT

48. Armament and dispenser master arm switches — SAFE

49. **Emergency exit lights**	**Checked**
a. DC power switch	BATTERY
b. Bus tie switch	TIED
c. Emergency lights	Out
d. DC power switch	OFF
e. Emergency lights	ON

Note

The bulbs of the emergency lights receive power from batteries contained within the lights. The check for bulb illumination should be accomplished as quickly as possible to conserve the batteries.

f. Emergency exit light extinguish switch	Depress
g. Emergency lights	Out
50. **Electrical control panel**	**Set**
a. Generator switches	OFF
b. Inverter switches	OFF
c. DC power switch	BATTERY
d. Bus tie switch	TIED
e. External ac power switch	EXT AC PWR (if available)

WARNING

Airplane will not be flown with a defective airplane battery.

Note

External dc power may be used if external ac power is not available.

51. Generator disconnect	Checked

Note

Check that the disconnect fired light is not illuminated. Check the continuity of the firing mechanism by holding the generator disconnect test switch to TEST. The disconnect fired light should illuminate.

52. Inverter system **Checked**

a. Turn each inverter control switch to the DC BUS position. The selected power OFF light should not illuminate when the inverters are stabilized. Check attitude indicators and TIT gauges for power indication.

b. Place the voltage and frequency selector switch to the inverter position.

c. Check the copilot's inverter by placing the phase selector switch to the A- and B-phase and reading the voltage and frequency on each phase.

d. Check the ac instrument and engine fuel control inverter by placing the phase selector switch to the C phase and reading the voltage and frequency.

e. Turn each inverter control switch to the AC BUS position. The selected power OFF light should not illuminate. The frequency and voltage cannot be read in this position. Check attitude indicators and TIT gauges for power indications.

53. Fuel quantity and distribution Checked

Note

Press the indicator test buttons and observe that the respective fuel quantity indicators move toward zero. Check the sum of the individual gages against the totalizer indication. Refer to fuel management in Section VII for distribution.

WARNING

If a fuel quantity indicator is inoperative, pull the associated fuel quantity indicator circuit breaker. The circuit breaker will not be reset until proper inspection and repairs have been made.

54. Fuel system **Checked**

Note

- When the ATM generator is used for supplying ac power, only the No. 2 boost pump will be operative.
- Bypass valve switches are inoperative and bypass valves will be wired to remain open if external tanks are removed.

a. Turn all crossfeed valve switches to vertical position, with exception of crossfeed separation valve.

Note

If external tanks are removed, leave external crossfeed valves closed.

b. Turn No. 1 boost pump on. No. 1 and 2 low pressure lights should go out, No. 3 and 4 should stay on, and no pressure should be indicated on manifold pressure gauge.

c. Open crossfeed separation valve. Check No. 1 boost pump pressure within limits. No. 3 and 4 low pressure lights go out.

d. Close No. 1 crossfeed valve. Deplete manifold pressure by depressing prime button. Turn No. 1 boost pump off.

Note

Crossfeed prime button may be depressed throughout the check to facilitate fuel pressure stabilization.

e. Turn No. 2 boost pump on, and check manifold pressure within limits. Close No. 2 crossfeed valve and deplete pressure. Turn No. 2 boost pump off.

f. Turn left auxiliary boost pump on and check pressure. Close left auxiliary crossfeed valve and deplete pressure.

Note

If external tanks are removed, open left external crossfeed valve and check pressure with left bypass valve switch in closed position. Close external crossfeed valve, deplete the pressure, and turn left auxiliary pump off. Steps g through k will not be required.

g. Open left bypass valve. Check manifold pressure gage to be sure it is opened. Close left bypass valve and deplete the pressure. Turn left auxiliary boost pump off.

h. Turn left external forward boost pump on. Check pressure within limits. Turn left external forward boost pump off and deplete the pressure.

Note

External tank boost pump pressures will be slightly lower than auxiliary boost pump pressures due to distance from crossfeed manifold.

i. Turn left external aft pump on. Check pressure within limits. Close left external crossfeed valve. Deplete pressure. Turn left external aft boost pump off.

j. Turn right external aft boost pump on. Check pressure within limits. Close right external crossfeed valve and deplete the pressure. Turn right external aft boost pump off.

k. Turn right external forward boost pump on. Open right bypass valve. Check pressure within limits. Close right bypass valve and deplete the pressure. Turn right external forward boost pump off.

l. Turn right auxiliary boost pump on. Check pressure within limits. Close right auxiliary crossfeed valve and deplete the pressure, and turn right auxiliary boost pump off.

Note

If external tanks are removed, leave right auxiliary pump on, open right external crossfeed valve, and check pressure with right bypass valve switch in the closed position. Close right external crossfeed valve, deplete the pressure, and turn right auxiliary pump off.

m. Turn No. 3 boost pump on and check manifold pressure within limits. Close No. 3 crossfeed valve and deplete the pressure. Turn No. 3 boost pump off.

n. Turn No. 4 boost pump on. Check pressure within limits. Depress crossfeed prime button for 30 seconds. Close No. 4 crossfeed valve and deplete the pressure. Turn No. 4 boost pump off and close the crossfeed separation valve.

55. Aerial refueling systems (if inflight use is anticipated) — Checked

Note

When this check is performed at times other than preflight, verify the dump valve switches are in NORMAL, cross-feed and bypass switches closed, and auxiliary and external tank pump switches off.

a. Aerial refuel panel power switch — ON

b. Air refuel system lights — Checked
Press to test pilot's, copilot's, and aerial refuel panel indicator lights.

57.	Control surface boost shutoff switches	ON, Safetied
58.	Oil cooler flaps switches	OPEN, FIXED

a. Open the cooler flaps fully and return to FIXED.

59.	Flight director system	Checked

a. Synch No. 1 and 2 C-12 compass systems — Check heading with standby compass.

b. Place the flight director switch in the NORMAL position.

c. Place the mode selector switch in HDG.

(1) All pointers and flags should be out of view.

(2) The course arrow should slave to the lubber line.

(3) The course selector window should indicate compass heading.

d. Place the flight director switch in the MANUAL position.

(1) Set the heading marker to the airplane heading. The bank steering bar should center.

(2) Rotate the heading marker left and right. The bank steering bar should move in the same direction.

(3) Rotate the pitch trim knob up and down. The attitude sphere should deflect up and down respectively. Align the horizon bar with the miniature airplane.

60.	Prop and overheat press-to-test lights/circuits	Checked
61.	Oxygen system	Test, Checked

Note

Depress the oxygen quantity indicator press-to-test switch until low quantity light illuminates.

62.	Radios (UHF or VHF)	ON, Checked
63.	GTC clear Fire extinguisher	Clear (GC) On hand (GC)

64. Start GTC and pressurize air manifold	On speed, pressure up

Note

Do not open GTC bleed air valve until on speed light illuminates.

CAUTION

Monitor the wing and empennage anti-icing indicators during operation of the GTC. A temperature rise indicates that an anti-icing valve is open, and the GTC should be shut down.

65. ATM and ATM generator Check loadmeter for ATM fan operation.	ON, Checked, OFF
66. Bleed air system	Checked

Note

Anytime the bleed air system is being utilized, the overheat indicators and warning lights should be continuously monitored.

a. All propellers	Clear (with GC)
b. All system using bleed air	OFF
c. Engine bleed air valves	OPEN
d. System pressure	Checked

Note

Check system pressure for a reading of 35 psi minimum. Failure to reach this pressure indicates that a valve in the system is not closed, a duct is leaking, or compressor output pressure is low.

e. GTC bleed air valve	CLOSED
f. System pressure leakage	Checked

Note

Time the drop from 30 to 15 psi. This time should not be less than 8.5 seconds.

g. Engine bleed air valves	CLOSED
h. GTC and ATM generator	As required
67. Wing isolation valves	Closed

Note

If ac external power is available, the ATM and GTC may be shut down at this time.

68.	**Air deflector door**	**Checked (GC)**

Note

Open air deflector door with emergency open switch forward of right hand paratroop door. Close door with normal air deflector switch on flight deck.

69.	All hydraulic systems pressure	Depleted

CAUTION

Pump brake pedals to deplete all hydraulic system pressure before opening or closing the ground test valve.

70.	Hydraulic ground test switch		ON (GC)
71.	Hydraulic ground test valve		OPEN (GC)
	a.	Ramp and door controls	NEUTRAL
	b.	105MM and 40MM gun hydraulic control valves	OFF
	c.	Flap lever	Set (to correspond to flap position)

CAUTION

When positioning the hydraulic ground test valve to either the normal or interconnect position, be sure the handle is moved through its full arc of travel and the internal ball detent in the valve engages. The engagement of the ball detent can be felt in the handle. If this is not done, then excessive return line pressures can cause damage to hydraulic motors.

72.	Aux hydraulic pump switch	ON
73.	Brake selector switch	NORMAL
74.	**Flaps**	**Clear, DN 100%**

Note

If flaps are down 100 percent, cycle flaps to UP, then back down.

75. Flight control and trim tabs — Checked (with GC)

a. Check for free and correct movement of all flight controls.

b. Check direction and movement of all tabs and coordination with the indicators. Check the elevator tab override feature, OFF position, and emergency power.

76. Autopilot — Checked

a. Check that the radio beam coupler switch is in the GYRO PILOT position and the pilot control switch is in the OFF position.

Note

With the pilot control switch OFF, the servo engage switches should be in the DISENGAGED position and the altitude control switch should be in the OFF position. If they are not, a malfunction is indicated.

b. Check that the turn knob and aileron trim knob are centered and that the elevator tab power selector switch is in the NORMAL position.

Note

Placing the elevator tab power selector switch to NORMAL, directs power to the elevator servo control. The elevator servo is rendered inoperative if the elevator tab power selector switch is positioned to OFF or EMERGENCY.

c. Center all flight controls.

d. Place the pilot switch in the ON position.

e. Check that the trim indicators on the pedestal controller are centered.

f. Place the servo engaging switches to the ENGAGE position.

CAUTION

In the following checks, hold the control wheel and rudder pedals to cushion movement against limit stops. Accomplish the checks as rapidly as possible to avoid prolonged servo effort and possible overheating.

g. Rotate the pitch knob forward and aft. The control columns should move forward and aft, and a deflection should be indicated on the elevator trim indicator.

Note

It may be necessary to apply a small force to the control wheel in the direction of pitch knob rotation to cause control wheel to move. Considerable more force on the control wheel in the opposite direction of pitch knob rotation will be required to override the autopilot and to check that movement is correct.

h. Rotate the aileron knob to the left and right. The control wheels should turn to the left and right, and a deflection should be indicated on the aileron trim indicator located on the autopilot controller.

i. Rotate the turn knob to the left and right approximately 45 degrees. The control wheels should turn to the left and right, the rudder pedals should move slowly in the direction of the turn and a deflection should be indicated in the rudder trim indicator located on the autopilot controller.

j. Place the altitude control switch to the ON position and rotate the pitch knob. The control columns should not move.

k. Push either the pilot's or copilot's release switch. The pilot switch should trip to OFF, the altitude control switch should trip to OFF, the servo engaging switches should trip to DISENGAGE, and the autopilot light should start flashing.

CAUTION

Hold the servo engaging bar close to the servo switches when the pilot's or copilot's release switch is pushed to prevent breaking the servo switches.

l. Push the autopilot reset button to extinguish the autopilot OFF light.

77. **Anti-skid test** **Completed**

CAUTION

Do not attempt to test the Mark II anti-skid system while airplane is being taxied.

WARNING

After test switch is actuated to either forward or aft position, wait at least 3 seconds before selecting test switch to opposite set of wheels. A more rapid actuation of test switch could result in loss of brakes momentarily with normal brake system selected. Also faster actuation of test switch will result in erroneous test light indicators.

a. Check anti-skid inoperative light out.

b. Check that all four anti-skid test lights are out.

c. Place test switch in the FWD position and release. The two forward lights should illuminate and then go out.

d. Place test switch in the AFT position and release. The two aft lights should illuminate momentarily and then go out.

e. Check to ensure that test switch is in the OFF position.

78. Utility isolation switch — ON

Note

Center and restrain control column while checking utility isolation valve.

79. Flight controls — Checked

Note

As pressure to flight controls is depleted, only the elevator controls should remain operational. This is due to auxiliary hydraulic pressure being routed through the power switching valve.

80. Utility isolation switch — OFF

Note

Insure all flight controls are restored to normal operation.

81.	Hydraulic ground test isolation switch	OFF (GC)
82.	All utility hydraulic system pressures	Depleted
83.	Hydraulic ground test valve	CLOSED (GC)
84.	Aux isolation switch	ON
85.	Brake selector switch	EMERGENCY
86.	Emergency brake pressure	Depleted

Note

Auxiliary hydraulic pressure should read normal.

87.	Aux isolation switch	OFF

Note

Insure emergency brake pressure returns to normal.

88.	Aux hydraulic pump switch	OFF
89.	Brake pressures	Depleted
90.	Left exterior lights	Checked (with GC)

a. Empennage navigation lights

b. Navigation lights

c. Anti-collision light

d. Leading edge light

e. Fuselage (IFR airplanes)

f. Landing light

g. Taxi light

91.	Feather No. 1 and 2 propellers	Checked (with GC)

Note

Feather valve check — place the condition lever in the FEATHER position. The blades should move to the feather position and the feather valve test light should illuminate. The propeller feather override button should pull in during the feathering operation and then pop out when the blades reach the feather position. The amber light in the feather override button should illuminate while the button is pulled in and should go out when the button pops out. If the button does not pop out, pull it out manually to shut off the pump. Record in Form 781. Maintenance action is required prior to flight.

92. Unfeather No. 1 and 2 propellers — Checked (with GC)

Note

Check that the throttle is in GROUND IDLE, and place the condition lever to AIR START until the blades stop in the ground idle position. Return the condition lever to GROUND STOP.

CAUTION

Do not exceed the propeller auxiliary pump operating time limit (1 minute ON, 1 minute OFF, not to exceed 2 minutes operation in a 30-minute period).

Note

When coming out of feather, the blades will hesitate momentarily at the flight idle blade angle (during retraction of the low-pitch mechanical stops) before continuing to the ground idle blade angle position.

93. Pitot heat — Checked (with GC)

Note

Check pilot's, copilot's, nose boom and total temp heaters.

94. Feather No. 3 and 4 propellers — Checked (with GC)

Note

Follow procedures outlined in items 91 and 92 and adhere to the caution in item 92 for feathering and unfeathering No. 3 and No. 4 propellers.

95. Unfeather No. 3 and 4 propellers — Checked (with GC)

    a. Return the feather valve and NTS check switch to NORMAL.

96. Right exterior lights — Checked (with GC)

    a. Navigation light

    b. Leading edge light

    c. Landing light

    d. Taxi light

    e. Lower navigation light

    f. Fuselage (IFR airplanes)

97. All unnecessary equipment — Off

98. Formation lights and combat beacon - On

TOP OF AIRPLANE INSPECTION.

Note

This inspection area may be accomplished before or after the Interior Inspection.

1. Top of airplane — Checked

WARNING

- A radiation hazard exists at the HF radio antennas during the transmit mode. Insure that no HF transmissions will be made during this inspection.
- All necessary safety precautions should be observed. Conducting this inspection during high winds or other conditions which cause the aircraft surfaces to be slippery could be hazardous. Under these circumstances, the pilot may waive this inspection.

inspection diagram

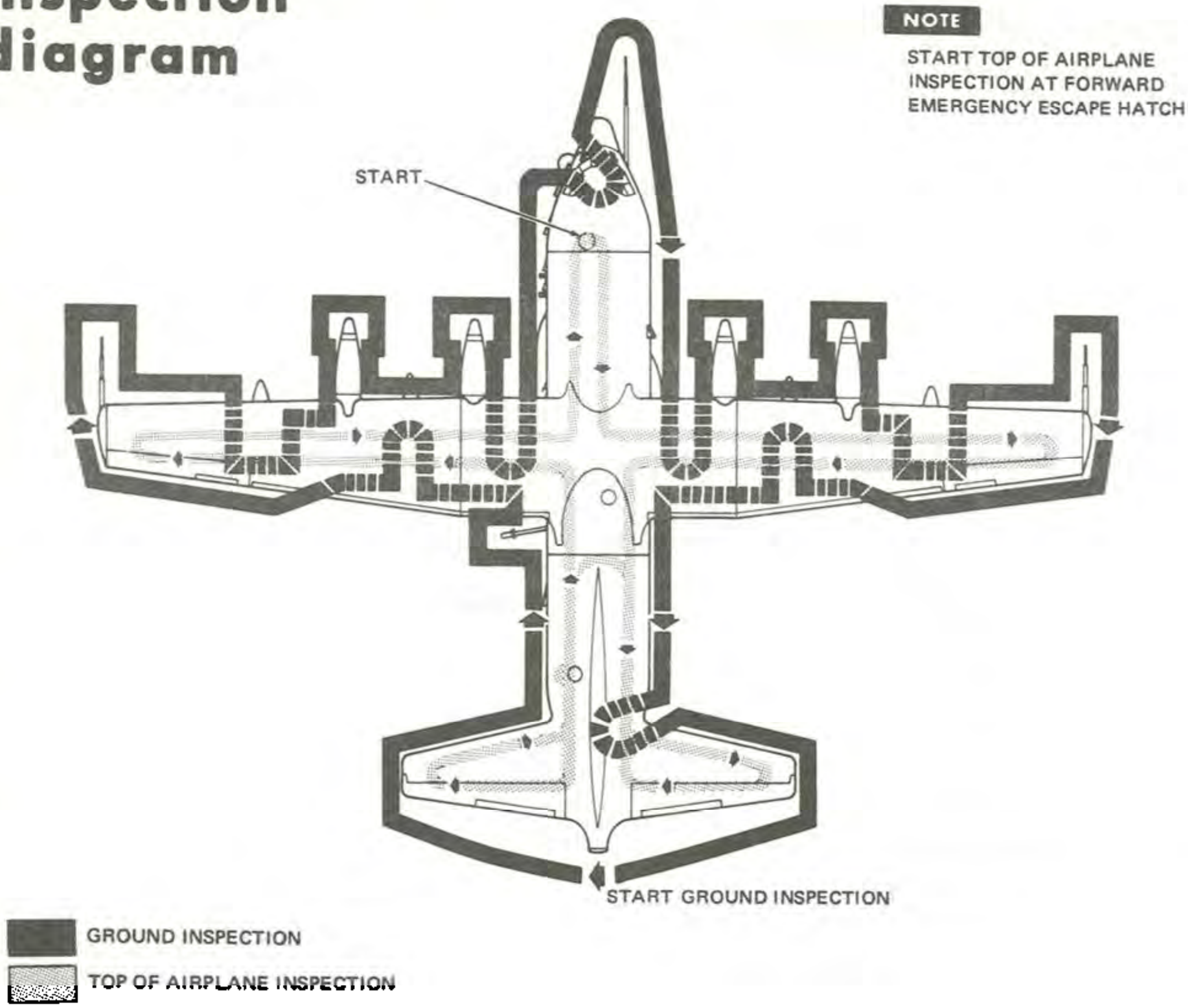


Figure 2-2.

CAUTION

Use extreme care at all times to avoid scratching or denting the skin while walking on the fuselage.

a. Refueling receptacle doors and lights (IFR airplanes).

WARNING

On airplanes modified by T.O. 1C-130-949, fuel spray during refueling may cause a slippery film on top of the airplane. Take extreme caution when performing duties on top of the airplane.

b. Fuselage, wing, control surfaces, flaps, and empennage

c. Dry bay areas for fuel or hydraulic fumes and leaks

d. Oil servicing access panels

e. Fuel tank caps

f. Emergency equipment access panels

g. Antennas

h. Escape hatches and release handles

i. Formation lights and combat beacon

Note

Turn off formation, combat beacon, slipway, and area fuselage lights. External power may be turned off if not needed for other crewmembers' preflight. Emergency exit light extinguish switch should be depressed if required.

INTERIOR INSPECTION.

The duties in this checklist will normally be accomplished by the illuminator operator. He will coordinate with the engineer to insure that all hydraulic components have been pressurized prior to accomplishing this inspection. In the event that the illuminator operator is not included in the crew, this inspection will be accomplished by the engineer.

1. **Galley — Checked, serviceable**
2. Crew entrance area — Checked

Note

Close door and visually check that hooks contact eyebolts and overcentering linkage contacts the stops.

   a. Crew door latch mechanism (when installed)
   b. Crew door, master warning shut-off switch — OFF (when door removed)/NORMAL (when door installed)
   c. TV/laser platform
   d. Under flight deck electronic equipment racks
   e. Emergency exit light — Checked, ARMED

3. Forward cargo compartment — Checked
   a. Forward cargo compartment light panel — Checked
   b. **Interphone panels — Checked, set**
   c. Oxygen regulators and portable bottles — OFF, 100%, checked
   d. Oxygen manual shutoff valve — ON, SAFETIED
   e. Cargo compartment circuit breaker panels (FS-245, 270)
   f. Fire extinguisher
   g. **Life history recorder — Set, OFF**

Note

Check that the remaining tape is enough for the flight. Insure recorder is set in accordance with Section IV procedures.

   h. Electronic equipment rack
      (1) Oxygen regulators — OFF, 100%
   i. Overhead electrical equipment rack
   j. Floor mounted crash seats
   k. Interphone panel — Checked, set
   l. **ALE-20 ARM/SAFE switch — SAFE**
   m. Egress panel, scanner's bubble, and pyrotechnic pistol — Checked
   n. Oxygen regulator — OFF, 100%
   o. Scanner's seat — Checked
   p. **Emergency exit light — Checked, ARMED**
   q. NLG emergency extension valve — NORMAL, safetied
   r. Booster hydraulic panel — Checked

CAUTION

The MLG emergency engaging handles should not be pulled when the airplane is on the ground.

   s. Right MLG emergency engaging handles and handcrank — IN, stowed
   t. Right bleed air manifold isolation valve — OPEN
   u. **Front and top of booth — Checked**
      (1) Aerial refueling valve (IFR airplanes) — Closed
      (2) Air conditioning ducts — Checked
      (3) Jacking attachments and emergency gear extension ratchet — Checked
      (4) Oxygen manual shutoff valve — ON, safetied

(5) First aid kits, hand axe, and fire extinguisher — Checked

v. Utility hydraulic panel

CAUTION

The MLG emergency engaging handles should not be pulled when the airplane is on the ground.

w. Left MLG and flap emergency engaging handle and hand crank — In, Stowed

x. 20MM and 7.62MM gun batteries — Checked

y. Left bleed air manifold isolation valve — OPEN

z. Left MLG inspection windows

4. Aft cargo compartment, center and left side — Checked

a. Aileron hydraulic boost unit and autopilot servos, flap motor, cables and hydraulic lines

b. Aft end of booth

(1) First aid kits, fire extinguishers, and hand axe

(2) Oxygen regulators — OFF, 100%

(3) Interphone panels — Checked, set

c. Booth

(1) Door (condition)

(2) Portable oxygen bottles

(3) Oxygen regulators – OFF, 100%

(4) Emergency equipment

(5) Right MLG inspection windows

d. Overhead escape/depressurization hatch and rope — Checked

e. Emergency exit light — Checked, ARMED

f. Manual oxygen shutoff valve — ON, Safetied

g. Aft fuselage J-box circuit breakers

h. Aft fuselage light control switches and circuit breakers

i. Fire extinguisher

j. Left paratroop door warning light switch — OFF

k. Emergency exit light — Checked, ARMED

5. Ramp area — Checked

a. Retainer reel

b. Oxygen regulators — OFF, 100%

c. Latrine

d. 2 KW illuminator — Pins installed

e. ALE-20 ARM/SAFE switch — SAFE

f. Ramp and door locks and telescoping arms (ADS)

g. 40 KW illuminator (if installed) — Checked

h. Aft fuselage flak curtains

i. Overhead escape hatch and rope

j. Emergency exit light — Checked, ARMED

k. Cabin pressure safety valve

l. Rudder and elevator boost units and autopilot servos, cables, and plumbing

m. Aft scanner's couch and bubble

n. Pyrotechnic pistols (if installed) — Secure

o. Oxygen regualtor — OFF, 100%

p. Aft cargo door uplock and safety lock

q. LAU-74 flare launcher (if installed) — Checked

r. Floor mounted crash seats

s. Auxiliary hydraulic system

t. Emergency hydraulic system

u. Liferaft release handles — IN, Safetied

v. Ramp, aft cargo door, and right paratroop door warning light shutoff switches — NORMAL

w. Interphone panel — Checked, Set (Check call button)

x. Oxygen regulator — OFF, 100%

6. Aft cargo compartment right side — Checked

a. Paratroop door and uplatch

b. Air deflector emergency switch — NORMAL

c. Emergency exit light — Checked, ARMED

d. Portable oxygen bottle

e. Fire extinguisher

f. Flare launcher control box and cable (if installed)

g. Dispenser junction box — Checked

(1) Right SUU-42/A — NORMAL

(2) Left SUU-42/A — NORMAL

(3) Right ALE-20 — NORMAL

(4) Left ALE-20 — NORMAL

(5) Two green lights — Checked

h. Tiedown equipment — Available, checked

7. Ramp controls

Note

Check ramp and door for complete operation.

a. Ramp and door controls — NEUTRAL

b. Auxiliary ramp — ON (check with E and NAV)

CAUTION

The emergency release handle will be used in conjunction with the auxiliary pump door open switch to preclude damage to the door and up lock.

c. Door — Open

d. Ramp — Down

e. ADS arms — Installed

f. Ramp actuators — Checked for leakage and conditions

g. Ramp — Up, checked

h. Door — Closed, checked

i. Door actuator — Checked for leakage and condition

j. Door — Open

k. Ramp — Down

l. Auxiliary pump — OFF

m. Loose equipment — Secured

EXTERIOR INSPECTION.

Walk Around Inspection.

Conduct a walk-around inspection, following the route shown in figure 2-2. The exterior structure of the airplane, including the flight controls and flaps, will be checked for general condition and fluid leaks. If not previously checked by maintenance, a workstand/ladder will be required to check the engine inlets, exhaust areas, ECM pods, and SUU-42A/A flare dispensers.

1. Aft fuselage area — Checked

a. Tail structure and control surfaces

b. Cargo ramp and aft cargo door

c. Exterior structure

d. Tail skid

e. AN/APQ-150 radome

f. Hydraulic ground test valve access door — Secure

g. Left ALE-20 dispenser

h. Antennas

2. No. 2 and 1 engine nacelles, external fuel tank, ECM pods, SUU-42 A/A dispensers, propellers, and left wing — Checked

a. Liferaft

b. Flaps, aileron, tab, and wing skin

c. External fuel tank cap and tank structure

d. ECM pods

WARNING

Do not walk directly beneath the SUU-42 A/A dispenser or stand directly behind a dispenser loaded with live munitions.

e. SUU-42A/A dispenser

f. Static air boom

g. Propeller spinner and blades

h. Nacelle exterior structure general condition and fluid leaks

3. Left wheel well area and center fuselage — Checked

a. Fire extinguisher bottles

b. Left MLG, wheel well area, MLG door attachment — Checked, secured

c. Exterior structure — Checked

d. Auxiliary fuel tank magnetic sight gage

4. Forward fuselage, left side, and bottom — Checked

a. GTC area

b. ATM inlet and exhaust

c. IR gimbal and fairing

d. Antennas

e. Exterior general condition

5. Nose section — Checked

WARNING

Remain clear of TV/laser mount if operator pre-flight is being performed.

a. TV/laser platform

b. Laser covers installed

c. Electronic equipment racks

d. Crew entrance door and spoiler

e. Battery compartment

f. BC radome and deflector

g. NLG lock and wheel well area

h. Brake accumulator pressures

i. Pitot masts and heads

j. Radome and nose exterior general condition

6. Forward fuselage, right side, and bottom — Checked

a. Oxygen filler access panel — Closed

b. Flight deck air-conditioning intake and exhaust

c. Antennas

d. Exterior structure general condition

7. Right wheel well area and center fuselage — Checked

a. Cargo compartment air-conditioning intake and exhaust

b. Right MLG wheel well area, MLG door attachment — Checked,secured

c. Single point refueling panel

d. Air deflector door area

e. Right ALE-20 dispenser

f. Exterior structure general condition

g. Aux fuel tank magnetic sight gages

8. No. 3 and 4 engine nacelles, external fuel tanks, ECM pods, SUU-42 A/A dispensers, propellers, and right wing — Checked

a. Nacelle exterior structure general condition and fluid leaks

b. Propeller spinners and blades

WARNING

Do not walk directly beneath the SUU-42A/A dispenser or stand directly behind a dispenser loaded with live munitions.

c. SUU-42 A/A dispenser

d. Static air boom

e. ECM pods

f. External fuel tank cap and tank structure

g. Flaps, aileron, tab, and wing skin

h. Liferaft

COCKPIT CHECKLIST.

Note

This checklist will be completed by the engineer prior to the Before Starting Engines checklist. A crewmember will remain at the airplane after completion of this checklist. If this checklist is completed and the airplane does not fly, complete the Engine Shut-Down checklist and the Before Leaving the Airplane checklist before securing the airplane.

WARNING

Before removing the SUU-42A/A ground safety pins, visually check that the flare master arm switch and the jettison switches are in the safe position. A crewmember must remain on the flight deck while the pins are being removed and until the pins are reinstalled. Do not walk directly beneath the SUU-42A/A dispenser or stand directly behind a dispenser loaded with live munitions.

1.	NLG lock, pitot covers, dust excluders, duct plugs, SUU-42A/A dispenser safety pins, and emergency egress pin	Removed
2.	Armament and dispenser master arm switches	SAFE
3.	Navigator's console	Set
	a. Radome anti-icing switch	OFF
	b. Radar function switch	As required
4.	IFF master switch	OFF, Ident OUT
5.	Pilot's and copilot's circuit breaker panels	Checked
6.	Landing gear lever	DN
7.	Air-conditioning control panel	Set
	a. Cargo compartment and flight deck shutoff switches	NORMAL
	b. Air-conditioning master switch	OFF
	c. Cargo compartment and flight deck temperature controls	OFF, NORMAL, FLT DECK
	d. Cargo underfloor heating switch	OFF
	e. Emergency depressurization switch	NORMAL
8.	GTC control panel	Set
	a. GTC control switch	OFF

b.	Bleed air valve switch	CLOSED
c.	Air turbine motor switch	STOP

9. Anti-icing control panel — Set

a.	Nesa windshield switches	OFF
b.	Nacelle preheat switches	OFF
c.	Prop & engine anti-icing master switch	AUTO
d.	Pitot heat switches	OFF
e.	Engine inlet duct anti-icing switches	OFF
f.	Propeller ice control switches	OFF
g.	Wing and empennage anti-icing switches	OFF

10. Engine bleed air valve switches — CLOSE

11. Fuel control panel — Set

a.	Dump pump switches	OFF, Safetied
b.	Boost pump switches	ON
c.	Aux and external tank pump switches	OFF
d.	Crossfeed valve switches	OFF
e.	Crossfeed separation switch	CLOSED
f.	Bypass valve switches	CLOSED
g.	Aerial refuel panel (IFR airplanes)	All switches OFF or CLOSED

Note

Safetied not required for IFR airplanes.

12. Fire handles — IN

13. Air deflector door switch — OFF

14. Propeller control panel — Set

a.	Feather valve and NTS check switch	NORMAL
b.	Propeller feather override buttons	OUT
c.	Propeller governor control switches	NORMAL
d.	Propeller master trim knob	ZERO

15. Throttles — GROUND IDLE

16. Synchrophaser master switch — OFF

17. Temp datum control valve switches — AUTO

CAUTION

It is not recommended that an engine be started with the temp datum control valve switches in the NULL position. If a start must be made with the temp datum control valve switch in the NULL position, the TIT should be closely monitored since over-temperature protection is not provided.

18. Oil cooler flaps switches — As required

Note

Oil cooler flap switches should be placed in AUTO when ambient temperature is 15°C or less. The switches should be placed to OPEN and then to FIXED when ambient temperature is above 15°C.

BEFORE STARTING ENGINES.

Crewmembers should check/set their oxygen system and, if their use is anticipated, their individual interior lights and clocks prior to initiating this checklist. Pilot and, copilot will set HOT MIC system to LISTEN ON, TALK ON. All others will be set to LISTEN ON.

PILOTS

1. HOT MIC — "Set" — P, CP, E, N, TV, IO
2. Forms and publications — "Checked" — P
3. Oxygen — "Set" — P, CP
   a. ON, 100%
4. Radio (UHF or VHF), IFF - Checked, STBY — CP

One radio will be checked prior to starting the GTC. The VHF radio is not operative without external ac power.

5. Clear GTC — "Clear" — GC
6. Lights — "Set" — P, CP
   a. Interior — As required — P, CP
   b. Landing, taxi — RETR, HOLD, OFF — CP
7. Fuel — "Checked" — P
   a. Quantity and distribution

Note

Fuel gages must be powered in order to ensure an accurate check.

ENGINEER

1. DC power switch — BATTERY/EXT DC PWR (external dc power may be used if external ac power is not available)
2. Bus tie switch — TIED
3. External ac power switch — EXT AC PWR (if available)
4. HOT MIC — "Set" — P, CP, E, N, TV, IO
5. Oxygen — Set
   a. ON, 100%

After the GTC is cleared by GC:

6. Start GTC — Set
   a. Control switch — START, RUN
   b. Bleed air valve switch — OPEN, pressure up

PILOTS

8. Ramp and door controls — "Neutral" GC

9. Hydraulic panel — Set CP

a. Brake select switch — EMERGENCY

b. Aux pump switch — ON, Pressure up

c. Anti-skid switch — ON

d. Engine pump switches — ON

e. Suction boost pump switches — ON, Lights out

CAUTION

Starting an engine with an inoperative suction boost pump may result in damage to the engine driven hydraulic pump.

f. Aux isolation switch — OFF

g. Utility isolation switch — ON

h. Emergency hydraulic pump switch — OFF

10. Parking brake — "Set, remove chocks" P

a. Depress pedals and monitor the emergency brake pressure gauge for pressure drop as pedals are depressed.

CAUTION

To avoid engaging the brakes on only one side of the airplane when setting the parking brakes, the brake pedals must be firmly depressed, the parking brake handle pulled, and force maintained on the handle as the pedals are released. This condition requires extreme care since toe brakes are difficult to actuate and set because of the angle of the brake pedals to the operator's feet.

11. Flap lever — Set CP

a. Set flap lever to correspond with flap position indicator.

12. Chocks — "Removed" GC

ENGINEER

CAUTION

Monitor the leading edge temperature indicators. A rise in temperature indicates that an anti-icing valve is open. The GTC must be shutdown to prevent damage to a heated surface or fuel tank sealant.

7. ATM and generator — As required

Note

If external ac power is available, the ATM should not be started at this time. The external ac power switch automatically goes to OFF when the ATM generator switch is placed to the ON position, regardless of whether the ATM and generator are operating.

8. Lights — On, As required

a. Interior

b. Exterior — Navigation, anti-collision leading edge formation, and combat beacon

9. Inverters — Set

a. Copilot's inverter switch — ESSENTIAL AC BUS

b. AC instrument and engine fuel control inverter switch — ESSENTIAL DC BUS

10. Fuel enrichment switches — As required

Note

- Normal start is with enrichment off. If light off is not achieved on first attempt, record in Form 781. One restart is permitted with fuel enrichment on provided TIT is below 100°C and an overtemp was not experienced on a previous start. During extreme cold weather, all starts may be accomplished with or without enrichment. Do not select enrichment after the starter has been actuated.
- Do not perform a start if the TIT is above 200°C. If TIT is above 200°C, it may be brought below 200°C by motoring the engine with the starter while the condition lever is in GROUND STOP.

PILOTS

13. Before starting engines checks — "Complete" E, N, TV, GC, CP

ENGINEER

11. Ground idle buttons — LOW

Note

Any engine may be started in normal or low speed. Peak TIT is generally lower in low speed and for that reason it is recommended that all engines be started in low speed.

12. Air refueling door (some airplanes) — Closed, door UNLKD light out.

Position amplifier switch to NORM and close door using AUX HYD pressure. After door closes, position both switches to OFF.

13. Before starting engines checks — "Complete" E, N, TV, GC, CP

STARTING ENGINES.

Normal engine start sequence is 3, 4, 2, and 1. The engineer has the primary duty to monitor the engine start. Should any crewmember note a condition which would necessitate discontinuing a start, call out, "Stop start," and state the reason. The pilot will discontinue a start by placing the condition lever to GROUND STOP and releasing the starter button unless a specific emergency procedure dictates other action. During start, an engine should accelerate smoothly and continuously; TIT should increase slowly within normal limits, and the engine should stabilize on speed (either normal or low speed) within 1 minute. For a typical engine start, the sequence of events after starter actuation and the cautions to be observed are as follows:

a. An rpm indication.

b. Fuel flow/enrichment — With fuel enrichment off, fuel flow will increase to approximately 300 pph. If fuel enrichment is selected, fuel flow should rapidly increase above 300 pph, then rapidly decrease to approximately 300 pph.

Note

The secondary pump pressure light may illuminate momentarily, then go out. It will normally illuminate again before the engine reaches 65 percent rpm.

c. Ignition — Should immediately follow fuel flow. Must occur by 35 percent rpm.

CAUTION

If an engine does not light-off before 35 percent rpm, discontinue start.

CAUTION

When the ATM and ATM generator are shut off for low density conditions during a self-contained start, a fire hazard may exist if the battery relay opens or the GTC stops at a low engine rpm after light-off. Should this occur, immediately position the engine condition lever to FEATHER to mechanically cut off fuel flow to the engine. This may be an indication of a defective battery.

WARNING

The airplane will not be flown with a failed battery.

d. Oil pressure — Positive oil pressure (both engine and gearbox) must be indicated by 35 percent rpm.

CAUTION

If there is no positive indication of oil pressure on the engine and reduction gear by 35 percent rpm, immediately discontinue the start.

e. Hydraulic pressure — Should be observed after observation of oil pressure. Must have positive indication by time engine is on speed.

f. Parallel — Indicated by secondary fuel pump pressure light on (40 to 65 percent rpm).

g. Starter — Released at 60%.

CAUTION

If the start button is prematurely released, discontinue the start to preclude shearing of the starter shaft.

h. Series — Indicated by secondary pump pressure light out and/or drop in TIT at approximately 65 percent rpm.

CAUTION

- The throttles must not be moved out the GROUND IDLE detent during starting. The resultant increase in propeller blade angle might overload the starter and/or reduce the rate of engine acceleration.
- If, after light-off, the engine does not accelerate smoothly to ground idle rpm, and/or a rapid increase in TIT is indicated, a stalled start is occurring. Immediately discontinue the start. Before attempting another start on that engine, motor the engine to approximately 25 percent rpm with the condition lever in GROUND STOP to remove gases and unburned fuel from the turbine.

i. Peak TIT — Observe maximum TIT rise during start excluding momentary overshoot at 94 percent rpm. Refer to Section V for limits during start.

Note

The engine should accelerate to either normal or low ground idle within 1 minute. If engine does not stabilize on speed in this time, discontinue the start. Exception: during the low air density conditions (high temperature above approximately 28°C/high altitude), if the engine accelerates smoothly with no indication of stall and TIT limits are not exceeded, time to stabilize on speed is 70 seconds. Do not exceed starter duty cycle limits.

CAUTION

After moving a condition lever to GROUND STOP, do not move the lever from this position until engine rotation has stopped. Do not re-engage the starter until rotation has stopped completely.

WARNING

If stall start occurs, start TIT or 70 seconds is exceeded, the engine must be shut down immediately.

Note

A positive hydraulic pressure indication should be noted by the time the engine is on speed, and the normal operating pressure should be indicated within 30 seconds after the engine is on speed. This pressure may not be reached if the control column is in the full forward position due to normal internal bypass of fluid in the elevator boost package. Pulling the column off its stop 2 to 3 inches will eliminate this bypass. Check the No. 3 hydraulic pump by operating the flight controls. After the controls are stable, check the static pressure for normal limits. Similarly, check the hydraulic pump on each remaining engine after starting by operating the flight controls, while the pump on that engine is the only source of pressure to its system. This check cannot be performed on the No. 1 and No. 2 hydraulic pumps until the utility isolation switch is turned off. Once the No. 1 engine is on speed, complete the checklist through utility isolation switch as rapidly as possible so as to complete a check of No. 1 and No. 2 hydraulic pumps as soon as possible.

PILOTS		ENGINEER
1. Clear No. 3 engine — "No. 3 clear"	GC	After the engine is cleared by GC:
"Turning"	P	1. Engine bleed air switch — OPEN

PILOTS

Note

- After engine is cleared, the pilot will place condition lever to RUN, depress the starter button, and hold and state "turning." An rpm indication should be noted. The pilot will release the ground start switch at 60 percent rpm. The starting cycle is automatic and requires no further action if the engine accelerates smoothly and continuously, if turbine inlet temperature is normal, and if the engine stabilizes on speed within 60 seconds. Monitor the engine instruments continuously during a start. Keep one hand on the condition lever and the other on the engine ground start switch of the engine being started, and be prepared to discontinue the start immediately if an abnormal indication is received. The ground controller will monitor the propeller and report if the propeller fails to or ceases to rotate or if rotation is not observed within approximately 5 seconds after the pilot states "Turning." Observe start sequence as outlined in this section.

- After the engine responds "Generator checked," proceed with checklist.

2. Clear No. 4 engine — "No. 4 clear" GC
"Turning" P

Note

After the engineer directs external equipment removal, proceed with checklist.

3. External power, ground wire and BC spoiler — "Removed, clear, secured" GC

4. Clear No. 2 engine — "No. 2 clear" GC
"Turning" P

5. Clear No. 1 engine — "No. 1 clear" GC
"Turning" P

ENGINEER

Note

Under low density condition (high temperature or press altitude), GTC mass output to accelerate the engine will be reduced. If the ATM and generator are being used, turn the generator OFF and ATM to STOP during engine start.

2. Observe start sequence

After engine is on speed:

3. Ground idle button — NORMAL

Note

After the first engine is started and stabilized at low speed ground idle and all engine instruments indicate normal, reset the engine to normal ground idle and allow the engine to stabilize. Use this engine as a starting air source for other engines.

4. Engine generator — "Generator checked"

When the engine is on speed, the E will ensure that the generator is developing voltage. Do not turn generator on at this time. State "Generator checked." This indicates the CP is clear to continue the checklist.

Note

If starting with external dc power only, No. 3 generator should be turned on prior to selecting battery with the dc power switch.

Repeat steps 1 through 4 for all engines as they are cleared, started.

5. DC power switch — BATTERY

6. No. 3 and 4 generators — ON/"Remove external power"

7. ATM and generator — Checked, ON

Note

Check voltage and frequency of each phase prior to placing generator ON. The ATM generator must be ON for four engine low speed ground idle operation since the engine generators will be off the line. If the generator fails, the low speed ground idle buttons must be disengaged to prevent a drain on the battery.

PILOTS

6. Utility isolation switch — OFF CP

7. Starting engines checks — "Complete" E, CP

Note

The GC is cleared off ground after engines are on speed.

ENGINEER

8. GTC — Set

a. Bleed air valve — CLOSED

b. Control switch — OFF

9. Air conditioning — Set

a. Master switch — AIR COND NO PRESS

b. Cargo compartment, booth selector switch — As required

Note

- The booth position will only be selected when a crewmember is stationed in the booth to monitor the temperature.
- After stabilization of the flight deck and cargo compartment temperatures, the temperature controls may be operated in auto or manual.

10. No. 1 and 2 generators — ON

11. Fuel enrichment switches — OFF

12. Starting engines checks — "Complete" E, CP

BEFORE TAXI. (Refer to Section V for engine limitations.)

PILOTS

1. Compass systems and indicators — "Checked, set, state heading" N/E, P, CP, TV

   a. Pilot will state magnetic heading of standby compass

   b. The pilot will compare headings with the magnetic compass.

2. Radios and navigation equipment — "Set" P, CP

   a. Radios — ON P, CP

   b. Radar altimeter — ON P

3. Flaps — Up CP

4. Hydraulic pressures — Checked CP

ENGINEER

1. Leading edge temperature — Normal

2. Compass systems and heading indicators — "Checked, set, state heading" (if navigator is not aboard)

   a. C-12 compasses

      (1) Latitude N-S switch — Local latitude

      (2) Latitude knob — Local latitude

      (3) Mode selector switch — As required

Note

Compare No. 1 and No. 2 and state heading of No. 1 compass

3. Radar — STANDBY (if navigator is not aboard)

PILOTS

5. IFF — Checked, STBY — CP

Refer to Section IV for self-test.

6. Altimeters — "Set, state setting" — CP, P, N, TV

Note

Copilot will state field elevation and altimeter setting. Check that altimeter reading is within 75 feet of field elevation.

WARNING

It is possible to set an altimeter in an error by 10,000 feet. This happens if the barometric set knob is continuously rotated after the barometric scale is out of view. The knob can be rotated until the numbers eventually reappear from the opposite side. If the correct altimeter setting is then established, the altimeters will read in error by approximately 10,000 feet. As a preflight check, special attention should be given to make sure that the 10,000 foot pointer is indicating correctly. Check the 10,000-foot counter indicator window for correct reading, and crosscheck counter, drum, and pointer to assure that indicated altitude agrees with field elevation.

CAUTION

On airplanes modified by T.O. 1C-130-838, during normal use of the baroset knob, momentary locking of the barocounters may be experienced. If this occurs, do not force the setting. Application of force may cause internal gear disengagement and result in excessive altitude errors. If locking occurs, the required setting may sometimes be established by rotating the knob a full turn in the opposite direction and approaching the setting again with caution.

7. Crew aboard, ramp and doors closed — "Aboard, closed, checked" — IO

8. Warning lights and alarm bells — (CP turns on alarm bell) "Checked" — E, TV, IO

9. Before taxi checks — "Complete" — E, N, FCO, TV, IO, CP

ENGINEER

4. Ground idle buttons — As required

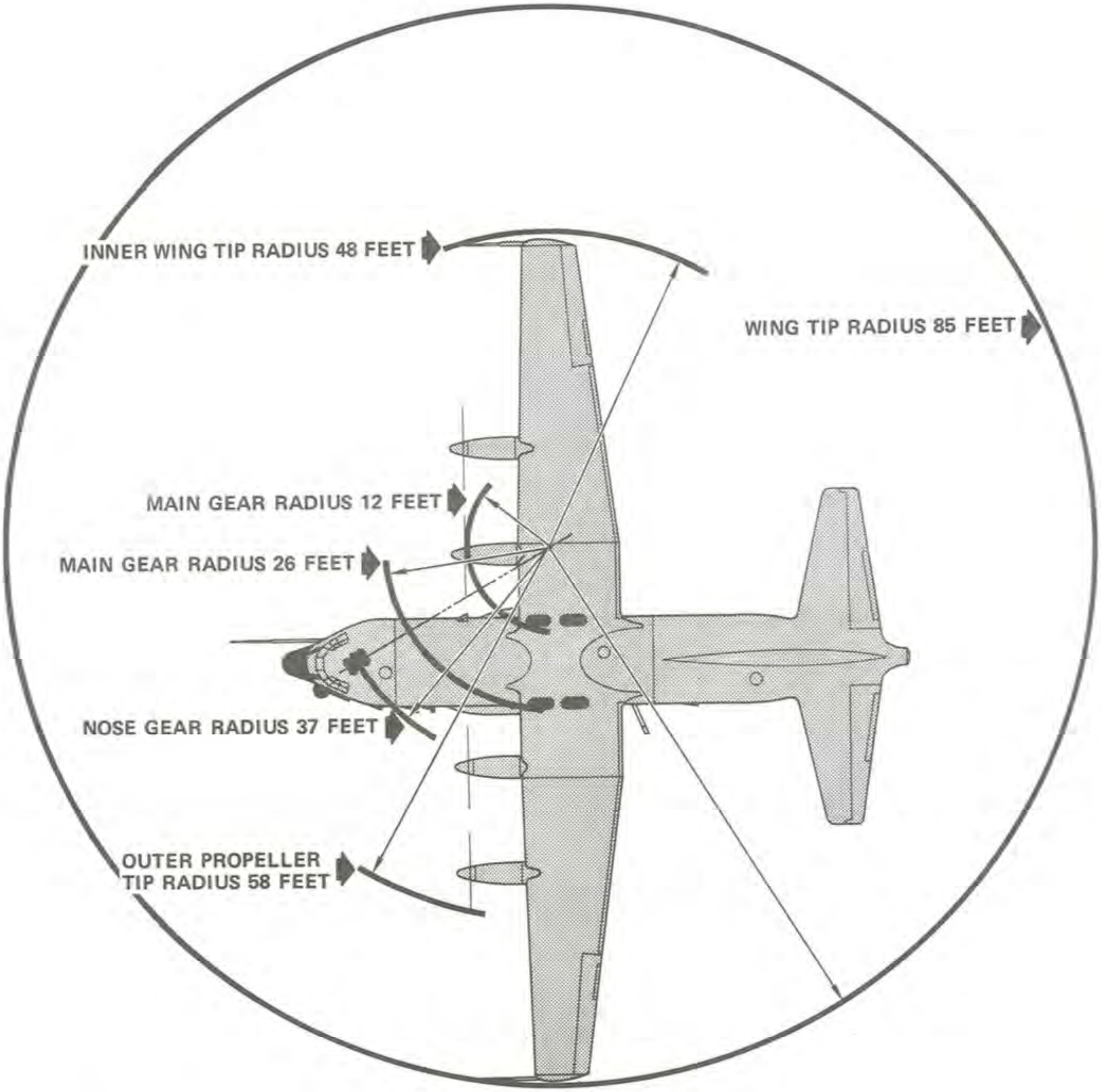
Note

If the fire control power supply is on, ensure the right-hand AC bus remains powered. If the fire control system is operating from the essential AC bus, do not downshift No. 2 engine or turn ATM on. Power interruptions in excess of one-half second may cause computer malfunction.

5. Warning lights and alarm bell — "Checked" — E, TV, IO

6. Before taxi checks — "Complete" — E, N, FCO, TV, IO, CP

turning radii



VERTICAL CLEARANCES

WING TIP	12 FEET
VERTICAL STABILIZER TIP	38 FEET 6 INCHES
INBOARD PROPELLER	5 FEET 9 INCHES
OUTBOARD PROPELLER	6 FEET 5 INCHES

CAUTION

MINIMUM SPACE REQUIRED FOR TURNING IS 170 FEET WITH THE NOSE GEAR TURNED TO THE MAXIMUM OF 60 DEGREES

Figure 2-3.

CROSSWIND TAXIING.

With four engines operating, the airplane can be taxied in a 30-knot, 90-degree crosswind by use of nosewheel steering and rudder control only. Taxiing can be accomplished in 90-degree crosswinds up to 60 knots by use of nosewheel steering, rudder and aileron control, differential braking, and differential power. Turns to a crosswind heading should be performed with great caution and at slow speeds to prevent centrifugal force from aiding the wind in tipping the airplane.

REVERSE TAXIING.

The following procedures should be adhered to during reverse taxiing.

a. Ensure that the maneuvering area is free of all debris and obstruction which could cause damage to the airplane or injury to personnel.

b. Reverse symmetrical propellers simultaneously.

c. Use forward thrust to stop the backward movement of the airplane.

CAUTION

- The use of brakes during reverse taxiing should be avoided to prevent the airplane from setting on the tail.
- Oil temperature is very critical in reverse and should be monitored closely to avoid exceeding limits.

d. Do not back the airplane when engine oil temperature is at or above 100°C.

e. After turning or backing, move the airplane approximately 5 feet in a straight line to realign the main landing gear.

TAXIING.

Skidding or skipping of the nose wheel may develop when the airplane is turning, either because of wet pavement or because of an aft center of gravity. These conditions can be prevented by avoiding abrupt steering changes or by asymmetrical power and brake applications.

Excessive or prolonged use of the brakes while taxiing will cause overheating of the brake assemblies with possible wheel failure and/or tire or brake fire resulting. Taxi speed can normally be controlled by use of minimum engine power and propeller reversing.

Propeller reversing over unprepared surfaces may cause foreign object damage to the propeller or engine compressor section. Every effort should be made to perform the propeller reverse check over hard surface.

It is recommended that the engines be changed to normal ground idle operation by disengaging the low-speed ground idle buttons rather than by throttle movement. Movement of the throttles beyond the limits of 9 to 30 degrees coordinator angle at ambient temperature above 81°F (27°C) may cause rpm stall or overtemperature. Should the low-speed ground idle buttons be inadvertently released with the throttles, return the throttles to ground idle; the engine should accelerate to normal ground idle rpm. When down-shifting from normal to low-speed ground idle, monitor the engine instruments and be prepared to shut down the engine if a stall or overtemperature of 850°C or greater occurs.

If, during prolonged ground operation, oil temperature approaches the maximum limit, the throttle should be advanced toward FLIGHT IDLE to increase airflow through the coolers. Operation in low speed ground idle with some positive thrust will aid in controlling oil temperatures.

When taxiing over rough, pitted, undulating, or washboard terrain, extreme caution must be taken and very low taxi speeds observed.

CAUTION

Turns with brakes locked on one side are prohibited. When possible, avoid braking in turns, since damage to gear and/or support structures may result. If a stop in a turn is required, record in Form 781. See figure 2-3 for the minimum space and clearances required for turning.

Taxi the airplane forward approximately 5 feet after turning or backing to realign the main gear.

The engineer may initiate his taxi checklist without pilot direction and as practical, after completion of Before Taxi checklist. Only Items 1, 3, 4, 5, and 7 of the pilot's Taxi checklist and item 4 (after refueling) and 6 of the engineer's Taxi checklist need be completed on same day/same crew flights.

PILOTS

1. Emergency brakes — "Checked" P

CAUTION

Do not perform following checks in a congested area.

2. Emergency hydraulic system — "Checked" P, CP (accomplish on first flight of the day)

Note

This check will be coordinated with the pilot.

   a. Emergency hydraulic pump switch — "ON, Pressure up" CP
   b. Utility pump switches — "OFF, Pressures depleted" CP
   c. Nose steering — "Checked" P
   d. Utility pump switches — "ON, Pressure up" CP
   e. Emergency hydraulic pump switch — "OFF"

3. Normal brakes — "Checked" P

4. Auxiliary hydraulic pump — As required CP

5. Flight instruments — "Checked" P, CP, N, TV

Note

Check heading and turn-and-slip indicators for correct movement. Check airspeed and vertical velocity indicators for proper reading.

6. Propeller reversing — "Checked" E

ENGINEER

1. Generators and loads — Checked

   a. Place the ATM generator switch to the OFF position and note that the No. 2 generator assumes the essential ac bus load.

Do not exceed generator ground load limit. (Refer to Section V.)

   b. Rotate the voltage and frequency selector to each engine generator position and check that voltage and frequency of each phase are within limits.

   c. Rotate the phase selector switch to each phase position and check each engine generator loadmeter for an indication of a load within limits.

   d. Check each TR unit loadmeter for an indication of a load within limits.

   e. Place the ATM generator switch in the ON position.

2. Prop and engine anti-icing/de-icing — Checked/As required

   a. Place the ice detector test switch in the No. 2 position and note that the ice detection light illuminates. Wait at least 12 seconds, during which the ice detection light should remain illuminated. Place the propeller and engine anti-icing master switch to the RESET position and note that the ice detection light is extinguished.

   b. Place the ice detector test switch in the No. 3 position and note that the ice detection light illuminates. Wait at least 12 seconds, during which the ice detection light should remain illuminated.

PILOTS

Note

The pilot will place symmetrical pairs of throttles in full reverse. Engineer will advise pilot of any discrepancy. Pilot should note airplane pull (if any) and compensate as necessary for any discrepancy during subsequent reverse operation.

7. Taxi checks — "Complete" E, IO, CP

ENGINEER

c. Place each engine inlet air duct anti-icing switch in the ON position (one at a time) and note a slight torque decrease and/or TIT increase. Place the switches in the OFF position (one at a time) and note a slight torque increase and/or TIT decrease.

d. Check propeller blade, spinner, and spinner base as follows:

(1) Determine the position of the de-icing timer by turning each propeller ice control switch (starting with No. 1) ON, then OFF, until a load is indicated on all three ammeters (spinner anti-ice, spinner de-ice, and blade de-ice).

(2) Leave propeller ice control switch on until heating cycle is complete as noted by drop on the de-icing ammeter.

(3) Turn next switch to ON and check for an approximate 20-ampere increase in spinner anti-ice ammeter and 65 to 90 amperes on spinner and blade de-ice ammeters.

(4) Repeat step (3) for each succeeding propeller.

(5) When all propellers have been checked, place the propeller and engine anti-icing master switch to RESET and note that the ice light is extinguished and there is no load on any of the anti-icing or de-icing ammeters.

(6) Place all ice control switches — OFF.

Note

If the blade de-icing ammeter falls below 65 amperes, do not fly into icing conditions. Airplane may continue on scheduled mission or depart from enroute station to home station when the automatic de-icer system is inoperative, provided the manual de-icer operation is satisfactory.

ENGINEER

CAUTION

When the airplane is on the ground, do not operate the propeller anti-icing or de-icing for an engine that is not running. The engine must be running in order to dissipate the heat generated by the heating elements to prevent damage to the elements. Never operate the system for more than two cycles while the airplane is on the ground. Anti-icing and de-icing may be used for a propeller feathered in flight.

3. Propeller reversing — "Checked"

Note

Engineer will observe rpm within limits and advise pilot of symmetric torque differences of 1,000 inch-pounds or more. Record discrepancies in Form 781.

4. Positive fuel flow — Checked

Note

Refer to Section VII for positive fuel flow check.

5. Fuel system — Checked

Note

The above step is necessary only if not accomplished during the preflight checks.

6. Taxi checks — "Complete" E, IO, CP

TWO-ENGINE SHUTDOWN FOR ORDNANCE LOADING.

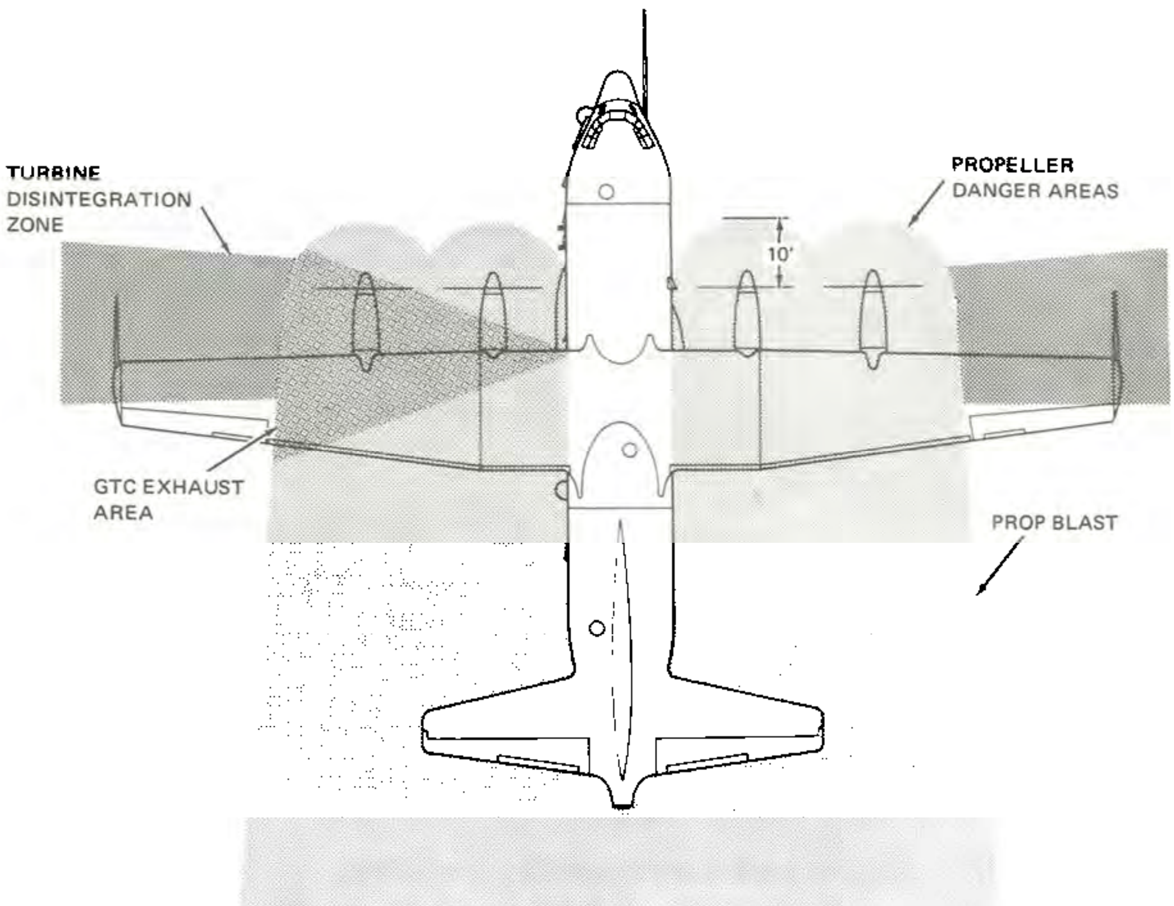
PILOTS

1. Nosewheel and parking brakes — "Centered, set" P
2. Shutdown and NTS check No. 3 and No. 4 engine — Completed CP
3. Exit clearance — "Clear, insert chocks and ground wire" P
4. Chocks, ground wire — "In place" IO
5. Engine shutdown checks — "Complete" E, IO, CP

ENGINEER

1. No. 3 & No. 4 engine bleed air switches — Close
2. No. 3 & No. 4 engine generator switches — Off
3. Ground idle buttons — LOW
4. Engine shutdown checks — "Complete" E, IO, CP

danger areas



MAXIMUM POWER, NO WIND

DISTANCE AFT OF PROPS – FEET	100	200	300	400	500
WAKE VELOCITY – KNOTS	128	107	92	80	69

Figure 2-4. (Sheet 1 of 2)

danger areas

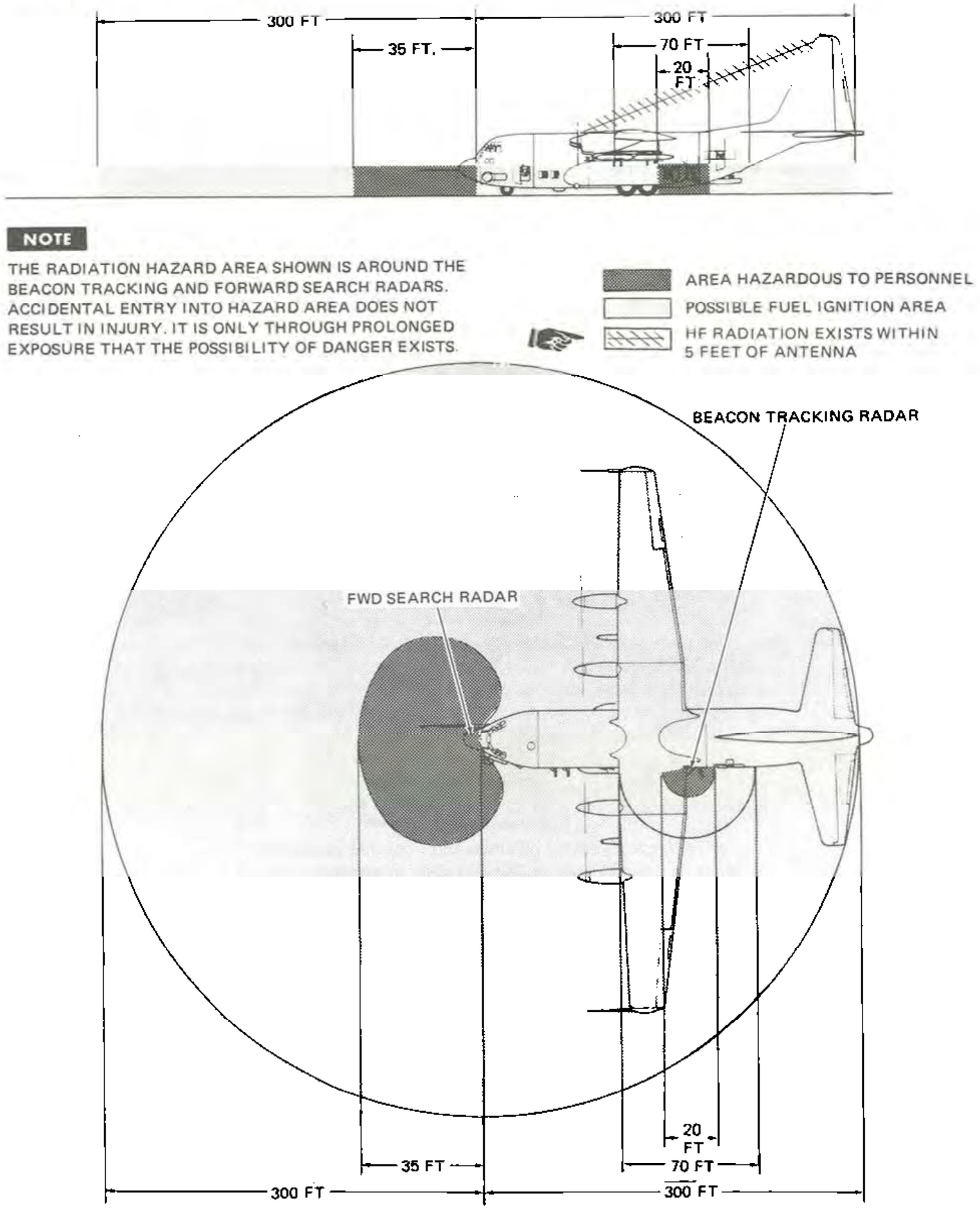


Figure 2-4. (Sheet 2 of 2)

ENGINE START AFTER ORDNANCE LOADING.

Note

Utilize the start procedures outlined under Starting Engines in this section.

PILOTS

1. Nose wheel and parking brake — "Centered, Set" P
2. Chocks and ground wire — "Removed" IO
3. Clear No. 3 — "No. 3 clear" IO
   "Turning" P
4. Clear No. 4 — "No. 4 clear" IO
   "Turning" P
5. Crew aboard, doors closed — "Aboard, closed, checked" IO
6. Ammo — "Secured, clear to taxi" IO
7. Starting engines checks — "Complete" E, CP

ENGINEER

After the engine is cleared by the IO:

1. Engine bleed air switch — Open
2. Observe start sequence

   After engine is on speed:

3. Ground idle button — NORMAL
4. Engine generator — "Generator checked"

Repeat steps 1 through 4 for all engines as they are cleared, started.

5. No. 3 and 4 generators — ON
6. Starting engines checks — "Complete" E, CP

ENGINE RUNUP.

CAUTION

To prevent excessive stresses on the propeller and to prevent wing lift and resultant severe structural damage due to a propeller contacting the ground, the airplane will be headed into the wind within 30° of wind direction for engine power settings in excess of 7,000 inch-pounds torque when the wind velocity is in excess of 10 knots.

CAUTION

When operating the airplane on either snow-covered surfaces at temperatures near freezing or on slippery surfaces, deviations must be made for engine and propeller check procedure. Check the engines in symmetrical pairs when necessary. Use reverse thrust on the remaining pair of engines to prevent the airplane from sliding forward. Brakes alone will not prevent the airplane from moving forward if each of the four engines is producing more than approximately 8,000 inch-pounds of torque. Avoid parking airplanes close together during ground tests. When runup must be conducted on slippery surfaces, do not attempt to make full power checks until the airplane is lined up on the runway, ready for takeoff.

CAUTION

Do not run up all four engines to maximum power simultaneously. The thrust available is sufficient to skid locked wheels and chocks. Do not run up two engines on one side simultaneously. The thrust available is sufficient to skid the nose wheel sideways. Simultaneous full reverse power on all engines may lift the nose wheel off the ground.

PILOTS | **ENGINEER**

Note

The Before Take-Off checklist may be performed prior to Engine Runup checklist only when runup on the active runway is required.

PILOTS

1. Nose wheel and parking brake — "Centered, set" P

Note

This check will be completed by the engineer. The pilot and copilot will position throttles and propeller governing switches respectively as requested. This checklist is considered complete upon response from the engineer.

ENGINEER

1. Ground idle buttons — NORMAL
2. Engine runup checks — "Complete" E, IO, CP

Note

The engineer will initate the runup checks after the pilot states the nose wheel and parking brake are centered and set. He will request positioning of throttles/switches as required. Remain silent on results of individual checks unless a discrepancy exists.

a. Ground idle rpm — within limits

b. Throttles — "FLIGHT IDLE"

(1) Note torque

c. "Propeller check" — (8,000 pounds torque Minimum)

Note

Runup area wind conditions may cause rpm fluctuations.

PILOTS		ENGINEER
2. Engine runup checks — "Complete"	E, IO, CP	

ENGINEER

d. Propeller governor control switch — "MECH GOV" (Check rpm within limits using frequency meter as crosscheck)

e. Propeller governor control switch — "NORMAL" (Check rpm within limits)

Note

Refer to section VII if reindexing is required.

f. Engine instruments — within limits

WARNING

If the engine instruments are not similar in fuel flow, TIT, or torque, with similar throttle position, a propulsion system malfunction may exist. Refer to Section VII for Propulsion System Checks.

g. Throttles — "FLIGHT IDLE" Note torque and rpm.

WARNING

Torque should be at least 400 inch-pounds higher per engine than those values observed in step 2 b. If not, a low pitch stop malfunction exists. Maintenance action is required prior to flight.

h. Throttles — "GROUND IDLE"

WARNING

If a positive decrease in torque is not indicated when throttles are moved to GROUND IDLE, shut down the engine by placing the condition lever in GROUND STOP. Do not attempt to force the propeller out of flight idle with additional throttle movement. Maintenance action is required prior to flight.

BEFORE TAKE-OFF.

If engine runup is not required, the Before Take-Off checklist may be completed while taxiing in uncongested areas, providing outside vigilance is maintained.

PILOTS

1. Trim tabs — "Set" — P
   a. Indicators — Checked
   b. Elevator tab power selector switch — NORMAL
2. Autopilot — "OFF" — P
3. Flaps — "50 percent" — CP
4. Flight controls — "Checked" — P

Note

Restrain the control column when checking elevator movement to prevent the bob weight from slamming the controls against the stops.

5. Hydraulic pressures — Checked — CP
6. Crew briefing — "Complete" — P
   a. Review take-off and climb data
   b. Signals for gear and flap retraction.
   c. Copilot/engineer emergency actions during take-off
      (1) Aborted take-off
      (2) Emergency return/fuel dumping
   d. Departure procedures
   e. Radios (Nav & Comm)
   f. Radar altimeter - Check, set (HAA/ HAT/500 ft for VFR)
   g. Terrain
7. Instruments — "Checked" — P, CP
8. Safety belt, shoulder harness — "Fastened, Unlocked" — P, CP
9. Oil cooler flaps — AUTO — CP
10. Landing and taxi lights — As required — CP
11. IFF — Set — CP
    Mode and code as briefed

ENGINEER

1. Windows, hatches — Closed, secure
2. Ground idle buttons — NORMAL
3. Electrical panel — Set
   a. Engine generators — ON
   b. ATM and generator — OFF, STOP
   c. AC instrument and engine fuel control inverter switch — ESSENTIAL AC BUS
   d. Bus tie switch — NORMAL
   e. DC voltmeter switch — BAT
4. Anti-icing panel — Set
   a. NESA — NORMAL
   b. Pitot heat — ON
   c. Propeller and engine anti-icing — ON, AUTO
5. Fuel panel — Set
   a. Crossfeed valves — CLOSED
   b. Main tank boost pumps — ON
6. Warning lights — Checked
7. Safety belt, shoulder harness — Fastened, Unlocked
8. Instruments — Checked
9. Pressurization — Set (ferry flight only)
   a. Rate knob — MIN
   b. Controller — As required (not below field elevation)
   c. Air-condition master switch — AUTO PRESS/As required
10. Engine bleed air switches — As required
11. Before take-off checks — "Complete" — E, N, TV IO, CP

PILOTS

12. Before take-off checks — "Complete" E, N, TV, IO, CP

TAKE-OFF.

Use T.O. 1C-130(A)H-1-2 as necessary to predict airplane performance for any take-off. Refer to Section V for airplane limitations. Refer to Section III for procedures to be followed during emergencies.

Note

When take-off performance is critical, utilize maximum power. When conditions dictate, close all engine bleed air valves prior to take-off to develop maximum power available.

NORMAL TAKE-OFF.

Note

- Increase rotation speed and take-off speed by the full gust increment not to exceed 10 knots.
- Nose wheel steering is required in addition to aerodynamic controls when take-off is continued after an engine failure and prior to reaching minimum control speed.

CAUTION

Operation over raised barrier cables with disc-type supports at speeds in excess of taxi speeds may result in damage to airplane antennas.

Note

If the airplane is loaded to an aft center of gravity, forward pressure on the control column will aid steering effectiveness.

During the take-off run, the pilot maintains directional control with the nose wheel steering until flight controls become effective. Concurrently, the copilot shall hold the control column forward and keep the wings level with the ailerons. As speed increases, the pilot discontinues nose wheel steering and maintains control of the airplane throughout the remainder of the take-off run by coordinated use of the flight controls and power, according to the cirucmstances of speed, crosswinds, and runway conditions. The engineer will monitor all systems and report any malfunction to the pilot. Take-off is made with 50 percent flaps.

For a smooth transition to take-off attitude, rotation of the airplane should be started approximately 5 knots below the take-off speed or at the minimum control speed, whichever is greater.

When maximum capability is not required, take-offs will be made using reduced power. Compute performance using the applicable reduced power take-off performance charts in T.O. 1C-130(A)H-1-2. The allowable power reduction takes into consideration effective runway length, gross weight, and density altitude and assures that critical field length is equal to or less than runway available. The greatest power reductions occur at lower gross weight/temperatures and on longer runways. A reduced power TIT is used in the computations as an allowable percentage of power reduction. This gives an adjusted take-off factor and a reduced power torque. This reduced power torque will be the primary take-off power setting, TIT being used as a cross check of engine efficiency only. It would be impractical to take off with reduced power and add power to climb. If a climb to optimum altitude is required, or higher speed/rates of climb are necessary, take-off and climb will be computed at climb power TIT provided torque is equal to or greater than the minimum allowable torque for a reduced power take-off. Reduced power torque should be used as the maximum power for the flight unless mission requirements dictate otherwise or the pilot determines that higher power settings are required during an actual emergency. Full power will be available at all times.

Advance the throttles to reduced power torque setting or maximum power, if maximum capability is required. The copilot will monitor the instruments and adjust throttles to prevent take-off power from being exceeded during take-off. Any time charted performance is desired, take-off power should be applied before the brakes are released as all take-off performance data is based on this type take-off.

CAUTION

Never place the throttles in the TAKE-OFF position without monitoring the torque-meters, since it is possible to exceed the maximum allowable torque before reaching the maximum turbine inlet temperature specified in Section V. In addition, increasing ram effect during take-off will increase torque for any fixed turbine inlet temperature. If indicated torque exceeds 19,600 inch-pounds, an entry in the AFTO Form 781 is required noting the highest torque value observed and describing the runway and/or flight conditions; i.e., rough runway, gusting winds, etc.

Note

If the predicted power (torque) or performance (acceleration) is not obtained as required in T.O. 1C-130(A)H-1-2, the take-off should be aborted.

MAXIMUM PERFORMANCE TAKE-OFF AND OBSTACLE CLEARANCE.

Note

If the runway or runway environment require maximum performance, all engine bleed air valves should be closed.

A maximum performance take-off is made by holding the brakes on until engines are stabilized at maximum power. For a maximum performance take-off, acclerate on the runway to take-off speed, and pull the nose up until the airplane leaves the ground. Take-off speed will be such that minimum control speed is disregarded. Retract the landing gear and adjust the attitude of the airplane to attain obstacle clearance speed. After clearing the obstacle, slowly retract the flaps while maintaining altitude and accelerate to best climb speed. Refer to T.O. 1C-130(A)H-1-2 for maximum effort take-off data. The minimum flap retraction speed for maximum performance take-off is obstacle clearance speed plus 10 knots.

Note

Maximum performance take-off should be made only when authorized or directed by the major air command concerned.

CROSSWIND TAKE-OFF.

Crosswind take-offs, with regard to directional control of the airplane are made essentially the same as normal take-offs. Initially, the pilot maintains directional control with nose wheel steering and differential power while the copilot maintains a wing-level attitude with the ailerons. In higher crosswinds, a greater amount of differential power and ailerons must be applied. After lift-off the line of flight should be aligned with the runway until crossing the airfield boundary. Refer to T.O. 1C-130(A)H-1-2 for crosswind performance data.

FLAPS UP TAKE-OFF PROCEDURE.

Note

Since this is not a recommended normal procedure, Flaps Up Take-Off should be made only when authorized or directed by the major command concerned.

The throttles are gradually advanced toward maximum power. The copilot will monitor the engine instruments and adjust throttles to prevent maximum allowable power from being exceeded during take-off. Any time maximum performance is desired, maximum power should be applied before the brakes are released as all take-off performance data is based on this type take-off.

CAUTION

Under low ambient temperature conditions never place the throttles in the TAKE-OFF position without monitoring the torque-meters since it is possible to exceed the maximum allowable torque before reaching the minimum turbine inlet temperature specified in Section V. In addition, increasing ram effect during take-off will increase torque for any fixed turbine inlet temperature. This means that torque must be set below maximum allowable when setting power for take-off or must be reduced as airspeed builds up.

Note

Nose wheel steering is required in addition to aerodynamic controls when take-off is continued after an engine failure and prior to reaching minimum control speed.

During the take-off run, the pilot maintains directional control with the nose wheel steering until flight controls become effective. Concurrently, the copilot shall hold the control column forward and keep the wings level with the ailerons. As speed increases, the pilot discontinues nose wheel steering and maintains control of the airplane throughout the remainder of the take-off run by coordinated use of the flight controls and power, according to the circumstances of speed, crosswind, and runway conditions. The engineer will monitor all systems and immediately report any malfunctions to the pilot.

Note

If the airplane is loaded to an aft center of gravity, forward pressure on the control column will aid steering effectiveness.

For a smooth transition to take-off attitude, rotation of the airplane should be started approximately 5 knots below the take-off speed or at the minimum control speed, whichever is greater.

AFTER TAKE-OFF.

Items 1 and 2 (landing gear and flaps) of this checklist may be completed at the pilot's command without direct reference to the checklist. The copilot will review these items before proceeding after the checklist is initiated.

After becoming airborne, at the command of the pilot, retract the landing gear. When a safe altitude and flap retraction speed (normally 20 KIAS above take-off speed) is reached, retract the flaps.

Note

- Retracting the landing gear and flaps simultaneously will result in slower than normal operation of both and may cause the hydraulic low-pressure warning light to illuminate.
- After airborne accelerate to the recommended climb speed as determined from T.O. 1C-130(A)H-1-2, or use the following table to prevent excessive nose-high attitudes:

  180 KIAS to 10,000 feet
  170 KIAS to 15,000 feet
  160 KIAS to 25,000 feet
  Performance charts above 25,000 feet

PILOTS

1. Landing gear — "UP" CP

Note

When the last main gear contacts the up limit switch, momentary flicker of the nose gear indicator may occur. Momentary flicker is considered normal and should not cause any adverse effect.

2. Flaps — "Up" CP
3. HOT MIC — "Set" P, CP
4. Landing Light panel — Set CP
   a. Landing lights — OFF, RETRACT, HOLD

Note

Lights must be off prior to retraction.

   b. Taxi lights — OFF
5. Aux hydraulic pump — OFF CP
6. Radar altimeter — "As required" P
7. After take-off checks — "Complete" E, N, TV, IO, CP

ENGINEER

1. Engine bleed air switches — OPEN
2. Synchrophase master switch — Engine 2/engine 3

Note

Use of the propeller resynchrophase switch should be limited to correct for an out-of-sync condition. Allow at least 1 minute between actuations of the switch to allow synchrophaser signals to stabilize.

3. Pressurization — Checked (ferry flight only)
4. Leading edge anti-icing — Checked/As required

Note

Leading edge anti-icing shall be checked on the first flight of the day in coordination with the pilot. Turn the wing and empennage anti-icing on until a temperature rise is noted on the indicators. This will also eliminate any moisture in the system. Monitor torque indicators for increase when wing and empennage switches are turned off.

5. Air refueling door (some airplanes) — As required

Note

If inflight use is anticipated, opening the UARRSI door at this time is mandatory to remove moisture from the slipway area. Open the air refueling door by positioning the air refueling door handle open, wait approximately 10 seconds for moisture to dissipate, and close the door using utility hydraulic pressure. Check door unlocked light out.

6. After take-off checks — "Complete" E, N, TV, IO, CP

AIRBORNE SENSOR/WEAPON ALIGNMENT.

PILOTS

1. Autopilot pitch reference system — "As required" P
2. Navigation control panel — "Set" N
   a. IAS and indicated true airspeed — Computed
   b. Wind inserted as required
3. HUD — "Set (State Detent)" P
   a. Power switch — ON/Adjusted
   b. STBY reticle — As required
   c. Detent setting – Checked
   d. Mil counter -- Checked
   e. Test switch – OFF
   f. Filter and declutter – As required
4. Flight director — "Set" P, CP
   a. AN/ASN91 — Selected P
   b. Pilot — Repeat — Selected CP
5. TD valves — "LOCKED" E
6. Master arm switch — "SAFE" E
7. Flaps — "As required" CP

ENGINEER

1. TD valves — "LOCKED"
2. Master arm switch - "SAFE"

Note

CP should adjust flaps to maintain less than 2 degrees pitch readout on navigation control panel.

8. Alignment, trainable weapons — "checked" FCO, P

Note

The pilot will specify settings for fire control/weapons panels if different from preset.

a. Ground tracking point — Identified/Confirmed

b. Sensors — Aligned

Note

Sensor alignment errors should be corrected by use of the boresight box for 1:1 resolvers only. If boresight adjustments are made for 1:1 resolvers, the 4:1 resolvers must be calibrated for IR and TV. If 4:1 resolvers are calibrated the pilot should confirm the primary aimline is still tracking the alignment point.

c. Consent and coincidence – Checked

Note

Pilot should check that consent light is off and note location of coincidence window. If coincidence window is not centered enter this in the Form 781.

d. Offset — Checked

e. Wind — Checked

f. Guidance — Checked

Note

Pilot should note position of vertical and horizontal bars when transitioning to the sight and again when superimposed in the sight. The position should be noted and applied to subsequent acquisitions (any gun/sensor or wind corrections inserted will effect primary aimline/CIP relationship).

g. Trainable weapons check — completed

Note

Pilot/FCO should note the box limits, appearance of hash marks (when limits exceeded) in the HUD during trainable weapons check.

9. Flaps — "As required" CP

10. Airborne sensor, weapons alignment checks — "Complete" TV, CP

CRUISE.

Refer to Section VII for fuel management procedures. See T.O. 1C-130(A)H-1-2 for cruise power settings.

CAUTION

Do not place the engine condition levers in any position other than FEATHER, RUN, or AIR START during flight.

Note

If offspeed or fluctuating condition occurs and resync operation does not correct the condition, refer to Propeller Failures in Section III. Turbulent flight conditions may cause excessive rpm fluctuations.

FLIGHT CHARACTERISTICS.

Refer to Section VI for detailed information on the airplane flight characteristics.

PRE-STRIKE.

PILOTS

1. Autopilot pitch reference system — "As required" P
2. Navigation control panel — "Set" N
3. HUD — "Set (State Detent)" P

Note

Sub items under HUD in the Airborne Sensor/Weapon Alignment checklist should be accomplished at this time.

4. Flight director — "Set" P, CP
5. TD valves — "LOCKED" E
6. Master arm switch — "SAFE" E

ENGINEER

1. TD valves — "LOCKED"
2. Master arm switch — "SAFE"
3. Dispenser, Flare Launcher, and Flare pistols — "Armed" CP, E, RS, IO
4. Lights — Set
5. Gun control panel — Set (as directed by pilot)
6. Guns — "Armed"
7. Pre-Strike checks — "Complete" E, N, FCO, TV, IO, CP

7. Auxiliary isolation switch — as required CP

8. Auxiliary hydraulic pump — as required CP

Note

Emergency brake pressure should not increase when auxiliary isolation switch and the auxiliary hydraulic pumps are on.

9. Illuminator (some airplanes) — "As required" P, IO

10. Dispensers, flare launchers, and flare pistols — "ARMED" CP, E, RS, IO

11. ECM equipment — "Checked/Set" EWO

12. IFF — As required. CP

13. Lights — "Set" P, CP

14. Pre-target briefing — "Complete" N

15. Weapons briefing — "Complete" P

Note

The pilot will coordinate with FCO on setting of fire control/weapons panels as mission/target dictates.

16. Flaps — "Set" CP

Note

Copilot should adjust flaps to maintain less than 2 degrees pitch read-out of the navigation control panel.

17. Guns — "Armed" E

18. Pre-strike checks — "Complete" E, N, FCO, TV, IO, CP

POST-STRIKE.

PILOTS

1.	Master arm switch — "SAFE"	E
2.	Flight director — "Set"	P, CP
3.	HUD — "OFF"	P

Note

Insure night filter is removed if used.

4.	Auxiliary hydraulic pump — As required	CP
5.	Auxiliary isolation switch — As required	CP
6.	Illuminator (some airplanes) — "As required"	P, IO
7.	Dispensers, flare launcher, and flare pistols — "Dearmed"	CP, E, RS, IO
8.	TD valves — "As required"	E
9.	Flaps — "As required"	CP
10.	Lights — "Set"	P, CP
11.	IFF — Set	CP
12.	Guns — "Dearmed"	E
13.	Post-strike checks — "Complete"	E, N, TV, IO, CP

ENGINEER

1.	Master arm switch — "SAFE"	
2.	Gun control panel — Set	
	a. All gun switches — SAFE	
3.	Dispenser, Flare launcher, and flare pistols — "Dearmed"	CP, E , RS, IO
4.	TD valves — "As required"	
5.	Lights — Set	
6.	Guns — "Dearmed"	
7.	Post-Strike Checks — "Complete"	E, N, TV, IO, CP

DESCENT.

MAXIMUM RANGE DESCENT.

This type of descent is made by retarding all throttles to FLIGHT IDLE with gear and flaps retracted and descending at maximum lift over drag speeds as shown on the performance chart. This type of descent will provide a moderate rate of sink (approximately 1,500 fpm) for an enroute letdown. Refer to the Maximum Range Descent chart in T.O. 1C-130(A)H-1-2.

RAPID DESCENT.

Gear and Flaps Up.

The highest rates of descent are obtained by retarding all throttles to FLIGHT IDLE with gear and flaps retracted and descending at maximum speeds, as shown in Section V and tabulated on the performance chart. Refer to the Rapid Descent Flaps Up chart in T.O. 1C-130(A)H-1-2.

Gear and Flaps Down.

At slow airspeeds, the highest rates of descent are obtained by retarding all throttles to FLIGHT IDLE, decreasing airspeed to flap limit speed (145 knots), and extending landing gear and full flaps. Descent at 145 knots. Refer to the Rapid Descent with Full Flaps chart in T.O. 1C-130(A)H-1-2.

Note

Repeated actuation of the landing gear under full cabin pressure differential conditions is not recommended.

BEFORE LANDING PATTERN.

This check will be accomplished prior to traffic pattern entry and/or before commencing any type of instrument approach, or it may be accomplished during the initial descent.

Note

Flight idle engine torque in slow speed descent and approach speeds may go negative and cause an NTS signal on one or more engines. This will cause an rpm and power fluctuation, resulting in a yawing condition on the airplane. To correct this condition, move the throttle(s) forward to bring engine torque out of the NTS range. The use of wing and empennage anti-icing will further decrease flight idle torque.

PILOTS

1. Crew briefing — "Complete"
   a. Approach to be used
   b. Minimums
   c. Missed approach intentions
   d. Radios/navigation aids
   e. Terrain/arrival restrictions

ENGINEER

P 1. Landing data — Computed

Note

A new TOLD card will be required any time gross weight changes 5,000 pounds or more or outside temperature changes 5°C or more. When required, the engineer will request field elevation and runway temperature from the pilot.

2. Pressurization - Set
3. Fuel panel — Set

PILOTS

2. Radar altimeter — "Set" P
(Set HAA/HAT/500 ft for VFR)

3. Altimeters — "Set, State setting" CP, P, N, TV

WARNING

Altimeters will be set to station pressure (QNH) if available when transiting the transition level. Altimeters may be set when above, but cleared through the transition level. The altimeter's internal vibrator may become inoperative due to internal failure or dc power failure. If this should occur, the 100-foot pointer may momentarily hang up when passing through 0 (12 o'clock position). Pilots should be especially watchful for this failure when their minimum approach altitude lies within the 800- to 1,000-foot part of the scale (1,800-2,000 feet, 2,800-3,000 feet, etc.) and should use any appropriate altitude backup information available. The 100-foot pointer hangup can be minimized by tapping the case of the altimeter.

4. ALR-69 intensity — CCW CP

5. Safety belt, shoulder harness — "Fastened, unlocked" P, CP

6. Landing data — "Checked" P, CP

7. Before landing pattern checks — "Complete" E,N,TV,IO,CP

ENGINEER

4. TD valve switches — Set

Note

A landing is normally made with the temp datum control valve switches in the AUTO position. When the LOCKED position is used, it is recommended that the switches be placed in LOCKED with the engines operating in temperature controlling and at an airplane altitude within 5,000 feet of field elevation.

5. Before landing pattern checks — "Complete" E, N, TV, IO, CP

BEFORE LANDING.

The pilot may direct lowering of flaps and gear prior to initiating this checklist.

PILOTS

1. Flaps — "As required" CP

2. Landing gear — "Down, indicators checked" CP, P

CAUTION

Prior to landing, the nose wheel steering indicator will be checked to assure the nose wheel is not cocked.

ENGINEER

1. Synchrophase master switch — OFF

2. Landing gear — Down, Indicators — Checked

3. Anti-skid test — Completed (after gear is down)

   a. Check that all four anti-skid test lights illuminate after wheel rotation stops.

   b. Place test switch in FWD position. All four lights should go out.

PILOTS

Note

The landing gear position indicators are the primary system to indicate the position of the gear. The warning horn and light are backup systems.

3. Landing light panel — As required CP

Note

Extend landing light prior to turning on.

4. Hydraulic control panels — Set CP

   a. Brake select switch — Checked

   b. Auxiliary hydraulic pump — As required

   c. Utility isolation switch — As required

   d. Auxiliary isolation switch — OFF

   e. Emergency hydraulic system switch — As required

Note

Recharge the emergency brake system by turning the auxiliary hydraulic on until emergency brake pressure is within limits.

Note

Higher than normal emergency brake system pressure may be encountered in flight. However, this should not cause damage to the system.

WARNING

- The auxiliary hydraulic pump must be turned on if any malfunction in the utility system is noted. The brake select switch must be placed in the EMERGENCY position if utility system fails.
- Do not land the airplane with the auxiliary isolation switch ON following loss of the utility system. Emergency brakes will be available only by operating the auxiliary system hand pump.

   f. Hydraulic pressures — Checked

5. HOT MIC — "Set" P, CP

ENGINEER

   c. Release test switch to OFF position. The two forward lights should illuminate momentarily. After 2 to 3 seconds, all four lights should illuminate and remain illuminated.

   d. Place test switch in AFT position. All four lights should go out.

   e. Release test switch to OFF position. The two aft lights should illuminate momentarily. After 2 to 3 seconds, all four lights should illuminate and remain illuminated.

4. Radar stabilization — OFF (if nav not aboard)

5. Safety belt, shoulder harness — Fastened, unlocked

6. HOT MIC — LISTEN ON

7. Before landing checks — "Complete" E, N, TV, IO, CP

Note

During touch-and-go landings, reaccomplish an anti-skid test prior to all full-stop landings.

PILOTS

Note

Pilot and copilot will set control panels to LISTEN ON, TALK ON. Other crewmembers will set to LISTEN ON.

6. **Before landing checks — "Complete"** E, N, TV, IO, CP

LANDING.

See figure 2-5 for approach and landing pattern.

WIND SHEAR.

Wind shear is a complex phenomenon. It can affect the airplane in all phases of flight, but is most critical during the approach and landing phase. Wind shear can exist as a rapid change in wind velocity and direction as well as vertical air movement. There are certain conditions which indicate the possibility of wind shear being present. As a general rule, the amount of shear is greater ahead of warm fronts, although the most common occurrences follow the passage of cold fronts during periods of gusty surface winds. When a temperature change of 10°F or more is reported across the front or if the front is moving at 30 knots or more, conditions are excellent for wind shear. In addition, when thunderstorms are present in the area of intended landing, the possibility of encountering wind shear is increased. The power required, vertical speed, and pitch attitude, used in conjunction with the wind reported on the ground, provide an indication of potential wind shear.

In relation to a known surface wind, be alert for:

a. An unusually steep or shallow rate of descent required to maintain glideslope.

b. An unusually high or low power setting required to maintain approach airspeed.

c. A large variation between actual and computed ground speed.

When a reported surface wind would not justify an increase airspeed (for example: calm wind on the surface), but wind shear is suspected, adjustment of approach speed may be used to provide an increased speed margin. The following are two wind shear phenomena which are commonly found on final approach:

a. DECREASING HEADWIND. Initial reaction of the airplane when suddenly encountering a decreasing headwind (or an increasing tailwind) is a drop in indicated airspeed and a decrease in pitch resulting in a loss of altitude. The pilot must add power and increase pitch to regain the proper glidepath. Once speed and glidepath are regained, however, prompt reduction of power is necessary. It will now require less power and a greater rate of descent to maintain the proper profile in the decreased headwind. If the initial corrections of increased power/pitch are not promptly removed after regaining glidepath and airspeed, a long landing at high speed will result.

b. INCREASING HEADWIND. The initial airplane reaction to an increasing headwind (decreasing tailwind) is an increase in indicated airspeed and an increase in pitch attitude resulting in a gain in altitude. The pilot should reduce pitch and power to regain the proper glidepath. As glidepath is regained, the pilot must immediately compensate for the increasing headwind by increasing pitch and power. It will now require more power and a decreased rate of descent to maintain the proper profile. Be very cautious in making reductions of power and pitch to avoid a low-power, high-sink condition which could lead to a correction through the glidepath from which a recovery could not be made.

WARNING

If the airplane becomes unstable on final approach due to wind shear and the approach profile cannot be promptly reestablished, a go-around should be immediately accomplished.

NORMAL LANDING.

Normal landing configuration is with 50 or 100 percent flaps. Refer to T.O. 1C-130(A)H-1-2 for landing speeds and distances.

CAUTION

- The pilot should anticipate a nose-heavy condition on landing due to configuration of the airplane.
- At high true airspeeds and/or high ambient conditions with the throttles at flight idle, the propeller blade angle may be in the pitchlock range. The exact airspeed at which this occurs is indeterminate due to the many variables involved. At the higher airspeeds, abrupt movement of the throttles into the ground range could result in pitchlock.

Note

Retarding the throttles below flight idle at high airspeed (approximately 100 KIAS or greater) could result in powerloss/bog-down on one or more engines. If this occurs, maintenance action is required prior to subsequent flight.

WARNING

If maximum reverse thrust is applied after landing, the failure of one or more propellers to reverse may result in complete loss of directional control. After touchdown, if the throttles are moved to the reverse range with a movement which is too rapid, it is possible to lose control of the airplane before a propeller malfunction can be detected. The movement from the flight range to the reverse range should be made at a reasonable rate which will permit detection of a malfunction, such as failure of the low pitch stop to retract. At the first indication of directional control difficulties during reversing, immediately return all throttles to ground idle. Maintain directional control with flight controls, differential braking, and nose wheel steering as required. After identifying the affected propeller, symmetrical propellers may be reversed and the affected engine should be shut down while it is in ground idle.

CAUTION

It is possible to scrape the aft bottom of the airplane when landing with extreme nose-high attitudes.

Every landing should be planned according to runway length available and the general prevailing operating conditions. Normal landings should also be planned so as to use all of the available runway length to promote safe, smooth, and unhurried operating practices; to preclude abrupt reverse power changes; and to save wear and tear on brakes. On final approach, begin to decrease airspeed from approach speed at a point that will allow a gradual slow-up to cross the runway threshold at threshold speed. Touchdown should be planned at the speed computed from the appropriate landing speed chart (see T.O. 1C-130(A)H-1-2). After the main wheels touch down, lower the nose wheel smoothly to the runway before elevator control is lost. When the main and nose landing gear are firmly on the ground, the copilot must hold forward pressure on the control column and maintain a wing-level

approach & landing- typical

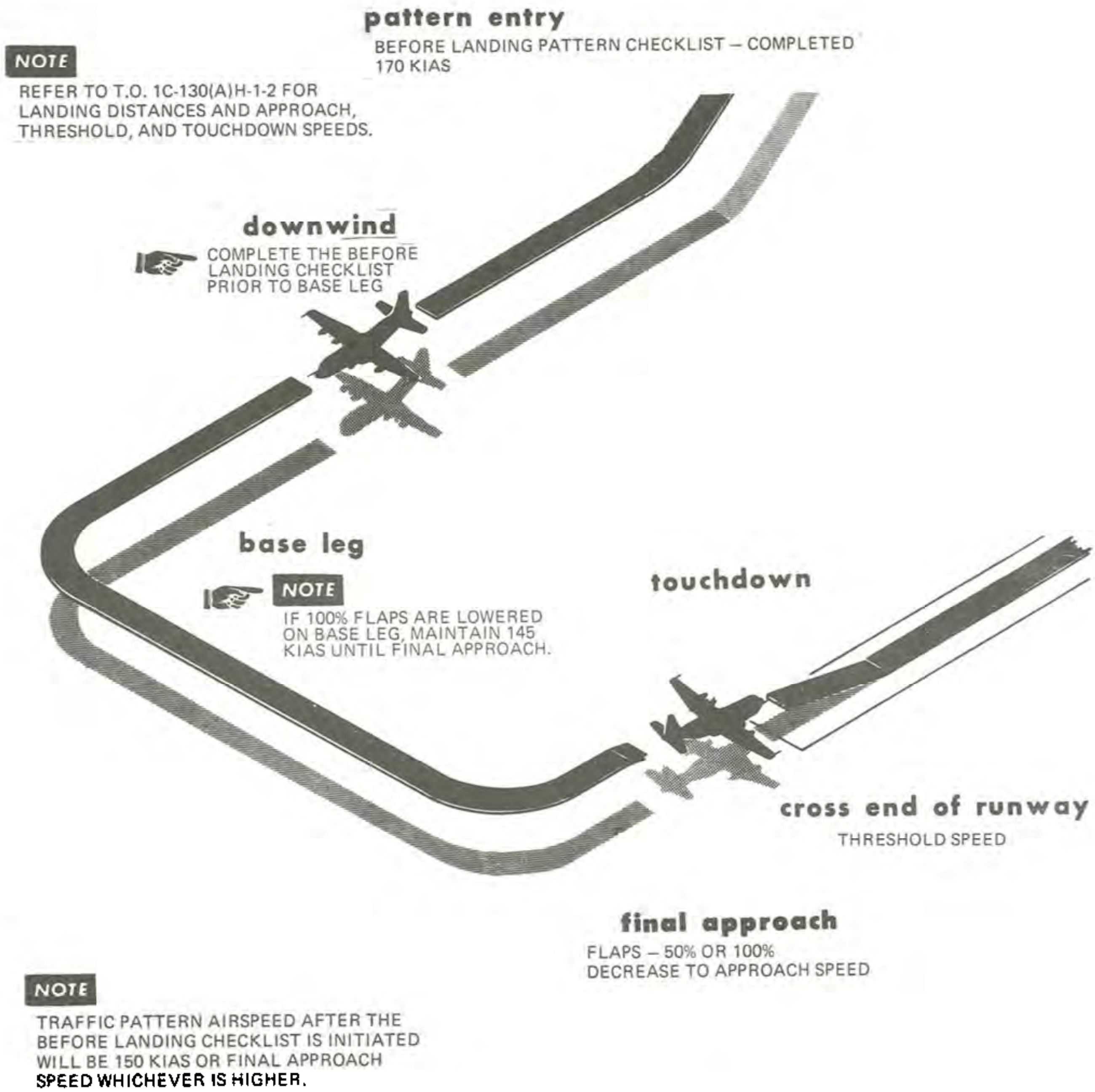


Figure 2-5.

attitude with ailerons, as needed. Concurrently, the pilot maintains directional control and decelerates the airplane through the coordinated use of the rudder, differential power, nose wheel steering, and differential brakes according to the speed, wind, and runway conditions. Reverse thrust is applied by moving the throttles from FLIGHT IDLE and then into REVERSE range in coordination with nose wheel steering. Brakes must be checked during the landing roll.

CAUTION

Propeller reversing with an unbalanced fuel load can cause an extreme wing-low attitude and undesirable control characteristics.

CROSSWIND LANDING.

To determine the proper approach and touchdown speeds for crosswinds as well as the maximum allowable crosswind components refer to T.O. 1C-130(A)H-1-2. Avoid touching down in a manner that will impose side loads on landing gear. After touchdown lower the nose-wheel and apply brakes as required. Maintain a wing's level attitude by use of the ailerons. In strong crosswinds (in excess of 35 knots), it may be necessary to use differential power and reduced flap settings to maintain control of the airplane. It is not recommended that less than 50 percent flaps be used.

Note

The upwind wing has a tendency to rise when reverse thrust is applied. This tendency is more pronounced in direct proportion to the amount of flaps used. This wing-up tendency can be corrected by the use of differential power and raising flaps (when possible) before reverse thrust is applied.

CAUTION

An engine-out condition may add difficulty to a crosswind approach and landing by adding to the drift and weather vaning.

MAXIMUM EFFORT LANDING.

Note

- Maximum effort landing should be made only when authorized or directed by the major air command concerned.
- Retard the throttles below flight idle at high airspeed (approximately 100 KIAS or greater) could result in power-low/bog-down on one or more engines. If this occurs, maintenance action is required prior to subsequent flight.

Normal traffic patterns will be flown unless airfield situations or mission requirements dictate otherwise. Complete the Before Landing Checklist, and turn the auxiliary pump on. When established on the final approach, slow to maximum effort threshold speed. Rate of descent on the approach should be adjusted to arrive over the end of the runway at maximum effort threshold speed with approximately a 500 fpm rate of descent. The touchdown area should normally be selected from 100 feet to 300 feet down from the approach end of the runway markers; however, touchdown within 500 feet is essential. Airspeed control during the final approach is important. After crossing the end of the runway, initiate flare and retard the throttles.

Note

During gusty wind conditions, the maximum effort threshold speed will be increased by the full gust increment, not to exceed 10 knots (any increase in touchdown speed will increase the minimum runway length required). Landings will be conducted only if computed touchdown speed is in the recommended area of the landing cross wind chart.

Immediately upon contact with the gear firmly on the ground, apply full reverse thrust and minimize nose gear loads by use of elevator back pressure. Apply braking action as required.

WARNING

- The nose gear must be on the ground prior to reversing.

- The failure of one or more propellers to reverse may result in complete loss of directional control. After touchdown, if the throttles are moved to the ground range with a movement which is too rapid, it is possible to lose control of the airplane before a propeller malfunction can be detected. The movement from the flight range to the ground range should be made at a reasonable rate which will permit detection of a malfunction, such as failure of the low pitch stop to retract. At the first indication of directional control difficulties during reversing, immediately return all throttles to ground idle. Maintain directional control with flight controls, differential braking, and nose wheel steering as required. After identifying the affected propeller, symmetrical propellers may be reversed and the affected engine shut down while it is in ground idle. Rudder, differential power and brakes are the primary means of directional control. During the final stage of landing roll, reduce reverse thrust if conditions permit, to prevent debris from causing restriction to visibility or engine damage.

LANDING ON WET RUNWAYS.

The anti-skid braking system, reverse thrust, and nose wheel steering capabilities minimize normal hazards associated with wet runways.

LANDING ON ICY RUNWAYS.

Operation of the airplane on ice is hazardous and should be attempted only when the mission is of the nature that such operation is necessary. Caution must be taken when landing or taxiing on ice. Use of nose wheel steering should be minimized and used with caution. Taxi speed must be slow and taxi turns should be planned for large radius turns. Directional control can be maintained with asymmetrical power and nose wheel steering at taxi speeds and with asymmetrical power and rudder at speeds above rudder effectiveness. Touchdown should be made from a power approach at the minimum safe speed possible. Hold the nose wheel "off" as long as possible to obtain maximum aerodynamic drag. Braking after lowering the nose wheel must be made with caution and use symmetrical power and reverse thrust as the primary means to obtain braking action and to prevent sudden yawing and skidding. It is also very difficult for the pilot to sense that the wheels are skidding. Landing on ice covered runways should not be attempted if existing crosswinds will require large crosswind approach or taxiing correction applications.

FLAPS UP LANDING.

Flaps up landing is not a recommended normal procedure and will be made only when authorized or directed by the major air command concerned, or when necessitated by the need to keep drag to an absolute minimum under partial power operation, or by a failure of the flap system. If possible, extend the downwind slightly in order to have more time on final to properly set up the approach. Complete the turn to final and slow to flap up approach speed. Monitor airspeed closely. The airplane pitch (angle of attack) on final will approximate a landing attitude and the rate of descent should be controlled with the throttles. Do not attempt to round out or flare the airplane, but allow it to touch down by maintaining the landing attitude and using power, as necessary, to control the descent rate.

CAUTION

If a normal landing round out or flare is used at touchdown with flaps up, the tail skid may contact the runway.

TOUCH AND GO LANDING.

Before the first touch and go, all normal checklists will be completed through the Before Landing Checklist. After the first touch and go, this checklist may be used until the airplane departs the aircraft traffic/approach control area. The Touch and Go Landing Checklist may be used for full stop and taxi back operations provided only flaps, trim tabs, ground idle (includes low speed), and throttles are moved. The After Landing and Before Take-off, checklists must be used for full stop landings when hatches/doors are opened and/or controls not listed above are operated and a subsequent take-off is planned. In this case, and when the aircraft is going to remain in the airport traffic/approach control area, the Touch and Go Checklist may be initiated immediately after take-off.

Touch and go landings require a significant element of caution because of the many actions that must be executed while rolling on the runway at high speed or while flying within the immediate proximity of the ground. The action required during touch and go landings are divided into three categories: on the runway, after take-off, and before landing. This procedure and checklist are designed for use when touch and go landings are being accomplished and the airplane remains in the airport traffic/approach control area.

After the airplane has touched down (both main and nose gears), the pilot flying the airplane will call for flaps to be set at 50 percent; the other pilot will set/check trim. When the trim is set for take-off, the pilot flying the airplane will advance the throttles for takeoff.

WARNING

- When moving the flaps at low airspeed, an asymmetrical flap may go undetected, until near or above take-off speed.
- On the Runway and After Take-off checklists may be accomplished without direct reference to the checklist. Reference to the Before Landing Checklist is required.

On The Runway.

1.	Flaps	"50 percent"	CP
2.	Trim tabs	"Set"	CP
3.	Throttles	As required	P

After Take-Off:

4.	Landing gear and flaps	"As required"	CP
5.	Landing light panel	As required	CP

Before Landing:

6.	Crew briefing	"Complete"	P
7.	Flaps	"As required"	CP
8.	Landing gear lever	"DN/Indicators checked"	CP,P
9.	Landing light panel	As required	CP
10.	Hydraulic pressures	Checked	CP
11.	Touch and go checks	"Completed"	CP

GO-AROUND.

The decision to go-around should be made as soon as possible on approach. When a go-around is decided upon, alert the crew and proceed as follows:

Advance throttles as required to establish safe airspeed and the appropriate climb profile.

When appropriate airspeed, altitude, and climb profile are established, direct the copilot to set/check flaps to 50 percent.

WARNING

Retracting flaps from 100 percent to 50 percent will increase stall speed. Sink rate will also increase if power and attitude changes are not made. If airspeed is lower than normal, inadvertent touchdown and/or stall may occur.

Signal the copilot to raise the landing gear when certain that the airplane will not be touched down (as required).

After the above procedures have been accomplished, proceed as though from take-off.

AFTER LANDING (AFTER COMPLETION OF LANDING ROLL).

This checklist will also be used for operational stop operations. Refer to normal Before Take-Off Checklist if engines remain running.

PILOTS

1. Flaps — "Up/50%" for operational stop — CP
2. Unnecessary equipment — Set — CP
   a. IFF — As required

   Note

   - Turn IFF OFF (STANDBY for operational stop) as soon as possible after landing. This will eliminate signals from taxiing or parked airplanes which would otherwise block the controller's scope and interfere with the control of airborne airplanes.
   - If another take-off is to be made, momentarily position the IFF code switch to HOLD; wait at least 15 seconds; then turn the master switch OFF, if mode 4 codes are being used.
   - Classified IFF codes must be removed, or properly protected.
   - For operational stop operations, all communications radios and navigational aids must remain ON.

   b. Radios — As required

ENGINEER

1. Air-conditioning panel — Set
   a. Master switch — NO PRESS
   b. Under floor heat — OFF
2. Electrical panel — Set
   a. ATM and generator — Checked, ON

   Note

   If the fire control power supply is on, ensure the right-hand AC bus remains powered. If the fire control system is operating from the essential AC bus, do not downshift No. 2 engine or turn ATM on. Power interruptions in excess of one-half second may cause computer malfunctions.

   b. Bus tie switch — TIED
3. Radar (if navigator is not aboard) — STANDBY
   a. Radome anti-icing — OFF
4. Ground idle buttons — As required
5. Anti-icing panel — Set
   a. Nesa — As required
   b. Pitot heat — As required
   c. Prop and engine anti/de-icing — As required
   d. Wing and empennage anti-icing — OFF

PILOTS

c. Navigational aids — As required.

3. Radar (pilot's repeater scope intensity) — CCW CP

4. Lights — As required CP

a. Landing and taxi — As required

b. Interior — As required

5. Auxiliary hydraulic pump switch — As required CP

Note

Turn auxiliary hydraulic pump on for 2 engine operation.

6. No. 1 and No. 4 NTS shutdown — As required CP

7. After landing checks — "Complete" E, N, CP

ENGINEER

Note

Steps 6 and 7 are not required on an operational stop unless all engines are to be shut down.

6. Fuel panel — Set

a. Boost pumps — As required

b. Crossfeed valves — No. 2 OPEN, others CLOSED.

7. GTC — Set

a. Control switch — START, RUN

b. Bleed air valve switch — OPEN

8. After landing checks — "Complete" E,N,CP

ENGINE SHUTDOWN.

PILOTS

1. Nose wheel, parking brake — "Centered, Set" P

2. Radar altimeter — "OFF" P

3. Navigation equipment — "OFF" N

4. FC power supply — "OFF" N

5. Auxiliary hydraulic pump — OFF CP

CAUTION

- Failure to turn auxiliary hydraulic pump switch OFF at this time will cause dumping of hydraulic fluid when No. 1 and 2 engines are shutdown.

- Assure that the auxiliary pump is also turned OFF at the ramp control panel by observing the hydraulic pressure decreasing to zero on the auxiliary hydraulic pressure gage.

6. Engine shutdown — Complete CP

a. Place feather valve and NTS check switch in NTS position.

ENGINEER

1. Radar (if navigator is not aboard) — OFF

Note

Engineer should monitor engine instruments during shutdown for zero fuel flow and TIT and rpm decrease.

2. Air-conditioning panel — Set

a. Master switch — OFF

b. Cargo compartment/booth selector switch — FLT DECK

3. Engine bleed air switches — CLOSE

4. Engine generators — OFF

5. Inverter switches — OFF

6. Fuel boost pumps — OFF

7. TD valve switches — NULL

8. Oxygen — OFF, 100%

9. Engine shutdown checks — "Complete" E,N,TV, IO,CP

PILOTS

b. Assure throttles in ground idle.

c. Place condition levers in GROUND STOP and observe zero fuel flow.

d. Observe the NTS lights, then return the feather valve and NTS check switch to normal.

Note

If NTS lights do not illuminate when shutting down engines from low-speed ground idle, a recheck of the NTS system must be made before the next flight.

CAUTION

During ground stop procedure, do not move the engine condition lever from STOP to RUN while the engine is still rotating.

7. Oxygen — "OFF, 100%" P,CP

8. Oil cooler flaps — OPEN, FIXED CP

9. Exits — "Clear, insert chocks" P

Note

Do not give clearance until propeller rotation has stopped.

10. Chocks — "In place" IO

11. Parking brake — "Released" P

12. Hydraulic panel — Set CP

    a. Suction boost pump switches — OFF

CAUTION

The engine pump switches are to be left in the ON position after engine shutdown. If the switch is left in the OFF position, pressure buildup due to thermal expansion of the hydraulic fluid may cause the suction line hydraulic firewall shutoff valve to fail.

13. Exterior lights — OFF CP

14. Engine shutdown checks—"Complete" E, N, TV, IO, CP

BEFORE LEAVING THE AIRPLANE.

Make appropriate entries in the Form 781 covering any limits in the Flight Manual that have been exceeded during flight. Entries must also be made when, in the judgment of the pilot, the airplane has been exposed to unusual or excessive operations such as hard landings or excessive braking action during aborted take-offs. The engineer will complete a brief general condition interior and exterior visual inspection prior to leaving the airplane.

Each crewmember should turn off all lights (as required), both interior and exterior, which are controlled from his crew station.

WARNING

If SUU-42A/A flare dispensers are installed, a crewmember will remain on the flight deck to assure that the flare master arm switch and the SUU-42A/A jettison switches remain in the safe position until the ground safety pins are installed. Do not walk directly beneath the SUU-42A/A dispenser or stand directly behind a dispenser loaded with live munitions.

This checklist will be accomplished as practical by the engineer.

1. **Lights — As required**

2. **ATM generator and ATM — OFF, STOP**
3. **GTC panel — Set**
   a. **Bleed air valve — CLOSE**
   b. **Control Switch — STOP**
4. **Radios — OFF**
5. **Electrical panel — Set**
   a. Bus tie switch — NORMAL
   b. AC, dc power switches — EXTERNAL PWR or OFF

Note

External power may remain applied if qualified personnel remain at the airplane.

   c. DC voltmeter switch — MAIN DC BUS
6. Emergency egress safety pin, nose pin, SUU-42A/A dispenser safety pins, and ground wire — Installed

CAUTION

Never install rig pins in the control system nor secure the flight station controls as a means of locking the surfaces against wind gust. Otherwise, damage to the hydraulic booster and/or cable system is likely to result.

CRUISE ENGINE SHUTDOWN.

Engine shutdown may be performed during cruise flight to achieve optimum fuel economy for various mission requirements when authorized by the major air command concerned.

Refer to T.O. 1C-130(A)H-1-2 for applicable performance data.

WARNING

Operating in the freezing range with visible moisture present may cause icing that will prevent restart of shutdown engines.

PILOTS

Note

1. NTS check — "Complete" E
2. Engine condition lever — "FEATHER" CP

CAUTION

When pulling a condition lever to FEATHER, pull it all the way to the detent to assure that the propeller is fully feathered when the engine fuel is shut off. If the lever is left at midposition and NTS is inoperative, an engine decoupling is possible.

After propeller rotation has stopped:

3. Cleanup - "Complete" E

CAUTION

After shutdown of the first engine, allow the TIT to decrease to restart TIT (200°C) prior to shutdown of the second engine.

Note

This checklist is arranged so that, after the engineer completes his cleanup items, controls for the inoperative engine are set for an immediate airstart by moving the condition lever to AIR START. Refer to Section III for Air Start Procedure.

ENGINEER

1. Synchrophase master switch — OFF
2. NTS check — "Complete"

CAUTION

The NTS check should be accomplished on one engine at a time.

a. Feather valve and NTS check switch — VALVE
b. Prop governor — MECH GOV
c. Torque (engine being checked) — 4,000 inch-pounds or more.
d. Wing and empennage anti-icing — ON
e. Bleed air switch (engine being checked) — OPEN
f. Bleed air switches (other engines) — CLOSED, one at a time
g. Have pilot slowly retard throttle, and observe decrease in torque (engine being checked)

Note

As torque decreases, read highest negative value. NTS should occur at −1260 (±600) inch-pounds. NTS action is indicated by an increase in torque and may fluctuate up to a positive 500 inch-pounds. NTS action should result in intermittent illumination of the valve check light.

ENGINEER

If NTS action is not observed by -1860 inch-pounds of torque, proceed as follows:

(1) Advance the throttle to normal operation.

(2) Wing and empennage anti-icing — OFF

(3) Bleed air switch (engine being checked)— As required

(4) Bleed air switch (other engines) — OPEN

CAUTION

Do not continue with the CRUISE ENGINE SHUT-DOWN procedure for an engine with a malfunctioning NTS system.

h. All affected switches — Returned to normal

After propeller rotation has stopped:

3. Cleanup — "Complete"

a. Engine bleed air switch - CLOSE

Note

If starter, engine inlet scoop anti-icing or oil cooler scoop anti-icing are required, place the bleed air switch to OPEN.

b. Engine generator — OFF

c. Fuel boost pump — As required

d. Fuel enrichment switch — NORMAL

e. Prop governor — MECH GOV

f. Feather valve and NTS check switch — VALVE

g. Throttle — 1 inch above FLIGHT IDLE

h. Oil cooler flap — CLOSED, FIXED

i. Synchrophase master switch — Reset as required

SECTION III

emergency procedures

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INTRODUCTION.

This section contains the procedures to be used in coping with the various emergencies that may be met from starting engines through engine shutdown. A thorough knowledge of these emergency procedures will enable crewmembers to perform their emergency duties in an orderly manner, and to judge more quickly the seriousness of the emergency. This will permit early planning for a bailout or forced landing and will greatly increase the crew's chances for survival. The procedures consist of items classified as critical or noncritical. The critical items are actions that must be performed immediately to avoid aggravating the emergency and causing injury or damage. Critical items are presented in boldface type and must be committed to memory. Noncritical items are actions that contribute to an orderly sequence of events and will be performed in conjunction with direct reference to the appropriate checklist. After determining that an emergency exists, the pilot should immediately establish communication with a ground station. The ground station should be given a complete description of the emergency, the action taken, and an accurate position report. The ground station should be further notified of any changes or developments in the emergency, so that the station can alert ARRS or other agencies to standby, if necessary. In the checklists presented, the codes, P, CP, E, N, IO, AG, FCO, TV and EWO for pilot, copilot, engineer, navigator, illuminator operator, airborne gunner, fire control officer, TV operator and electronic warfare officer. This presentation does not preclude the pilot from redelegating the duties at crew briefing. Never initiate a boldface procedure before command of the pilot.

The pilot will command emergency procedure initiation by calling for the procedure desired, but need not call out each step. The affected crewmembers will accomplish the required steps in accordance with the appropriate checklist. The engineer will monitor all engine shutdown steps and other coordinated emergency procedures.

When an airborne emergency occurs, the following rules apply:

1. Maintain aircraft control. It is desirable for one pilot to fly the aircraft and not be directly involved in the emergency actions.

2. Analyze the situation. Emergency procedures, BOLD print included, should be accomplished only after the crew member has positively identified the malfunctioning system and considered the effect of emergency-related actions on aircraft performance.

3. Take coordinated corrective Action. Although many inflight emergencies require immediate corrective action, difficulties can be compounded by the tempo of the pilot's commands and hurried execution by the crew. Commands must be clear and concise, allowing time for acknowledgement of each command prior to issuing further instructions. The pilot must exercise positive control of the crew by allowing time for acknowledgement and execution. The other crew members must be certain their reports to the pilot are clear and concise, neither exaggerating nor understating the nature of the emergency. This eliminates confusion and insures efficient, effective, and expeditious handling of the emergency.

4. Study the aircraft's configuration and land as the situation dictates. A controllability check may be advisable.

Note

Refer to T.O. 1-1C-1-29 for emergency procedures associated with the C-130 aerial refueling system.

ENGINE SHUTDOWN CONDITIONS.

If any of the following conditions occur in flight or on the ground, shut down the affected engine when the necessary corrective action fails to remedy the adverse condition.

1. Generator failure
2. An engine fire
3. Engine (turbine) overheat
4. Nacelle overheat
5. Excessive or uncontrollable power
6. Certain propeller malfunctions (see Propeller Failures in this section)
7. An uncontrollable rise in turbine inlet temperature
8. An uncontrollable drop in oil pressure
9. An uncontrollable rise in oil temperature
10. Unusual vibration or roughness

When it is necessary to continue operation of an engine with any of these conditions present, in the interest of safety of the airplane and crew, operate the engine with extreme caution, and at the minimum power required.

Note

Before making an engine shutdown, when it is anticipated that the engine may be restarted, perform an NTS check using the procedure in Section II, Cruise Engine Shutdown.

ENGINE SHUTDOWN PROCEDURES.

1. CONDITION LEVER	"FEATHER"	CP

CAUTION

When pulling a condition lever to feather, pull it all the way to the detent to assure that the propeller is fully feathered when the engine fuel is shut off. If the lever is left at midposition and NTS is inoperative, an engine decoupling is possible.

2. FIRE HANDLE	"PULLED" (FOR FIRE OR NACELLE OVERHEAT)	CP
3. AGENT	"DISCHARGED" (FOR FIRE OR NACELLE OVERHEAT)	CP

WARNING

If condition persists, a break in the bleed-air manifold may exist. Isolate the wing by closing the engine bleed-air valve for the other engine on the wing and the wing isolation valve. If the fire or nacelle overheat continues, discharge the remaining bottle on command of the pilot.

CAUTION

Do not hold the agent discharge switch in No. 1 or No. 2 position longer than two seconds. To do so may cause the fire ext circuit breaker to open.

Note

The intent of step 3 is to require the agent to be discharged when an indication continues after the fire handle has been pulled. However, if any other indication or malfunction is suspected which requires fire extinguisher agent it should be discharged on command of the pilot.

4. Flaps	"As required"	CP
5. Landing gear	"As required"	CP

6. Cleanup	"Completed"	E
a. Engine bleed air valve switch	CLOSE	
b. Generator switch	Tripped/OFF	
c. Fuel boost pump switch	OFF	

Note

If on crossfeed, assure source of fuel to operate engines before shutting off fuel boost pump and crossfeed valve for the affected engine.

d. Crossfeed valve switch	CLOSED
e. Propeller governor control switch	MECH GOV
f. Synchrophase master switch	Reset as necessary
g. TD valve switch	NULL
h. Throttle	Full forward
i. Oil cooler flap switch	CLOSED/FIXED

Note

Performance data should be checked (refer to TO 1C-130(A)H-1-2).

GROUND EMERGENCIES.

GAS TURBINE COMPRESSOR EMERGENCY SHUTDOWN.

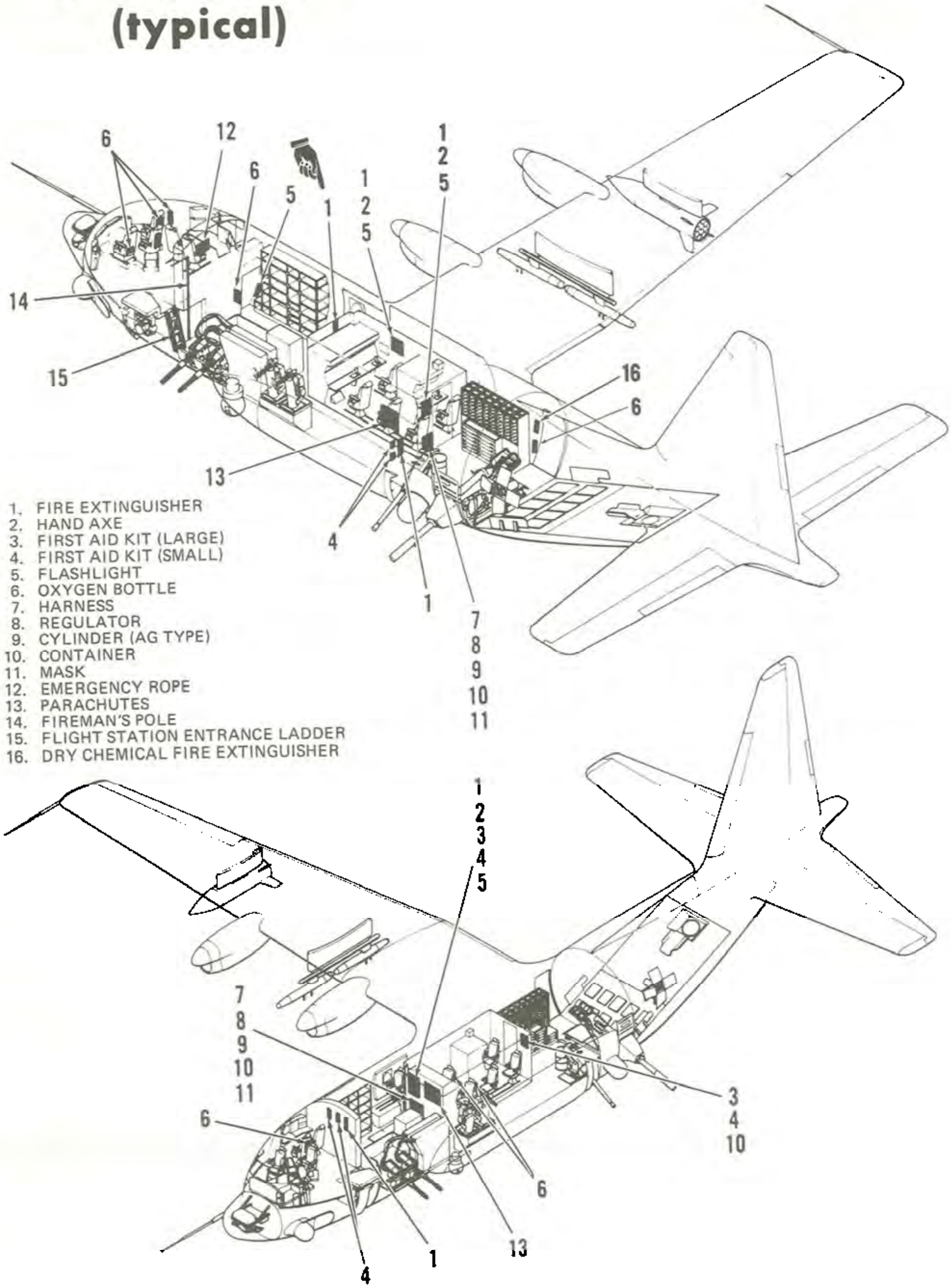
1. FIRE HANDLE	**"PULLED"**	**E**
2. AGENT	**"DISCHARGED" (FOR FIRE)**	**E**

WARNING

If condition persists, discharge the remaining bottle.

3. Cleanup	"Completed"	E
a. ATM and generator	OFF/STOP	
b. GTC bleed valve switch	CLOSED	
c. GTC control switch	OFF	

emergency equipment (typical)



1. FIRE EXTINGUISHER
2. HAND AXE
3. FIRST AID KIT (LARGE)
4. FIRST AID KIT (SMALL)
5. FLASHLIGHT
6. OXYGEN BOTTLE
7. HARNESS
8. REGULATOR
9. CYLINDER (AG TYPE)
10. CONTAINER
11. MASK
12. EMERGENCY ROPE
13. PARACHUTES
14. FIREMAN'S POLE
15. FLIGHT STATION ENTRANCE LADDER
16. DRY CHEMICAL FIRE EXTINGUISHER

Figure 3-1.

ENGINE FIRE (GROUND/INFLIGHT)

Engine fires are indicated by a steady illumination in the respective fire control handle and the master fire warning light on the pilot's instrument panel. If an engine fire is experienced on the ground or in flight, shut down the engine in accordance with the ENGINE SHUTDOWN PROCEDURE in this section.

Tailpipe Fires or Torching(Ground/Inflight)

A tailpipe fire is defined as abnormal flame or torching coming from the engine tailpipe. During starting, if the condition is reported before ground start switch release, the condition lever should be placed in GROUND STOP and the engine motored with the starter. This will normally clear the engine of unburned fuel. If flames spread beyond the tailpipe, follow the ENGINE SHUTDOWN PROCEDURE in this section. Inform ground crew of the situation so that they may use ground fire extinguishers if necessary.

If during flight the aircrew notices a loss of engine oil quantity with heavy smoke coming out of the tailpipe area, the engine should be monitored during flight and shutdown in accordance with the ENGINE SHUTDOWN PROCEDURE prior to landing. This should prevent oil combustion in the tailpipe after landing.

If a tailpipe fire occurs inflight, follow the ENGINE SHUTDOWN PROCEDURE. If the fire persists, the airplane should be accelerated as rapidly as possible, not exceeding maximum airspeed. High air speed should be maintained as long as heavy smoke continues to come from the tailpipe area.

If a tailpipe fire occurs during engine shutdown, continue with engine shutdown and notify the fire department.

CAUTION

Do not motor the engine when a tailpipe fire exists on engine shutdown.

ENGINE OVERHEATING (GROUND/INFLIGHT)

There are four indications of overheating in the engines and nacelles: the turbine overheat warning light, nacelle overheat warning light, high turbine inlet temperature, and high oil temperature.

Turbine Overheat Warning.

If an overheat condition is indicated by the flashing of the master fire warning light and/or lights in a fire control handle, proceed as follows:

ON THE GROUND: Move the throttle to GROUND IDLE and proceed with the ENGINE SHUTDOWN PROCEDURE in this section.

INFLIGHT: Retard throttle toward FLIGHT IDLE. If condition persists, proceed with the ENGINE SHUTDOWN PROCEDURE in this section.

Nacelle Overheat Warning.

When an overheat warning is indicated by a nacelle overheat warning light on the copilot's instrument panel, proceed as follows:

ON THE GROUND: Move all throttles to GROUND IDLE and proceed with ENGINE SHUTDOWN PROCEDURE in this section.

INFLIGHT: Proceed with ENGINE SHUTDOWN PROCEDURE in this section.

High Turbine Inlet Temperature.

Should an overtemperature be indicated by a high turbine inlet temperature, proceed as follows:

ON THE GROUND: Move the throttle for the affected engine toward GROUND IDLE, and place the temperature datum control switch in the NULL position. If this fails to eliminate the overtemperature condition, place the condition lever in GROUND STOP.

INFLIGHT: Retard the throttle for the affected engine toward FLIGHT IDLE, and place the temperature datum control switch in the NULL position. If this fails to eliminate the overtemperature condition, proceed with the ENGINE SHUTDOWN PROCEDURE in this section.

High Oil Temperature.

For corrective action to be taken in case of high oil temperature, refer to ENGINE OIL SYSTEM FAILURE in this section.

EMERGENCY ENTRANCES.

Emergency entrances are those used by ground rescue personnel (figure 3-2).

External Release.

The side emergency exit and the three escape hatches (figure 3-2) are equipped with external pull-type releases. The releases are flush-mounted on the fuselage surface next to the exit they release. Pulling the release permits the exit to be pushed inward, and entrance may be made.

Chopping Locations.

Chopping locations, marked in yellow (figure 3-2), are painted on each side of the fuselage. On the right side, the marking is located above the right paratroop jump door. On the left side, the marking is located above the left paratroop jump door with the 105MM cannon removed and above the 105MM cannon, when installed.

GROUND EVACUATION.

If it becomes necessary to evacuate the airplane, proceed as follows:

a. Set parking brake

Note

If main wheel well fire exists, set opposite brake only.

b. Notify tower

c. Auxiliary pump off.

d. Shutdown engines and GTC using fire handles and place condition levers to feather.

e. Notify crew/passengers to evacuate the airplane.

WARNING

If main wheel well fire exists, all personnel other than those in the fire department should evacuate the immediate area. The area on both sides of the wheel will be cleared of personnel and equipment for at least 300 feet. If ammunition is on board, personnel will be evacuated at least 2,000 feet. Do not approach the main wheel area when extreme temperatures due to excessive braking are suspected. If conditions require personnel to be close to an overheated wheel or tire assembly, the approach should be from the fore or aft only.

f. Battery switch - OFF

g. Chock airplane

Note

If main wheel well fire exists, chock nose gear only.

BRAKE SYSTEM FAILURE.

Loss of Normal Hydraulic Pressure.

If sufficient pressure is not available in the normal brake system for adequate braking, proceed as follows:

Position the auxiliary pump switch to ON.

CAUTION

When switch is turned OFF, wait at least 10 seconds before turning back to ON.

Place the brake select switch in the EMERGENCY position.

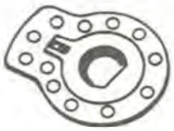
WARNING

Normal or emergency brakes will not be available with auxiliary isolation switch on following loss of utility hydraulic system pressure, but will be available with the AUX system hand pump.

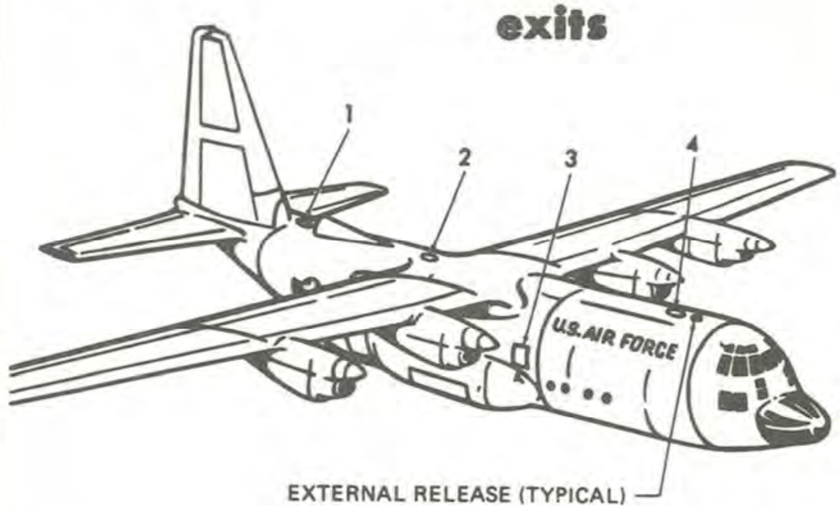
emergency entrances

escape exits

1. AFT ESCAPE HATCH
2. CENTER ESCAPE HATCH
3. SIDE EMERGENCY EXIT
4. FORWARD ESCAPE HATCH



EXTERNAL RELEASE FOR ESCAPE HATCHES AND SIDE EMERGENCY EXIT

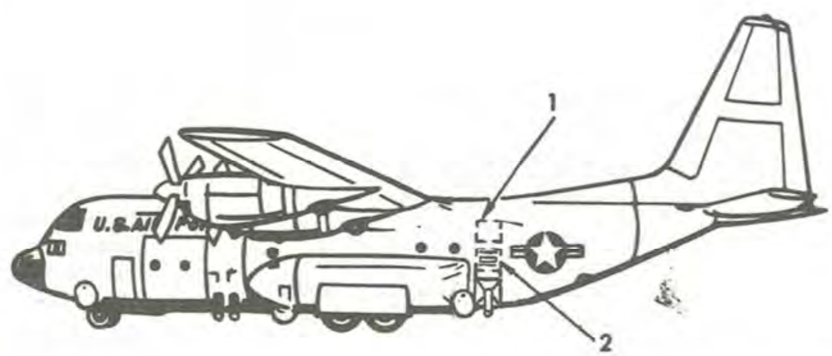


chopping locations

INTERIOR AND EXTERIOR CHOPPING MARKINGS

(CANNON REMOVED)

(CANNON INSTALLED)



1. LEFT-HAND LOCATION SHOWN WITH 105MM CANNON REMOVED (RIGHT OPPOSITE).
2. LEFT-HAND LOCATION WITH 105MM CANNON INSTALLED.

Figure 3-2.

CAUTION

Use brakes cautiously after landing; no anti-skid protection is available on the emergency system. Avoid taxiing into congested areas due to the possibility of auxiliary hydraulic pump failure.

Note

The auxiliary hydraulic system handpump may be used for stopping the airplane in an emergency by holding the brake pedals down while the handpump is being operated.

Anti-Skid System Failure.

Whenever the anti-skid system is not operating as an integral part of the brake system, an anti-skid inoperative light will illuminate. Use of the anti-skid system after the light illuminates may result in uneven braking and a tendency for the airplane to swerve. The anti-skid switch should be turned to the OFF position if the anti-skid inoperative light illuminates.

Anti-Skid Test Unsatisfactory

During test of the anti-skid system, failure of a wheel to test properly indicates that the wheel may have braking without anti-skid protection, or that the wheel may rotate freely without any braking capability. Use of the anti-skid system after an unsatisfactory test indication may result in uneven braking and a tendency for the airplane to swerve when brakes are applied. The anti-skid switch should be placed in the OFF position if the test indicates a system malfunction.

TAKE-OFF EMERGENCIES.

WARNING

- Under certain conditions it may be impossible to obtain or maintain safe flight. When ground contact is unavoidable maintain directional control and touchdown with wings level.
- If a failure occurs in the throttle control system, the controls may go to either full power or full reverse. A possible indication may be unrelated power and throttle setting. In the event of throttle control linkage failure, do not move the throttle and immediately shut down the affected engine in accordance with the Engine Shutdown Procedures in this section.

ENGINE FAILURE DURING TAKE-OFF.

If an engine failure occurs before reaching refusal speed, the airplane must be stopped. If an engine failure occurs after exceeding refusal speed, the take-off must be continued because the airplane cannot be stopped on the remaining runway.

ABORT PROCEDURES.

If it becomes necessary to abort a take-off, proceed as follows:

a. Throttles - FLIGHT IDLE P

b. Condition lever - FEATHER (If required, on command of the pilot) CP

WARNING

If aborting for a propulsion system malfunction (either prop or engine) which could result in asymmetric power, shutdown the affected engine while throttle is in FLIGHT IDLE. Directional control problems may be encountered if throttles are placed in the ground range and a malfunction prevents the affected propeller from entering the ground range or if engine power output is abnormal.

c. Throttles - GROUND IDLE P

d. Reverse symmetrical engines and apply brakes as required. P

e. If required, initiate or continue with engine shutdown procedure in this section after safe control of the airplane is assured. P

NOSE WHEEL SHIMMY.

Nose wheel shimmy is a indication of an unbalanced condition of one or both of the nose wheel tires or failure of the steering system. If this occurs during take-off, the decision to continue or abort the take-off will depend on the severity of the shimmy and whether refusal speed has been reached. If the take-off is continued, the nose wheel should be raised as soon as directional control permits to reduce the severity of the shimmy.

TAKE-OFF CONTINUED AFTER ENGINE FAILURE.

If engine failure or fire occurs after reaching refusal speed.

a. Maintain directional control with flight controls and engine power as necessary. During reduced power operation, the throttles of operating engines may be advanced up to maximum power as directional control permits.

b. When safely airborne and certain that the airplane will not touch down, raise gear while accelerating to flap retraction speed.

c. After gear is up, and airspeed permits, commence flap retraction.

Note

- If obstacle clearance is a consideration, pilots should be aware that obstacle clearance performance data is based on the assumption that gear retraction is initiated 3 seconds after take-off and propeller feathering initiated 6 seconds after take-off. Flap retraction should be accomplished in 10 percent increments with airspeed increasing approximately 5 knots between retraction increments. This procedure will prevent the airplane from settling during flap retraction at heavy gross weights.

- It is important to obtain two engine minimum control speed plus 20 knots as soon as possible after take-off and prior to raising the flap lever above 15 percent.

CAUTION

Positioning the flap lever above 15 percent or operating the gear or flaps will increase the minimum control speed due to reduction in available hydraulic pressure.

d. After gear and flaps are up, continue as a normal take-off, accelerating to three engine climb speed or two engine minimum control speed, plus 20 knots, whichever is higher.

THREE ENGINE TAKE-OFF.

It is possible to make a three-engine take-off when required. This type of take-off requires particular caution because of the possibility of losing another engine during the take-off prior to reaching minimum control speed. A three-engine take-off will be made only when authorized.

Note

If the inoperative engine could not be started because of a faulty starter, and if an air start of the inoperative engine is to be made, the starter or starter shaft should be removed prior to take-off.

Before making the take-off, the propeller for the inoperative engine must be feathered. To make the take-off:

a. Accomplish the Before Take-Off Checklist.

b. Hold the airplane with the brakes and advance the throttles to FLIGHT IDLE.

c. Advance the throttles for symmetrical engines to maximum power; then release the brakes and advance power for the other operative engine as directional control will permit.

d. When safely airborne and certain that the airplane will not touch down again, raise gear while accelerating to flap retraction speed.

e. After gear is up, and airspeed permits, commence flap retraction. Flap retraction should be accomplished in 10 percent increments with airspeed increasing approximately 5 knots between retraction increments.

Note

It is important to obtain two-engine minimum control speed plus 20 knots as soon as possible after take-off and prior to raising the flap lever above 15 percent.

CAUTION

Positioning the flap lever above 15 percent or operating the gear or flaps will increase the minimum control speed due to reduction in available hydraulic pressure.

f. After gear and flaps are up, continue as a normal take-off, accelerating to three-engine climb speed.

SIMULATED THREE-ENGINE TAKE-OFF.

Before making a simulated three-engine take-off, advance the throttle for the simulated inoperative engine to a minimum of 8,000 inch-pounds of torque and then retard to FLIGHT IDLE. This will insure that the propeller blade angle is on or above the low pitch stop setting. A simulated three-engine take-off should be made only when authorized.

PRACTICE TAKE-OFF ENGINE FAILURE.

If engine failure is simulated before refusal speed is reached:

a. Follow Abort Procedures as outlined in this section. Simulate engine shutdown procedure as required. If engine failure is simulated after refusal speed, follow Take-Off Continued After Engine Failure procedures in this section.

INFLIGHT EMERGENCIES.

WARNING

- Under certain conditions it may be impossible to obtain or maintain safe flight. When ground contact is unavoidable maintain directional control and touchdown with wings level.

ENGINE FAILURE.

The effect of losing various combinations of engines must be understood and anticipated, because related systems are integrated between the engines (see figure 3-3). In all combinations of two-engine failures, watch the generator loading. If generator loading is too high, shut off electrical equipment, as required, to keep loading within the range of available output. Depending on aircraft weight, it may not be possible to maintain level flight with two engines inoperative and wing flaps extended. Upon loss of either number one or number two engine, retraction of the wing flaps may be advisable.

WARNING

Two-engine operation above 120,000 pounds is marginal.

Flight Characteristics Under Partial Power Conditions.

The airplane has excellent flight characteristics even when an engine is inoperative. All control surfaces are booster operated, so that no great amount of pilot force is necessary to correct the turning action caused by uneven power conditions. Some trim changes will be required. More rudder deflection will be required at low speed to counteract the unbalanced thrust. With uneven power conditions, the minimum control speed will be limited by the available rudder effectiveness. Failure of an outboard engine may require the reduction on the opposite outboard engine. Consult T.O. 1C-130(A)H-1-2 for recommended cruise and climb procedure for two-and three-engine operation. In the event two engines fail and a safe altitude cannot be maintained, jettison fuel and equipment as necessary.

Note

Directional trim is used to compensate for the asymmetric drag on the gunship configurations. This trim reduces the rudder effectiveness by less than 1 degree and will have a negligible effect on minimum control speeds.

Practice Maneuvers With One or More Engines Inoperative.

Engine failures may be simulated for practice, when desired. To simulate a feathered propeller, retard one or more throttles to FLIGHT IDLE position. The checklist procedure for engine failure can be called out without actually performing the operations named. Practice maneuvers at a safe altitude. Select a base point and set up a simulated field elevation. Traffic patterns can be flown at the normal altitude above this base point.

WARNING

- During take-off, or while airborne, do not move the throttles below the FLIGHT IDLE position. Placing any propeller in the taxi range may result in immediate loss of control of the airplane.
- If the airplane is allowed to fly in an extreme yaw condition, it is possible to experience engine failure(s) due to fuel starvation.

During practice feathering, perform engine shutdown by Engine Shutdown Procedure in this section. Prior to practice engine shutdown in flight, perform an NTS check as outlined in Section II.

two engines inoperative

CAUTION

IN ALL COMBINATIONS OF TWO ENGINE FAILURES, MONITOR GENERATOR LOADING TO KEEP IT WITHIN THE RANGE OF AVAILABLE OUTPUT.

ENGINES INOPERATIVE	SYSTEMS AFFECTED	
	HYDRAULIC	ELECTRICAL
NO. 1 AND NO. 4	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 1 AND NO. 4 GENERATOR OUT.
NO. 2 AND NO. 3	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	AUTOMATIC ICE DETECTION SYSTEM WILL BE OUT. DE-ICING SYSTEMS MAY BE OPERATED MANUALLY. NO. 2 AND NO. 3 GENERATOR OUT. SYNCHROPHASER MASTER WILL BE INOPERATIVE.
NO. 1 AND NO. 2	UTILITY SYSTEM PUMPS WILL BE OUT. WING FLAPS TO BE OPERATED MANUALLY. EMERGENCY SYSTEM AVAILABLE FOR LANDING GEAR EXTENSION AND NOSE WHEEL STEERING. AUXILIARY SYSTEM AVAILABLE FOR EMERGENCY BRAKES AND ELEVATOR BOOST. AILERON AND RUDDER BOOST TO BE SUPPLIED BY BOOSTER SYSTEM AT HALF NORMAL FORCE.* **CAUTION** ANTI-SKID INOPERATIVE.	NO. 1 AND NO. 2 GENERATOR OUT.
NO. 1 AND NO. 3	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 1 AND NO. 3 GENERATOR OUT.
NO. 2 AND NO. 4	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 2 AND NO. 4 GENERATOR OUT.
NO. 3 AND NO. 4	BOOSTER SYSTEM PUMPS WILL BE OUT. FLIGHT CONTROLS BOOST TO BE SUPPLIED BY THE UTILITY SYSTEM AT HALF NORMAL FORCE. *	NO. 3 AND NO. 4 GENERATOR OUT.

* ADDITIONAL RUDDER HYDRAULIC BOOST OBTAINED BY MOVING FLAP LEVER BELOW 15 PERCENT.

Figure 3-3.

Turns.

Turns can be made safely with one or more engines inoperative on the same side if an adequate speed margin is maintained above the respective charted minimum control speed. The minimum speed increment recommended is 20 knots for one engine inoperative and 25 knots for two engines inoperative. Such turns should be well coordinated to minimize slip or skid. Minimum control speeds are defined for straight flight using the favorable sideslip effect on yawing moment developed by a maximum of 5 degrees of bank away from the failed engine(s). The above speed margins allow the use of the rudder for turn coordination and a safety margin for inadvertent slip or skid. Banking into the inoperative engine(s) increases minimum control speed.

Effect of Speed on Trim.

During engine-out operation, as in all other types of operation, trim is affected by speed. After trim is set, any increase of airspeed increases the effect of the trim tabs; conversely, any decrease of airspeed reduces the effect of trim tabs.

Landing and Go-Around.

Landings and go-arounds with feathered engines may be simulated at altitude by flying a traffic pattern over a basic altitude. Roll out most of the trim as touchdown point is reached. During a go-around practice, note the altitude lost between the go-around decision and the time the airplane is safely in a climb condition. Note the airplane acceleration characteristics during these maneuvers.

Air Minimum Control Speed.

In-flight minimum control speed is defined as the minimum speed, for a given airplane configuration, at which directional control of the airplane may be maintained with one outboard engine inoperative and windmilling on NTS, the operating engines at maximum power, using full rudder pedal deflection and a five degree bank away from the inoperative engine. Increasing the bank away from the inoperative engine reduces minimum control speed because of the favorable effect of the sideslip angle which must accompany the increased bank angle. A 5 degree bank is specified in the definition of minimum control speed in order to maintain safe margins of control and operating conditions. Minimum control speeds will be higher if less than 5 degree bank angle or bank into the inoperative engine is attempted. Minimum control speed will be a higher value when the flap lever is set between zero and 15 percent due to a decrease in rudder boost pressure from 3000 to 1300 psi. Refer to T.O. 1C-130(A)H-1-2 for minimum control speeds.

AIR START PROCEDURE.

CAUTION

- Do not attempt to restart an engine which was shut down because of evidence of fire. Do not attempt to restart an engine which was shut down because of fire warning without evidence of fire, or any other engine malfunction unless, in the opinion of the pilot, a greater emergency exists.
- Do not attempt to restart an engine with an inoperative NTS except in case of a greater emergency. Prior to air start of an engine on which the NTS has been previously determined to be inoperative, reduce the air speed to 130 KIAS and the altitude to below 5,000 feet.

Before restarting an engine that has been shut down in flight, be sure that the TIT for that engine has dropped below 200°C. Temperature higher than 200°C will increase the likelihood of a hot start. Never move the throttle below the FLIGHT IDLE position in flight. The position of the engine condition lever is assumed to be FEATHER. The engine will normally come up to speed more rapidly if the airspeed is reduced to 180 knots or less. The recommended airspeed for airstart is 180 KIAS or less.

1. Prepare for air start	"Complete"	E
a. Fire handle-	IN	
b. Throttle-	1 inch above FLIGHT IDLE	

c. Fuel boost pump switch — ON

d. Oil cooler flap switches — AUTO

e. Fuel enrichment switches — NORMAL

CAUTION

When engine airstarts using AVGAS are initiated above an indicated TIT of 100°C, the fuel enrichment switches should be OFF to prevent torching and explosive ignition.

f. Propeller governor control switch — MECH GOV

g. NTS check switch — VALVE

h. TD valve switch — AUTO

2. Condition lever — "AIR START" — CP

Note

- Hold the engine condition lever in AIR START until lightoff; then release to RUN. Monitor engine instruments as during a ground start. The engineer will monitor the NTS check light and state "NTS check" when NTS indication is observed by blinking of the light. If NTS is not indicated by 10 percent engine rpm, the copilot will return the condition lever to FEATHER immediately and discontinue the start.

- If normal airstart cannot be accomplished because of failure of the propeller to rotate, and blade angle change is indicated by illumination of NTS light, an emergency start may be attempted by opening the bleed air valve and using the engine starter to help unlock the propeller brake.

CAUTION

Normal lightoff should occur by the time engine rpm reaches 30 percent. If the engine does not lightoff prior to reaching 40 percent rpm, discontinue the start and return the condition lever to FEATHER immediately.

CAUTION

If NTS is not indicated, interruption of the start cycle after light-off by an attempt to feather before the engine has reached a stabilized speed may result in decoupling and severe overspeed.

3. Engineer's report	"Complete"	E
a. Generator switch	RESET, ON	
b. Engine bleed air switch	OPEN	
c. Propeller governor switch	NORMAL	
d. Prop resynchrophase switch	RESYNC, NORMAL	
e. Feather valve and NTS check switch	NORMAL	
f. Fuel enrichment switch	OFF	
g. Engine instruments	"Within limits"	

PROPELLER FAILURES.

A propeller malfunction may be caused by synchrophaser, electrical, or hydro/mechanical malfunction.

Improper synchrophaser operation may cause indications of a propeller malfunction which may be eliminated by assuring proper setting of the master trim knob or by performing the Re-Indexing Procedure contained in Section VII of this manual. Additionally, a tachometer generator failure may give false indications of propeller failure by unusually pronounced low or fluctuating rpm indication. Refer to Tachometer Generator Failure in this section.

Major propeller operating malfunctions will be indicated by one or both of the following indications.

a. RPM outside allowable limits (surge, fluctuation, exceeding cycle variation limits, or stabilized operation outside normal governing limits in Section V of this manual).

b. Illumination of propeller low oil light. Other indications, such as audible beat, periodic minor changes in rpm (hunting), etc., are considered minor trim or adjustment problems and may be handled by following normal procedures in this manual.

Propeller Malfunctions During Take-off Prior to Refusal Speed:

a. Follow Abort Procedures in this section.

Note

With a propeller malfunction which may result in directional control problems, the aircraft can be expected to pull toward the side with the affected propeller as power application and/or airspeed increases.

After refusal speed:

a. Continue the take-off, maintaining directional control with flight controls and engine power as necessary.

WARNING

Below two-engine operative air minimum control speed, it may be necessary to reduce power on the symmetrically opposite engine to help maintain directional control.

b. When safely airborne, raise landing gear while accelerating to 150 KTAS.

Note

It is important to attain two engine minimum control speed plus 20 knots as soon as possible after takeoff and prior to raising flap lever above 15 percent.

WARNING

If uncontrolled overspeed (above 105 percent rpm) occurs, attain an airspeed (not less than two-engine inoperative air minimum control speed) at which safe control of the airplane can be maintained prior to adjusting throttle position for the affected engine or otherwise attempting to analyze the malfunction.

c. Place prop governing control switch to MECH GOV. E/CP

(1) If malfunction is eliminated, continue operation in MECH GOV.

d. If malfunction persists, accelerate to and maintain as near 150 KTAS as possible. If immediate landing is feasible, follow Engine Shutdown Procedure in this section. If immediate landing is not feasible, continue with propeller malfunctions during flight in this section

Propeller Malfunctions During Flight.

WARNING

If uncontrolled overspeed (above 105 percent rpm) occurs, reduce airspeed to the speed at which safe control of the airplane can be maintained but not less than two-engine inoperative air minimum control speed. Do not adjust the throttle position for the affected engine before the malfunction has been analyzed.

RPM WITHIN ALLOWABLE LIMITS AND LOW OIL WARNING LIGHT ILLUMINATED. Proceed as follows:

1. Shutdown the engine in accordance with the ENGINE SHUTDOWN PROCEDURE in this section.

RPM OUTSIDE ALLOWABLE LIMITS WITH LOW OIL LIGHT ILLUMINATED. Proceed as follows:

1. Propeller governor control switch MECH GOV (E/CP)

   a. If rpm stabilizes within allowable limits, shutdown the engine in accordance with the ENGINE SHUTDOWN PROCEDURE in this section.

   b. If rpm does not stabilize within allowable limits, perform Pitchlock Check Procedure in this section.

RPM OUTSIDE ALLOWABLE LIMITS WITHOUT LOW OIL LIGHT ILLUMINATED. Proceed as follows:

1. Propeller governor control switch - MECH GOV (E/CP)

   a. If rpm stabilizes within allowable limits, continue operation in MECH GOV.

   b. If rpm remains outside allowable limits, perform Pitchlock Check Procedure in this section.

Pitchlock Check Procedure.

1. TD valve switch for affected engine "LOCKED" E

Note

Locking the TD valve will prevent a crossover bump if throttle is moved through crossover (65°) position.

2. Slowly move the throttle (until a TIT change is noted) while maintaining constant TAS. P

Note

- If a TIT change is not noted and engine rpm is high, the engine may be on fuel control governing and throttle travel may be insufficient for rpm to follow. In this case, a change in TAS will be necessary to verify pitchlock. A reduction in TAS is recommended (not below two-engine minimum control) as rpm is already on the high side.
- If rpm increases or decreases with a corresponding change in throttle setting/TAS, it is reasonable to assume that the propeller is pitchlocked.

3. If rpm does not follow the throttle/TAS, follow the Engine Shutdown Procedure in this section.
4. If rpm follows the throttle/TAS, continue to operate in accordance with the Pitchlocked Propeller Operation.

Pitchlocked Propeller.

In nearly all cases after an inflight pitchlock, the propeller can be utilized to provide some positive thrust. RPM will be determined by engine power and true airspeed.

When determination of a pitchlock is made, it is desirable to operate the propeller in an underspeed condition 96 to 98 percent rpm. Then, if intermittent governing is experienced, the propeller will try to decrease pitch to return to an onspeed condition, thus assuring a positive pitchlock. It is necessary that the underspeed not be low enough for the engine acceleration bleed valves to open.

To maintain a constant rpm will require a relatively constant true airspeed. For this reason, the flight and descent (if required) should be conducted at approximately the same true airspeed as when the malfunction occurred.

Points of major importance concerning a pitchlocked propeller are:

a. A pitchlocked propeller may not feather.

b. Drag produced by a windmilling propeller coupled to the power section is approximately six times higher than decoupled drag, thus in case of a failure to feather, it is desirable to cause the propeller to decouple. 150 KTAS is considered high enough to cause decoupling but not high enough to produce excessive drag or overspeed after decoupling occurs.

c. If at least 96 percent rpm cannot be maintained by throttle advancement when slowing to 150 KTAS, it can be assumed that blade angle is high and shutdown at higher airspeed will produce an acceptable windmilling drag and rpm.

d. If rpm can be maintained at 150 KTAS, blade angle is probably near or at the low pitch stop. In this case, shutdown at higher true airspeed would produce excessive drag or overspeed.

Pitchlocked Propeller Operation.

1. TD valve switch	"LOCKED"	E
2. Engine bleed air valve	"CLOSED"	E
3. Establish 96 to 98 percent rpm with throttle and/or airspeed adjustment and continue to operate at this rpm.		P
4. Upon reaching a suitable landing area, attain 150 KTAS (if possible).		P

WARNING

Do not allow airspeed to decrease below two-engine inoperative air minimum control speed plus 20 knots.

5. Upon reaching 150 KTAS or a point where 96 percent rpm cannot be maintained with the throttle, whichever occurs first, shut down the engine in accordance with Engine Shutdown Procedures in this section.

Propeller Fails to Feather.

If a propeller fails to feather, a landing can be made with it windmilling. The drag will be greater than with a feathered propeller and high RPM and noise may be experienced.

WARNING

To prevent loss of aircraft control, minimum safe airspeed must be maintained. It may be necessary to reduce power on the symmetrically opposite engine to help maintain directional control.

If propeller rotation continues after feathering, proceed as follows:

1. Attain 150 KTAS (if possible). P

WARNING

Use caution when applying asymmetrical engine power.

2. Hold feather override button in for 30 seconds and then pull out. CP

CAUTION

If rotation continues without indication of fire, restore oil to engine by resetting the fire handle.

3. Land as soon as practical. P

WARNING

Maintain airspeed above two-engine inoperative air minimum control speed until the landing is assured. A go-around should not be attempted if airspeed is below two-engine inoperative air minimum control speed. Go-around with a windmilling propeller may be marginal.

Inflight Decoupling of Engine and Propeller.

The reduction gear section decouples from the power section of the engine if a propeller attempts to drive the power section, and the engine negative torque control system fails to operate. As negative torque builds up before decoupling of an engine takes place, airplane yaw may be noticed. However, there may be little or no difference in airplane feel, and the knowledge that an engine has decoupled must be gained from instrument indication. If the decoupling is caused by engine failure or flame out, torque, turbine inlet temperature and fuel flow will drop to near zero, and power section oil pressure will drop. RPM may temporarily increase, then settle to normal. Hydraulic pressure, generator output, and reduction gear section oil pressure will remain normal. Extremely low turbine inlet temperature and fuel flow for a given power lever position, accompanied by fluctuating and near zero torque, may be an indication of a decoupling in which the engine has continued to operate. When decoupling is observed, follow the Engine Shutdown Procedure in this section. Do not restart the engine.

ENGINE SYSTEMS FAILURE.

THROTTLE CONTROL FAILURE.

Throttle control failure may be indicated by any of the following conditions:

1. Throttle moves independently of pilot input.

WARNING

Do not attempt to restrain a throttle which moves on its own. To do so may cause the propeller to go immediately into reverse or to full power.

2. Throttle frozen or binding.

3. Power indication unrelated to throttle position.

If any of the above conditions are present, a throttle cable/control failure may have occurred. Shut down the engine immediately, utilizing the Engine Shutdown Procedure in this section.

WARNING

Do not move the throttle prior to engine shutdown. To do so could cause the propeller to go immediately into reverse pitch or to full power.

TD Control Valve System Malfunction.

A malfunction of the TD control valve system of an engine may cause a sudden increase or decrease in TIT with an accompanying change in torque and fuel flow indication. If this condition occurs during stabilized operation, place the TD control valve switch for that engine in the NULL position. If TIT stabilizes and returns to near normal, place the switch in the LOCKED position, and continue operation. If the malfunction persists, other engine systems are at fault. Monitor TIT closely during NULL operation as maximum TIT can often be exceeded at advanced throttle settings under these conditions.

Secondary Fuel Pump Pressure Light Illumination.

Illumination of the secondary fuel pump pressure light above 65 percent engine rpm may be caused by failure of the engine driven fuel pump, pressure switch, paralleling valve stuck closed, or failure of the 65 percent switch in the speed sensitive control. If the light is extinguished when the ignition control circuit breaker for the corresponding engine is pulled, failure of the 65 percent switch in the speed sensitive control is indicated. Leave the circuit breaker pulled and continue operation. After landing, shut down engine by placing the condition lever to FEATHER.

Note

> If the secondary fuel pump pressure light remains illuminated with the ignition control circuit breaker pulled, reset the circuit breaker. Failure of the primary fuel pump could cause metal contamination of the engine fuel system. Engine shutdown may be advisable at the pilot's discretion.

Speed Sensitive Control Failure (Sheared Shaft).

A sheared shaft on the speed sensitive control with the throttle above 65 degrees travel may be indicated by momentary illumination of the secondary fuel pump pressure light, fuel correction light and TIT will not exceed start limiting temperature of 830 degrees C. A sheared shaft with throttle below 65 degrees may be indicated by momentary illumination of the secondary fuel pump pressure light and TIT will not exceed start limiting temperature of 830 degrees C. If either of the above conditions occur, place the TD valve switch to NULL, pull the ignition control circuit breaker and continue operation. After landing, use normal ground idle speed only and shutdown the engine by placing the condition lever to FEATHER.

Note

> Overtemperature protection is not available with TD valve switch in NULL.

Engine Oil System Failure.

The indications of an engine oil system failure that may lead to engine failure are: loss of oil pressure or an oil temperature increase. High oil temperature may result from failure of an oil cooler flap to function in AUTOMATIC . To correct this, hold the oil cooler flap switch in the OPEN position until the oil cooler flap is open. Thereafter, manually open or close the oil cooler flaps as required to maintain normal engine oil temperature. If engine oil temperature cannot be maintained within limits, shutdown the engine in accordance with the Engine Shutdown Procedure in this section. The low oil quantity warning light glows when the oil level in a tank drops to approximately 4.0 gallons. This condition warrants careful monitoring of the engine instruments for the engine with the low oil quantity gage reading, but no corrective action is required as long as the engine instrument readings are within limits. In case of a loss of oil pressure, shut down the engine in accordance with the Engine Shutdown Procedure.

Note

> If the rate of quantity loss is gradual and length of mission would require engine shutdown prior to termination, the pilot may elect to shut down the affected engine and restart at a later time when conditions necessitate.

VISIBLE FLUID LEAK.

If the pilot determines that excessive engine fluid leaks are present the engine should be shut down in accordance with the ENGINE SHUTDOWN PROCEDURE.

Tachometer Generator Failure.

A tachometer generator failure may be indicated by the following simultaneous indications.

Decrease or fluctuation of rpm.

Increase or fluctuation of fuel flow.

Decrease or fluctuation of torque.

If a tachometer generator failure occurs, proceed as follows:

a. Sync master switch (if the affected engine is selected) - OFF/other MASTER

b. Prop gov control switch - MECH GOV

FUEL SYSTEM FAILURE.

Fuel Boost Pump Failure.

A fuel boost pump failure, in a tank containing fuel, will be indicated by a low pressure warning light (main tanks) or a tank empty light (auxiliary external/fuselage tanks). Pressure loss will be verified by use of fuel pressure indicator. If failure is confirmed or pop out of either A, B, or C phase circuit breaker is experienced, continue as follows:

a. Turn off affected boost pump switch.

b. Pull affected boost pump circuit breakers.

c. Set up another fuel supply if required.

WARNING

The fuel boost pump switch should not be turned on or the circuit breakers reset until proper inspection and repairs have been performed. Resetting of the circuit breakers and turning the switch on should be considered only to prevent fuel starvation of the engines when a landing cannot be accomplished within the range of available fuel.

If a main tank boost pump failure occurs during climb, crossfeed the engine from another tank and continue climb to mission altitude. Allow the fuel to stabilize for several minutes, then switch the engine back to the tank with the inoperative boost pump, closely observe fuel flow, turbine inlet temperature, and torque. If the engine operates satisfactorily in this condition continue the mission as planned, if the engine will not operate satisfactorily in the tank to engine position switch back to crossfeed operation.

Note

- For IFR modified aircraft, the fuel may still be usable from main or external tanks by pressurizing the crossfeed manifold with the dump pump.
- When operating in tank-to-engine position with an inoperative boost pump, avoid rapid acceleration or nose low attitudes. Descents should be made with minimum nose down attitude. If a high rate of descent is required, it is advisable to select crossfeed operation.

Wait several minutes and repeat preceding step. If engine fails to operate satisfactorily return to crossfeed operation. At this time it may be necessary for the pilot to change his flight plan to avoid major fuel unbalancing and loss of range due to unavailable fuel. If the mission can be accomplished at a lower altitude, descend until engine will run satisfactorily on tank-to-engine flow.

Note

Do not select crossfeed unless the crossfeed system is pressurized by operating boost pumps in other tanks.

Gradual power losses will occur between twelve and twenty thousand feet during rapid climb out to an engine without boost pump pressure. This altitude will vary with the prevailing fuel temperature and type fuel in tanks (the higher the fuel temperature the lower the altitude at which the power loss will occur). This condition results from the highly aerated condition of the fuel caused by rapidly decreasing atmospheric pressure during climb allowing entrapped air in the fuel to expand. The period of time required for the fuel to stabilize from this aerated condition will depend upon both the rate of climb and fuel temperature. Fuel stabilization should occur in a few minutes after level off at cruise altitude once the excess air has escaped from the fuel. Maximum power settings can be maintained up to altitude of 30,000 feet with a boost pump inoperative if nose up or nose down attitude and rapid acceleration are avoided. Fuel aeration does not occur during descent. If a boost pump is lost, the corresponding jet-pump-ejector will be turned off when the boost pump switch is placed in the OFF position. This may result in fuel starvation for the affected engine in an extreme nose-down attitude unless crossfeed operation is used. It is impossible to gravity feed fuel from a tank with an inoperative boost pump through the crossfeed system to another engine. If a partial tank and an empty tank are on crossfeed with the boost pump inoperative in the partial tank, the engine being fed from the empty tank will be starved by air being drawn into the fuel line.

Fuel Quantity Indicator Failure.

A malfunction of any fuel quantity indicator may indicate a possible failure that would, with the proper sequence of events, allow the introduction of high voltage electrical power into the associated fuel tank. If the fuel quantity indicator goes to off scale high or off scale low, the following action must be complied with:

Pull the associated fuel quantity indicator circuit breaker.

WARNING

The indicator will not be removed or changed and the circuit breaker will not be reset until proper inspection and repairs have been made.

External or Auxiliary Tank Crossfeed Valve Failure.

If an external or auxiliary tank crossfeed valve fails to open when crossfeed operation from that tank is desired, open the bypass valve for that tank and the operative external or auxiliary tank crossfeed valve on the same side.

External or Auxiliary Tank Dump Valve Failure.

If an external or auxiliary tank dump valve fails to open when fuel dumping from that tank is desired, the fuel may be dumped through the bypass valve and the operative dump system for the external or auxiliary tank on that side.

Auxiliary Tank And External Tank Boost Pump Failure.

If an auxiliary or external tank empty light illuminates when its respective quantity gage indicates fuel inboard, refer to Fuel Boost Pump Failure in this section.

To confirm failure by use of the fuel pressure indicator, go on main tank feed for all engines and check the pump pressure. Open the crossfeed separation valve and close all crossfeed valves except for tank being checked.

If no pressure is obtained, the pump is inoperative.

Note

If an external tank pump has failed, turn on the tanks alternate pump and check for operation. If both external tank pumps are inoperative, fuel remaining in the tank will not be available and the flight must be altered accordingly.

If a pressure of approximately 28 psi is indicated, the pump is operating properly and the pressure sensing tank empty light switch is malfunctioning. Flight may be continued normally except that the quantity gage for that tank must be monitored to determine an empty condition. A pressure of less than approximately 28 psi on a single boost pump is an indication of possible failure. Operation under these conditions may be continued with caution, except other boost pumps supplying pressure to the same manifold must be turned off to allow the pump with the lower boost pressure to dominate.

Refer to Section VII for allowable fuel unbalance.

External Fuel Leaks (Drip or Running Type).

External fuel leaks encountered in flight present a fire hazard if the leak is in close proximity to an engine. The possibility of a wing fire from an external fuel leak is increased on landing if reverse thrust is applied. If an external fuel leak is encountered near an engine, shutdown of the engine should be considered. Land at the nearest airfield which has sufficient runway to complete the landing ground roll without use of reverse thrust. Because of the possibility of fire, an emergency should be declared and fire suppression equipment requested.

WARNING

Do not use reverse thrust when landing with a known or suspected fuel leak. If reverse thrust is used a fire may develop.

FUEL DUMPING.

Should it become necessary to dump fuel in preparation for an emergency landing, to reduce gross weight in an emergency, or to provide for additional buoyancy in ditching operation, follow the procedure outlined below:

1. Advise an air traffic control facility of the intentions to dump fuel.

2. Set the fuel system for tank-to-engine flow.

WARNING

If the fuel dump switches for the external tanks or the auxiliary tanks are placed in the DUMP position while those tanks are supplying fuel to the engines, the respective tanks crossfeed valves are automatically closed, shutting off fuel flow to the crossfeed manifold.

3. Place both dump valve switches to OPEN (airplanes modified by T.O. 1C-130-949).
4. Turn all unnecessary radio equipment off.
5. Turn the radar off.
6. Turn all unnecessary electrical equipment off.
7. Turn off the anti-collision light.
8. Do not operate the landing lights.
9. No smoking while dumping.
10. Break the safety wire on the fuel dump switch for each of the fuel tanks from which fuel is to be jettisoned, and place the switches in the DUMP position.

Note

Dump opposite tanks at the same time in order to maintain lateral balance.

11. Monitor the fuel quantity indicators closely.
12. Return the fuel dump switching to NORMAL when the fuel quantity in each tank has been decreased as required.
13. Place dump valve switches to NORMAL (airplanes modified by T.O. 1C-130-949).
14. Landing lights - As required.
15. Anti-collision light - ON.
16. Electrical equipment - As required.
17. Radar - As required.
18. Radio equipment - As required.

The following procedures are recommended when dumping fuel if conditions permit:

Do not dump fuel under 5,000 feet above the terrain. This will prevent the possibility of a ground source igniting the fuel vapors.

Do not dump in a circular pattern; this will prevent turning into the dropping fuel.

Do not use wing and empennage and anti-icing. The temperature of the hot air may ignite the fuel.

Avoid engine power changes. Static charges could conceivably build up and ignite the fuel.

After the dumping operation, inspect the airplane for fumes.

Note

After completing fuel dumping and if time permits prior to landing, the fuel dumping manifold should be cleared of residual fuel. Cross-controlling the airplane and ensuring a wing-low attitude with slight skid, will deplete all residual fuel except that located at low points in the manifold. This will minimize the fire hazard of excessive fuel drainage coming from the fuel dumping jettison mast due to normal wing deflections and attitudes during taxi or while the airplane is parked.

ELECTRICAL SYSTEMS FAILURE.

Note

Never use circuit breakers as switches. Circuit breakers should be pulled only during emergencies or maintenance. Any open circuit breaker system will be checked unless recorded in AFTO Form 781.

With modern complex airplanes, it is extremely difficult to anticipate all the possible electrical failures and to plan corrective action and procedure for each failure. However, a broad analysis of the situation indicates that failures fall into three possible categories:

Loss of one or more of the primary power sources.

Faults on the distribution system.

Faults within equipment items.

fuel dumping chart

APPROXIMATE DUMP TIME				
POUNDS FUEL	MINUTES TO DUMP			
	4 PUMPS OPERATING	6 PUMPS OPERATING	8 PUMPS OPERATING	10 OR MORE PUMPS OPERATING
5,000	3.0	2.0	1.0	1.0
10,000	6.0	4.0	3.0	2.0
20,000	12.0	8.0	6.0	4.0
30,000	17.0	12.0	9.0	7.0
40,000	23.0	15.0	12.0	9.0
50,000	29.0	19.0	14.0	12.0

Figure 3-4.

Faults in the distribution system and load circuits should be controlled through protective devices such as circuit breakers, fuses, and current limiters. Should one of these devices fail to operate, considerable smoke can result and some emergency action on the part of the crew may be needed. If a malfunction occurs to the left hand, right hand, or main ac bus or equipment on these busses, it may be necessary to turn off all four engine driven generators to isolate the problem. In this case the ATM generator should be turned on prior to turning the engine driven generators off. This will supply power to the essential bus only. This will allow the crew to evaluate the situation and determine which bus and/or component caused the malfunction and to take the proper corrective action. Loss of one or more of primary power sources, however, will require the crew to take prompt action by closely watching electrical loads, so that the remaining power sources will not be overloaded.

Note

If electrical power to the IFF is lost, mode 4 codes will be zeroized unless the HOLD function has been activated.

Loss of the Essential AC Bus.

A loss of one phase of the essential ac bus may occur with or without illumination of the essential ac bus off light. The malfunction is most likely to occur during high load conditions of the essential ac bus and may be indicated by one of the following conditions:

a. Failure of normal brakes (if on the ground).

b. Erratic autopilot operation (if in use).

c. Loss or malfunction of heading indicators and navigational aids.

d. Auxiliary hydraulic pump failure.

e. Illumination or flickering of the No. 2 fuel boost pump low pressure warning light.

f. Illumination of a hydraulic suction boost pump light.

g. Illumination of the essential ac bus off light which remains illuminated after the affected generator is turned off (another generator does not assume the bus load).

h. Loss of propeller synchrophaser.

If partial loss of the essential ac bus either occurs or is suspected, proceed as follows:

a. Turn anti-skid OFF. CP

b. Place both inverters to the DC BUS POSITION. E

c. Reduce load on the essential ac bus to the minimum. Do not operate the auxiliary hydraulic pump. Pull the 6 DC ESS TR-1 and TR-2 circuit breakers located on the pilots' side circuit breaker panel. E/CP

d. Check all A, B, and C phase essential ac bus power circuit breakers on the pilot's side circuit breaker panel and on the main ac distribution panel at F.S. 245. Reset any tripped breakers. E

Note

Place the propellers to mechanical governing prior to resetting the circuit breakers. If all four propellers are not placed in the mechanical position prior to resetting the circuit breakers, a significant power fluctuation may be experienced.

e. If breakers are in, will not reset, or trip again, place ATM and generator ON. Again attempt to reset any tripped breakers. E

f. If breakers still will not reset, or trip again, isolate the essential ac bus. E

g. Turn the generator, which was supplying the bus at the time of the malfunction, to OFF and monitor. If generator indications are subsequently lost, follow Illumination of a Generator Out Light procedure in this section. E

h. Review Section I to ascertain which systems have been lost. E

i. If an essential ac bus malfunction is experienced, the airplane will be landed as soon as possible, regardless of the apparent success of the corrective action. P

Generator Failure.

Generator failure or generator system malfunction will be indicated by illumination of a generator out light only, illumination of a Bus Off light only, or a generator out light and a Bus Off light simultaneously or fluctuating/out of limits voltage. If the average phase voltage of a generator is below approximately 90 volts, the Bus Off light will illuminate. If any phase voltage is below approximately 70 volts, the generator out light will illuminate.

CAUTION

With low generator voltage and normal frequency, the generator will continue to energize its respective bus, possibly causing damage to airplane equipment, unless the generator switch is turned off.

Corrective action for each condition is covered in the following paragraphs.

Illumination of a Generator Out Light.

If a generator out light illuminates, the engineer will proceed as follows:

a. Check frequency, voltage and load.

b. If normal, leave generator switch ON and monitor frequency, voltage, and load.

Note

If the generator control switch is turned OFF, it may not be possible to utilize power from the generator because the power to energize the generator contactor relay is supplied by the transformer rectifier unit within the generator control panel.

c. If voltage and frequency are normal with no indication of load, place the generator switch to OFF and monitor the voltage and frequency.

d. If no voltage and frequency are indicated, place the generator switch to RESET then OFF.

e. If frequency and voltage are normal, resume normal operation.

f. If frequency and voltage are not indicated on all three phases after placing the switch to RESET, it can be assumed the generator has failed. Disconnect the generator using the procedure under Generator Disconnect in this section. If generator disconnect is not installed or is inoperative, the engine should be shut down in accordance with engine shutdown procedures in this section.

g. If frequency and voltage are indicated but voltage is observed to momentarily peak above normal and return to zero, it can be assumed an overvoltage or generator feeder fault condition caused illumination of the light. In this case, disconnect the generator using the procedure under Generator Disconnect in this section. If generator disconnect is not installed or is inoperative, the engine should be shut down in accordance with engine shutdown procedures in this sections.

Note

If generator failure is confirmed during taxi, the affected engine may be shutdown by placing the condition lever to ground stop in lieu of generator disconnect or engine shutdown procedures.

Illumination of an AC Bus Off Light.

a. Place the affected generator switch on the OFF position; insure another generator picks up the failed bus.

b. Check for frequency and voltage of the affected generator.

c. If voltage is low on any phase, leave the generator off and monitor the voltage and frequency closely. Upon loss of indication, disconnect the generator using the procedure under Generator Disconnect in this section. If generator disconnect is not installed or is inoperative, shutdown the engine in accordance with the engine shutdown procedures in this section.

d. If the bus off light remains illuminated with frequency and voltage normal, and no other items have failed or are erratic that are operated by that bus, it indicates the power (bus off) indicator relay for that bus has failed, resume normal operation and monitor affected generator.

e. If the other generator does not pick up the failed bus and the failed bus cannot be restored to normal operation, Section I should be reviewed to ascertain which systems have been lost.

Generator Disconnect.

The generator can be mechanically disconnected from the engine by holding the gen disc switch to DISC for approximately two seconds. Firing of the disconnect mechanism is indicated by the illumination of the disc fired light. Once disconnected, a generator cannot be reconnected in flight.

Note

If generator failure is confirmed during taxi, the affected engine may be shut down by placing the condition lever to ground stop in lieu of generator disconnect or engine shutdown procedures.

Loss of Electrical Systems.

The possibility of the loss of all electrical systems is very remote. In the event of a complete loss of electrical power, the following systems will be operable.

Flight instruments:

Altimeter
Airspeed Indicator
Magnetic Compass
Attitude Director Indicator (slip indicator portion)
Vertical Velocity Indicator
Accelerometer

Engines and Propellers:

Engine shutdown can be accomplished only by placing condition lever to FEATHER.

Throttle control only (TD valves locked - no TD control system)
Tachometer
Propellers will go to mechanical governing

Anti-Icing and De-Icing:

Engine air inlet scoop and guide vane anti-icing

Pressurization and Air Conditioning:

Flight Controls:

Normal boost (Rudder boost pressure reduced to low boost)
Wing flaps (Hydraulic override)

Note

Due to the loss of power to the trim tab system, a no flap landing is recommended.

Fuel available from main tanks.

Normal brake system (no anti-skid)
Nose wheel steering
Landing gear system (hydraulic override)
Emergency lights
Oxygen system
Aft cargo door and ramp system (manual)

Illumination of the Isolated DC Bus on Battery Light.

Inflight failure of the reverse current relay connecting the essential and isolated dc buses will be indicated by illumination of the isolated dc on battery light and/or battery voltmeter indication of 24 volts or less. If these indications are observed, battery power conservation measures must be initiated. An assessment of flight conditions and electrical power requirements should be made to determine what battery and isolated dc powered items may be turned off to conserve battery power. Land the aircraft as soon as possible.

BLEED AIR SYSTEM FAILURE.

A serious bleed air system leak may cause burning of electrical wire bundles and/or overheating of aircraft equipment and may be indicated by one of the following conditions:

Illumination of the GTC fire warning lights.
Erratic operation of engine instruments.
Erratic operation electrical equipment.
Zero or fluctuating liquid oxygen quantity.
Inoperative or intermittent radar operation.

Two types of bleed air system failure may occur:

a. An uncontrollable loss of bleed air.

b. Failure of an engine air valve.

Uncontrollable Loss of Bleed Air.

If bleed air is being lost from the system, the engineer will proceed as follows:

a. Engine bleed air switches on the affected wing - CLOSED.

b. Isolation valve on the affected wing - CLOSED.

If the uncontrolled loss of bleed air cannot be isolated, proceed as follows:

c. All engine bleed air switch - CLOSED.

CAUTION

Do not operate the GTC after landing. If the uncontrolled loss of bleed air cannot be isolated, operation of the GTC would repressurize the area(s) where the failure has occurred.

Failure of an Engine Bleed Air Valve.

If an engine bleed air valve cannot be closed and the bleed air system is leaking, proceed as follows: Valve closure is determined by observing torque increase on the affected engine.

a. Check bleed air valve circuit breakers. E

b. If the malfunction persists, shut down the engine (conditions permitting). P

c. If conditions do not permit engine shutdown, turn on all pneumatic systems. E

d. Land as soon as practical. P

Note

The torque increase may be impossible to detect if the engine's air output is low.

Air-Conditioning Airflow Regulator.

If a system is leaking hot bleed air into the airplane, it should be shut down immediately. If the system cannot be shut off because of regulator malfunctioning and it is leaking bleed air, the engine bleed air valves must be closed to depressurize the bleed air system. In case of duct failure in a wing, close the wing isolation valve and the engine bleed air valves for the engines on that wing.

Pressurization System Failure.

Two types of pressurization system failures may occur. One type can result only from failure of the outflow valve in a closed or nearly closed position when it cannot be opened either by automatic or manual control methods. In this case, cabin pressure might increase at an excessive rate and could not be reduced by normal means. If this condition is encountered, proceed as follows:

1. Immediately close engine bleed air valves, one at a time, until the rate of pressure increase is at a safe value.

2. Control pressure by opening and closing engine bleed air valves as necessary to vary the amount of conditioned air supplied for pressurization.

3. If necessary for further control when descending, one of the air conditioning systems can be shut down to expedite depressurization of the airplane. If the flight deck unit cannot be shut down normally, manually override the flight deck refrigeration shutoff valve by pulling it to the out position to stop the air flow.

The other type of pressurization system failure is loss of ability to pressurize or maintain pressurization on either automatic or manual control and may result from any of several causes. If this situation is encountered, proceed as follows:

1. The crew should don oxygen masks immediately while initiating a descent.

2. Descend to or maintain an airplane altitude where oxygen is not required.

3. Check for excessive cabin leakage by checking doors, windows, hatches, and the safety valve.

WARNING

Do not attempt to lock or unlock any window, door, or hatch while the airplane is pressurized. First, depressurize the airplane; then turn the air-conditioning master switch to AUX VENT.

4. Check the bleed air system for excessive external leakage. Turn off all pneumatic systems, and observe the bleed air pressure gage. Close all engine bleed air valves, and time the bleed air system pressure drop from 65 to 35 psi. The time required for the pressure to drop from 65 to 35 psi should not be less than 10 seconds.

final isolation procedure

BUS	ISOLATION PROCEDURE
LH AC	REMOVE THE THREE LH AC BUS POWER CURRENT LIMITERS AT STATION 245.
RH AC	REMOVE THE SIX CURRENT LIMITERS AT STATION 245 (3 RH AC BUS POWER AND 3 DE-ICING POWER).
LH DC RH DC	PULL THE SIX LH AND RH TR CIRCUIT BREAKERS LOCATED ON THE PILOT'S UPPER CIRCUIT BREAKER PANEL (THREE ON LH AC PANEL AND THREE ON RH AC PANEL).
MAIN AC	REMOVE THE THREE MAIN AC BUS CURRENT LIMITERS AT STATION 245.
MAIN DC	PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOTS UPPER CIRCUIT BREAKER PANEL AND THE MAIN GROUND CONTROL CIRCUIT BREAKER ON THE COPILOTS LOWER CIRCUIT BREAKER PANEL.
ESS AC	PULL THE NINE ESSENTIAL AC CIRCUIT BREAKERS AT STATION 245 AND THE NINE ESS AC CIRCUIT BREAKERS ON THE PILOTS SIDE CIRCUIT BREAKER PANEL.
ESS DC	PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOTS UPPER CIRCUIT BREAKER PANEL AND THE SIX ESSENTIAL TR CIRCUIT BREAKERS ON THE PILOTS SIDE CIRCUIT BREAKER PANEL. DO NOT TIE THE BUS TIE SWITCH AFTER LANDING.
ISOL DC	PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOTS UPPER CIRCUIT BREAKER PANEL, THE SIX ESSENTIAL TR CIRCUIT BREAKERS ON THE PILOTS SIDE CIRCUIT BREAKER PANEL AND TURN THE DC POWER SWITCH TO THE OFF POSITION.
BAT BUS	THE BATTERY BUS IS POWERED ANYTIME THE BATTERY IS CONNECTED AND CANNOT BE ISOLATED. ITEMS THAT OPERATE FROM THE BATTERY BUS MAY BE ISOLATED BY PULLING ITS ASSOCIATED CIRCUIT BREAKER.

WARNING

ANY TIME POWER IS REMOVED FROM THE ISOLATED DC BUS, THERE WILL BE NO POWER FOR THE ADIS REGARDLESS OF POWER SOURCE SELECTED.

Note

ANY TIME THE MAIN AND ESSENTIAL AC BUS TR CIRCUIT BREAKERS HAVE BEEN PULLED AS A METHOD OF ISOLATING A DC BUS, THE BATTERY IS POWERING THE REMAINING DC BUSSES AND IS NOT BEING CHARGED FROM THE AC BUSSES. TURN OFF ALL UNNECESSARY EQUIPMENT.

AFTER THE FINAL ISOLATION PROCEDURE HAS BEEN ACCOMPLISHED AND THE SITUATION HAS STABILIZED, EVERY EFFORT SHOULD BE EXPENDED TO LOCATE THE MALFUNCTIONING UNIT, ISOLATE IT BY PULLING CIRCUIT BREAKERS OR REMOVING CANNON PLUG, AND RETURN ALL BUSSES TO THEIR NORMAL OPERATION. IF FOR ANY REASON A BUS CANNOT BE RESTORED TO NORMAL OPERATION, SECTION I SHOULD BE REVIEWED TO ASCERTAIN WHICH SYSTEMS HAVE BEEN LOST.

Figure 3-5.

Wing/Empennage and Wheel Well Overtemperature

If a wing leading edge or wheel well overtemperature warning light illuminates, or a wing/empennage temperature gage indicates an overheat condition, the engineer will proceed as follows:

1. If a inner or outer wing light illuminates or a wing/empennage temperature gage indicates an overheat while anti-icing is ON, immediately turn the respective system OFF. If the system was not being used or if the condition is not corrected (indicator normal/light out) within approximately 1 minute, proceed with item 3.

2. If a left, right or nose wheel well overtemperature warning light illuminates, turn the appropriate system (ATM or cargo compartment refrigeration or radome anti-icing) OFF. If the system was not being used or if the condition is not corrected (light out) within approximately 1 minute, proceed with item 3.

3. In either case, or if the system was not in use, a bleed air leak is indicated. Immediately proceed with the overheat chart.

4. If left or right wheel well overheat condition persists, a break in the bleed air manifold may have occurred outboard of the isolation valve in the wheel well sensor area. In this case, place engine bleed air switches to CLOSE/OFF (affected side only).

OVERHEAT INDICATED OR LIGHT ILLUMINATED	ACTION
EITHER L OR R OUTER WING (INDICATORS OR LIGHTS)	a. ENGINE BLEED AIR SWITCHES (AFFECTED WING) - CLOSE b. WING ISOLATION VALVE (AFFECTED WING) - CLOSED
EITHER L OR R INNER WING (CENTER WING) SOME AIRPLANES, (LIGHTS ONLY)	a. ENGINE BLEED AIR SWITCHES (AFFECTED WING) - CLOSE b. WING ISOLATION VALVE (AFFECTED WING) - CLOSED.
EITHER L OR R WHEEL WELL (LIGHTS ONLY)	a. ALL ENGINE BLEED AIR SWITCHES CLOSED b. GTC - OFF NOTE IF EITHER THE L OR R WHEEL WELL OVERHEAT LIGHT ILLUMINATES AFTER TAKEOFF AND THE CONDITION PERSISTS AFTER THE ISOLATION PROCEDURES HAVE BEEN ACCOMPLISHED, IT MAY BE ADVISABLE TO LOWER THE LANDING GEAR TO PROVIDE COOLING.
NOSE WHEEL WELL (LIGHTS ONLY)	a. ASSURE RADOME ANTI-ICING IS OFF. b. BOTH WING ISOLATION VALVES CLOSED. c. GTC - OFF
EMPENNAGE (INDICATORS ONLY)	a. ALL ENGINE BLEED AIR SWITCHES - CLOSE b. GTC - OFF

NOTE

If anti-icing is necessary, to sustain flight, engine bleed air valves may be opened as necessary provided the leading edge and empennage temperatures do not go above the normal operating range.

WING FIRE.

If a fire develops in the wing, proceed as follows:

a. Close the wing isolation valve and engine bleed air valves for engines on that wing.

b. Sideslip the airplane to keep the fire away from the fuselage.

c. Land the airplane as soon as possible.

CAUTION

It is not recommended that the wing isolation valves be reopened once they have been closed for an overheat condition. Damage to the warning system may prevent detection of a subsequent overheat condition.

ELECTRICAL FIRE.

WARNING

Because of the important part electrical controls play in the operation of this airplane, electrical power should not be shut off until the pilot is reasonably certain that it is, or will be, a contributing factor to smoke or fire, and that loss of electrical controls will not be a greater hazard than the smoke or fire.

If fire, smoke, or overheat of electrical equipment occurs every attempt should be made to locate the malfunctioning unit(s)/bus. If able to locate the source of the malfunction, isolate by turning off/pulling circuit breaker(s)/removing the cannon plug(s).

In case the fire originates in a nacelle, refer to procedures under Engine Fires for extinguishing the flame. Field trip the generator control switch for the generator in that nacelle, then turn the switch to the off position.

If unable to locate the malfunction unit(s), proceed as follows:

a. ATM and generator - "ON"

b. All engine generators - "OFF"

If the situation stablizes again attempt to locate the malfunctioning unit(s) and isolate by turning off/pulling circuit breaker(s)/removing the cannon plug(s).

If condition persists proceed as follows:

a. Copilot's inverter - "DC BUS"

b. ATM and generator - "OFF, STOP"

If the fire goes out, determine the malfunctioning bus and proceed with the isolation procedures shown in the isolation chart.

FUSELAGE FIRE/SMOKE AND FUME ELIMINATION.

If a fire, smoke, or fumes develop in the fuselage, notify the crew and passengers and proceed as follows:

1. Oxygen **"ON/100 PERCENT"** **P**

a. The pilot will direct all crew members to don oxygen/smoke masks (as appropriate) and to select 100 percent on their oxygen regulators.

Three types of regulators, types A-21, A-15, and A-13 are used on portable oxygen bottles. For 100 percent oxygen with A-15 regulators, place hand over the diluter valve opening. With the A-21 regulator place the control knob at NORMAL. The A-21/A-13 regulator will provide 100 percent oxygen at any setting.

Note

The pilot will direct crewmembers to fight the fire as required.

WARNING

Prolonged exposure (5 minutes or more) to high concentrations (pronounced irritation of eye and nose) of bromochloromethane (CB) or its decomposition products should be avoided. CB is an anesthetic agent of moderate intensity. However, especially in confined spaces, adequate respiratory and eye protection from excessive exposure, including the use of oxygen when available, should be sought as soon as the primary fire emergency will permit.

2. Pressurization "EMERGENCY DEPRESSURIZATION (on command of the pilot) E

WARNING

If passengers are aboard and oxygen equipment is not available for them, descend to a lower altitude before depressurizing the airplane.

3. Descent "As required" P

WARNING

If flammable fumes are present, electrical equipment not required to complete the above steps should not be turned on or off until the fumes are eliminated.

4. Engine bleed air switches — "CLOSED" (if source of smoke or fumes has not been isolated) — E

CAUTION

In the event the ATM generator is powering the essential AC bus, closing all the engine bleed air valve switches will eliminate the pneumatic air source for the ATM. The resulting underspeed condition and generator disconnect will cause essential ac bus power loss.

If depressurization was necessary proceed as follows:

5. Air-conditioning master switch — "AUX VENT" — E

6. Forward escape hatch — "OPEN" — E

WARNING

If a flare ignites in the cargo compartment during flare launch operations, the density of smoke will be severe. This smoke will be drawn into the crew compartment if the overhead escape hatch is open, under these circumstances, do not remove the overhead escape hatch.

CAUTION

Electrical power should not be reapplied to circuits found to have caused the fire or which received fire damage.

7. Right paratroop door — "Open" (on pilot's command) — IO

WARNING

The IO will open the door only when wearing a parachute or restraining harness.

INFLIGHT DOOR WARNING

When the door warning light illuminates, notify the crew and passengers and proceed as follows:

1. Oxygen — "As required" — P

   a. The pilot will direct all crewmembers to don oxygen/smoke masks (as appropriate) and to select 100 percent on their oxygen regulators.

   b. The IO will notify all crewmembers/passengers that are not on interphone.

2. Pressurization	"Begin depressurization"	E
3. Descent	"As required"	P

Note

If range is an important consideration, and passengers without supplemental oxygen are not being carried, the pilot may elect to have the flight crew go on oxygen, the airplane depressurized, and the door inspection made at altitude.

E

4. Air-conditioning master switch	"AUX VENT"	E
5. Doors	"Checked"	IO/E

WARNING

The airplane shall be completely depressurized before making a door check. Do not unlock any door with the airplane pressurized. The IO/E will check the door, wearing a restraint harness. If it can not be determined what caused the door light to illuminate, the flight may be continued with partial pressurization at the discretion of the pilot (below the point where the light illuminates and with all personnel secured with safety belts.) If the doors are secured and the trouble is determined to be a door warning switch, the airplane may be fully pressurized.

6. Master door warning light switch	"OFF"	IO/E

CARGO DOOR AND RAMP.

Cargo Door Uplock Emergency Release.

To release the cargo door uplock after normal procedures have failed, proceed as follows:

a. Pull the cargo door manual release and safety lock lever simultaneously forward and down.

b. After cargo door free-falls, proceed with normal closing procedures to lock door closed.

Ramp Locks Fail to Lock.

In the event the ramp locks fail to lock ramp closed, proceed as follows:

a. Check the hydraulic fluid level in the auxiliary system reservoir.

b. If the reservoir fluid level is low, attempt to find the leak and isolate it.

c. If the reservoir fluid level is normal, leave the auxiliary hydraulic pump on.

d. Attain airspeed of 1.2 V_S flaps up, not to exceed 150 KIAS.

e. Retract flaps to full up.

f. Raise and lock the ramp by using the manual control knob on the ramp and door control valve.

g. If the ramp locks, continue the mission (pressurized if desired).

h. If the ramp still does not lock in the closed position (locks visually checked for engagement and door warning light extinguished), select position 4 on the manual control knob on the ramp and door control valve. Leave the knob in position 4 for the remainder of flight. Leave the auxiliary hydraulic pump on the remainder of the flight.

CAUTION

Do not pressurize the airplane if the ramp fails to lock.

INFLIGHT RELEASE OF LIFERAFT.

If severe vibration occurs in flight, cause unknown, immediately retard power and decrease airspeed. Lower the flaps, and have an aircrew member make a visual inspection of the liferaft compartments and tail through a rear cargo compartment window. (The absence of a liferaft should be noticeable through one of the inspection windows provided on the lower sides of the liferaft compartments.) If a raft has released and lodged on the tail, fish-tail the airplane slightly, or execute a shallow banking maneuver right or left. Make an emergency landing at the nearest suitable base, and conduct a thorough inspection.

CAUTION

Do not reverse propellers on landing if the liferaft (s) cannot be removed in flight. To do so may draw the raft into the propeller.

WINDSHIELD AND WINDOW FAILURE.

If the inner or outer pane of the windshield or cargo compartment windows crack during flight, reduce the cabin differential pressure to 10 inches of mercury or less. If both panes of the windshield crack, flight may be continued at 10 inches of mercury or less; however, if both panes of a cargo compartment window crack, reduce the cabin differential pressure to zero.

RAPID DECOMPRESSION.

Sudden and uncontrollable loss of cabin pressure is known as rapid decompression. This may result from losing a nonstructural member such as a door or window, or from a rupture in the fuselage. If a rapid decompression occurs, proceed as follows:

a. Oxygen - "As required" P

Pilot will direct crew to go on 100 percent oxygen as required.

If descent is required, continue as follows:

The engineer should make an inspection of the fuselage (using a walk-around oxygen bottle, if required, and wearing a restraint harness or parachute) to determine what caused the decompression and the extent of any damage. With no structural damage, descent airspeed may be increased not to exceed maximum speeds, as shown in Section V. With structural damage, the flight will be completed at a safe speed as determined by the pilot, the flap configuration for landing will depend on type of structural damage.

b. Throttles - "FLIGHT IDLE" P

c. Descent - "As required" P

CAUTION

With certain types of structural damage, changing the center of lift with the flaps may induce further damage. Careful consideration should be given to type of damage prior to changing airplane configuration.

HYDRAULIC SYSTEMS FAILURE.

Loss of System Pressure.

If a pressure loss is indicated, proceed as follows:

a. Turn OFF pump switches (affected systems only).

b. Turn the electric suction boost pump off if utility or booster system pumps are off.

c. Check hydraulic fluid level in reservoir.

d. Check for fluid loss at units being supplied by malfunctioning system.

e. Isolate units causing trouble, if possible. If not possible, leave pump switches OFF.

Engine Driven Pump Failure.

If engine-driven pump failure is indicated, proceed as follows:

a. Turn OFF pump switch (applicable pump only).

b. Check hydraulic fluid level in reservoir. If supply is normal, monitor system.

c. Turn OFF pump switch for other system pump if the reservoir oil supply is low and diminishing.

d. Turn the affected system suction boost pump OFF when both engine-driven pumps are turned OFF.

Pump failure can lead to a flight hazard for the following reasons:

There is approximately one gallon of hydraulic fluid trapped in the isolation circuit and a line or pump rupture can dump this fluid in the nacelle.

The engine-driven pump is geared directly to the engine and if the shear neck of the pump drive spline does not separate (mainly to protect the engine gearbox) the pump can disintegrate internally and this metal-to-metal disintegration can generate enough heat to cause a fire hazard. Because of this hazard, pilot's discretion should be exercised to the need of continued engine operation.

WARNING

In the event utility or boost hydraulic pressure in excess of 3,450 psi is indicated, do not shut off the individual hydraulic pump switches. If the hydraulic pump switches are shut off, the pressure line between the hydraulic pump and the shutoff valve is isolated from the pressure relief valve. Excessive pressure will build up until the hydraulic pump or line ruptures, dumping this fluid into the engine nacelle.

Note

If hydraulic pressure cannot be brought within limits by actuation of flight controls or flaps, it is recommended to shutdown an engine using the Cruise Engine Shutdown procedures in Section II on one engine supplying pressure to affected system. If hydraulic pressure drops to normal, that pump was the defective one. Pilots discretion should be exercised to the need of restarting that engine. If the hydraulic pressure remains high, perform an air start on the shutdown engine. Shutdown of the other engine affecting the hydraulic system will be at the discretion of the pilot, and should be accomplished by using the condition lever only.

CAUTION

If the affected hydraulic system pressure exceeds 3,500 psi (malfunction of engine driven hydraulic pump volume regulator) it is recommended that the engine with the malfunctioning hydraulic pump be shut down using the condition lever only.

Electric Suction Boost Pump Failure.

Loss of electric suction boost pump may be indicated by illumination of the suction boost pump pressure warning light. If the suction boost pump fails, a 100 to 200 psi drop in the static system pressure may also be indicated. High flow demand requirements may cause substantial pressure drop and additional time will be required to cycle hydraulic systems. If a suction boost pump failure is indicated, proceed as follows:

a. Turn off suction boost pump.

b. Check system static pressure and hydraulic fluid level.

   (1) If system static pressure is less than 2500 psi, or fluid level has decreased, follow loss of system pressure procedure.

   (2) If system static pressure is 2500 psi or above, and fluid level is normal, leave switch off and continue operation minimizing hydraulic systems use.

Utility System Failure.

Note

High flow demand requirement during single utility pump operation will cause substantial hydraulic pressure drop during main landing gear, flap extension/retraction, and elevator control surface operation.

Failure of the utility hydraulic system will result in loss of normal landing gear extension and retraction, flap retraction and normal extension, normal brake supply, nose wheel steering, and half the power supplied to the flight controls. In each case, alternate provisions are made for essential operations. For emergency operation of the particular systems, see Landing Gear System Failure, Flap System Failure, and Flight Controls Systems Failure in this section. For emergency brake pressure, refer to Brake Failure in this section.

Power to the utility portion of the elevator booster may be obtained by placing the auxiliary hydraulic pump to on. Auxiliary pressure will be supplied to the elevator through the power switching valve.

WARNING

If there is a leak in the elevator control unit, turning the auxiliary hydraulic pump on will deplete the auxiliary hydraulic system. The aux system hand pump can be used to operate the aft cargo door and ramp, emergency brakes, and emergency nose gear extension.

In the event of line rupture to flight control booster units or trainable weapons system, placing the utility isolation switch to ON will isolate the leak and leave the utility system operable. Booster system hydraulic pressure will still be applied to flight control units.

Note

If leak is determined to be at one of the flight control booster units, the leak may be isolated by placing the respective control boost shut-off valve switch to the OFF position. The utility isolation switch can then be placed off, restoring system pressure to remaining two control units.

WARNING

If there is a leak in the elevator control unit, turning the auxiliary hydraulic pump on will deplete the auxiliary hydraulic system. The auxiliary system hand pump can be used to operate the aft cargo door and ramp, emergency brakes, and emergency nose gear extension.

Booster System Failure.

Failure of the booster hydraulic system affects only the flight controls systems. See Flight Controls Systems Failure for information on emergency management.

Auxiliary System Failure.

Failure of the motor-driven pump in the auxiliary hydraulic system results in the loss of hydraulic power for normal inflight operation of the ramp and aft cargo door, loss of electrically controlled emergency hydraulic power for the main landing gear brakes, and loss of electrically controlled emergency hydraulic power for extension of the nose landing gear. If circumstances require opening the ramp and aft cargo door, or supplying emergency brake pressure manually, or lowering the nose landing gear without electrically controlled hydraulic system pressure, the handpump may be used. If both utility and auxiliary pressure are lacking for brakes, stopping and taxiing control must be accomplished with reverse thrust and differential power application. Stop the airplane as soon as possible. Taxiing the airplane under its own power without brakes is not recommended.

If auxiliary system pressure is lost due to leakage in plumbing or units down stream of auxiliary isolation valve, the auxiliary isolation valve may be turned on to isolate the leak from the pump and leave the auxiliary system pressure available for elevator boost operation.

FLIGHT CONTROLS SYSTEMS FAILURE.

WARNING

- If hydraulic assistance for movement of the flight controls is lost, there may be an unpredictable control response if pressure is reapplied.
- Never purposely remove the hydraulic assistance from the flight control boosters to simulate complete loss of boost assistance to the flight controls. To remove the assistance would result in an immediate pitch change and the requirement for high manual forces to move the flight controls.
- If a control booster unit is suspected to have failed in a hardover position, turn the respective control boost switches to OFF. Prior to turning off the control booster switches verify that the cockpit control matches the hardover maneuver being experienced. Expect that greatly increased forces will be required to move the control for which the hydraulic assistance has been turned off.

Note

- Any suspected or known structural failure which may cause airplane control problems will require a check of airplane controllability prior to landing.
- If a hydraulic leak develops in any of the flight control booster units, it may be isolated by placing the respective control boost shut-off valve switch to the OFF position.

Failure of only one control booster unit may indicate a leak or other malfunction within the unit. It should be examined immediately, if possible, to determine corrective action. Loss of hydraulic assistance for movement of the flight controls will result in loss of ability to move these controls in flight, except at low airspeeds. Maneuvering the airplane at cruising speeds under these conditions must be accomplished with the trim tabs. Landing the airplane without hydraulic assistance is a marginal operation and requires skillful handling of the trim tabs and engine power, plus coordinated efforts of the pilot and copilot on the flight controls. When possible, avoid crosswinds, short fields, or narrow runways since the chances of making a successful landing will be decreased. When a landing without hydraulic assistance for the flight controls is necessary, proceed as follows:

a. Reduce the weight of the airplane as much as possible.

b. With elevator hydraulic assistance failure, land with minimum flaps.

c. Make a long, flat approach to reduce the amount of flare necessary and fly the airplane onto the ground.

Rudder Failure.

If rudder control should fail (hydraulic assistance lost), the rudder can be moved manually, but only at a reduced airspeed and with greatly increased effort.

Elevator Failure.

If elevator control should fail (hydraulic assistance lost) or become erratic, the elevators can be moved manually, but only at a reduced airspeed and with greatly increased effort. Increasing airspeeds will require increased pilot effort on the controls.

Aileron Failure.

The ailerons are powered concurrently by both the utility and the booster hydraulic system. Should both hydraulic systems fail, the ailerons can be moved manually, but only at a reduced airspeed, and with greatly increased effort. Increasing airspeeds will require increased pilot effort on the controls.

Aileron and Rudder Trim Tab System Failure.

Failure or runaway of the aileron trim tab will not cause a serious control problem. Should the aileron trim tab run away:

a. Hold the aileron trim tab switch in the opposite direction.

b. Pull the aileron trim tab circuit breaker on pilot's side circuit breaker panel.

Directional control cannot be maintained at high airspeeds if the rudder trim tab runs away to an extreme position. If this occurs, airspeed should be reduced until directional control is regained. Should the rudder trim tab run away:

a. Hold the rudder trim tab switch in the opposite direction.

b. Pull the rudder trim tab power circuit breaker on the pilot's side circuit breaker panel.

Elevator Trim Tab System Failure.

Should the elevator trim tab run away, hold the elevator tab switch on the control wheel in the opposite direction of tab indicator movement, and place the elev tab power selector switch in the OFF position. This should stop the runaway tab. Place the elev tab power selector switch in the EMER position, and operate the elevator trim tab switch on the control pedestal to retrim the airplane. If trouble is encountered using emergency power, return the elev tab power selector switch to OFF. Tab movement will be slower in EMER than in NORMAL.

Note

- The elevator tab switches on the control wheels will not operate the emergency system. Emergency operation is controlled only by the pedestal-mounted switch.
- When on autopilot operation and the elev tab power selector switch is in the EMER or OFF position, the elevator servo is disconnected from the autopilot and the elevator must be controlled manually.

FLAP SYSTEM FAILURE.

Failure of the wing flaps to operate normally may be caused by failure of the flap electrical control system or by failure of the utility hydraulic system. The utility hydraulic system supplies hydraulic pressure for normal operation of the flap system. Protection against asymmetrical extension or retraction of the flaps is provided only when dc power and utility hydraulic pressure are simultaneously available for the flap system. A manually operated wing flap selector valve, located on the left hydraulic panel, provides flap control if the flap electrical control system fails. Also, a system is provided for mechanical operation of the flaps in the event that utility hydraulic pressure is lost.

WARNING

During flap operations, failure of certain components in the jack screw area may cause a split flap condition resulting in a change in trim about the roll axis and aileron binding. Under these conditions, if it is possible to control the airplane, no attempt should be made to move the flaps. If movement of the flaps must be attempted, move the controllable flaps in increments of 10 percent toward the position of the uncontrollable flap. During flap movement, check aileron control constantly. If it is noted that binding increases, stop flap movement immediately.

Flap Electrical Control Failure.

If the circuit breaker is in, or if resetting the circuit breaker does not clear the trouble:

1. Pull the wing flap control circuit breaker.
2. Place the flap lever in the desired position (this will give proper rudder boost pressure).

wing flap selector valve

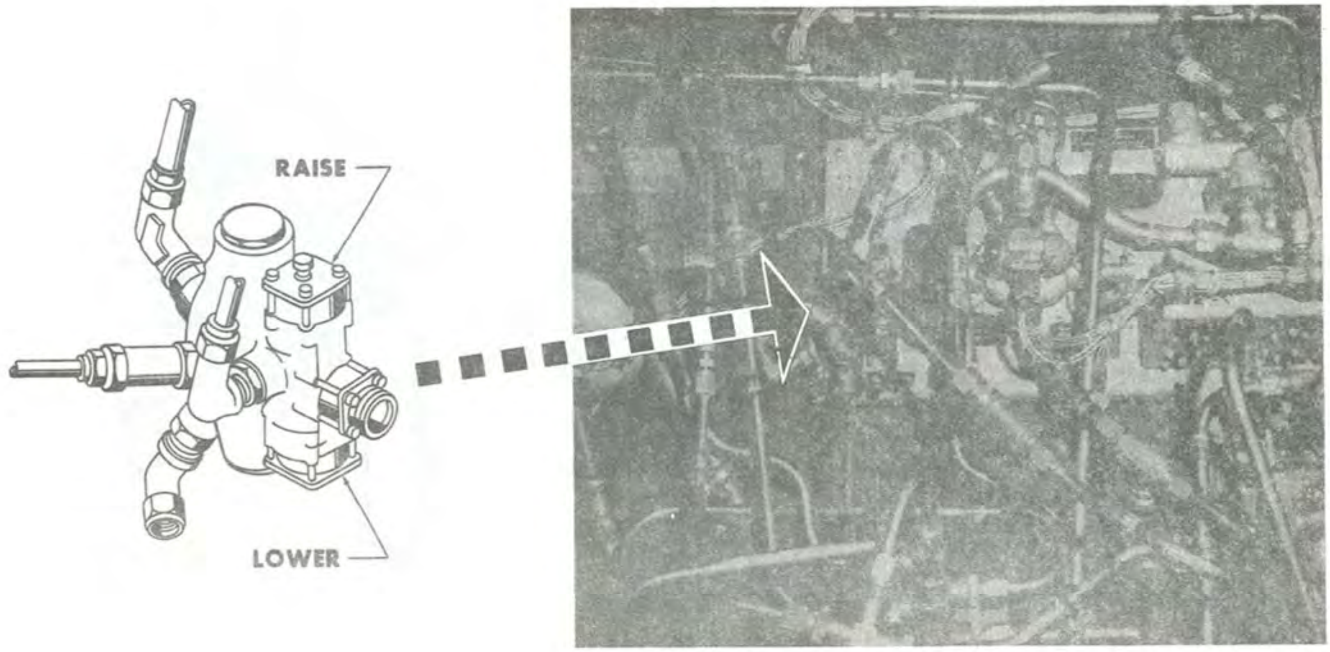


Figure 3-6.

3. Station a crew member at the forward face of the left wheel well, and establish communications with the flight station by means of an intercommunication extension cord.

4. Remove the left hydraulic panel cover.

5. Depress and hold the lower button or raise button of the flap selector valve (figure 3-6) until the flaps are fully lowered or raised, or until directed by the pilot to stop flap travel.

WARNING

Protection against asymmetrical operation is provided only during normal hydraulic flap operation. Should a failure of flap drive torque tubes occur during override operation, resulting in a change in trim about the roll axis, stop flap movement immediately. Return the controllable flaps to the position assumed by the uncontrollable flaps.

6. If the cause of electrical malfunction is located and corrected in flight, move the flap lever to a setting corresponding with the flap position before resetting the flap control circuit breaker.

Loss of Hydraulic Pressure.

Normal operation of the flaps will cause a drop in utility hydraulic pressure as long as the flaps are in motion. A leak in the flap system hydraulic plumbing will be indicated by a rapid loss of pressure while the flaps are operating, and by slower than normal flap movement. Under these conditions, proceed as follows:

1. Pull the wingflap control circuit breaker on the copilot's lower circuit breaker panel.

2. Place the flap lever in the desired position for proper rudder boost pressure.

3. Remove the utility hydraulic panel cover.

4. Make an inspection for plumbing leaks, breaks, and any other faults. If fault is corrected, reset the flap lever to correspond with the flap position indicator, reset the wing flap control circuit breaker and proceed with normal flap operation.

If fault is not corrected:

5. Establish communications between the flight station and a crew member stationed at the forward face of the left wheel well by means of an intercommunication extension cord.

wing flap manual operation controls

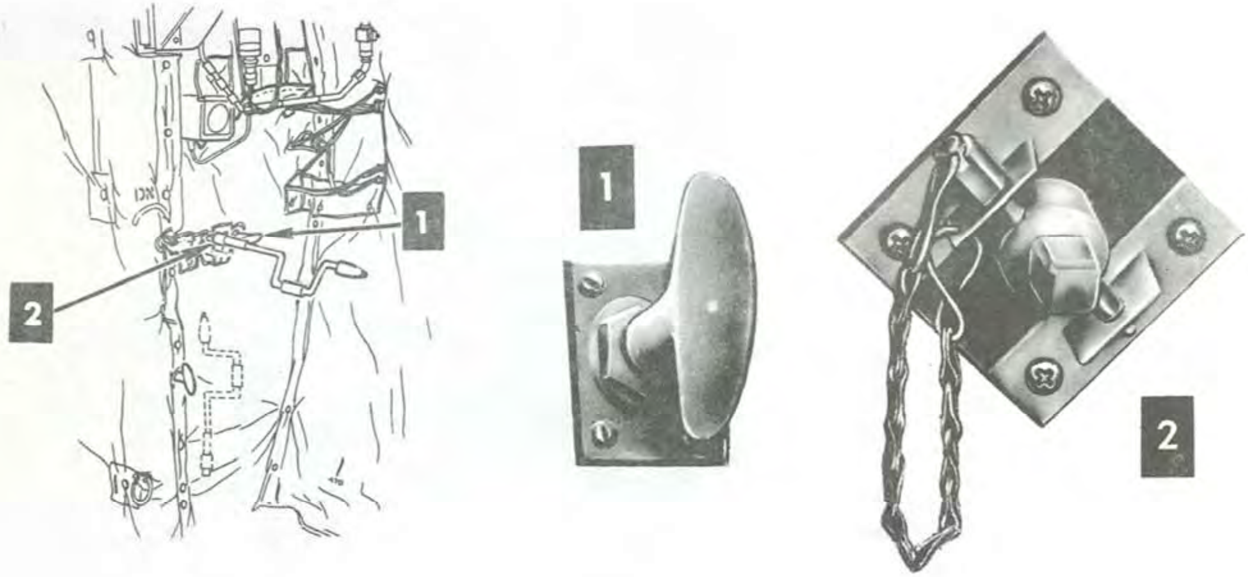


Figure 3-7.

6. Turn the No. 1 and No. 2 engine-driven hydraulic pumps off, utility suction boost pump off, and deplete the utility system pressure.

7. Remove the handcrank (figure 3-7) from the stowed position, in the cargo compartment. Engage the handcrank on the input shaft, and hold the crank firmly to prevent rotation.

8. Remove the pin from the input shaft. It may be necessary to rotate the crank slightly in either direction to relieve binding on the pin.

9. Rotate the manual shift handle (1, figure 3-7) counterclockwise to its stop, and pull (approximately 2 inches) to engage the manual extension system. The handle will lock out after it is pulled.

10. Operate the flaps to the desired position (approximately 650 turns for full extension), as shown on the flap position indicator. A slip clutch is provided in the manual gearbox to prevent the operator from overloading the drive system. Slippage of the clutch indicates the screwjack nuts are bottomed, and the flaps are full up or full down, or that interference will not permit flap operation.

WARNING

Protection against asymmetrical operation is provided only during normal hydraulic flap operation. Should a failure of flap drive torque tubes occur during manual operation, resulting in a change in trim about the roll axis, stop flap movement immediately. Manually return the controllable flaps to the position assumed by the uncontrollable flaps.

11. Replace the pin in the input shaft to hold the flaps in the selected position.

12. Remove the handcrank and return to the stowed position.

13. Leave the manual shift handle out.

14. Turn on the utility suction boost pump and No. 1 and No. 2 engine-driven hydraulic pumps, if available, and no leaks are evident.

Practice Manual Flap Extension.

Practice manual extension of the wing flaps is accomplished by following the procedure for manual extension in paragraph Loss of Hydraulic Pressure. The shift from manual back to hydraulic drive after an actual inflight failure of the hydraulic system normally would be accomplished on the ground. However, after practice manual extension of the flaps, use the following procedure to shift back to hydraulic drive:

a. Rotate the manual shift clockwise against its stop, and push in as far as possible.

b. Remove the pin in the input shaft, and rotate the shaft with the handcrank. The shaft should turn freely, indicating that the manual drive has disengaged.

c. Replace the pin in the input shaft, and remove the handcrank and return it to the stowed position.

d. Place the flap lever to correspond with the position of the flaps.

e. Reset the wing flap control circuit breaker.

CAUTION

When the wing flap control lever is first moved after shifting from manual to hydraulic actuation, observe the utility hydraulic system pressure and the wing flap position indicator. A drop in pressure with no result in flap movement indicates a failure of the flap drive to re-engage. If this happens, immediately return the wing flap lever to its original position and pull the wing flap control circuit breaker. If these steps are not observed, serious damage to the wing flap drive could result.

Asymmetrical Flap Positioning.

Should flap movement stop before the flaps have reached the position desired, failure of the flaps to move in either direction may be due to engagement of the emergency flap brake. The flap handle should be positioned to correspond to the position of the flaps, and no further inflight movement of the flaps should be attempted.

WARNING

Do not release the manual override on the emergency flap brake valve while the airplane is in flight, as an asymmetrical condition of the flap may result. This manual override is for ground use only.

Wing Flap Position Indicator Failure.

If no change in flap position is shown on the wing flap position indicator after movement of the flap lever, the trouble may be in the indicator rather than in the flap system. This trouble may be identified by observing hydraulic pressure and by observing the pitch attitude of the airplane. Immediately after selecting a change in flap position, a pressure drop in the utility hydraulic system indicates either that the flaps are moving or that there is a hydraulic leak or failure in the actuating system. If the flaps are moving, this will be indicated by a change in the pitch attitude of the airplane. During flap extension the pilot may direct a crew member to make a visual inspection of the flap position. Also while in the cargo compartment, check the tabs and flaps position indicators circuit breaker on the aft fuselage junction box.

LANDING GEAR SYSTEM FAILURE.

SEE 15-61 CAUTION ADDED

If the main and nose landing gears fail to extend after normal operation of the landing gear lever, attempt to identify the malfunction before making further attempts to lower the gear. Check circuit breakers, utility hydraulic pressure, and hydraulic fluid quantity. Check for evidence of hydraulic leaks. If the fault is not located and there is no evidence of leaks, proceed to lower the gear by overriding the landing gear selector valve. If a hydraulic leak is the cause of the malfunction, or hydraulic pressure was lost after the landing gear handle was placed in the down position, return the gear handle to the UP position and proceed with the Manual Gear Extension procedure.

Note

Pressure-sealed doors are provided in the wheel bulkheads to permit access while in flight to inspect the two gearbox and hydralic brake assemblies, and the vertical torque shafts in the event of a malfunction of the MLG system. A NLG inspection window is provided in the nose wheel well aft bulkhead to permit visual inspection while in flight. This window may be removed to permit access to the NLG while in flight. The emergency extension handcranks fit the nuts on the MLG pressure-sealed doors and on the NLG inspection window. Depressurize the airplane before removing the pressure-sealed doors or windows.

Overriding the Landing Gear Selector Valve.

If the landing gears fail to extend while using utility hydraulic system pressure because of failure of the landing gear selector valve to operate (no evidence of hydraulic pressure loss), proceed to extend them by overriding the valve.

1. Pull the landing gear control circuit breaker located on the copilot's lower circuit breaker panel.

landing gear system selector valve

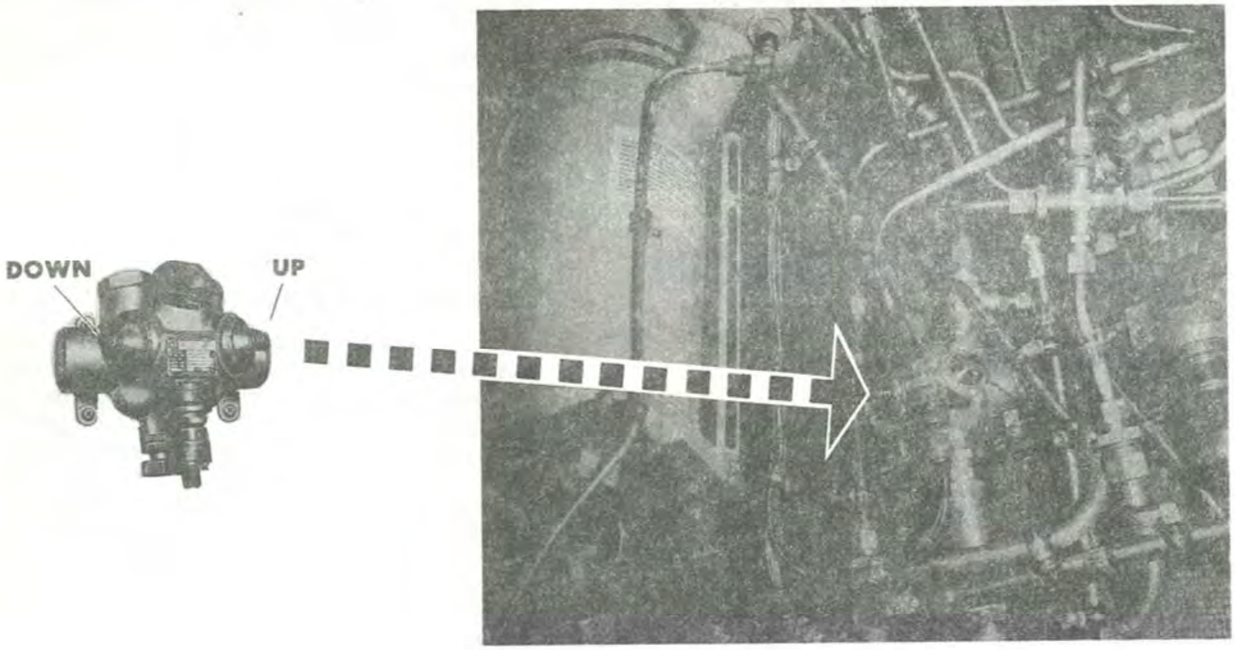


Figure 3-8.

2. Place the landing gear lever in the DN position.
3. Direct a crewmember to establish communications with the flight station by means of an intercommunication extension cord and to go to the left wheel well.
4. Remove the left hydraulic panel cover.
5. Depress the down button on the aft side of the landing gear selector valve (figure 3-8) to lower the landing gear.

CAUTION

If the landing gear does not extend, depress and hold the down button until the main and nose landing gear is extended. If the button requires holding to lower the gear the mechanical detent in the landing gear selector valve has failed. If nose wheel steering is required the button must be held in.

Note

The landing gear position indicators should continue to operate regardless of landing gear malfunction. The pilot should inform the crewmember when a down position is indicated so that the crewmember will know when to release the override button. If a malfunction of the landing gear position indicator is suspected, observe the main landing gear position through the glass panels on the wheel wells and the nose gear position through the nose wheel inspection window or by removing the access cover on airplanes not having a window.

CAUTION

If nose wheel inspection plate is removed, do not allow it to be blown through the opening.

Emergency Hydraulic System Gear Extension.

CAUTION

If utility system failure was caused by leakage downstream of the pressure transfer valve, this procedure will not be used. Refer to Manual Gear Extension.

Hydraulic power for nose and main landing gear extension and nose wheel steering may be obtained from the emergency hydraulic system utilizing the following procedures:

1. Emergency hydraulic system - ON

WARNING

Do not exceed pump operating limitation of 1 minute under full load or 30 minutes under no load. Cool pump for 15 minutes when either of these limits is reached. Pump has internal thermal protection which will turn the pump off when overheated resulting in complete loss of emergency system. If this condition exists, several minutes of cooling is required before pump operation may be restored.

2. Landing gear lever - DN

3. Emergency hydraulic system - OFF (after landing gear is down)

CAUTION

When switch is turned off, wait at least 10 seconds before turning back to on.

Just prior to landing turn emergency hydraulic system on to supply power for nose wheel steering. When landing is complete and airplane is clear of runway, stop airplane and turn emergency hydraulic system off.

CAUTION

Do not attempt to taxi airplane utilitzing emergency hydraulic system. To do so would overheat pump causing thermal protection to turn pump off and loss of hydraulic power to nose wheel steering.

Brakes will be available by turning auxiliary hydraulic pump on and selecting emergency brakes.

Note

Failure of the motor-driven pump in the emergency hydraulic system results in the loss of hydraulic power for emergency extension of the main and nose wheel landing gear and nose wheel steering.

Manual Gear Extension.

If the landing gears fail to extend and lock after the override control valves are used, manually extend the gears as follows:

1. Pull the landing gear control circuit breaker located on the copilot's lower circuit breaker panel.

2. Place the landing gear control handle in the DN position.

3. Deplete the utility hydraulic pressure by turning off the utility suction boost pump and No. 1 and No. 2 engine-driven hydraulic pumps and operating the flight controls.

MAIN LANDING GEAR MANUAL EXTENSION.

WARNING

Make sure the ratchet on the handcrank is set for down rotation before placing it on the emergency extension stub shaft. If the main landing gear starts to free fall after the handcrank is placed on the emergency extension stub shaft, immediately remove the handcrank. The extension handle ratchet may change direction due to the rotation speed of the emergency extension stub shaft.

1. Remove the extension handcrank from the stowed position. Rotate the emergency engaging handle (figure 3-9) counterclockwise to its stop and pull handle to engage the manual extension system. If the handle will not lock out after it is pulled, rotate counterclockwise until locked.

CAUTION

Do not force the emergency engaging handle out. To do so may result in a bent manual drive clutch lever, making it difficult or impossible to engage the manual drive. It may be necessary to place the extension handcrank on the emergency extension stub shaft and rotate slightly until the manual drive gear teeth align.

Note

If the manual drive fails to engage or the spring loaded brake fails to release, it may be an indication of the emergency engaging handle cable being broken or disconnected. This could be indicated by the emergency engaging handle being extremely easy to pull to the extended position. Should this occur, remove the access panel on the forward upper wheel well area (figure 3-10) for main landing gear brake and gear box assembly. Pull down and hold (secure) the manual shift lever at the bottom of gear box to disengage brake and shift gear box to manual drive. Continue with manual extension of gear.

2. If the main landing gear does not free fall, place the extension handcrank on the emergency extension stub shaft and extend the landing gear by rotating the extension stub shaft approximately 330 turns in the direction of the arrow above the shaft.

3. Make sure that the landing gear is down and locked.

4. After manual operation, return the emergency engaging handle(s) to the disengaged position by rotating clockwise to its stop and pushing in. Verify proper disengagement by rotating the handcrank one turn in each direction.

Note

- If manual extension mechanism does not disengage, recycle the emergency engaging handles again, and rotate the handcrank in each direction.

- If the manual shift lever was manually pulled and secured, insure its return to the up position and proceed as above.

5. Turn on utility suction boost pump and No. 1 and No. 2 engine-driven hydraulic pumps to obtain hydraulic pressure (when available) for operation of flaps, normal brakes, and nose landing gear steering.
6. Check that the landing gear stays in the DN position.

Note

If the landing gear returns to the up position, place the utility hydraulic switches in the OFF position, and crank the landing gear down manually.

NOSE LANDING GEAR MANUAL EXTENSION.

1. Determine that the manual controls for the ramp and aft cargo door control valves (figure 3-9) are in the NEUT and 6N positions, respectively. Move the nose landing gear emergency extension valve handle, just forward of the booster hydraulic reservoir on the right side (figure 3-9), to the NLG EMER EXT position. Operate either the auxiliary system motor-driven pump or the auxiliary system handpump until the landing gear is down and locked.

CAUTION

Do not move the nose landing gear emergency extension valve handle from the NLG EMER EXT position until after the airplane lands and the nose gear ground safety lock is installed. Maintain hydraulic pressure on the system.

Note

- If complete electrical failure occurs, the nose gear emergency release handle (figure 3-9), recessed into the flight station floor at the left of the copilot's seat, may be used to release the nose landing gear up lock. This will permit the nose gear to free-fall to the down, but not necessarily locked, position. Use the auxiliary system handpump to position the nose landing gear to the down-and-locked position.

- Dropping the nose landing gear by using the emergency release handle may allow air to enter the hydraulic system and may require bleeding before normal operation can be restored.

NOSE LANDING GEAR MANUAL EXTENSION AFTER COMPLETE LOSS OF HYDRAULIC PRESSURE.

If a complete loss of hydraulic pressure is experienced, accomplish emergency nose landing gear extensions as follows:

WARNING

Check stall speed prior to decreasing airspeed to 120 KIAS.

1. Position the landing gear handle to the DN positions.
2. Decrease airspeed to or below 120 KIAS if possible.
3. Pull the nose landing gear emergency release.

Note

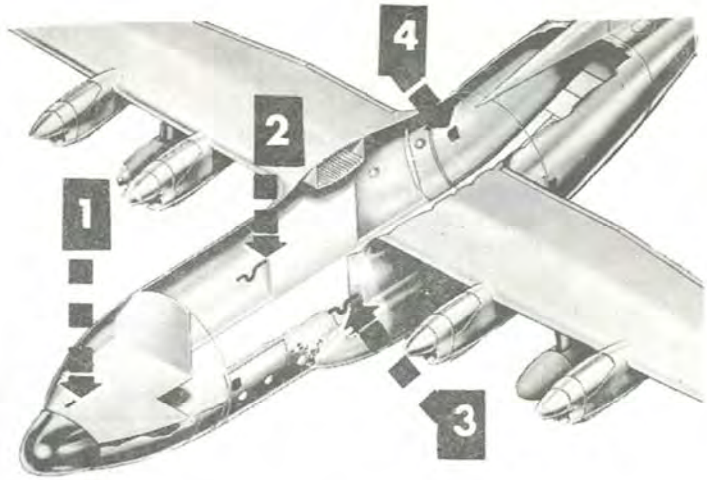
The nose landing gear should extend into the slipstream. Allow the nose landing gear to extend until the forward gear door starts to close at reduced speed, this may require 30 to 45 seconds.

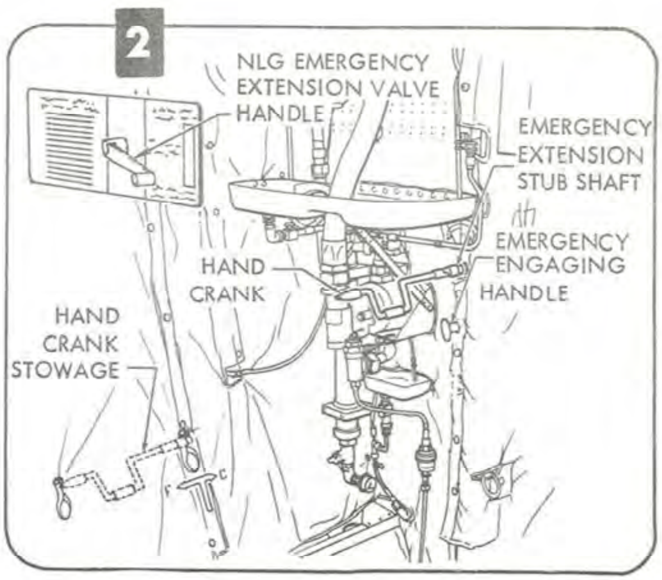
4. Increase airspeed as rapidly as possible, not to exceed gear speed limit.

Note

The nose landing gear should extend to the down and lock position.

landing gear emergency extensions controls





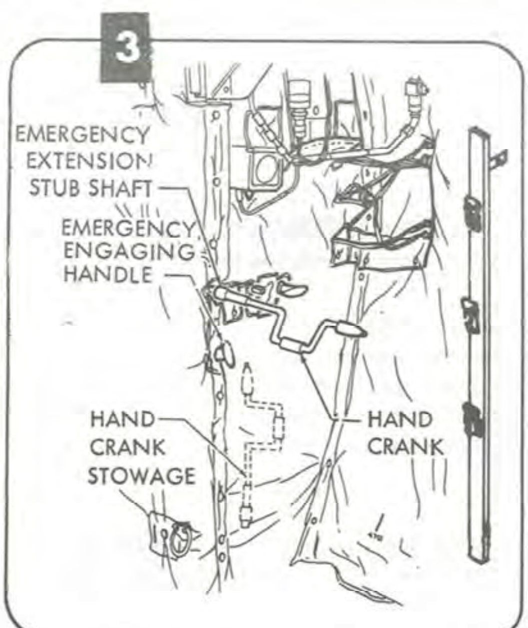


Figure 3-9. (Sheet 1 of 2)

NOTE

PRESSURE FOR EMERGENCY EXTENSION OF THE NOSE LANDING GEAR SUPPLIED BY EITHER THE MOTOR-DRIVEN OR THE HAND-OPERATED PUMP OF THE AUXILIARY SYSTEM.

landing gear emergency extensions controls

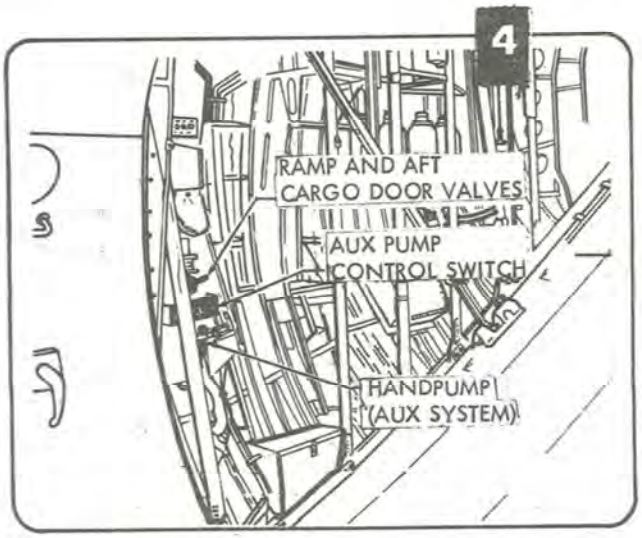


Figure 3-9. (Sheet 2 of 2)

Main Landing Gear Extension After Normal And Emergency System Failure.

A malfunction that locks any component of the main landing gear extension system may also lock the remainder of the system. In such a case, if the universal joints on the vertical torque shaft are disconnected, the landing gear may free-fall to the down position. If the landing gear does not free-fall. each landing gear strut can be extended by rotating the ball screws, using the vertical torque shaft as an improvised wrench, or with the emergency extension wrench. Use this procedure to lower the main landing gear only after all other normal and emergency procedures have failed. Refer to figure 3-10 for access doors or cutting areas.

Note

> Extend the aft strut first. The main landing gear doors are opened by a mechanical connection to the aft strut, and damage to the doors could result if the forward strut is extended first.

Leave the main landing gear manual extension system engaged, the utility hydraulic system depleted, and the landing gear control circuit breaker pulled. Depressurize the airplane. Place the air conditioning master switch to AUX VENT.

a. Remove the upper access doors with the emergency extension handcrank.

b. At the aft strut, remove the two outboard bolts and nuts connecting the companion flanges at the lower end of the vertical torque shaft.

c. Remove the nuts from the two inboard bolts, and remove the bolts without extending the hands through the access hole.

WARNING

> The weight of the landing gear may cause the gear to extend rapidly when released. If the above steps are not followed in proper sequence, serious injury to the hands may result when the gear falls.

Note

> If the strut does not free-fall, application of g forces may aid in extending the strut.

If the aft strut free-falls approximately halfway down, attempt to extend the forward strut using the manual extension system. The horizontal torque strut will prevent the landing gear strut from fully extending.

If the landing gear does not extend using the above procedure, extend the struts using the emergency extension wrench (if available) or the vertical torque shaft.

To remove the vertical torque shaft on airplanes without the emergency extension wrench, cut a hole above the upper access door (see figure 3-10). Secure the top of the vertical torque shaft to some point inside the cargo compartment with wire to prevent loss of the shaft. Remove the bolt and nut that retains the upper end of the shaft spline to the gearbox. Pull the vertical torque shaft into the cargo compartment through the upper access hole.

On airplanes having the emergency extension wrench, do not disconnect the upper end of the shaft but move the vertical torque shaft clear of the companion flange on the upper end of the ball screw.

At the aft strut, slip the companion flange off the splines on the upper end of the ball screw.

Using the vertical torque shaft or the emergency extension wrench, engage the splines on the upper end of the ball screw. Rotate the jackscrew counterclockwise approximately one-half revolution and remove wrench. Application of g forces may aid in extending the strut.

Note

On airplanes with an emergency extension wrench installed, use the fixed end of the wrench to start the ball screw.

If the strut has not extended, rotate the ball screw counterclockwise to extend the strut halfway down.

Note

Use the ratchet end of the emergency extension wrench to rotate the ball screw. The handcrank may be installed in the square drive of the wrench to extend the strut more rapidly.

Extend the forward strut using the above procedure. Fully extend the aft strut.

Emergency Retraction.

If the landing gear lever will not move to the UP position due to malfunction of the touchdown switch or down lock, manually release the down lock by pushing the lock release button on the landing gear lever panel. If either or both of the main gears fail to retract, an emergency retraction may be attempted at the discretion of the pilot. Investigation of the system should be made prior to manual retraction. To accomplish emergency retraction proceed as follows:

a. Remove the left hydraulic panel cover.

b. Depress and hold the UP button on the landing gear selector valve until the landing gears are retracted and the doors are closed. Release the button.

If the main landing gears fail to retract after operation of the manual override of the landing gear selector valve, proceed as follows:

a. Pull the landing gear control circuit breaker located on the copilot's lower circuit breaker panel.

b. Place the landing gear control handle in the UP position.

c. Deplete the utility hydraulic pressure by turning off the No. 1 and No. 2 engine-driven hydraulic pumps and operating the flight controls.

d. Rotate the emergency engaging handle (figure 3-9) counterclockwise to its stop, and pull while rotating the handcrank until the force required for rotation indicates engagement of the manual extension system. The handle will lock out after it is pulled.

e. Retract the main landing gears with the handcranks, reversing the rotational direction used in extending the gears.

f. After retraction, return the emergency engaging handle to the disengage position by rotating clockwise to its stop and pushing in.

g. Verify proper handle position by rotating the handcranks one revolution each way.

h. Check visually that the main landing gears are up.

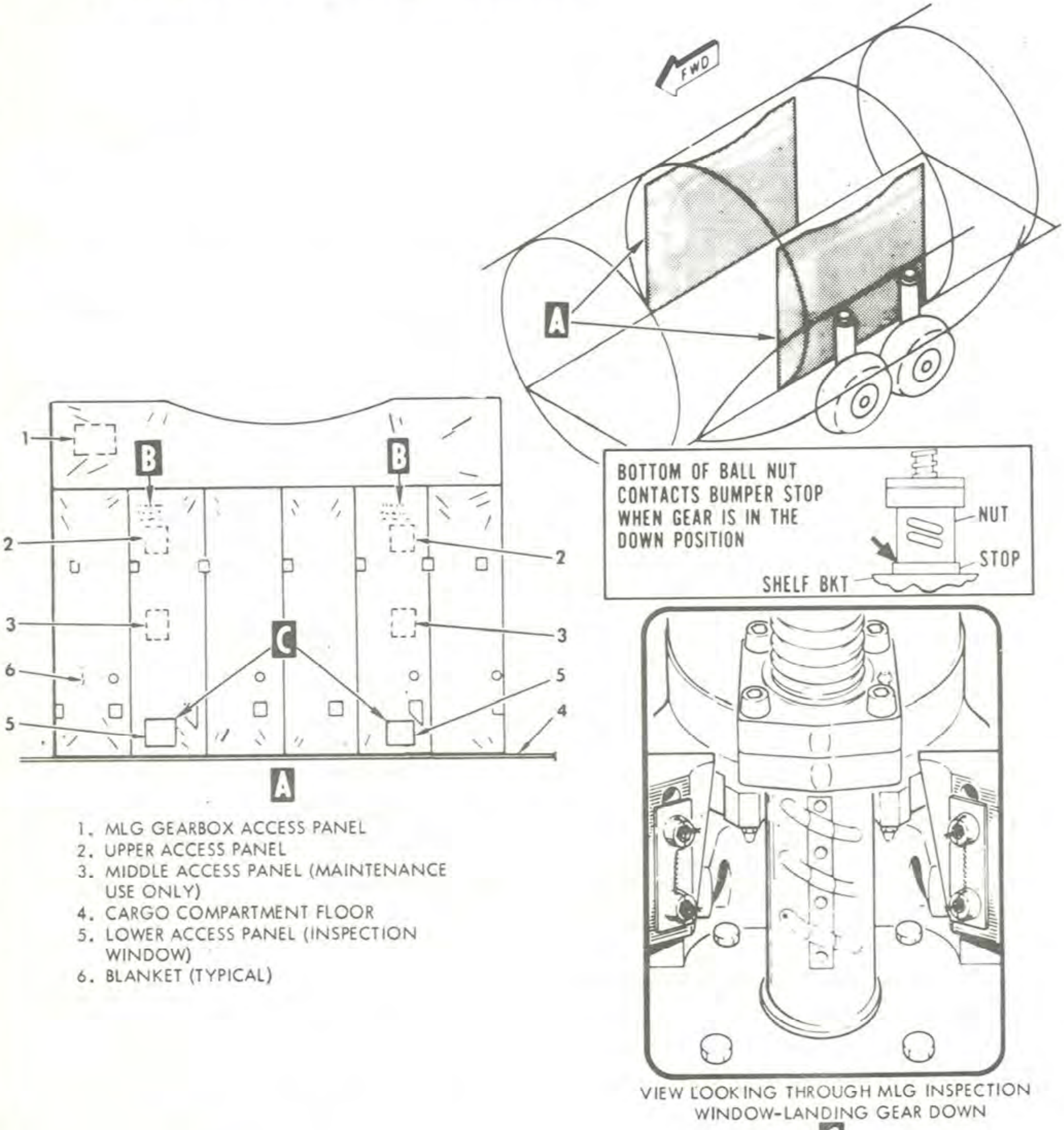
Note

No provisions exist for manual retraction of the nose landing gear.

Landing Gear Tie-Down. (See figure 3-11.)

Before landing with a broken shelf bracket or drag pins not engaged in the self bracket, the following procedure will be used to tie the landing gear down. If 25,000-pound tie-down chains are not available, two connectors (tie-down devices) and six 10,000-pound chain segments, forming two chain loops, are required to tie-down each pair of opposite struts. If

mlg wheel well access



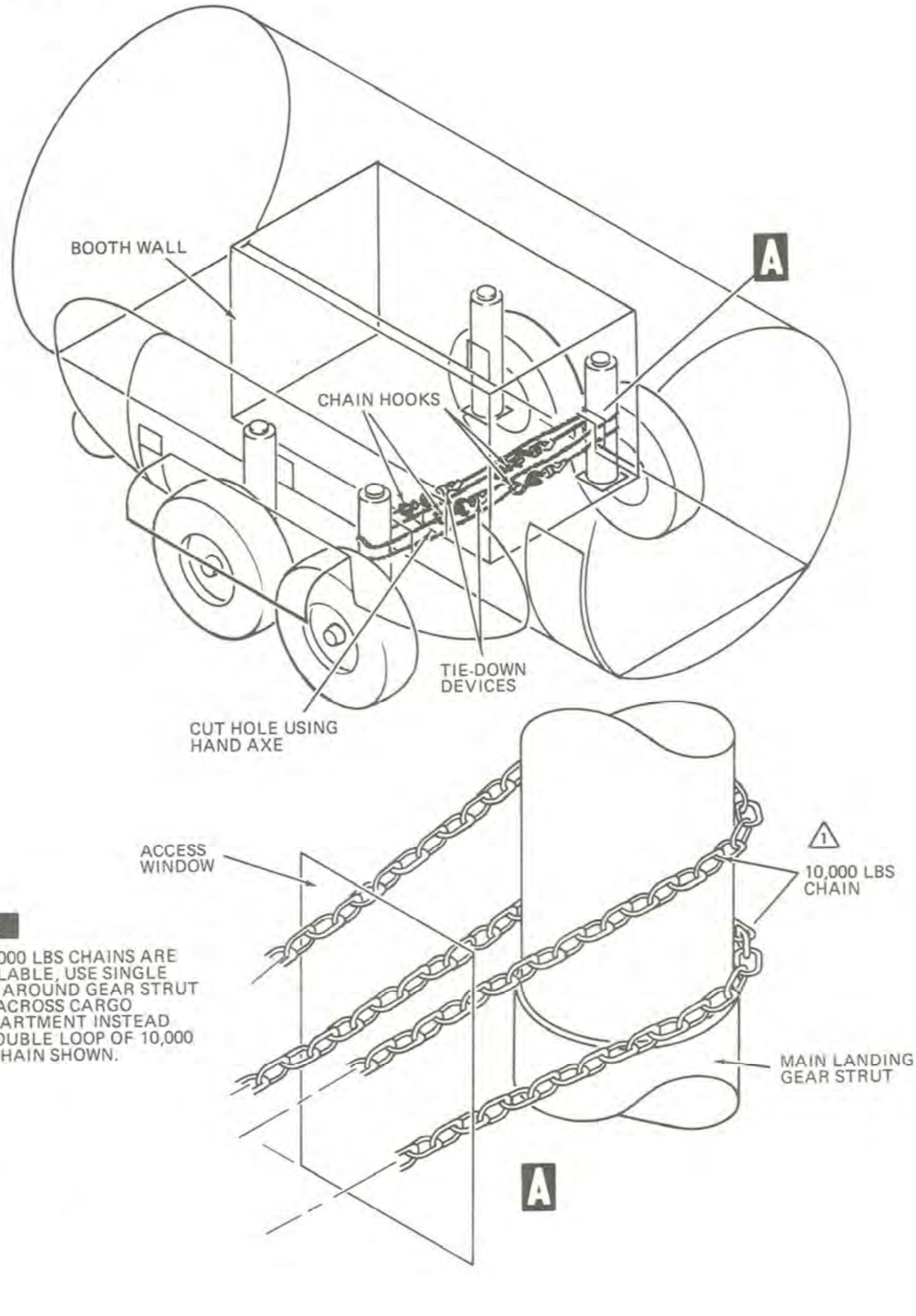
1. MLG GEARBOX ACCESS PANEL
2. UPPER ACCESS PANEL
3. MIDDLE ACCESS PANEL (MAINTENANCE USE ONLY)
4. CARGO COMPARTMENT FLOOR
5. LOWER ACCESS PANEL (INSPECTION WINDOW)
6. BLANKET (TYPICAL)

VIEW LOOKING THROUGH MLG INSPECTION WINDOW-LANDING GEAR DOWN

C

Figure 3-10.

landing gear tie-down



NOTE

⚠1 IF 25,000 LBS CHAINS ARE AVAILABLE, USE SINGLE LOOP AROUND GEAR STRUT AND ACROSS CARGO COMPARTMENT INSTEAD OF DOUBLE LOOP OF 10,000 LBS CHAIN SHOWN.

Figure 3-11.

25,000-pound chains are available, two connectors, and three 25,000-pound chain segments are required. See figure 3-11 for chain arrangement.

a. Depressurize the airplane and place the air-conditioning master switch to AUX VENT (for ferry flight only).

b. Landing gear control circuit breaker pulled.

c. Remove the wheel well inspection windows of the struts to be tied down. Cut a hole in the booth wall near the floor.

Note

Securing a piece of safety wire to the end of the chain will make it easier to guide the chain around the strut.

d. Pass the ends of two 10,000-pound chain segments (or the end of a single 25,000-pound chain segment, if available) around the applicable strut and back through the inspection opening. Repeat this for the opposite strut.

e. Fasten two other 10,000-pound chain segments (or a single 25,000-pound chain segment, if available) between the ends of the chains placed around the struts.

f. Install connectors between the remaining loose ends of the chains around the struts, and tighten the connectors. Repeat the process for the other pair of opposite struts, if necessary.

WARNING

Move all personnel to the forward and aft ends of the cargo compartment to prevent injury if a chain should break.

Land the airplane in a normal manner, after notifying the control tower of the difficulty and requesting that the crash equipment be alerted. Do not attempt to taxi the airplane after landing.

CAUTION

Do not attempt a take-off with a known or suspected main landing gear malfunction.

Nose Landing Gear Visual Check

Note

Due to the configuration of the nose landing gear on these airplanes, tiedown is not necessary, nor is it practicable.

Remove the nose gear inspection panel. Visually check the pin which protrudes from the aft end of the actuator and operates the down-and-locked indicator switch. If a band of fluorescent paint is visible on the pin, the downlock is engaged. If this band is not visible, the downlock is not engaged. In either case, maintain pressure on the down side of the nose landing gear hydraulic system.

During landing, hold the nose wheels off the ground as long as possible, but touch down while elevator effectiveness allows gentle lowering of the nose. Do not attempt to taxi the airplane. Set the parking brake. Place chocks in front of the nose wheels, or jack the nose of the airplane, and then install the ground lock pin.

FLARE LAUNCHER/DISPENSER EMERGENCIES.

Flare Fire (LAU-74/A).

In the event of a fire in the flare launcher, the following procedures will be accomplished:

The pilot will be advised and all crewmembers not required to control the airplane will immediately go on 100 percent oxygen. The pilot will direct crewmembers to fight the fire as required.

WARNING

Due to the intensity of a flare fire, an extremely short period of time is available to jettison the flare launcher and/or to evacuate the airplane.

Note

The oxygen bottles in the aircraft may be equipped with one of three types of regulators: The A-13, the A-15, or A-21. For 100 percent oxygen on the A-15, the crewmember must cover the diluter opening with his hand. With the A-21 regulator place the control knob at NORMAL. The A-21/A-13 regulator will provide 100 percent oxygen at any setting.

1. Flare Launcher	Jettison	P/IO
2. Eliminate smoke and fumes (refer to Fuselage/ Smoke and Fumes Elimination)		

Hung Flare Procedure (LAU-74/A).

1. Pilot	Advised	IO
2. Selector valve	OFF	IO
3. Ejector shutoff valve of malfunctioning chute	OFF	IO
4. Selector valve	ON	IO
5. Resume normal operation for remaining chutes		IO

WARNING

Do not attempt to down load flares during flight. To do so could result in the cap coming loose from the flare and pulling the lanyard, resulting in a flare fire.

Manuel Flare Ejection (LAU-74/A).

In the event of an electrical failure, and launcher air pressure is above 750 psi, flares can be manually launched by the following steps:

WARNING

Visually verify correct placement of the flare in the launcher tube breech before pressing the manual ejection level for which no ready light indication is present.

1. Pilot	Advised	IO
2. Manual ejection lever lock pin	Unlocked	IO
3. Manual ejector lever	Pressed	IO

Flare Fire (SUU-42A/A).

WARNING

In the event of a fire in the dispenser, immediate consideration should be given for jettisoning the dispenser. Due to the intensity of a flare fire, an extremely short period of time is available to jettison the dispenser or to evacuate the aircraft.

1. Flare dispenser	Jettision	P

Hung Flare (SUU-42A/A).

In the event a flare fails to dispense completely, normal flare dispensing operations can be continued. The flare(s) in that tube will not be usable for the remainder of the mission.

If a flare is protruding from the aft end of the dispenser, a hung flare condition exits. Avoid overflying populated areas for the remainder of the mission and declare an inflight emergency prior to landing.

Dispenser Fire (ALE-20).

The dispenser has no provision to jettison the AN/ALA-17 flare set. In the event of a flare fire, the dispenser is designed to contain the fire within the flare set. If conditions require, the three controlling crewmembers will attempt to launch all remaining flares.

ILLUMINATOR EMERGENCIES (40 KVA).

Should any malfunction of the illuminator be indicated by illumination of the interlock lights or apparent smoke or fire, and the unit does not shut down automatically, employ the following procedure:

1. Main power switch "OFF" IO

WARNING

Do not use high pressure water extinguisher on electrical fires.

2. Store illuminator by manual operation. IO

GUN EMERGENCY AND MALFUNCTION PROCEDURES.

Note

After completing emergency and malfunction procedures, refer to Pre-Strike Gun Arming or Post Strike checklists as required.

M61 20MM Gun.

WARNING

Serious personal injury can result when attempting to clear or repair a malfunctioning gun before allowing adequate cooling time to preclude the possibility of a cook-off.

1. ARM/SAFE switches SAFE AG
   (both malfunctioning and adjacent gun)

2. E/Pilot	Advised	AG
3. Firing lead	Disconnected	AG
4. Gun	Malfunction cleared if possible	AG

MXU-470/A Module and GAU-2B/A Gun.

WARNING

Serious personal injury can result when attempting to clear or repair a malfunctioning gun before allowing adequate cooling time to preclude the possibility of a cook-off.

1. ARM/SAFE switches (both malfunctioning and adjacent gun)	SAFE	AG
2. E/Pilot	Advised	AG
3. Gun switch	SAFE/LOAD	AG
4. Drive motor lead	Disconnected	AG
5. Safing sector	Removed	AG

WARNING

Anytime ammunition is present in the gun, no attempt will be made to remove the gun from module.

6. Gun	Malfunction cleared if possible	AG

40MM Loader/Jam.

WARNING

These procedures will be used whenever gun stoppage occurs with the loader tray and breech clear.

1. ARM/SAFE switch	SAFE	AG
2. E/Pilot	Advised	AG
3. LWCP MODE CONTROL switch	OFF	AG
4. Breechblock locking bolt	Installed	AG
5. Firing selector lever	STOP FIRE	AG
6. Hand operating lever	SAFE	AG
7. Thumb control lever	Rotate away from the arrow	AG
8. Loader	Cleared if possible	AG

40MM Failure To Fire.

WARNING

These procedures will be used whenever gun stoppage occurs with the breech closed or whenever a round is either fully or partially chambered.

1. E/Pilot	Advised	AG
2. Fire round	Manually	AG
3. ARM/SAFE switch	SAFE	AG
4. LWCP MODE CONTROL switch	OFF	AG
5. Firing selector lever	STOP FIRE	AG
6. Thumb control lever	Rotate away from arrow	AG
7. Ammunition from loader	Removed	AG

WARNING

- After sustained, heavy firing, the gun tube may be hot enough to cause a cookoff. Following such use, if the round cannot be removed and discarded overboard within 5 minutes after chambering, no further attempt will be made to remove the round until adequate cooling time has elapsed.
- **No attempt will be made to remove a round from the chamber until the hand operating lever is moved to the SAFE or COCKED position.**

8. Round	Removed and discarded	AG

105MM/40MM Gun Drift and Oscillation.

1. ARM/SAFE switch	SAFE	AG
2. LWCP MODE CONTROL switch	OFF	AG
3. E/Pilot	Advised	AG

105MM Failure To Fire.

1. E/Pilot	Advised	AG

WARNING

Personnel will not reach over the top of the weapon to recock the percussion mechanism or to perform any function.

WARNING

Allow 30 seconds to elapse prior to attempting to manually recock the percussion mechanism.

2. Percussion Mechanism	Recocked and fired (2 times)	AG
3. ARM/SAFE switch	SAFE	AG

WARNING

No further steps will be accomplished until a 2-minute waiting period has elapsed from last attempt to fire.

4. LWCP MODE CONTROL switch	LOAD	AG
5. Round	Removed, Discarded	AG

a. Inspect percussion mechanism for proper operation. Replace if necessary.

b. Should round separation occur, follow round separation procedures.

105MM Round Separation Procedures

Note

- These procedures are to be followed when a round separation is experienced while performing Post-Strike or Failure to Fire procedures.
- Care must be taken when loading a new case and propelling charge to prevent propellent bags from falling forward and lodging between the projectile and case. It may be necessary to reposition the gun to a smaller depression angle.

1. Case and propellant Close and lock breech.	Loaded	AG
2. LWCP MODE CONTROL switch	SLAVE	AG
3. ARM/SAFE switch	ARM	AG
4. E/Pilot	Advised	AG

105MM Tube Retraction.

Note

- These procedures are to be used when a hydraulic failure is experienced that prevents the weapon from being stowed either electrically or manually.
- The Post-Strike checklist must be accomplished prior to accomplishing tube retraction.

1. Safety cage	Down	AG
2. Breech	Closed, Locked	AG
3. Tube retraction pump relief valve	Closed	AG
4. Tube	Retracted	AG

Operate tube retraction pump until tube is completely retracted out of battery and tube retraction lockpin can be installed.

5. Tube retraction lockpin	Installed	AG
6. Tube retraction pump relief valve	Open	AG
7. E/Pilot	Advised, tube retracted and secured	AG

INFLIGHT DAMAGE ASSESSMENT.

If suspected or actual inflight damage occurs to the aircraft, immediate steps must be taken to determine the extent of the damage and the controllability of the aircraft for landing. If, at anytime, it becomes apparent that a safe landing cannot be made, consideration should be given to bailing out the entire crew while controlled flight is still possible. If inflight damage occurs, attempt to maintain positive control of the aircraft at all times and proceed as follows:

1. Conduct a preliminary check for aircraft damage and personnel injuries. Having the crew check in with this information from the front to the rear of the aircraft will assure a complete and orderly gathering of information.

a. Guns	Safe	E, AG
b. Engine bleed air valves	Closed	E
c. Air-conditioning master switch	AUX VENT	E

WARNING

If flammable fumes are present, electrical equipment not required to complete the above steps should not be turned on or off until the fumes are eliminated.

d. Unnecessary electrical equipment	Off	All
e. ECM pods	Isolate, as required	E, IO

CAUTION

In the event damage has been received to ECM equipment, pull circuit breakers located at fuselage station 245.

f. Electrical buses	Isolate, as required	E
g. Fuel boost pumps	As required	E
h. Aircraft controllability	Checked	P

(1) Attempt to climb to or above 10,000 feet AGL.

(2) Consider dumping fuel to lighten aircraft.

(3) Jettison cargo if required.

(4) Complete the Before Landing Pattern checklist.

(5) Configure the aircraft for landing.

WARNING

With structural damage, there is a possibility of a split flap condition when flaps are lowered.

(6) Slow to landing speed in 5-knot increments and execute turns as required to determine controllability of the aircraft.

(7) If at any time a stall buffet occurs or the aircraft becomes uncontrollable, immediately accelerate to a safe flying speed. Plan landing speed where safe control of the aircraft can be maintained.

WARNING

The speed must never be decreased to the point at which full control deflection is required since there may be no recovery capability beyond this point. Control and configuration changes changes should be input gradually.

CARGO/AMMO JETTISON.

Jettisoning of cargo/ammo can be dangerous, due to possible loss of airplane control or structural damage; therefore, the airplane commander must consider carefully the emergency situation, operational consideration, availability of suitable drop area, and whether jettisoning is necessary.

Parachutes, or restraining harness, will be worn by personnel jettisoning cargo/ammo. Depressurization will be required prior to jettison operations, and the crew members must use oxygen or the airplane must descend to an altitude below 10,000 feet. Cargo/ammo should be jettisoned out the ramp and aft cargo door opening. The ramp and aft cargo door should be in the airdrop position. Individual round of ammunition may be jettisoned through the port in the right paratroop door.

Jettison by Hand.

Relatively light weight cargo/ammo should be jettisoned by hand. The aft ramp and cargo door will be used for cargo jettisoning. Use the paratroop door if ramp and cargo doors cannot be opened. Jettison ammunition out of right paratroop door or ramp. No more than 100 round belts of 20MM ammunition will be jettisoned at any one time.

BAILOUT.

Inflight evacuation exits are shown in figure 3-12.

References to pressurization are not applicable unless the airplane is in a ferry flight configuration.

Bailout exits are:

1. Aft cargo ramp and door.
2. Right paratroop door.

Note

Air deflector door may be opened by actuating the air deflector door emergency operating switch located just forward of the right paratroop door.

3. Emergency egress panel.

Bailout Procedures.

a. Bailout warning will be given over the interphone and by three short rings of the alarm bell.
b. Reduce airspeed if possible.
c. Depressurize the airplane (ferry flight only).
d. Place the air-conditioning master switch in the AUX VENT position.
e. If possible, head the airplane toward an isolated area and engage the autopilot.
f. Turn off auxiliary isolation switch.
g. Turn on auxiliary pump.
h. Open the cargo door and ramp.

CAUTION

Do not lower ramp when airspeed is above 150 knots. To do so may cause severe buffeting.

Note

If airspeed cannot be reduced to 150 knots, direct the IO to go to the ramp control panel and open only the aft cargo door.

i. If unable to open cargo door and ramp, open the right air deflector and right paratroop door.
j. If smoke and/or fire prevent exit from ramp door and right paratroop door, use the explosive egress panel near the scanner/observer station. (See figure 1-65.)

WARNING

If possible, feather No. 3 propeller before using the emergency egress for bailout.

k. Give abandon airplane signal over the interphone, and one long ring of the alarm bell.
l. Evacuate the airplane.

Jettisoning Emergency Egress Panel.

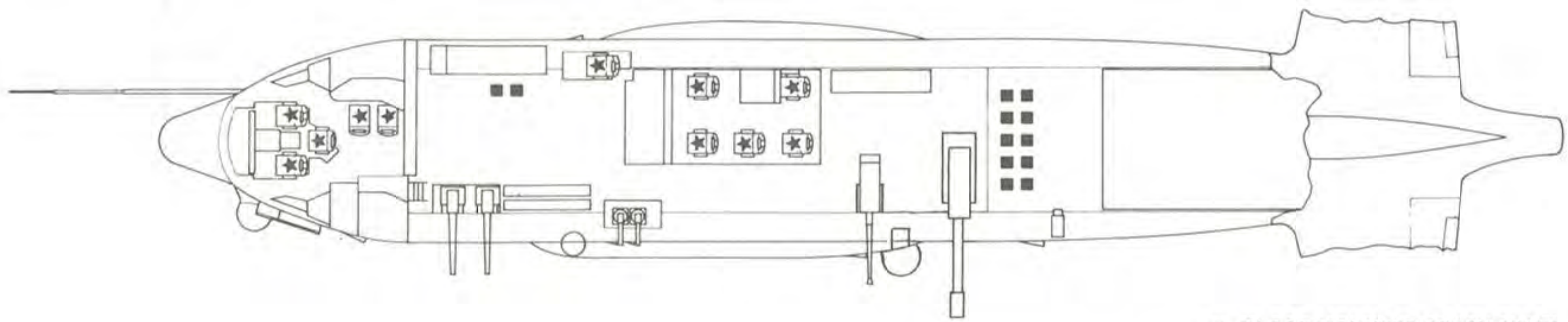
1. Safety cover - Break or remove
2. Arm-safe switch - ARM
3. T-handle - Squeeze and pull

Bailout Over Water.

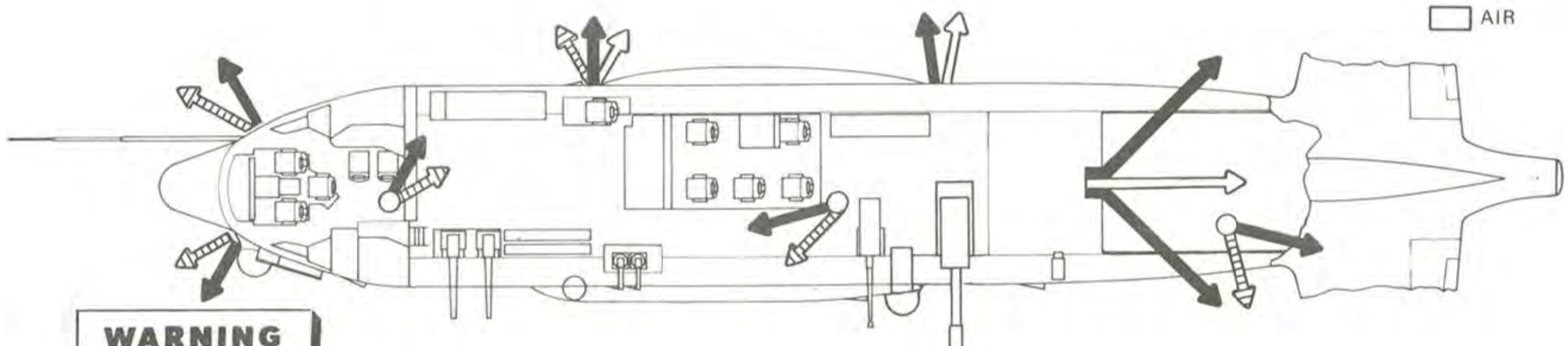
Consideration of various unfavorable factors involved in an over-water bail-out limits the decision recommending over-water bail-out to several specific instances; namely, when visual contact is made with land or adequate surface help; when wind and sea conditions are such as to preclude ditching; when fire or loss of control makes ditching impossible. Should a bail-out over water be required, the following procedures in addition to normal Bailout Procedures will be employed.

a. Give spoken warning over the interphone and three short rings of the alarm bell.
b. Turn IFF to EMERGENCY. The copilot should send distress signals and position reports as directed by the pilot.

crash stations



emergency exits



WARNING

WITH SMOKE AND/OR FUMES PRESENT, THERE MAY BE INSUFFICIENT TIME OF USEFUL CONSCIOUSNESS TO ATTEMPT EGRESS FROM MORE THAN ONE EXIT.

Figure 3-12.

c. If time permits (approximately one extra minute is required) put on exposure suits over flying clothing. (Exposure suits are carried on special missions.)

d. Don life jackets and parachutes, making certain the individual liferaft pack is secured to the parachute harness. Personnel should check the equipment of each other for completeness and proper adjustment.

WARNING

Do not attempt to inflate the life jacket prior to bailing out as it may be damaged in egress from the airplane as well as hinder the wearer in his exit.

e. Reduce airspeed as much as possible without losing control.

f. Trim airplane to approximately level flight.

g. Open cargo door and ramp.

h. If a ship is in the vicinity, make a run so that personnel, on bailing out, will drift onto the course and just ahead of the ship.

i. Give bail-out order over the interphone and one long ring of the alarm bell.

LANDING EMERGENCIES.

WARNING

In any condition of tire or landing gear extension failure, No. 5 and 6 guns should be elevated prior to landing.

Note

Consideration should be given to expending all munitions/flares prior to anticipated gear up landing.

WARNING

- If either or both No. 1 and No. 2 engines are inoperative, the auxiliary hydraulic pump must be turned on before landing.
- Under certain conditions it may be impossible to obtain or maintain safe flight. When ground contact is unavoidable maintain directional control and touchdown with wings level.
- If a failure occurs in the throttle control system, the controls may go either full power or full reverse. A possible indication may be unrelated power and throttle setting. In the event of the throttle control linkage failure, do not move the throttle and immediately shut down the affected engine in accordance with ENGINE SHUTDOWN PROCEDURES in this section.
- Prior to crash landing or ditching the airplane or in the event of fire in the vicinty of the AN/ALE-20 flare ejector case, the pilot shall, time and conditions permitting, direct ejection of the remaining flares. The flare ejection system does not have a jettison capability, however, flares can be rapidly dispensed by repeatedly depressing and releasing any one of the flare ejector switches until all flares have been ejected.
- Airplanes landing with an unsecured external panel or broken HF antennae should avoid the use of reverse thrust except for a greater emergency.

LANDING WITH ENGINES INOPERATIVE.

Landing With One Engine Inoperative.

The approach for landing with one engine inoperative is made in the same manner as for a normal landing except flaps should not be extended more than 50 percent until landing is assured. Below 110 knots airspeed during flareout the combined flight idle thrust on the side with two operating engines will tend to turn the airplane into the side with only one operating engine. This is particularly noticeable when a landing is made with an outboard engine feathered.

After nose wheel touchdown, retard throttles to GROUND IDLE, and use reverse thrust from symmetrical engines.

CAUTION

Reverse thrust on unsymmetrical engines may cause the airplane to veer to one side.

Landing With Two Engines Inoperative.

WARNING

Two-engine operations above 120,000 pounds is marginal.

After loss of two engines, attempt to decrease airplane weight, if necessary, by dumping fuel and/or jettisoning cargo before landing.

Note

If both No. 1 and No. 2 engines are inoperative, additional time is required to extend gear (unless the emergency hydraulic system is used) and flaps.

Change the landing procedures as follows:

DOWNWIND LEG

160 KIAS minimum

Gear and Flaps as required

Note

Positioning the flap lever below 15 percent will decrease minimum control speed due to an increase in available hydraulic pressure.

BASE LEG

160 KIAS

Gear and flaps as required

TURN TO FINAL

150 KIAS minimum

FINAL APPROACH

Maintain 150 KIAS, or approach speed, whichever is higher, until landing is assured.

Landing gear down

Flaps as required

WARNING

- A go-around is not recommended after flaps are lowered. Do not extend full flaps until landing is assured.
- When landing with two engines inoperative, assure firm nose wheel contact before reversing and use reverse thrust only as needed.

GO-AROUND WITH ONE OR TWO ENGINES INOPERATIVE.

The decision to go-around should be made as soon as possible on approach. When a go-around is decided upon, alert the crew and proceed as follows:

a. Begin the go-around at or above minimum control airspeed.

Note

- Two engine minimum control speed plus 20 knots must be obtained as soon as possible after initiation of go-around, and prior to raising the flap lever above 15 percent.
- If a go-around must be attempted and speed is less than minimum control speed, it may be necessary to reduce power on the opposite engine to help maintain directional control until minimum control speed is attained.

WARNING

The use of 5 degrees of bank away from the inoperative engine is necessary to maintain directional control when power is applied during go-around. Attempting to fly with wings level increases minimum control as much as 20 knots. Go-around with two engines inoperative should be avoided unless absolutely necessary. Every precaution should be taken so as not to let a situation develop that necessitates a go-around under these conditions. Descent below safe, comfortable altitudes and airspeed should not be made until absolutely assured of landing.

b. Advance throttles for all operating engines to maximum power as directional control will permit. Power applied to the asymmetrical engines will depend on the airspeed of the airplane at initiation of go-around.

c. When appropriate airspeed, altitude, and climb profile are established, direct the copilot to set check flaps to 50 percent.

WARNING

Retracting flaps from 100 percent to 50 percent will increase sink rate and stall speed. This is particularly noticeable at lower than normal airspeed. If safe altitude and airspeed are not attained, inadvertent touchdown and/or stall may occur.

d. Direct the copilot to raise the landing gear when certain that the airplane will not touch down.

After gear retraction:

e. Continue to raise flaps as airspeed and altitude permit.

CAUTION

Positioning the flap lever above 15 percent or operating the gear or flaps will increase the minimum control speed due to reduction in available hydraulic pressure.

Note

At low airspeeds, raise flaps in 10 percent increments with airspeed increasing approximately 5 knots between retraction increments.

f. After gear and flaps are up, continue as a normal take-off using three engine climb speed or 2-engine V_{MCA} plus 20 kts, whichever is higher if on three engines. Minimum climb out airspeed on two engines should be V_{MCA} (two engines out). If gross weight and altitude permit, use 160 KIAS.

LANDING WITH TIRE FAILURE.

Nose Landing Gear Tire Failure.

If one nose wheel tire is flat at time of landing, a normal landing may be made. If both nose wheel tires are flat at the time of landing, keep the nose wheels off the ground as long as possible. After nose gear contact use maximum reverse thrust and minimum braking. This procedure gives minimum nose wheel loading. Taxiing is not recommended.

Main Landing Gear Tire Failure.

If a main landing gear tire is flat at the time of landing, touch down the nose gear as soon as possible and use maximum reverse thrust. Taxiing is not recommended. If both tires of the main landing gear are flat, there will probably be a tendency to swerve toward that side. Line up and land on the side of the runway with the good tires. Touch down the nose gear as soon as possible, hold forward pressure on the control column, and assure directional control with the nose wheel steering system. Use wheel brakes (on the side opposite the flat tires only) to assist the nose gear in maintaining directional control. Use reverse thrust cautiously, but to the fullest extent possible to reduce landing roll to a minimum. Do not attempt to taxi.

LANDING GEAR RETRACTED.

Landing With One or Both Main Gears Retracted.

Note

To extend only the nose gear when the utility system is pressurized, raise the landing gear and pull the landing control circuit breaker after the gear indicates up and locked, then proceed with Nose Gear Manual Extension procedure. The landing gear control circuit breaker should remain pulled and the landing gear control lever will remain up for the landing.

If one main landing gear cannot be extended, the recommended procedure is to retract the other main gear and land with only the nose landing gear down, or to Land with all landing gears retracted. (Refer to Gear-Up Landing.)

Landing With Nose Gear Retracted and Main Gears Down.

If the nose gear fails to respond to normal and emergency operating procedures, an emergency landing may be accomplished, holding the nose of the airplane up as long as possible. Use the following procedure to make a nose-gear-up landing:

a. Give warning over the interphone, and six short rings of the alarm bell.

b. If cargo can be safely moved, shift it to an aft center of gravity location of not more than 30 percent.

c. Stow or secure all loose equipment.

d. Depressurize the airplane and close all engine bleed air valves.

e. Open the emergency escape hatches, the paratroop doors, the booth door, and the booth emergency kick-out panel.

f. Turn off all unnecessary electrical equipment.

If time permits, drain all liquid oxygen by placing all oxygen regulators on emergency.

g. Take crash position, passengers behind cargo.

h. Lock shoulder harness inertia reel.

WARNING

Insure that all controls which cannot be easily reached are properly positioned before locking the harness.

i. Request foam on the runway.

j. Assume a normal landing attitude.

k. Give warning over the interphone, and one long ring on the alarm bell to brace for impact.

l. Immediately upon ground contact, apply sufficient up-elevator to keep the airplane in a level attitude as long as possible. Do not use brakes.

m. After nose contact, use reverse thrust, but do not allow the nose to rise off the ground.

n. When the airplane comes to a complete stop, complete Ground Evacuation procedure as necessary.

Gear-Up Landing.

Before making a gear-up landing, perform the following operations:

a. Give warning over the interphone, and six short rings on the alarm bell.

b. Stow or secure all loose equipment.

c. Depressurize the airplane and close all engine bleed valves.

d. Jettisoning of cargo/ammo/flares should be considered.

e. Dump or consume all unnecessary fuel. (Refer to Fuel Dumping in this section.)

f. Open the emergency escape hatches, the paratroop doors, the booth door, and the booth emergency kick-out panel.

g. Turn off all unnecessary electrical equipment.

If time permits, drain all liquid oxygen by placing all oxygen regulators on emergency.

WARNING

Time permitting, when crash landing appears imminent, all crew members should don their protective helmet to minimize the risk of injury caused by any loose objects or equipment that may become dislodged during impact.

h. Take crash position, passengers behind cargo.

i. Fasten shoulder harness and inertia reel lock.

WARNING

Insure that all controls which cannot be easily reached are properly positioned before locking the harness.

j. Request foam on the runway (an area 3000 feet long by 30 feet wide should be requested) if available. Make a normal approach.

k. Assume a normal landing attitude.

l. Give warning over the interphone, and one long ring on the alarm bell to brace for impact.

m. When the airplane comes to a complete stop, complete Ground Evacuation procedure as necessary.

EMERGENCY LANDING ON SOFT GROUND.

If it should become necessary to land on soft ground or an unprepared runway, the decision to land with gears extended or retracted must be made by the pilot.

LOSS OF NOSE WHEEL STEERING DURING LANDING.

Whenever a loss of nose wheel steering is indicated by an immovable pilot's steering wheel, no further attempt will be made to force the wheel to turn, as this might prevent the nose wheel from castering. Under this condition, the pilot will pull back on the control column to relieve pressure on the nose wheel and maintain directional control of the airplane through the coordinated use of flight controls. differential power and differential brakes according to the prevailing circumstances of speed, crosswinds, engine out, and runway conditions.

CAUTION

With complete utility hydraulic and emergency hydraulic system failure do not use nose wheel steering on landing roll. Inadvertent use of nose wheel steering may allow hydraulic fluid to be bled from the shimmy dampener and allow the wheel to shimmy or turn from center.

LANDING WITH A COCKED NOSE WHEEL.

Basically, the procedure for landing with a cocked nose wheel is the same as landing with loss of nose wheel steering, with the following addition: request foam on the runway.

NOSE WHEEL SHIMMY.

Nose wheel shimmy is an indication of an unbalanced condition of one or both of the nose wheel tires or failure of the steering system. If shimmy occurs during the landing roll, decelerate gradually and apply up-elevator to keep as little load on the nose wheels as possible. In landing with a known shimmy condition, keep the nose wheels off the ground as long as possible, but touch down while elevator effectiveness allows gentle lowering of the nose.

DITCHING.

WARNING

Ditching of the airplane in this configuration should be attempted only as a last resort. If conditions permit, personnel in the cargo compartment should abandon the airplane.

Under ideal conditions of wind and sea, and by skillful execution of the recommended techniques, the ditching of transport-type airplanes can usually be accomplished with a high degree of success. However, due to the high-wing configuration of this airplane, the fuselage may be expected to settle after touchdown with consequent flooding of the cargo compartment. Consideration of various unfavorable factors involved in an over-water bail-out limits the decision recommending bail-out to serveral specific instances; namely, when near to land or adequate surface help; when wind and sea conditions are such as to preclude ditching; when fire or loss of control makes ditching impossible. Therefore, it is considered better to ditch if circumstances permit since this makes available the additional life rafts and survival equipment carried in the airplane. In any event, the decision to ditch or bail-out must be made by the pilot in view of the existing circumstances. This decision should never be delayed until the fuel supply is exhausted since the most effective ditching approach is made with power on at a speed slightly above the stall speed.

Ditching Characteristics.

Ditching characteristics of the C-130 airplane are not known; however, NACA controlled ditching tests of models similar to the C-130 in configuration indicate that there is a reasonably high probability that the airplane can be landed on water without major collapse of structure or a sudden rush of water into occupied compartments. On the basis of these tests, it is concluded that the following results can be expected upon ditching:

Note

These characteristics assume the airplane is ditched at a nose high attitude with 50 percent flaps, gear up, and at an airspeed of 10 knots above stalling speed.

Upon contact with the water, moderate bottom damage may occur in the area immediately forward of the cargo loading ramp hinge. The bottom damage will tend to stabilize the airplane laterally during the ditching run, maintaining the wings in an essentially level attitude. Wing dipping or water looping are not expected.

During the initial portion of the ditching run - the tail-down portion - the aft cargo door may be damaged. But the damage probably will not affect either the ditching run or the sinking rate since the location of the door is such that it will be above the water line when the nose settles during the latter part of the run. It is very unlikely that the ramp will open. The crew door, the emergency exit on the forward right side, and the right hand paratroop door, which will be out of the water during the tail-down portion of the ditching run, probably will not experience damage at any time during the ditching run.

When recovering from the tail-down, attitude, proposing may occur; but if it does, it probably will not result in further major structural damage. If porpoising does not occur, the airplane will probably assume a trim-up attitude, holding the nose clear until a fairly low speed is reached. In all probability, the nose wheel well structure and the windows will not be damaged.

As the nose settles during the final part of the ditching run, the fuselage will fill with water .airly fast. The airplane will sink to the wings, then float.

Ditching Procedures.

DITCHING.

The ditching charts (figure 3-15) give duties of personnel prior to, and during ditching. Figure 3-13 illustrates the emergency exits used during ditching. Figure 3-14 illustrates the liferaft releases.

WARNING

> Time permitting, when ditching appears imminent, all crew members should don their protective helmet to minimize the risk of injury caused by any loose objects or equipment that may become dislodged during impact.

The following are the standard alarm signals for ditching:

SIX SHORT RINGS . . . PREPARE FOR DITCHING

ONE LONG RING . . . . . BRACE FOR IMPACT

EMERGENCY DITCHING EQUIPMENT.

Ditching equipment should be in readiness at all times when flying over water. Prior to each overwater flight, the pilot will ensure that the necessary equipment is aboard, in serviceable condition, and stowed in the proper places.

EMERGENCY DITCHING EXISTS (FLIGHT CREW).

See figure 3-12 for emergency exits and for added crash station positions. Normally, crewmembers on the flight deck will use the forward escape hatch for exit after ditching. Crewmembers in the cabin will use the aft hatch for exit after ditching. In the event the center escape hatch is to be used, access to the hatch must be gained from the top of the operator's compartment.

PREPARATION FOR DITCHING.

Plans for ditching cannot be made without taking the wind direction into consideration. Waves move downwind, and the spray from wave crest is also blown downwind. Swells, however, do not always indicate wind direction and can be very large even when the wind is calm. Swells are the result of underwater disturbances. Over a sea, a pilot must be more exacting and alert when judging height.

ABANDONING AIRPLANE.

Evacuation of the airplane after ditching should be accomplished in an orderly manner in the shortest time possible. This cannot be done well without practice and in the event that the fuselage is dark and filling with water, further difficulty can be expected.

WARNING

> The crew and/or passengers must not leave ditching positions until it is ascertained that the airplane has stopped forward movement. Serious injuries can occur as the result of personnel unfastening safety belts prior to the airplane coming to a full stop.

Immediately after the airplane comes to a stop, additional emergency equipment may be collective and distributed to each crewmember. The crewmembers must carry out their After Ditching duties (figure 3-15) and then evacuate the airplane through the hatch previously assigned to them, in the correct order, and carrying the required equipment. They must also see that each piece of equipment for use in the liferaft is secured by lines to prevent its being lost overboard.

WARNING

> Assure that personnel are outside of the airplane and clear of escape hatches prior to inflating life vests.

CREW DUTIES.

When it is certain that the airplane has come to a complete stop, each crewmember will proceed with the following duties:

The engineer checks the pilot and copilot to see that they are uninjured, then pulls the flight station liferaft release handles. He then exits through the crew escape hatch and assures that the liferafts have been properly ejected. If they have not been released, he will pull the release handles located on top of the wing. When he has determined that equipment is properly launched, he will board right raft.

WARNING

> Liferaft release handles must be pulled through their full travel, for complete ejection and inflation of the liferaft.

The navigator collects the emergency equipment, exits through the crew escape hatch and boards the left raft.

The pilot and copilot will check each other to see if either has been injured. The copilot exits through the crew escape hatch and boards the right raft.

emergency exits - water

WARNING

SIDE EMERGENCY EXIT AND FLIGHT STATION HINGED WINDOWS ARE NOT TO BE USED IN HEAVY SEAS OR NOSE-DOWN CONDITION

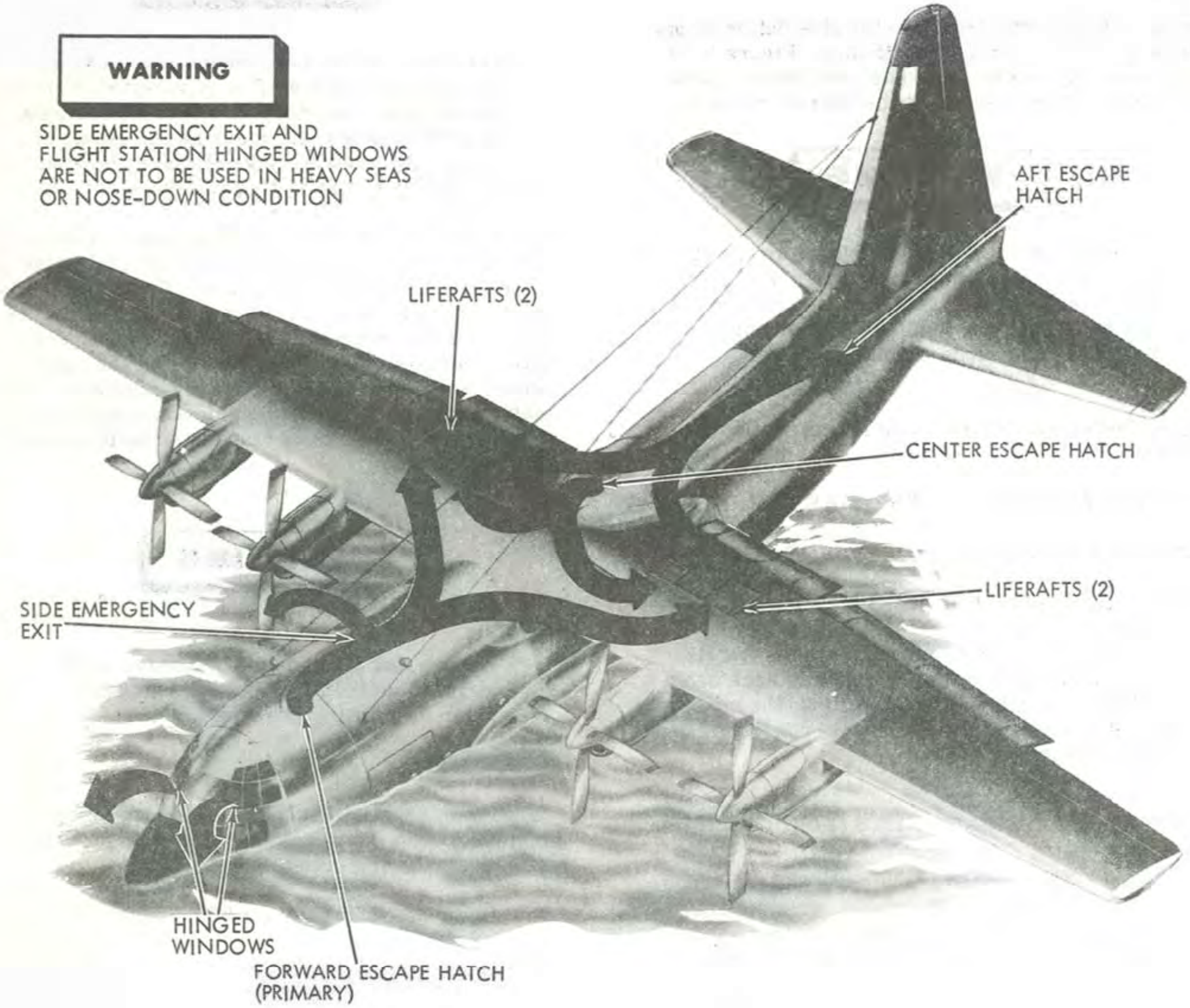


Figure 3-13.

liferaft releases

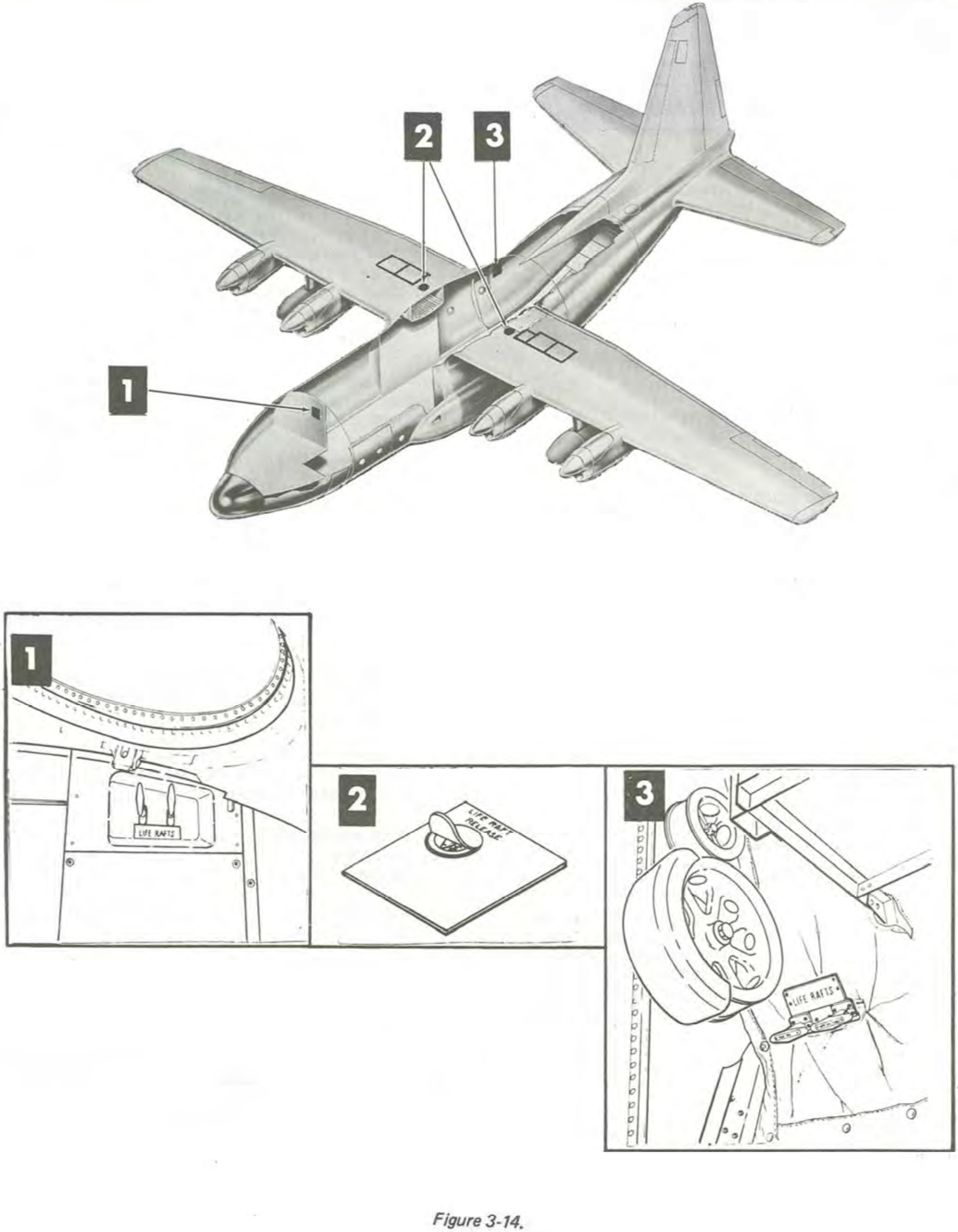


Figure 3-14.

The pilot ensures that all emergency equipment has been removed and all crewmembers have been safely evacuated, and then exits through the crew escape hatch and boards the left raft.

WARNING

In an emergency the pilot's and copilot's side windows may be used as emergency exits; however, heavy flooding may occur.

The illuminator operator will pull the aft liferaft release handles and evacuate through the aft escape hatch and board the left raft.

The IR operator exits through the aft emergency escape hatch, assists in loading liferaft, and boards left raft.

The airborne gunner exits through the aft emergency escape hatch, assists in loading raft and boards right raft.

The fire control officer exits through the flight station emergency escape hatch, checks life raft for proper ejection and boards right raft. Passes out emergency equipment.

The TV operator exits through the aft emergency escape hatch and boards left raft.

The electronic warfare officer exits through the aft emergency escape hatch and boards left raft.

DITCHING TECHNIQUE.

WARNING

Maintain deck angle of at least 7 degrees, optimum 9 degrees. Do not exceed recommended airspeed. Rate of descent not to exceed 200 feet per minute (recommend 100 feet per minute). Maintain constant back pressure on control column. Ditch at 10 knots above stalling speed. Under no circumstances should the airplane be stalled in, since this will result in severe impact and cause the airplane to nose into the water.

If possible, use up or dump most of the fuel supply to lighten the airplane and reduce stalling speed. Empty tanks also help keep the airplane afloat.

If possible, jettison cargo to lighten the airplane.

NORMAL POWER-ON DITCHING. Best results will be obtained by following the procedures outlined below:

a. Ditch while power is available. Power will allow the pilot to choose the spot for ditching, and the most favorable landing position and attitude.

b. Use 50 percent flaps with gear up.

c. Ditch at 10 knots above power-off stall speed. This will give an approximate angle of ditching slightly above level flight. Under no circumstances should the airplane be stalled in, since this will result in severe impact and cause the airplane to nose into the water.

In daylight it is recommended that the airplane be ditched along the top of the swell, parallel to the rows of swells, if the wind does not exceed 30 knots. In high winds, it is recommended that ditching be conducted upwind to take advantage of lowered forward speed. However, it must be remembered that the possibility of ramming nose-on into a wave is increased, as is the possibility of striking the tail on a wave crest and nosing in.

PARTIAL POWER DITCHING. When ditching with one or more engines inoperative, the following technique is recommended.

a. With two engines inoperative on the same side of the airplane, use power on the operative inboard engine only.

b. If power is available from the No. 2 and 4 engines or the No. 1 and 3 engines, considerable power may be used to control the airplane.

c. With symmetrical power conditions, use power as required to give flattest approach using 50 percent flaps and gear up.

d. On final approach, it is advisable to hold speed 20 knots above power-off stall speed until flare-out, at which time speed will be reduced to 10 knots above power-off stall speed.

CROSSWIND DITCHING. The basic rules for ditching listed in Normal Power-On Ditching will still apply, in addition to the following:

a. Crab the airplane to kill drift.

b. Land on the downward side of the swell or wave.

UPWIND DITCHING. The basic rules for ditching listed in Normal Power-On Ditching will still apply, in addition to the following:

a. Maintain nose-up condition, avoid nose striking wave face.

b. Touch down immediately behind the crest of a rising wave, avoid the face of the wave.

c. Hold nose up after first impact.

NIGHT DITCHING. Night ditching will be conducted with the aid of instruments to establish proper attitude of airplane.

Make an instrument approach, holding airspeed 20 knots above stall speed. At 500 to 700 feet above the water (use radio or radar altimeter if available) set up approximately 200 feet per minute rate of descent and establish an airspeed 10 knots above stall speed, with 50% flaps and gear up.

Use landing lights as necessary.

Hold wings level to avoid digging a wing into the water and cartwheeling the airplane.

Land at 10 knots above power-off stall speed, using 50 percent flaps and gear up.

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 minutes left)	AFTER DITCHING
PILOT'S DUTIES	1. Order crew to prepare for ditching, giving approximate time remaining. Order crew to start emergency procedures. Each crewmember will acknowledge. 2. Transmit on UHF/VHF emergency frequency "MAYDAY" 3 times, and identification 3 times, transmit tone for 20 seconds, and request fix or bearing. 3. Obtain flashlight and first aid kit. 4. Don anti-exposure suit and life vest. Fasten shoulder harness and safety belt.	1. Remove parachute or any other bulky item which may hinder movement, and loosen collar. 2. Alert cargo compartment personnel with interphone and six short rings on the alarm system. 3. Order copilot to send final distress signal. 4. Order IO to secure 40 KVA and close cargo door. 5. Order all crewmembers and other personnel to secure themselves in ditching position. 6. Lock shoulder harness. 7. Immediately before ditching, warn personnel over interphone to brace for impact, and order copilot to give one long ring on alarm system.	1. Check flight station and cargo compartment to ensure that all personnel and emergency equipment have been evacuated. 2. Exit through forward escape hatch and inflate life vest. 3. Board left liferaft and receive emergency equipment. 4. Destroy classified documents and equipment.
COPILOT'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Set IFF/SIF to emergency. Send emergency signal of HF radio followed as soon as possible by emergency message as provided by navigator.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Send final distress signal and intentions of pilot as to ditching.	1. Exit through forward escape hatch. 2. Inflate life vest.

Figure 3-15. (Sheet 1 of 5)

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 minutes left)	AFTER DITCHING
COPILOT'S DUTIES (Continued)	3. Obtain DF service, bearing, fixes, etc.	3. Lock shoulder harness.	3. Board right liferaft.
	4. Obtain flashlight, first aid kit, and confidential folder.	4. On orders from pilot, give one long ring on alarm system.	
	5. Destroy classified documents and equipment.		
	6. Don anti-exposure suit and life vest. Fasten shoulder harness and safety belt.		
	7. Continue transmitting outlined emergency message as required.		
ENGINEER'S DUTIES	1. Acknowledge pilot's order to prepare for ditching.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar.	1. Pull liferaft release handles at flight station.
	2. Depressurize airplane (ferry flight only), engine bleed air valve switches closed, emergency depressurization switch normal (ferry flight only), air conditioning master switch MANUAL PRESS, hold MANUAL PRESS control switch to increase for 90 seconds.	2. Remove and stow flight station emergency escape hatch.	2. Exit through forward escape hatch with container of water if possible.
	3. Obtain flashlight, hand axe, and first aid kit.	3. Secure loose articles.	3. Inflate life vest, check liferaft and radio, and discard hand axe.
	4. Don anti-exposure suit and life vest.	4. Turn seat to face forward and full down and fasten safety belt and lock shoulder harness.	4. Board right liferaft.
	5. Destroy classified documents and equipment.		

Figure 3-15. (Sheet 2 of 5)

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 minutes left)	AFTER DITCHING
NAVIGATOR'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Provide position, time, true heading, TAS, altitude, estimated ditching position, and relay fix or bearing to copilot for inclusion in the distress signal. 3. Transmit "MAYDAY" and airplane position coordinates on UHF/VHF. 4. Collect essential navigation equipment. 5. Destroy classified documents and equipment. 6. Don anti-exsposure suite and life vest. 7. Inform crew and other personnel of distance and direction to nearest land or rescue vessel.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Turn seat to face forward, fasten seat belt and lock shoulder harness.	1. Exit through forward escape hatch, inflate life vest, and check liferaft for proper ejection. 2. Board left liferaft
IR OPERATOR'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Remove kick-out panel. 3. Obtain flashlight and first aid kit. 4. Don anti-exposure suit and life vest. 5. Destroy all classified documents and equipment.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Secure loose articles. 3. Face forward, fasten seat belt and lock shoulder harness.	1. Exit through aft escape hatch. 2. Inflate life vest. 3. Assist in loading liferaft. 4. Board left liferaft.

Figure 3-15. (Sheet 3 of 5)

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 minutes left)	AFTER DITCHING
ILLUMINATOR OPERATOR'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Instruct non-crewmembers to prepare for ditching. 3. Don anti-exposure suit and life vest. 4. Secure loose articles. 5. Destroy all classified documents and equipment.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Jettison flare launcher, stow 40 KVA and close cargo ramp door. Remove aft emergency escape hatch and secure. 3. Fasten seatbelt.	1. Actuate aft liferaft release handles. 2. Exit through aft escape hatch. 3. Inflate life vest. 4. Assist in loading raft. 5. Board left liferaft.
AIRBORNE GUNNER'S DUTIES	1. Acknowledge pilot's order for ditching. 2. Elevate No. 5 and No. 6 guns and raise safety cage on No. 6. 3. Obtain flashlight and first aid kit. 4. Don anti-exposure suit and life vest. 5. Secure loose articles 6. Destroy all classified documents and equipment.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Assist engineer and illuminator operator as required. 3. Obtain large first aid kit. 4. Occupy crash seat on ramp. 5. Face forward, fasten seat belt and lock shoulder harness.	1. Exit through aft escape hatch. 2. Inflate life vest. 3. Assist in loading raft. 4. Board right liferaft.

Figure 3-15. (Sheet 4 of 5)

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 minutes left)	AFTER DITCHING
FIRE CONTROL OFFICER'S DUTIES	1. Acknowledge pilot's order for ditching. 2. Collect pyrotechnic pistol, signal flares, first aid kit, flashlight, and survival supplies. 3. Destroy all classified documents and equipment. 4. Don anti-exposure suit and life vest.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Turn seat to face forward, fasten safety belt, position seat full left, and lock shoulder harness.	1. Exit through forward escape hatch, inflate life vest, and check liferaft for proper ejection. 2. Board right liferaft. 3. Pass out emergency equipment.
TV OPERATOR'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Obtain flashlight and large first aid kit. 3. Don anti-exposure suit and life vest. 4. Destroy all classified documents and equipment.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Secure loose articles. 3. Face forward, lock seat, fasten seat belt and lock shoulder harness.	1. Exit through aft escape hatch. 2. Inflate life vest. 3. Board left liferaft.
ELECTRONIC WARFARE OFFICER'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Obtain flashlight. 3. Don anti-exposure suit and life vest. 4. Destroy all classified documents and equipment.	1. Remove parachute or any other bulky items which may hinder movement, and loosen collar. 2. Secure loose articles. 3. Face forward, lock seat, fasten seat belt and lock shoulder harness.	1. Exit through aft escape hatch. 2. Inflate life vest. 3. Board left liferaft.

Figure 3-15. (Sheet 5 of 5)

SECTION IV

auxiliary equipment

TABLE OF CONTENTS

Refer to T.O. 1C-130(A)A-1-3 for the following equipment:

TRIM-7A
AN/ASD-5
AN/ALQ-87(V)
AN/ALR-46(V)
AN/ALR-69

BLEED AIR SYSTEM.

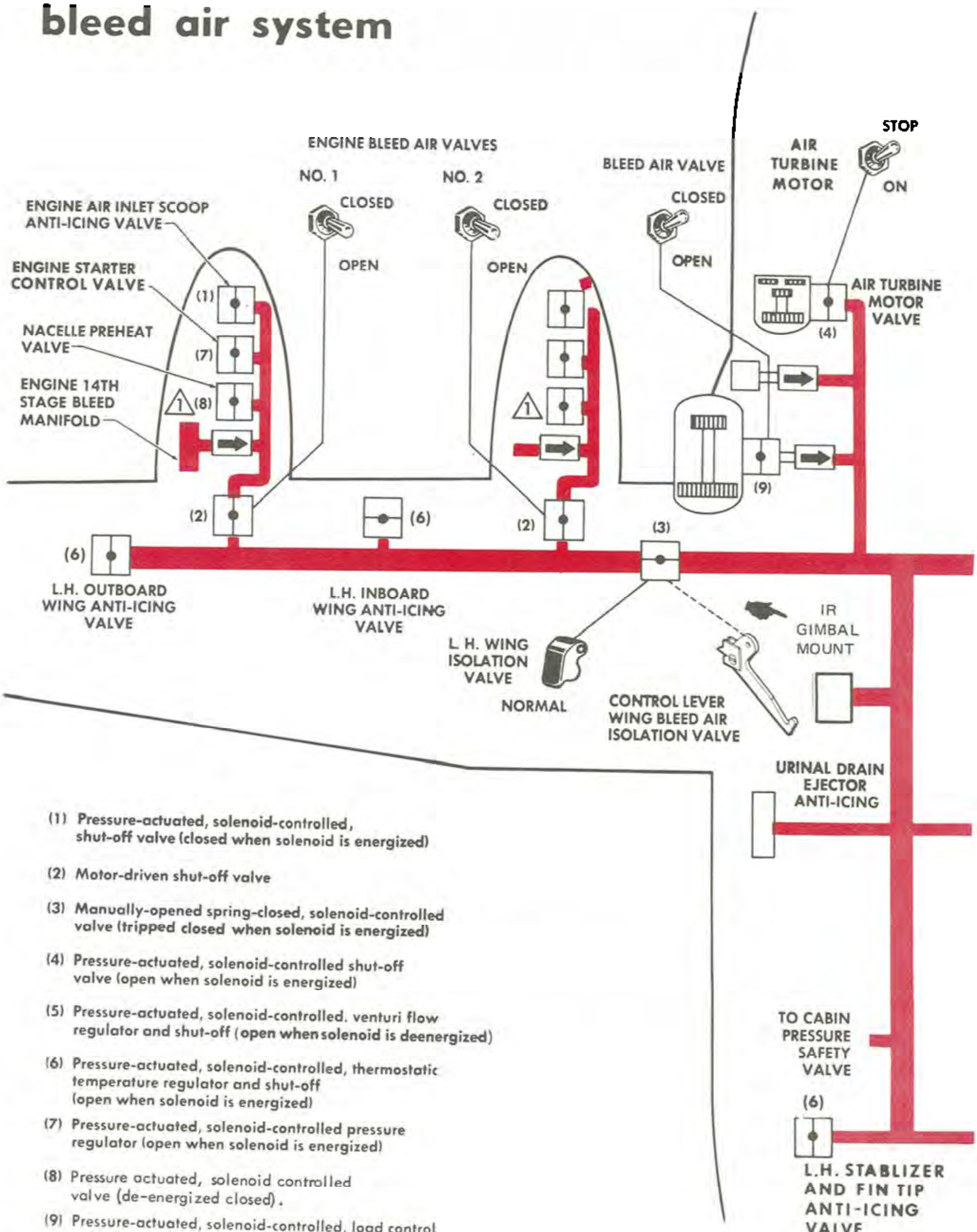
The bleed air system (figure 4-1) consists of high-pressure, stainless steel ducts and air shutoff valves which direct compressed air to pneumatically operated systems of the airplane. The entire system of ducts serve as a plenum from which air is distributed to other systems. The pneumatic systems served by the bleed air system are as follows:

- Engine starting system
- Nacelle preheat systems
- Air-conditioning systems
- Cabin pressurization system
- Windshield defogging system
- Engine air inlet scoop anti-icing systems
- Leading edge anti-icing system
- Radome anti-icing system
- Air turbine motor
- Urinal drain ejectors

Compressed air is supplied to the bleed air system from the engines when they are running, or compressed air is supplied from either the gas turbine compressor or from an external pressure source when the airplane is on the ground and the engines are not running. The normal procedure is to supply air from the gas turbine compressor or from an external source until the first engine is started; then, engine bleed air is used. The main bleed air manifold extends across the leading edge of the wing. Air enters the main manifold through five ports: four from the engines and one from the gas turbine compressor or an external source. Branch ducts connected to the main manifold distribute air for operating the following:

- Air-conditioning systems
- Radome anti-icing system
- Leading edge anti-icing system
- Air turbine motor
- Urinal drain ejectors
- Cabin pressurization system

bleed air system



(1) Pressure-actuated, solenoid-controlled, shut-off valve (closed when solenoid is energized)

(2) Motor-driven shut-off valve

(3) Manually-opened spring-closed, solenoid-controlled valve (tripped closed when solenoid is energized)

(4) Pressure-actuated, solenoid-controlled shut-off valve (open when solenoid is energized)

(5) Pressure-actuated, solenoid-controlled, venturi flow regulator and shut-off (open when solenoid is deenergized)

(6) Pressure-actuated, solenoid-controlled, thermostatic temperature regulator and shut-off (open when solenoid is energized)

(7) Pressure-actuated, solenoid-controlled pressure regulator (open when solenoid is energized)

(8) Pressure actuated, solenoid controlled valve (de-energized closed).

(9) Pressure-actuated, solenoid-controlled, load control valve (open when solenoid is energized)

Figure 4-1. (Sheet 1 of 2)

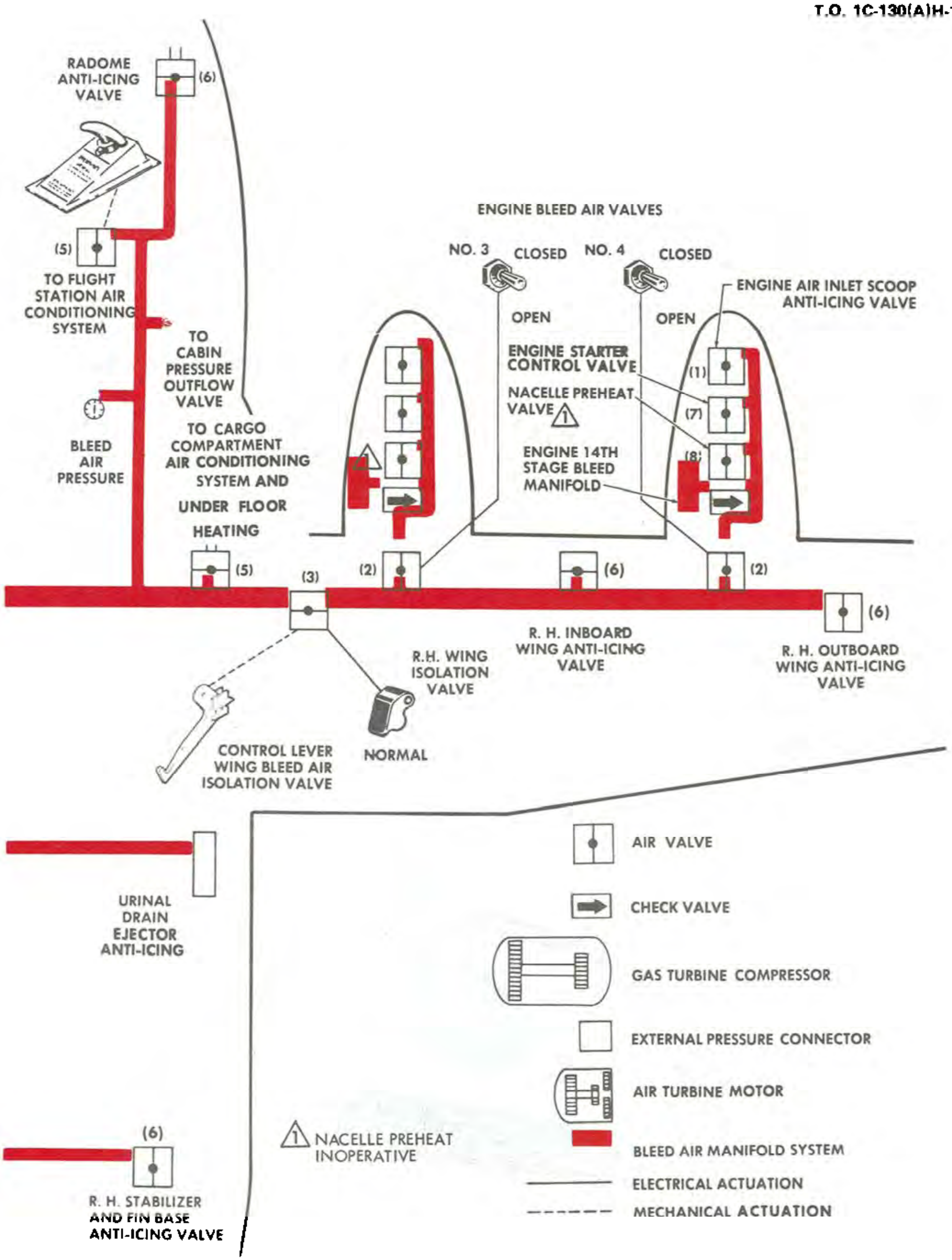


Figure 4-1. (Sheet 2 of 2)

Each engine bleed air manifold is connected to the main manifold just aft of the fire wall by an engine bleed air shutoff valve. Branch ducts connected to the engine manifold forward of the fire wall distribute air for operating the following:

Engine starting system
Nacelle preheat system
Engine air inlet scoop anti-icing

Check valves installed in each engine bleed air manifold, the gas turbine compressor supply duct, and the external pressure supply duct prevent reverse flow when any of these sources of supply are inoperative.

ENGINE BLEED AIR VALVE CONTROLS.

Four engine bleed air valve switches on the anti-icing systems control panel (figure 4-13) control the opening and closing of the engine bleed air valves. The control circuit for each valve is connected through a switch actuated by the fire handle. When the fire handle is pulled, the engine bleed air valve is closed and the normal switch control is rendered inoperative. Twenty-eight volt dc power for operation of each of the motor-driven valves is supplied from the essential dc bus through the bleed air fire shutoff circuit breaker on the copilot's side circuit breaker panel.

BLEED AIR PRESSURE GAGE.

A direct-reading pressure gage (figure 4-3) located on the copilot's upper circuit breaker panel indicates main bleed air manifold pressure in pounds per square inch. The gage is used to check the pressure of the bleed air supply and the operation of the pneumatic systems.

WING BLEED AIR ISOLATION VALVES.

Two wing isolation valves are installed in the bleed air manifold near the inboard section of the wing. These valves are electrically closed by the wing isolation valve switches on the anti-icing system control panel (figure 4-13) and manually opened by two handles mounted in the top of the cargo compartment (figure 4-2) forward of the left and right wheel well wall. Twenty-eight volt dc power for operation of the valves is supplied from the essential dc bus through the bleed air isolation valve circuit breakers on the copilot's lower circuit breaker panel.

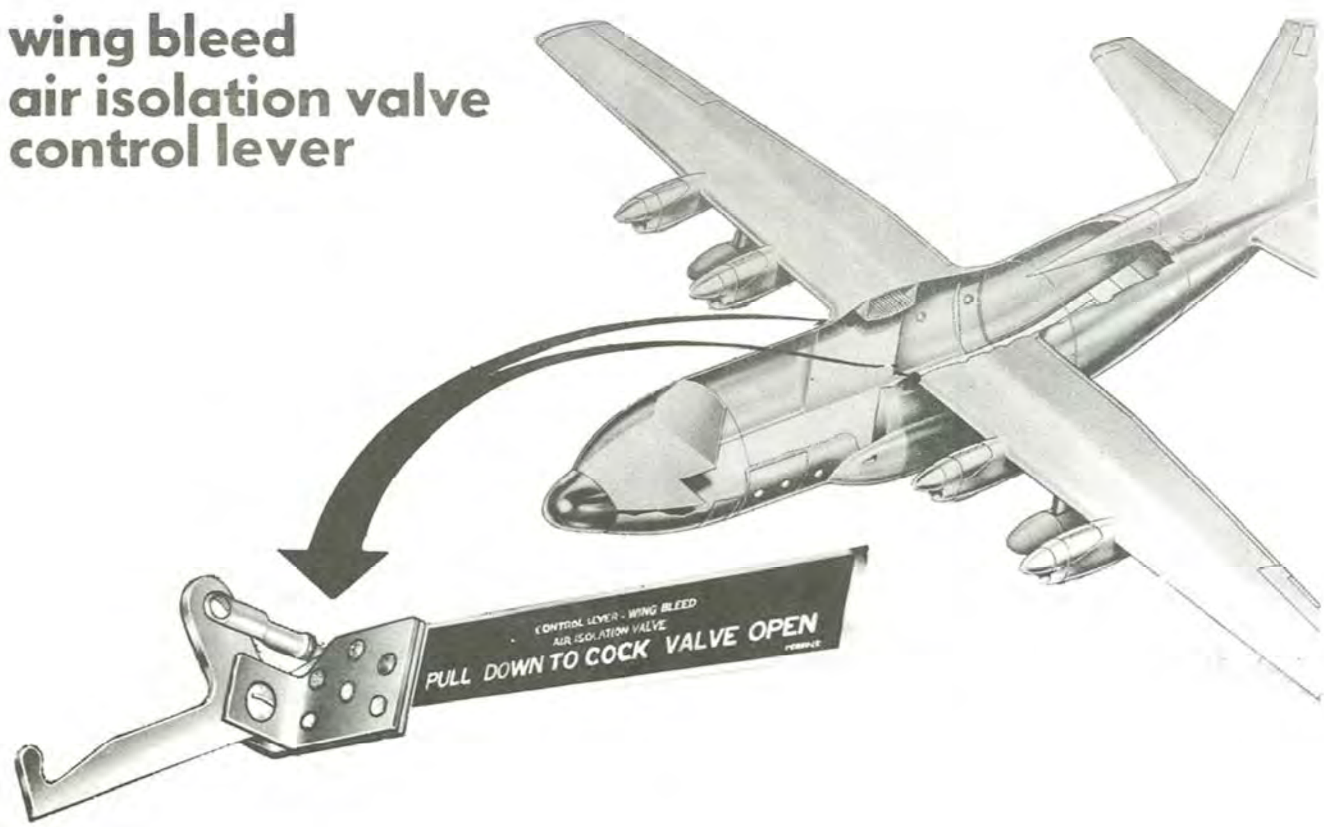


Figure 4-2.

bleed air pressure gage

Figure 4-3.

GROUND CHECKOUT OF THE BLEED AIR SYSTEM.

The bleed air pressure gage can be used to check the bleed air system. Use the following steps to check out the system with external ac or dc power and with air supplied by the gas turbine compressor:

a. Open the engine bleed air valves and turn off all systems that use bleed air.

b. Open the gas turbine compressor bleed air valve.

c. Check system pressure for a reading of 35 psi minimum Failure to reach this pressure indicates that a valve in the system has not closed, that a duct is leaking, or that the compressor output is low.

d. Close the gas turbine compressor bleed air valve.

e. As pressure in the system drops, time the drop from 30 to 15 psi. This time should not be less than 8.5 seconds.

Use the following steps to check out the bleed air system with air supplied by an engine:

f. Close the engine bleed air valves, and turn off all systems which use bleed air.

g. Open the bleed air valve for one operating engine and all engines not operating.

h. When the system pressure reaches 70 psi or higher, close the bleed air valve of the operating engine. Pressure should begin to drop almost immediately. If pressure does not drop, the engine bleed air valve has failed to close.

i. Time the pressure drop from 65 to 35 psi. This time should not be less than 10 seconds.

AIR-CONDITIONING SYSTEMS.

The airplane is equipped with two independently operating air-conditioning systems (figure 4-4), one for the flight deck and the other for the cargo compartment. Both are operated by bleed air supplied from the engine compressor or they may be operated on the ground by air supplied from the gas turbine compressor or by the attachment of an external ground compressor unit. Each system keeps the air at a required temperature and removes excess moisture from it before sending it through a system of ducts into the crew and cargo compartments. The principal components of each system comprise a venturi-type airflow regulator, an electrical temperature control system, a water separator, a refrigerating unit, auxiliary vent valve and controls, and distribution ducts. A duct provides air flow to the booth. A manually operated diffuser controls the amount of air flow to the cargo compartment or booth. The manual diffuser control handle is located on the left side of the booth ceiling over the crew rest seats. Air flow to the cargo compartment and booth can be adjusted by turning the control handle counterclockwise and moving it up or down. Positioning the handle full up (IN) directs air flow to the booth; full down (OUT) directs air flow to the cargo compartment. To distribute air to both cargo compartment and the booth, the manual diffuser handle must be positioned between maximum limits. Turning the handle clockwise locks it into position. The flight deck system includes a windshield defogging system and controls; the cargo compartment system includes a heating system for the cargo compartment floor. Both systems are similar except for flow capacity; the higher capacity system serves the cargo compartment, and the lower capacity system is used for the flight deck. Electrical power for the air-conditioning system control components is supplied through circuit breakers on the copilot's lower circuit breaker panel. Ground air-conditioning can be accomplished by connecting an external unit to the cooling air scoops with airscoop adapters and using the airplane ducting.

AIRFLOW REGULATION.

The amount of air flowing through each air-conditioning system is controlled by the venturi-type airflow regulator in the system. Each regulator is set by the position of the air-conditioning master switch, on the air-conditioning and pressurization control panel (figure 4-5), for three operating conditions: during flight, on the ground with the gas turbine compressor supplying bleed air, and the shutoff condition when neither air conditioning nor pressurization are required.

The flight deck airflow regulator maintains a constant airflow of 30 pounds per minute when the air-conditioning master switch is in either the AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS position, and 15 pounds per minute when in the AIR COND GTC position. The cargo compartment airflow regulator maintains a constant airflow of 70 pounds per minute when the air-conditioning master switch is

air-conditioning system
flight station

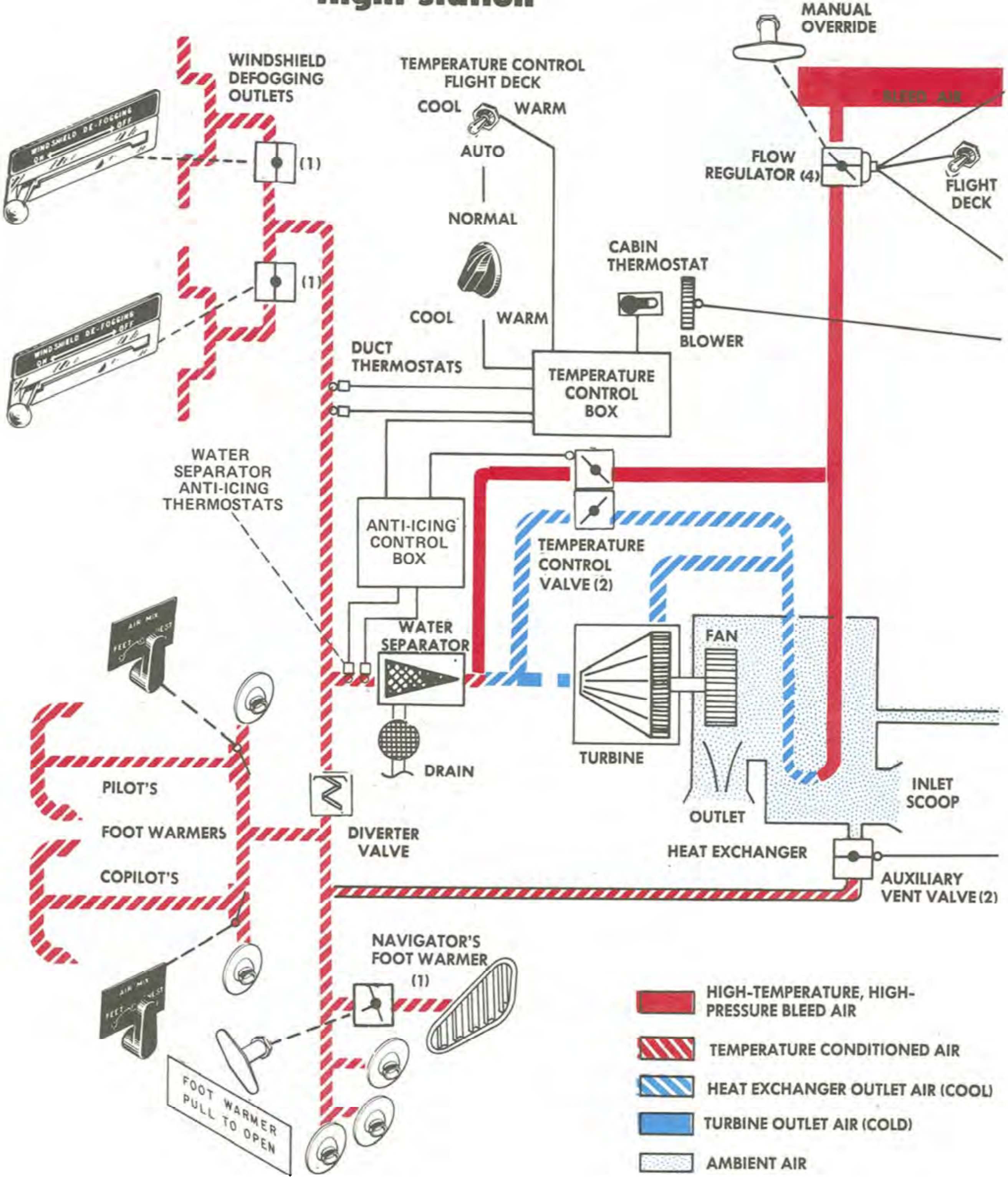


Figure 4-4. (Sheet 1 of 2)

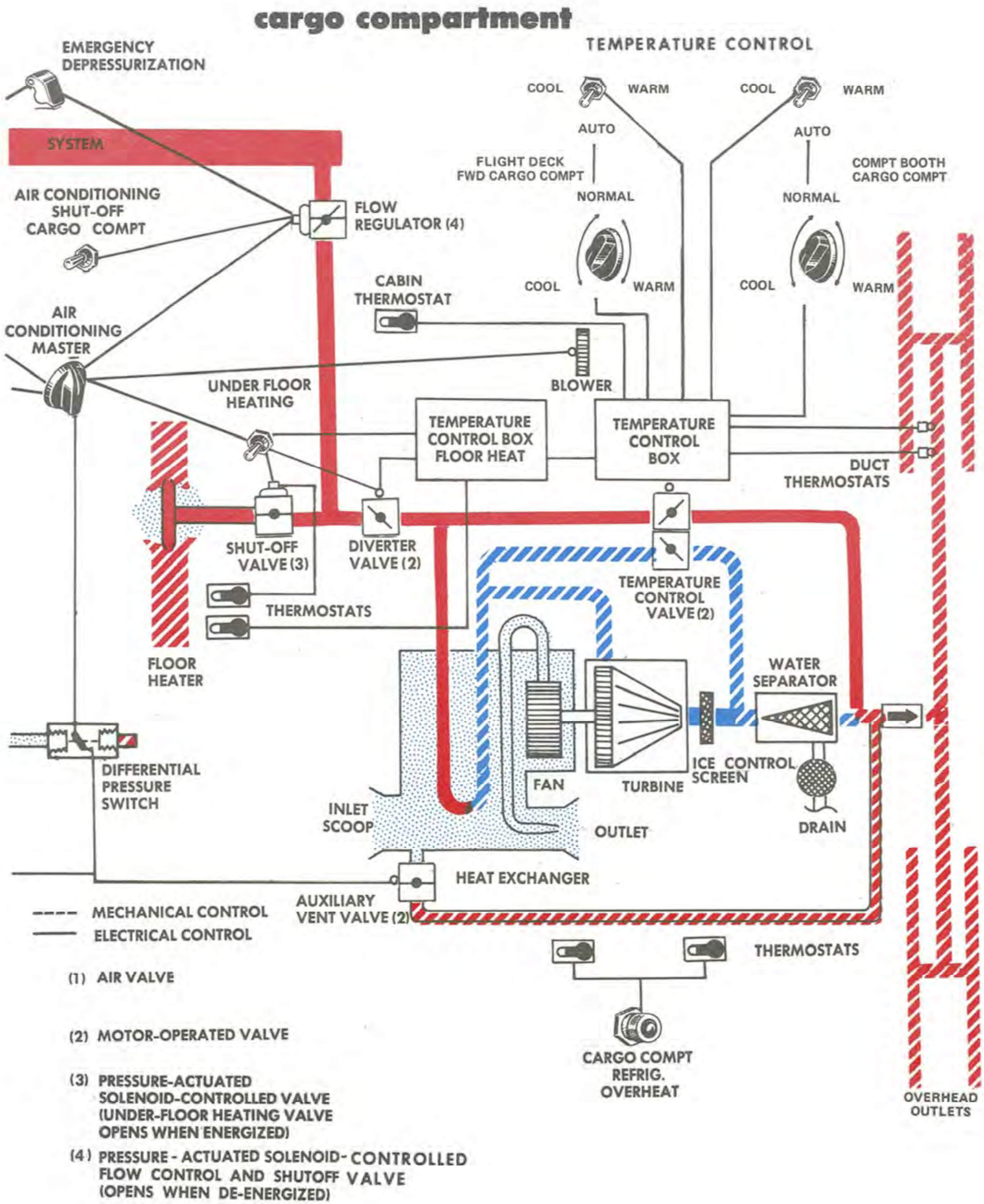


Figure 4-4. (Sheet 2 of 2)

in either the AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS position. When the switch is in the AIR COND GTC position, the airflow regulator maintains a minimum pressure upstream of the valve at 27 psi, regardless of flow through the cargo compartment air-conditioning system, to ensure air turbine motor operation and to allow airflow through the flight deck air-conditioning system. These airflow regulators also act as shutoff valves to stop the bleed airflow through the air-conditioning systems. They are pneumatically actuated and electrically controlled through solenoid valves to select the normal airflow, reduced airflow, or shutoff condition. Electrical power for control of the airflow regulators is supplied from the essential dc bus through the cabin press and auxiliary vent circuit breaker on the copilot's lower circuit breaker panel.

AIR TEMPERATURE CONTROL.

The dual temperature control valve in each air conditioning system opens or closes two bypass ports to establish flow routes for bleed air entering the system. Conditioned air is the combined flow of bypassed bleed air, heat exchanger cooled air, and air cooled by the turbine unit. The dual temperature control valve is electrically operated by either automatic or manual control. During automatic operation, a desired temperature is selected, and the system positions the valve intermittently until the selected temperature is sensed by a thermostat. Approximately 5 minutes are required for the valve to travel from one extreme position to the other during automatic operation. A high-limit thermostat prevents excessively high output air temperature during automatic operation of the temperature control valve. When the valve is controlled manually, it will travel from full cold to full hot in approximately 4 minutes and from full hot to full cold in approximately 35 seconds. Electrical power for temperature control is supplied from the essential dc bus through the flight deck temperature control and cargo compartment temperature control circuit breaker on the copilot's lower circuit breaker panel.

REFRIGERATION.

Part or all of the bleed air flowing to each air conditioning system flows through the heat exchanger and turbine. The first stage of cooling is provided by heat transfer in the air-to-air heat exchanger. During flight, ambient air under ram pressure passes through the heat exchanger and provides the cooling medium to initially reduce the bleed air temperature. Air which enters the turbine after being partly cooled in the heat exchanger is cooled further by expending its energy to drive the turbine, which is loaded by the cooling air fan. In loading the turbine, the fan also augments the cooling airflow through the heat exchanger. During ground operation, with no ram air provided, the fan will draw air through the heat exchanger whenever the turbine is rotating to assure first-stage cooling of the bleed air. The air-conditioning system incorporates a jet pump in series with the cooling fan to assure augmented cooling airflow over the entire area of the heat exchanger. The temperature of the output air depends on what portion of the total airflow is routed through the heat exchanger and turbine.

WATER SEPARATION.

Each water separator will remove approximately 80 percent of the moisture which condenses when air is refrigerated. Moisture remaining in the air maintains a comfortable humidity level in the compartments. The water separator contains a cone-shaped bag, and a drain. The bag causes fog in the air to form into water droplets which are swirled and thrown against the shell of the separator; then they collect and run down to the drain. If the bag in the water separator becomes clogged, a pressure-sensitive relief valve at the tip of the bag opens to bypass the airflow. Icing of the cargo compartment separator is prevented by an ice control screen at the turbine outlet, which keeps the turbine outlet air temperature above freezing. Icing of the flight deck separator is prevented by addition of an anti-icing control box and two thermostats that eliminate temperatures below 35°F in the water separator.

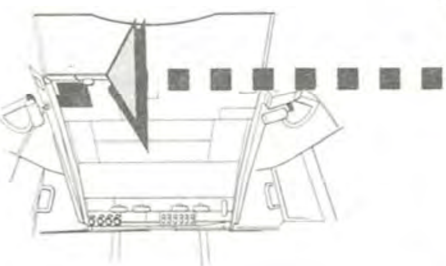
Note

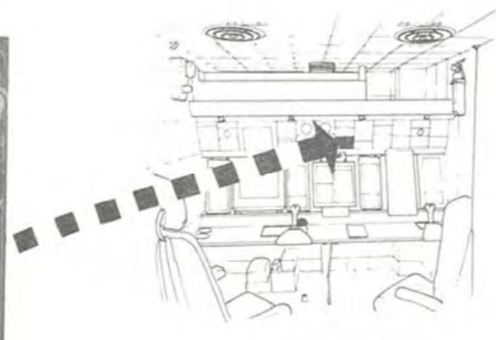
> Water separators do not remove all moisture from conditioned air. When cargo compartment temperature and/or flight deck temperature selectors on the air-conditioning control panel (figure 4-5) are moved all the way over to cool, a considerable amount of fog may enter compartments from diffusers. Evaporation of fog increases the cooling effect of air, and moisture provides a comfortable humidity level in the compartments. Output of fog normally decreases as selectors are moved toward WARM.

CARGO COMPARTMENT UNDERFLOOR HEATING.

The cargo compartment underfloor heating is controlled by the underfloor heating switch on the air conditioning and pressurization control panel (figure 4-5) on the overhead control panel. It is operative through any of the air conditioning positions of the air-conditioning master switch. This two-position (ON, OFF) toggle switch energizes the shutoff and the flow diverter valves to the underfloor heating ducts. Placing the switch in the ON position opens the shutoff valve, and the cargo floor thermostat modulates the diverter valve to maintain an underfloor temperature of approximately 80°F. The bleed air to the underfloor ducts passes through a double jet pump to ensure circulation of the warm air. An overhead duct auxiliary fan operates whenever the underfloor heating is turned on. This fan ensures proper circulation of the air entering the cargo compartment from the overhead ducts.

air conditioning and pressurization control panels





IR/EWO CONSOLE

Figure 4-5.

AUXILIARY VENTILATION.

The auxiliary ventilation provision in each system consists of a valve connecting the heat exchanger cooling air inlet duct to the conditioned air distribution ducts. When the valve is opened, most of the air entering the cooling air scoop flows directly into the distribution ducts. In flight, the air thus admitted to the airplane is ambient air under ram pressure. On the ground, adapters can be attached to the cooling air scoops so that air from an external air conditioner can be supplied for ventilation. If the cabin is pressurized, a differential pressure switch prevents the auxiliary vent valves from opening until the differential pressure is reduced to approximately 0.28 psi (0.6HG). The purpose of the switch is to prevent differential pressure from collapsing the air-conditioning low-pressure ducts. The power for the auxiliary vent valves is supplied from the main dc bus through air pressure and flow shutoff valve circuit breakers.

AIR-CONDITIONING SYSTEMS CONTROLS.

The main controls for the two air-conditioning systems are located on the air-conditioning and pressurization control panel for the flight deck and on the IR/EWO console for the cargo compartment (figure 4-5). The flight deck controls comprise a six-position rotary master switch, a temperature control switch and rheostat, an underfloor heating control switch and a two position selector switch (COMPT BOOTH - FLT DECK). The IR/EWO control panel permits either automatic or manual control of air temperature in the booth. With the cargo compartment temperature control in the AUTO position, the temperature is automatically controlled by thermostats that can be adjusted by the use of the switch. The temperature can also be adjusted manually by holding the cargo compartment temperature switch in either the cool or the warm position until the desired temperature is reached. Associated controls on the panel includes a manual pressurization control switch and a guarded two-position emergency depressurization switch. Other air-conditioning controls in the flight deck include air delivery diverter levers on the main instrument panel, windshield defogging outlet valve controls on the pilot's side shelves, and a flight deck refrigeration shutoff override handle at the navigator's station. When the two-position switch is in FLT DECK position, the air-conditioning controls operate normally; in the COMPT BOOTH position, the temperature in the cargo compartment and the booth is regulated by the controls at the IR/EWO position. A cargo compartment refrigerator overheat warning light is located on the anti-icing systems control panel (figure 4-13). A manual emergency depressurization handle, which operates a quick-opening door in the center escape hatch, is located directly above the pilot's seat.

Air-Conditioning Master Switch.

The air-conditioning master switch, located on the air-conditioning and pressurization control panel (figure 4-5) is a six-position (AIR COND GTC, AUX VENT, OFF, AIR COND AUTO PRESS, AIR COND MAN PRESS, AIR COND NO PRESS) rotary switch which selects the type of air conditioning and pressurization desired. The control functions of the master switch are as follows:

AIR COND GTC

Flow regulators open and provide reduced airflow.

Auxiliary ventilation valves close.

Outflow valve opens.

Safety valve opens.

Thermostat blowers are turned on.

AUX VENT.

Airflow regulators shut off bleed air flow.

Auxiliary ventilation valves open.

Outflow valve opens.

Safety valve opens.

OFF

Airflow regulators shut off flow of bleed air.

Outflow valve opens.

Safety valve closes.

AIR COND AUTO PRESS

Airflow regulators provide normal airflow.

Safety valve closes.

Outflow valve is modulated automatically.

Auxiliary ventilation valves close.

Thermostat blowers are turned on.

AIR COND MAN PRESS

Airflow regulators provide normal airflow.

Safety valve closes.

Outflow valve is modulated manually.

Auxiliary ventilation valves close.

Thermostat blowers are turned on.

AIR COND NO PRESS

Airflow regulators provide normal airflow.

Outflow valve opens.

Safety valve opens.

Auxiliary ventilation valves close.

Thermostat blowers are turned on.

Flight Deck and Cargo Compartment Temperature Controls.

The flight deck and cargo compartment temperature controls consist of two toggle switches and two rheostats on the air-conditioning and pressurization control panel (figure 4-5). One switch and one rheostat are used to control temperature conditions within the flight deck, and the second switch and rheostat control temperature within the cargo compartment.

The toggle-type temperature control switches are used to select warm, cool, or automatically controlled temperature conditions, but they function only when the air-conditioning master switch is set to one of the four AIR COND positions. Each switch may be moved from the center (off) position upward to COOL or WARM or downward to AUTO. With the temperature control switch set to AUTO, the temperature control valve is controlled automatically to maintain the compartment temperature selected on the temperature rheostats. When the switch is moved to the COOL position, the temperature control valve moves toward the extreme cold setting; the switch must be held for approximately 35 seconds for the valve to move from the extreme hot position to the extreme cold setting. With the switch at WARM, the valve turns to the extreme hot setting, complete movement of the valve from the extreme cold setting to the extreme hot position taking approximately 4 minutes. The switch may be released at any time from either the WARM or COOL positions and is spring-loaded to return to the center (off) position; the temperature control valve will remain at the setting achieved when the switch is released. The system thermostat blowers are activated whenever the air-conditioning master switch is at one of the four AIR COND positions.

The two temperature rheostats, located below their respective temperature control switches, are used to select the temperature conditions desired within the flight deck and cargo compartment during automatic temperature control. The settings of each rheostat cover a temperature range from COOL through NORMAL to WARM. Power for the temperature control system is supplied from the essential dc bus through flight deck and cargo compartment temperature control circuit breakers on the copilot's lower circuit breaker panel.

Air Diverter Controls.

A lever at each side of the main instrument panel controls a valve through which the conditioned airflow may be directed, by way of a louver, toward each pilot's chest or through floor-level outlets toward each pilot's feet; a central position for the lever, marked MIX, divides the available airflow between the upper and lower outlets. At the rear of the flight deck, a similar valve arrangement controlled by a handle on the right-hand edge of the navigator's table, directs the conditioned airflow through a foot-warming louver below the navigator's table or through three directable louvers disposed about the aft flight deck. The handle is pulled to open the foot-warming louver and admit temperature-conditioned air to the navigator's station, or it is pushed in to close the louver. The three individual louvers in the rear of the flight deck and similar louvers at the pilot's stations may be moved manually to change the direction of the airflow.

Windshield Defogging Levers.

A windshield defogging lever on each pilot's side shelf controls a valve connecting the temperature-conditioned air duct to the windshield defogging outlets on that side of the flight deck. With the lever moved to ON, the valve is opened and the available airflow is directed by a diverter valve to the windshield defogging outlets and away from the flight deck air distribution louvers and outlets.

Air-Conditioning Shutoff Switches.

Two shutoff switches, at the top of the air-conditioning and pressurization control panel (figure 4-5), override the air-conditioning master switch and enable either air-conditioning system to be shut down individually. Each switch may be set to either OFF or NORMAL. If the flight deck switch is set to OFF, the airflow regulator for the flight deck air-conditioning system halts the flow of bleed air regardless of the setting of the air-conditioning system master switch. Similarly, if the cargo compartment switch is placed to OFF, the airflow regulator closes off the supply of bleed air to both the cargo compartment air-conditioning system and the underfloor heating system. With either switch set to NORMAL, the associated airflow regulator maintains the normal flow of air to the air-conditioning system. In an emergency, the flight deck system airflow regulator may be closed, to halt the entry of bleed air, by pulling the override flight deck refrigeration shutoff valve handle on the floor of the navigator's station.

Flight Deck Refrigeration Shutoff Valve Override.

A manual override, which allows the flight deck system airflow regulator to be controlled manually, is located on the floor below the navigator's table. When the handle is pulled, the flow regulator will close whether the system is pressurized or not. When the handle is pushed in, the regulator will open only if the system is pressurized. During normal operation of the air-conditioning system, the handle must remain in the neutral position.

Cargo Compartment Refrigerator Overheat Warning Light.

A red press-to-test light (figure 4-13) located on the anti-icing control panel is provided to warn of an overheat condition in the cargo compartment refrigerator area. Two overheat detectors are located in the refrigerator area of the wheel well. When an overheat condition of 200°F exists, the warning light will illuminate and the overheat condition must be corrected to extinguish the light. Electrical power for the light is supplied from the essential dc bus through the wing and empennage overheat lights circuit breaker on the copilot's lower circuit breaker panel.

Emergency Depressurization Switch.

The emergency depressurization switch is a guarded, two-position toggle switch on the air conditioning and pressurization control panel (figure 4-5). When the switch is moved from NORMAL to EMERGENCY DEPRESSURIZATION, an electrical circuit closes both air-conditioning system flow regulators and opens both the outflow and safety valves to the pressurization system (figure 4-6).

NORMAL OPERATION OF AIR CONDITIONING SYSTEMS.

The air-conditioning systems can be operated from bleed air supplied by the gas turbine compressor or by the engines while the airplane is on the ground, or an external ground compressor unit may be attached.

The engines supply the bleed air for operating the air conditioning systems in flight.

Ground Air Conditioning.

Ground air conditioning is accomplished by using either an external unit or the airplane air conditioning system.

AIR CONDITIONING WITH AN EXTERNAL UNIT.

1. Place a ground air conditioning adapter in the air scoop of the system to be operated.
2. Attach the hose of the ground air-conditioning unit to the adapter.
3. Position the air-conditioning master switch to OFF.

Note

Air scoop adapters for ground air conditioning are stowed on a rack aft of the right paratroop door.

AIR CONDITIONING WITH AIRPLANE SYSTEM.

1. Place the engine bleed air valve switches in the CLOSE position.
2. Start the gas turbine compressor.
3. Place the gas turbine compressor bleed air switch in OPEN.
4. Check the bleed air pressure gage.
5. Position the air-conditioning shutoff switches to NORMAL.
6. Position the emergency depressurization switch to NORMAL.
7. Turn the air-conditioning master switch to AIR COND GTC.

CAUTION

- If the engine bleed air valve switches are in the OPEN position and the air-conditioning master switch is in the AIR COND GTC position, the cargo compartment airflow regulator will go to the full flow position. In this position, sufficient air may not be available to operate the ATM and the flight deck air-conditioning system.
- Do not turn the master switch to AIR COND GTC while the engines are supplying bleed air, because the increase pressure can damage the airflow regulators.

8. Hold the temperature switches in COOL or WARM as desired for 30 seconds; then return to AUTO. This procedure will position the temperature control valve to the approximate desired position more rapidly and minimize the amount of hot bleed air entering the compartment when the temperature rheostats are in COOL.
9. Position temperature rheostats as desired.
10. Turn the air-conditioning master switch to OFF before starting an engine.
11. With one or more engines operating, place the air-conditioning master switch in AIR COND NO PRESS.

InFlight Air Conditioning.

1. Place the air-conditioning master switch in AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS, as desired.
2. Position temperature switches to AUTO.
3. Position temperature rheostats as desired.

Emergency Operation of Air-Conditioning Systems.

An air-conditioning system failure can result in an emergency condition when cabin pressurization cannot be maintained as a result of the failure, or when the system is malfunctioning and cannot be shut down. As long as operation of the cargo compartment air-conditioning system (70 pounds per minute) can be maintained, sufficient air output is available to keep the airplane pressurized. With the cargo compartment air-conditioning unit inoperative, the flight deck unit may not be able to maintain selected cabin pressure, depending on cabin leakage rate. Consult the paragraph in this section on pressurization system failure for the procedure to follow when pressurization cannot be maintained. When the temperature of the air output of an air-conditioning system cannot be controlled either automatically or manually, the crew has the option of shutting down the system or suffering discomfort in order to maintain pressurization if at altitude.

CABIN PRESSURIZATION SYSTEM.

Pressurization of the flight deck and cargo compartment for high-altitude flight is achieved by air supplied from the bleed air system and ducted through the air-conditioning system. The pressurization system basically consists of an outflow valve, pressure controller, differential pressure gage, cabin rate-of-climb indicator, cabin altimeter, safety valve, and a manually operated emergency depressurization door. The outflow valve, which opens to relieve excess pressure, is used with the pressure controller to maintain cabin pressure automatically at a constant level or to limit the cabin-to-atmosphere differential pressure. The safety valve gives excess pressure relief if the combination of the pressure controller and outflow valve fails to regulate the cabin pressure properly. The pressure controller differential pressure gage, and cabin rate-of-climb indicator are mounted on the air-conditioning and pressurization control panel (figure 4-5). Two knobs on the pressure controller permit pre-setting of the cabin rate of climb and cabin pressure. The differential pressure gage indicates the difference between cabin and atmospheric pressure, and the rate-of-climb indicator shows the rate at which the cabin pressure is changing. The airplane is pressurized when pressure within the flight deck and cargo compartment exceeds atmospheric pressure. This may be accomplished by automatic control of the pressurization system or by manual operation, depending upon the setting of the air-conditioning master switch.

OUTFLOW VALVE.

The outflow valve is located on the right side of the airplane at the aft end of the flight station. It exhausts cabin air to the atmosphere through a louver in the skin. The valve consists of a butterfly valve, a main actuating diaphragm, a relay valve, an air jet pump, a solenoid dump valve, and an electric actuator. During automatic pressurization, the butterfly valve is pneumatically positioned by differential pressure across the main actuating diaphragm. The relay valve and air jet pump control the differential pressure in accordance with the cabin altitude selected on the pressure controller. The solenoid dump valve opens the butterfly valve for emergency depressurization. Electrical power to energize the dump solenoid is supplied by the battery bus through the emer depress circuit breaker on the pilot's side circuit breaker panel. The electric actuator is controlled by a switch to position the butterfly valve during manual operation of the system. Electrical power for manual operation of outflow valve is supplied from the essential dc bus through the cabin pressure and auxiliary vent circuit breaker on the copilot's lower circuit breaker panel.

CABIN PRESSURE CONTROLLER.

The cabin pressure controller, on the air-conditioning and pressurization control panel (figure 4-5) is divided into three chambers, each providing a separate cabin pressure control system: a constant pressure or isobaric control, a differential control system, and a rate-of-climb control.

The isobaric control system positions the outflow valve to maintain a constant cabin pressure. Any desired cabin altitude, from -1,000 feet to 10,000 feet, can be selected on the controller, and during automatic pressurization the cabin altitude will be held constant upon reaching the selected cabin altitude. The differential control system positions the outflow valve to vary the cabin pressure altitude when the maximum differential pressure is reached. The cabin altitude will change in order to maintain a constant differential pressure. This system protects the airplane structure from excessive pressures by overriding the isobaric control system. (Refer to Section V for differential pressure limitations.) The rate control system positions the outflow valve to maintain a constant rate of cabin pressure change up to the isobaric altitude selected. Any desired rate of cabin pressure change, from MIN (30 to 200 feet per minute) to MAX (1,600 to 2,900 feet per minute), can be selected on the controller. During automatic pressurization, the cabin pressure will change at the selected rate until the cabin pressure altitude reaches the isobaric altitude selected on the controller.

SAFETY VALVE.

The safety valve is located on the aft cargo door. It is electrically controlled and pneumatically opened in a nonpressure condition or for emergency depressurization. The valve is normally closed during any pressurized operation. It will open to relieve cabin pressure if the positive differential pressure reaches 15.9 inches of mercury or if the negative differential pressure reaches .76 inches of mercury. When either emergency depressurization or nonpressure operation is selected, the valve is opened. Electrical power to energize the safety valve solenoid during emergency depressurization is supplied from the battery bus through the emergency depress circuit breaker on the pilot's side circuit breaker panel.

pressurization system

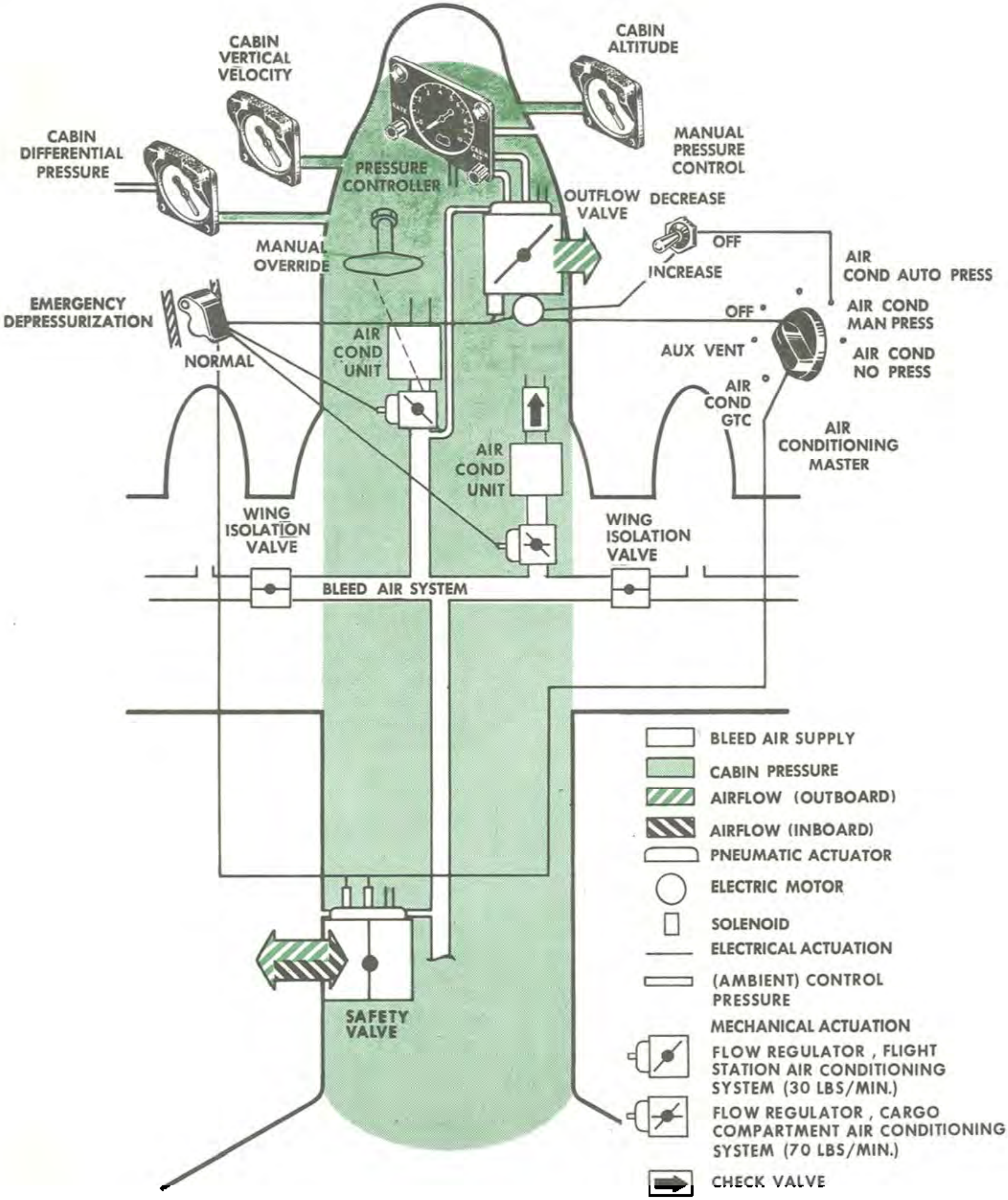


Figure 4-6.

cabin pressurization chart

● ICAO STANDARD ATMOSPHERE

NOTE

FOR MAXIMUM DIFFERENTIAL RANGE OF CABIN PRESSURE, READ CABIN ALTITUDE AT JUNCTION OF AIRPLANE ALTITUDE AND MAXIMUM DIFFERENTIAL PRESSURE LINE. REFER TO SECTION V FOR LIMITS

SAMPLE PROBLEM

GIVEN:

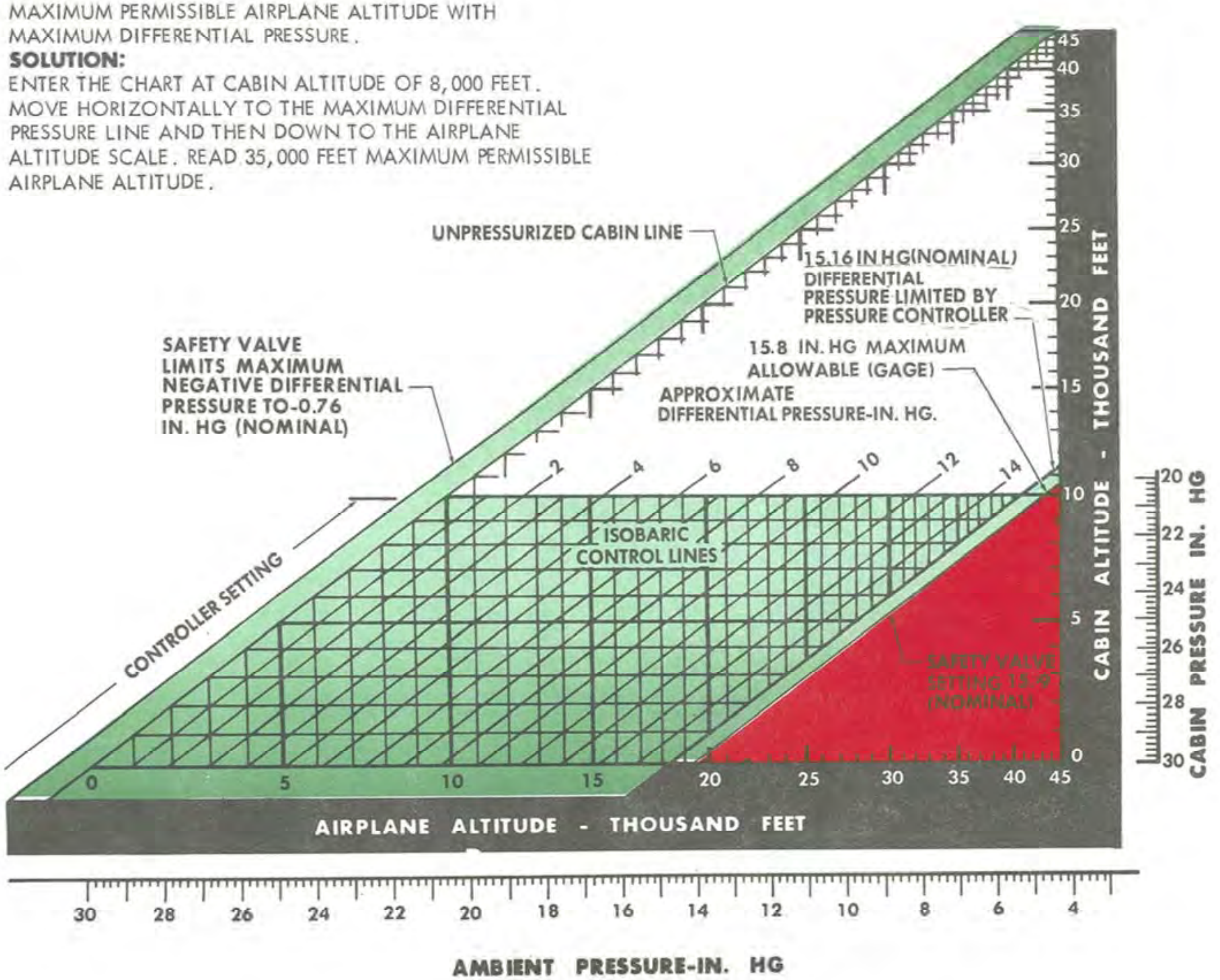
LONG RANGE MISSION WITH PASSENGERS ON BOARD. CABIN PRESSURE LIMITED TO 8,000 FEET.

FIND:

MAXIMUM PERMISSIBLE AIRPLANE ALTITUDE WITH MAXIMUM DIFFERENTIAL PRESSURE.

SOLUTION:

ENTER THE CHART AT CABIN ALTITUDE OF 8,000 FEET. MOVE HORIZONTALLY TO THE MAXIMUM DIFFERENTIAL PRESSURE LINE AND THEN DOWN TO THE AIRPLANE ALTITUDE SCALE. READ 35,000 FEET MAXIMUM PERMISSIBLE AIRPLANE ALTITUDE.



ISOBARIC RANGE — READ DIFFERENTIAL PRESSURE AT JUNCTION OF CONTROLLER SETTING (CABIN ALTITUDE) AND AIRPLANE ALTITUDE LINES.

EXCESSIVE DIFFERENTIAL PRESSURE.

Figure 4-7.

CHECK VALVE.

To prevent rapid loss of cabin pressure in the event of failure in the air recirculating duct system, a check valve is installed in the cargo compartment air conditioning and pressurization system. The valve basically consists of a hinged flap which normally assumes an open position under pressure of the inward-flowing air, but will close if inward air pressure is lost.

EMERGENCY DEPRESSURIZATION DOOR.

An emergency depressurization door, located in the center emergency escape hatch, is released by pulling the emergency depressurization handle (figure 4-8) on the overhead control panel directly above the pilot. The handle is connected by a cable to the release mechanism of the door which is restrained from consequential loss by two shock cords. After depressurization is accomplished, the door can be replaced and the release mechanism reset manually.

CABIN PRESSURIZATION CONTROLS.

Controls for the cabin pressurization system consist of the air conditioning master switch, a pressure controller, manual pressure control switch, and emergency depressurization switch. All controls are located on the air conditioning and pressurization control panel. A manually operated emergency depressurization system also is provided.

Air-Conditioning Master Switch.

The air-conditioning master switch on the air-conditioning and pressurization control panel (figure 4-5) is used to select the type of operation of the air conditioning and pressurization systems. It controls operation of the outflow and safety valve under conditions of pressurized and nonpressurized operation. For functions of the switch positions, refer to Air-Conditioning Systems Controls.

Electrical power for control circuits of the outflow and safety valves is supplied from the essential dc bus through the cabin press and aux vent circuit breaker on the copilot's lower circuit breaker panel.

Cabin Pressure Controller.

The cabin pressure controller on the air-conditioning and pressurization control panel (figure 4-5) includes the cabin differential pressure gage, a rate-of-climb indicator, a cabin altitude selector knob, a rate selector knob, and an altitude selector indicator. The cabin altitude selector on the pressure controller consists of a cabin altitude knob and an indicator. When the knob is turned, it positions the large pointer and small rotating dial of the indicator and also mechanically opens and closes the metering valve which sets selected cabin altitude into the isobaric system of the controller. When the knob is set as required, the large pointer indicates the cabin altitude selected and the small rotating dial indicates the maximum airplane altitude at which the isobaric control system can maintain control of the outflow valve.

CAUTION

Do not force the cabin altitude knob below a setting of -1,000 feet or above 10,000 feet. To do so may damage the pressure controller.

emergency depressurization handle

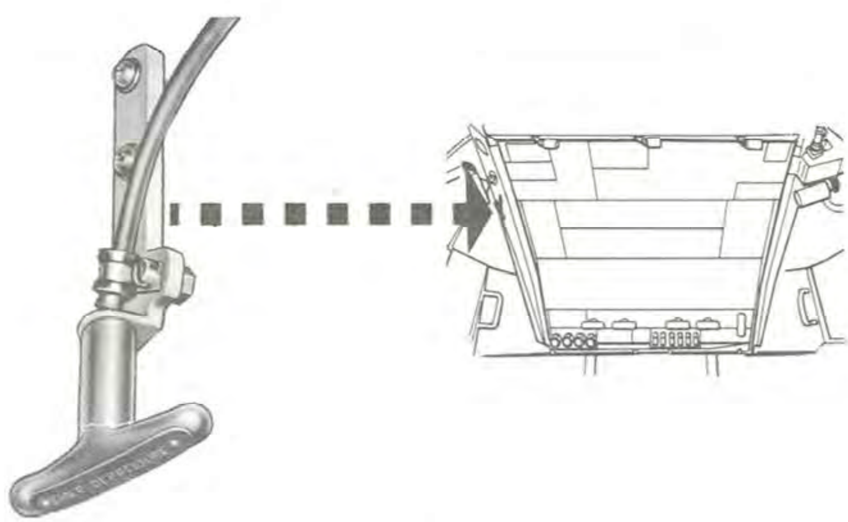


Figure 4-8.

The rate selector knob is used to determine the rate of cabin pressure change until the cabin altitude, as shown by the pointer, is reached. The knob is turned from MIN (30 to 200 feet per minute) clockwise to MAX (1,600 to 2,900 feet per minute).

Manual Pressure Control Switch.

The manual pressure control switch is a three-position (INCREASE, OFF, DECREASE) toggle switch, located on the air-conditioning and pressurization control panel (figure 4-5). It has a center spring-loaded OFF position and momentary INCREASE and DECREASE positions. The switch controls the electric actuator of the outflow valve when the air-conditioning master switch is in the AIR COND MAN PRESS position. When the switch is held in the INCREASE position, the actuator turns the outflow butterfly valve toward its closed position. When the switch is held in the DECREASE position, the actuator turns the butterfly valve toward its open position. When operating the system manually, the cabin vertical velocity indicator will give the first indication of pressurization. Electrical power for manual pressure control is supplied from the essential dc bus through the cabin pressure and auxiliary ventilation circuit breaker on the copilot's lower circuit breaker panel.

Note

After switching from automatic to manual pressure control, the manual pressure control switch must be held in the INCREASE or DECREASE position for approximately 40 seconds to gain control of the outflow valve.

CAUTION

Deliberate operation of the manual pressure control switch in a manner that will drive the outflow valve to the closed position, resulting in the safety valve opening, is prohibited.

Emergency Depressurization Switch.

The emergency depressurization switch is a two-position (NORMAL, EMERGENCY DEPRESSURIZATION) guarded toggle switch. When the switch is positioned to EMERGENCY DEPRESSURIZATION, battery power from the battery bus through the emer depress circuit breaker on the pilot's side circuit breaker panel is used to override the normal control circuit to open the outflow and safety valves and to close both air conditioning shutoff valves. However, if the flight deck air conditioner is being operated by the manual override handle, the emergency depressurization switch will not close the flow regulator. It must be closed by use of the manual override.

Pressurization Test Valves.

An isobaric and an atmospheric test valve, labeled "No. 1" and "No. 2" respectively, are located on the left side of the overhead control panel. These valves, wired in the open position are intended only for ground use.

CABIN PRESSURIZATION SYSTEM INDICATORS.

The cabin pressurization system indicators are a differential pressure gage, a cabin rate-of-climb indicator, and a cabin altimeter.

Differential Pressure Gage.

The differential pressure gage, located on the air-conditioning and pressurization control panel (figure 4-5), senses both cabin and atmospheric pressures and indicates the pressure differential in inches of mercury.

CAUTION

The normal differential pressure operating limits specified in Section V should never be exceeded.

Cabin Rate-Of-Climb Indicator.

The cabin rate-of-climb indicator, which shows the rate of change of cabin altitude in feet per minute, is mounted on the air-conditioning and pressurization control panel.

Cabin Altimeter.

The cabin altimeter (figure 4-9) indicates cabin air pressure altitude within the range 0 to 50,000 feet; it is installed on the copilot's instrument panel.

cabin altimeter

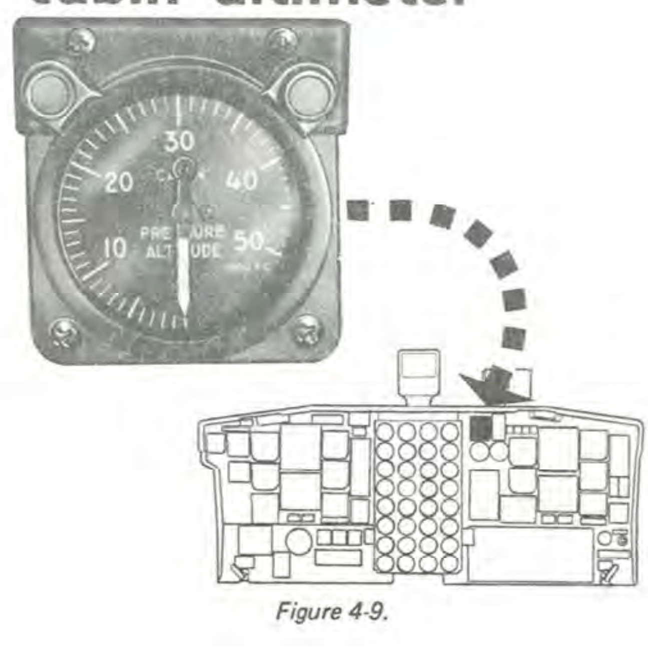


Figure 4-9.

NORMAL OPERATION OF CABIN PRESSURIZATION SYSTEM

Pressurized Flight—Automatic Pressure Control.

CAUTION

To allow rapid egress in event of an emergency, do not pressurize the airplane during taxi or take-off operations.

BEFORE TAKE-OFF.

1. Turn the rate knob to MIN.
2. Set the cabin altitude knob to the desired cabin altitude, but never less than field pressure altitude.
3. Set the air-conditioning master switch to AIR COND AUTO PRESS.

AFTER TAKE-OFF CLIMB.

1. Set the rate knob to the desired rate.

Adjust the rate setting as required during climb so that the cabin reaches the selected altitude at the same time the airplane reaches cruise altitude. Thus, the rate of cabin pressure change is held to a minimum. The rate of cabin pressure change is held constant only up to pressure controller differential limit.

Note

Monitor cabin altitude against airplane altitude to make sure that cabin altitude stays within the isobaric range. (See figure 4-7.)

CRUISE.

During pressurized flight, monitor the cabin differential pressure and cabin altitude. Do not allow cabin differential pressure to exceed the maximum allowable for the airplane.

DESCENT.

1. Set the cabin altitude knob for the desired cabin altitude.
2. Set the rate knob to desired rate.

BEFORE LANDING.

Check the cabin differential pressure before landing. If more than 1.5 inches of mercury is indicated, the cabin altitude selector and the rate knob should be adjusted to higher settings to increase the rate of depressurization.

Note

Cabin differential pressure will be zero for landing. If the differential pressure is less than 0.5 inch of mercury, no discomfort will be experienced if the air-conditioning master switch is turned to a nonpressure position.

Pressurized Flight—Manual Pressure Control.

BEFORE TAKE-OFF.

1. Set cabin altitude selector to 10,000 feet and position air-conditioning master switch to AIR COND MAN PRESS.
2. Hold the manual pressure control switch to the INCREASE position until a pressure indication is noted on the cabin rate-of-climb indicator. Then toggle switch to the decrease position until the decrease pressure indication has returned to zero rate. Maintain the cabin in the non-pressurized condition until airborne.

AFTER TAKE-OFF CLIMB.

Hold the manual pressure control switch in the INCREASE position until an indication of cabin pressure is observed on the cabin vertical velocity indicator. Exercise caution during manual pressure control in order to prevent excessive rates of cabin pressure change which can cause extreme discomfort to passengers and crew. Operation of the manual pressure control switch by momentarily holding it in the desired position and then releasing it to the OFF position will provide satisfactory control. Monitor the airplane vertical velocity indicator, cabin vertical velocity indicator, the cabin differential pressure gage, and the cabin altimeter. Establish as closely as possible a constant cabin rate of climb by intermittently positioning the manual pressure control switch momentarily to the INCREASE position. By reaching the normal differential pressure at the desired cabin altitude when the airplane reaches cruise altitude, the minimum rate of cabin pressure change will be attained.

Note

Monitor cabin altitude against airplane altitude to make sure that cabin altitude stays with the isobaric range. (See figure 4-7.)

CRUISE.

When the airplane has reached stabilized cruise conditions, adjust the outflow valve with the manual control switch to maintain a constant differential pressure and constant cabin pressure altitude. Monitor the cabin differential pressure gage and the cabin altimeter so as not to exceed the allowable limits.

DESCENT.

As soon as the airplane starts the descent, position the manual pressure control switch momentarily to the INCREASE position, in order to establish a decrease of cabin pressure altitude. Maintain a comfortable rate of cabin pressure change by intermittently positioning the outflow valve until the desired altitude is reached. Allow cabin differential pressure to decrease by positioning the manual pressure control switch to open the outflow valve.

BEFORE LANDING.

Check the cabin differential pressure prior to landing. If more than 1.5 inches of mercury differential pressure exists, momentarily position the manual pressure control switch to the DECREASE position, to control the rate of cabin depressurization.

Set air conditioning master switch (as required).

Note

Cabin differential pressure will be zero for landing. If cabin differential pressure does not exceed 0.5 inch of mercury, no discomfort will be experienced if the airplane is depressurized by turning the air conditioning master switch to a nonpressure position.

Nonpressurized Flight.

BEFORE TAKE-OFF

1. Set the air-conditioning master switch to AIR COND NO PRESS or AUX VENT.

Transition from Nonpressurization to Pressurization During Flight.

1. Turn rate knob to MIN.
2. Set cabin altitude knob to desired cabin altitude.
3. Turn air-conditioning master switch to AIR COND AUTO PRESS.

Allow cabin differential pressure to build up to approximately 2 inches of mercury to provide sufficient pressure for the pneumatically actuated controller to stabilize and maintain a selected rate.

4. Turn rate knob to desired rate.

Adjust the rate setting so that the cabin reaches the selected altitude at the same time the airplane reaches cruise altitude. The rate of cabin pressure change is thus held to a minimum.

Transition From Pressurization To Nonpressurization During Flight.

1. Set rate knob to desired rate.
2. Set cabin altitude knob to airplane altitude at altitudes below 10,000 feet.
3. When above 10,000 feet, turn the air-conditioning master switch to AIR COND MANUAL PRESS, and hold the manual pressure control switch in the DECREASE position.

Cabin altitude will increase at the rate selected until cabin pressure equals atmospheric pressure. The differential pressure is thus reduced at a controlled rate.

4. Turn air-conditioning master switch to AIR COND NO PRESS (as soon as differential pressure reaches zero).

ANTI-ICING AND DE-ICING SYSTEMS.

Anti-icing systems, which can be used to prevent the formation of ice on critical areas of the airplane, and de-icing systems, which will remove ice after it is formed, are installed on the airplane. Heat for the systems is obtained either by the use of electrical heating elements or by heated air drawn from the compressor of each engine.

Anti-icing systems using heated air from the bleed air system serve the wing and empennage leading edges, the nose radome, and the engine inlet air and oil cooler scoops. Anti-icing of the engine compressor inlet vanes also is accomplished by heated air, but this is supplied directly from the engine compressor and not through the bleed air system.

Anti-icing systems using heat from electrical sources are installed for the windshields, pitot tubes and the forward section and afterbody of the propeller spinner. De-icing of the propeller blades and rear section of the propeller spinner also is accomplished electrically.

An ice detection system may be used to achieve automatic operation of the following anti-icing and de-icing systems:

Nose radome anti-icing
Engine inlet air scoop anti-icing
Compressor inlet vane anti-icing
Propeller spinner forward section, and afterbody anti-icing
Propeller blade de-icing
Propeller spinner middle and rear section de-icing
Propeller spinner plateaus de-icing

Figure 4-10. deleted

leading edge anti-icing system

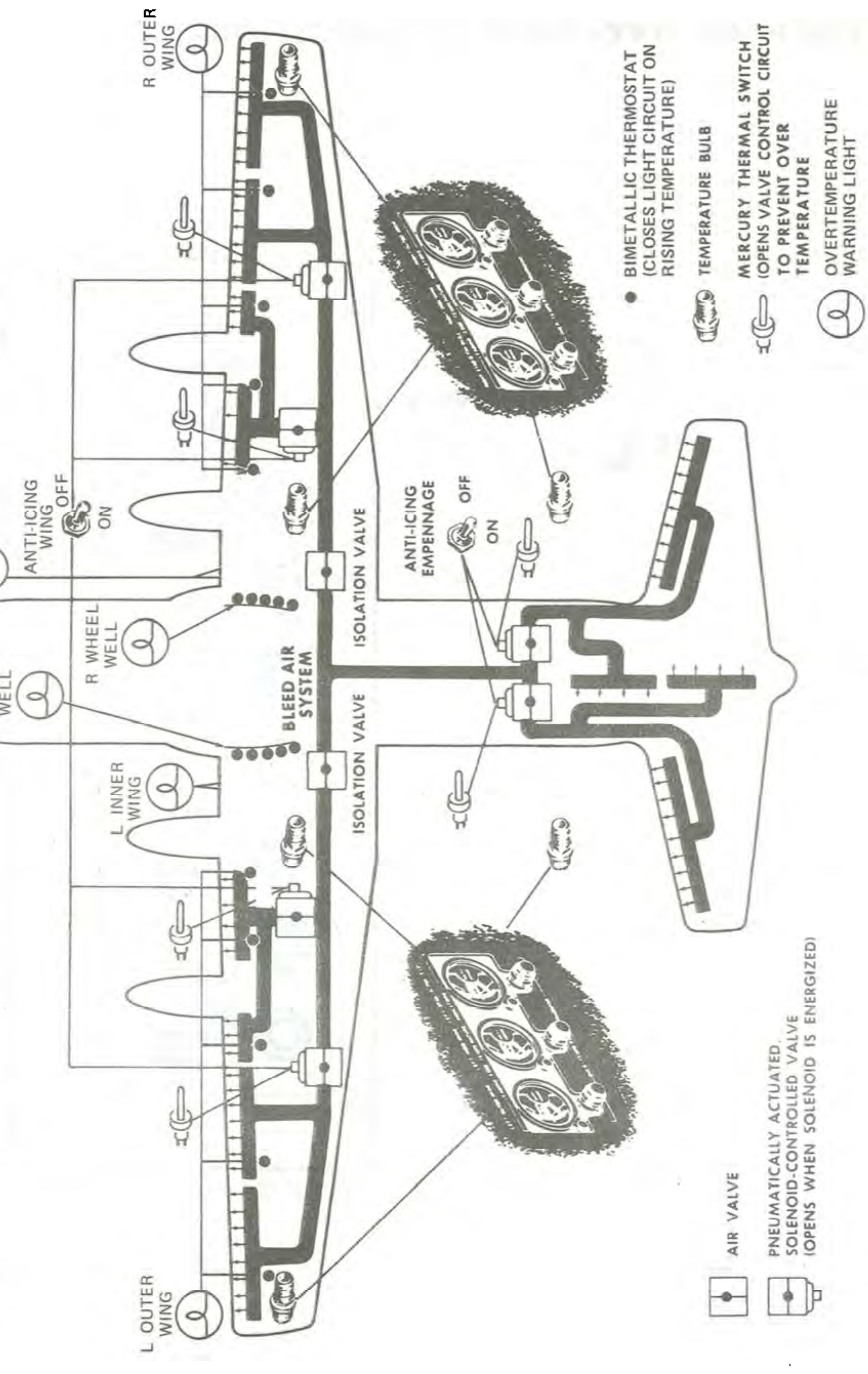
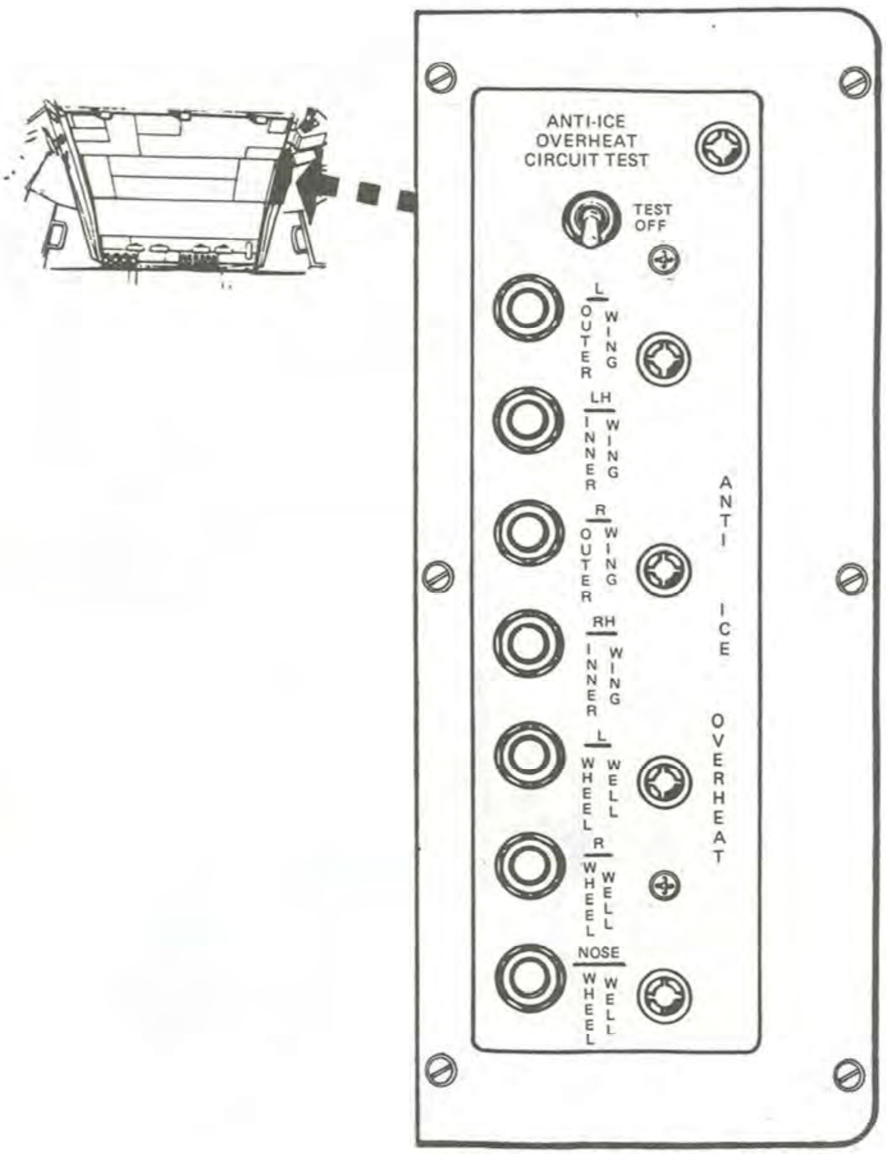


Figure 4-11.

anti-ice overheat warning panel



ANTI-ICE OVERHEAT WARNING PANEL

Figure 4-12.

WING AND EMPENNAGE LEADING EDGES ANTI-ICING SYSTEM.

The leading edge anti-icing system (figure 4-10) is divided into six sections, each consisting of a shutoff valve, ejectors, and control components. The shutoff valve controls the flow of air from the bleed air system to the ejectors, where it is ejected through small nozzles into mixing chambers. The hot bleed air at approximately 600°F is mixed with ambient air drawn into the mixing chambers. The resultant mixed air at approximately 350°F flows through passages next to the leading edge skin. Since some of the air leaving the passages is drawn back in for recirculation, a lower percentage of bleed air is required for continuous anti-icing. Each of the six shutoff valves is pneumatically actuated and electrically controlled. Each shutoff valve acts as a shutoff valve to stop anti-icing and to control airflow when anti-icing is required. When a solenoid on the valve is energized, the valve permits flow of bleed air to the leading edge area. The differential pressure assures a flow of air through the leading edge passages. Thermoswitches connected to the control solenoid of the shutoff valve cause the valve to close and shut off the flow of bleed air when the temperature in the leading edge reaches approximately 180°F. When the temperature drops, the valve opens and hot bleed air enters the leading edge. An overheat warning system is installed in the leading edge area. When the temperature in the leading edge area reaches approximately 200°F, the overheat warning light for that area is energized and the light illuminates.

Wing and Empennage Anti-icing Switches.

The wing and empennage anti-icing switches are two-position (ON, OFF) toggle switches located on the anti-icing system control panel (figure 4-13). When the switches are placed in the ON position, solenoids on the anti-icing shutoff valves are energized and the valves control a flow of bleed air to the leading edge air ejectors. When the switches are in the OFF position, the anti-icing regulators shut off the flow of bleed air to the anti-icing ejectors. Electrical power for control of the wing and empennage anti-icing shutoff valves is supplied from the essential dc bus through the wing and empennage ice control circuit breakers on the copilot's lower circuit breaker panel.

Leading Edge Temperature Indicators.

Six leading edge temperature indicators, one for each section of the anti-icing system, are located on the anti-icing system control panel (figure 4-13). Each indicator is connected to a resistance bulb located in the leading edge area. The resistance bulbs are placed so that they sense temperature of the air in the area aft of the leading edge skin, not the hot air passed next to the skin. Electrical power for the indicators is supplied from the essential dc bus through the wing and empennage temp indicator circuit breaker on the copilot's lower circuit breaker panel. Each indicator is marked in ranges as follows:

INOPERATIVE - Approximately 75°F and below.

NORM OPER RANGE - Between approximately 75°F and 200° F.

OVERHEAT - Approximately 200°F and above.

Wing Leading Edge and Wheel Well Overtemperature Warning Lights.

The anti-ice overheat panel is installed on the right outboard edge of the overhead control panel. Seven overtemperature warning lights, labeled L OUTER WING, LH CENTER WING, R OUTER WING, RH CENTER WING, L WHEEL WELL, R WHEEL WELL, and NOSE WHEEL WELL, are located on the panel. A two-position, spring loaded to OFF, anti-ice overheat circuit test switch is located on the panel above the warning lights.

Overheat warning for the ATM compartment is combined with the left wheel well area and overheat warning for the cargo compartment refrigeration unit is combined with the right wheel well area. There are no warning light circuits for the empennage stabilizer and fin; consequently the STAB and FIN temperature indicators are the only means of overheat detection. Sensors for the left outboard and left inboard temperature indicators are located in the left outer wing area and, therefore, correspond to the left outer wing overheat light only. Sensors for the right outboard and right inboard temperature indicators are located in the right outer wing area and, therefore, correspond to the right outer wing overheat light only. No temperature indicators are provided for the left or right inner wing lights (left or right center wing lights, some airplanes), left or right wheel well lights, or the nose wheel well light. When the test switch is positioned to TEST, all seven lights should illuminate. If a light fails to illuminate, it indicates that the overheat warning for that area is inoperative. When the temperature reaches approximately 200°F in any area, the overheat warning sensor(s) will complete the electrical circuit and the light for that area will illuminate. Electrical power for the lights is supplied from the essential dc bus through the anti-ice overheat warning circuit breaker on the copilot's circuit breaker panel.

Normal Operation of Leading Edge Anti-Icing System.

The wing and empennage leading edge anti-icing system is turned on or off by the anti-icing switches on the anti-icing systems control panel. Regulation of temperatures within the leading edges is achieved automatically by thermostatic control of the valves, permitting entry of bleed air to the system ejectors. The temperature indicators on the control panel, however, should be monitored while the system is operating, since an emergency condition will exist if either the associated indicators or the warning lights show an overheated condition in any section.

anti-icing and de-icing systems control panels

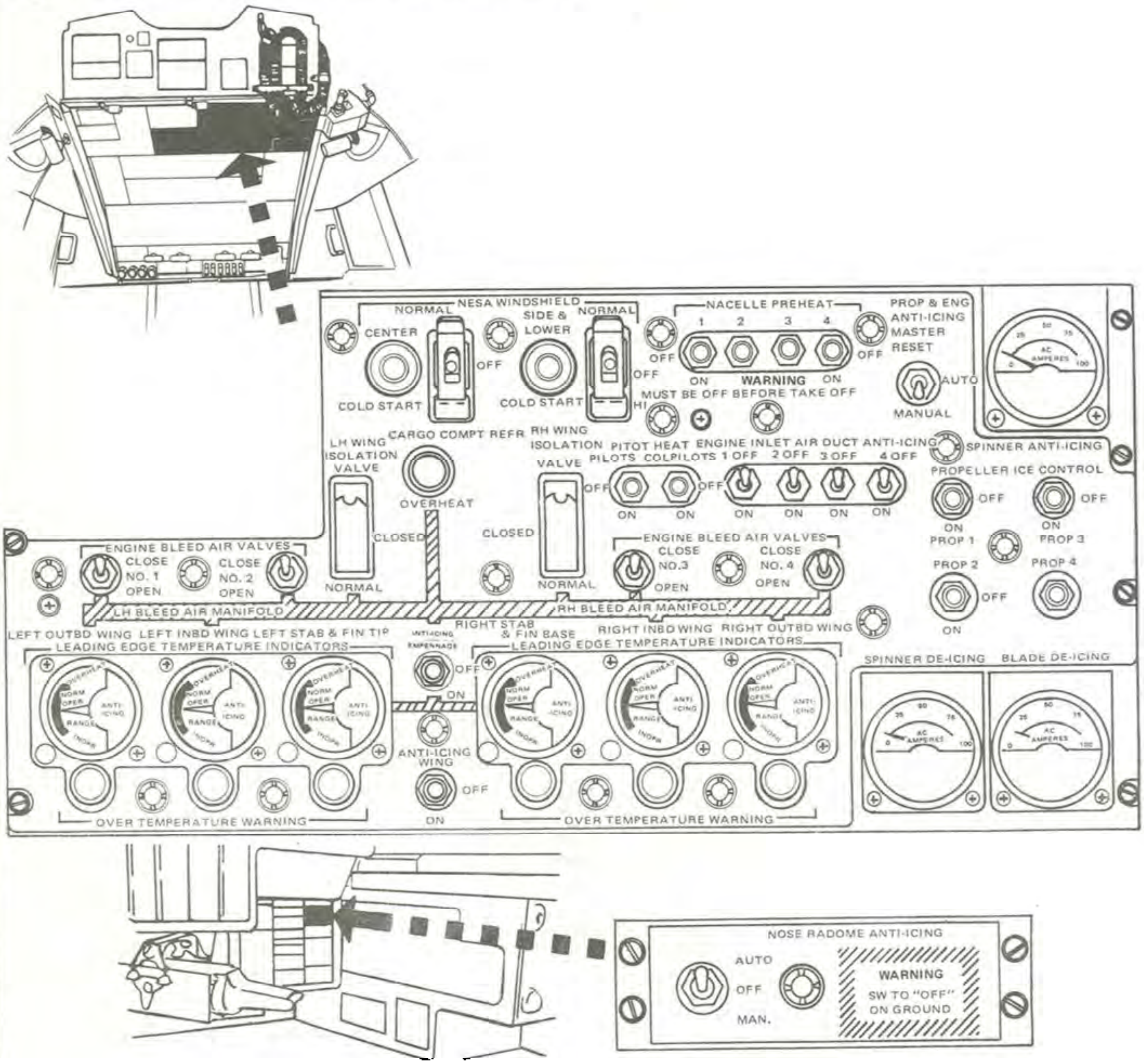


Figure 4-13.

CAUTION

The leading edge anti-icing system must not be used to remove ice from surfaces when the airplane is on the ground. With no airflow over the surface, the air within the leading edge area quickly rises in temperature, and the excessive heat damages fuel tank sealants, paint, structure, and other equipment. If the system is operated for testing, constant monitoring of the temperature indicators must be maintained, and the system must not remain on more than 30 seconds.

RADOME ANTI-ICING SYSTEM.

The radome anti-icing system (figure 4-14) conducts a mixture of hot bleed air and recirculated return air through passages in the radome structure to heat the radome surface. The flow of bleed air is controlled by a throttling and shutoff valve, which is pneumatically actuated and electrically controlled. When the system is operating, the valve opens to allow hot bleed air at a temperature of approximately 600°F to flow through a nozzle in an ejector. Return air from the radome passages is mixed with the bleed air in the ejector to provide a mixture at a temperature of approximately 200°F, which is ejected into the radome passages. A pneumatic thermostat controls the valve so as to regulate anti-icing air temperature and another thermostat prevents air at a temperature higher than 275°F from entering the radome passages. Pressure of air in the radome passages is held constant by a relief valve on the ejector. A solenoid on the throttling and shutoff valve is energized to permit the valve to open; it is de-energized to cause the valve to close to shut off the airflow. The valve control circuit is interconnected with the ice detection system so that the radome anti-icing can be turned on automatically when the detection system senses icing. Twenty-eight volt dc electrical power for control of the radome anti-icing system is supplied from the main dc bus through the radome anti-icing control circuit breaker on the copilot's lower circuit breaker panel.

Nose Radome Anti-Icing Switch.

The nose radome anti-icing switch (see figure 4-54) is located on the navigator's panel. It is a three-position (AUTO, OFF, MANUAL) toggle switch. When the switch is in the AUTO position, it permits control of the radome anti-icing valve by the ice detection system. If the propeller and engine anti-icing master switch is also in the AUTO position, the radome system is turned on automatically when ice is detected by the ice detection system. When the radome anti-icing switch is in the OFF position, the anti-icing valve is closed to shut off all air flow through the radome passages. When the switch is in the MANUAL position, the anti-icing system is on.

Normal Operation of Radome Anti-Icing System.

CAUTION

The radome anti-icing system must not be operated when the airplane is on the ground. To do so may overheat and damage the radome.

For direct operation of the nose radome anti-icing system, independently of the sensing of ice by the detection system, the nose radome anti-icing switch at the navigator's station should be set to MAN. Turning the switch to OFF immediately closes the throttling and shutoff valve, stopping the flow of anti-icing air to the radome.

To permit automatic operation of the nose radome anti-icing system when ice is sensed by the airplane ice detection system, both the nose radome anti-icing switch at the navigator's station, and the propeller and engine anti-icing master switch on the anti-icing systems control panel (figure 4-13, must be set to AUTO. The nose radome, propeller, and engine anti-icing systems are then simultaneously controlled. Placing the propeller and engine anti-icing master switch to the momentary RESET position will turn off all three systems. The ice detection system, however, will remain armed if the switch then is returned to AUTO. With the switch thus positioned, the detection system will automatically turn on the radome, propeller, and engine anti-icing systems if ice conditions are again detected by the ice detection system.

Normally radome anti-icing should not be used except when ice accumulation interferes with the scope presentation or for a 5 minute period when climbing through the freezing level to remove possible moisture from the radome or from the anti-icing system valves.

ENGINE INLET AIR DUCT ANTI-ICING SYSTEMS.

Two systems (figure 4-15) are provided for engine inlet air duct anti-icing. One system routes bleed air from the bleed air system to passages in the engine inlet air scoop and oil cooler scoop to heat the scoops. The other system routes air from the compressor diffuser section of the engine to passages in the compressor inlet vanes. The scoop anti-icing airflow is shut off by a solenoid valve which is energized closed. The air flows when the valve is deenergized open. The vane anti-icing airflow is controlled by two pressure-actuated valves, which are controlled by a single solenoid valve. When the solenoid valve is energized, the pressure-actuated valves shut off the airflow, and when the solenoid valve is deenergized, the pressure-actuated valves open. Both the scoop and vane anti-icing systems are termed fail-safe, meaning that anti-icing is provided when the system power supply is lost. The electrical control circuits are interconnected with the ice detection system so that the duct anti-icing can be turned on automatically when the detection system senses icing. Electrical power for actuation of engine anti-icing shutoff valves is supplied from the essential dc bus through the engine anti-ice shutoff circuit breakers on the copilot's side circuit breaker panel.

radome anti-icing system

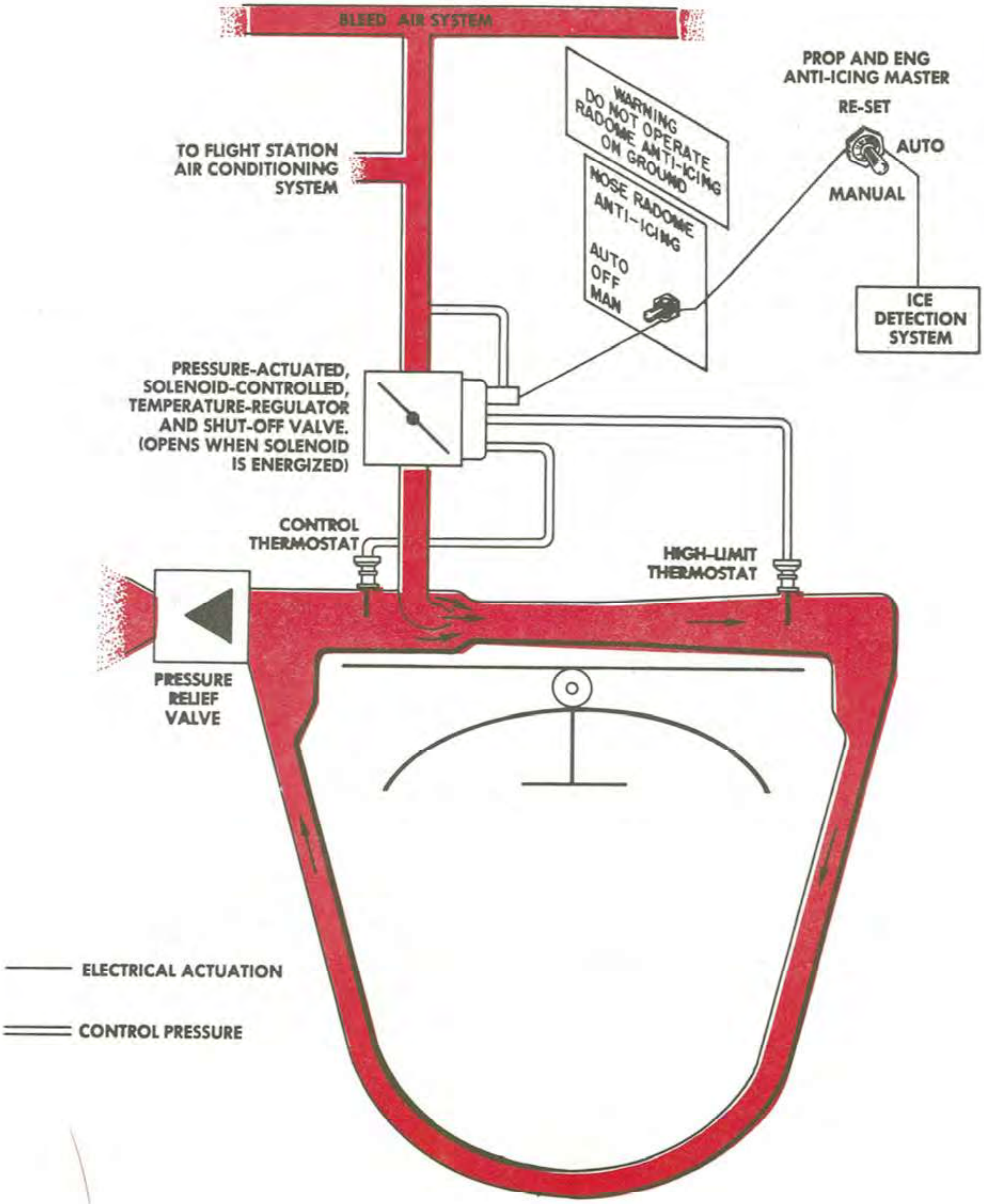


Figure 4-14.

Engine Inlet Air Duct Anti-Icing Switches.

Four engine inlet air duct anti-icing switches are located on the anti-icing systems control panel (figure 4-13). Each switch has ON and OFF positions. If a switch is in the ON position, the scoop and vane anti-icing systems for that engine are turned on if the propeller and engine anti-icing master switch is in MANUAL. If the master switch is in the AUTO position, anti-icing is turned on when the ice detection system detects ice. When an engine inlet air duct anti-icing switch is in the OFF position, both scoop and vane anti-icing valves for that engine close to shut off the anti-icing airflow.

Normal Operation of Engine Inlet Air Duct Anti-Icing Systems.

1. To turn the systems on manually, position the propeller and engine anti-icing master switch to MANUAL and the engine inlet air duct anti-icing switches to ON.
2. To allow the system to be turned on automatically by the ice detection system, position the propeller and engine anti-icing master switch to AUTO and the engine inlet air duct anti-icing switches to ON.
3. To shut the systems off while leaving them subject to automatic control, position the propeller and engine anti-icing master switch to RESET and release to the AUTO position. Let the engine inlet air duct anti-icing switches remain in the ON position.
4. To shut the systems off, place the engine inlet air duct anti-icing switches in the OFF position.

Note

If an engine is shut down during flight, the inlet duct anti-icing should be left on if icing conditions exist. However this will not be possible if the fire handle was pulled.

PROPELLER ANTI-ICING AND DE-ICING SYSTEMS.

The propeller spinner and blades are equipped with heating elements for anti-icing and de-icing (figure 4-16).

Propeller Anti-icing System.

The forward section of the spinner and the propeller afterbody are covered by electrical resistance-type heating elements to provide anti-icing. Phase A primary ac power is applied to the heating elements to warm the surface of the spinner and prevent the formation of ice. The ac power is protected by the spinner anti-icing circuit breakers on the pilot's upper circuit breaker panel and is applied by relays which are controled by dc control circuits. The control circuits are interconnected with the ice detection system so that the propeller anti-icing can be turned on automatically when the detection system senses icing. The propeller anti-icing is a continuous heating type system.

Propeller De-Icing System.

The aft portion of the front spinner section, the rear rotating spinner section, the spinner plateaus, and the leading edges and fairing of the propeller blades contain heating elements for de-icing the surfaces. The control circuits for the propeller de-icing, like the control circuits for the propeller anti-icing system, are connected to the ice detection system so that they may be turned on automatically. The application of spinner and blade de-icing power to the heating elements is controlled by the de-icing timer. The timer receives 28-volt dc power from the essential dc bus through the propeller de-icing timer circuit breaker on the copilot's lower circuit breaker panel. The timer applies power to the heating elements of only one propeller at a time, the elements of each propeller are energized 15 seconds during each one-minute cycle.

The aft portion of the front spinner section, along with the forward part of the rear rotating spinner section and the spinner plateaus, use phase B primary ac power and are protected by the spinner de-icing circuit breaker on the upper main ac panel. The aft portion of the rear rotating spinner section and the leading edges and fairing of the propeller blades use phase C primary ac power and are protected by the blade de-icing circuit breaker on the upper main ac panel. The 115-volt ac power for the heating elements is supplied from the right-hand ac bus through the blade and spinner de-icing circuit breakers on the upper main ac panel.

Propeller Ice Control Switches.

Four propeller ice control switches are located on the anti-icing systems control panel (figure 4-13). These 2-position (ON,OFF) toggle switches control the propeller anti-icing

engine anti-icing system

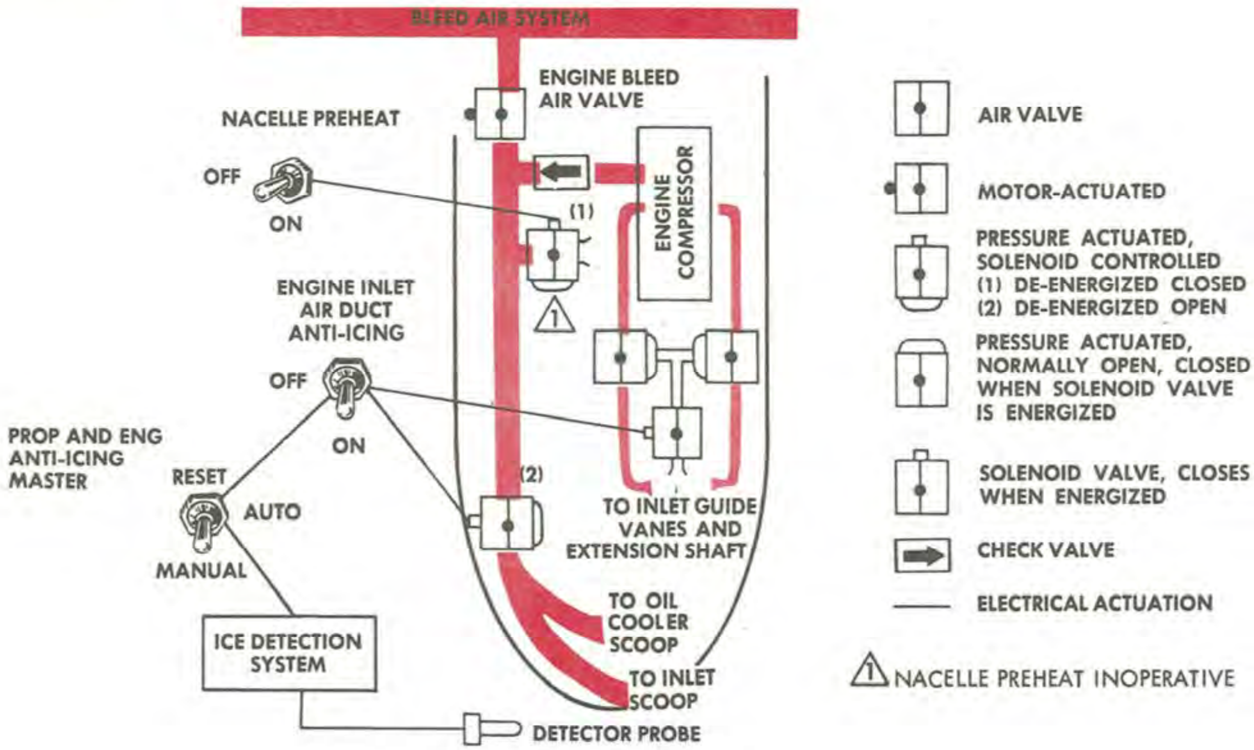


Figure 4-15.

and de-icing systems. When a switch is placed in the ON position and the propeller and engine anti-icing master switch is in the MANUAL position, the anti-icing and de-icing systems for the corresponding propeller are energized. If a switch is positioned to ON while the propeller and engine anti-icing master switch is in the AUTO position, the anti-icing and de-icing systems are energized only when the ice detection system detects icing. When a switch is placed in the OFF position, the anti-icing and de-icing systems for the corresponding propeller are de-energized.

Anti-Icing and De-Icing Ammeters.

Three ammeters located on the anti-icing systems control panel indicate the amperage of the various phases of primary ac power drawn for the propeller anti-icing and de-icing systems. The spinner anti-icing ammeter indicates the amperage of phase A power drawn for anti-icing; the spinner de-icing ammeter indicates the amperage of phase B power drawn for de-icing; and the blade de-icing ammeter indicates the amperage of phase C power drawn for de-icing. (Refer to Section V for limits.)

Normal Operation of Propeller Anti-Icing and De-Icing Systems.

1. To turn on the anti-icing and de-icing systems manually, place the propeller and engine anti-icing master switch in the MANUAL position and the propeller ice control switches in the ON position.

Note

To allow the systems to be turned on automatically by the ice detection system, place the propeller and engine anti-icing master switch in the AUTO position and the propeller ice control switches in the ON position.

propeller anti-icing and de-icing system

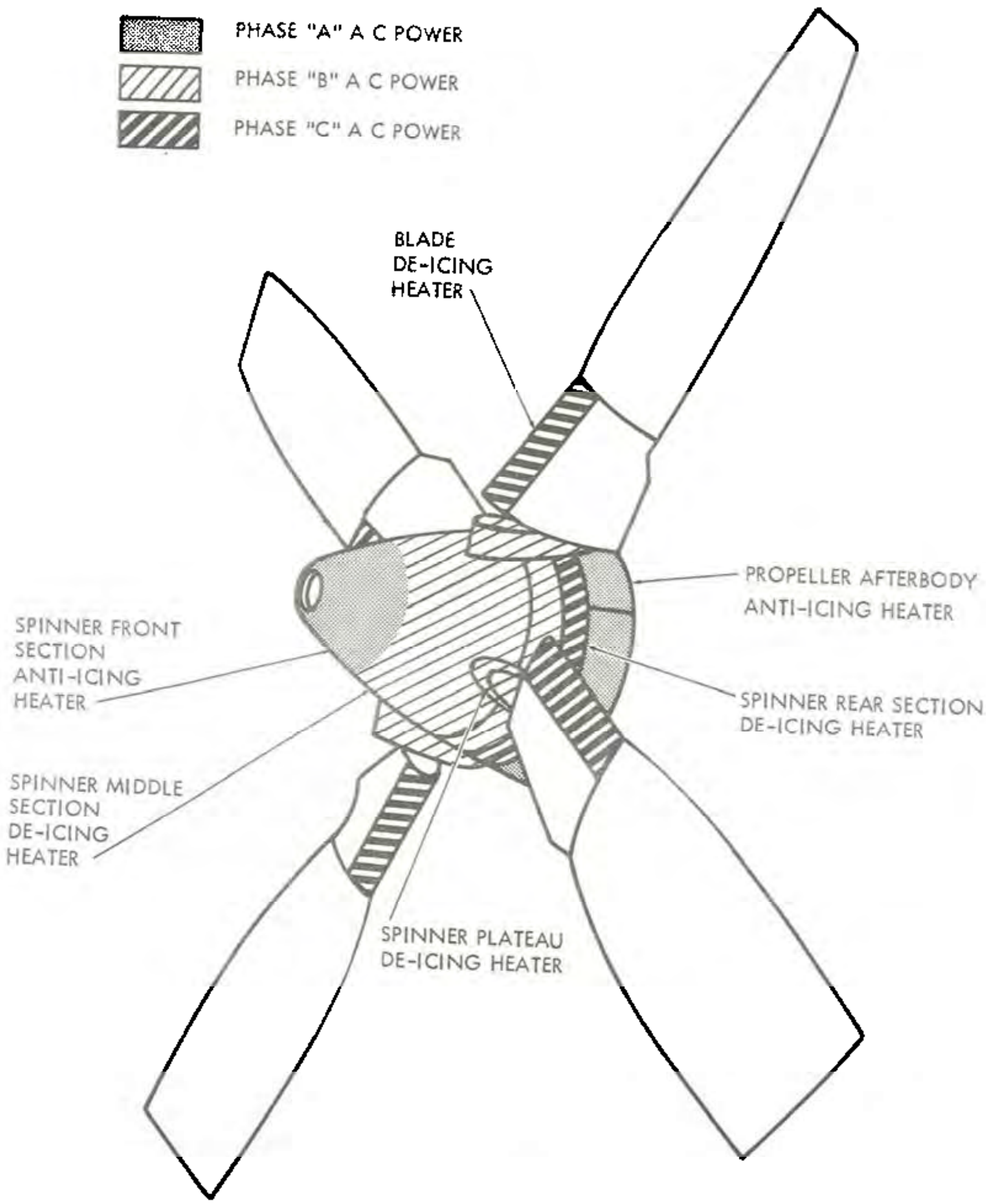


Figure 4-16.

2. To turn off the system and leave them subject to automatic control by the ice detection system, move the propeller and engine anti-icing master switch to the RESET position, and release it to the AUTO position.

3. To turn off the propeller anti-icing and de-icing systems, place the propeller ice control switches in the OFF position.

Note

A preflight check of the propeller anti-icing and de-icing system may be made with the engines running in accordance with the procedures outlined in Section II.

CAUTION

When the airplane is on the ground, do not operate the propeller anti-icing or de-icing for an engine that is not running. The engine must be running in order to dissipate the heat generated by the heating elements to prevent damage to the elements. Never operate the system for more than two cycles while the airplane is on the ground. Anti-icing and de-icing may be used for a propeller feathered in flight.

WARNING

Before flying into known or suspected icing conditions, turn on the propeller blade de-icing system. If a blade de-icing ammeter reading falls below 65 amperes for a period of 15 seconds in each one-minute de-icing cycle, do not fly into known or suspected icing conditions.

ICE DETECTION SYSTEM.

The ice detection system is used as an automatic control for turning on the radome anti-icing, engine inlet air duct anti-icing, and propeller anti-icing and de-icing systems. The detection system consists of a propeller and engine anti-icing master switch, two sets of detector units, indicator lights, a test switch, and control relays. Each set of detection units has a detector and an interpreter. Each detector includes a probe; one is mounted in the No. 2 engine inlet air duct, and the other is in the No. 3 engine duct. The detection units are energized by essential dc power applied through the engine starting circuits, and they are operative when the No. 2 or No. 3 engine condition lever is in RUN position and the prop and engine anti-icing master switch is in AUTO. On airplanes not equipped with the solid state ice detectors in the nacelles, the engines must be running for the ice detection system to operate. Electrical protection for the ice detectors is provided by the left and right ice detector circuit breakers on the copilot's lower circuit breaker panel. If either probe becomes iced over while the engine in which it is installed is running, and if the propeller and engine anti-icing master switch is at AUTO position at that time, the detection units trigger a control relay. This relay turns on the anti-icing and de-icing systems if the switches for those systems are at ON or AUTO positions. The relay also turns on an indicator light. The ice detection system does not turn off the anti-icing and de-icing systems automatically when icing conditions no longer exist, but the master switch can be held at RESET position to turn them all off simultaneously. Timers in the ice detection system operate after the No. 2 and No. 3 engines are shut down and disarm the detection system. If any of the anti-icing or de-icing systems have been left in automatic operation, they are turned off upon disarming of the detection system at engine shutdown.

Propeller and Engine Anti-icing Master Switch.

The propeller and engine anti-icing master switch is located on the anti-icing systems control panel (figure 4-13). It has three positions - AUTO, MANUAL, and RESET. When at AUTO position, it permits control of the radome anti-icing, engine inlet air duct anti-icing, and propeller anti-icing and de-icing systems by the ice detection system. The AUTO position is also used to permit testing of the ice detection system. When at MANUAL position, the switch permits control of the anti-icing and de-icing systems by the individual control switches for the systems. The RESET position is a momentary position used to turn off the anti-icing and de-icing systems when icing conditions no longer exist. When the switch is positioned at RESET and allowed to return to AUTO, the ice detection system remains armed; therefore, it will automatically turn on the anti-icing and de-icing systems again if it senses icing.

Test Switch.

The test switch is located on the ice detection panel (figure 4-17). It has No. 2 and No. 3 momentary positions and a center OFF position. It is used to test operation of the two sets of ice detector interpreter units by simulating detection of icing. If it is held at No. 2 position while the No. 2 engine is running and the propeller and engine anti-icing master switch is at AUTO, the ON indicator light on the ice detection panel comes on to indicate that the ice detection system has triggered the control relay which turns on the anti-icing and de-icing systems. The No. 3 position of the switch is used in the same manner to test operation of the other set of detector interpreter units. After the test switch is operated to either posi-

ice detection panel

Figure 4-17.

tion, the propeller and engine anti-icing master switch must be held at RESET momentarily to unlock the control relay and rearm the detection system.

On Light and Press-for-Light Out Switch.

The on-light and the press-for-light-out switch is located on the ice detection panel (figure 4-17). The indicator light is turned on by the ice detection system whenever it detects ice while the propeller and engine anti-icing master switch is in the AUTO position. When lighted, it indicates that icing has been detected by probes in the engine inlet air scoops and that anti-icing and de-icing systems have been turned on automatically if the individual system switches are at ON or AUTO. It also lights when the test switch is operated and then indicates that the detection units are functioning. The momentary light out switch can be operated to turn the light out. If the propeller and engine anti-icing master switch is held in the RESET position to turn off the anti-icing and de-icing systems, the light remains off if icing no longer exists.

No-Ice Light.

The no-ice light is on the ice detection panel (figure 4-17). It is turned on when the probes of the detection system are no longer icing and indicates that the anti-icing and de-icing systems can be turned off. If the propeller and engine anti-icing master switch is held in the RESET position to turn the anti-icing and de-icing systems off, the light is also extinguished.

PITOT TUBE ANTI-ICING SYSTEM.

Pitot tubes, static booms and air data boom anti-icing is provided by electrical heaters and controlled by the pilot's pitot heat switches. The left hand pitot tube and the left wing tip static boom are controlled by the pilot's pitot heat switch. The right hand pitot tube, right wing tip static boom, air data boom and total temperature pick-up are controlled from the copilot's pitot heat switch. Electrical power for the heaters is supplied by the essential ac bus (115V 400 Hz, single phase) to the left and right wing tip static booms and from the main ac bus (115 vac 400 Hz, single phase) to the air data boom and total temperature pickup. The left hand pitot tube is supplied 28 vdc from the essential dc bus. The right hand pitot tube is supplied 28 vdc from the isolated dc bus.

Pitot Heat Switches.

The pilot's and copilot's pitot heater switches are located on the anti-icing systems control panel (figure 4-13). These two- position toggle switches have ON and OFF positions. When a switch is placed in the ON position, the heating element for the corresponding pitot tube is energized. When the switch is in the OFF position, the heating element is de-energized.

WINDSHIELD ANTI-ICING SYSTEM.

The three windshields, the two windows on each side of the windshields, and the two lower windows in front of the pilot are Nesa-type. These panels are heated by applying primary ac power from the left ac bus to a resistance material between the layers of glass. The ac power is applied by automatic dc control systems which cycle to maintain window temperature within specific limits. A center windshield system controls heating of the three center windshields, and a side and lower system controls heating of the side and lower windows. The two systems are identical except for the amount of total ac power provided. Provisions are made for selecting either normal or high rate of heating. When high rate is selected, higher voltage is applied for shorter periods of time so that the Nesa heats more rapidly, but not to a higher temperature. Provisions are also made for controlling the temperature increase manually when the Nesa panels are extremely cold. The control systems do not function automatically when window temperature is below -43°C (-45°F).

Nesa Windshield Switches.

The Nesa windshield switches are on the anti-icing systems control panel (figure 4-13). Each switch has NORMAL, OFF, and HI positions. When the center windshield switch is in the NORMAL position, the three center windshields are heated at the normal rate. If the switch is positioned to HI, the three center windshields have higher voltage applied to the heating material so that they heat more rapidly. Heating of the side and lower windows is controlled in the same manner by the side and lower windshield switch.

Nesa Windshield Coldstart Switches.

The coldstart switches are located on the anti-icing systems control panel (figure 4-13) next to the Nesa windshield control switches. The coldstart switches are push-type momentary switches. The purpose of the switches is to provide manual control of windshield heating to raise the windshield temperature gradually from extremely cold temperature so as to prevent damaging the glass panels. If temperature of the windshield panels is below -43°C (-45°F) the control systems do not function automatically. Pressing the coldstart switches causes the control systems to apply ac power to the windshield panels while the switches are held.

Normal Operation of Windshield Anti-Icing System.

WARNING

Do not check the temperature of a crazed outer glass with the bare hand with the NESA switches ON.

Note

Operation of Nesa anti-icing when outside air temperature is above 27°C (81°F) will increase the possibility of delamination within the Nesa panels.

1. Always place the Nesa windshield anti-icing switches in the NORMAL position before take-off to reduce thermal shock and the possibility of cracking the windshield.

CAUTION

Monitor operation of the anti-icing systems by feeling the glass and observing ice formation on the panels. Turn off the system if any of the following conditions are noticed:

Panels feel excessively hot.

Electrical arcing is observed in one of the panels.

One of the panels containing thermistors is not heating. This might cause the other panels in the same system to overheat.

2. If ice is forming on the windshields at a rate higher than it can be removed by operating the anti-icing system in NORMAL, set the switches to HI until out of the extreme icing conditions. Do not use the HI position when turning on a system initially.
3. When ambient temperature is below -43°C, place the Nesa windshield anti-icing switches in the NORMAL position. Actuate the cold-start switches, 5 seconds ON and 10 seconds OFF, until the temperature of the windshield is above -43°C.

CAUTION

Do not exceed the operating limits of 5 seconds on, 10 seconds off when operating the coldstart switch. To do so might cause the windshield panels to be damaged.

NACELLE PREHEAT SYSTEM.

Note

The nacelle preheat system is inoperative due to the preheat valves not being installed.

The nacelle preheat system allows hot air from the bleed air system to flow into the nacelle to heat the engine and nacelle equipment before starting the engine. A solenoid valve and diffuser in each nacelle controls the airflow. The engine bleed air valve in a nacelle must be open before bleed air can flow to the preheat valve. The preheat valves are controlled by four nacelle preheat switches on the anti-icing systems control panel (figure 4-13). The control circuits for the valves are energized by 28-volt dc power from the isolated dc bus through the nacelle preheat circuit breakers on the copilot's lower circuit breaker panel only while the corresponding engine condition levers are at GROUND STOP or FEATHER position and the airplane is on the ground.

NACELLE PREHEAT SWITCHES.

The four nacelle preheat switches, located on the anti-icing systems control panel (figure 4-13), are two-position (ON, OFF) toggle switches. When a switch is placed in the ON position while the airplane is on the ground and the corresponding engine condition lever is at GROUND STOP or FEATHER, the nacelle preheat valve is energized open and remains open as long as the switch is in the ON position. Placing the nacelle preheat switch in the OFF position deenergizes the valve closed.

Note

Nacelle preheat is operational only when the touchdown switch is closed, that is, when the airplane is on the ground.

Normal Operation of Nacelle Preheat System.

1. To apply heat to a nacelle, place the nacelle pre-heat switch for that engine in the ON position and the corresponding engine condition lever in GROUND STOP or FEATHER.
2. To stop nacelle heating, place the nacelle preheat switch for that engine in the OFF position.

CAUTION

Nacelle preheat should be used only when the ambient temperature is below 0°F and only when necessary to remove frost or ice from equipment in the nacelle to facilitate engine starting. The bleed air for nacelle preheating is at approximately 600°F when supplied by engine or 350°F when supplied by GTC. Air at this temperature can quickly bake electrical cables and damage electronic components in the nacelle. Closely monitor the nacelle overheat warning light. If it illuminates, place the nacelle preheat switch to the OFF position.

AIR TURBINE MOTOR (ATM).

The ATM, located in the left wheel well above and aft of the GTC, is a single-stage, axial-flow turbine used to drive a 20-kva, ac generator to supply 115/200-volt, three-phase, ac power. With the airplane on the ground and at an ambient temperature of 40°C(104°F) or less, the ATM-driven ac generator is rated at 30 kva (1.0 reading on loadmeter). Compressed air for ground operation of the ATM is furnished by the GTC or an external source. Compressed air for inflight operation of the ATM is supplied by bleed air from the engines. The speed of the unit is controlled by a speed-sensing butterfly valve in the turbine inlet which meters the amount of air supplied the turbine and provides automatic shutdown in case of overspeed and must be manually reset in the ATM compartment. A cooling fan for the ac generator, energized by generator output, is included in the unit. A plug assembly for the ATM cooling fan air intake is supplied with the airplane and stowed in the miscellaneous stowage box. The ATM generator can be operated with the fan failed as follows:

During Flight	Full load No time limit
Ground Operation	20 KVA (66% load 0.66) No time limit

ATM CONTROL SWITCH.

The ATM control switch is located on the GTC control panel (figure 4-18). This two position (ON, STOP) toggle switch controls a shutoff valve in the ATM inlet line. When the switch is moved to the ON position, the shutoff valve is opened, and compressed air is admitted to drive the ATM. The shutoff valve operates from 28-volt dc power through the ATM control circuit breaker on the pilot's side circuit breaker panel.

ATM OVERHEAT WARNING LIGHT.

A red press-to-test light located on the GTC control panel (figure 4-18) is installed to warn the pilot of an overheat condition in the ATM compartment. When an overheat condition of 200°F exists, the warning light will illuminate and the overheat condition must be corrected to extinguish the light. Electrical power for the light is supplied from the essential dc bus through the wing and empennage overheat lights circuit breaker on the copilot's lower circuit breaker panel.

GAS TURBINE COMPRESSOR (GTC).

The GTC (figure 4-19), located forward in the left wheel well, supplies air for ground operation of the air turbine motor, engine starting, nacelle preheat, and air conditioning system. The unit is composed of a compressor assembly, power turbine assembly, and an accessory assembly. The GTC ignition, and electrical controls are energized by 28-volt dc power from the isolated dc bus. Circuit protection is provided by the GTC control circuit breaker on the pilot's side circuit breaker panel.

gas turbine compressor control panel

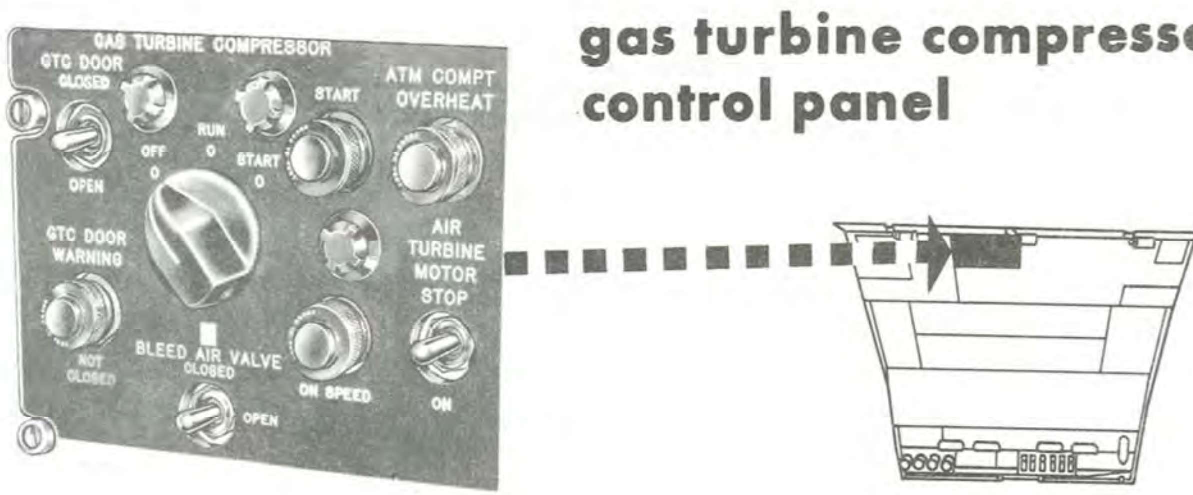
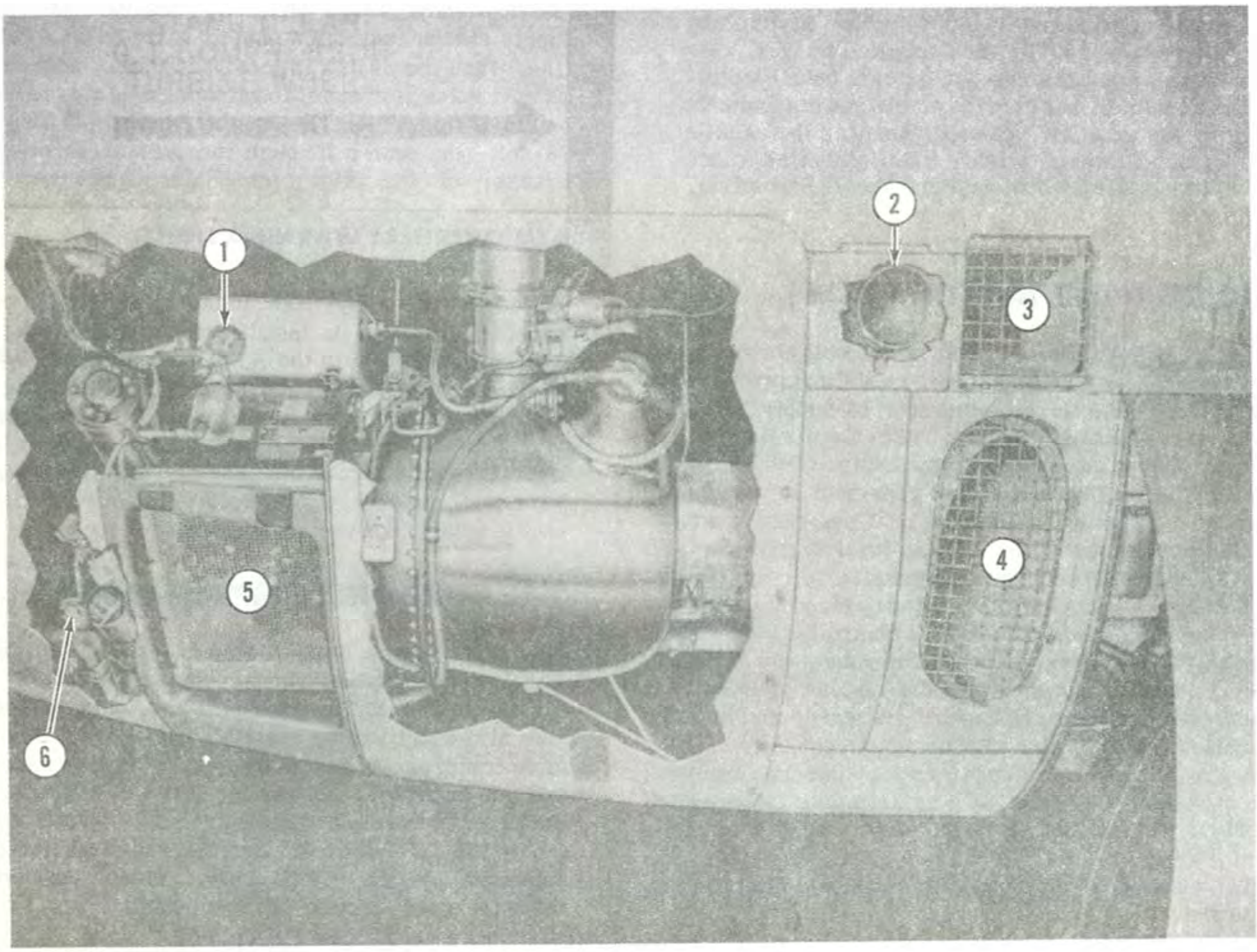


Figure 4-18.

gas turbine compressor



1. HOURMETER
2. EXTERNAL PRESSURE CONNECTION
3. GTC COMPARTMENT COOLING EXHAUST
4. EXHAUST
5. INLET
6. GTC PRIMER BUTTON

Figure 4-19.

COMPRESSOR ASSEMBLY.

The GTC uses a two-stage, centrifugal-type compressor. When the compressor is operating at full speed, part of the compressed air is discharged into the power turbine to support combustion, and the remainder is available as pneumatic power.

POWER TURBINE ASSEMBLY.

The power turbine assembly drives the compressor and the GTC accessories. The assembly consists of a turbine section and a combustor. Fuel is injected into the combustion chamber, mixed with air, and burned. The combustion gases are directed against the turbine wheel, which supplies rotary power to drive the compressor and accessory assemblies. After being used to turn the turbine wheel, the combustion gases pass out the exhaust.

ACCESSORY ASSEMBLY.

The accessory assembly of the GTC consists of a starter motor, oil and fuel pumps, an oil cooler fan, and a governor. The accessory group, with the exception of the starter motor, is powered through a reduction gear train directly coupled to the compressor drive shaft. The starter motor is coupled to the reduction gear train through a spring-loaded clutch. The starter clutch is disengaged by centrifugal force when the unit reaches approximately 35 percent of its nominal governed speed.

GTC OIL SYSTEM.

The GTC oil circulation system provides lubrication for all gears and shaft bearings. Oil from a fuselage-mounted reservoir is delivered by a gear-type pump through an oil filter to the various lubrication points. A relief valve in the system maintains the desired pressure. Oil is removed from the unit by a dual scavenge pump and returned to the reservoir, either through the oil cooler or, if oil temperature is below 27° C (81° F), through the oil cooler bypass valve. An oil drain line is connected to the accessory section to eliminate the possibility of oil accumulation after the gas turbine compressor is stopped. Oil used in this unit must conform to the specification and grade listed in the servicing diagram (figure 1-72).

GTC FUEL SYSTEM.

Fuel for operation of the GTC may be supplied from any fuel tank through the cross-feed manifold. A pressure regulator limits the inlet pressure to the GTC gear-driven fuel pump to approximately 15 psi. A fuel strainer is located in the supply line between the pressure regulator and the combustion chamber. In addition to filtering the fuel, the strainer removes water from the incoming fuel and collects it in a sump. A valve is provided for sump drainage. During the starting cycle, when the oil pressure in the GTC oil system reaches approximately 3 psi, the fuel and ignition circuits are energized through a switch actuated by oil pressure. The fuel supply to the GTC is shut off by moving the GTC control switch to OFF or by pulling the GTC fire handle.

GTC CONTROL SYSTEM.

The operation of the GTC is governor-controlled to maintain a nearly constant speed of approximately 100 percent rpm under varying load conditions. The speed-sensing governor, powered by the accessory gear train, controls the unit by regulating fuel flow into the combustion chamber. An overspeed switch closes the fuel shutoff valve to prevent overspeeding.

GTC CONTROLS.

All GTC controls are located on the GTC control panel (figure 4-18), on the overhead control panel. The GTC controls are energized by 28-volt dc power from the isolated dc bus through the GTC control circuit breaker on the pilot's side circuit breaker panel.

GTC Control Switch.

A selector switch for the GTC is located on the GTC control panel (figure 4-18). This three-position (OFF, RUN, START) rotary switch controls the operation of the GTC. Holding the selector switch in the spring-loaded START position energizes the self-holding GTC starter relay. This relay will remain closed until the circuit is broken by the 35-percent speed switch or by moving the selector switch to the OFF position. When the switch is released, it moves to the RUN position. In this position, all GTC circuits are energized to the various automatic controls. These oil-pressure and speed-sensitive switches control their respective circuits to accomplish starting and running of the GTC. In the OFF position, all circuits are de-energized.

Bleed Air Valve Switch.

A bleed air valve switch is located on the GTC control panel (figure 4-18). After the compressor reaches operating speed, this two-position (OPEN, CLOSED) toggle switch controls the normally closed, solenoid-operated bleed air valve. With the valve closed, air is supplied to the power turbine combustion chamber only. With the valve open, air is supplied to both the combustion chamber and the bleed air system of the airplane. Applying a bleed air load to the compressor before it reaches operating speed is prevented by the 95-percent speed switch, which completes the circuit to the bleed air valve switch only after operating speed is reached.

Fire Handle.

The GTC fire handle (figure 1-65) on the overhead control panel provides for emergency shutdown of the GTC. This handle, when pulled, energizes the motor operated oil shutoff valve closed, and de-energizes power to the GTC door and control switch. When the circuit to the control switch is broken, the motor operated fuel valve is energized closed. The solenoid operated fuel and bleed air valves are also de-energized to the closed position.

GTC INDICATORS.

The indicators for the GTC are located on the GTC control panel (figure 4-18), which is part of the overhead control panel.

Start Light.

A start light is located on the GTC control panel. This press-to-test light glows to indicate that the starter motor is energized. The light stays on until the compressor reaches approximately 35 percent rpm, at which time a centrifugal switch de-energizes the starter and the start light.

ON Speed Light.

An on speed light is located on the GTC control panel. This press-to-test light is energized through the 95-percent speed switch, and it indicates that the compressor has reached or is maintaining operating speed.

GTC OPERATING INSTRUCTIONS.

The GTC can be operated on the ground only. The GTC is operated from the GTC control panel on the overhead control panel.

WARNING

During starting and operation of the GTC, personnel must stand clear of compressor air intake and exhaust and plane of rotation of turbine and compressor. Exercise extreme care to prevent foreign material from entering the air intake, as turbine failure may be sufficiently violent to damage equipment and endanger nearby personnel.

Starting the GTC.

Start the GTC as follows:

1. Turn on dc power. (If external dc power is available, turn the battery switch to EXT DC PWR position. If external ac power is available, turn the external ac power switch to the EXT AC PWR position and turn the battery switch to BATTERY. If no external power is available, turn the battery switch to the BATTERY position.
2. Tie the bus tie switch (if required).
3. Route fuel to the GTC by opening a cross-feed valve.
4. Place the bleed air valve switch in the CLOSED position.
5. Turn the GTC control switch to the spring-loaded START position. The start light should illuminate immediately.
6. Release the control switch. The spring return will move the switch to the RUN position.

CAUTION

As soon as the GTC starter disengages, the starter light will go out. If the light does not go out within 1 minute, move the control switch to OFF, and wait 4 minutes before making another start attempt. The starter duty cycle is 1 minute on, 4 minutes off.

After the GTC control switch is placed in START, power is supplied to the starter, the start light, and to the fuel and ignition circuits, through the fuel and ignition circuits are not yet complete. When the starter brings the GTC up to approximately 12 percent rpm, a switch operated by oil pressure closes to complete the fuel and ignition circuits. After lightoff, the combined power of the starter and combustion gases on the power turbine continues the acceleration of the assembly.

Note

If the GTC does not light-off, the cause could be a lack of oil in the line to actuate the switch to complete the fuel and ignition circuits. If this is the case, the oil system can be primed manually by pressing the primer button on the check valve in the pump assembly while motoring the compressor. Then attempt another start.

At approximately 35 percent rpm the 35-percent switch opens, de-energizing the starter, the ignition circuit, and the start light. The GTC is now under its own power, and acceleration continues. At 95-percent speed, another centrifugal switch closes and connects power to the bleed air valve switch and the on speed light. When full speed is reached, the governor assumes control and limits rotation to approximately 100 percent rpm. In case of governor failure, the overspeed switch prevents the turbine from running away by breaking the circuit to the fuel shutoff valve holding relay, which shuts off the fuel.

CAUTION

If dc power is interrupted while the GTC is operating, the control circuit will be opened, causing the unit to stop.

Loading Operation.

Apply load to the GTC as follows:

1. Insure that the unit is on speed.
2. Place the bleed air valve switch in the OPEN position.
3. Check bleed air pressure.

Stopping the GTC.

Stop the GTC as follows:

1. Place the bleed air valve switch in the CLOSED position.
2. Turn the GTC control switch to the OFF position.

LIGHTING SYSTEM.

The lighting system is composed of exterior and interior groups of lights and their controls. Receptacles are also provided on the sides of the pilot's and copilot's side shelves for connecting a signal light. The pilot's and copilot's instrument lights and the engine instrument lights operate on ac power and all others operate on dc power. The pilot's and copilot's instrument lights and the engine instrument lights use 6-volt bulbs only. All other panel lights use 28-volt bulbs.

EXTERIOR LIGHTS.

The exterior group of airplane lights (figure 4-20) comprises a landing light on the under surface of each wing; two taxiing lights on the main landing gear doors; nine formation; six navigation, two anti-collision lights and combat beacon light disposed around the airplane, and a light on each side of the fuselage to illuminate the wing leading edges. Power for all these lights is supplied from the essential and main dc buses through the exterior lights circuit breakers on the copilot's lower circuit breaker panel.

On airplanes modified by T.O. 1C-130-949 additional exterior lighting includes UARRSI unit slipway lights and four area lights to provide illumination of the UARRSI unit area and two fuselage lights on top of the fuselage to provide illumination of the wing leading edge, engine nacelles, and propellers.

Combat Beacon.

A rotating combat beacon (figure 4-20) provides visual aid to fighters escorting the gunship. The beacon (shielded to prevent viewing from the ground) is controlled by a switch on the exterior lights panel on the flight deck. Circuit protection is provided by the formation lights circuit breaker on the copilot's lower circuit breaker panel.

Landing Lights.

A retractable landing light is mounted in the underside of each wing approximately midway between the inboard and outboard engine nacelles. Switches for extension and retraction and for illumination control are located on the landing lights control panel (figure 4-22). The two extension and retraction switches, labeled right and left, are three-position (EXTEND, HOLD, RETRACT) toggle switches. The right switch energizes the right-hand landing light actuator, retracting or extending the light when the switch is moved to RETRACT or EXTEND positions. The left switch energizes the left-hand light actuator in the same manner. When either switch is moved to the HOLD position, the landing light actuator motor is de-energized, and the light will lock in position. Two two-position (ON, OFF) toggle switches control the illumination of the landing lights. When either switch is moved to the ON position, the corresponding light illuminates. When either switch is moved to OFF, the corresponding light is de-energized. Power for the landing lights is supplied from the essential dc bus through the left-hand and right-hand landing lights circuit breakers on the copilot's lower circuit breaker panel, and for the light extension and retraction actuators through the left-hand and right-hand landing lights mtr circuit breakers on the same panel.

CAUTION

Do not operate landing lights for prolonged periods while airplane is on ground, since neither light has any cooling facility.

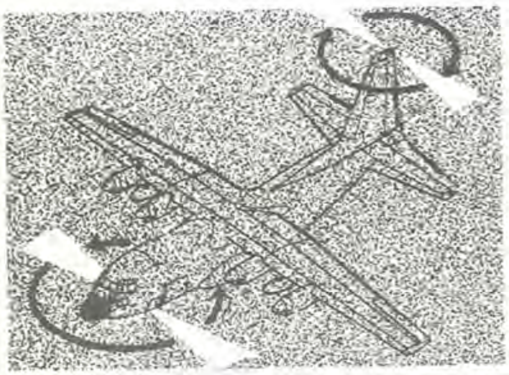
Taxiing Lights.

Illumination of the two taxiing lights, one mounted on the inside of each main landing gear door, is controlled by a two-position (ON, OFF) toggle switch on the landing light control panel (figure 4-22). Power is supplied from the main dc bus through the taxi circuit breaker on the copilot's lower circuit breaker panel.

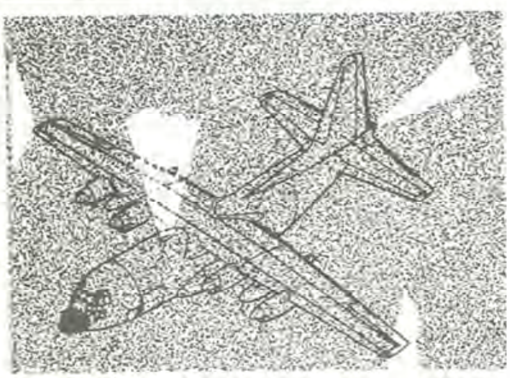
Formation Lights.

The nine formation lights comprise three on the outer panel of each wing and three on top of the fuselage aft of the wing. The illumination and brilliance of all nine formation lights is controlled simultaneously through a single rheostat switch on the exterior lights control panel (figure 4-22). The switch is turned clock-

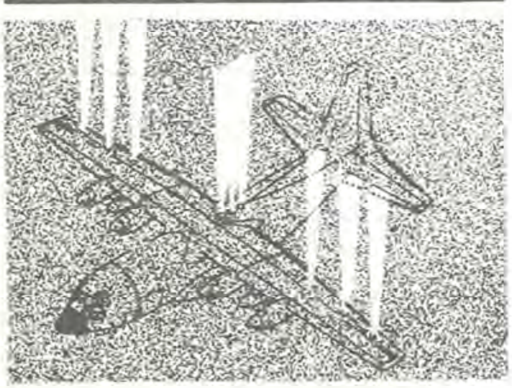
exterior lights locations



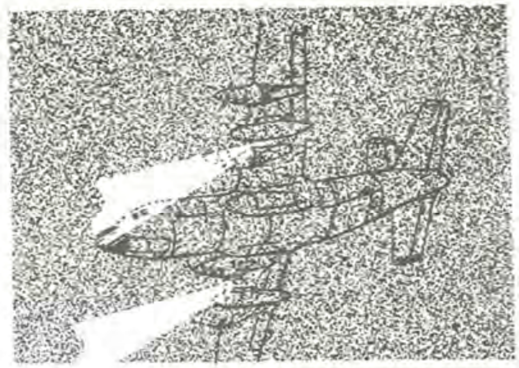
ANTI-COLLISION LIGHT



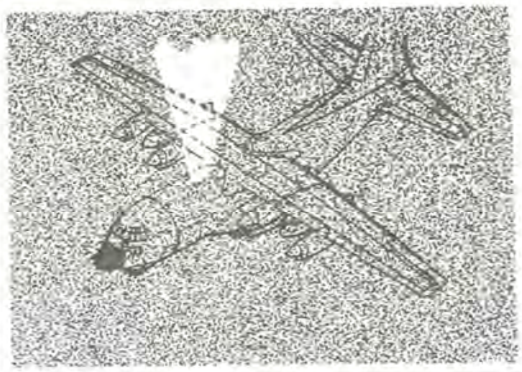
NAVIGATION LIGHTS



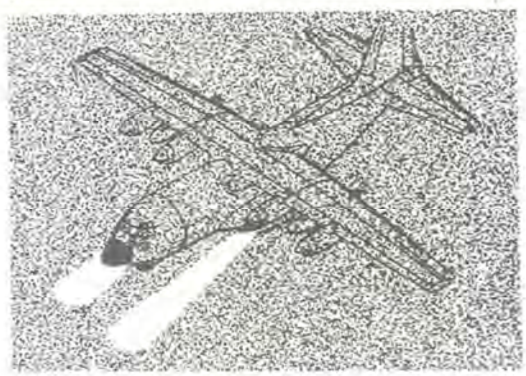
FORMATION LIGHTS



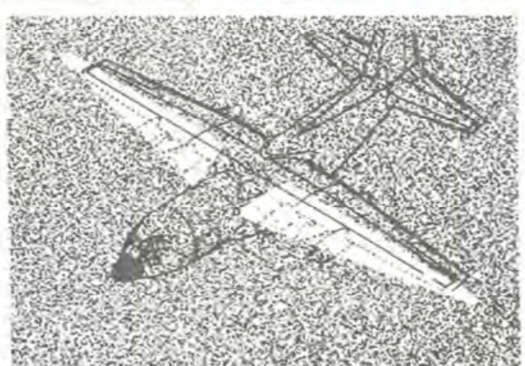
LANDING LIGHTS



COMBAT BEACON



TAXI LIGHTS

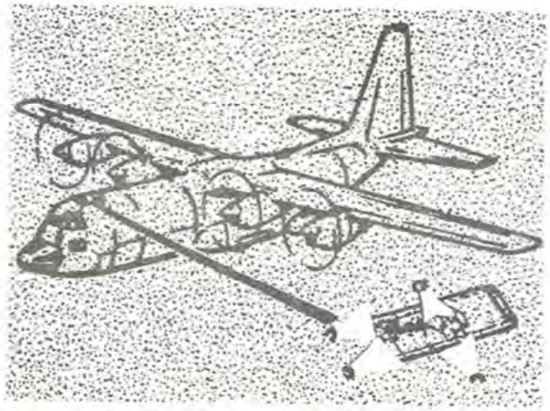


LEADING EDGE LIGHTS

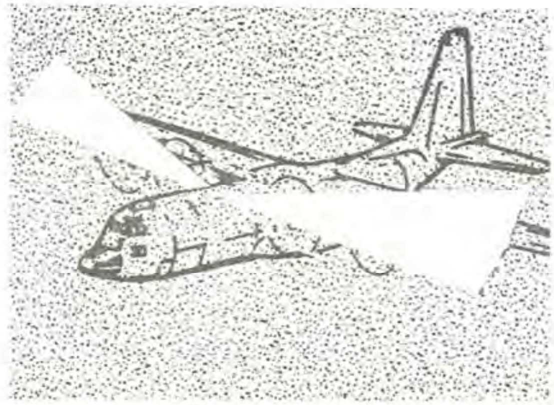
Figure 4-20.

exterior lights

(AIRPLANES MODIFIED BY T.O. 1C-130-949)



AERIAL REFUELING AREA AND SLIPWAY LIGHTS



AERIAL REFUELING FUSELAGE LIGHTS

Figure 4-21.

wise from the OFF position to illuminate the lights and then further turned toward BRIGHT to increase the brilliance; rotation of the switch in the counterclockwise direction decreases the brilliance of the lights until the OFF position is reached. Power for the lights is supplied from the main dc bus through the formation circuit breaker on the copilot's lower circuit breaker panel.

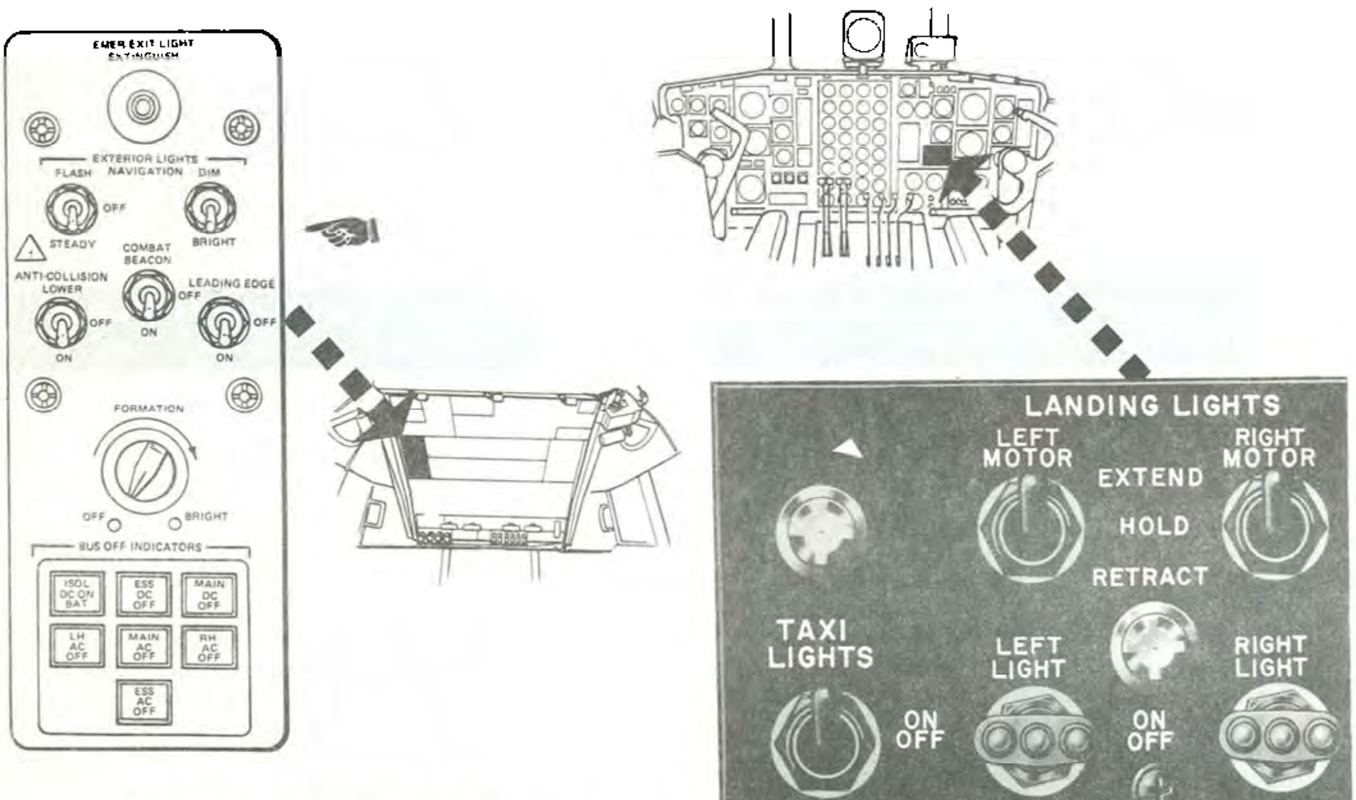
Navigation Lights.

The navigation lighting system consists of six lights; a red light on the left wingtip, a green light on the right wingtip, two white lights on the trailing edge of the tail cone, a white light on top of the fuselage forward of the wing, and a white light on the lower surface of the fuselage. All lights can be set DIM or BRIGHT. The red and green wingtip lights and the white tail lights can also be set to flash or to glow continuously. The white lights on the top and bottom of the fuselage, however, will only illuminate continuously. The navigation lights selector switch turns the lights on and off and controls the flashing mechanism, and the navigation lights dimming switch controls the intensity of the lights. The selector switch is a three-position (STEADY, OFF, FLASH) toggle switch, located on the exterior lights control panel (figure 4-22). When the switch is in the STEADY position, the lights glow continuously. When the switch is in the FLASH position, the wingtip lights and the white tail light flash simultaneously. The navigation lights dimming switch is a two-position (BRIGHT, DIM) toggle switch and is located on the exterior lights control panel. Power for the lights is supplied from the essential dc bus through the navigation and position circuit breaker on the copilot's lower circuit breaker panel.

Anti-Collison Lights.

The airplane carries two anti-collision lights, one on top of the vertical stabilizer and the other on the underside of the fuselage. Each light is contained within a red transparent housing and flashes through a motor-driven rotating reflector. The lights are controlled by a two-position (ON, OFF) toggle switch, located on the exterior lights control panel (figure 4-22), which also controls operation of the motor-driven reflector. When the switch is set to ON, the lights are illuminated and the reflector commences to rotate. Power for both the lights and the motors is supplied from the essential dc bus through the anti-collision circuit breaker on the copilot's lower circuit breaker panel.

exterior lights control panel



⚠1 AIRPLANES MODIFIED BY T.O. 1C-130-949.

Figure 4-22.

On airplanes modified by T.O. 1C-130-949 the anti-collision light switch and circuitry has been modified to permit operation of both lights simultaneously or the lower light only by changing the light switch to a three-position (LOWER-OFF-ON) switch shown in figure 4-22. In LOWER position, only the lower light (under the forward fuselage) will operate. In ON position, both anti-collision lights will be in operation.

WARNING

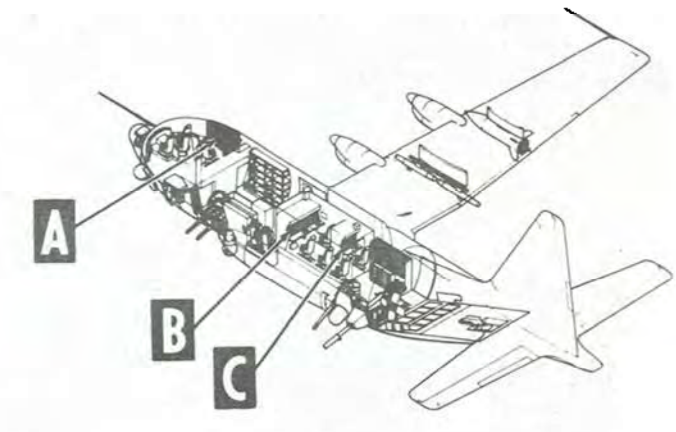
Operation of the anti-collision light when flying in actual instrument conditions is not recommended. The light reflecting on surrounding clouds may cause spatial disorientation.

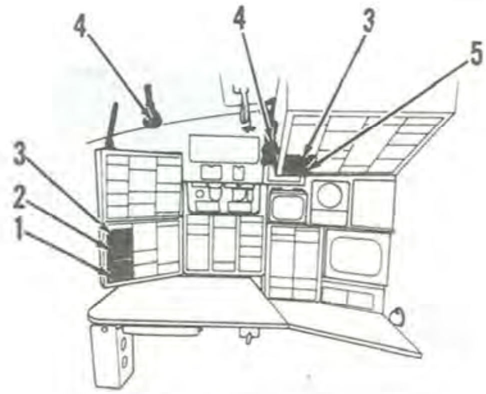
Wing Leading Edge Lights.

A light is installed on each side of the fuselage in a position which will illuminate the engine nacelles and the immediate leading edge area of each wing. The lights are controlled through a two-position (ON, OFF) toggle switch on the exterior lights control panel and are powered from the main dc bus through the wing leading edge circuit breaker on the copilot's lower circuit breaker panel.

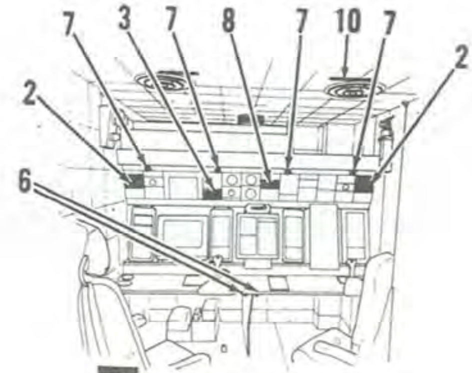
On airplanes modified by T.O. 1C-130-949 the leading edge lights circuitry has been modified to provide a secondary control from the aerial refuel panel. Primary control of the lights is accomplished by the leading edge lights switch on the exterior lights control panel; however, when positioned to OFF, control is transferred to the leading edge lighting control on

interior lighting controls

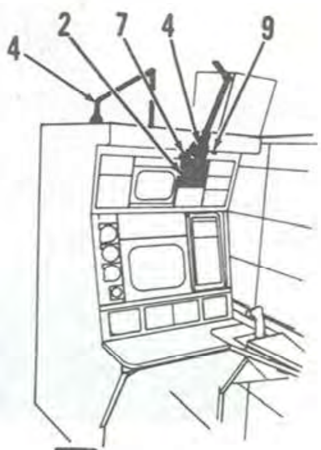




A NAV/ FCO CONSOLES



B IR/EWO CONSOLE

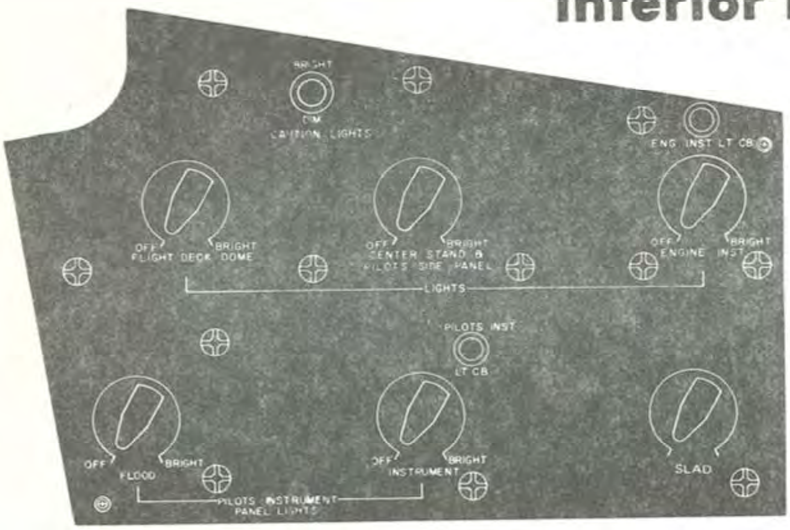


C TV CONSOLE

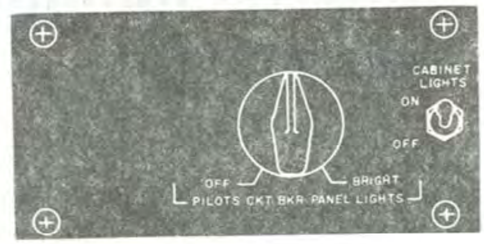
1. FLOOD LIGHT CONTROL
2. LIGHTING CONTROL – PANEL AND WORKTABLE
3. 5 VOLT LIGHTING CONTROL
4. WORK LIGHT
5. CONSOLE LIGHTING CONTROL
6. UTILITY LIGHTS
7. CONSOLE LIGHTS
8. CEILING LIGHTS CONTROL
9. CONSOLE LIGHT SWITCH
10. BOOTH CEILING LIGHTS

Figure 4-23 (Sheet 1 of 2).

interior lighting controls

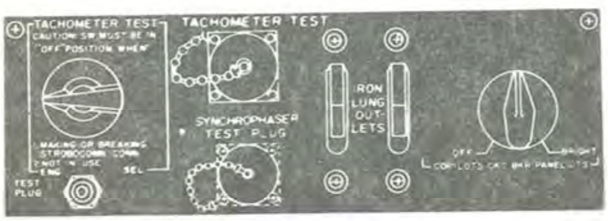


PILOT'S SIDE SHELF PANEL



PILOT'S CIRCUIT BREAKER PANEL

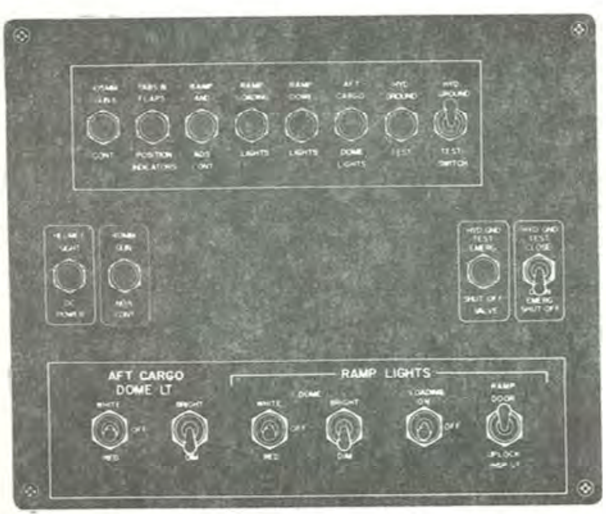
NOSE WHEEL WELL
LIGHT SWITCH



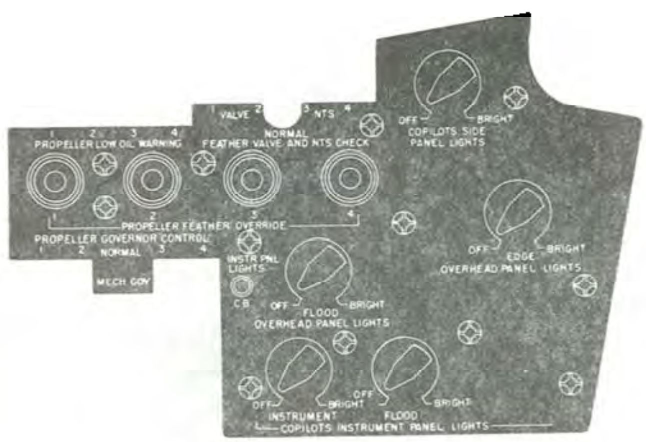
COPILOT'S SWITCH PANEL

NOTE

THE NOSE WHEEL WELL LIGHT IS CONTROLLED BY EITHER OF TWO SWITCHES, ONE LOCATED ON THE LEFT SIDE OF THE NOSE WHEEL WELL AND THE OTHER BELOW THE FLIGHT DECK NEAR THE NOSE GEAR INSPECTION WINDOW.



AFT FUSELAGE JUNCTION BOX

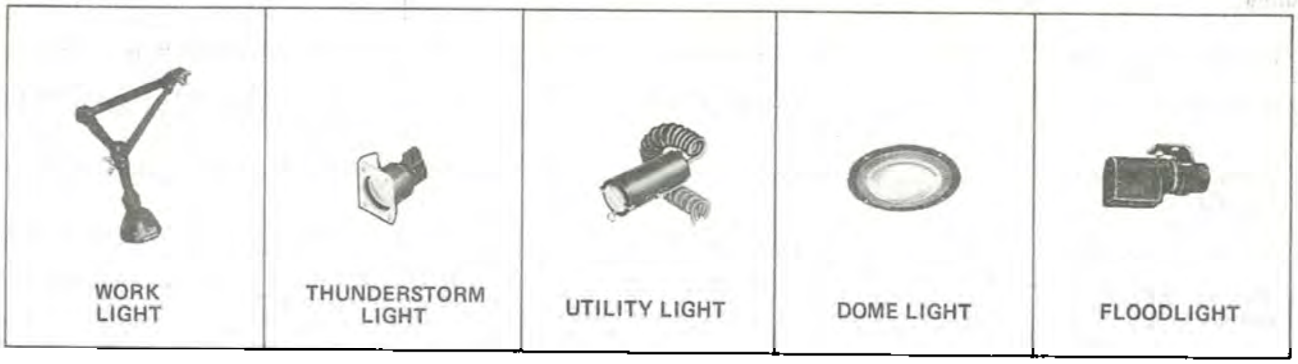


COPILOT'S SIDE SHELF PANEL

Figure 4-23 (Sheet 2 of 2).

interior lighting

FLIGHT DECK



LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
pilot		
Instrument Lighting	Pilot's Side Shelf	Pilot's Side Shelf and Fuse ON Main AC Distribution Panel
Engine Instrument Lighting	Pilot's Side Shelf	Pilot's Side Shelf and Fuse On Main AC Distribution Panel
Center Stand and Pilot's Side Shelf Lighting	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Flight Deck White Dome Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Pilot's Utility Light on side of overhead panel	On Light	Copilot's Lower Circuit Breaker Panel
SLADS Panel Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Instrument Flood Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
	(Thunderstorm Lights Switch turns on these lights)	
Two White Thunderstorm Lights on sides of overhead panel	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Four White Dome Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Instrument Flood Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
	(Dome Lights Switch turns on these lights)	
Four White Dome Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Two White Thunderstorm Lights	Pilot's Side Shelf	Copilot's Lower Circuit Breaker Panel

Figure 4-24 (Sheet 1 of 4).

interior lighting

LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
copilot		
Instrument Flood Lights	Copilot's Side Shelf	Pilot's Side Circuit Breaker Panel
Instrument Lighting	Copilot's Side Shelf	Copilot's Side Shelf and Fuse on Main A-C Distribution Panel
Instrument Panel White Floodlighting	Copilot's Side Shelf	Pilot's Side Circuit Breaker Panel
Overhead Panel Edge Lighting	Copilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Overhead Panel White Floodlighting	Copilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Copilot's Side Shelf Lighting	Copilot's Side Shelf	Copilot's Lower Circuit Breaker Panel
Copilot's Utility Light on side of overhead panel	On Light	Copilot's Lower Circuit Breaker Panel
navigator		
Navigator's Work Light	Navigator's Console	Copilot's Lower Circuit Breaker Panel
Navigator's 5 Volt Lighting	Navigator's Console	Copilot's Upper Circuit Breaker Panel
Navigator's Instrument and Control Panel Lighting	Navigator's Console	Copilot's Lower Circuit Breaker Panel
Navigator's Panel White Floodlighting	Navigator's Console	Copilot's Lower Circuit Breaker Panel
Sextant Lights	On Sextant	Copilot's Lower Circuit Breaker Panel
engineer		
Engineers Utility Light	On Light	Copilot's Lower Circuit Breaker Panel
fire control officer		
FCO Console Lighting	FCO Overhead Panel	Copilot's Upper Circuit Breaker Panel
FCO Work Light	FCO Overhead Panel	Copilot's Lower Cirucit Breaker Panel
FCO 5 VOLT Lighting	FCO Overhead Panel	Copilot's Upper Circuit Breaker Panel
miscellaneous		
Pilot's Circuit Breaker Panels Edge Lighting	On Panel	Copilot's Lower Circuit Breaker Panel
Copilot's Circuit Breaker Panels Edge Lighting	On Panel	Copilot's Lower Circuit Breaker Panel
Nose Wheel Well Inspection Light	Left Side of Nose Wheel Well and Below Flight Deck Near Nose Gear Inspection Window	Copilot's Lower Circuit Breaker Panel
Pilot's Circuit Breaker Panel Cabinet Lights	On Panel	Copilot's Lower Circuit Breaker Panel

Figure 4-24 (Sheet 2 of 4).

interior lighting

CARGO COMPARTMENT

FLOOR LIGHT

DOME LIGHT

RAMP LOADING LIGHT

DOME LIGHT UNDER FLIGHT STATION FLOOR

CARGO AREA UTILITY LIGHT

JUMP PLATFORM LIGHT

LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
Loader's Weapons Control Panel Lights	On LWCP	Aft Fuselage Junction Box
40MM And 105MM Gun Position Indicator Lights	On LWCP	Aft Fuselage Junction Box
Forward Dome Lights (White or Red)	Forward Cargo Compartment (Above No. 1 20MM Gun)	Copilot's Lower Circuit Breaker Panel
Center Dome Lights (White or Red)	Forward Cargo Compartment (Above No. 1 20MM Gun)	Copilot's Lower Circuit Breaker Panel
Aft Dome Lights (White or Red)	Aft Fuselage Junction Box	Copilot's Lower Circuit Breaker Panel
Ramp Dome Lights (White or Red)	Aft Fuselage Junction Box	Aft Fuselage Junction Box
Two Ramp Loading Lights	Aft Fuselage Junction Box	Aft Fuselage Junction Box
Cargo Area Panel Lights	Aft Side Station 245	Copilot's Lower Circuit Breaker Panel
Cargo Area Utility Lights	On Light	Copilot's Lower Circuit Breaker Panel
Ramp Door Uplock Light	Forward Cargo Compartment (Above No. 1 20MM Gun and Aft Fuselage Junction Box)	Aft Fuselage Junction Box
Dome Light Under Flight Station Floor	Switch Adjacent to Light	Copilot's Lower Circuit Breaker Panel
Crew Entrance Door Red or White Light	Panel Under Galley	Copilot's Lower Circuit Breaker Panel

Figure 4-24 (Sheet 3 of 4).

interior lighting

CARGO COMPARTMENT BOOTH


WORK LIGHT


UTILITY LIGHT


CEILING LIGHT


CONSOLE LIGHT

LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
t. v. operator		
Console Lights	T.V. Control Panel	T.V. Console Circuit Breaker Panel
Work Light	T.V. Control Panel	T.V. Console Circuit Breaker Panel
Panel Lights	T.V. Control Panel	T.V. Console Circuit Breaker Panel
ir/ewo console		
Console Lighting	IR/EWO Control Panels	Two-Man Console Circuit Breaker Panel
Panel Lighting	IR/EWO Control Panels	Two-Man Console Circuit Breaker Panel
5 Volt Lighting	IR Control Panel	Two-Man Console Circuit Breaker Panel
Utility Lights	On Light	Two-Man Console Circuit Breaker Panel
miscellaneous		
Booth Ceiling Lights Red or White	Two-Man Console and Aft Wall of Booth by Door	Two-Man Console Circuit Breaker Panel
Recorder Work Light	Above Recorder	T.V. Console Circuit Breaker Panel
Aerial Refuel Panel Lighting (Airplanes Modified by T.O. 1C-130-949)	Edge Overhead Panel Lights Control (Copilot's Side Shelf)	Copilot's Lower Circuit Breaker Panel (OVERHEAD PRIMARY CB)
Aerial Refuel Panel Flood Lights (Airplanes Modified by T.O. 1C-130-949)	Overhead Panel Lights Flood Control (Copilot's Side Shelf)	Copilot's Lower Circuit Breaker Panel (OVERHEAD SECONDARY CB)

Figure 4-24 (Sheet 4 of 4).

the aerial refuel panel. (See figure 4-149.) Rotation of the control on the aerial refuel panel toward BRT turns the lights on and increases the brilliance of illumination. In addition, the leading edge lamps have been replaced with lamps that provide a wider angle of illumination.

Signal Lamp.

A portable signal lamp and a case containing four colored lenses (red, amber, blue and green) are stowed at the navigator's station. An extension cord permits the lamp to be plugged into receptacles on either the pilot's or copilot's side shelves. The lamp is illuminated by depressing a trigger switch. Power is supplied from the main dc bus through pilot and copilot signal outlets circuit breakers on the copilot's lower circuit breaker panel.

Aerial Refueling Fuselage Lights.

Two aerial refueling fuselage lights have been installed on airplanes modified by T.O. 1C-130-949 on top of the fuselage approximately 14 inches to the right and left of centerline at FS 394 as shown in figure 4-22. The lights illuminate the top of the wings, nacelles, and upper propeller area. The lights are controlled by the fuselage lights switch on the aerial refuel panel (Figure 4-149). The two lights operate on 28 volts dc from the main dc bus through a circuit breaker labeled REFUEL LIGHTS FUS located on the copilot's lower circuit breaker panel.

Slipway Lights.

The slipway lights on airplanes modified by T.O. 1C-130-949 are integral components of the UARRSI unit (figure 4-148) and are controlled by the slipway light switch on the aerial refuel panel (figure 4-149). The lights operate on 28 volt dc power from the essential dc bus through a refueling slipway lights circuit breaker on the copilot's side circuit breaker panel.

Aerial Refueling Area Lights.

Four aerial refueling area lights have been installed on airplanes modified by T.O. 1C-130-949 to illuminate the UARRSI area, as shown in figure 4-21. The lights are controlled by the area light switch on the aerial refuel panel (figure 4-22). The four lights operate on power from the main dc bus through a circuit breaker labeled REFUELING LIGHTS AREA located on the copilot's lower circuit breaker panel.

INTERIOR LIGHTING.

Interior lighting consists of flight station and cargo compartment lighting. The various types of lighting, locations of light controls, and locations of circuit breakers for the light circuits are listed in figure 4-24). Locations of lighting control panels are shown in figure 4-23. The pilot's and copilot's instrument lights and the engine instrument lights are ac powered from the essential ac bus and protected by fuses on the ac distribution panel aft of the upper bunk and by circuit breakers located adjacent to the respective switches.

The copilot's secondary lights are powered by the isolated dc bus through a circuit breaker on the pilot's side circuit breaker panel. The pilot's and engine secondary instrument lights are powered by the essential dc bus through a circuit breaker on the copilot's lower circuit breaker panel. All other interior lighting is dc powered from the main dc bus and protected by circuit breakers on the copilot's lower circuit breaker panel.

Thunderstorm Lights.

Thunderstorm lighting is provided by four white dome lights, two white thunderstorm flood lights, and main instrument panel white floodlights. These lights are controlled by a two-position (ON, OFF) thunderstorm lights switch on the pilot's side shelf. Also, when the thunderstorm lights switch is placed in the ON position, the circuits to the instrument lights dimming relays are opened, thereby preventing the instrument and warnings lights from being dimmed.

Nose Wheel Well Light.

A nose wheel well light aids in visual inspection of the nose landing gear while on the ground or while in flight. The light may be controlled from within the wheel well or from within the airplane by either one of two, two-position (ON, OFF), toggle switches (figure 4-23). The switch inside the airplane is guarded to the OFF position, and is mounted adjacent to the nose landing gear inspection window on the aft bulkhead of the nose wheel well. The switch inside the wheel well is not guarded, and is mounted on the left side of the wheel well. The light receives 28-volt dc from the main dc bus through a nose wheel well light circuit breaker on the copilot's lower circuit breaker panel.

OXYGEN SYSTEM.

The airplane is equipped with a 300 psi liquid oxygen system (figure 4-25) capable of maintaining oxygen supply for a minimum of 96 manhours. The system uses diluter-demand automatic pressure-breathing regulators and operates at a pressure of 295 to 430 psi in a static system under a no-flow condition. Under a continuous breathing condition the pressure should read 295 to 315 psi. Manual selection enables the system to provide oxygen diluted in varying proportions corresponding to changes in cabin altitude or, for emergency use, 100 percent oxygen.

Oxygen is supplied from a 25-liter liquid oxygen converter in the right-hand side of the nose wheel well which is filled through an externally accessible valve. The oxygen supply is fed from the converter through two heat-exchanger units to twenty-three diluter-demand automatic pressure-breathing regulators and eight portable oxygen units. Seven regulators are are installed in the flight deck, eleven in the cargo compartment and five in the booth. Three oxygen shutoff valves are provided in event of oxygen line rupture. One is installed at the FS 245 bulkhead, one forward of the operator's compartment and one aft of the right wheel well bulkhead.

oxygen system

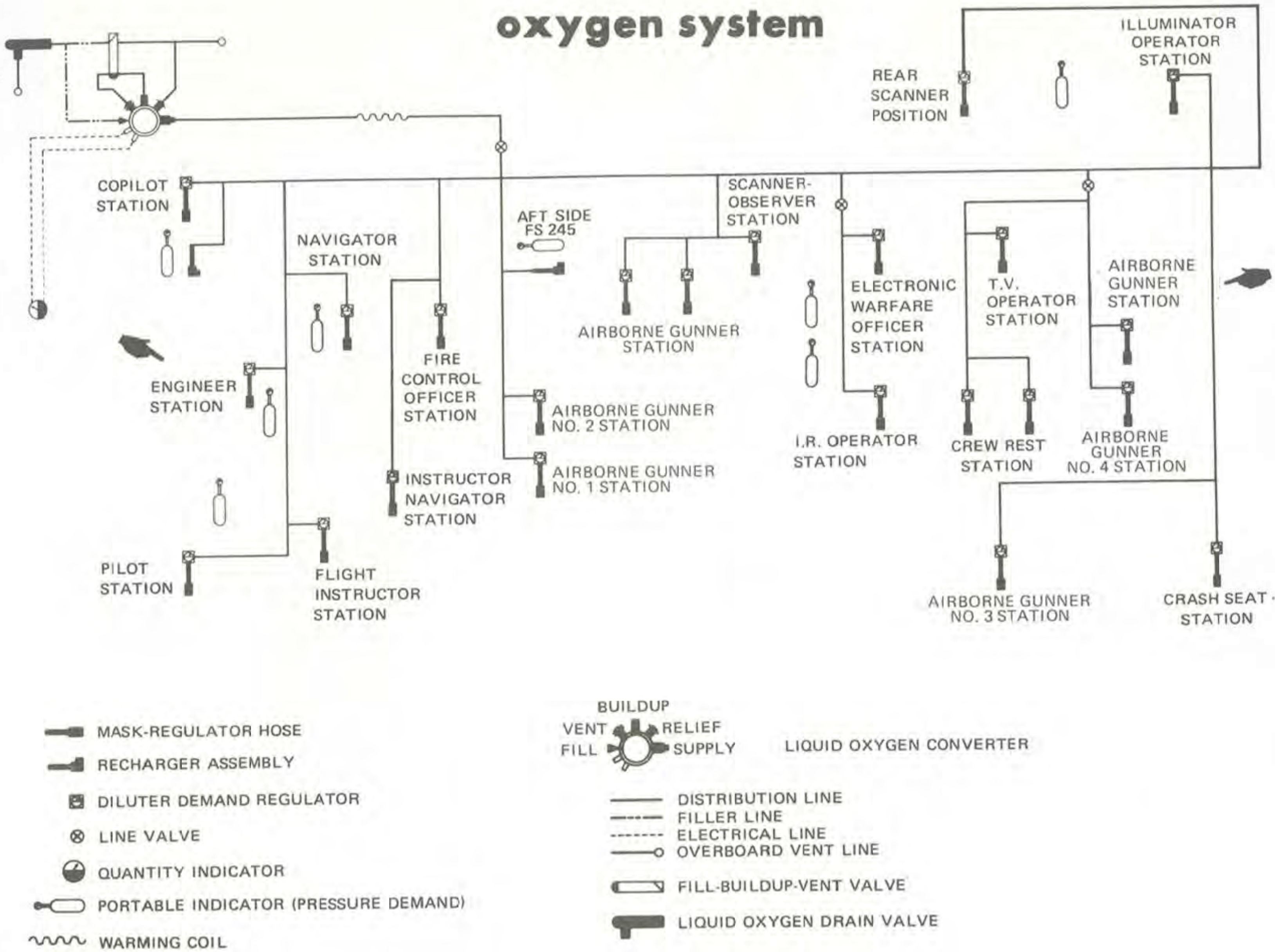


Figure 4-25.

oxygen regulator

Figure 4-26.

Note

> When 100 percent oxygen is being supplied, less oxygen is consumed per person as altitude increases; therefore, the oxygen duration increases with an increase in cabin altitude (figure 4-27).

OXYGEN SYSTEM COMPONENTS.

The components of the oxygen system comprise the twenty-three diluter-demand automatic pressure-breathing regulators, the 25-liter liquid oxygen converter connected to a filler box containing a combination filler-buildup-vent valve, two heat-exchanger units, a totalizing quantity indicator, and eight portable units. A low-level oxygen warning light and a press-to-test switch for the quantity indicator are provided at the copilot's station.

OXYGEN REGULATOR.

A diluter-demand automatic pressure-breathing regulator (figure 4-26) is installed at each crewmember's station. Each regulator incorporates a visual flow indicator, a pressure gage, three toggle-type switches to control regulator operation, and an inlet filter to prevent the entry of foreign particles into the system.

Oxygen Supply Lever.

A manual, two-position supply lever is located at the lower right corner of each regulator. When the lever is set to ON, oxygen is supplied to the regulator unit; when the lever is at OFF, the oxygen supply to the regulator is shut off to prevent any waste of oxygen from the regulator unit when not in use.

Diluter Lever.

The two-position diluter lever on each regulator unit may be used to shut off the air port manually and allow the regulator to deliver pure oxygen at all altitudes or to provide automatic mixing of air and oxygen as required to maintain normal body oxygen needs at all altitudes. When set to 100 percent OXYGEN, the regulator supplies pure oxygen without air dilution; with the lever at NORMAL OXYGEN, the normal air/oxygen dilution characteristics of the regulator are maintained. The lever is designed to prevent intermediate settings between 100 percent OXYGEN and NORMAL OXYGEN.

Emergency Toggle Lever.

The emergency toggle lever on each regulator may be set to one of three positions: EMERGENCY, NORMAL, and TEST MASK. With the lever at EMERGENCY, oxygen is supplied to the mask at continuous positive pressure for emergency use. (The EMERGENCY position is used during individual oxygen equipment preflights to check for leaks in connections.) With the lever at NORMAL, oxygen flow is controlled automatically by the regulator. The TEST MASK setting is used when a positive pressure is required at any altitude to test the fit of the mask around the face.

CAUTION

> When positive pressure is required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to ensure no leakage, the continued use of positive pressure under these conditions will result in rapid depletion of the oxygen supply. Except when unscheduled pressure increase is required, the emergency toggle lever should remain in the center (NORMAL) position.

Visual Flow Indicator.

The visual flow indicator on each regulator is a slide-and-window device in which, during normal use of the oxygen mask, the indicator shows oxygen flow by blinking with the breathing cycle of the user. Oxygen flow ceases when the blinker is not visible.

Pressure Gage.

The pressure gage on the regulator is a dial-type instrument indicating system pressure in pounds per square inch.

oxygen duration

ALTITUDE	REGULATOR SETTING	GAGE READING – LITERS (LIQUID)												
		25	24	22	20	18	16	14	12	10	8	6	4	2
		Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins	Hrs Mins
35,000 & ABOVE	100%	9:45	9:21	8:34	7:47	7:00	6:15	5:28	4:40	3:53	3:06	2:21	1:34	:47
	NORMAL	9:45	9:21	8:34	7:47	7:00	6:15	5:28	4:40	3:53	3:06	2:21	1:34	:47
30,000	100%	7:08	6:51	6:17	5:40	5:08	4:34	4:00	3:25	2:51	2:17	1:43	1:08	:34
	NORMAL	7:15	6:58	6:23	5:47	5:12	4:38	4:04	3:30	2:53	2:19	1:45	1:10	:34
25,000	100%	5:30	5:17	4:51	4:23	3:58	3:32	3:08	2:39	2:13	1:47	1:19	:53	:23
	NORMAL	6:49	6:32	6:00	5:28	4:56	4:21	3:49	3:17	2:43	2:11	1:34	1:06	:32
20,000	100%	4:11	4:00	3:41	3:21	3:00	2:41	2:21	2:00	1:41	1:19	1:00	:41	:19
	NORMAL	7:43	7:23	6:47	6:11	5:34	4:56	4:19	3:43	3:04	2:28	1:51	1:15	:36
15,000	100%	3:21	3:13	2:58	2:41	2:26	2:08	1:53	1:36	1:21	1:04	:49	:32	:17
	NORMAL	9:23	9:02	8:17	7:30	6:47	6:02	5:17	4:30	3:45	3:00	2:15	1:30	:45
10,000	100%	2:43	2:36	2:24	2:11	1:58	1:45	2:32	1:16	1:04	:51	:38	:26	:13
	NORMAL	9:23	9:02	8:17	7:30	6:47	6:02	5:17	4:30	3:45	3:00	2:15	1:30	:45
	DURATION OF OXYGEN SUPPLY (HOURS) FOR 14 CREW MEMBERS (NORMAL)													

Figure 4-27.

Liquid Oxygen Converter.

The 25-liter liquid oxygen converter, enclosed within a removable fiberglas cover is mounted in the right side of the nose wheel well. It is filled through a combination filler-buildup-vent valve contained in a filler box adjacent to the converter but accessible through a door on the right side of the nose fuselage. The converter is also connected to a drain valve in the lower side of the nose wheel well skin. The function of the combination filler-buildup-vent valve is automatic, and charging of the oxygen system is accomplished automatically on completion of the filling operation.

Heat Exchange Units.

Two heat-exchanger units, interposed in the system below the flight deck floor, ensure the delivery of oxygen within the required temperature range to all regulators. The oxygen is warmed by passing through the heat exchangers and not by any form of controllable system heating.

Liquid Oxygen Quantity Indicator.

A capacitance-type quantity indicator, which permits monitoring of the total airplane supply of liquid oxygen available in the converter, is installed at the lower right side of the copilot's instrument panel (figure 1-63). A press-to-test switch adjacent to the quantity indicator allows functional checking of the indicator. The indicator is powered by the ac instrument and engine fuel control bus through a circuit breaker on the pilot's lower circuit breaker and fuse panel.

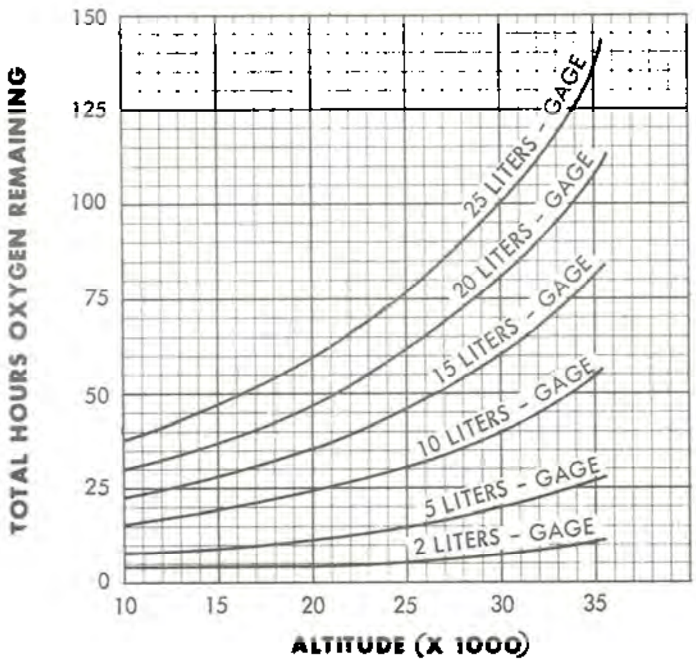
Low Level Warning Light.

A warning light, which illuminates to indicate that the supply of liquid oxygen remaining within the converter has reached a low level of approximately 2.5 liters, is mounted on the copilot's instrument panel adjacent to the oxygen system quantity indicator. The warning light is powered by the essential dc bus through the liquid oxygen low level circuit breaker on the copilot's lower circuit breaker panel.

Portable Units.

The eight type MA-1 portable oxygen units provide the crew members mobility during high altitude operations and emergencies. Each unit consists of a type A-6 cylinder and type A-21 pressure demand regulator (or a type A-15 demand regulator). Four of the units are located on the flight deck; one behind the pilot's seat, one behind the copilot's seat, one behind the engineer's seat and one behind the navigator's seat. The remaining four units are located in the cargo compartment; one on the aft side of cargo compartment (FS 245 bulkhead), one aft of the 40MM/105MM ammunition rack - forward of the right paratroop door, and two in the booth. The total availability of oxygen for 14 crewmembers is shown in figure 4-27.

100 % oxygen supply duration

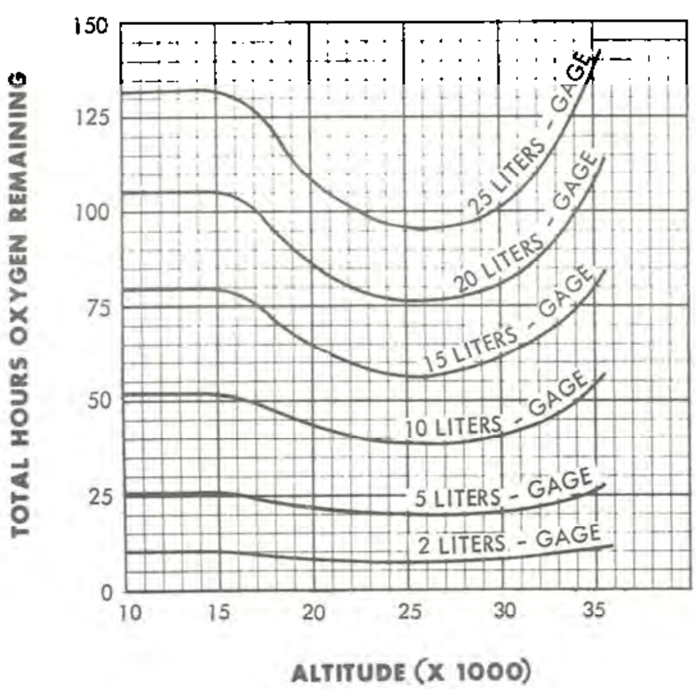


NOTE

CURVES ARE FOR TOTAL HOURS OXYGEN SUPPLY PER GAGE READING. FOR ACTUAL OPERATIONAL HOURS AVAILABLE, DIVIDE TOTAL HOURS BY NUMBER OF CREW MEMBERS.

Figure 4-28.

normal oxygen supply duration



NOTE

CURVES ARE FOR TOTAL HOURS OXYGEN SUPPLY PER GAGE READING. FOR ACTUAL OPERATIONAL HOURS AVAILABLE, DIVIDE TOTAL HOURS BY NUMBER OF CREW MEMBERS.

Figure 4-29.

MA-1 portable oxyqen system duration schedule

USING MBU/5P, MBU/12P, SMOKE MASK AND C.B. MASK, A-21 REGULATOR AND MS21227-1 CYLINDER (300 PSIG INITIAL, 50 PSIG FINAL, DISCHARGE PRESSURES)

REGULATOR SETTING	CABIN ALTITUDE	PHYSICAL ACTIVITY LEVEL	
		MODERATE	PASSIVE
NORMAL	SEAL LEVEL	3.8 Minutes	9.6 Minutes
	8,000 ft.	4.3 Minutes	10.7 Minutes
	18,000 ft.	7.1 Minutes	17.5 Minutes
	25,000 ft.	9.7 Minutes	17.5 Minutes
30 M	32,000 ft.	13.0 Minutes (2)	30.0 Minutes (2)
	40,000 ft.	17.0 Minutes (2)	30.0 Minutes (1) (2)
EMER (3)	45,000 ft.	20.0 Minutes (2)	20.0 Minutes (1) (2)

(1) PHYSICAL STRESS LIMITS FOR INDIVIDUALS UNACCUSTOMED TO ALTITUDE VARIATIONS.

(2) THESE DURATION TIMES DO NOT PROVIDE FOR LEAKAGE AROUND THE MASK FACE SEAL.

(3) OPERATION OF REGULATOR IN THIS SETTING WITH SMOKE MASK NSN 1660-00-330-3900 WILL CAUSE RAPID (LESS THAN 1 MINUTE) DEPLETION OF OXYGEN SYSTEM.

Figure 4-30.

Adjacent to the stowage locations at the copilot's position and on the aft side of FS 245 is a charging outlet fed from the main oxygen supply system. Recharging of the portable units is accomplished at the normal system pressure of 300 psi through a filler valve and flexible hose stowed in a clip at the recharging point.

OXYGEN SYSTEM OPERATION

For normal operation of the system, the oxygen supply lever is placed in the ON position, and the diluter lever set at the NORMAL OXYGEN position. If any symptoms of anoxia are felt, or if doubt exists that the diluter mixture is sufficient, place the diluter lever in the 100 percent OXYGEN position. Use the 100 percent OXYGEN position when prolonged exposure to smoke or fumes is experienced. The emergency toggle lever is used for short emergency periods of time or to pressure-check oxygen mask operation and fit.

Oxygen Check.

Note

Each crewmember shall check the oxygen regulator with mask on and connected to the oxygen supply hose as follows:

a. Supply toggle lever - ON

b. Diluter toggle lever - 100%

c. Emergency toggle lever - EMERGENCY

d. Breathe normally for a minimum of three cycles. The blinker should show black and white alternately.

e. Hold breath momentarily. (Blinker should remain black.) Return emergency toggle lever to NORMAL. (Blinker should remain black.)

f. Breathe normally for a minimum of three cycles as in step d above. Leave regulator in following positions:

(1) Emergency toggle lever - NORMAL

(2) Diluter toggle lever - 100%

(3) Supply toggle lever - ON

(4) Oxygen mask - Connected

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

The communication and associated electronic equipment (figure 4-31) consists of radio and intercommunication equipment to provide airplane-to-airplane communication, airplane-to-ground communication, and intraplane communication; navigation sets for guidance; and radar sets for identification and warning. For equipment rack locations, see figure 4-32. For antenna locations, see figure 4-33.

Note

No transmission will be made on emergency (distress) frequency channels except for emergency purposes. For test, demonstration, or drill purposes, the radio equipment will be operated in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.

INTERCOMMUNICATION SYSTEM (AN/AIC-18A).

The intercommunication system permits voice communication between crewmembers at stations throughout the aircraft. In addition, communications with the ground crew is provided through an auxiliary interphone connection located inside the crew entrance door forward of the TV/laser platform. Audio signals from all radio receivers and transmitters can be monitored at the pilot's, co-pilot's, flight instructor's, navigator's and fire control officer's station. The remaining stations have the capability of monitoring transmission and reception on UHF 1, UHF 2, VHF, and FM 1 only. Transmission through the radio transmitters, however, can be accomplished only at the pilot's, co-pilot's, navigator's, and fire control officer's intercommunication stations. Reception and transmission over the channels available at a particular station are made possible by headset microphone at each intercommunication station. A three - position microphone/interphone switch on both the pilot's and co-pilot's control wheels permits transmissions from these stations. A press-to-talkbutton on the connector cords at all other stations can be used to talk from these stations. A foot switch at the engineer's navigator's, fire control officer's, EWO's, TV's, and IR's station can be used as an alternate switch-in to talk from these stations. Four independent systems are provided for intercommunication between the various flight stations. They are MAIN INTERPHONE, HOT MIC, PRIVATE 1, and PRIVATE 2. Transmission - and reception capability on these systems are provided at each flight station with the exception, the pilot's and co-pilot's stations do not have the capability of transmission on PRIVATE 1. The intercommunication systems operates from 28-volt dc power supplied from the isolated bus through the interphone circuit breakers on the pilot's upper circuit breaker panel.

On airplanes modified by T.O. 1C-130-949 the AN/AIC-18A system has been expanded to provide interphone voice communication between the C-130 and certain modified KC-135 tankers when the tanker boom is inserted in the UARRSI receptacle. A signal amplifier and induction coil in the UARRSI unit and a similar coil in the boom and signal amplifier in the tanker provide for through-the-boom talk. In order to talk through-the-boom, the amplifier switch on the aerial refuel panel must be set to NORM or OVRD. Communications may then be established by the pilots by selecting INT on their yoke switches and the engineer by selecting INT on his interphone panel and depressing his interphone button.

Intercommunication System Control Panels.

Intercommunication control panels (figure 4-34) are installed at each flight station. Each station control panel is equipped with monitoring or mixer switches, enabling the various communications systems and audio navigational systems to be connected to the intercommunication system. The switches are of push-pull type (pulled for ON, pushed for OFF). They may be turned to regulate volume at the individual intercommunication station. The intercommunication control panels at the pilot's, co-pilot's, flight instructor's, navigator's, and fire control officer's stations are equipped with eight push-pull type monitor switches which provide interconnection with the following communication systems.

INPH	- Main Interphone System
UHF	- UHF Commnad Radio (AN/ARC-34), No 1
HF-1	- Liaison Radio (Collins HF-102) No. 1
PVT2	- Private Interphone No. 2
LISTEN	- Hot Mike System
UHF-2	- UHF Command Radio (AN/ARC 133), No. 2
HF-2	- Liaison Radio (Collins HF-102), No. 2
VHF	- VHF Command Radio (Collins VHF-101)

The intercommunication system control panels at all other flight stations are equipped with eight push-pull type monitor switches which provide interconnection with the following communication system:

INPH	- Main Interphone System
VHF	- VHF Command Radio (Collins VHF-101)
FMI	- VHF/FM Radio (FM-622/A) No. 1
PVT 1	- Private Interphone No. 1
LISTEN	- Hot Mike System
UHF 1	- Command Radio (AN/ARC-34) No. 1
UHF 2	- UHF Command Radio (AN/ARC-133) No. 2

An additional monitor panel is installed at the pilot's, copilot's, flight instructor's, navigator's, and fire control officer's station equipped with eight push-pull monitor switches which serve to provide interconnection with the following communication and audio navigational systems:

PVT 1	- Private Interphone No. 1
BCN	- Marker Beacon Receiver (Collins 51Z-4)
FM 1	- VHF/FM Radio (FM-622/A) No. 1
TACAN 1	- TACAN (AN/ARN-21) No. 1
VOR	- Localizer and VOR Reciver (AN/ARN-14)
ADF	- Radio Compass (AN/ARN-6)
FM	- VHF/FM Radio (FM-622/A) No. 2
TACAN 2	- TACAN (AN/ARN-21) No. 2

An additional push-pull switch is provided on all intercommunication control panels (HOT MIC TALK) for transmission on the hot mike system. This panel also carries a master volume control, a call button, and a rotary transmission selector switch.

TRANSMISSION SELECTOR SWITCH.

The transmission selector switch on each of the intercommunication control panels may be set to enable transmission from that station on the selected communication system. The switch on the pilot's and co-pilot's control panel may be set to any one of seven positions marked; INPH, U1, U2, HI/FI, H2/F2, P2 and V. The switch on the navigator's and fire control officer's panel may be set to any one of seven positions marked; U1, U2, HI/FI, H2/F2, P1/P2, and V. All other flight station control panels are equipped with a three position selector switch and may be set to; INPH, PVT 1, or PVT 2.

HOT MIC SWITCHES.

The hot mike (HOT MIC) mode of operation permits direct transmission to all other intercommunication stations on the aircraft without operating the individual microphone switches. To connect the intercommunication control panel at any flight station to the hot mike mode of operation, pull the HOT MIC TALK switch, to talk on the hot mike system and pull the HOT MIC LISTEN switch, to monitor the hot mike system. Only stations with LISTEN switch pulled will receive transmission on the hot mike system. When the hot mike system is not being used, the HOT MIC switches should be pushed in.

ISOLATED HOT MIC SYSTEM.

Incorporated with the HOT MIC system is an ISOLATED HOT MIC system enabling the engineer, NAV-FCO, and cargo compartment positions to be isolated from the normal HOT MIC system. (The EWO position can be further isolated from the rest of the system with a toggle switch located at the EWO position). This permits instructor-student communication to occur without interfering with normal crew communications. The system is controlled by three guarded toggle switches located on the the FCO panel.

CALL BUTTON.

A call button is located at the lower right-hand corner of each intercommunication control panel, and in addition a press-to-talk call switch is located on the cord connectors at the right scanner's station and the illuminator operator's station. When the button is pressed all radio receivers are isolated from the intercommunication system, and all intercommunication stations are put into direct contact with the calling station.

table of communications, navigation, fire control, sensor and associated electronic equipment

TYPE	DESIGNATION	FUNCTION
INTERCOMMUNICATION EQUIPMENT	AN/AIC-18A	CREW INTERCOMMUNICATION
LIAISON RADIO (2)	COLLINS HF-102	AIRBORNE VOICE COMMUNICATION IN THE 2 TO 30 MEGAHERTZ RANGE
VHF/FM TRANCEIVER (2)	FM-622/A	TWO-WAY VOICE COMMUNICATIONS IN RANGE OF 30.00 TO 75.95 MHz. (FM1 HAS HOMING PROVISIONS; FM2 HAS SECURE VOICE CAPABILITY)
VHF COMMAND RADIO	COLLINS VHF-101	TWO-WAY VOICE COMMUNICATION IN THE RANGE OF 116.00 TO 149.95 MC
UHF1 COMMAND RADIO	AN/ARC-34	VOICE TRANSMISSION AND RECEPTION IN RANGE OF 225 TO 399.9 MC
UHF2 COMMUNICATION SYSTEM See 15-59	AN/ARC-133	PLAIN AND SECURE VOICE COMMUNICATION IN THE RANGE OF 225.00 TO 399.95 MHz
DIRECTION FINDER	AN/ARA-50	HOMING ON UHF TRANSMITTER
SECURE SPEECH SYSTEM	KY-28	PROVIDES SECURE VOICE COMMUNICATION ON UHF2 OR FM2
PERSONNEL LOCATOR BEACON (4)	AN/URC-10	EMERGENCY SEA RESCUE
TACAN	AN/ARN-21	RECEIVES BEARING AND DISTANCE INFORMATION
VOR RECEIVER	AN/ARN-14	RECEPTION OF ALL VHF/VOR, TONE LOCALIZER AND VOICE FACILITIES IN THE 108 TO 136 MC RANGE

NOTE

NUMBERS IN PARENTHESIS INDICATE THE NUMBER OF SETS INSTALLED.

Figure 4-31 (Sheet 1 of 8).

POWER SOURCE	RANGE	LOCATION OF CONTROLS
ISOLATED DC	STATIONS WITHIN THE AIRPLANE AND EXTERNAL FOR GROUND CREW	FLIGHT CONTROL PEDESTAL, OVERHEAD CONTROL PANEL, NAVIGATOR'S CONTROL PANEL, CARGO COMPARTMENT FORWARD LEFT BULKHEAD, AND AT LEFT-HAND PARATROOP DOOR
LIAISON-1 ESSENTIAL AC; ESSENTIAL DC LIAISON-2 MAIN AC; MAIN DC	100 TO 2500 MILES ON AM AND GREATLY EXTENDED RANGE ON SSB DEPENDING ON OPERATING FREQUENCY, ALTITUDE AND TIME OF DAY.	HF1 FLIGHT CONTROL PEDESTAL HF2 NAVIGATOR'S CONSOLE
MAIN DC; ESSENTIAL DC	LINE-OF-SIGHT	FM1 – NAVIGATOR CONSOLE FM2 – COPILOT CONTROL PANEL
ESSENTIAL AC; ESSENTIAL DC	LINE-OF-SIGHT	FLIGHT CONTROL PEDESTAL
UHF NO. 1 ISOLATED DC	LINE-OF-SIGHT	UHF NO. 1 – FLIGHT CONTROL PEDESTAL
ESSENTIAL DC SSS 15-59	LINE-OF-SIGHT	RIGHT SIDE COPILOT CONTROL PANEL
MAIN DC	LINE-OF-SIGHT	FLIGHT CONTROL PEDESTAL
DC RADIO	- - -	RIGHT OF COPILOT
SELF CONTAINED	LINE-OF-SIGHT	ON TRANSMITTER UNIT
ESSENTIAL AC; ESSENTIAL DC	FROM 75 TO 200 MILES LINE OF SIGHT, DEPENDING ON ALTITUDE	FLIGHT CONTROL PEDESTAL
ESSENTIAL DC	LOCALIZER-45 MILES, OMNI-100 MILES, DEPENDING ON ALTITUDE	FLIGHT CONTROL PEDESTAL

Figure 4-31 (Sheet 2 of 8).

table of communications, navigation, fire control, sensor and associated electronic equipment

TYPE	DESIGNATION	FUNCTION
RADIO COMPASS	AN/ARN-6	FOR HOMING AND BEARING; ALSO RECEIVES VOICE AND CODE SIGNALS
MARKER BEACON RECEIVER	COLLINS 51Z-4	RECEIVES LOCATION MARKER SIGNALS
GLIDE SLOPE RECEIVER	COLLINS 51V-4	RECEIVES GLIDE SLOPE INFORMATION FOR VERTICAL GUIDANCE IN I.L.S. OPERATION
RADAR ALTIMETER	AN/APN-171	INDICATES ABSOLUTE ALTITUDES OF AIRPLANE ABOVE THE TERRAIN
FLIGHT DIRECTOR SYSTEM (2)	STANDARD AIR FORCE	FOR ILS APPROACHES, VOR, VAR, DOPPLER, OR TACAN COURSES, HEADING INFORMATION, PITCH-AND-ROLL ATTITUDE
IFF	AN/APX-72 AIMS	PROVIDES AUTOMATIC RADAR IDENTIFICATION, POSITION, AND ALTITUDE INFORMATION TO INTERROGATING GROUND STATIONS
X-BAND RADAR TRANSPONDER	SST-181XE	PROVIDES AIR-TO-GROUND AND AIR-TO-AIR IDENTIFICATION BEACON IN THE FREQUENCY RANGE OF 9310 TO 9415 MHz
DOPPLER RADAR NAVIGATION SYSTEM	AN/APN-147	PROVIDES CONTINUOUS GROUND SPEED AND DRIFT ANGLE INFORMATION WHILE AIRPLANE IS IN FLIGHT
DOPPLER COMPUTER SYSTEM	AN/ASN-35	DISPLAYS DATA, IN NAUTICAL MILES, ON DISTANCE TO DESTINATION AND CROSS-TRACK DEVIATION
SEARCH RADAR	AN/APN-59B	NAVIGATION AND SEARCH RADAR
RADIO ALTIMETER	AN/APN-133	TO DETERMINE ABSOLUTE ALTITUDE OF AIRPLANE ABOVE THE TERRAIN
COMPASS SYSTEM (2)	C-12	GYRO STABILIZED MAGNETIC HEADING

NOTE

NUMBERS IN PARENTHESIS INDICATE THE NUMBER OF SETS INSTALLED.

Figure 4-31 (Sheet 3 of 8).

POWER SOURCE	RANGE	LOCATION OF CONTROLS
ESSENTIAL DC	20 TO 200 MILES DEPENDING ON POWER CLASS OF GROUND STATION, FREQUENCY AND TIME OF DAY	FLIGHT CONTROL PEDESTAL, NAVIGATOR'S CONTROL PANEL
MAIN DC	ANY ALTITUDE	HI-LO SWITCH ON PILOT'S INSTRUMENT PANEL
ESSENTIAL AC	15 MILES	AUTOMATICALLY CONTROLLED FROM VHF NAV PANEL OR VOR PANEL
ESSENTIAL AC; ESSENTIAL DC	0 TO 5,000 FEET ALTITUDE	PILOT'S INSTRUMENT PANEL
COPILOT'S INVERTER; ESSENTIAL AC; ESSENTIAL DC; MAIN DC	- - -	- - -
ESSENTIAL DC	LINE-OF-SIGHT	FLIGHT CONTROL PEDESTAL
ESSENTIAL DC	LINE-OF-SIGHT (MINIMUM 100 MILES)	NAVIGATOR CONSOLE
ESSENTIAL AC; ESSENTIAL DC	GROUND SPEEDS 90 TO 999 KNOTS; DRIFT ANGLES TO 30 DEGREES ON EITHER SIDE	NAVIGATOR'S CONTROL PANEL
ESSENTIAL AC; ESSENTIAL DC	DISTANCE TO 999 NAUTICAL MILES; CROSS-TRACK TO 99.9 NAUTICAL MILES.	NAVIGATOR'S CONTROL PANEL
MAIN AC; MAIN DC	3 TO 240 MILES	NAVIGATOR'S CONTROL PANEL
MAIN AC	40,000 FEET ALTITUDE	NAVIGATOR'S STATION
ESSENTIAL AC; ESSENTIAL DC		NAVIGATOR CONSOLE

Figure 4-31 (Sheet 4 of 8).

table of communications, navigation, fire control, sensor and associated electronic equipment

TYPE	DESIGNATION	FUNCTION
LORAN	AN/ARN-92	NAVIGATION
FCS POWER SUPPLY		PRIMARY POWER FOR THE FCS
GYROSCOPIC ATTITUDE REFERENCE SYSTEM (3 AXIS GYRO)	A24G-1A	BACKUP HEADING AND ATTITUDE REFERENCE TO THE FCS
INERTIAL MEASUREMENT SYSTEM	AN/ASN-90(V)	PROCESSES NAVIGATIONAL DATA
TACTICAL COMPUTER	AN/ASN-91(V)	NAVIGATION/FIRE CONTROL
FIRE CONTROL DISPLAY AND HEAD-UP DISPLAY	AN/AVQ-21	FIRE CONTROL DATA PRESENTATION
THERMOCHROME TELEPRINTER	TT-521/ARC-96	TAPE PRINTOUT OF FIRE CONTROL DATA
SENSOR ANGLE DISPLAY		SENSOR LOOK ANGLES
SLAVE SWITCHING UNIT		PROVIDES SENSOR AUTOMATIC SLAVING
VIDEO TAPE RECORDER	AN/AXH-2	RECORD LLLTV AND IR IMAGERY AND FCO INTERPHONE AUDIO
LLLTV	AN/AXQ-10	TARGET ACQUISITION
LASER ILLUMINATOR	AN/AAQ-7	LASER ILLUMINATION AND RANGING
LTD/R	AN/AVQ-19	LASER TARGET DESIGNATOR/ RANGER
2 KW LIGHT	AN/AVQ-17	PROVIDES TARGET ILLUMINATION
IR	AN/AAD-7	TARGET ACQUISITION.
BLACK CROW	AN/ASD-5	TARGET ACQUISITION

Figure 4-31 (Sheet 5 of 8).

POWER SOURCE	RANGE	LOCATION OF CONTROLS
LH DC, LH AC; ESSENTIAL AC; 26 VAC REF. POWER	- - -	NAVIGATOR CONSOLE
RH DC	- - -	FCO CONSOLE
LH AC 26 VAC REF. POWER	- - -	NAVIGATOR CONSOLE
MAIN AC OR FC POWER SUPPLY SYSTEM	- - -	NAVIGATOR CONSOLE
ESSENTIAL AC OR FC POWER SUPPLY SYSTEM	- - -	NAVIGATOR CONSOLE
LH AC; MAIN DC	- - -	LEFT SIDE PILOT CONTROL PANEL, FCO CONSOLE
RH AC OR FC POWER SUPPLY SYSTEM	- - -	FCO CONSOLE
MAIN DC	- - -	LEFT SIDE OF PILOT, FCO CONSOLE, IR/BC CONSOLE AND TV CONSOLE
RH AC; MAIN DC	- - -	NAVIGATOR CONSOLE
ESSENTIAL DC; ESSENTIAL AC	- - -	FCO CONSOLE TV CONSOLE
ESSENTIAL DC	- - -	TO OPERATOR CONSOLE
RH DC	- - -	TV OPERATOR CONSOLE
ESSENTIAL AC; RH DC	- - -	TV OPERATOR CONSOLE
ESSENTIAL AC; LH AC; RH AC	- - -	TV CONSOLE
RH AC; MAIN DC	- - -	IR OPERATOR CONSOLE
MAIN AC; MAIN DC	- - -	EWO CONSOLE

Figure 4-31 (Sheet 6 of 8).

table of communications, navigation, fire control, sensor and associated electronic equipment

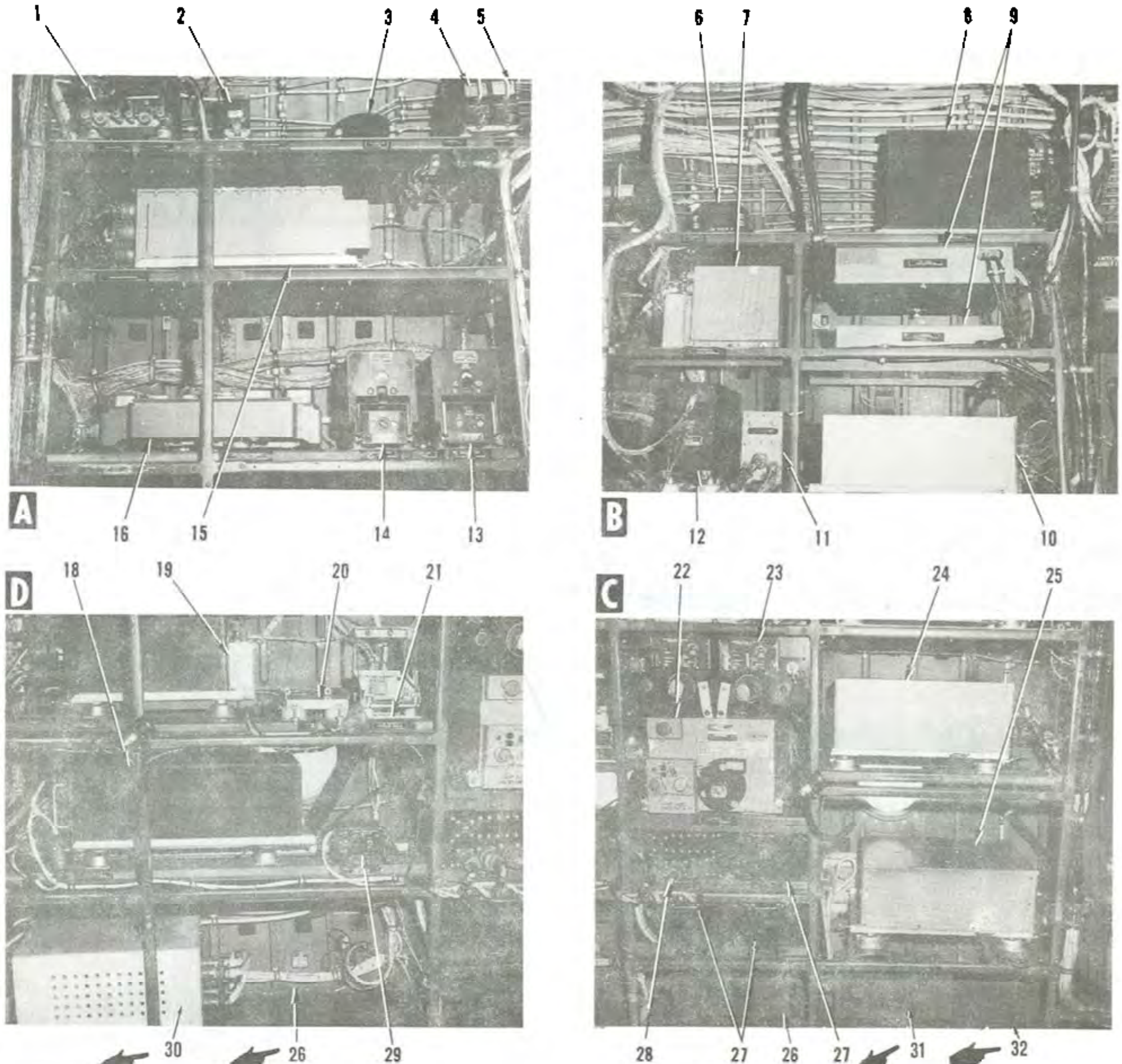
TYPE	DESIGNATION	FUNCTION
BEACON TRACKING RADAR	AN/APQ-150	SEARCH, ACQUISITION AND ANGLE-TRACKING OF GROUND-LOCATED BEACONS.
RADAR WARNING RECEIVER (RWR)	AN/ALR-69	RADAR WARNING INDICATION
TRIM	TRIM-7	ECM
ECM POD	AN/ALQ-87	ECM
STORE DISPENSER POD	SUU-42A/A	FLARE AND COUNTER-MEASURE DISPENSER
INTERNAL DISPENSER	AN/ALE-40(V)	COUNTER MEASURE DISPENSER
FLARE EJECTOR SYSTEM	AN/ALE-20	FLARE EJECTOR
GUN CONTROL AND TGM	- - -	ARM/SAFE GUNS AND TGM ELECTRONICS
MOVING TARGET INDICATOR	- - -	TARGET ACQUISITION
40 KVA LIGHT SET	AN/AVQ-8	VISIBLE AND IR ILLUMI-NATION.
FLARE LAUNCHER	LAU-74/A	PROVIDES TARGET ILLUMI-NATION.

Figure 4-31 (Sheet 7 of 8).

POWER SOURCE	RANGE	LOCATION OF CONTROLS
LH AC; LH DC	2,000 FEET TO 10 NAUTICAL MILES	EWO CONSOLE
LH DC MAIN AC	– – –	EWO CONSOLE, COPILOT PANEL
ESSENTIAL AC, LH DC	– – –	EWO CONSOLE
NO. 1 AC GENERATOR; NO. 4 AC GENERATOR	– – –	EWO CONSOLE
MAIN DC	– – –	CO-PILOT'S CONTROL PANEL, EWO CONSOLE AND TV CONSOLE
MAIN DC	– – –	EWO CONSOLE
MAIN DC	– – –	CO-PILOT STATION, FE STATION, RIGHT SCANNER, I.O. STATION
MAIN DC	– – –	FCO CONSOLE, FE STATION, GUN STATIONS
MAIN AC; MAIN DC	– – –	NAVIGATOR CONSOLE
NO. 1 AC GENERATOR; NO. 4 AC GENERATOR	– – –	NAVIGATOR'S OVERHEAD (REMOTE) AND RAMP
RH DC	– – –	RAMP

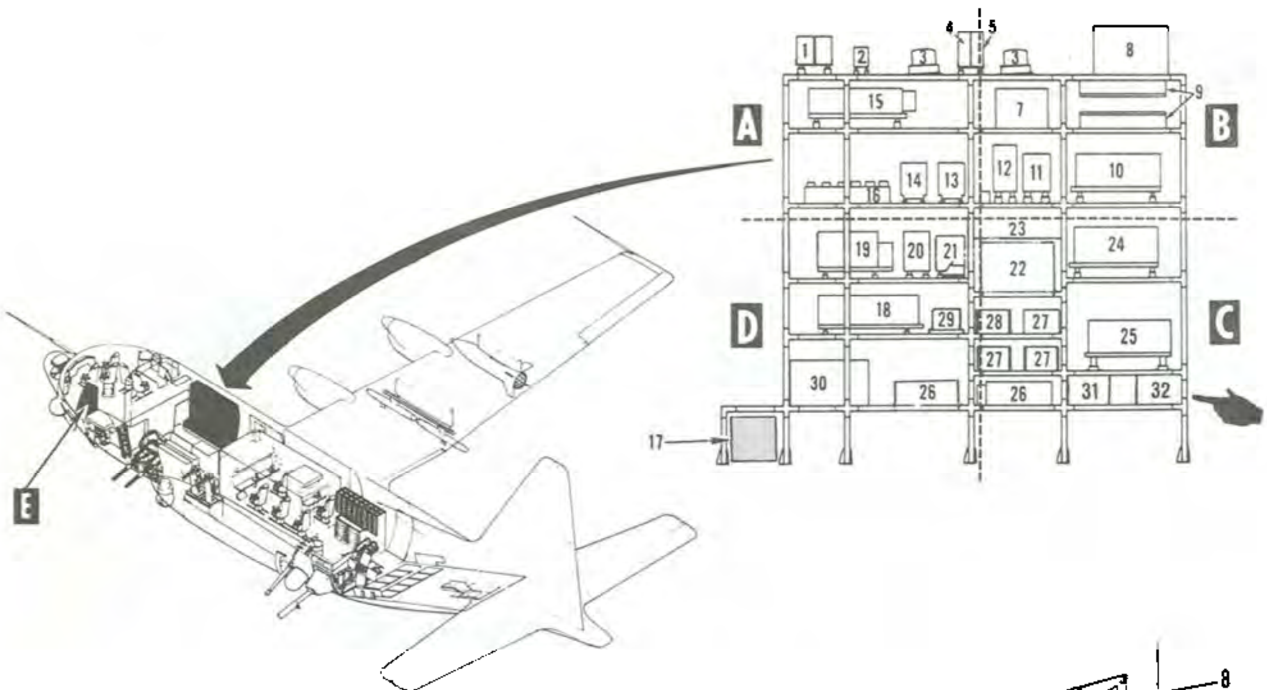
Figure 4-31 (Sheet 8 of 8).

cargo compartment electronics equipment racks



1. VHF 101 RCVR/XMTR
2. 51V-4 GLIDESLOPE RCVR
3. C-12 DIRECTIONAL GYRO NO. 1
4. C-12 AMPLIFIER NO. 1
5. C-12 AMPLIFIER NO. 2
6. C-12 DIRECTIONAL GYRO NO. 2
7. PP-6141/ASN-90(V) ADAPTER POWER SUPPLY (A/PS)
8. SA-1784/AXQ-10 VIDEO SWITCHING UNIT
9. TRIM 7A SWITCHING UNIT (2)
10. TRIM 7A MAIN UNIT (2)
11. AN/ALR-69(V) PROCESSOR
12. MTI SIGNAL DATA CONVERTER (PROCESSOR)
13. FM 622 RCVR/XMTR VHF/FM 1
14. FM 622 RCVR/XMTR VHF/FM 2
15. ANALOG TO DIGITAL CONVERTER (SSIU)
16. NAVIGATIONAL INSTRUMENT RELAY
17. AVIONICS EQUIPMENT RACK BLOWER
18. CP-898/ARN-92 LORAN NAVIGATION COMPUTER
19. R-1503/ARN-92 LORAN RECEIVER
20. KY-28 SECURE SPEECH CODER/DECODER
21. AN/APX-72 IFF TRANSPONDER COMPUTER
22. AN/ASN-91/V TACTICAL COMPUTER
23. OXYGEN REGULATORS & ELECTRONIC TEST EQUIPMENT RECEPTACLES
24. AM-6451/AAD-7 ELECTRONIC CONTROL AMPLIFIER
25. PP-6685/AAD-7 POWER SUPPLY
26. TRANSFORMER RECTIFIER (2)
27. STATIC INVERTER (FCS)
28. FC INVERTER SYNCHRONIZER
29. LORAN COMPUTER POWER PROTECTION UNIT
30. AN/ASD-5 DIRECTION FINDER POWER SUPPLY
31. AN/ALR-69 RECEIVER CONTROLLER
32. AN/ALR-69 COUNTER MEASURE RECEIVER

Figure 4-32 (Sheet 1 of 2).



cargo compartment electronics equipment racks (galley)

1. SIGNAL DATA PROCESSOR
2. SLAVE SWITCHING UNIT (SSU)
3. CLOSEOUT PANEL
4. CLOSEOUT PANEL
5. 26 VAC POWER PANEL
6. BORESIGHT ADJUST PANEL (BOX)
7. MAP RACK
8. CLOSEOUT PANEL

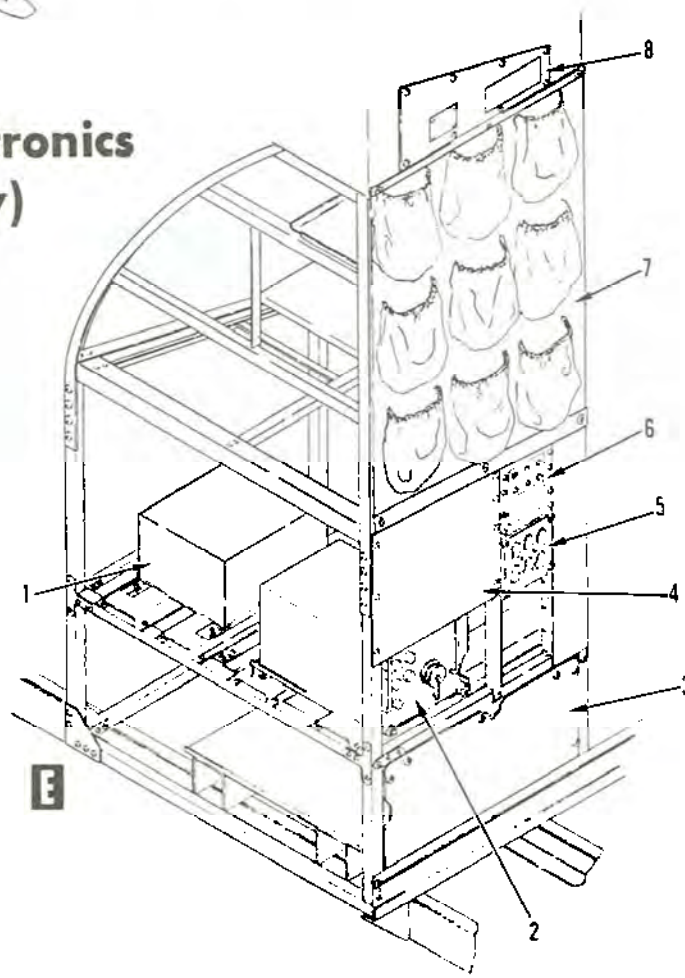
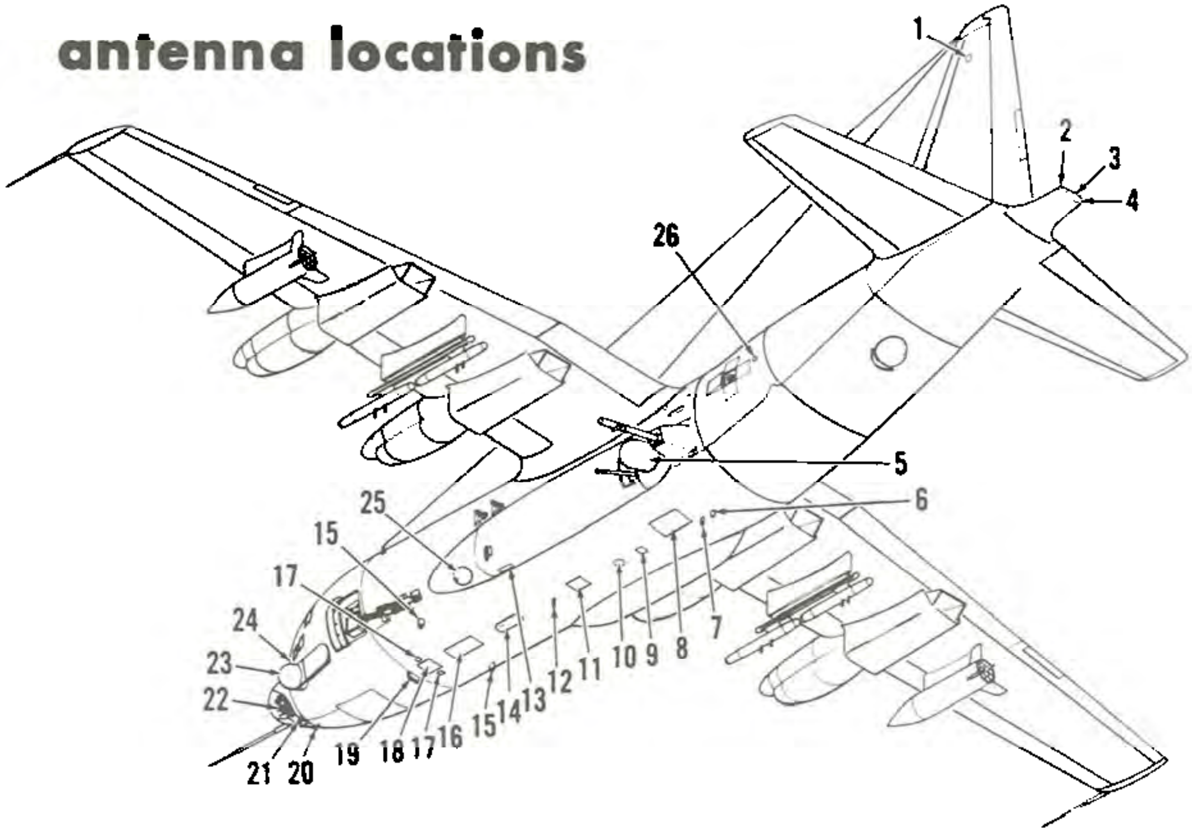


Figure 4-32 (Sheet 2 of 2).

antenna locations



* Airplanes Modified by TO 1C-130-949

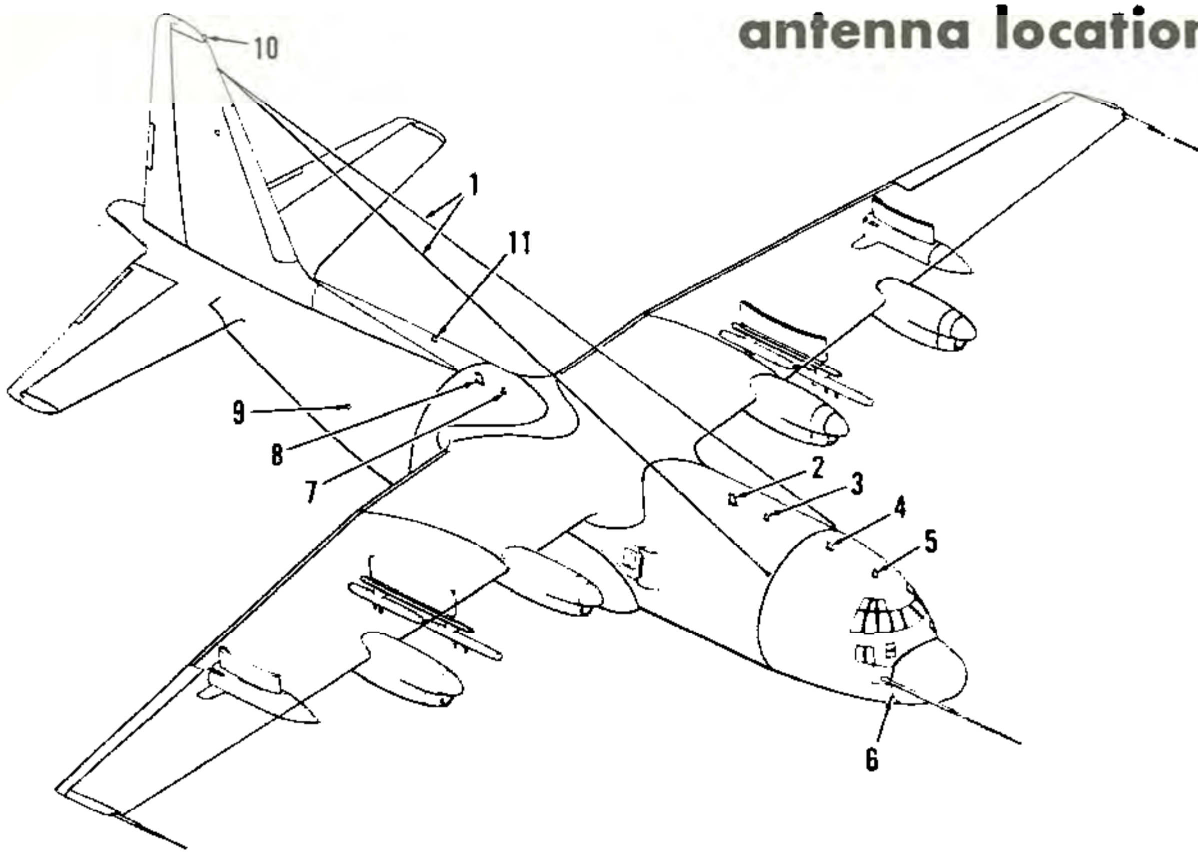
1. VHF NAVIGATION (AN/ARN-14)
2. ECM F.S. 1200 (AN/ALR-69)
3. ECM (TRIM-7A) F.S. 1216.
4. ECM F.S. 1200 (AN/ALR-69)
5. BEACON TRACKING RADAR (AN/APQ-150) F.S. 717.
6. ECM F.S. 700 (AM-6971/AN/ALR-69)
7. IFF (AN/APX-72) F.S. 667.
8. RADIO COMPASS (AN/ARN-6) F.S. 617.

*9. NO. 2. UHF COMM (AN/ARC-133) F.S. 413

10. UHF DIRECTION FINDER (AN/ARA-50) F.S. 547.
11. HIGH RANGE ALTIMETER TRANSMITTER (AN/APN-133)
12. NO. 1 UHF COMM (AN/ARC-34C) F.S. 451.
13. MARKER BEACON (51Z-4) F.S. 461.
14. ECM (TRIM-7A) and AN/ALR-69) F.S. 367
15. TACAN RADIO (AN/ARN-21C) F.S. 370.
16. DOPPLER RADAR (AN/APN-147) F.S. 291.
17. LOW RANGE ALTIMETER (AN/APN-171) F.S. 267
18. HIGH RANGE ALTIMETER RECEIVER (AN/APN-133) F.S. 257.
19. VHF/FM-1 HOMING ANTENNA (FM622A) F.S. 249.
20. ECM (TRIM-7A) F.S. 95.
21. GLIDESLOPE (51V-4) F.S. 88.
22. SEARCH RADAR (AN/APN-59)
23. (AN/ASD-5) F.S. 116.
24. ECM F.S. 95 (AN/ALR-69)
25. IR (AN/AAD-7) F. S. 337
26. ECM (TRIM-7A) F.S. 867.

Figure 4-33 (Sheet 1 of 2).

antenna locations



1. NO. 1 AND NO. 2 LIAISON COMM AND LORAN (AN/ARN-92)
2. VHF/FM 1 (FM-622A) F.S. 360.
3. IFF (AN/APX-72) F.S. 303.
4. NO. 2 UHF COMM (AN/ARC-133) F.S. 208.
*5. VHF COMM (COLLINS VHF-101) F.S. 280.
6. ECM F.S. 95 (AN/ALR-69)
7. NO. 1 UHF COMM (AN/ARC-34C) F.S. 680
8. VHF/FM-2 COMM (FM-622A) F.S. 710.
9. ECM (TRIM-7A) F.S. 867
10. "X" BAND BEACON (SST-181X)
11. ECM F.S. 702 (R-1854/AN/ALR-46) (deactivated)

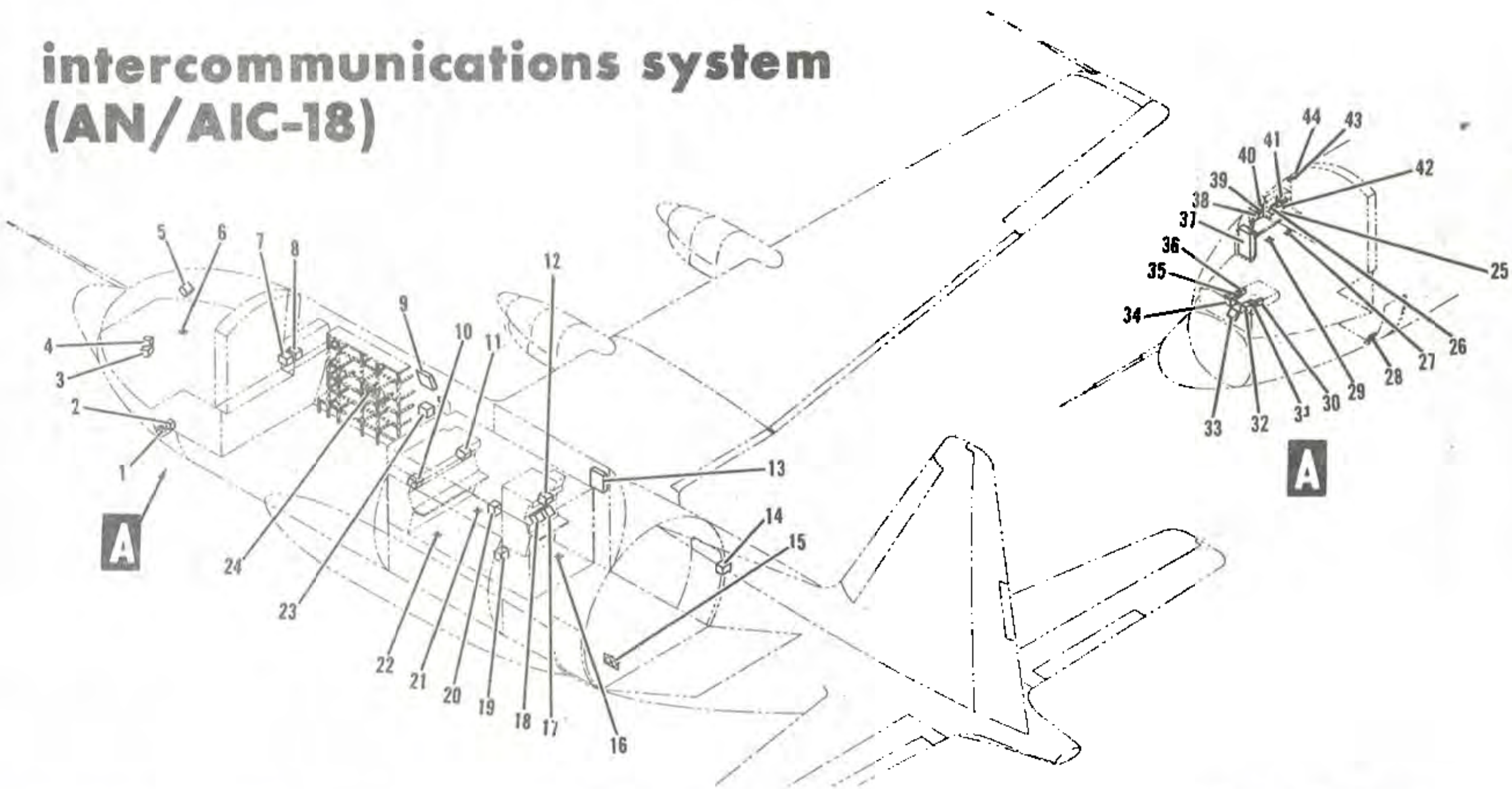
*AIRPLANES MODIFIED BY T.O. 1C-130-949.

Figure 4-33 (Sheet 2 of 2).

Microphone Switches.

Each flight station is equipped with a microphone switch to enable the operator at the station to transmit on the selected communication system. The pilot and co-pilot positions are equipped with a three-position, (INTER, OFF, MIC) switch located on the control wheels and spring loaded to the OFF position. With the switch held at the INTER position, the pilot can transmit through the main intercommunication system or PRIVATE 2 communication system, if P2 system is selected on the transmission selector switch. If the switch is held in the MIC position, the pilot can transmit through the communication transmitter selected on the transmission selector switch and the MIC transfer switch. All other flight station positions are equipped with a press-to-talk button on the connector cords. Pressing the button will enable the operator at that station to transmit on the communication system selected by the transmission selector switch at that station. The MIC transfer switches at the navigator's and fire control officer's stations must also be set to the corresponding transmission selector switch position. An additional foot switch located at the engineer's, navigator's fire control officer's, EWO, IR's,and TV's position works in the same manner as the push-to-talk switch on the connector cord.

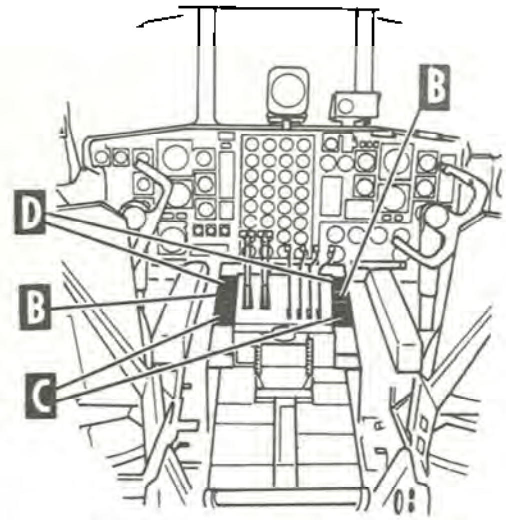
intercommunications system (AN/AIC-18)



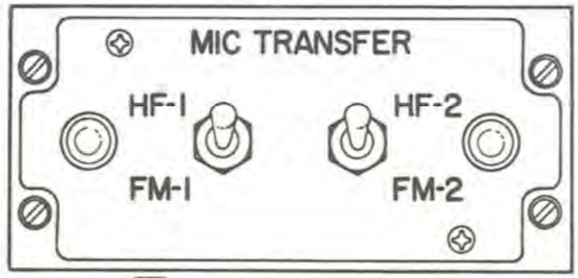
1. AUX INTERCOM CONNECTION
2. AUX INTERCOM CONTROL PANEL
3. FLT INSTR INTERCOM SET CONTROL
4. FLT INSTR MONITOR PANEL
5. INTERCOM SET CONTROL
6. FOOT SWITCH
7. AIRBORNE GUNNER NO. 1 INTERCOM SET CONTROL
8. AIRBORNE GUNNER NO. 2 INTERCOM SET CONTROL
9. FWD INTERCOM JUNCTION BOX
10. IR OPERATOR INTERCOM SET CONTROL
11. EWO INTERCOM SET CONTROL
12. TV OPERATOR INTERCOM SET CONTROL
13. AFT INTERCOM JUNCTION BOX
14. IO INTERCOM SET CONTROL
15. CRASH SEATS INTERCOM JACK CONNECTIONS (2 EACH)
16. TV OPERATOR FOOT SWITCH
17. AIRBORNE GUNNER NO. 5 INTERCOM SET CONTROL
18. AIRBORNE GUNNER NO. 4 INTERCOM SET CONTROL
19. AIRBORNE GUNNER NO. 3 INTERCOM SET CONTROL
20. AIRBORNE GUNNER LANDING/TAKEOFF INTERCOM SET CONTROL
21. EWO FOOT SWITCH
22. IR OPERATOR FOOT SWITCH
23. SCANNER/OBSERVER INTERCOM SET CONTROL
24. AIRBORNE GUNNER INTERCOM JACK CONNECTIONS (2 EACH)
25. FCO INTERCOM SET CONTROL
26. FCO MONITOR PANEL
27. FCO FOOT SWITCH
28. EXTERNAL AUX INTERCOM JACK CONNECTION
29. NAV FOOT SWITCH
30. PILOT MONITOR PANEL
31. PILOT MIC TRANSFER PANEL
32. PILOT INTERCOM SET CONTROL
33. SECURE VOICE RELAY
34. COPILOT INTERCOM SET CONTROL
35. COPILOT MIC TRANSFER PANEL
36. COPILOT MONITOR PANEL
37. MAIN JUNCTION BOX
38. NAV INTERCOM SET CONTROL
39. NAV MONITOR PANEL
40. NAV MIC TRANSFER PANEL
41. FCO MIC TRANSFER PANEL
42. SECURE VOICE RELAY
43. INPHONE DISCONNECT PANEL
44. FCO INSTR MONITOR PANEL

Figure 4-34 (Sheet 1 of 5).

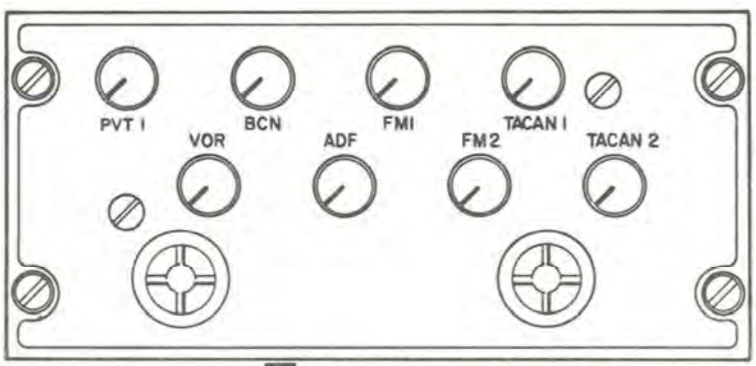
intercommunications system (AN/AIC-18)



FLIGHT STATION CONTROL PEDESTAL



B MIC TRANSFER PANEL



C MONITOR PANEL

Figure 4-34 (Sheet 2 of 5).

Note

When in HOT MIC on any station, actuation of headset, foot, or control wheel switch will override the hot mike line and place transmission on intercommunications or radio as selected by the transmission selector switch.

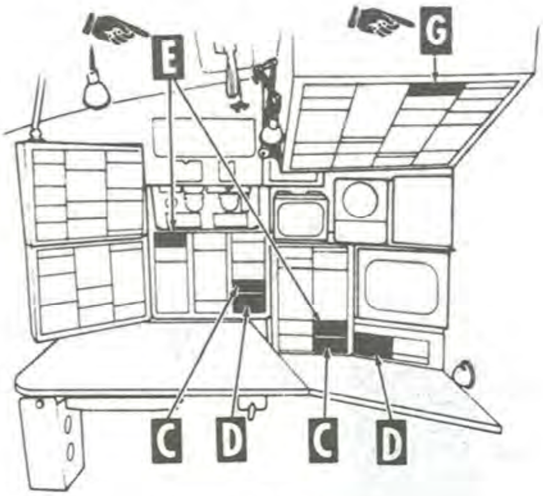
MIC Transfer Control Panels.

A MIC transfer panel is located at the pilot's, co-pilot's, navigator's, and fire control officer's stations to enable selection of the desired communication system when the transmission selector switch is in any one of it s dual marked positions. The MIC transfer panels at the pilot's and co-pilot's stations provide two switches each, one for selection of HF-1 or FM-1 and one for selection of HF-2 or FM-2. The MIC transfer panels at the navigators and fire control officer's station provide three switches each, one for selection of HF-1 or FM-1, one for selection of HF-2 or FM-2, and one for selection of PVT-1 or PVT-2. The transmission selector switch must be in the corresponding MIC transfer position to enable the MIC transfer switches.

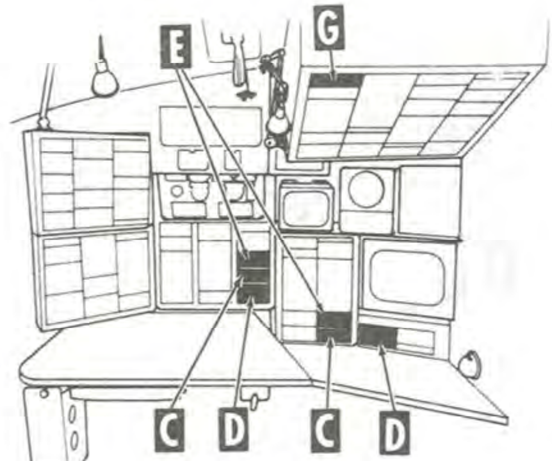
Auxiliary Intercommunication Connectors.

Two auxiliary connectors are provided on the flight deck, one at the engineer's position and one at the fire control officer's position. The connectors operate through the control panels at their respective locations. Two auxiliary connectors are located on the forward electronic equipment rack in the cargo

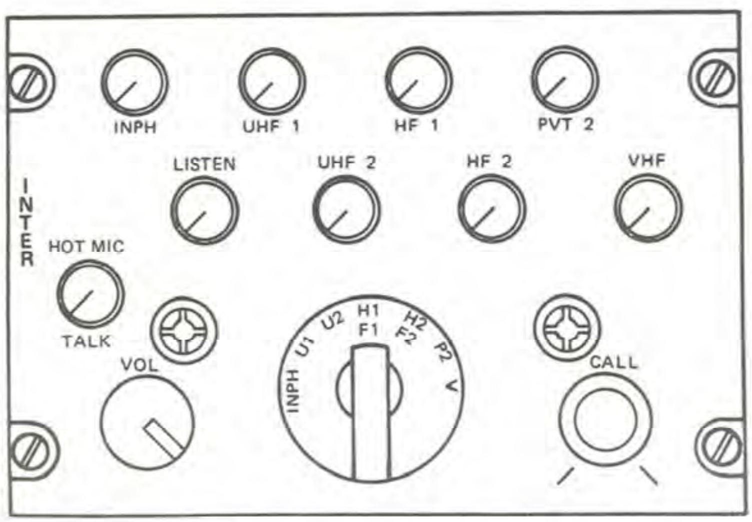
intercommunications system (AN/AIC-18)



NAV / FCO CONSOLE
AIRPLANES MODIFIED BY T.O. 1C-130-949



NAV / FCO CONSOLE

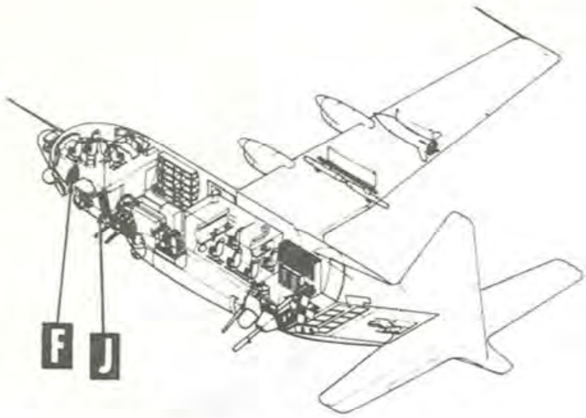


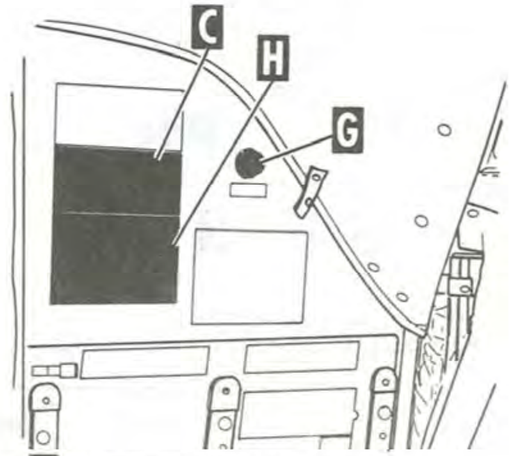
D INTERCOMMUNICATION SET CONTROL

E MIC TRANSFER PANEL

Figure 4-34 (Sheet 3 of 5).

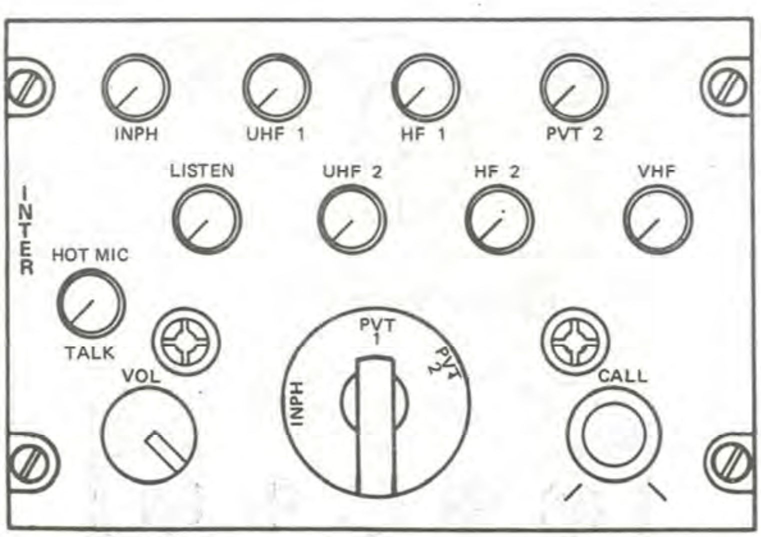
intercommunications system (AN/AIC-18)





F FLIGHT INSTRUCTOR STATION

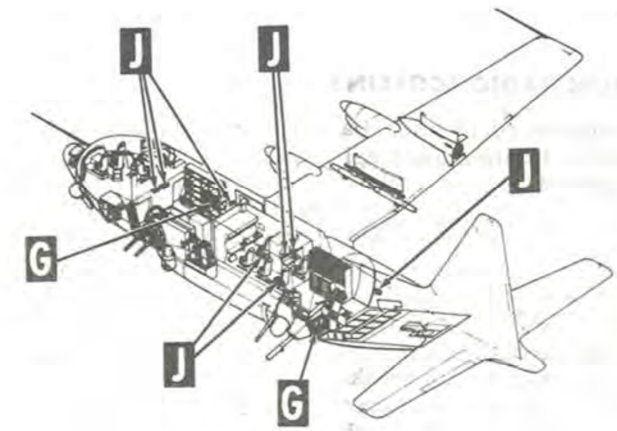
G INTERPHONE CONNECTION

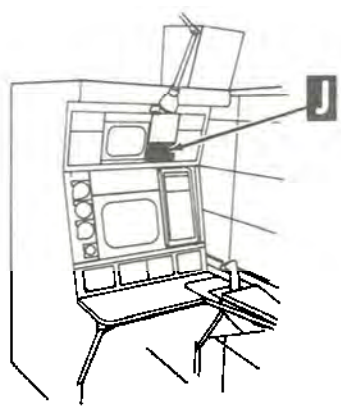


H INTERCOMMUNICATION SET CONTROL

Figure 4-34 (Sheet 4 of 5).

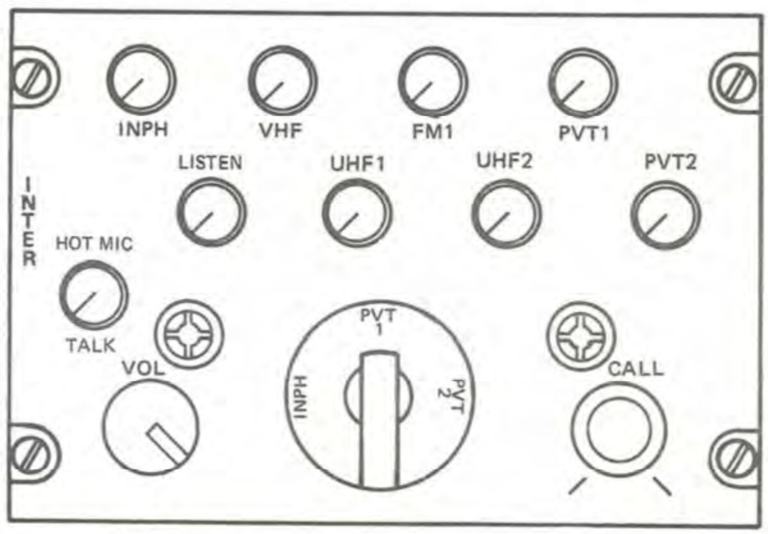
intercommunications system (AN/AIC-18)





TV CONSOLE

IR/EWO CONSOLE



J INTERCOMMUNICATION SET CONTROL

Figure 4-34. (Sheet 5 of 5)

compartment and operate in conjunction with the airborne gunner's control panels located on the aft side of station 245. An additional connector panel is located forward of the TV/laser platform for use by the ground controller. The panel contains a connector, a volume control and a call button. The ground control position can transmit on main interphone and CALL only and receives both main interphone and HOT MIC transmissions.

LIAISON RADIO (COLLINS HF-102).

Two separate but identical liaison radio installations, for single-sideband and amplitude-modulation operation, provide two-way voice and code communication in the 2- to 30-megacycle frequency range and are capable of providing communication on any one of 28,000 directly selectable channels. The transceiver for the pilot's radio operates from 28-volt, essential dc power and 115-volt, 3-phase, essential ac power supplied through liaison No. 1 circuit breakers on the pilot's side circuit breaker panel. The transceiver for the navigator's radio operates from 28-volt, main dc power and 115-volt, 3-phase, main ac power supplied through liaison No. 2 circuit breakers on the copilot's upper circuit breaker panel.

Liaison Radio Controls.

A separate control panel (figure 4-35) for each transceiver contains all the controls necessary for frequency selection of any of the 28,000 available channels. A four-position (OFF, USB, LSB, AM) rotary switch is used to turn the set on and off and to select sideband (upper or lower) operation or AM operation. This rotary switch controls the selection of two mechanical filters, one of which will pass only the upper sideband signal and the other only the lower sideband signal. When the set is operated in AM mode, the upper sideband mechanical filter is also selected automatically. The operating frequency, selected by use of four knobs on the control panel, is shown in a direct-reading indicator in the upper center of the control panel. An rf sens control switch, located on the right side of the panel controls the radio frequency gain control of the transceiver. Selection for reception or transmission through the liaison radio transceivers is made at the appropriate intercommunication system control panel.

Normal Operation of No. 1 Liaison Radio.

To put the No. 1 liaison radio transceiver into operation:

1. Place the rotary selector switch on the No. 1 liaison radio control panel at the desired mode of operation.
2. Allow approximately 1 minute for warmup.
3. Select the desired channel frequency.
4. Position the transmission selector switch on the intercommunication system control panel to HF-1 and trigger the microphone to tune the transmitter.
5. To receive, pull the HF-1 switch on the intercommunication system control panel.
6. To transmit, position the transmission selector switch on the intercommunication system control panel to HF-1.

Note

A loss of Loran lock-on may be caused by transmissions exceeding 24 seconds on either HF radio.

To turn the liaison radio set off:

7. Turn the function selector switch to OFF.

Normal Operation of No. 2 Liaison Radio.

Operation of the No. 2 liaison radio transceiver is the same as for the No. 1 set, except that the No. 2 liaison radio control panel is used to select the desired mode and frequency of operation and the HF-2 switch on the applicable intercommunication systems control panel must be pulled.

355 13-57

VHF/FM TRANSCEIVER SETS (FM 622/A).

Two VHF/FM transceiver sets (FM1 and FM2), (see figure 4-36), are installed in the aircraft. FM1 is controlled by the navigtaor; FM2 is controlled by the copilot. The VHF/FM transceivers are used to transmit and receive frequency modulated (FM) signal between the airplane and ground stations, or other airplanes. FM transmission is possible on any one of 920 crystal-controlled channels in the band from 30.00 to 75.95 mHz.

FM1 has a transceiver, homing indicator, control panel, one homing antenna, and one TR antenna. The FM1 set can home on any radio signal in the tuning range and sensivity of the system. The homing indicator presents homing information to the pilot. Homing is automatically interrupted for voice communications and is resumed when transmission is complete. The FM1 control panel is located at the navigator's control panel.

liaison radio control panel (HF-102)

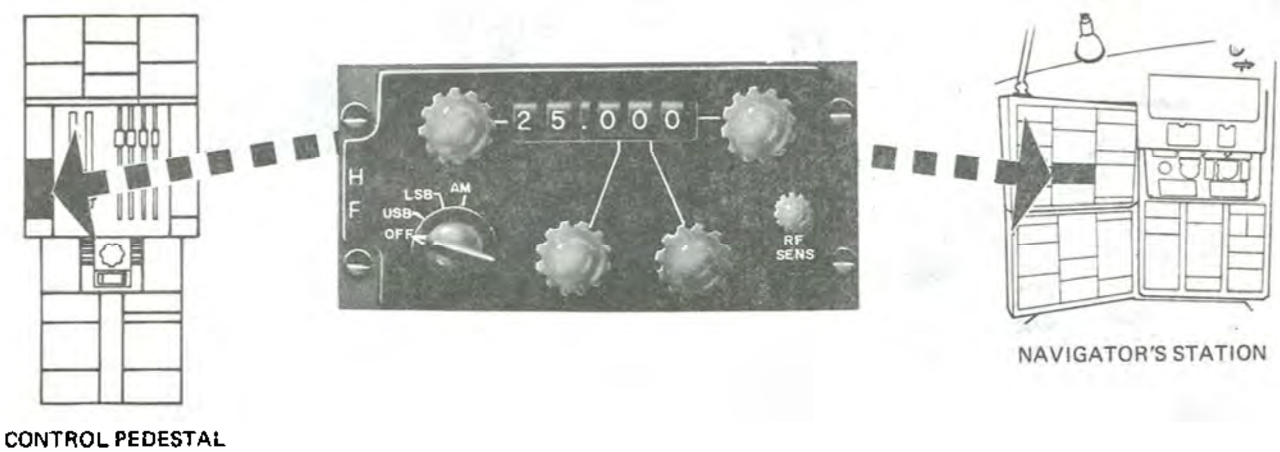


Figure 4-35.

VHF/FM Controls.

The control panels contain all the necessary controls to provide remote operation of the transceiver by the navigator (FM1) and copilot (FM2). Four rotary selector knobs are used for frequency selection. Two of the knobs are used to adjust the frequency in 1 and 10 mHz steps. The other two knobs adjust the frequency in 10 and 100 kHz steps. A squelch selector switch and a volume control knob adjust the audio. The squelch selector switch has three positions: DIS (disabled, squelch not operating), CARR (operated by carrier signal), and TONE (operated off a signal containing a 150 Hz tone modulation).

During normal FM operation the CARR position is selected. If, by prior arrangement, both transmitting and receiving FM operators have agreed to use the TONE position, then TONE must be selected. The 150 Hz tone signal is then used to unsquelch the receiving radio set. The mode selector switch is used to energize the transceiver. The T/R is connected to control the reception and transceiver mode of operation on both systems. FM1 system has homing switch position to control the homing mode of operation. RETRAN position is not operative.

Homing Indicator (ID-48).

This instrument is located on the pilot's flight panel. The vertical needle indicates left, right, or on-course position. The flags indicate sufficiency of the homing signal. The horizontal needle indicates relative signal strength of the transmitter.

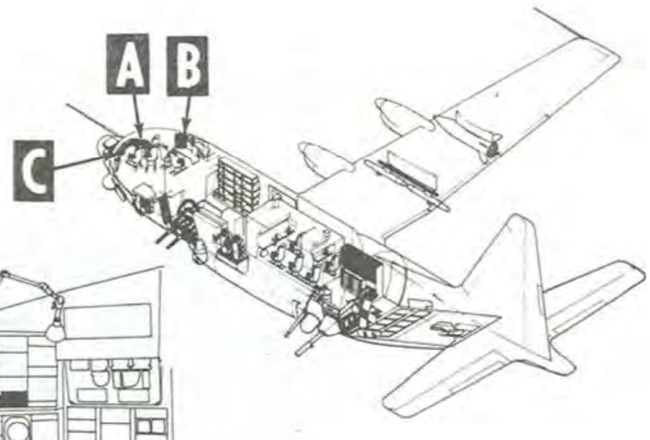
VHF/FM Operation.

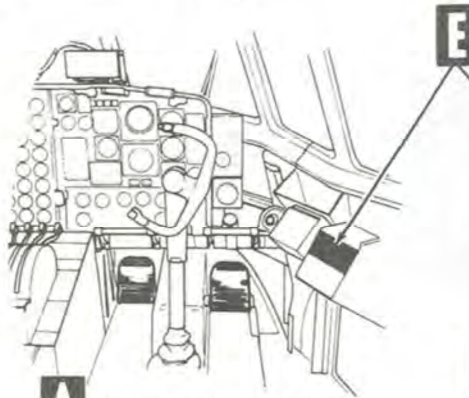
All controls necessary to operate the set are located on the control panel. To operate the set, rotate the mode selector switch to T/R. To operate the FM1 system in the homing mode, rotate the mode selector switch to HOME and observe indication on the ID-48 indicator. Rotate the frequency selectors to set the desired frequency. Adjust the volume control to set the desired audio level.

VHF COMMAND RADIO(COLLINS VHF-101).

The VHF communication system consists of a VHF transmitter, a VHF receiver and a control unit. The VHF system provides communication facilities in the frequency range of 116.00 to 149.95 megacycles with reception possible up to 151.95 megacycles. There are 680 crystal-controlled channels available for transmission and 720 channels available for reception; all channels may be selected at intervals of 50 kilocycles from the control panel (figure 4-37) located on the pedestal. The VHF command radio receives 28-volt dc power from the essential dc bus through the VHF transmitter and receiver circuit breakers located on the copilot's upper circuit breaker panel. The VHF system also receives 115-volt, 400-cycle, single-phase, ac power from the essential ac bus through the VHF transmitter and receiver fuses located on the pilot's lower circuit breaker panel.

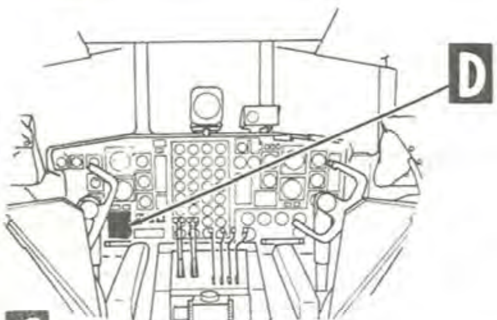
vhf/fm system (FM-622)



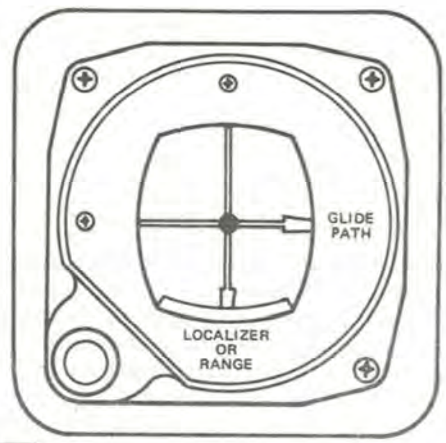


A COPILOT'S STATION

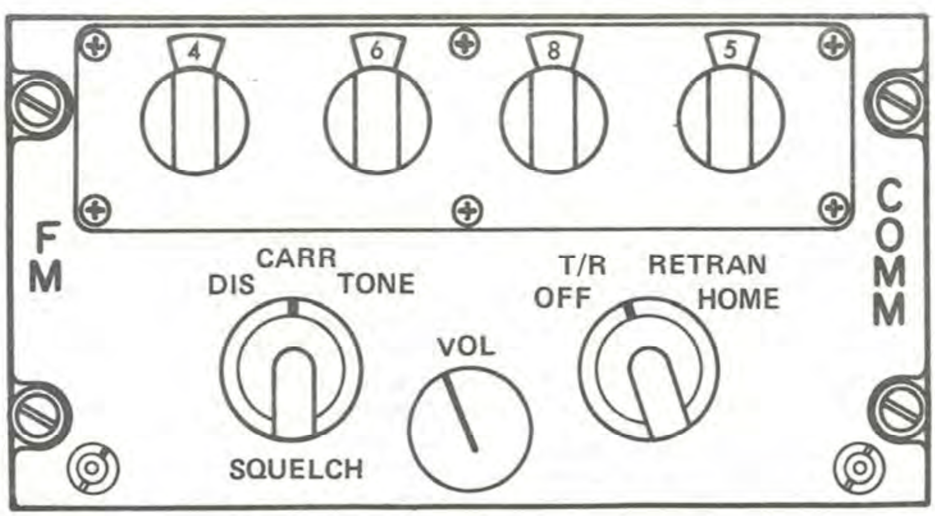
B NAVIGATOR STATION



C MAIN INSTRUMENT PANEL



D INSTRUMENT APPROACH INDICATOR



E VHF/FM CONTROL PANEL

Figure 4-36.

VHF Command Radio Controls.

A panel (figure 4-37) on the flight control pedestal provides operating control for the VHF command radio. The controls consist of a frequency indicator, a power on-off switch, and SCS-DCS/DCD switch, two frequency selector knobs, and a dual control for squelch and volume control. The two frequency selector knobs are used to select an operating channel. The selected frequency appears as a direct reading number (in megacycles) in the frequency indicator window. The power on-off switch controls the power application to the system. The volume control is provided to adjust the receiver volume level in the interphone system. The SQ control is provided to adjust the squelch threshold on the receiver output. The SCS-DCS/DCD switch is provided to select the mode of operation. When SCS (single-channel-simplex) is selected, the receiver and transmitter are tuned to the same frequency and the receiver is disabled during operation of the transmitter, thereby restricting operation to either transmission or reception on the assigned channel. When DCS/DCD (double-channel-simplex/double-channel-duplex) is selected, the operation is the same as SCS, except that the transmitter is automatically tuned to a frequency that is 6 megacycles above the receiver frequency indicated on the control panel.

Normal Operation of the VHF Command Radio.

To put the VHF command radio into operation:

1. Place the power switch in the ON position.
2. Allow 1 minute for warmup.
3. Select the mode of operation desired (SCS or DCS).

Note

When operating in SCS, all transmissions and voice communications will be on the frequency indicated on the control panel. When operating in DCS, the receiver frequency is indicated on the control panel and the transmitting frequency will be automatically tuned 6 megacycles higher than the receiving frequency.

4. Select the desired operating frequency.
5. To receive, pull the VHF switch on the intercommunication control panel; turn the switch to adjust the volume.
6. Adjust the squelch and volume control as necessary to obtain a comfortable reception level.
7. To transmit, place the transmission selector on the intercommunication control panel to VHF.

To turn the VHF command radio off:

8. Place the power switch in the OFF position.

UHF COMMAND RADIO (AN/ARC-164(V)10) UHF-1 AND UHF-2.

The UHF command radio provides voice transmission and reception in the frequency range of 225.000 to 399.975 mHz with 7000 frequencies available in steps of 0.025 mHz. Receiver and transmitter tuning is accomplished automatically after a frequency change. A main receiver and a guard receiver are used in each system. The main receiver are used in each system. The main receiver tunes to any selected frequency; the guard receiver remains tuned to a guard frequency. In addition, the UHF radio set is capable of automatic direction finder (ADF) reception. Two identical, independently operating UHF command radio systems, each with its own antenna system, are installed in the airplane. The No. 1 system is provided for the pilot's use and the No. 2 system control for the copilot's use. However, each may use either system. The UHF command radio systems are independently supplied with 28-volt dc power from circuit breakers on the copilot's upper circuit breaker panel. Electrical power is supplied to the No. 1 (pilot's) system from the isolated dc bus. The No. 2 (copilot's) system is supplied from the essential dc bus.

vhf command radio control panel (COLLINS VHF-101)

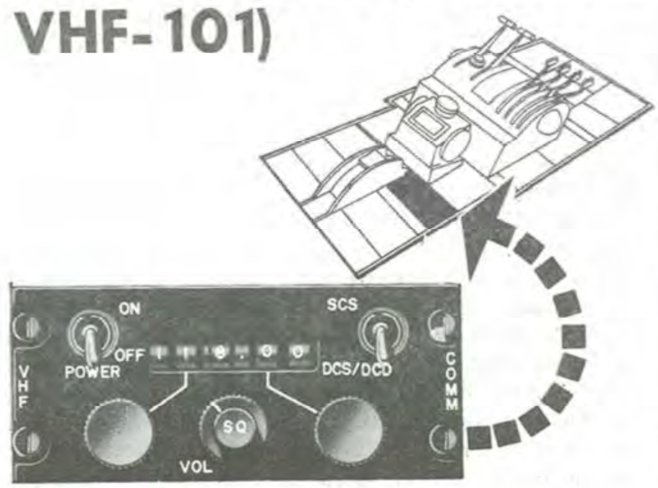


Figure 4-37.

UHF Command Radio Controls.

COMMAND CONTROL PANEL. (See figure 4-38.)

The three-position (MANUAL, PRESET, GUARD) frequency mode selector switch, located on the right side of the control panel, is used to select the type of frequency control desired. With the switch positioned to PRESET, the preset channel selector knob, located at the top right of the control panel, can be used to select any one of 20 preset frequencies. The preset channel selected is displayed on the channel readout indicator to the left of the preset channel selector knob. When the frequency mode selector switch is positioned to MANUAL, the five manual selector knobs, located across the top of the control panel, can be used to select any one of 7000 frequencies in the operating range. The manual selector knobs control the digits making up the desired frequency. Each of the digits appears in a window above the associated knob. When the selector switch is positioned to GUARD, reception and transmission are on the guard frequency.

Note

The GUARD position of the frequency mode selector switch should not be used except in actual emergencies.

The four-position (OFF, MAIN, BOTH, ADF) function selector switch on the left side of the control panel turns the radio set on and determines whether the main or the guard receiver is being used in conjunction with the transmitter. When the switch is positioned to MAIN, the main receiver and the transmitter are ready for use, and the guard receiver is inoperative. If the function selector switch is at MAIN and the frequency mode selector is at GUARD, the main receiver and the transmitter will be ready for use on the guard frequency. With the function selector switch positioned to BOTH, the main receiver, guard receiver, and the transmitter are all ready for use; the main receiver and transmitter are ready for use on the selected frequency and the guard receiver monitors the guard frequency.

The UHF-2 ADF position is inoperative. When the function selector switch is positioned to ADF, the guard receiver is switched to the UHF direction finder antenna. When the switch is in this position, the transmitter will tune to the manual, preset, or guard frequency depending on the position of the frequency mode selector switch, but the switching arrangement within the command control panel is such that no transmissions can be made. When the function selector switch is in any position other than ADF or OFF, the tone button at the bottom of the control panel can be used to transmit a continuous wave tone modulated at 1,020 Hz. Pressing the tone button energizes the transmitter and an audio oscillator. A volume control knob, located at the bottom center of the control panel, is used to adjust the level of the audio signal. The two-position (OFF, ON) squelch switch enables (ON position) or disables (OFF position) the main and the guard receiver squelch.

ANTENNA SELECTOR PANEL. (See figure 4-39.)

The antenna selector panel for each UHF command radio is equipped with a single toggle-type switch which can be set to one of three positions: TOP, AUTO, or BOTTOM. The switch permits manual selection of operation through the top-mounted antenna; automatic selection of the antennas is achieved by placing the switch at the center (AUTO) position.

Note

Due to unreliable operation of the automatic antenna selector, it is recommended that the antenna selector switch not be placed in AUTO.

Normal Operation of the UHF Command Radio.

To put the radio into operation, proceed as follows:

1. Place the function selector switch for the selected radio to any position except ADF or OFF; allow 1 minute for warmup.
2. Select a channel, using the preset channel selector knob or the manual selector knobs.
3. To receive, actuate the respective UHF monitor switch on the intercommunication system control panel.
4. To transit, place the rotary transmission selector on the intercommunication system control panel to UHF.
5. Select the desired antenna for the radio being operated by placing the antenna selector switch to TOP or BOTTOM.

To turn the UHF command radio system off, place the function selector switch to OFF.

Emergency Operation of the UHF Command Radio.

Note

When operating a UHF command radio under emergency conditions, set the frequency mode selector switch to GUARD and the function selector switch to MAIN. Do not use the BOTH position, since the noise from the two receivers may make the incoming signal unintelligible.

uhf command radio control panel (AN/ARC-164(V)10)

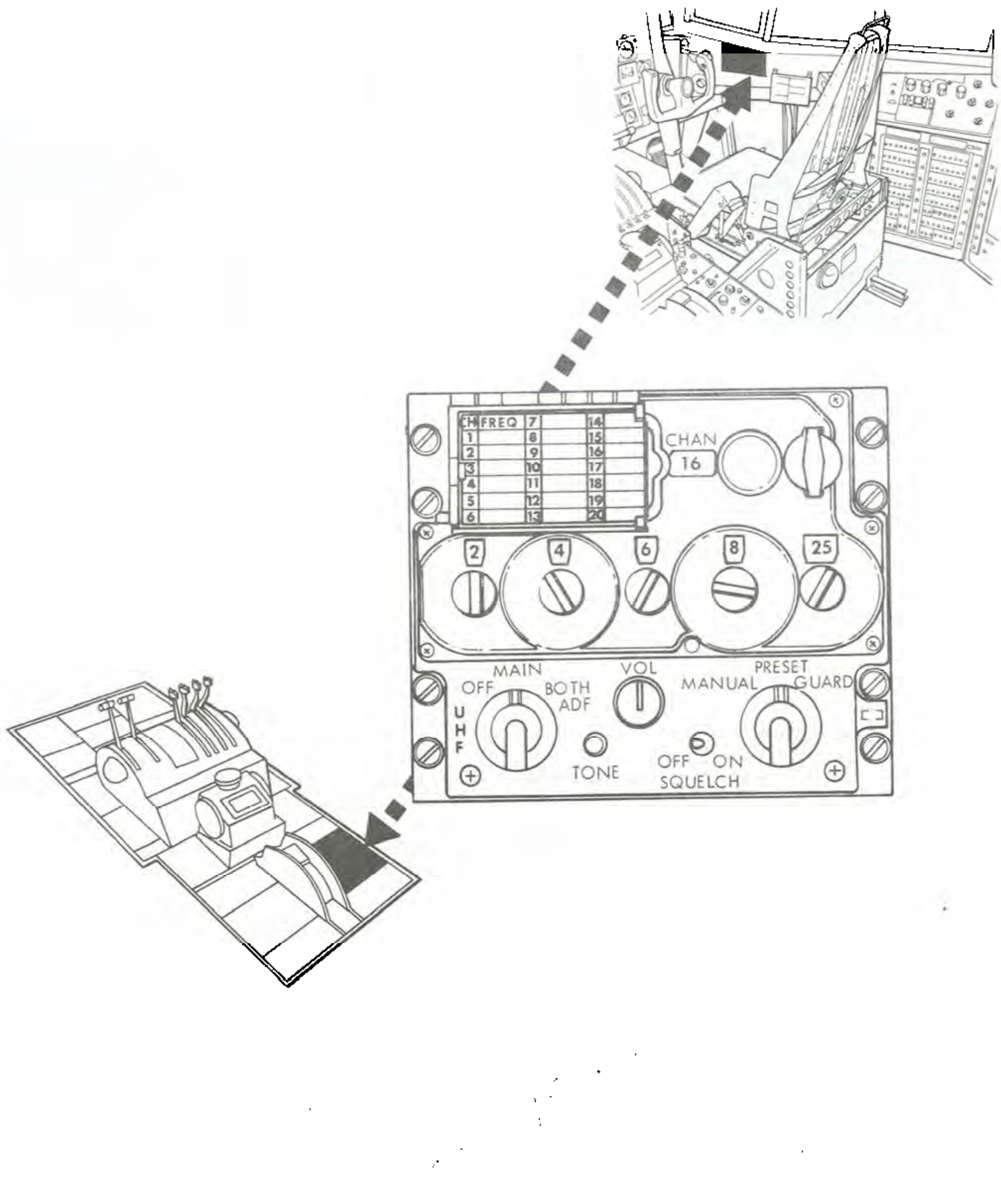


Figure 4-38.

uhf antenna selector control panels

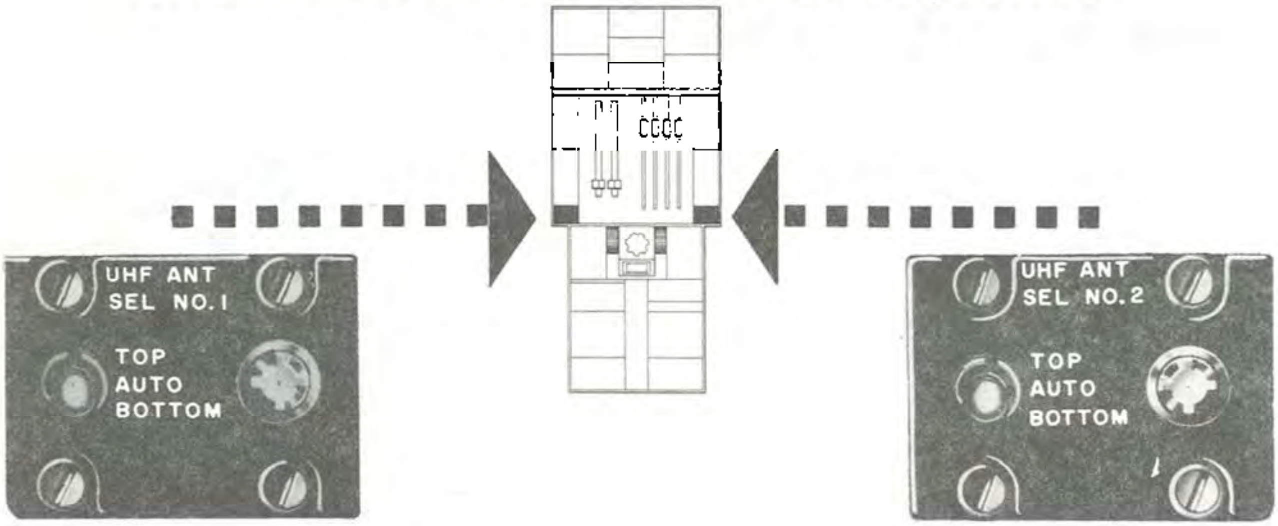


Figure 4-39.

The dual installation of the UHF command radio systems should make emergency operation of the radio unnecessary, since a malfunctioning radio could be switched off and the remaining radio operated in its place. If the equipment fails in some particular function, the remaining workable functions may satisfy minimum requirements for operation. If transmission on a preset channel is not possible, an attempt may be made to use a manually selected channel or the guard frequency. If reception fails on a selected channel, reception on the guard frequency may be tried.

UHF DIRECTION FINDER (AN/ARA-50).

A direction finder is used to indicate the relative bearing of, and to home on, radio signals being received by the UHF command radio. Continuous indication of relative bearing is provided by the UHF/DF bearing pointer of the radio magnetic indicators (rmi), on the pilot's and copilot's instrument panels. The direction finder operates from 28-volt dc power supplied by the main dc bus and 115 volt ac power from the main ac bus. The source of power comes through UHF/DF circuit breakers on the copilot's upper circuit breaker panel.

UHF Direction Finder Controls.

The direction finder group is controlled from the UHF command panel (figure 4-38). The direction finder is turned on by placing the function switch in the ADF position. The operating frequency of the direction finder is selected on the UHF command panel.

Normal Operation of the UHF Direction Finder.

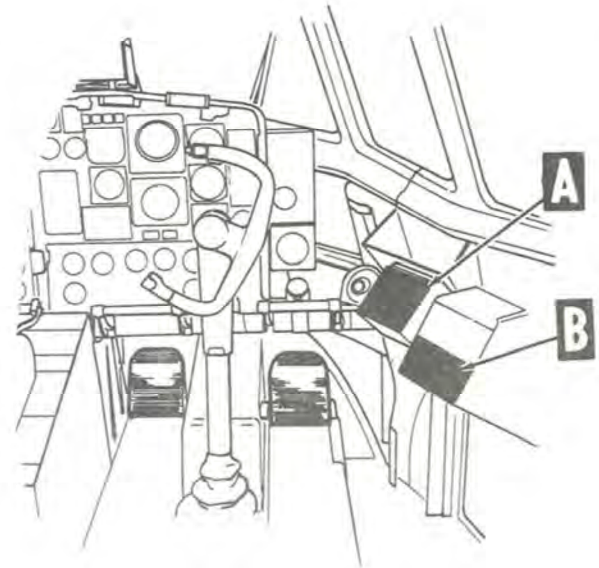
HOMING. Home on UHF radio stations as follows:

1. Rotate the function switch on the UHF (No. 1 UHF when dual UHF is installed) command panel to the ADF position.
2. Select the operating frequency on the UHF command panel.
3. Turn the airplane to place the head of the UHF D/F bearing pointer under the top index of the rmi.
4. To turn off, move the function switch on the UHF command panel from the ADF position.

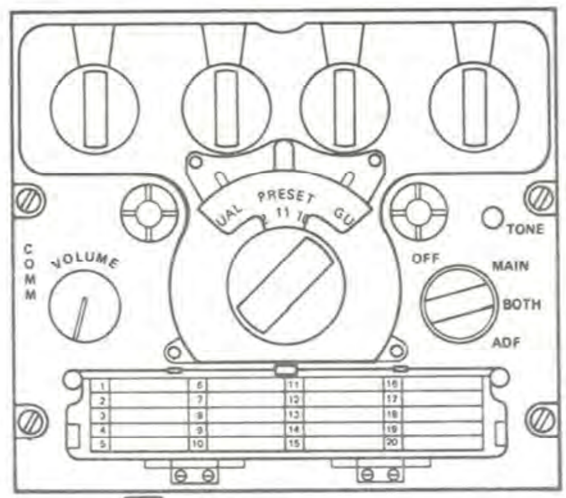
DIRECTION FINDING. Perform direction finding as follows:

1. Rotate the function switch on the UHF command panel to the ADF position.
2. Select the operating frequency on the UHF command panel.
3. Read the bearing to the received signal under the head of the UHF D/F bearing pointer on the compass card of the rmi.
4. To turn off, move the function switch on the UHF command panel from the ADF position.

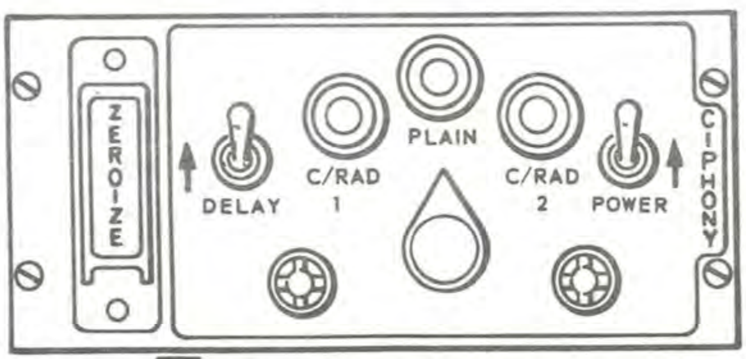
uhf/secure speech components



COPILOT'S STATION



A CONTROL UNIT, UHF 2



B SPEECH SECURITY CONTROL PANEL

Figure 4-40.

Emergency Operation of the Direction Finder.

The direction finder has no provision for emergency operation. If a fault in the direction finder interferes with operation of the UHF command radio, remove the P-101 power plug from J-101 on the front panel of the AM-608/ARA-25 electronic control amplifier. The amplifier is located on the left underdeck rack.

SECURE SPEECH SYSTEM (KY-28).

The speech security system provides remote control for operation of secure speech equipment used in conjunction with FM2 and UHF2 communication systems.

Secure Speech Control Panel.

The control panel (see figure 4-40) is located outboard of the copilot's seat. A power switch provides power to the secure speech equipment. A function switch connects the UHF2 (C/RAD 2 position) or VHF FM2 (C/RAD 1 position) to the secure speech equipment. In the plain position neither communication set is connected to the secure speech equipment and both communication sets operate in the normal mode.

Note

When operating the UHF-2 in secure speech mode, the UHF-2 antenna selector control must not be in the AUTOMATIC position and should not be changed during transmission.

A delay switch connects the retransmit delay line to system ground. A zeroize switch connects the zeroize control line to the 28 vdc input. Function switch position is visually indicated by three indicators. Panel illumination is provided by two lamps.

TACAN (AN/ARN-21).

The purpose of the tacan system is to provide continuous indications of bearing and distance from tacan surface beacon located within a line-of-sight distance from the airplane. Bearing information is presented in the pilot's radio magnetic indicator, on the flight director system horizontal situation indicator, on the copilot's radio magnetic indicator and on the copilot's course indicator. Distance information is indicated in nautical miles by the tacan range indicator on the pilot's instrument panel.

Two independently-operating, AN/ARN-21 tacan navigation systems are installed. The No. 1 tacan system is controlled by the pilot, and the No. 2 system by the copilot, by means of the tacan control panels on the flight control pedestal. When the No. 1 system is operating and the mode selector switch on the pilot's instrument selector panel is positioned to TAC 1, the following deployment of information is accomplished: bearing information is fed to the No. 2 bearing pointer of the pilot's bearing-distance-heading indicator (bdhi) and to the pilot's horizontal situation indicator; distance information is fed to the same two indicators; course deviation and to-from information is fed to the horizontal situation indicator; steering information is fed through the flight director computer system to the pilot's attitude director indicator; and, if the appropriate pointer selector switch on the navigator's instrument panel has been positioned to TAC 1, bearing and distance information will be available at the navigator's station on the No. 2 bearing pointer and on the range indicator, respectively, of the ADF/TAC bdhi. When the No. 2 system is operating and the mode selector switch on the copilot's instrument selector panel is positioned to TAC 2, a similar deployment of information is accomplished, except that the information goes to those indicators (bdhi, hsi, and adi) normally monitored by the copilot, rather than to those normally monitored by the pilot, and that the information available at the navigator's station is presented on the VOR/TAC, rather than the ADF/TAC bdhi, when the appropriate pointer selector switch has been positioned to TAC 2. Distance information from the No. 1 system is presented on the pilot's horizontal situation indicator whenever system No. 1 is operating and the pilot's mode selector switch is in any position except DOP or TAC 2. Similiary, distance information from the No. 2 system is presented on the pilot's horizontal situation indicator whenever system No. 2 is operating and the copilot's selector switch is in position except DOP or TAC 1. Tacan audio signals can be monitored by pulling the appropriate tacan button. The tacan system is powered by 28-volt dc power and 115-volt ac power from the essential ac and dc buses through tacan No. 1 and tacan No. 2 circuit breakers on the copilot's upper circuit breaker panel.

Tacan Controls.

Controls for the tacan systems are located on the tacan control panels (figure 4-41) on the flight control pedestal. A three-position (OFF, REC, T/R) function switch selects mode of operation. With the switch in REC position, only bearing information is received; with the switch in T/R position, both bearing and range data are received. The channel selector tunes the equipment to any of 126 frequency channels.

The volume control knob varies the volume of the audio signals received from the surface beacon and heard through the intercommunication system when the instrument select switch is in tacan position.

Normal Operation of the Tacan System.

a. Move the function switch to the desired position.

b. Place the navigator's pointer selector switch in the TAC position. Select as follows at that station: TAC 1 for information from the pilot's tacan system, TAC 2 for information from the copilot's tacan system.

c. Place the required mode selector switch in the appropriate position for tacan operation.

d. Place the flight director switch in the NORMAL position.

Note

Normal warmup time is 90 seconds. There is no delay when switching from REC to T/R.

e. Turn the channel selector knob to the desired tacan channel.

Note

VHF (VOR) omni bearing is continuously displayed on the No. 2 pointers of the pilot's and copilot's ID-250 indicators regardless of the position of the VOR-ILS tacan selector switch. Tacan information is presented on the No. 1 pointers unless ADF is selected, and eliminates the automatic selection of tacan if power to the VOR or ILS power circuits fails. On these airplanes, it is not necessary to turn tacan OFF when using VOR-ILS.

f. Check station identification by pulling out the appropriate tacan intercom button, and adjust audio to a comfortable level by turning the tacan button.

tacan control panel (AN/ARN-21)

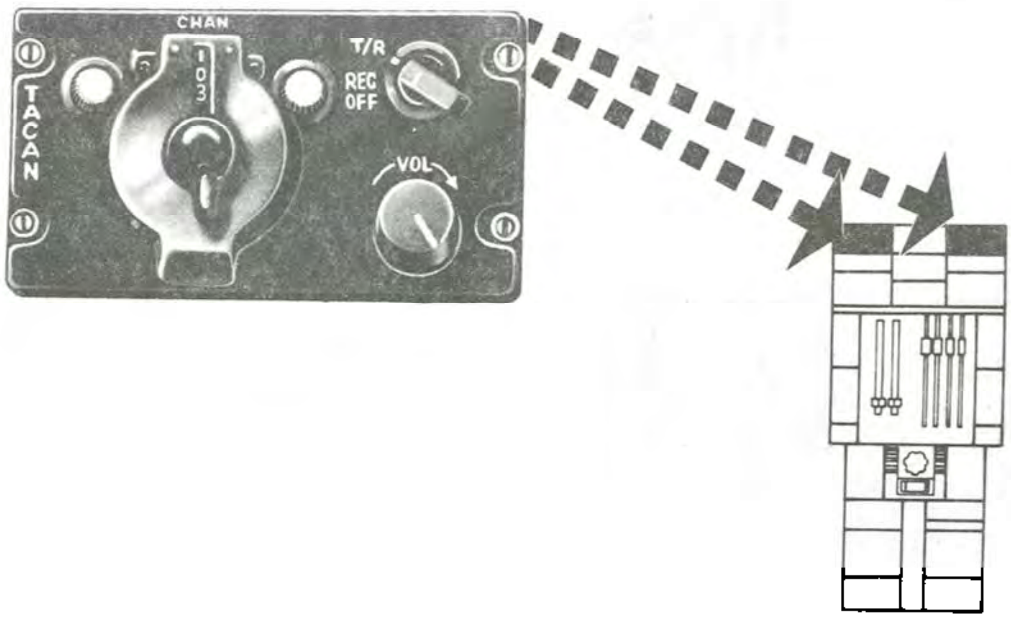


Figure 4-41.

g. To turn the tacan system off, place the function switch in the OFF position.

Note

During banking maneuvers, excessive bearing and distance unlock conditions should be expected when the airplane is more than approximately 15 miles from the station.

False Lock-ON.

WARNING

Because of improperly adjusted or malfunctioning ground or airborne tacan equipment, it is possible for the tacan to lock-on to a false bearing. The error will probably be 40 degrees, but can be any value which is a multiple of 40 degrees.

a. If a false lock-on is suspected, switch to another channel, check it for correct bearing, and then switch back to the desired channel.

b. Check for correct lock-on.

c. If false lock-on is still suspected, turn set off and and then on.

d. Recheck for correct lock-on.

e. If false lock-on persists, utilize the other equipment or aids available.

Note

If, during an emergency, the size and direction of error can be determined, tacan can be utilized if compensation is made for error in tacan bearing.

TACAN AN/ARN-118(V).

The tacan navigation set AN/ARN-118(V) is a polar coordinate navigation system that is used to determine the relative bearing and slant range distance to a selected tacan station. The selected tacan station can be a ground, shipboard, or airborne station. The ground and shipboard tacan stations are considered surface beacons. An airborne station only supplies slant-range distance information unless the aircraft is specially equipped with a bearing transmitter and rotating antenna. Tacan navigation set AN/ARN-118(V) is not capable of transmitting bearing information but does supply slant-range distance replies when interrogated. The tacan navigation set has provisions for 126 X channels and 126 Y channels. The Y channels differ from the X channels in pulse spacing. The maximum operating range of the tacan navigation set is 390 NMI when the selected tacan station is a surface beacon and 200 NMI when the selected tacan station is an airborne beacon.

tacan control panel (AN/ARN-118(V)) typical

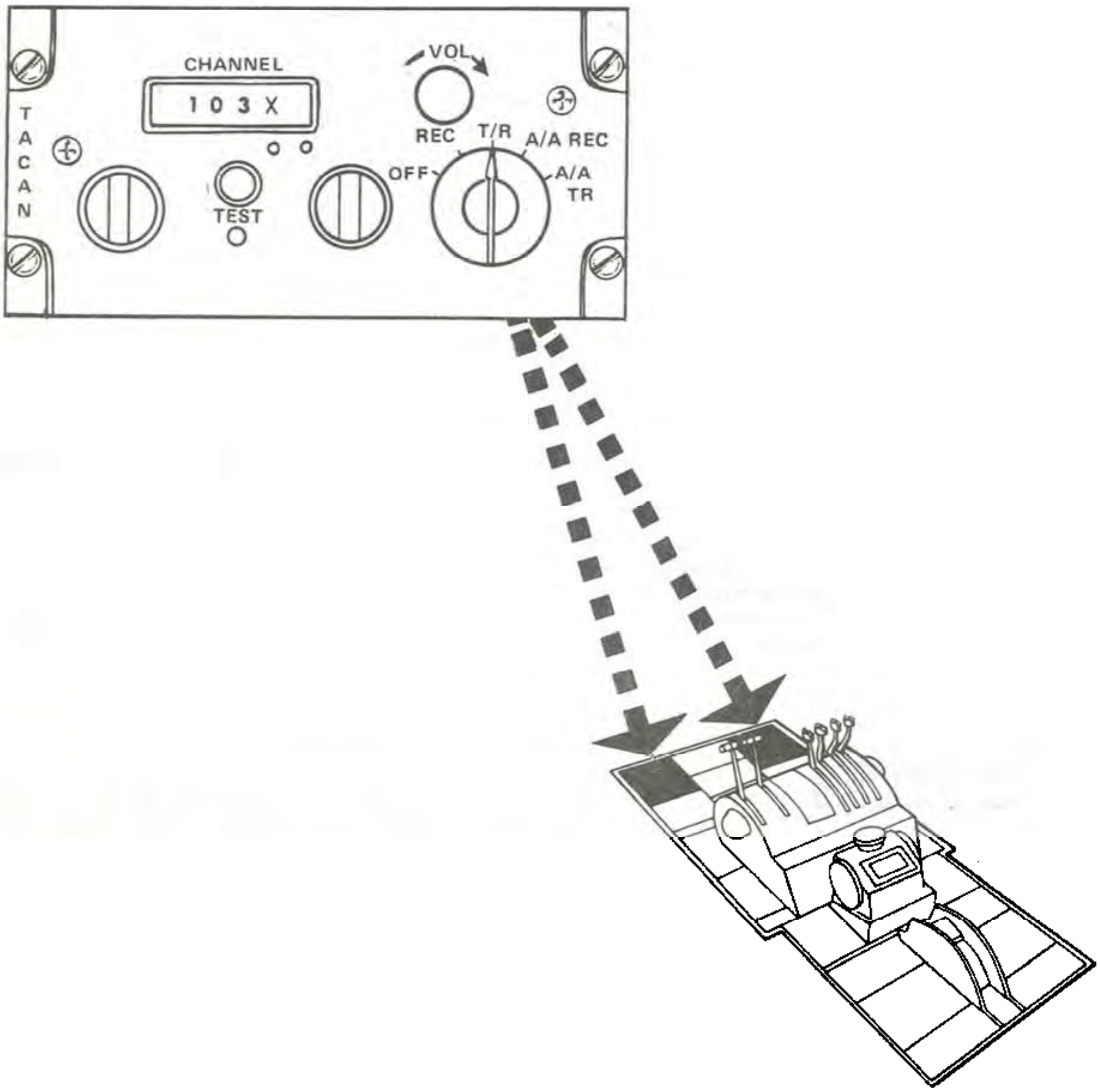


Figure 4-42.

Note

The Y channels were developed to alleviate congestion of the X channels but have not yet been implemented in AF ground stations. Use of Y channels is encouraged in air-to-air modes.

Two independently operating AN/ARN-118 tacan navagation systems are installed. The No. 1 tacan system is controlled by the pilot, and the No. 2 system by the copilot, by means of the tacan control panels on the flight control pedestal.

When the No. 1 system is operating and the mode selector switch on the pilot's instrument selector panel is positioned to TAC 1, the following deployment of information is accomplished: bearing information is fed to the No. 2 bearing pointer of the pilot's bearing-distance-heading indicator (bdhi) and to the pilot's horizontal situation indicator; distance information is fed to the same two indicators; course deviation and to-from information is fed to the horizontal situation indicator; steering information is fed through the flight director computer system to the pilot's attitude director indicator; and, if the appropriate pointer selector switch on the navigator's instrument panel has been positioned to TAC 1, bearing and distance information will be available at the navigator's station on the No. 2 bearing pointer and on the range indicator, respectively, of the ADF/TAC bdhi. When the No. 2 system is operating and the mode selector switch on the copilot's instrument selector panel is positioned to TAC 2, a similar deployment of information is accomplished except that the information goes to those indicators (bdhi, hsi and adi) normally monitored by the copilot, rather than to those normally monitored by the pilot, and that the information available at the navigator's station is presented on the VOR/TAC, rather the ADF/TAC bdhi, when the appropriate pointer selector switch has been positioned to TAC 2. Distance information from the No. 1 system is presented on the pilot's horizontal situation indicator whenever system No. 1 is operating and the pilot's mode selector switch is in any position except DOP or TAC 2. Similarly, distance information from the No. 2 system is presented on the copilot's horizontal situation indicator whenever system No. 2 is operating and the copilot's horizontal mode selector switch is in any position except DOP or TAC 1. Tacan audio signals can be monitored by pulling the appropriate tacan button. The tacan system is powered by 28-volt dc power and 115-volt ac power from the essential ac and dc buses through tacan No. 1 and tacan No. 2 circuit breakers on the copilot's upper circuit breaker panel.

Tacan Controls.

Controls for the tacan systems are located on the tacan control panels (figure 4-42) on the flight control pedestal. A five-position (OFF, REC, T/R, A/A REC, A/A TR) function switch selects the mode of operation. With the function switch in the REC position only bearing information is received; with the switch in T/R position both bearing and range data are received. The A/A REC and A/A T/R positions of the switch are the same as the REC and T/R positions, except that the tacan system is transmitting and receiving signals to and from a suitably equipped cooperating airplane rather than a ground station.

Note

The tacan system can receive both distance and bearing information from other suitably equipped airplanes but can only transmit distance information.

CAUTION

The channel selector switch contains a built-in stop to prevent rotation past the nine (9) position on the units (ones) digit setting. Do not attempt to override the stop. Reverse direction when the stop is reached.

The channel selector tunes the equipment to any of 126 frequency channels. The volume control knob varies the volume of the audio signals received from the surface beacon and heard through the intercommunication system when the appropriate monitor button is pulled out. The manual self-test provides a test of the complete tacan system except for the antennas.

Manual Self-Test of Tacan System(s).

CAUTION

Do not perform in-flight self-test when the autopilot is engaged and in the TACAN NAV mode. During the test, the HSI bearing pointer slews to 270 and 180-degree bearings and this can cause the autopilot to fly the aircraft in a manner that causes abrupt aircraft movements.

To initiate self-test, select a course of 180 degrees, place the function switch in the T/R position, and allow 90 seconds for warmup. Depress the test button and, observe that the indicator illuminates for about 1 second and that for about 7 seconds the DME flags and NAV flags come into view and the bearing pointers indicate 270 degrees. For the next 15 seconds, the flags go out of view, the DMEs indicate 000.0 + 0.5), the bearing pointers indicate 180 (+ 3) degrees, the course deviation bar centers to within + 1/2 dot, and the FROM arrow indicates TO. When the self-test is complete, all indicators return to indications displayed prior to initiation of self-test. A failure is recorded on the indicator light if the light stays on during the test; however, the test can be performed again in the REC mode. If the indicator light does not come on in the REC mode, the malfunction is isolated to the transmitter section and the bearing information is valid.

CAUTION

Bearing and/or distance indications may still be present when the TEST lamp is on. Such indications could be either partially usable or grossly inaccurate. They should be cross-checked using every available means. Be prepared for the possibility of tacan equipment failure if the TEST lamp illuminates.

Automatic Self-Test of Tacan System (s).

An automatic self-test occurs when the receiver signal becomes unreliable or the signal is lost to insure that the tacan system is operating properly. The results of the automatic self-test are the same as for the manual self-test except the DME flags and NAV flags remain in view.

CAUTION

Bearing and/or distance indications may still be present when the TEST lamp is on. Such indications could be either partially usable or grossly inaccurate. They should be cross-checked, using every available means. Be prepared for the possibility of tacan equipment failure if the TEST lamp illuminates.

Air-to-Air Modes.

A/A T/R MODE.

In the A/A T/R mode, the AN/ARN 118(V) interrogates a cooperating airplane and receives slant range distance information. Up to five airplanes can receive slant range from one cooperating airplane at one time. If the cooperating airplane has bearing transmitting capabilities, bearing information will be received. Any number of airplanes can receive slant distance range from a cooperating airplane with bearing transmitting capabilities.

A/A REC MODE.

In the A/A REC mode only bearing can be received; however, the cooperating aircraft must have bearing transmitting capabilities.

Note

In air-to-air modes, the receiving airplane must select a channel 63 channels above or below the cooperating airplane channel. Use of Y channels is recommended to prevent possible DME interference. Also to prevent interference from IFF or transponder signals, select Y channels or select X channels between 11 and 58, or 74 and 121.

Normal Operation of the Tacan System(s).

a. Move the function switch to the desired position.

b. Place the navigator's pointer selector switch in the TAC position. Select as follows at that station: TAC 1 for information from the pilot's tacan system, TAC 2 for information from the copilot's tacan system.

c. Place the required mode selector switch in the appropriate position for tacan operation.

d. Place the flight director switch in the NORMAL position.

Note

Normal warmup time is 90 seconds. There is no delay when switching from REC to T/R.

e. Turn the channel selector knob to the desired tacan channel.

Note

VHF (VOR) omni bearing is continuously displayed on the No. 2 pointers of the pilot's and copilot's ID-250 indicators regardless of the position of the VOR-ILS tacan selector switch. Tacan information is presented on the No. 1 pointers, unless ADF is selected, and eliminates the automatic selection of tacan if power to the VOR or ILS power circuits fails. On these airplanes, it is not necessary to turn tacan OFF when using VOR-ILS.

f. Check station identification by pulling out the appropriate tacan button, but adjust audio to a comfortable level by turning the tacan button.

g. To turn the tacan system off, place the function switch in the OFF position.

LOCALIZER AND VOR RECEIVER (AN/ARN-14).

One localizer and VOR receiver receive signals from VHF/VOR stations and from instrument landing system (ILS) localizers. Course information from the receiver is supplied to the following:

Navigator's VOR/TAC radio magnetic indicator (rmi) or VOR/TAC bearing-distance-heading indicator (bdhi) No. 1 bearing pointer.

vhf navigation receiver control panels

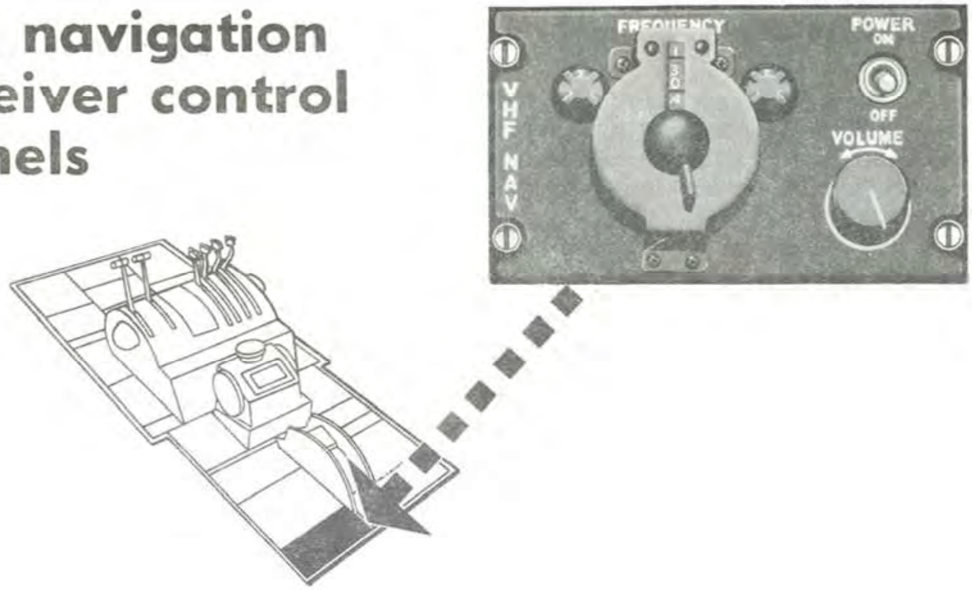


Figure 4-43.

Pilot's VOR/TAC rmi or VOR/TAC bdhi No. 1 bearing pointer (when pilot's pointer sel switch is in the VOR 1 position).

Copilot's VOR/TAC rmi or VOR/TAC bdhi No. 1 bearing pointer (when pilot's pointer selector switch is in the VOR 1 poaition).

Pilot's and copilot's flight director systems (when selected by the mode selector switches).

Audio signals from VOR stations may be monitored by pulling the appropriate VOR button. The localizer and VOR receivers are supplied 28-volt, dc power from the essential dc bus through the VHF navigation No. 1 circuit breakers on the copilot's upper circuit breaker panel.

Localizer and VOR Receiver Controls.

Controls for the localizer and VOR receiver are located on the VHF navigation panels (figure 4-43) on the flight control pedestal. On this panel is a two-position (ON, OFF) power switch, a frequency selector control, and a volume control. Any frequency in the range of 108.0 through 135.9 megacycles is tuned by the frequency selector and displayed in a vertical window. Reading down, the numbers represent hundreds, tens, units, and tenths of megacycles. Additional controls used in conjunction with the localizer and VOR receivers are discussed under the Instrument Selector Control Panels paragraph in this section.

Normal Operation of the Localizer and VOR Receiver.

Operate the equipment by the following procedure:

a. Place the power switch in the ON position.

b. Select the desired operating frequency with the frequency selector.

c. Set the pointer selector switches as necessary to connect the selected VOR receiver to the VOR/TAC rmi or VOR/TAC bdhi.

d. Select the appropriate VOR/ILS position with the mode selector switch.

e. Set the course to be flown with the course set knob on the horizontal situation indicator.

f. Place the flight director switch in the NORMAL position.

g. Check station identification by pulling out the appropriate VOR intercom button, and adjust audio to a comfortable level by turning the VOR button.

To turn the receiver off:

h. Place the power switch in the OFF position.

Emergency Operation of the Localizer and VOR Receiver.

The localizer and VOR receivers are critically adjusted instruments. Any attempt at repairs during flight may temporarily destroy all usefulness of the equipment. In case of failure, check all cables for security. If spare tubes are carried, check for tubes with burned out filaments.

RADIO COMPASS (AN/ARN-6).

The radio compass provides direction finding and homing in the 100- to 1750- kilocycle range. It also may be used as a communication and range receiver in the 100- to 1750-kilocycle range. The control panels (figure 4-44) for the radio compass are located on the flight control pedestal and on the navigator's control panel. Bearing information is fed to the No. 1 bearing pointer of the pilot's and copilot's ADF radio magnetic indicators (rmi) and to the No. 1 bearing pointer of the navigator's ADF/TAC rmi or ADF/TAC bearing-distance-heading indicator (bdhi). Audio signals from the radio compass are available through the intercommunication system. The radio compass operates from 28-volt power from the essential dc bus. The loop antenna assembly operates from 26-volt ac power through a radio compass circuit breaker on the pilot's upper circuit breaker panel.

Radio Compass Controls.

A function switch with OFF, ADF, ANT, LOOP, and CONT positions selects the type of operation of the radio compass and, if necessary, takes control of the No. 1 radio compass from the alternate control panel. A loop control knob provides for rotation of the loop antenna. The volume knob controls the audio output to the intercommunication system. The band switch and tuning crank provide for frequency tuning. A cw-voice switch controls the beat frequency oscillator.

Normal Operation of the Radio Compass.

To put the radio compass into operation.

1. Place the function switch in the ANT position.

Note

Check for control by placing the function switch to the LOOP position and rotate the loop L-R control. If the appropriate bearing pointer does not rotate, momentarily move the CONT position to gain control of the set.

2. Allow a 5-minute warmup period.
3. Place the cw-voice switch in the desired position.
4. Place the appropriate adf mixer switch to ON (forward).
5. Select the operating frequency with the band switch and turning crank. Tune for minimum or zero modulated tone.
6. Place the cw-voice switch in desired position.

To use the radio compass for automatic position findings:

7. Move the function switch to the ADF position.

Note

Do not use a station unless it can be identified by oral or cw signals, as appropriate.

To use the radio compass for aural-null position finding:

8. Move the function switch to the LOOP position.
9. Rotate the loop with loop L-R control knob.

To turn the compass off:

10. Place the function switch in the OFF position.

MARKER BEACON RECEIVER (COLLINS 51Z-4).

A marker beacon receiver gives visual and aural coded signals when the airplane is in range of or passing over a marker beacon transmitter. The visual signal is given through three colored indicator lights on a panel (figure 4-45) on the pilot's instrument panel: blue for an ILS outer marker, amber for an ILS inner marker, and white for airway markers. A two-position (HI, LO) marker beacon switch, located below the three indicator lights, is used to select either high or low receiver sensitivity according to the strength of the incoming signal. The aural signal (400 cps for outer marker, 1,300 cps for inner marker, and 3,000 cps for airway markers) is provided through the intercommunication system. The marker beacon receiver operates from 28-volt dc power supplied from the main dc bus through the copilot's upper circuit breaker panel.

Note

To narrow the apparent width of marker beacon transmissions, it is necessary to select the LO position of the marker beacon switch when flying at high altitudes.

radio compass (adf) control panel (AN/ARN-6)

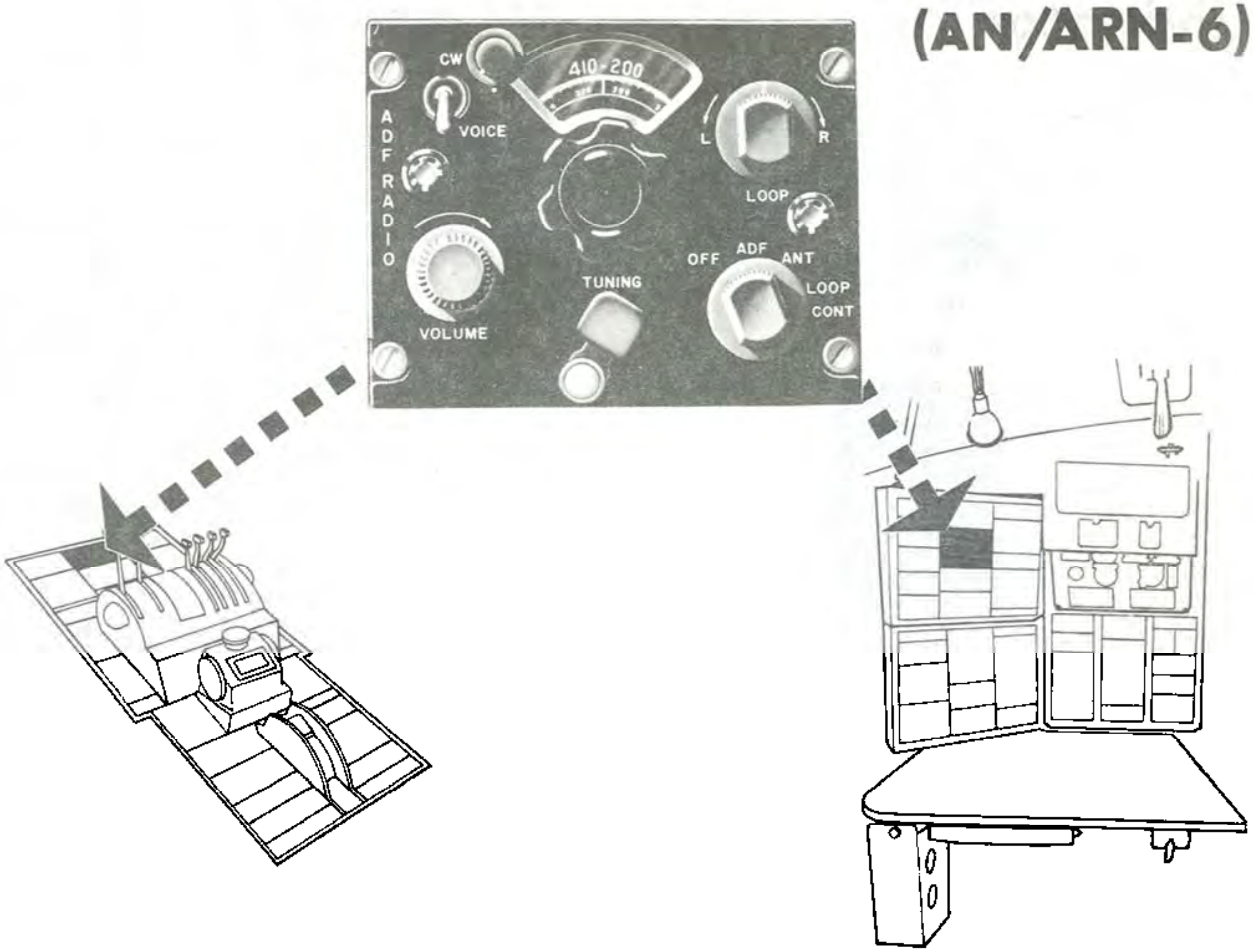


Figure 4-44.

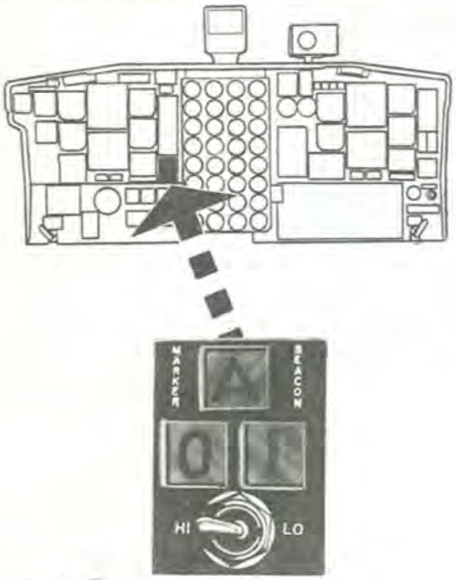
GLIDESLOPE RECEIVER (COLLINS 51V-4).

Two glideslope receivers are installed to provide vertical guidance information to the pilot's flight director systems. When an ILS frequency is selected, the glideslope receiver is automatically tuned to a frequency corresponding with the selected ILS frequency. The glideslope receivers operate on 28-volt dc power supplied from the essential dc bus through the glideslope No. 1 and No. 2 circuit breakers on the copilot's upper circuit breaker panel. The elapse time indicators operate on 115-volt ac supplied from the essential ac bus through the glideslope No. 1 and glideslope No. 2 circuit breakers located on the copilot's upper circuit breaker panel.

RADAR ALTIMETER (AN/APN-171).

This radar altimeter is located on the pilot's instrument panel (figure 1-62). The radar altimeter provides an indication of terrain clearance of the airplane and displays a LOW warning light when the altitude is below the manually set low level warning index. A system test feature provides an indication that the radar altimeter is operating correctly. A warning flag on the indicator is displayed when the radar altimeter is turned off or when power is lost. The radar altimeter operates from 28-volts dc from the essential dc bus and 115-volts ac from the essential ac bus through low range altimeter circuit breakers on the copilot's upper circuit breaker panel.

marker beacon indicator



SEE 15-60
WARNING Added
Figure 4-45.

Radar Altimeter Controls.

All functions of the radar altimeter are controlled by the off-set knob on the indicator. Rotating the off-set knob to move the low level warning index above zero turns the radar altimeter on and sets the clearance altitude, below which warning will be given. A red LOW warning light on the indicator glows whenever the airplane is below the preset altitude. When the off-set knob is held depressed the indicator will indicate a test altitude of 100 ± 15 feet if the radar altimeter is operating correctly. Release of the knob restores the system to normal operation.

SEE 15-60

Normal Operation of the Radar Altimeter.

To put the radar altimeter into operation:

1. Rotate the off-set knob clockwise.
2. Set the desired altitude reference with the off-set knob, and allow 5-minutes warmup before relying on the indications.

To test the radar altimeter for correct operation:

3. Hold the off-set knob depressed and observe that indicator is indicating a test altitude of 100 + 15 feet.

To turn the radar altimeter off:

4. Rotate the off-set knob to the extreme counter-clockwise position.

FLIGHT DIRECTOR SYSTEM.

Two complete and separate flight director systems are installed in the airplane, one each for the pilot and copilot. Each consists of a flight director computer, an attitude director indicator, a horizontal situation indicator, a rate gyro, and MD-1 gyro, a rate-of-turn sensor, and instrument selector switches for connecting navigation systems to the flight director. These systems are Doppler, tacan, and VOR/ILS. Because the individual navigation systems are designed to supply only a certain number of instrument loads and only one course set knob can be used to control the course selected, it is necessary to have only one pilot using any one system at a time, with the pilot having priority. Therefore, the copilot is provided with a selected system off indicator light that illuminates when the copilot selects any mode of operation, other than HDG (Heading), that is selected by the pilot. The flight director computers are powered from the essential ac bus through the flight director No. 1 and flight director No. 2 computer circuit breakers on the copilot's upper circuit breaker panel. The flight director gyros are powered by 115-volt, 400-cycle, phase A and B power from the copilot's inverter bus through the No. 1 and No. 2 flight director gyro and indicator fuses on the pilot's lower circuit breaker panel. The rate-of-turn gyros are powered by 28-volt dc from the essential dc bus through the flight director No. 1 and flight director No. 2 gyro circuit breakers on the copilot's upper circuit breaker panel.

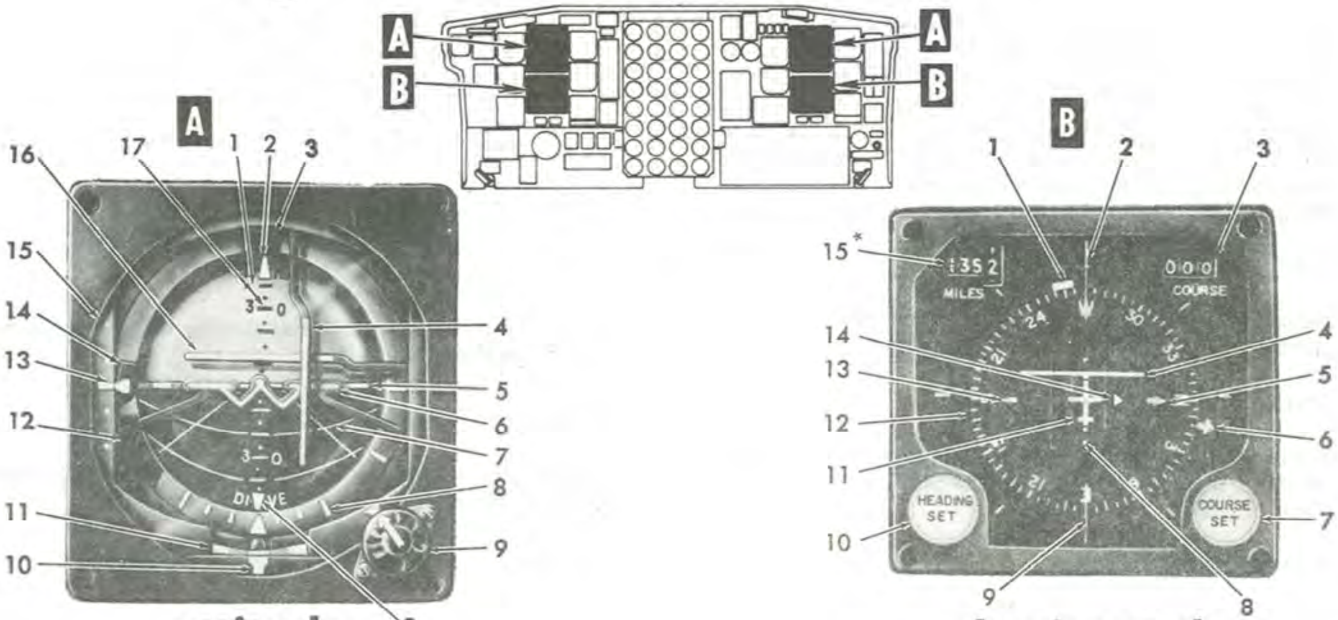
Note

Power for the flight director system should be obtained from the essential ac bus during all modes of flight operation. In the event that standby power from the copilot's inverter is being used in lieu of the essential ac bus the bank and pitch steering bars may give jittery indications. If oscillation is excessive, it is recommended that the mode selector and flight director switches on the instrument selector panels (figure 4-47) should be positioned to HDG and NORMAL respectively.

Horizontal Situation Indicator.

Each of the two horizontal situation indicators (figure 4-46) presents a plan view display of the airplane with respect to heading, bearing, distance, displacement off course, and ambiguity information. A selected heading or course may be selected on either the pilot's or copilot's horizontal situation indicator and tied in with the flight director and navigation systems. The pilot's selection may be tied in with the autopilot. Navigation systems are connected to the horizontal situation indicators by means of a mode selector switch. The horizontal situation indicators receive 115-volt power from the essential ac bus through the HSI No. 1 and HSI No. 2 fuses on the pilot's lower circuit

flight director system indicators



attitude director indicator

1. ATTITUDE SPHERE
2. BANK POINTER
3. COURSE WARNING FLAG
4. BANK STEERING BAR
5. HORIZON BAR
6. MINIATURE AIRCRAFT
7. GROUND PERSPECTIVE LINES
8. BANK INDEX SCALE
9. PITCH TRIM KNOB
10. TURN NEEDLE
11. SLIP INDICATOR
12. ATTITUDE WARNING FLAG
13. GLIDE SLOPE INDICATOR
14. GLIDE SLOPE WARNING FLAG
15. GLIDE SLOPE DEVIATION SCALE
16. PITCH STEERING BAR
17. PITCH REFERENCE SCALE

horizontal situation indicator

1. HEADING MARKER
2. UPPER LUBBER LINE
3. COURSE SELECTOR WINDOW
4. COURSE DEVIATION INDICATOR
5. COURSE ARROW (HEAD)
6. BEARING POINTER
7. COURSE SET KNOB
8. COURSE DEVIATION DOTS
9. LOWER LUBBER LINE
10. HEADING SET KNOB
11. AIRCRAFT SYMBOL
12. COMPASS CARD
13. COURSE ARROW (TAIL)
14. TO-FROM INDICATOR
15. RANGE INDICATOR

Figure 4-46.

breaker panel. The horizontal situation indicators contain the following components:

COMPASS CARD (12).

The compass card on the pilot's horizontal situation indicator repeats the heading of the No. 1C-12 compass, and the compass card on the copilot's indicator repeats the heading of the No. 2 C-12 compass.

HEADING MARKER (1).

Set to the desired magnetic heading by the heading set knob (10); rotates with compass card.

COURSE SELECTOR WINDOW (3).

Gives a digital readout of the position of the course arrow.

COURSE ARROW (5).

Indicates airplane heading with the mode selector switch in the HDG position. Indicates the selected radial with the mode selector switch in any of the navigator aid positions. This arrow is set by the course set knob (7), and rotates with the compass card.

COURSE SET KNOB (7).

Used to set course arrow, with the mode selector switch in any position except HDG.

Note

The course set knob should be turned smoothly at a slow or moderate rate to prevent damage to the indicator.

COURSE DEVIATION INDICATOR (4).

Presents displacement of the airplane to the right or left of the selected course. There are two dots on each side of the aircraft symbol. The dot scale is calibrated at 5 degrees for each dot on the VOR or tacan and 1.25 degrees for each dot on the ILS. During the Doppler mode, the first dot on the scale represents 3 miles, the second dot is uncalibrated; the scale then becomes nonlinear after the first dot.

TO-FROM INDICATOR (14).

Indicates which end of the course arrow points toward the selected VOR or tacan station.

BEARING POINTER (6).

Indicates magnetic bearing of a selected VOR or tacan station, except in Doppler the pointer gives track angle error.

RANGE INDICATOR (15).

Indicates distance in nautical miles from the airplane to a selected tacan station or destination in Doppler mode.

Attitude Director Indicator.

The attitude director indicators (figure 4-46) present the forward display of the airplane and are the primary attitude instruments for combining roll and pitch, turn and slip, and computed steering information. The attitude director indicators receive power from the copilot's ac instrument bus through the flight director gyro No. 1 and No. 2 fuses on the pilot's lower circuit breaker panel. The attitude director indicator is made up of the following items:

ATTITUDE SPHERE (1).

Provides an aritificial horizon which, relative to the miniature airplane (6), shows roll and pitch attitudes of the airplane.

BANK POINTER (2).

Rotates with the roll gimbal to indicate bank angle against the bank index scale (8).

PITCH TRIM KNOB (9).

Used to adjust the position of the attitude sphere in in the pitch axis.

BANK STEERING BAR (4).

Supplies an indication for steering to and maintain a selected heading, with the flight director switch in the MANUAL position.

Note

For operation with the flight director switch in the NORMAL position, refer to individual mode of operation this section.

SLIP INDICATOR (11).

Indicates airplane slip or skid information.

TURN NEEDLE (10).

Used in conjunction with the slip indicator to indicate coordinated turns.

PITCH STEERING BAR (16).

Supplies an indication for steering to intercept and maintain the glide slope beam.

GLIDE SLOPE INDICATOR (13).

Presents airplane position relative to the glide slope, as indicated on the glide slope deviation scale (15). Each dot on the deviation scale equals 0.25 degree.

WARNING FLAGS (3) (14) (12).

Each attitude director indicator contains three warning flags, the course warning flag (3), the glide slope warning flag (14), and the attitude warning flag (12). The course warning flag indicates loss of signal and monitors information from the VOR/ILS or tacan system and the flight director computer. The glide slope warning flag indicates loss of signal or invalid signal from the glide slope receiver.

WARNING

If failure of the attitude sphere occurs and the copilot's inverter switch is in the NORMAL or AC position, place the switch to the STANDBY or INVERTER position.

The attitude warning flag (12) indicates loss of power to the indicator.

Instrument Selector Control Panels.

Each of the two instrument selector control panels (figure 4-47) contains a flight director switch, a mode selector switch, and a pointer selector switch. The copilot's panel is also equipped with an ADI selector switch.

instrument selector control panels

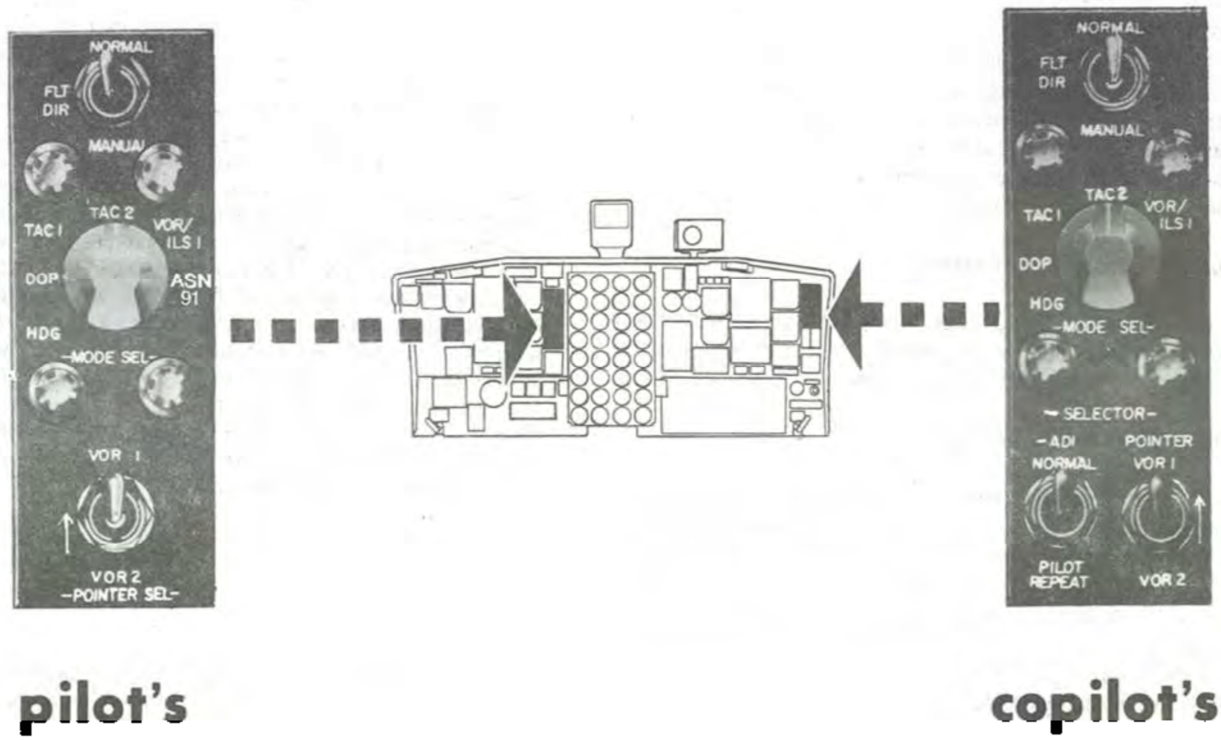


Figure 4-47.

FLT DIR SWITCH.

The two-position (NORMAL, MANUAL) flight director switch controls the manner in which information selected by the mode selector switch will be supplied to the flight director computer and the attitude director indicator.

MODE SEL SWITCH.

The multi-position mode selector switches are provided to connect a navigation system to the horizontal situation indicators and the flight director computers. The copilot's switch has five positions (HDG, DOP, TAC-1, TAC-2 and VOR/ILS-1) on the switch. The pilot's switch has six positions (HDG, DOP, TAC-1, TAC-2, VOR/ILS-1 and ASN-91) available.

POINTER SELECTOR SWITCHES.

Pointer selector switches, located on the pilot's and copilot's instrument selector panels (figure 4-47) and on the navigator's instrument panel (figure 4-54) are provided to permit selection of the source of information to be displayed on radio magnetic indicators (rmi) or on bearing-distance-heading indicators (bdhi). The pilot and copilot can selectively direct VOR 1 or VOR 2 information on the No. 1 bearing pointer of the VOR/TAC rmi or VOR/TAC bdhi located on their respective instrument panels; the navigator can selectively direct TAC 1 or information to the No. 2 bearing pointer of his VOR/TAC rmi or VOR/TAC bdhi.

ADI (ATTITUDE DIRECTOR INDICATOR) SELECTOR SWITCH.

The adi selector switch (figure 4-47) is a two-position (NORMAL, PILOT REPEAT) toggle switch located on the copilot's instruments selector panel. When the adi selector switch is placed in the PILOT REPEAT position during an ILS approach, the copilot's attitude director indicator displays the information being presented on the pilot's attitude director indicator. The copilot's adi repeat indicator will illuminate when the adi selector switch is placed in the PILOT REPEAT position, provided the pilot has selected VOR/ILS 1 with the mode selector switch and an ILS frequency has been selected. The adi repeat indicator receives power from the main dc bus through the No. 1 flight director relay circuit breaker on the copilot's upper circuit breaker panel.

Selected NAV System Off Indicator.

The selected navigator system off indicator (figure 1-63), located on the copilot's main instrument panel, will illuminate to indicate that the copilot's selection with the mode selector switch has been disconnected. Any selection made by the copilot, other than HDG, will be disconnected if the pilot selects the same mode of operation. The selected navigator system off indicator is powered through the circuit breaker associated with the system selected by the pilot.

Mode Selector Operation.

In the following paragraphs, each position of the mode selector switch will be discussed with the flight director switch in both the NORMAL and MANUAL positions.

HDG (HEADING SELECTION).

With the mode selector switch in HDG and the flight director switch in NORMAL, the flight director computer operates in the auto navigator mode. No radio aid is used in this mode, and the attitude director indicator operates as a basic attitude indicator. The horizontal situation indicator will function only as a compass repeater, with the range indicator connected to tacan. The course arrow is slaved to the respective compass heading signal, thus always straight up. This gives a continuous digital indication of airplane heading in the course selector window. By switching the flight director switch to MANUAL, the flight director is in a manual heading mode. The horizontal situation indicator continues to operate as in auto navigator, except that the heading set knob can be used to select a heading to fly as directed by the flight director computer on the bank steering bar of the attitude director indicator. The flight director computer combines heading error and bank angle so that a selected heading may be intercepted and maintained, by centering the bank steering bar and keeping it centered. The course warning flag remains out of view as long as the computer functions properly.

Note

The following paragraphs describe only the equipment. For normal operation, refer to Doppler, tacan, and VOR/ILS normal operating procedures in this chapter.

DOP (DOPPLER) SELECTION.

With the mode selector switch in DOP and the flight director switch in NORMAL, the flight director will be in the radio track mode, using information from the Doppler navigation system. The navigator selects the desired course and determines the distance to destination, which is then set on the Doppler computer. Flying a Doppler track differs from a radio radial in that the airplane must be over a known starting point when the system is turned on. After that, the Doppler computer keeps track of airplane location to supply proper information to the indicator. (The course arrow on the horizontal situation indicator should be set to the desired course.) The flight director is supplied with a track angle error signal from the Doppler system, which is combined with course deviation and bank angle to drive the bank steering bar on the attitude director indicator so that an intercept of the Doppler track can be made and maintained. All other pointers on the attitude director indicator remain out of view. Information displayed on the horizontal situation indicator consists of course (cross-track) deviation in miles on the course deviation indicator, track angle error on the bearing indicator, distance to go along track in the range indicator window, and heading.

Note

The bearing pointer will indicate the direction of flight required to gain the correct track rather than the actual direction of flight.

The bearing pointer will be straight up under the lubber line when the proper crab angle for maintaining the desired track is obtained. However, it is possible that the airplane could still be displaced from the proper track, as this indication only assures that the airplane is flying on or parallel to the desired track. With the bearing indicator and the course deviation indicator centered, the course is being made good, and the drift angle can then be determined as the difference between airplane heading and the position of the head of the course arrow. The range indicator will indicate distance to go to destination. There is no ambiguity information, and the to-from indicator is out of view. By switching the flight director switch to MANUAL, the flight director goes into the manual heading mode. The attitude director indicator will display steering information on the bank steering bar for a selected heading as set by the heading set knob on the horizontal situation indicator. In Doppler operation, except for computer failure, there is no warning flag. All other functions of the horizontal situation indicator remain the same as described with the flight director switch in the NORMAL position.

TAC-1 and TAC-2 SELECTIONS.

With the flight director switch in NORMAL and the mode selector switch in TAC 1 or TAC 2, the associated flight director computer will be in the radio track mode, using information from the selected tacan system. Tune the tacan transceiver to the desired station. The course arrow on the associated horizontal situation indicator is set to the selected tacan radial to supply a course error signal to the flight director and to resolve the signals from the tacan receiver. The flight director combines the course error signal with course deviation and bank angle to drive the bank steering bar on the attitude director indicator so that an asymptotic intercept of the selected radial can be made and the maintained. The course warning flag remains out of view as long as the computer functions properly and is receiving valid information. All other pointers in the attitude director indicator remain out of view. Information displayed on the horizontal situation indicator consists of course deviation in degrees on the course deviation indicator, bearing to the selected tacan station on the bearing pointer, distance to the station on the range indicator, ambiguity on the to-from indicator, and heading. By switching the flight director switch to MANUAL, the flight director computer selects the manual heading mode. The attitude director and will display steering information on the bank steering bar for a selected heading as set by the heading set knob on the horizontal situation indicator. The course warning flag remains out of view while a valid signal from the tacan set is maintained. The course set knob still controls the selection of the desired radial, and all other functions of the horizontal situation indicator remain the same as when the flight director switch is in the NORMAL position.

VOR/ILS SELECTION.

With the mode selector switch in VOR/ILS 1 and the flight director switch in NORMAL, the flight director will be in the radio track mode when the corresponding omni receiver is tuned to a VOR frequency. Information displayed on the horizontal situation indicator and the attitude director indicator is the same as described for tacan. When the flight director switch is placed in the MANUAL position, the manual heading mode is selected by the flight director system, and the information displayed on the horizontal situation indicator and the attitude director indicator is the same as described for tacan. When an ILS frequency is selected, with the mode selector switch in VOR/ILS 1 and the flight director switch in NORMAL, the flight director computer selects the ILS mode, and the corresponding glide slope receiver is tuned to a frequency corresponding with the selected ILS frequency. The flight director now uses information from the localizer receiver. The course arrow on the horizontal situation indicator should be set to the inbound localizer course. The localizer course supplies the flight director computer with a heading error signal that is combined with localizer deviation and bank angle to drive the bank steering bar on the attitude director indicator so that an intercept of the localizer beam can be made and maintained. The localizer warning flag remains out of view as long as valid information is being received and the flight director computer is functioning properly. The glide slope warning flag remains out of view as long as valid information is being received. The pitch steering bar remains out of view until the computer automatically switches to the ILS approach mode. Localizer deviation is displayed on the course deviation indicator of the horizontal situation indicator. No ambiguity or bearing information is available. The flight director computer will automatically switch from the ILS mode to the ILS approach mode when the airplane is within approximately one needle width of the center of the glide slope while making an ILS approach from beneath the glide slope. On some airplanes it is possible to capture the glide slope from above or below. If the airplane moves off the glide slope on localizer by approximately two dots (one dot on some airplanes) the computer will automatically switch back to the ILS mode, and the pitch steering bar will disappear. On some airplanes it will be necessary to descend below the glide slope to reswitch the flight director automatically to the ILS approach mode and thereby regain the pitch steering bar. The flight director computer combines heading error, localizer deviation, and bank angle to drive the bank steering bar on the attitude director indicator The flight director computer also combines glide slope deviation and pitch angle, which is displayed on the pitch steering bar as information to intercept and maintain the glide slope beam. The glide slope indicator continues to give glide slope information; however, the pitch steering bar will be masked from view in this configuration. The horizontal situation indicator continues to operate as in the ILS mode. If the flight director switch is placed in the MANUAL position, the flight director computer goes into the ILS manual mode.

ASN-91 SELECTION.

The pilot's attitude director indicator (ADI) is used as part of the flight director system and also as the approach guidance indicator (AGI) for the fire control system. In the ASN-91 position, the ADI is controlled by the fire control system, provides the pilot with steering information to the attack circle and indicates when to enter the bank angle.

Two types of guidance, waypoint or orbit, are available from the tactical computer. Waypoint provides guidance directly to the selected destination. Orbit is the same as waypoint up to 8nm from the destination. At this point approach guidance is automatically activated and the AGI steering bars will direct

guidance interface

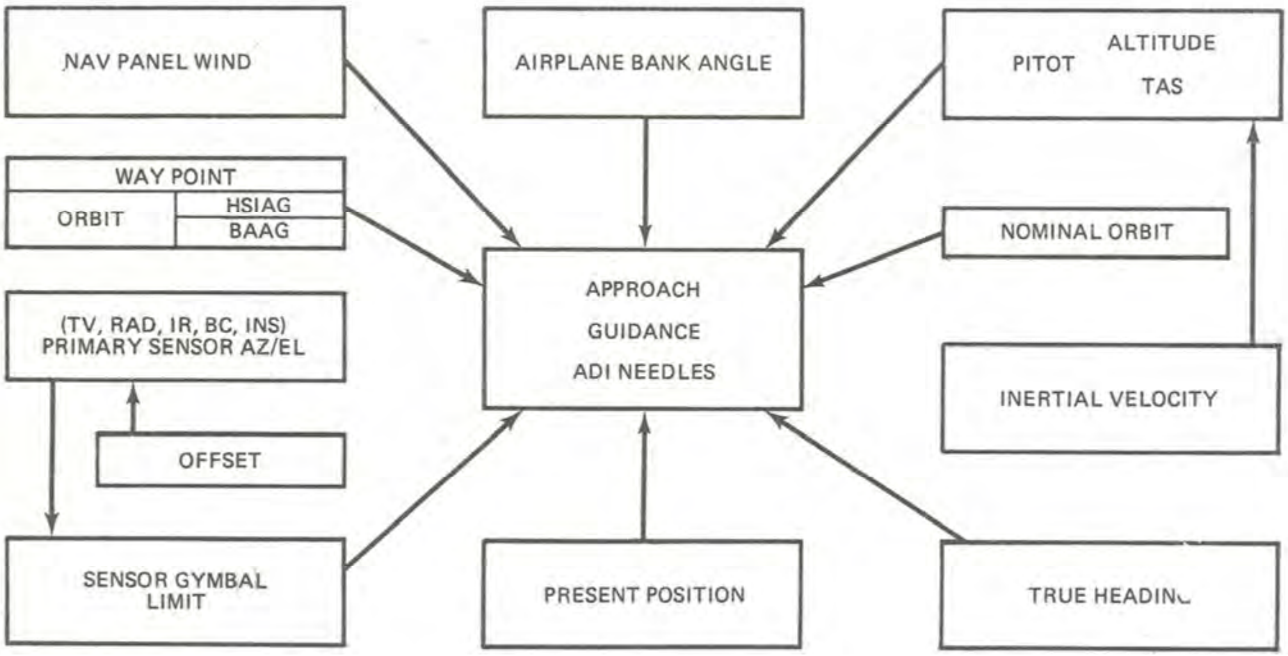


Figure 4-48.

the aircraft into attack geometry. Two types of approach guidance HSIAG and BAAG, are available when orbit is selected. Horizontal situation indicator approach guidance (HSIAG) is a wings level approach to a tangent point on the attack circle. Bank angle command attack guidance (BAAG) provides lead in guidance for nominal bank angle upon arrival at the attack circle.

The ADI has three warning flags which, during normal operation, are deflected from view. The attitude warning flag comes into view when roll and pitch information is unreliable or not available, or when indicator power is lost. The glideslope warning flag indicates lost or unreliable glideslope information, and the course warning flag indicates lost or unreliable course information, or a malfunction in the flight director computer (FDC). In the ASN-91 mode, the flag is present until horizontal and vertical needles are centered; at that time, the flag disappears behind the mask. This indicates that the pilot should transition to HUD symbology. During trainable gun operations, the flag is present until the CIP and PA are within limits set into the FCP (box limits).

Normal Operation of the Flight Director System.

The following procedures should be used to place the flight director system into normal operation:

a. Set ADI mode selector switch to NORM (some airplanes).

b. Place the flight director switch in the NORMAL position.

c. Place the mode selector switch in HDG.

(1) All pointers and flags should be out of view.

(2) The course arrow should slave to the lubber line.

(3) The course selector window should indicate the compass heading.

d. Place the flight director switch in the manual position.

(1) Set the heading marker to the airplane heading. The bank steering bar should center.

(2) Rotate the heading marker left and right. The bank steering bar should move in the same direction.

(3) Rotate the pitch trim knob up and down. The attitude sphere should deflect up and down respectively. Align the horizon bar with the miniature airplane.

OFF-NOMINAL INDICATORS.

The off-nominal indicators panel is located above the copilot's instrument panel (figure 4-49). It has two displays that provide aircraft off-nominal true airspeed and altitude data to the copilot. The altitude digital display indicates off nominal altitude on the last three digits to an accuracy of 10 feet. The first digit indicates (-) if the aircraft is lower than nominal altitude. The off nominal true airspeed needle indicates the aircraft is flying faster (high) or slower (low) than nominal true airspeed. The green area of the display includes a range of + 2 1/2 knots, yellow indicates 2 1/2 to 5 knots and white indicates 5 knots or more off nominal true airspeed. The off-nominal indicators panel is interfaced with the computer which provides drive signals for both displays.

AIMS RADAR SYSTEM (IFF) (AN/APX-72).

Note

The term AIMS as applied to the radar identification system is defined as follows:

A - Air traffic control radar beacon

I - Identification-friend or foe

M - Military equipment

S - Special systems

The AIMS radar identification system provides automatic radar identification of the airplane when interrogated by surface or airborne radar sets using correctly coded pulse transmissions. Five modes of interrogation are used in the AIMS (IFF) system, and the set will reply to any or all of these depending on how the master selector and mode switches are set. Airplane identification, location, and pressure altitude are transmitted to interrogating radar sets utilizing Modes 1, 2, 3 and C. A special altimeter-encoder (figure 1-62) is used to produce a digital output of pressure altitude which is transmitted when interrogated on Mode C. Mode 4 provides a secure (encrypted)IFF capability. The special Mode 4 computer processes Mode 4 interrogations and causes the transponder to generate appropriately coded reply signals.

off-nominal indicator

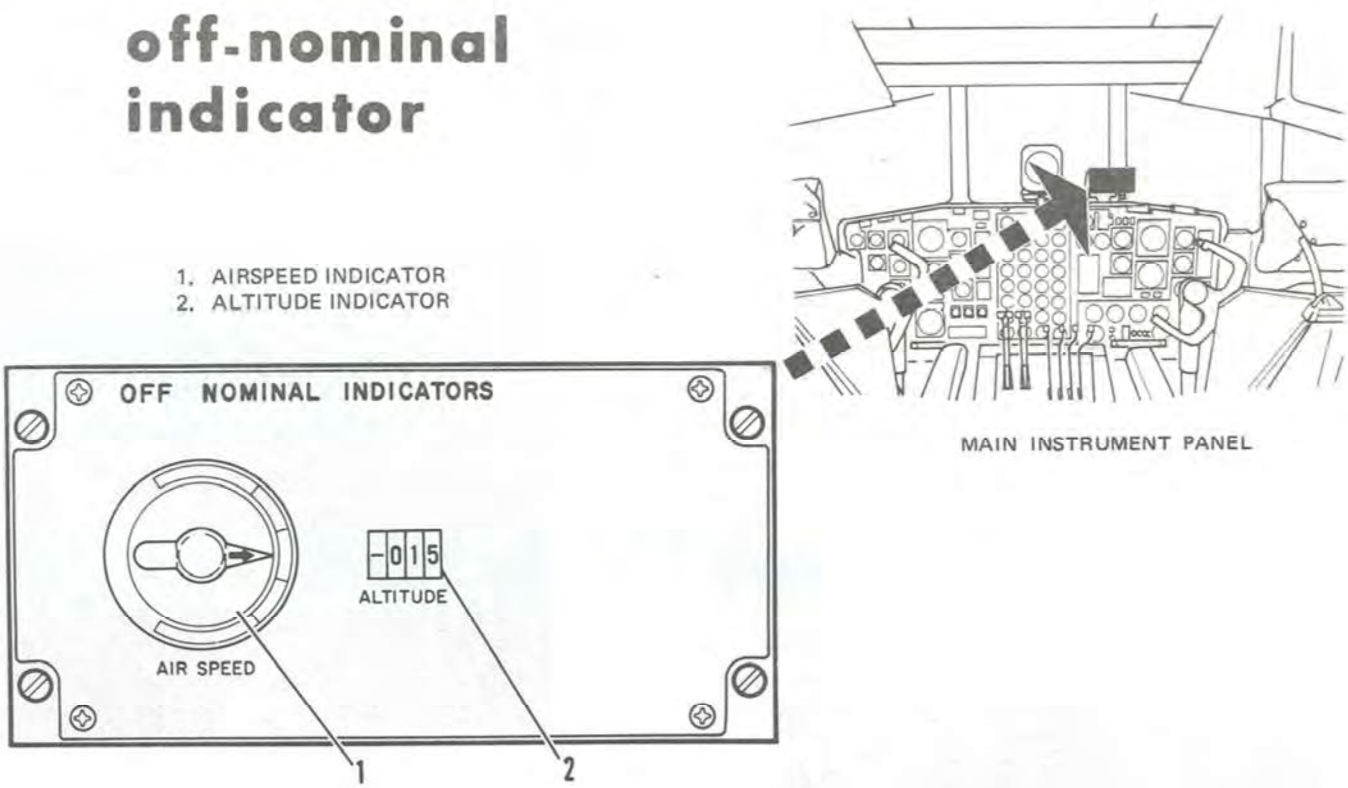


Figure 4-49.

The system also enables friendly airplanes to identify themselves apart from other friendly airplanes and provides a means of transmitting a special coded signal known as an emergency reply.

The system is powered by 28 volts dc, and regulated 115 volts ac through circuit breakers on the copilot's upper circuit breaker panel.

Transponder Control Panel.

Operation and control of the system is accomplished with the transponder control panel (figure 4-50) which contains the following controls and indicators:

MASTER SWITCH.

A rotary-type, five-position master switch allows the operator to select the following operating conditions: OFF, STBY (standby), LOW (low sensitivity), NORM (normal sensitivity), and EMER (emergency). When the switch is set to OFF, all power is removed from the system. In STBY, operating power is applied and the system is ready for immediate operation when the master switch is set to LOW or NORM. However, when in STBY, the absence of replies when interrogated in Mode 4 causes the IFF caution light to illuminate. When the master switch is set to EMER, the system transmits an emergency reply when interrogated. To prevent accidentally switching to either EMER or OFF, the switch knob must be pulled out before the switch can be turned to either of these positions.

IDENT-OUT-MIC SWITCH.

A three-position IDENT, OUT, MIC toggle switch controls the ident function. When the switch is set to IDENT, and the Mode 1 or Mode 3 coder group selector control has a code set in, the system generates coded replies for Modes 1 through 3. Mode C and 4 are not affected. The ident pulse trans are transmitted from 15 to 30 seconds, plus the time the switch is held to IDENT. The switch is spring-returned to the OUT position from the IDENT position. The OUT position disables the ident function. When the MIC position is selected, control of the ident function is transferred to the pilot's microphone switch when the UHF command radio is operating.

MODE 1 ENABLE AND TEST SWITCH.

A three position toggle-type switch allows the operator to enable, test, and disable Mode 1. When held in the TEST position, the transponder test set is energized and generates a Mode 1 interrogation. If a correct reply is made by the transponder the reply indicator light illuminates. ON position enables the Mode 1 function and the OUT position disables the Mode 1 function. The switch is spring-returned from the TEST position to the ON position.

MODE 2 ENABLE AND TEST SWITCH.

This switch is the same as the Mode 1 switch and performs functionally for Mode 2 in the same manner as Mode 1.

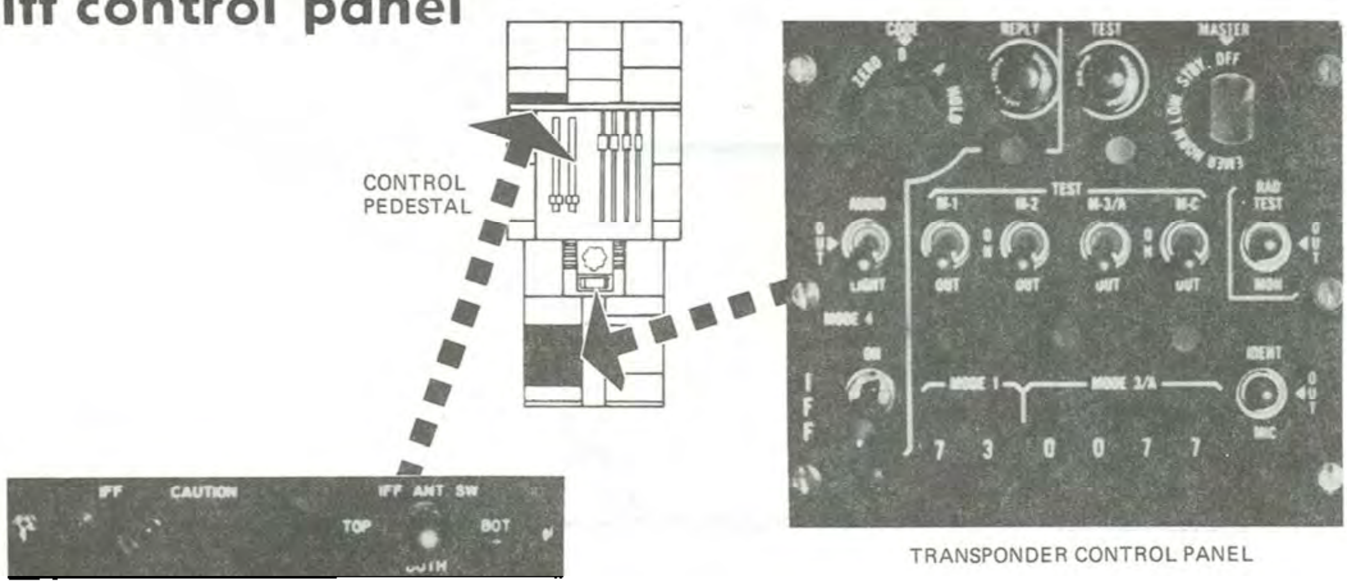
MODE 3/A ENABLE AND TEST SWITCH.

This switch is the same as the Mode 1 switch and performs functionally for Mode 3/A in the same manner as Mode 1.

MODE C ALTITUDE REPORTING ENABLE AND TEST SWITCH.

This switch is the same as the Mode 1 switch and performs functionally for Mode C in the same manner as Mode 1.

iff control panel



TRANSPONDER CONTROL PANEL

IFF ANTENNA SWITCH AND CAUTION LIGHT PANEL

Figure 4-50.

RADIATION-TEST-MONITOR ENABLE SWITCH.

A three-position (RAD TEST, OUT, MON) toggle-type switch is provided for control of the monitor and radiation-test functions of the system. When placed to the MON position, the monitor circuits of the transponder test set are enabled for inflight monitoring of the transponder's replies to interrogations on any mode other than Mode 4. Correct replies are indicated by illumination of the test indicator light. The RAD TEST position is used by maintenance personnel when performing checkout of the system utilizing an IFF test set. The switch is spring-returned from the RAD TEST position to the OUT position.

MODE 1 CODE SELECTORS.

These selectors consist of two in-line edge-wise-mounted thumb wheels which select the Mode 1 codes, and are continuously rotatable with no stops. The left wheel has eight positions, numbered 0 through 7 consecutively. The right wheel is similar to the left except that the numbering is 0 through 3, appearing twice (one on each half of the drum).

MODE 3/A CODE SELECTORS.

These selectors consists of four in-line edgewise-mounted thumb wheels which select the Mode 3 codes, and are continuously rotatable with no stops. Each wheel has eight positions, numbered 0 through 7 consecutively.

MODE REPLY SELF-TEST INDICATOR LIGHT.

A green reply indicator light is provided to indicate satisfactory operation of the transponder for self tests of Modes 1, 2, 3, and C and for monitoring proper response to any interrogation other than Mode 4.

MODE 4 ENABLE SWITCH.

A two-position, lever lock type switch is provided for control of the Mode 4 operation. When placed to ON, the switch is in the up and locked position and Mode 4 is enabled. When the switch is unlocked and moved down, it is in the OUT position.

MODE 4 INDICATION SWITCH.

A three-position, (AUDIO, OUT, LIGHT) toggle-type switch is provided for control of the Mode 4 indication. The AUDIO position enables both the visual and audio reply indication. The OUT position disables the mode 4 indicator function of the system. When the switch is placed to LIGHT, only the visual indication is enabled.

Note

No provision is made for audio indications; therefore, only the visual indication can be received whether in AUDIO or LIGHT position.

MODE 4 CODE SWITCH.

A four-position, (HOLD, A, B, ZERO) rotary-type switch is provided for control of Mode 4 operation. HOLD position provides for retaining Mode 4 codes during a refueling stop. When placed to the HOLD position momentarily and 15 seconds is allowed before turning power off, the codes are mechanically latched and will be retained when power is removed from the set provided the airplane's landing gear is down and locked. The switch is spring loaded to return to A from the HOLD position. The A position selects A codes. The B position selects B codes. The ZERO position zeroizes the code settings. The switch is designed so that it must be pulled out before it can be turned to ZERO or OFF thereby preventing inadvertent selection of these positions.

MODE 4 REPLY INDICATOR LIGHT.

A green indicator light is provided for indication of Mode 4 replies that occur when the Mode 4 indication switch is either in the AUDIO or LIGHT position.

IFF CAUTION LIGHT.

An IFF caution light on the IFF antenna switch and caution light panel is provided to warn the pilots that the transponder has not replied to a Mode 4 interrogation.

IFF ANTENNA SWITCH.

A three-position toggle-type switch on the IFF antenna switch and caution light panel is provided for selection of IFF antennas. TOP position selects the top IFF antenna only, BOT position selects the bottom IFF antenna only, and BOTH position selects the top and bottom IFF antennas.

IFF Self Test.

1. Set the IFF master switch to STBY. Allow 3 minutes for the set to warm up.
2. Set Mode 1, 2, 3/A, and C enable switches to OUT.
3. Set code selectors as required.
4. Set master switch to NORM or LOW.
5. Hold Mode 1 enable switch to TEST. The test light should illuminate.
6. Release the Mode 1 enable switch. The light should go out.
7. Return the Mode 1 switch to OUT.
8. Repeat steps 5 through 7 for Mode 2, 3A, and C.

equipment power panel

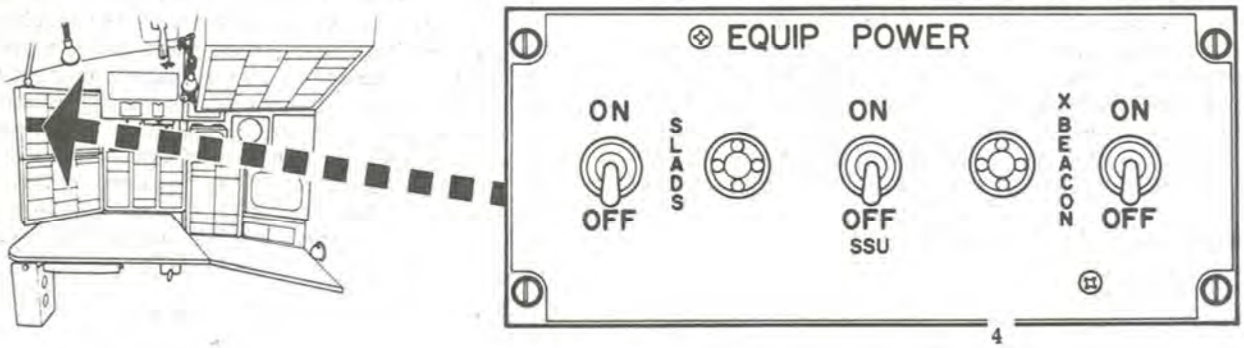


Figure 4-51.

9. Set master switch to STBY.

10. Set enable switches, code select switches, and Mode 4 switches as required.

11. Set radiation test monitor switch as required.

12. Set IFF antenna switch to BOTH.

Normal Operation of IFF.

To place the IFF in operation, proceed as follows:

1. Set the master switch on the transponder control panel as required before take-off and during flight.

2. Select the desired mode of operation (1, 2 or 3/A).

3. Set in the desired code with the code selectors or mode enable switches.

4. Set Mode C to On.

5. Set Mode 4 to ON.

6. Set Mode 4 code switch to appropriate code (A or B).

7. Set IFF antenna switch to TOP, BOT, or BOTH as desired.

Emergency Operation of IFF.

To place the IFF in emergency operation, pull up on the master switch, and rotate to the EMER position.

To turn the IFF system off, pull up on the MASTER switch and rotate to the OFF position.

X-BAND RADAR TRANSPONDER (SST-181X).

The radar transponder (SST-181X) is a receiver-transmitter that operates in the frequency range of 9310 to 9415 mHz to provide an air-to-ground or air-to-air identification beacon. It has a range of at least 100 nautical miles at all azimuth angles at radar line-of-sight altitudes. The SST-181X has the capability to transmit 10 codes. Major components are the receiver-transmitter unit located in the top area of the vertical stabilizer and an antenna located just forward of the anticollision light on the vertical stabilizer. The receiver-transmitter unit is controlled by an ON-OFF toggle switch at the navigator's station (figure 4-51). The unit operates on 28 volts dc from the essential dc bus through the X-band beacon 5-ampere circuit breaker located on the copilot's lower circuit breaker panel. When required, one of nine codes must be preset by maintenance personnel. On airplanes modified by T.O. 130-949 the code setting is made in the receiver-transmitter for aerial refueling rendezvous purposes.

Note

Under extremely cold conditions the SST-181X transponder may require 5 minutes to warm up.

AUTOPILOT.

The E-4 autopilot operates the flight control system of the airplane to maintain normal stabilized attitudes automatically. The autopilot also maintains any desired heading by using C-12 compass information. The system provides coordinated turn control, automatic elevator trim, constant-pressure altitude control, automatic VOR, Doppler radar, and tacan tracking, and automatic ILS approach control for instrument landing system approaches.

The autopilot is powered by 28-volt dc power from the essential dc bus through circuit breakers on the copilot's lower circuit breaker panel and 115-volt, 400-cycle ac power from the essential ac bus through a circuit breaker on the pilot's upper circuit breaker panel.

AUTO PILOT CONTROLS.

The autopilot controls (figure 4-52) are located on the autopilot controller and the autopilot control panel on the flight control pedestal.

Pilot Switch.

A pilot switch on the autopilot controller controls the electronic circuits of the autopilot. The pilot switch can be placed in the ON position only if the following conditions are met:

1. Airplane ac and dc power uses have been energized to supply power to the autopilot for approximately 3 minutes.
2. Servo engaging switches are in the DISENGAGED position.
3. Turn knob is centered (in detent).
4. Radio beam coupler switch is in the GYRO PILOT position.

Servo Engaging Switches.

There are three engaging switches for the autopilot. These two-position (ENGAGE, DISENGAGE) switches are located on the autopilot control panel and are labeled RUD (rudder); AIL (aileron), and ELEV (elevator). The ENGAGE position of the switches provides individual engaging of the rudder, aileron, elevator, and elevator trim tab servo controls.

Pitch Control Knob.

Two pitch control knobs, one on each side of the autopilot controller, are mounted on a common shaft and control climb and glide. Forward rotation of the knobs gives nose down; aft rotation gives nose up. The climb or glide angle is proportional to the amount of rotation of the pitch control knobs.

Turn Control Knob.

A turn control knob, located on top of the autopilot controller provides for coordinated turns at all airspeeds. A climbing or descending turn can be made by using the pitch and turn knobs simultaneously. The turn control knob is left in the centered (detent) position at all times except when being used to maneuver the airplane.

Aileron Trim Knob.

An aileron trim knob, located on the autopilot controller is used to make minor corrections should a wing-low attitude occur when the aileron servo is engaged.

autopilot controls

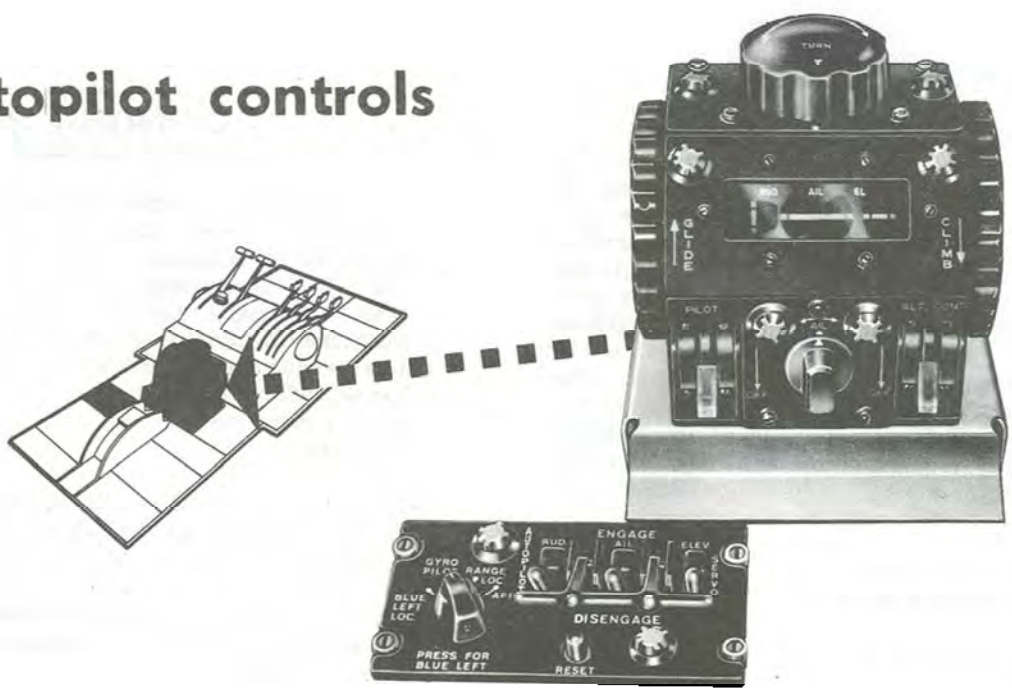


Figure 4-52.

Altitude Control Switch.

A two-position (OFF, ON) altitude control switch is located on the autopilot controller. Placing the switch in the ON position disengages the pitch control knob and engages a barometric pressure control unit, which then controls the elevator servomotor and the elevator trim tab control to maintain a constant pressure altitude flight.

CAUTION

Do not engage the altitude control if the vertical velocity indicator gives an indication of ascent or descent greater than 300 feet per minute.

Autopilot Release Button.

A release button is installed on both the pilot's and copilot's control wheels. Pressing either of these pushbutton switches releases the pilot switch and the altitude control switch, allowing them to return to the OFF position; and it releases the engaging switches, allowing them to return to the DISENGAGED position.

Radio Beam Coupler Switch.

A four-position (BLUE LEFT-LOC, GYRO PILOT, RANGE-LOC, APPROACH) radio beam coupler switch located on the autopilot control panel coordinates signals from the localizer and VOR receiver, the glide slope receiver, and the tacan receiver with the autopilot. The first switch position BLUE LEFT-LOC, connects the localizer and VOR receiver to the autopilot for flying inbound on the back course of the localizer or outbound on the localizer beam. The switch must be depressed before it can be turned left to this position. The second position, GYRO PILOT, is used during all operations not involving the use of radio signals. With the switch in this position, the airplane is kept straight and level by the gyros, unless maneuvered by means of the autopilot controller. The third switch position, RANGE-LOC, connects the localizer and VOR receiver to the autopilot for normal localizer beam bracketing or when flying VOR or tacan courses. This switch position is also used to connect the Doppler system to the autopilot. The fourth switch position, APPROACH, connects the localizer and VOR receiver and the glide slope receiver to the autopilot to control both azimuth direction of the airplane and descent angle on final approach.

AUTOPILOT INDICATORS.

Autopilot indicators are provided to monitor the operation of the autopilot and warn of malfunction.

Trim Indicators.

The autopilot controller includes three trim indicators, labeled RUD (rudder), AIL (aileron) and EL (elevator). Average meter deflection away from zero, on the rudder and aileron indicators, is evidence that the airplane is improperly trimmed and that an unnecessary load is being imposed on the servo system. The elevator indicator should show an average deflection of zero at all times, as the elevator trim tab is controlled by the autopilot in this installation.

Autopilot OFF Light.

The airplane is protected against possible malfunction of the autopilot by a system of circuit breakers and interlocking relays. Circuit overloads which could affect the operation of the autopilot will immediately cause the pilot switch to return to and lock in the OFF position. At the same time, the autopilot off light on the pilot's instrument panel will flash on and off to warn the pilot that the autopilot is no longer functioning. This light will also flash on and off when the pilot switch has been in the ON position and, either intentionally or unintentionally, is placed in the OFF position.

Beam Coupler OFF Light.

The beam coupler off light (figure 1-62) illuminates whenever the beam guidance coupler unit is inoperative and the radio beam coupler switch is in a position other than GYRO PILOT. The light does not indicate malfunctioning of a receiver or transmitter.

NORMAL OPERATION OF THE AUTOPILOT.

To place the autopilot in operation:

WARNING

- Do not have the autopilot engaged below 1,000 feet above terrain. The only exceptions allowed are for automatic ILS approach control and ARRS operational missions, during the time (operational mode) the controls must be continuously monitored. Failure to immediately recognize a pitch axis malfunction may cause 1,000 feet altitude loss before completion of recovery with a two-G maneuver effectivity.
- Do not operate the autopilot system at speeds in excess of the recommended speed limit or 250 KIAS whichever is lower.
- Do not operate with the autopilot engaged at gross weights above the maximum normal take-off weight.

1. Check that the pilot control switch is in the OFF position.

Note

With the pilot control switch OFF, the servo engage switches should be in the DISENGAGED position and the altitude control switch should be in the OFF position. If they are not, a malfunction is indicated.

2. Check that the turn control knob is in the detent.

3. Check that the elevator tab power selector switch is in the NORMAL position.

Note

Moving the elevator tab power selector switch from the NORMAL position renders pitch control inoperative.

4. Place the radio beam coupler switch in the GYRO PILOT position.

Note

The radio beam coupler switch should be in the GYRO PILOT position during all flights when the autopilot is not using radio signals. If the switch is accidently left in another position and VOR or localizer signal is intercepted or the Doppler system is on, an undesirable maneuver may result.

5. Check that the C-12 compass is operating and that the latitude control knob is in the OFF position.

Note

If the C-12 compass is not operating, the rudder servo engaging switch will be locked in the DISENGAGED position by the autopilot interlock circuit. With this axis disengaged, the autopilot will not maintain a heading.

WARNING

Trim the airplane for hands off flight. An improperly trimmed airplane imposes an unnecessary load on the autopilot servomotors.

6. Place the pilot switch in the ON position.

WARNING

Check that the trim indicators on the autopilot controller indicate an average signal of zero before placing the engaging switches in the ENGAGE position. A permanent deflection of any one of the meters indicates that the automatic synchronization is not functioning and that the servo for that axis should not be engaged. Engaging a servomotor for an axis with an out-of-trim condition may result in a violent maneuver.

7. Move the engaging switches to the ENGAGED position.

WARNING

During normal operation, do not attempt to overpower or assist autopilot pitch control through use of the control column. To do so will cause the autopilot to oppose pilot input with elevator trim causing an adverse out-of-trim condition. If the autopilot is disconnected while in this condition, a violent pitch maneuver may result with possible structural damage.

Note

Except as stated in the following note, do not engage the autopilot when in a turn or just after a prolonged turn.

WARNING

- Continually monitor the autopilot trim indicators during normal autopilot operation to ensure that the airplane is properly trimmed. If a sustained out-of-trim condition is observed, disengage the appropriate autopilot axis, retrim the airplane, re-engage the autopilot axis.

- Prior to disengaging any autopilot axis, maintain firm control of the rudder pedals and control wheel. Failure to do so may result in a violent maneuver if an out-of-trim condition exists during disengagement.

The airplane is now under automatic control about all three axes. Any axis may be controlled manually by placing the engaging switch for that axis in the DISENGAGED position. Standard maneuvers may be executed with the pitch and turn knobs.

WARNING

To prevent possible structural damage to the vertical stabilizer in the event of a rudder malfunction, perform the following while accelerating or decelerating through 200 KIAS: disengage the autopilot rudder axis, retrim the airplane, and re-engage the rudder axis.

Note

- In recovering from a turn, return the turn knob to the detent slowly. Returning the turn knob to the detent too quickly will result in a control overshoot and then stabilizing in a wing-low attitude.
- Substantial changes in airspeed (20 to 30 knots) with the autopilot engaged and with the altitude control on, may result in altitude gain or loss. The recommended procedure to follow under the above conditions is to disengage the attitude hold until established at the desired speed and altitude, then re-engage the altitude hold.

Automatic flight may be discontinued at any time by pressing the pilot's or copilot's autopilot release button, by placing the servo engaging switches in the DISENGAGED position, or by placing the pilot switch in the OFF position.

When disengaging the autopilot with the pilot's or copilot's release button or by placing the pilot switch in the OFF position, visually check the servo engaging switches for proper movement to the DISENGAGE position. It is possible to have indications of autopilot disengagement (pilot switch OFF, OFF light illuminated, trim indicators and trim controls deactivated) and still have individual engagement of the rudder, aileron, and elevator servo controls.

SWITCHING UNIT AUTOPILOT PITCH REFERENCE (SUAPR) (SA-1923/A).

Switching unit autopilot pitch reference (SUAPR) provides a more accurate pitch reference to the autopilot system than the K6A gyro. A control panel is installed at the pilot's station forward of the SAD panel. (See figure 4-53.) Power for the system is available whenever the fire control computer is on. The pitch reference will switch to the inertial navigation pitch reference whenever the INS pushbutton indicator is depressed and the INS is aligned. If the INS fails, the autopilot will disengage. If the autopilot is reengaged at this time, pitch reference will be provided by the K6A gyro. The illuminated pushbutton indicates which pitch reference is being used.

RADIO BEAM COUPLER EQUIPMENT.

The radio beam coupler equipment operates with the autopilot to provide automatic flight on VOR and Doppler courses or to guide the airplane on localizer and glidepath beams. The radio beam coupler amplifies and modifies signals received by the ILS, VOR, or tacan receivers, and supplies the modified signals to the autopilot to guide the airplane on the selected course. The various functions of the radio beam coupler are connected to the autopilot by the radio beam coupler switch. The autopilot must be in operation for the radio beam coupler to function. The radio beam coupler is powered through the autopilot circuit breakers.

OPERATION OF THE RADIO BEAM COUPLER EQUIPMENT.

By radio signals received from the localizer and VOR receiver and the glideslope receiver, and heading information from the No. 1C-12 compass, the radio beam coupler controls the autopilot to accomplish automatic range flight or automatic approaches.

SUAPR control panel

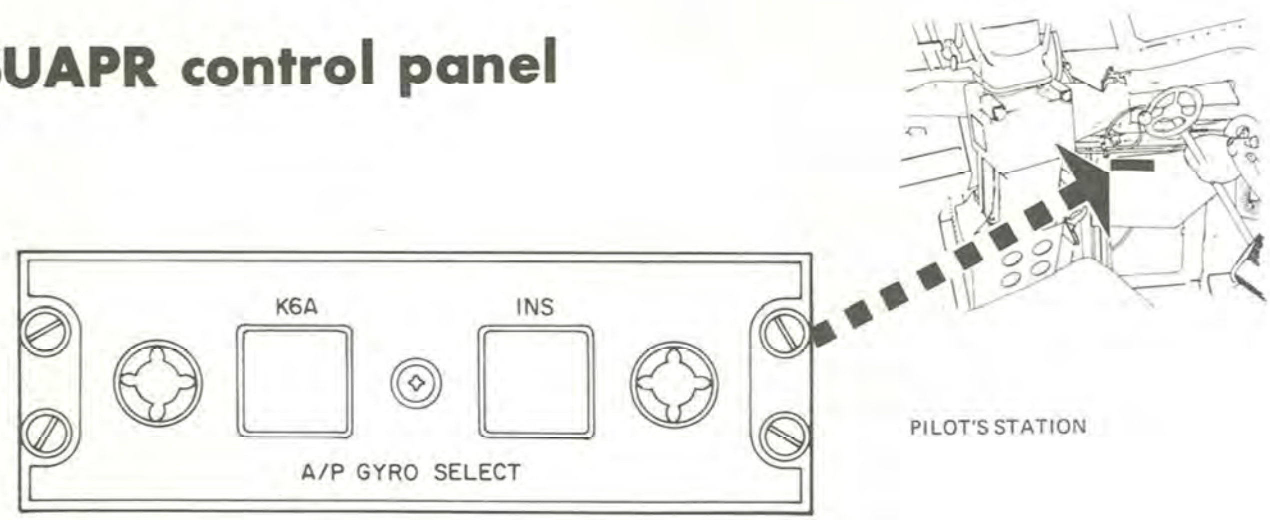


Figure 4-53.

VOR and Tacan Operation.

To accomplish automatic flight on an VOR course:

1. Place the autopilot in operation.
2. Turn the tacan or VOR receiver to the desired frequency.
3. Turn pilot's instrument selector switch to desired system.
4. Set the desired course on the pilot's horizontal situation indicator.
5. Turn the radio beam coupler switch to the RANGE-LOC position.

If the airplane is not on the selected course, the autopilot will turn the airplane to a 60-degree intercept heading. When the selected course is reached, the autopilot will turn the airplane to bracket the course. After course interception and bracketing, the autopilot, through the beam coupler, will fly the airplane along the selected course. When the "zone of confusion" over the station is reached, a sensor circuit cuts out coupler response to the erratic beam signal and provides smooth straight flight on a course that is dictated by gyro reference and corrected heading information. Upon reaching the far side of the "zone of confusion," the radio beam coupler smoothly re-establishes beam signal control. Within the "zone of confusion," course changes up to 30 degrees may be accomplished by selecting a new radial on the horizontal situation indicator. Between stations, course changes up to 5 degrees may be accomplished in the same manner. If larger course changes are required, it is necessary to re-cycle the radio beam coupler switch to the GYRO PILOT position after selecting the new course to re-establish the initial bracket coupler configuration; then the radio beam coupler switch should be returned to the RANGE-LOC position.

Automatic Approach.

To accomplish an automatic approach to an instrument landing facility:

1. Place the autopilot in operation.
2. Tune the localizer and VOR receiver to the desired frequency.
3. Establish an intercept course, up to 60 degrees, to the localizer beam.

Note

Interception must take place beyond the outer marker and below the glidepath.

4. Turn the radio beam coupler switch to the RANGE-LOC position.

The autopilot will fly the airplane on the intercept heading and turn onto the localizer beam upon interception. When the localizer heading is established, turn the radio beam coupler switch to the APPROACH position. When the glideslope is intercepted, the altitude control switch will go to the OFF position, and the airplane will begin a descent down the glidepath.

Note

The radio beam coupler system is not an automatic landing system. Under all conditions, automatic control should be discontinued at a safe altitude and the landing completed manually. All operations of the radio beam coupling equipment can and should be monitored on the attitude-director indicators.

WARNING

The beam guidance coupler is not cut out automatically in the "zone of confusion" over the localizer transmitter when making an ILS approach or when flying inbound on the back beam.

Operation of the Autopilot in Conjunction with the Doppler Computer.

Once the Doppler computer system has been placed in operation at the navigator's station, according to the instructions in the paragraph Operation of the Doppler Computer, the autopilot can be used to navigate the airplane to the desired destination.

To accomplish automatic flight using the Doppler computer:

1. Place the Doppler computer system in operation at the navigator's station.
2. Place the autopilot in operation.
3. Position the distance scale switch on the auxiliary cross-track panel to NAV.
4. Turn the pilot's instrument selector switch to DOP.
5. Turn the radio beam coupler switch to the RANGE LOC position.

The autopilot will now fly the airplane to the desired destination.

Note

If the airplane is being flown on a course which has several destinations in the form of end points of the various legs of a planned flight, the autopilot should be turned to the GYRO PILOT position prior to reaching these destinations, and the airplane turned manually with the autopilot to the new heading. The 5-degree bank-angle turn characteristics of the autopilot would otherwise introduce an unnecessary, long-way around, deviation from the planned flight path.

NAVIGATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

The navigator's console (figure 4-54) contains the necessary controls and indicators to perform enroute navigation, aircraft positioning in the target area, and traffic separation. Some equipment controls on the console (Loran control indicator, (AN/ARN-92), tactical computer (AN/ASN-91), and inertial measurement set (AN/ASN-90), are used with the fire control system.

PERISCOPIC SEXTANT.

The D-1 periscopic sextant is a precise and delicate navigation instrument; it should be handled with care. The sextant may be rotated in azimuth through 360 degrees, and minus 10 degrees to plus 92 degrees in elevation, with a true field of 15 degrees. An averaging device on the sextant gives a continuous moving average; after 30 seconds of use it can be terminated. The light for the sextant mount is powered by 28-volt, dc power from the main dc bus through the interior lights, flt mech, navigator utility circuit breaker located on the copilot's lower circuit breaker panel. The sextant mount is located above the navigator's seat.

Note

- The upper UHF communication antenna blocks sextant field of vision for approximately 15 degrees of azimuth (215° to 230° relative bearing) and from 0° to 43° of sextant altitude.
- The installation of the aerial refueling unit and fuel line in accordance with T.O. 1C-130-949 necessitated the relocation of the sextant mount. The new location, FS 228, 1.25 inches to the left of the airplane centerline, modifies the headings used for the alignment check, as noted in item 3a of the Normal Operation of the Periscopic Sextant procedure.

Normal Operation of the Periscopic Sextant.

1. Insert the sextant in the mount.

CAUTION

Any time the sextant is being installed, removed, or lowered to the retract position, hold the sextant securely in one hand before actuating the release knob.

a. Align the arrow on the tube of the sextant with the arrow on the mount.

b. Insert the sextant as far as possible. Pull out the knob marked "PULL TO INSERT OR REMOVE" and turn the sextant counterclockwise.

c. Open the mount shutter with the lever.

d. Extend the sextant and check the operation of the pull to retract knob.

e. Make the cable connection between the mount and the sextant.

f. Turn the light switch ON.

2. Adjust the size of the bubble as desired.

3. Check the alignment of the sextant mount.

a. Set 180.4 degrees in the azimuth counter. On airplanes modified by T.O. 1C-130-949, set 179.9 degrees.

b. Sight on the liaison tie-in bracket mounted on the vertical stabilizer. The heading in field of vision should be 0.

c. For errors up to 2 degrees, rotate the projection lens until the heading reads 360.

4. Remove the sextant from the amount.

a. Turn the light switch OFF, and disconnect the electrical cable.

b. Pull out the knob marked "TO RETRACT SEXTANT-PULL," and lower the sextant.

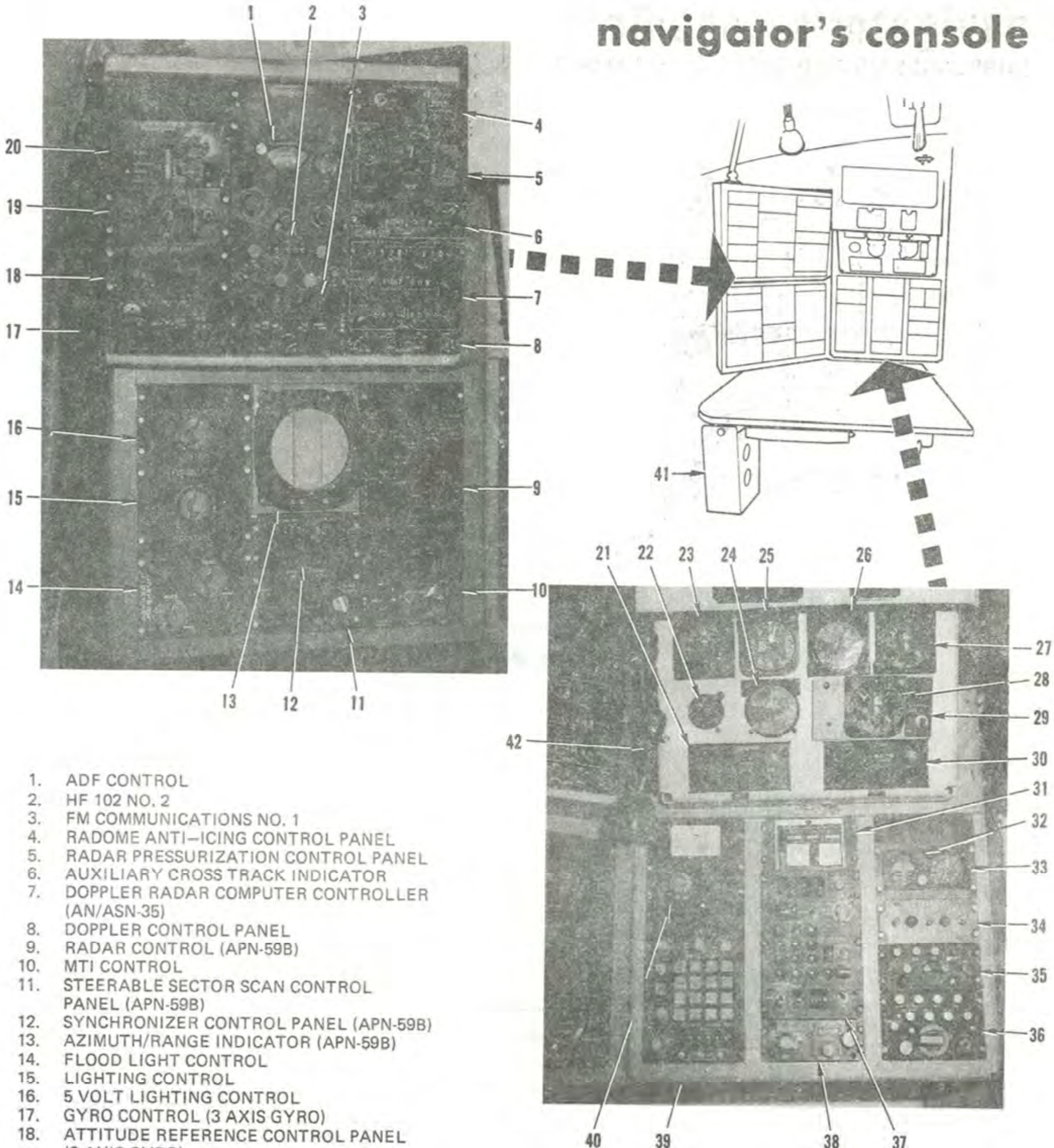
c. Close the mount shutter.

d. Pull out the knob marked "TO INSERT, REMOVE-PULL," and rotate the sextant until the arrows are aligned.

e. Lower the sextant.

f. Return the sextant to the carrying case and stow.

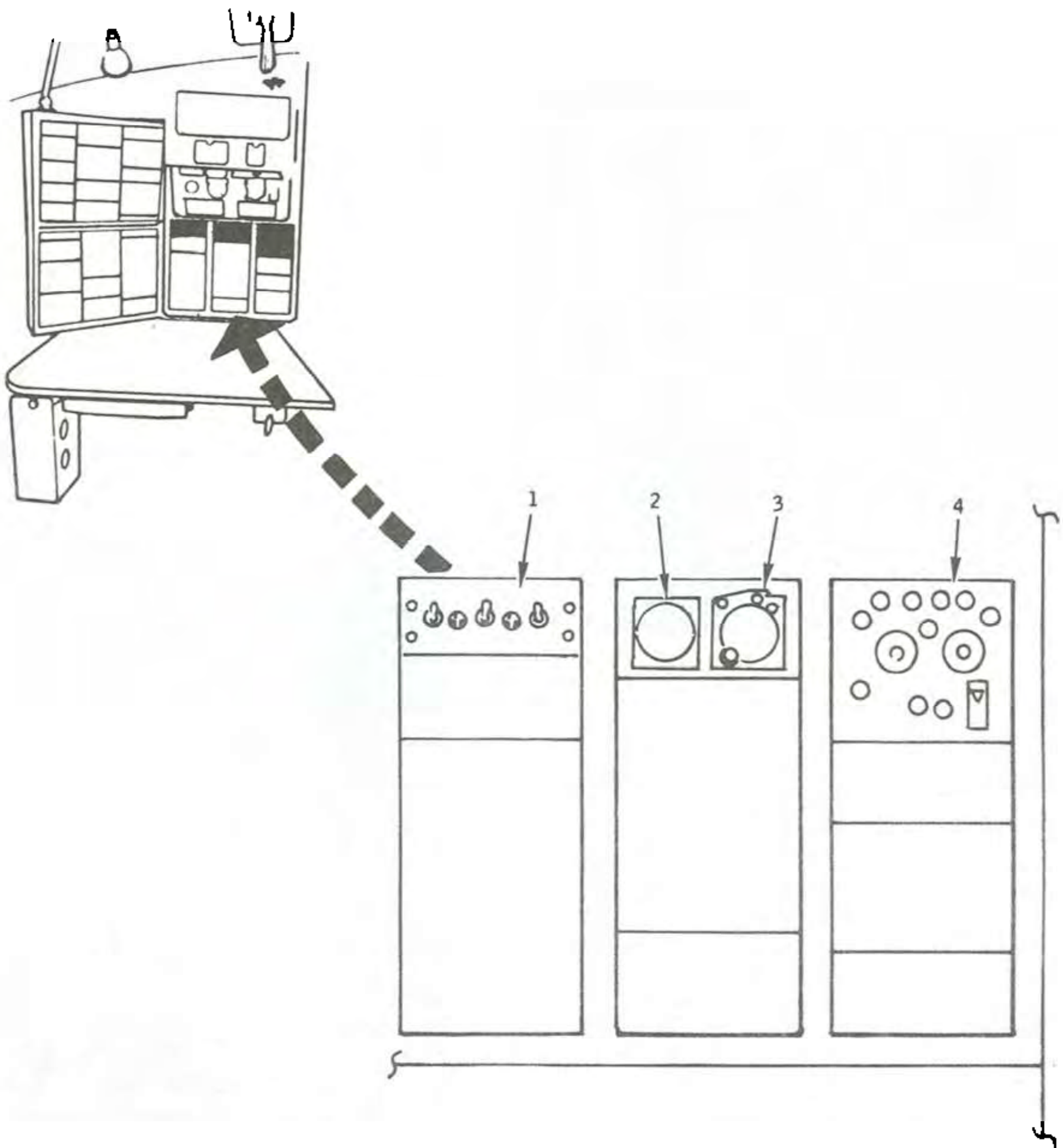
navigator's console



1. ADF CONTROL
2. HF 102 NO. 2
3. FM COMMUNICATIONS NO. 1
4. RADOME ANTI–ICING CONTROL PANEL
5. RADAR PRESSURIZATION CONTROL PANEL
6. AUXILIARY CROSS TRACK INDICATOR
7. DOPPLER RADAR COMPUTER CONTROLLER (AN/ASN-35)
8. DOPPLER CONTROL PANEL
9. RADAR CONTROL (APN-59B)
10. MTI CONTROL
11. STEERABLE SECTOR SCAN CONTROL PANEL (APN-59B)
12. SYNCHRONIZER CONTROL PANEL (APN-59B)
13. AZIMUTH/RANGE INDICATOR (APN-59B)
14. FLOOD LIGHT CONTROL
15. LIGHTING CONTROL
16. 5 VOLT LIGHTING CONTROL
17. GYRO CONTROL (3 AXIS GYRO)
18. ATTITUDE REFERENCE CONTROL PANEL (3 AXIS GYRO)
19. EQUIPMENT POWER SWITCHES
20. OXYGEN REGULATOR
21. COMPASS HEADING NO. 1 C-12
22. FREE AIR TEMPERATURE
23. DRIFT ANGLE INDICATOR
24. TRUE AIR SPEED INDICATOR (TAS)
25. ALTIMETER
26. DIRECTION INDICATOR (ADF-TAC 1)
27. DIRECTION INDICATOR (VOR 1-TAC 2)
28. HEADING INDICATOR GYRO (3 AXIS GYRO)
29. POINTER SELECT SWITCH (VOR TAC 2)
30. COMPASS HEADING NO. 2 C-12
31. IMU DATA PANEL
32. ATTITUDE INDICATOR
33. CLOCK
34. MICROPHONE TRANSFER PANEL
35. MONITOR PANEL
36. INTERPHONE CONTROL
37. NAV CONTROL PANEL (C8991/A)
38. IMS CONTROL
39. CONTROL INDICATOR (ARN-92)
40. ARN-92 TAS CONTROL
41. RADIO ALTIMETER (APN-133)
42. WORK LIGHT

Figure 4-54.

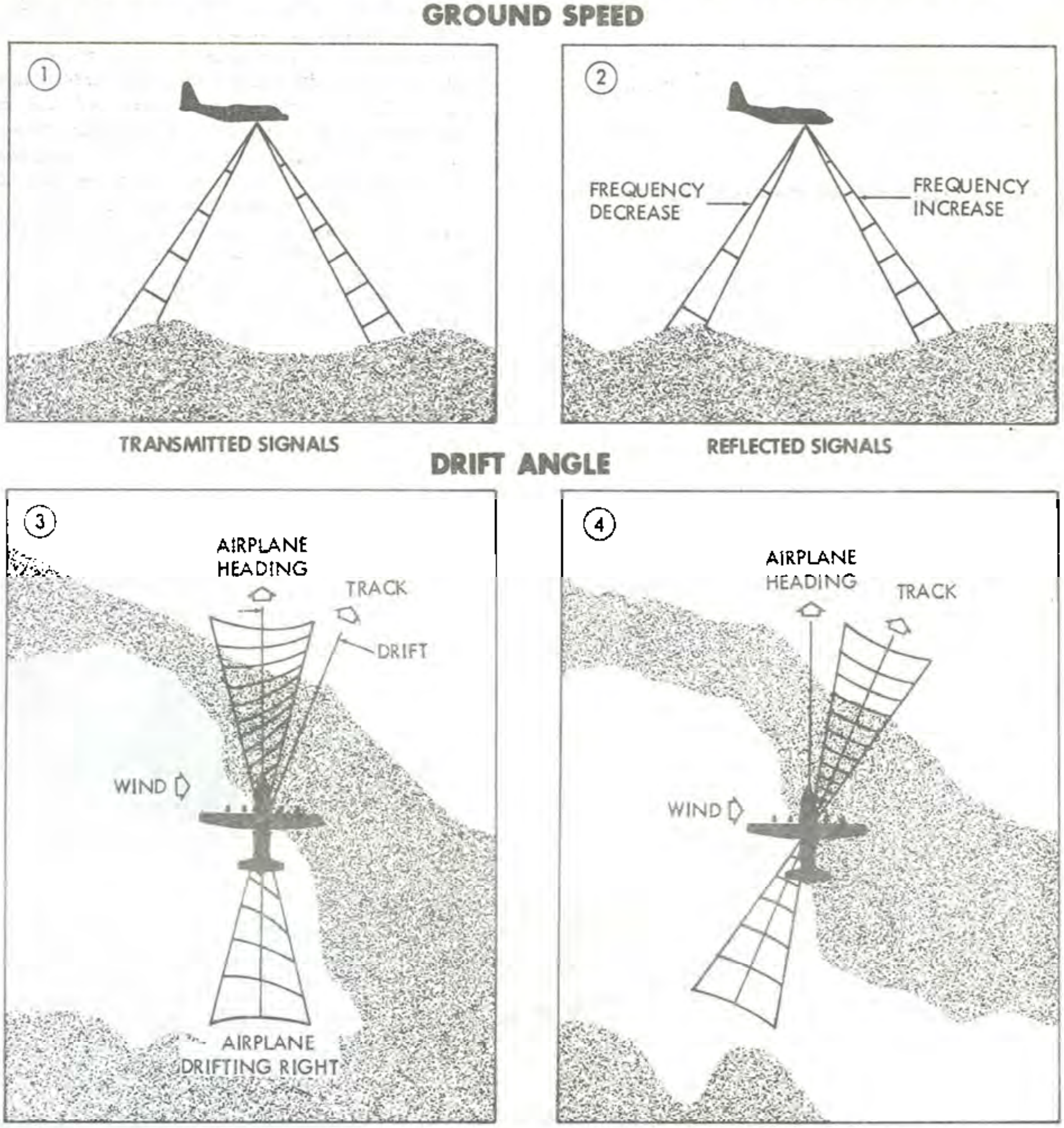
navigator's console
(AIRPLANES MODIFIED BY T.O. 1C-130-949)



1. MICROPHONE TRANSFER PANEL
2. ATTITUDE INDICATOR
3. CLOCK
4. FIRE CONTROL POWER SUPPLY CONTROL

Figure 4-55.

doppler radar principles of operation



(1) ANTENNA RADIATES TWO FAN SHAPED SIGNALS IN JANUS MODE.

(2) FREQUENCY CHANGES CAUSED BY DOPPLER SHIFT. GROUND SPEED PROPORTIONAL TO DOPPLER SHIFT.

(3) UNEQUAL FREQUENCY OF REFLECTED SIGNALS BETWEEN LEFT AND RIGHT LOBES OF ANTENNA.

(4) ANTENNA ROTATES UNTIL REFLECTED SIGNAL OF LEFT AND RIGHT LOBES OF ANTENNA ARE AT SAME FREQUENCY. ANTENNA POSITION GIVES DRIFT ANGLE RELATIVE TO AIRPLANE HEADING.

Figure 4-56.

CAUTION

Before replacing the sextant in the case, always press the actuating lever or button. Always rotate the bubble knob to the maximum increase position.

Emergency Operation of the Periscopic Sextant.

Do not loosen, tamper with, or remove any screws on the sextant shaft. The sextant mount may be loosened and aligned if necessary. For detailed operation of the sextant, consult the instructions contained in the sextant carrying case. Do not leave the sextant in the mount during rough weather; it should be removed and stowed. If the averager is inoperative, the sextant can be used to take instantaneous shots.

DOPPLER RADAR NAVIGATION SYSTEM (AN/APN-147).

The Doppler radar provides continuous indications of drift angle and groundspeed. The system consists of an antenna, receiver/transmitter, frequency tracker unit, control unit, and a drift angle-ground speed indicator. The system is self-contained and functions independently of any ground installation. Groundspeed and drift information is obtained by radiating beams of energy toward the ground forward and aft of the airplane, and measuring the Doppler effect which is observed on the signals reflected from the ground. Figure 4-55 illustrates this principal. The Doppler radar navigation system receives 28-volt dc power from the essential dc bus through a Doppler circuit breaker on the copilot's upper circuit breaker panel, and 115-volt ac power from the essential ac bus through a Doppler circuit breaker on the pilot's upper circuit breaker panel. The design performance limitations are as follows:

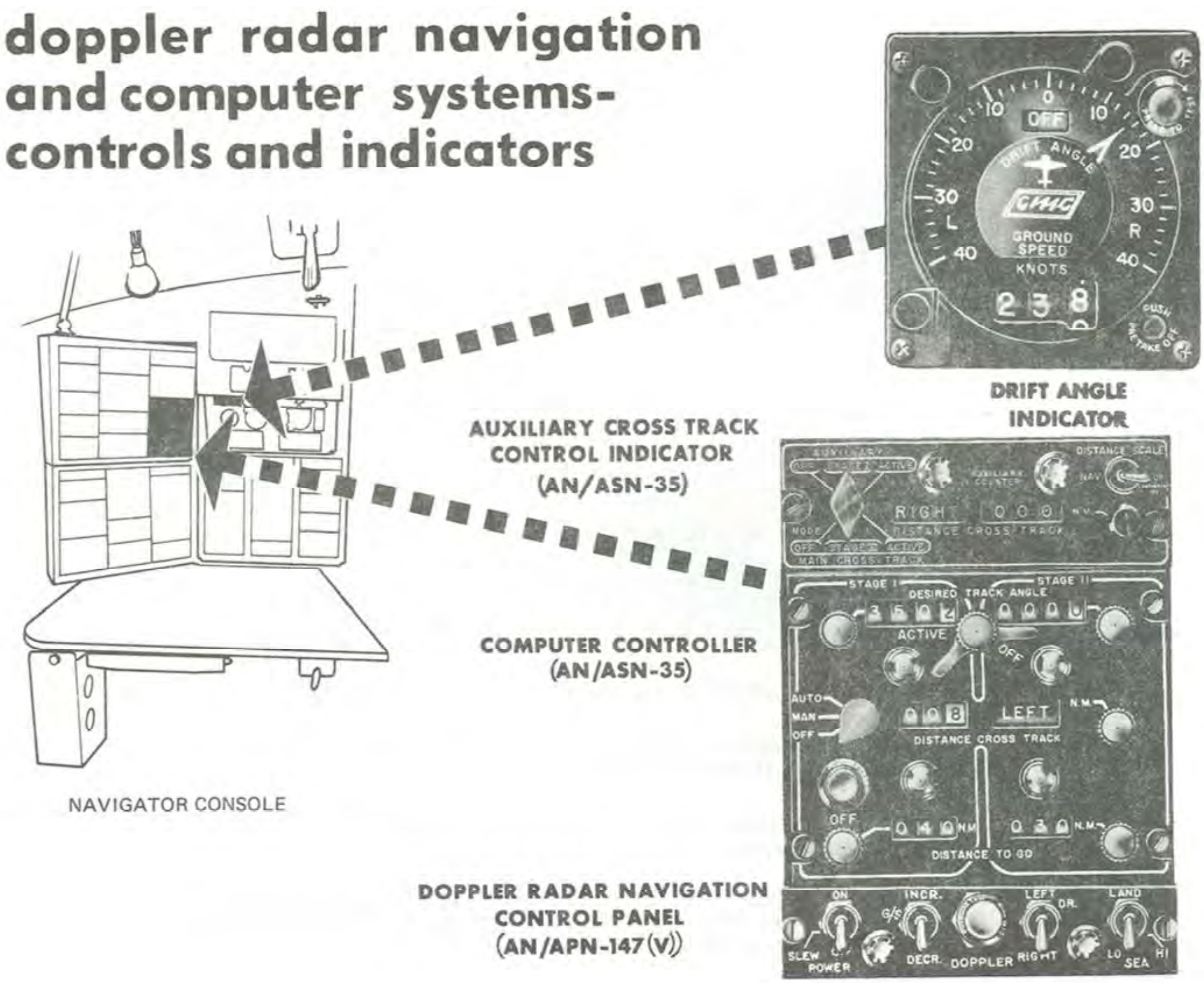


Figure 4-57.

Altitude - approximately 40 to 50,000 feet.

Drift Angle - 40 degrees left or right, within 0.25 degree.

Groundspeed - 90 to 999 knots, within 0.5 percent.

Antenna Attitude:

Pitch - Plus or minus 20 degrees, stabilized to plus or minus 1 degree up to a 12-degree climb or 8-degree dive.

Bank - 30 degrees right or left.

Note

Power is supplied to the drift angle-groundspeed indicator from the C-12 compass circuit breakers on the pilot's upper circuit breaker panel.

Doppler Radar Navigation System Controls.

The control unit (figure 4-57) on the navigator's control panel contains all switches necessary for inflight operation of the Doppler radar. This unit comprises four toggle switches and a warning light.

POWER SWITCH.

The power switch has three positions (OFF, SLEW, ON). The SLEW position is used for warmup and taxiing, and it activates the ground speed and drift slew switches. With the power switch in the ON position, the system is fully active.

G/S SWITCH.

The two-position (INCR, DECR) groundspeed switch is spring-loaded to the unlabeled center position. This switch becomes active when the power switch in a SLEW position and is used on conjunction with a drift angle-groundspeed indicator to set up the system to approximate groundspeed values prior to operation.

DR SWITCH.

The two-position (LEFT, RIGHT) drift switch is spring-loaded to the unlabeled center position. This switch becomes active when the power switch is in SLEW position, and is used in conjunction with the drift angle-groundspeed indicator to set up the system to approximate drift angle values prior to operation.

LAND-SEA SWITCH.

The land-sea switch, or terrain selector, has three positions (LAND, SEA HI, SEA LO). The LAND position is used for flights over land. In SEA HI position the system is calibrated for the reflective properties of water and may operate in either janus or smooth sea mode, depending on reflected signal strength. The SEA LO position is used for low-level flights over water which involve frequent turns and bank angles in excess of 20 degrees such as in low level search missions. In this position the system is calibrated for the reflective properties of water and is maintained in the janus mode.

MEMORY WARNING LIGHT.

The press-to-test warning light in the center of the radar control is illuminated when the power switch is in SLEW position or when the unit is in memory mode and serves to warn the operator of deteriorated system performance.

Drift Angle—Groundspeed Indicator (ID938).

This indicator (figure 4-57) gives visual indications of prevailing drift angle and groundspeed. The drift angle scale is marked from zero to 40 degrees left or right, but the antenna stops are set at 30 degrees left or right. The groundspeed counter reads from zero to 999 knots.

MEMORY WARNING LIGHT.

This light operates in the same manner as the memory warning light on the control panel.

INDICATOR WARNING FLAG.

This flag indicates OFF in the event of 28-volt dc power loss, or when the system is operating in the memory mode.

PUSH PRE-TAKE-OFF BUTTON.

When depressed, this button automatically slews the groundspeed indicator to a take-off value (165 knots) and the drift angle pointer to zero. Use of this button is not recommended.

Note

- The Doppler system may fail to lock on if the pre-take-off button is used. If the set does not lock on soon after take-off, switch to SLEW and use the ground speed slew switch to manually bring the set within 20 percent of the prevailing groundspeed.
- When the radar is tracking, a regular 3 to 5 knot oscillation occurs about the mean value of the ground speed. This is a normal indication and is caused by the lock-check circuit. If the oscillation becomes irregular or ceases altogether, the system reverts to the memory mode after a 5 second delay period.

Modes of Operation.

Three modes of operation are possible; they occur automatically as determined by the position of the land-sea switch, the available signal strength, and system performance.

JANUS MODE.

The janus mode is the normal mode of operation over land and water, if there is sufficient reflected signal. The highest accuracy is realized when in this mode.

SMOOTH SEA MODE.

This mode occurs automatically when the land-sea switch is in SEA HI position only, and if there is insufficient reflected signals to maintain proper operation. The forward end of the antenna is titled down 7 degrees to improve signal strength from the forward area. The rear beams are blocked resulting in some loss of accuracy. During a prolonged flight over smooth sea surfaces the system will cycle in and out of this mode, returning to janus mode every 2 minutes for a period of 1 minute. If sufficient signal is observed while in janus mode, the system will remain in this mode. This process is indicated by a cyclic operation of the memory warning lights and flag.

Note

At times, during smooth sea mode, when the memory warning lights are out, the pointers are at prevailing values of groundspeed and drift with some loss of accuracy in the groundspeed indication.

MEMORY MODE.

This mode is indicated by the operation of the memory warning lights and flag, and occurs automatically if the reflected signal is too weak or if the system performance is deteriorated. In this mode, the groundspeed and drift angle indications are locked at the last readings prior to memory operation.

Normal Operation.

STARTING PROCEDURE BEFORE TAKE-OFF.

1. Set the power switch on the Doppler radar control unit to SLEW, and allow 1 minute for warmup.
2. Slew the groundspeed to approximately 165 knots, using the ground speed switch.
3. Slew the drift to zero, using the drift switch.
4. Set the land-sea switch as required.
5. Turn the power switch ON above 40 feet absolute altitude.

STARTING PROCEDURE - INFLIGHT.

The starting procedure inflight is similar to that for a ground start, except that the groundspeed and drift angle must be slewed to prevailing estimated or flight plan values. Groundspeed must be slewed within 20 percent, and drift angle within 15 degrees, of prevailing value.

Operating Indications.

Refer to figure 4-58 for the various Doppler radar navigation system indications available during operation of the system.

Suspected Malfunction in Flight.

In the event of a suspected malfunction in flight, as indicated by illumination of the memory warning lights for more than 3 minutes, proceed as follows:

1. Set the power switch to SLEW.
2. Slew the groundspeed and drift indications to the prevailing value.
3. Set the power switch to ON.
4. If the memory warning lights remain illuminated, slew the groundspeed about 20 percent higher and/or lower than the estimated value, and try for lock-on.
5. If the memory warning light still remains illuminated, slew the groundspeed and drift to the prevailing values, and leave the set in operation.

Note

- Excessive memory periods should not be encountered over land at any altitude. Should this occur it is an indication of deteriorated performance and should be recorded in maintenance forms.
- When airplanes are flying in close proximity, the signals radiated from one Doppler radar can cause interference with the set operating in the other airplane. This interference can produce unreliable system indications in both airplanes.

DOPPLER SYSTEM ERRORS.

There are two main categories of system errors: design limitations and external sources of error. If errors are additive, they can amount to 2 to 3 percent of distance flown and can vary with type of sea surface, tidal currents, wave motion, and several other factors. Some of these errors can be avoided by adequate preflight planning and calibration.

DOPPLER COMPUTER SYSTEM (AN/ASN-35).

The Doppler computer system (figure 4-57) relies on two data inputs from the Doppler radar navigation system. One of these inputs is actual track, which is produced in the Doppler radar by combining heading information from the No. 1 C-12 compass with the drift angle. The computer vectorily compares

doppler radar system indications

TERRAIN SELECTOR SWITCH POSITION		LAND		SEA-HI ⚠2 AND SMOOTH SEA			SEA-LO	
MODES		JANUS	MEMORY	JANUS	NON-JANUS	MEMORY	JANUS	MEMORY
MEMORY WARNING LIGHTS		OFF	ON	OFF	OFF 120 SECONDS, ON 50 SECONDS ALTERNATELY	ON	OFF	ON
DRIFT ANGLE - GROUND SPEED WARNING FLAG		NO INDICATION	OFF	NO INDICATION	NO INDICATION 120 SECONDS, OFF 50 SECONDS ALTERNATELY.	OFF	NO INDICATION	OFF
INDICATORS	GROUND SPEED COUNTER ⚠1	PREVAILING VALUE	LAST INDICATION OR AS SET	PREVAILING VALUE	⚠3 PREVAILING VALUE OR LAST INDICATION	LAST INDICATION OR AS SET	PREVAILING VALUE	LAST INDICATION OR AS SET
INDICATORS	DRIFT ANGLE POINTER	PREVAILING VALUE	LAST INDICATION OR AS SET	PREVAILING VALUE	⚠3 PREVAILING VALUE OR LAST INDICATION	LAST INDICATION OR AS SET	PREVAILING VALUE	LAST INDICATION OR AS SET

⚠1 WHEN THE RADAR IS TRACKING, A REGULAR 3 TO 5 KNOT OSCILLATION OCCURS ABOUT THE MEAN VALUE OF THE GROUND SPEED. THIS IS A NORMAL INDICATION AND IS CAUSED BY THE LOCK-CHECK CIRCUIT. IF THE OSCILLATION BECOMES IRREGULAR OR CEASES ALTOGETHER THE SYSTEM REVERTS TO THE MEMORY MODE AFTER A 5-SECOND DELAY PERIOD.

⚠2 THE SYSTEM AUTOMATICALLY CYCLES BETWEEN THE SMOOTH SEA AND MEMORY MODES WHEN THE SIGNALS ARE TOO WEAK TO MAINTAIN THE JANUS MODE. THIS CYCLE CONTINUES UNTIL A CHANGE IN SIGNAL LEVEL CAUSES THE SYSTEM TO RETURN TO THE JANUS MODE OR REMAIN IN THE MEMORY MODE. THIS SIGNAL CONDITION IS MOST LIKELY TO OCCUR AT HIGH ALTITUDES OVER SMOOTH SEAS.

⚠3 AT TIMES WHEN THE MEMORY WARNING LIGHTS ARE EXTINGUISHED, THE INDICATORS ARE AT PREVAILING VALUES OF GROUNDSPEED AND DRIFT ANGLE. AT TIMES WHEN THE MEMORY WARNING LIGHTS ARE ILLUMINATED, THE POINTERS ARE LOCKED AND THE SYSTEM OPERATES IN MEMORY MODE.

Figure 4-58.

this actual track angle with a desired track angle (desired course) inserted by the operator and, using a second input of digital groundspeed (from the Doppler radar), continuously computes the airplane position with respect to desired course. The main control/indicator displays airplane position on digital counters which read distance to go and distance cross-track in nautical miles.

Note

> A repeat of the above information is also available for display on the horizontal situation indicator together with the direction of flight required to gain the correct track.

In addition, the track error angle and distance cross-track produced within the computer may be used to control the autopilot. The major components of the system are the computer, main control/indicator, and auxiliary cross-track control indicator.

The system receives 28-volt dc from the essential dc bus through a Doppler computer circuit breaker on the copilot's upper circuit breaker panel, and 115-volt, 400-cycle, ac from the essential ac bus through a Doppler computer circuit breaker on the pilot's upper circuit breaker panel.

Note

> The No. 1 C-12 compass system must be operational before the Doppler computer can function properly.

Main Control/Indicator.

The main control/indicator is divided into two separate stages comprising two desired track angle controls and two distance to go counters, with a stage selector control to transfer from one stage to the second. This allows the operator to program the inactive stage for the second leg of the intended flight while using the active stage for the first leg. This main control/indicator also contains a function selector, a warning light and a distance cross-track counter.

DESIRED TRACK ANGLE CONTROLS.

The desired track angle controls are located at the top of the main control/indicator and are used by the operator to program the computer with the intended or desired course which can be set in degrees and tenths of a degree by a reset knob. If a magnetic heading reference is used, the desired track angle = true course ± average variation. If a gyro heading reference is used, the desired track angle = grid course ± gyro precession.

DISTANCE TO GO COUNTERS.

The distance to go counters are located at the bottom of the main control/indicator and are used by the operator to program the computer with the intended distance to go along the desired course. In flight, the computer operates to reduce this distance as the airplane progresses towards the intended destination. If a magnetic heading reference is used, the distance to go is the magnetic rhumb line distance. If a gyro heading reference is used, the distance to go is the average great circle distance. The counters are calibrated to read from 000 to 999 nautical miles (99.9 nm, see distance scale switch), but are free to move through zero if required. For example, if the distance to go is overflown by 9 miles, the counter will read 991 miles.

STAGE SELECTOR.

The stage selector is a two-position rotary switch located below the desired track angle display. Its positions are marked ACTIVE and OFF for each stage. When Stage I is active, Stage II is off, and vice versa. The active stage can be selected manually by setting the function selector to MAN position and turning the stage selector to the desired position. Automatic stage transfer can be achieved when the active distance to go reaches 000 miles if the function selector is in AUTO position. However, automatic transfer will occur only if the inactive stage is programmed with some distance to go.

CAUTION

> The function selector switch should be in the manual position if manual change of stage is to be accomplished.

FUNCTION SELECTOR.

The function selector switch is located on the left of the main control/indicator and is a three-position switch marked OFF-MAN-AUTO. The computer becomes active immediately when the function selector is placed in the MAN or AUTO position. In the MAN position, power is applied to the computer, and stage selection is achieved manually. In the AUTO position, power is applied to the computer, and stage selection can be achieved automatically.

OFF WARNING LIGHT.

The warning light below the function selector is not fully operational as an equipment failure indication; it is illuminated only in the event of a 115-volt ac failure (such as a disengaged circuit breaker).

DISTANCE CROSS TRACK COUNTER.

The distance cross track counter is located in the center of the main control/indicator and function to display cross-track distance left or right of track up to 99.9 nautical miles (or 9.99 nm, see distance scale switch). This counter may be reset or offset, as required, by a reset knob.

Auxiliary Cross-Track Control Indicator.

The auxiliary cross-track control indicator, used in conjunction with the main control/indicator, consists of a distance cross track counter, (identical to that used in the main control/indicator), an auxiliary-main cross-track selector, and a distance scale switch.

AUXILIARY-MAIN CROSS-TRACK SELECTOR SWITCH.

This switch, located on the left side of the auxiliary cross-track control indicator, is used to permit selection of cross-track counter. It is a three-position switch providing the following three separate modes:

Fully counterclockwise - main cross-track counter active on both stages.

Fully clockwise - auxiliary cross-track counter active on both stages.

Center-vertical - auxiliary counter active on Stage I. Main counter active on Stage II.

This selector switch will normally be used in the center-vertical position but provides the means of changing to an updated counter part way along a programmed leg. It is particularly desirable to have a record of the cross-track reading at the time of stage transfer when a change in course is planned. By operating with the selector in the vertical position, the cross-track counters are changed at the time of stage transfer, and the formerly active stage is left with a reading of cross-track distance. This distance can then be resolved (using an MB-4 computer) with respect to the new course, and the inactive counter set up to the corrected cross-track distance and selected active.

DISTANCE SCALE SWITCH.

The distance scale switch is located on the right side of the auxiliary cross-track control indicator, and is a two-position switch marked NAV and DROP (EXPANDED x 10). This switch is used to change the scale on the computer readout on both distance to go and distance cross-track. In NAV position, the distance to go readings are in increments of one nautical mile, and distance cross-track is in increments of one-tenth of a mile. In DROP position the distance to go readings are in increments of one-tenth of a mile and distance cross-track is in increments of one-hundredth of a mile.

Note

The distance scale switch must be used only on a stage which has been programmed with distance consistent with the scale selected, and it must not be changed part way along a leg.

Operation of the Doppler Computer.

Note

- When using the Doppler computer in conjunction with the autopilot, refer to paragraph entitled Autopilot in this section.
- Whenever possible, avoid use of the Doppler cross track indicator for along-track distance information, drop function (X10), when the ground speed is over 150 knots. This will cause the counter drums to rotate so rapidly they are unreadable and will not synchronize with the computer information, thus giving incorrect along-track distance information.

Operation of the Doppler computer is contingent upon concurrent operation of the Doppler navigation system, and the C-12 compass installation, since these provide the sources of navigational information fed to the computer unit. The computer unit is directly controlled at the navigator's control panel by means of the computer controller and the auxiliary cross-track control indicator. To place the computer in operation:

1. Set the desired track angle for Stage I on the computer controller.
2. Set the distance to go for Stage I. (Distance to go for Stage II may be set at this time if known and required.)
3. Set the counter on the main and auxiliary cross-track indicators to RIGHT-000.
4. If navigational operation is desired, then:
   a. Position the distance scale switch to NAV.
   b. Position the mode selector switch to AUXILIARY OFF-MAIN CROSS TRACK ACTIVE.
   c. Select AUTO or MAN on the operation selector switch.

The computer controller will now monitor the actual versus the desired (programmed) flight path for Stage I. The accuracy of the main cross-track indicator can be subjected to a cross reference check at any time during the flight prior to reaching the drop point of a currently active stage. To accomplish this, position the mode selector switch to AUXILIARY ACTIVE-MAIN CROSS-TRACK OFF at the time of a known airplane position. This engages the counters of the auxiliary cross-track indicator and disengages (deactivates) the counters of the main cross-track indicator. A system malfunction can be detected by warning lights on both the computer controller and the AN/APN-147 control panel and by the appearance of the range warning flag on the selected HSI or the word OFF on the pilot's multiple indicator on the navigator's drift angle/ground speed indicator ID938/ID938A.

5. If drop operation is desired, then:

   a. Position the distance scale switch to DROP for closer approximations of the cross-track deviation and the distance to go along track, if desired.

   Note

   NAV/DROP selection on the auxiliary controller must be made only at start of a leg or reset programmed distance to go for the new computer rate.

   b. Position the mode selector switch to AUXILIARY OFF-MAIN CROSS-TRACK ACTIVE.

   c. Select AUTO or MAN on the operation selector switch.

6. If the DROP or NAV point of Stage I defines a final destination, no further steps are required. If, however, the DROP or NAV point of Stage I is to serve as the point of intersection with the next leg of a planned flight path, then, sometime prior to reaching the drop point of the currently active stage:

   a. Determine the track angle that will be required for Stage II, and set this up on Stage II of the computer controller.

   b. Set the distance to go for Stage II, if it has not already been set.

7. If the airplane is on the desired track (track angle steady, cross-track deviation zero).

   a. Position the operation selector switch to AUTO, if it has not already been so positioned.

   b. Turn the mode selector switch to AUXILIARY STAGE I - MAIN CROSS-TRACK STAGE II.

   c. Position the distance switch to NAV or DROP, as desired.

   d. Reset the counters of the main cross-track indicator to RIGHT-0.

Uninterrupted monitoring of the transition from Stage I to Stage II should now be available.

8. If the aircraft is not on the desired track, return to the desired track or apply an off-track correction to the next leg.

9. Apply necessary track angle and along-track corrections to succeeding legs.

Note

The AN/ASN-35 is a completely transistorized unit and requires no warmup period.

In the event of a failure of the C-12 compass or the Doppler radar systems, the computer performance will be seriously affected. However, the Doppler computer system can often be used as a simple D/R computer even if the Doppler radar is not fully operational. This is achieved by slewing the Doppler radar to estimated or flight plan values of ground speed and drift angle and frequently updating these as conditions change. The computer will function on the information shown on the Doppler drift angle and ground speed indicator and the compass heading.

SEARCH RADAR SET (AN/APN-59B).

Radar set is designed to operate as a search radar, a weather radar or a radar beacon interrogator-receiver. When used as a search radar it displays a map-like scope picture up to a distance of 240 nautical miles. When used as a weather radar it displays storm fronts, heavy rainfall or other weather features with precipitation. When used for beacon navigation it transmits an interrogating signal and then displays the coded identification of the automatic beacon reply.

The radar set operates on 28-volt dc power from the main dc bus and 115-volt primary ac power from the main ac bus through the radar circuit breakers on the copilot's upper circuit breaker panel. The radar set is also protected by five fuses that are located on the receiver transmitter unit in the nose wheel well.

WARNING

Dangerous voltages (at times as high as 15,000 volts) are present in radar set. Do not attempt to make any internal repairs or adjustments. If such repairs or adjustments are necessary, notify authorized service personnel.

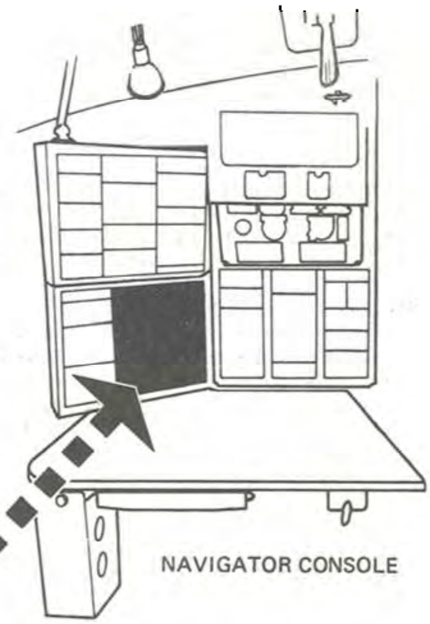
Radar Set Controls.

Note

The following indications are for operational use and should not be confused with maintenance instructions.

Functional control of the set is accomplished from the controls shown in figure 4-59. Selection of radar function, range, type of scanning, and antenna tilt is done on the radar control panel. By selecting the proper combination of switches, the desired function and indicator presentation can be obtained. The following controls, located on the radar control panel

search radar system (AN/APN-59B)



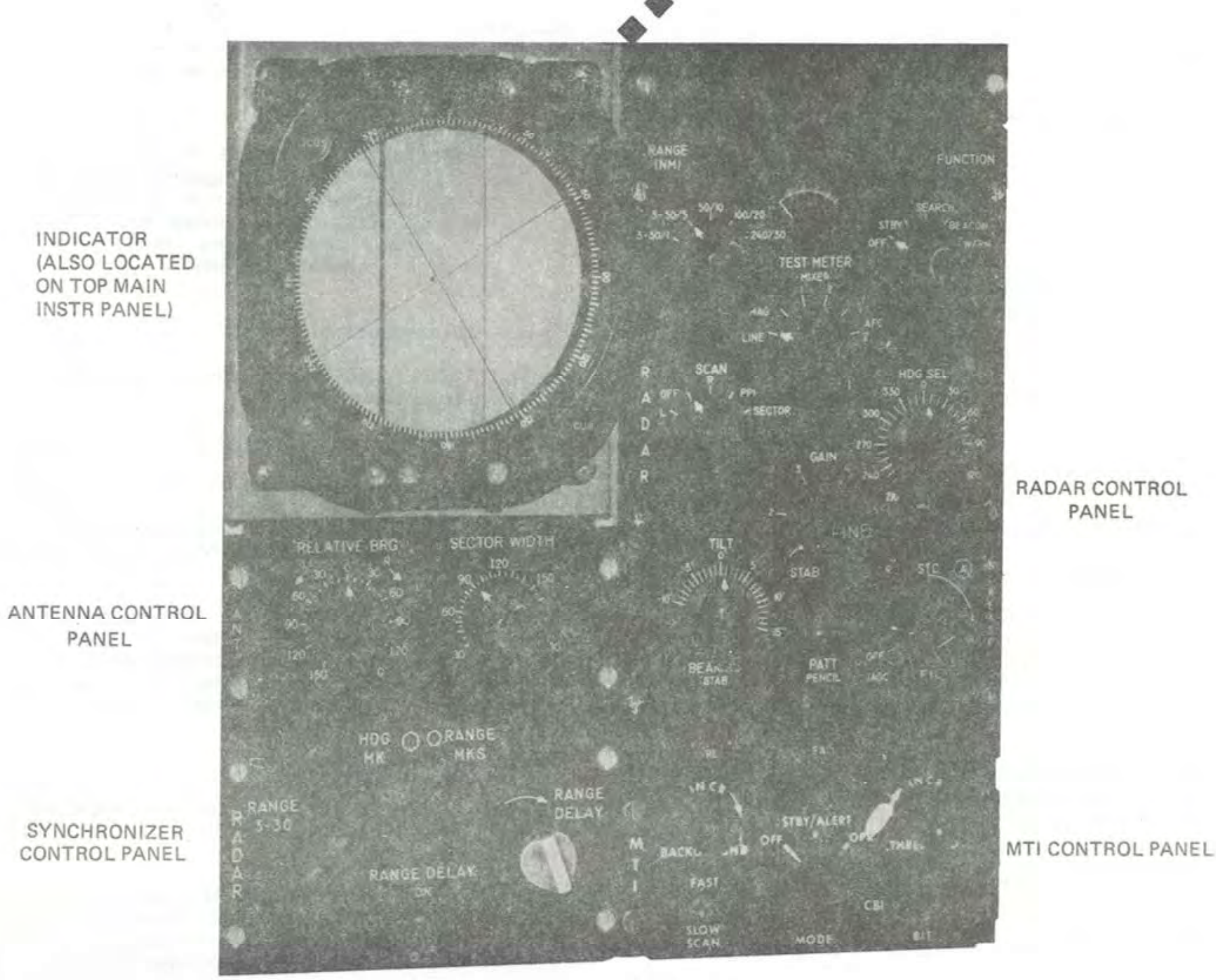


Figure 4-59.

at the navigator's station, are used for operating the radar set.

RANGE SELECTOR — Selects desired range.

FUNCTION SWITCH —

Note

- Overload circuitry in the Receiver-Transmitter may be activated during routine operation. This may be caused by erratic (but normal) magnetrol behavior or inadvertent short circuits.
- If loss of all TEST METER indicators occurs and equipment shuts down, set FUNCTION selector to OFF, then back to desired function; for transmitter operation, allow time for recycling of the 180-sec. transmitter delay. If only MAG indication of TEST METER drops to zero, place FUNCTION selector to STDBY, then back to the desired position.

OFF position — No power to set.

STANDBY position — Used for the 3-minute warmup. In this function the magnetron is not operating.

SEARCH position — Presents a visual map-like scope picture.

BEACON position — Presents a space-coded identification of radar beacons.

WARNING position — Used to detect weather buildups.

TEST METER — MIXER CONTROL — Used to monitor line, magnetron, mixer and AFC systems voltages.

Note

Line milliampere should read 0.6 ± 0.08 and steady. Magnetron milliampere should read 0.65 ± 0.35 and steady. Mixer No. 1 and No. 2 and AFC No. 1 and No. 2 milliampere should read 0.60 ± 0.30 and steady. If line voltage fluctuates, have the flight engineer check the airplane power supply for fluctuations.

SCAN SELECTOR — Used to select type of antenna scan. The following selections may be made with the scan selector.

L — Rotates counterclockwise (12 rpm).

OFF — Antenna is stationary.

R — Rotates clockwise (12 rpm).

PPI — Rotates clockwise (12 or 45 rpm).

SECT. — Antenna scans back and forth across lubber line of the airplane.

HDG SEL CONTROL — Numeral in window at left of control shows knob setting. Used in conjunction with the bearing switch.

GAIN CONTROL — Used to adjust receiver gain. OFF is fully counterclockwise.

TILT CONTROL — Used to control tilt of radar antenna beam.

STAB SWITCH — Used to select stabilization of antenna.

UP — The antenna plane of rotation is stabilized parallel to the earth's surface.

DOWN — The antenna is locked to the plane of the airplane.

STC CONTROL — Reduces gain on short range returns. Inner knob controls the amount of reduction. Outer knob controls the range (maximum of approximately 40 miles).

OFF — Turn inner knob fully counterclockwise.

BEARING SWITCH — Used to select PPI reference azimuth.

STAB — PPI top center is magnetic north plus HDG SEL setting.

REL — PPI top center is airplane heading.

PATT SWITCH — Used to select type of radar beam.

IAGC SWITCH — Used to reduce gain of strong returns. System is operating when in the up position.

FTC SWITCH — Used to break up large target area returns. In the down position the system is inoperative.

Antenna Control Panel.

The sector scan control (antenna) is mounted on the navigator's console. The antenna control provides adjustment of sector width and relative bearing of the sector center with respect to the airplane heading.

Note

If RELATIVE BRG control on Antenna Control C-4006(P)/APN-59B is rapidly changed to a new position, the Antenna may stop or jitter erratically. If this occurs, rotate RELATIVE BRG control until Antenna begins normal sectoring; then rotate it slowly to the desired position.

Synchronizer Control Panel.

RANGE DELAY CONTROL — Used to set in the amount of desired range delay.

RANGE DELAY SWITCH — Used to turn on range delay.

RANGE MKS — Used to adjust intensity of range marks.

RANGE 3-30 CONTROL — Will vary range on scope from 3 to 30 miles. Fully counterclockwise represents 3 miles on scope.

HDG MK CONTROL — Varies the intensity of the heading mark. The mark is black in its extreme clockwise position. As the control is turned in a counterclockwise direction, the mark disappears and then reappears as a bright mark on the extreme counterclockwise position.

Indicator Controls .

The following controls are located on the IP-268A/APN-59 indicator that is located above the main instrument panel at the navigator's station:

INT. CONTROL — Used to adjust intensity of PPI trace for best signal visibility and contrast. When the control is rotated to the extreme counterclockwise position, power is removed from the indicator. Optimal setting is just visible with receiver gain at minimum.

FOCUS CONTROL - Used to adjust focus of sweep trace.

VIDEO GAIN ADJUSTMENT - Used to adjust intensity of PPI picture for best contrast.

S-R SWITCH - To select slaved (S) or relative (R) PPI orientation for pilot's indicator.

RETICLE - Used to facilitate offset-track flying.

RETICLE GEAR - Used to move reticle.

DIAL DIM CONTROL - Used to adjust azimuth ring illumination.

AZIMUTH RING - Used to read azimuth of targets.

CURSOR - Used to indicate azimuth of targets.

CURSOR CONTROL - Used to move cursor.

RANGE-INDICATOR LAMPS - Used to indicate range selected for display.

Normal Operation of the AN/APN-59B Radar Set.

WARNING

Before placing the function switch in SEARCH, BEACON, or WARN, make sure that all personnel are clear of the antenna radiation hazard area. Avoid directing the energy beam toward inhabited structures, personnel groupings, or areas where airplanes are being refueling/defueled. (See figure 2-4.)

To put the radar set into operation:

1. Insure that all controls on the control panel are positioned off, zero, down or fully counterclockwise. The range switch selected to 50/10 NM or less.
2. Insure that heading/range marks and intensity controls are fully counterclockwise. Turn range delay OFF.
3. Turn function switch to STB and allow a 3-minute warm up.

Note

For best results, avoid using the WARN function, the 100/20, or the 240/30 ranges for the first 10 minutes.

4. Select type of scan desired.
5. Turn function switch to SEARCH.
6. Check with the test meter for proper current readings in all systems.
7. Turn function switch to BEACON and check with test meter for proper current readings.
8. Turn the test switch to the MAG position for inflight monitoring.
9. Turn the intensity control (on indicator) until a faint sweep appears on the face of the scope.
10. Adjust the heading and range markers.
11. Adjust the gain control for best scope presentation; use the tilt control in conjunction with gain control.
12. Turn bearing switch to STAB; insure that the set is operating properly.

CAUTION

Stab switch must be OFF (down) prior to touchdown and during all ground operations. This will insure engagement of antenna locking pins and prevent damage to the antenna during ground operations.

To turn radar set off:

13. Turn the intensity, range and heading mark controls fully counterclockwise.
14. The radar control panel shutdown sequence:

STAB switch OFF, gain control fully counterclockwise, scan switch OFF, function switch to STBY and all remaining controls to down, off, zero, or fully counterclockwise.

15. After 30 seconds turn function switch OFF.

RADAR PRESSURIZATION.

Pressurized air for operation of the AN/APN-59B receiver-transmitter and a radio frequency wave guide is supplied by a pressure pump mounted on the right under-deck rack. The pressure pump draws air from the cabin through a dehydrator, and then pressurizes the air before it is routed to the units. The pump operates from the main 28-volt dc bus through a circuit breaker on the copilot's upper circuit breaker panel.

Radar Pressurization Controls and Operation.

CAUTION

During the leakage test, hold the switch in the MOMENTARY ON position until the pressure gage indicates approximately 40 inches of mercury. The system should hold to pressure within 2 inches of mercury for approximately 10 minutes. At no time during this check should the pressure be allowed to exceed 41 inches of mercury or the airplane structure may be damaged.

The radar pressurization system control panel (figure 4-60) at the navigator's station has a radar pressurization

radar pressurization control panel

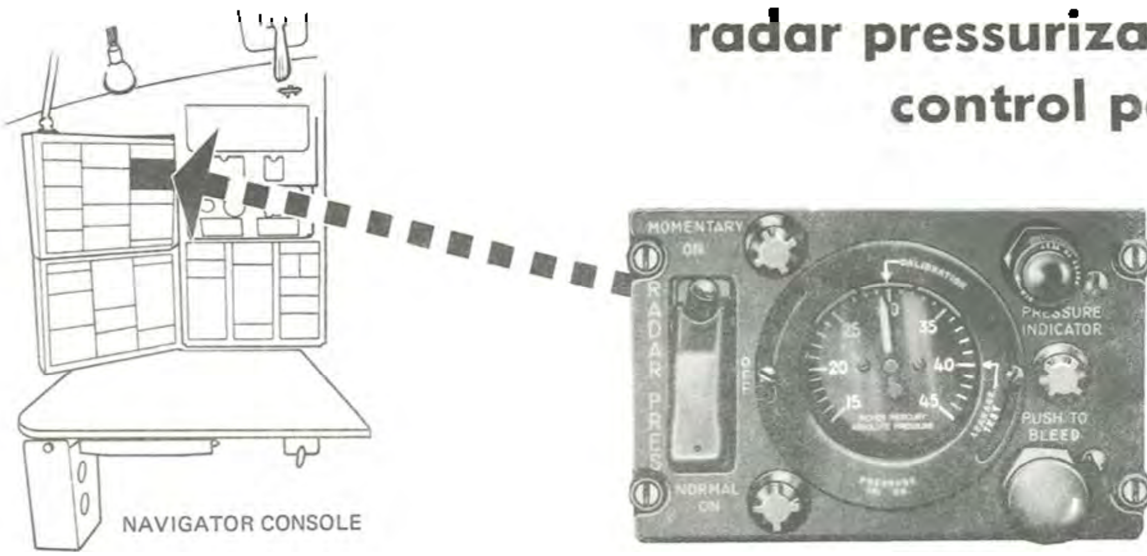


Figure 4-60.

switch, a pressure gage, and indicator light, a push to bleed valve. The radar pressurization switch is a 3-position (NORMAL ON, OFF, MOMENTARY ON), guarded toggle switch that selects the desired type of system operation. When the switch is in NORMAL ON position, operation of the pressure pump is controlled automatically by the action of a pressure switch in the system. When the switch is in the spring-loaded MOMENTARY ON position, the pressure pump is manually actuated, and continues to operate until the switch is released. The indicator light glows when the pump is in operation. If the pressure exceeds its specified limits, as indicated on the pressure gage, stop the pump by placing the radar press. switch in OFF position. Excessive pressure may be bled from the system by depressing the push to bleed valve.

CAUTION

Do not operate the radar set in flight until the receiver-transmitter pressure gage reads 27 to 32 inches of mercury. By maintaining this pressure, arc-over is prevented within the receiver-transmitter and the waveguide pattern is held normal regardless of airplane altitude.

RADIO ALTIMETER (AN/APN-133).

A radio altimeter (figure 4-61) is provided at the navigator's station to indicate the altitude of the airplane above the terrain. The radio altimeter operates from 115-volt ac from the main ac bus through the high range altimeter circuit breaker on the copilot's upper circuit breaker panel.

WARNING

The terrain clearance indications received from the radio altimeter are unreliable when operating over large depths of snow and ice, since the radio waves will actually penetrate the surface and indicate greater terrain clearance than actually exist.

Radio Altimeter Controls.

All operating controls of the radio altimeter are located on the front panel of the indicator. Controls are provided for adjusting circle size, range, receiver gain, and the reference lobe position.

Normal Operation of the Radio Altimeter.

To put the radio altimeter into operation:

1. Rotate the receiver gain knob clockwise to turn power on.
2. Position the scale switch to the desired range.
3. Allow a 3-minute warmup period.
4. Adjust receiver gain and circle size as required.

To turn the radio altimeter on:

5. Rotate the receiver gain knob to the extreme counterclockwise position.

radio altimeter (AN/APN-133)

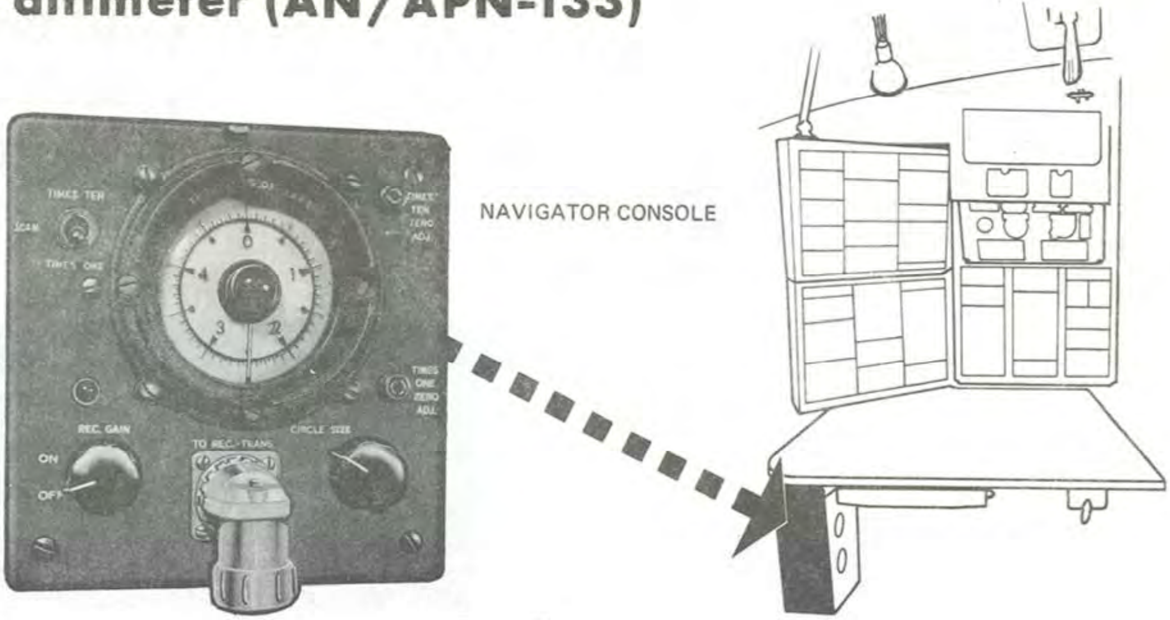


Figure 4-61.

Note

Set zero adjustment on the times 1 and times 10 scale immediately prior to take-off and prior to each reading taken, to position the counterclockwise edge of the reference pulse on zero. Adjust circle size as required.

C-12 COMPASS SYSTEM.

Two individual C-12 compass systems are installed in the airplane. Each system provides an accurate heading reference to aid in navigation, regardless of the latitude position of the airplane. In addition to providing a visual heading reference, each system furnishes heading information to other navigation systems in the airplane (figure 4-63). Operating controls and indicators for the No. 1 and No. 2 compass systems are located on the digital controller (figure 4-62) for each system. The digital controllers are located on the navigator's instrument panel. Each system is capable of operating in either one of two modes. In the magnetic heading mode, used in latitudes where no distortion of the earth's magnetic field is encountered, the directional gyro in the system is slaved to the earth's magnetic field and the indicators display magnetic heading of the airplane. In the directional gyro mode, used in latitudes where the magnetic meridian is distorted or weak, the system gyro acts as a directional gyro and maintains the position manually selected by the operator. The indicators display the manually established heading.

The C-12 compass systems receive 28-volt dc power from the essential dc bus through the bdhi amplifier No. 1 and No. 2 on the copilot's lower circuit breaker panel and 26-volt, 400 cycle, single phase ac power from the No. 1 and No. 2 C-12 compass transformers through the compass No. 1 and No. 2 transformer primary and secondary circuit breakers on the pilot's upper circuit breaker panel. The No. 1 and No. 2 C-12 compasses receive 15-volt, 400 cycle, single phase ac power from the essential ac bus through the No. 1 and No. 2 compass power circuit breakers on the pilot's upper circuit breaker panel.

Digital Controller.

Controls and indicators for the compass systems are located on the respective system digital controller (figure 4-62). The following paragraphs list the controls and indicators and describe their function in the system.

LATITUDE N-S SWITCH.

The latitude N-S switch allows selection of north (N) or south (S) latitude correction, dependent on airplane location.

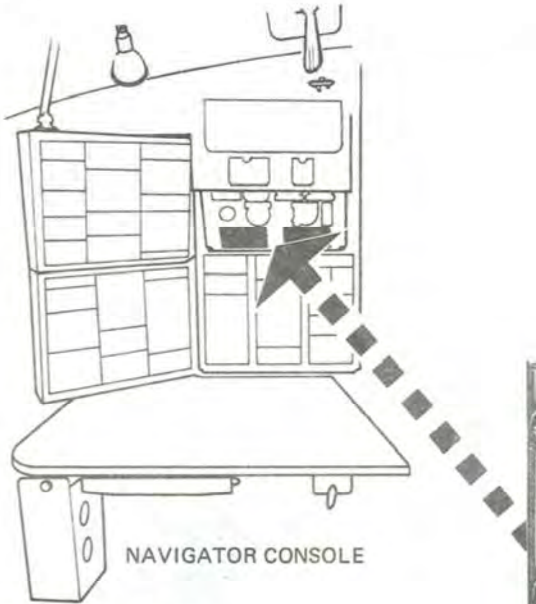
LATITUDE KNOB.

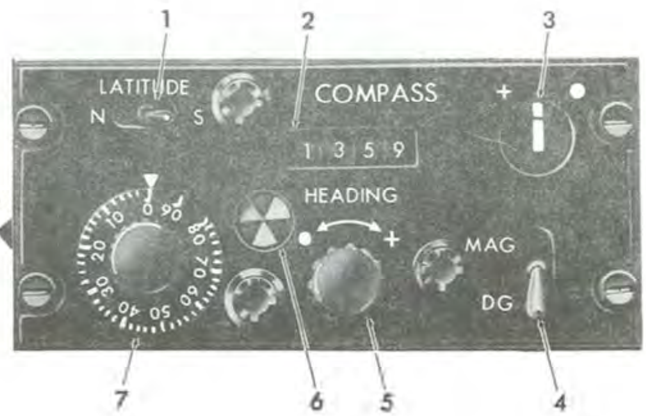
The latitude knob is rotated to set the correct latitude location, in degrees, of the airplane position. This setting allows the compass system to automatically correct the earth rate and coriolis errors at the set latitude.

MODE SWITCH.

The mode switch selects compass operating mode. When the switch is set in MAG position the directional gyro in the compass is slaved to a magnetic azimuth detector. The digital reading on the heading indicator will show magnetic heading. This switch position is used in lower latitudes where no distortion of the earth's magnetic field is encountered.

C-12 compass system digital controller





1. LATITUDE N-S SWITCH
2. HEADING INDICATOR
3. ANNUNCIATOR
4. MODE SWITCH
5. SYNCHRONIZING CONTROL
6. POWER ADEQUACY INDICATOR
7. LATITUDE KNOB

Figure 4-62.

When the switch is set in DG, the gyro acts as an independent directional gyro unslaved to any magnetic detector. The digital reading in the heading indicator is manually set with the synchronizer knob. This mode of operation is normally used for navigation in the polar areas where meridian convergence is excessive, or where the magnetic field is distorted.

SYNCHRONIZING CONTROL.

The synchronizing control is used in conjunction with the annunciator to provide fast system synchronization when the compass system begins initial operation in the magnetic heading mode (MAG) selection of the mode switch. The synchronizer knob is rotated in the direction indicated by annunciator until the needle is centered. When the needle is centered, the compass is synchronized in magnetic heading mode and the digital drums in the heading windows display the magnetic heading of the aircraft. When the directional gyro mode (DG) has been selected with the mode switch, the synchronizer knob is used to manually set the digital drums in the heading windows to the desired course heading.

ANNUNCIATOR.

The annunciator provides visual indication of system synchronization when the compass system is operating in the magnetic heading mode.

HEADING INDICATOR.

The heading indicator provides digital readout of airplane heading in 0.1-degree increments.

POWER ADEQUACY INDICATOR.

The power adequacy indicator gives a red indication (warning flags) to indicate that system power input has dropped below safe operating level.

Operation of the C-12 Compass.

Note

The C-12 compass systems begin to operate when power is supplied to the airplane electrical ac buses. However, a 5-minute warmup is required for gyro stabilization.

To set the compass for desired airplane heading:

1. Set hemisphere (latitude) N-S switch to correct for current airplane position.
2. Rotate latitude knob to set present airplane position degrees of latitude under the index.
3. Set desired compass operating mode with the mode switch (MAG or DG).
4. If MAG has been selected in step 3, allow annunciator needle to center automatically or manually synchronize the system with the synchronizing control.

C-12 compass system tie-in

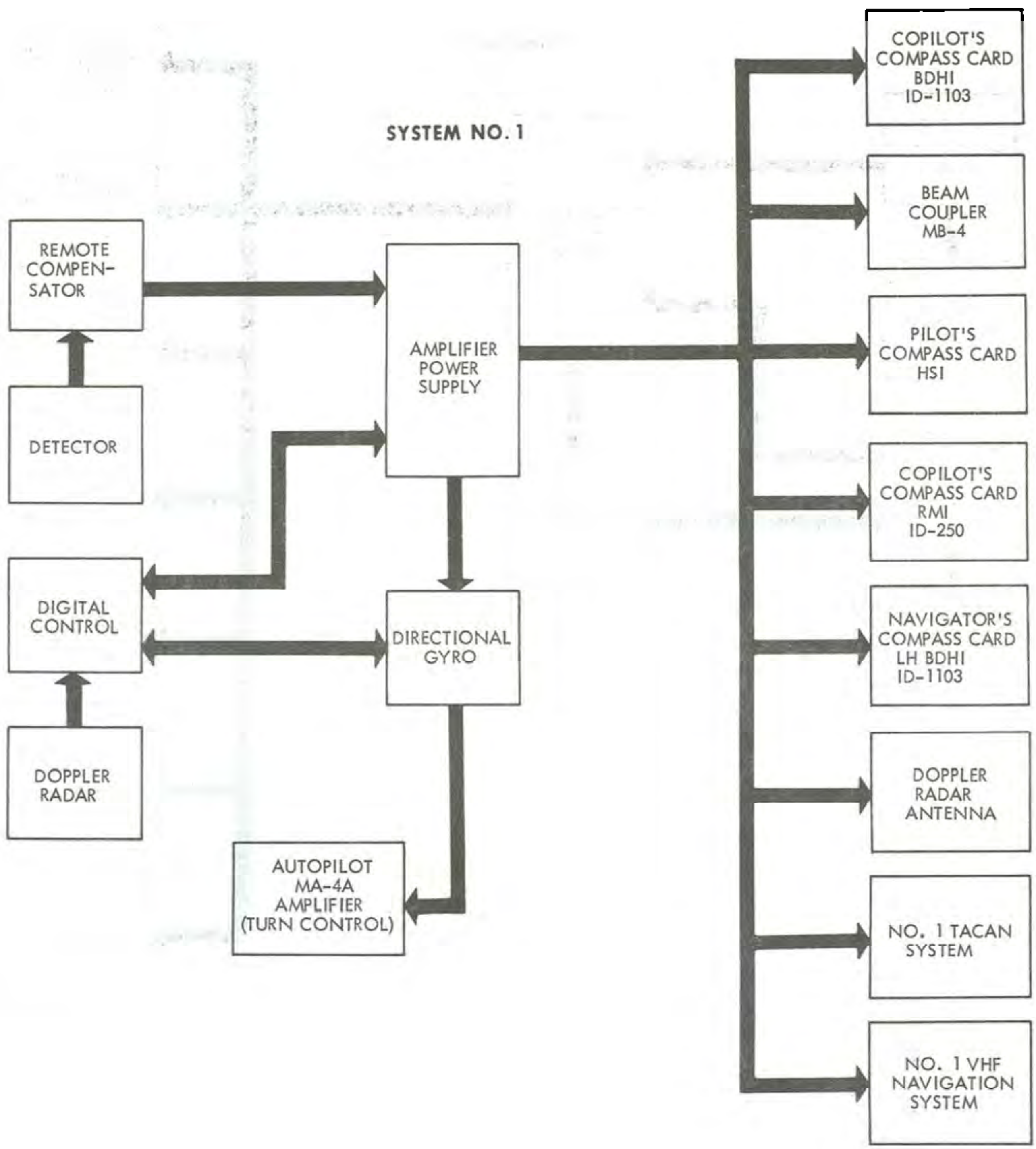


Figure 4-63. (Sheet 1 of 2)

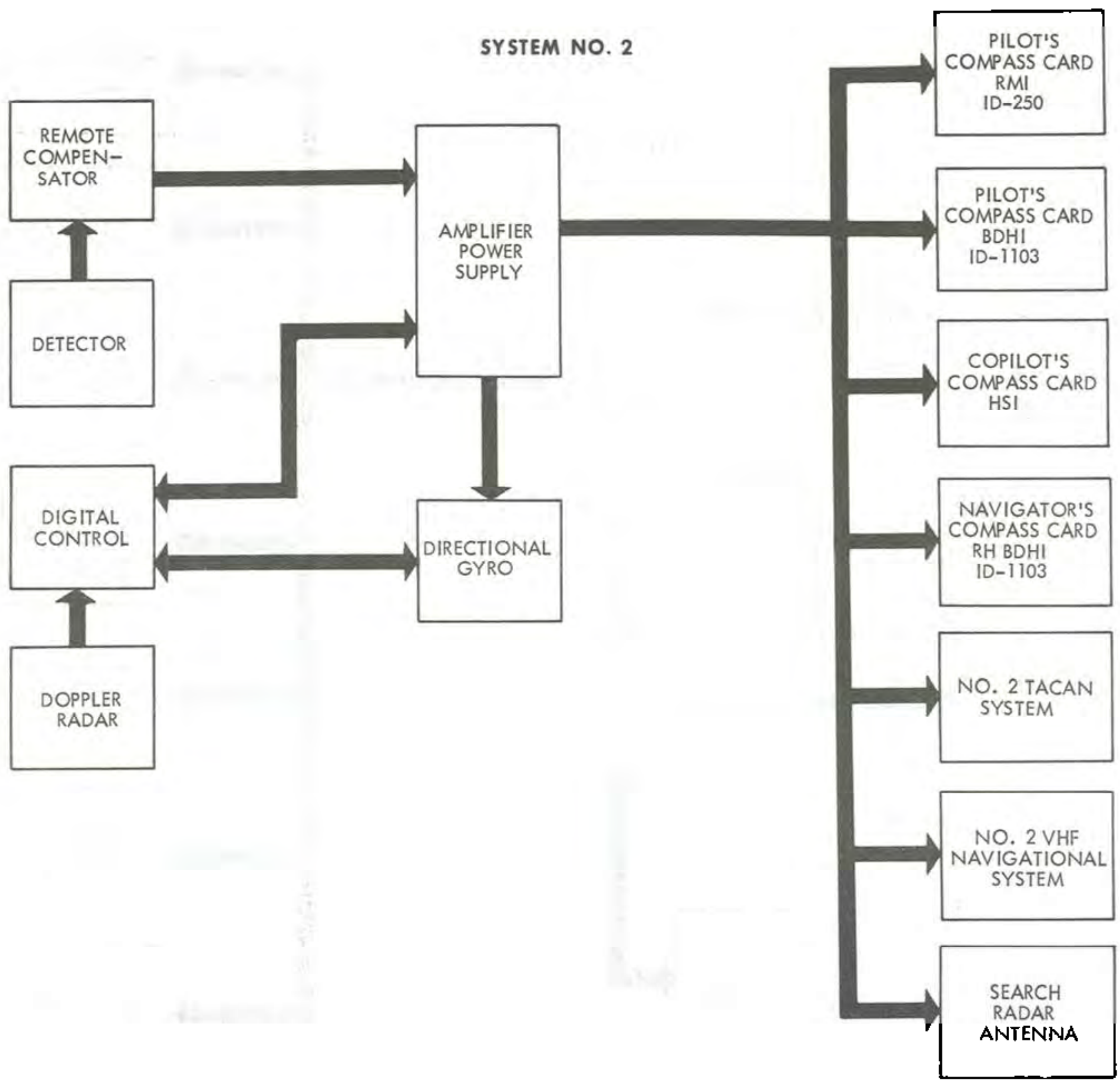


Figure 4-63. (Sheet 2 of 2)

5. If DG position has been selected in step 3, set desired airplane heading in the heading windows with the synchronizing control.

Note

- During directional gyro operation, changing the heading with the synchronizer knob will cause a change only in the heading indicator and will not cause the airplane to change heading.
- Illumination of the power adequacy indicator on the digital controller indicates that system power has dropped below safe operating level. Utilize the other C-12 compass system if it is still operable. If both compass systems are inoperable, utilize other means of navigation.
- A warning flag by the power adequacy indicator, on the digital controller, indicates that system power has dropped below safe operating level. Utilize the other C-12 compass system if it is still operable.

Doppler Ground Speed Tie-In Check.

To check the Doppler ground speed tie-in to each compass system, accomplish the following:

1. With the AN/APN-147 Doppler radar set and both compass systems operating, set the compass mode switch on the navigator's compass controller to MAG and the latitude knob to a latitude of zero (0) degrees.
2. Move the ground speed (G/S) slew switch on the Doppler radar set control panel to the DECR position and hold until a ground speed of 950 knots is indicated on the Doppler display indicator; then release the slew switch.
3. Observe that the annunciator needle is in the synchronized (center) position.
4. Rotate the latitude knob to 90 degrees and observe that the annunciator needle is displaced from the synchronized position.
5. Return the latitude knob to 0 degree and observe that the annunciator needle is centered.
6. Move the ground speed slew switch to the INCR position until a ground speed of 50 knots is indicated on the Doppler display indicator, and then release the slew switch.
7. Rotate the latitude knob 90 degrees and observe that the annunciator needle remains centered.

Emergency Operation of the C-12 Compass.

Emergency operation of the compass systems can be accomplished as follows:

1. If one of the compass systems becomes inoperable, the airplane can be flown by using the other compass heading reference.

2. If the Doppler radar becomes inoperable, the ground speed readout on the drift angle-ground-speed indicator will be fixed. Operation will be normal, and the difference between correct ground speed and the fixed groundspeed would require negligible compensation. Correction for any accumulated error can be accomplished by position-fixing.

Note

The coriolis error compensation circuits provide a maximum of about 4.25 degrees correction at a latitude of 80 to 90 degrees with a north or south ground speed of 500 knots. However, at a ground speed of about 250 knots at 80 degrees latitude, there would be about 1.25 degrees correction, and under normal operating conditions in the midlatitudes, the total compensation including Meridian convergence would be in the vicinity of .62 degrees.

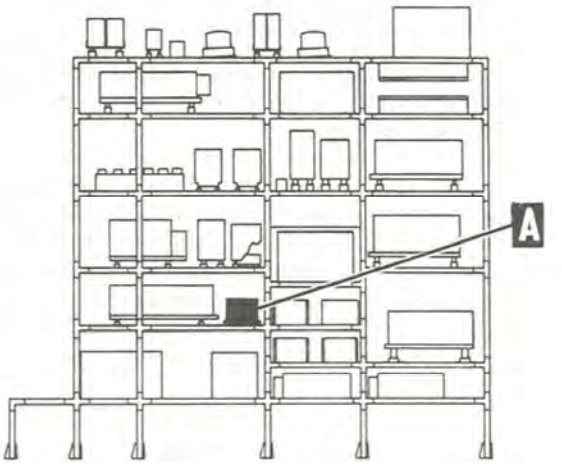
3. In the event of Doppler failure in the extreme conditions as noted above, or if desired, the compass system may be operated as a directional gyro (DG mode) which will bypass coriolis and meridian convergency compensation since these corrections are applied to the magnetic slaving circuits.

LORAN C/D SYSTEM (AN/ARN-92).

The AN/ARN-92 navigation system (see figure 4-64) is a computerized system that has the capability of handling airplane navigation problems with information derived from Loran C or D. The AN/ARN-92 has three modes of operation. They are Loran (LRN), doppler/inertial (DOP/INS) and dead reckoning (DR). LRN is the primary mode while DOP/INS and DR are backup modes.

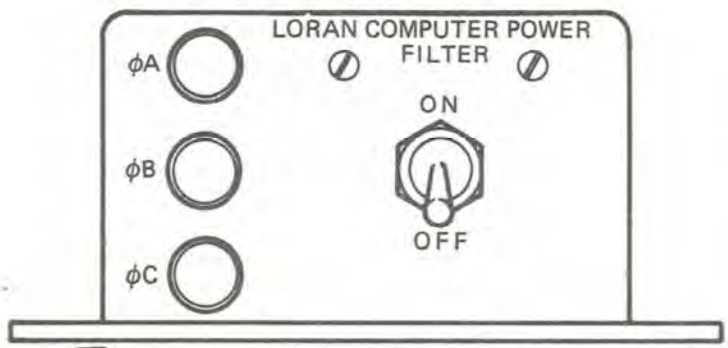
The navigation system consists of receiver (R1503/ARN-92), antenna coupler unit (CU-1721/ARN-92), computer (CP898/ARN-92), control indicator (C7417/ARN-92)the true airspeed control (TAS) and computer power filter unit. It functions in conjunction with

loran control and indicators (AN/ARN-92)

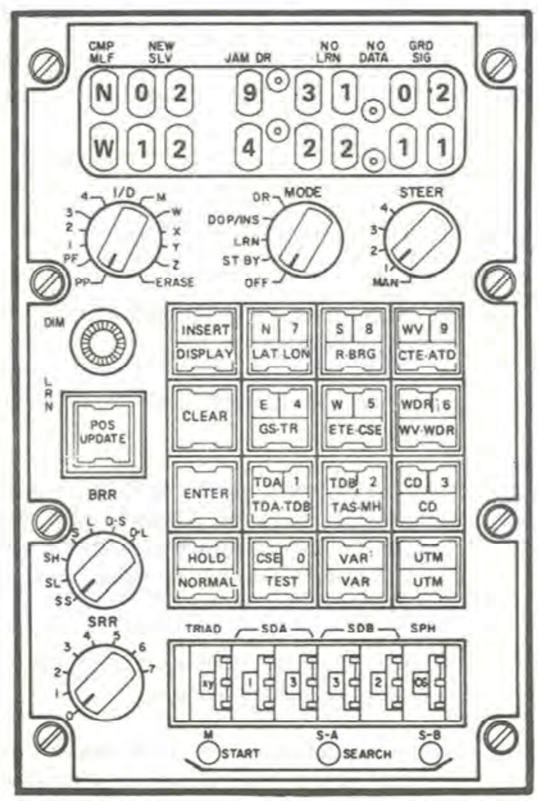


CARGO COMPARTMENT ELECTRONICS EQUIPMENT RACK

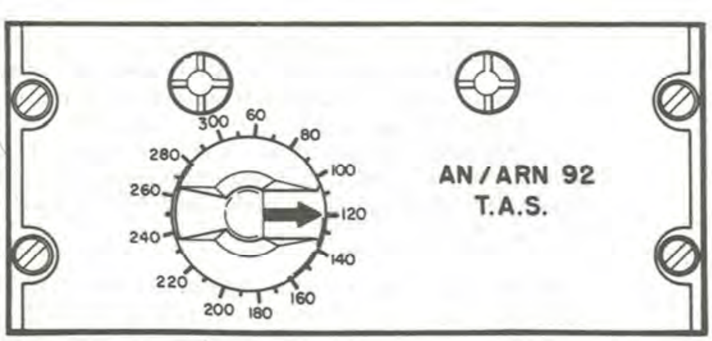
NAVIGATOR CONSOLE



A LORAN COMPUTER POWER FILTER UNIT



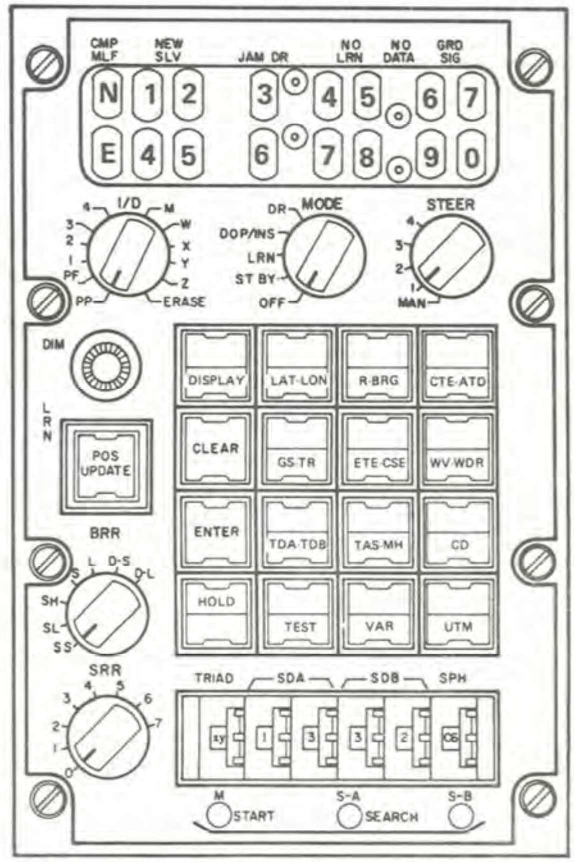
B CONTROL INDICATOR, C-7417/ARN-92



C ARN-92 TAS CONTROL

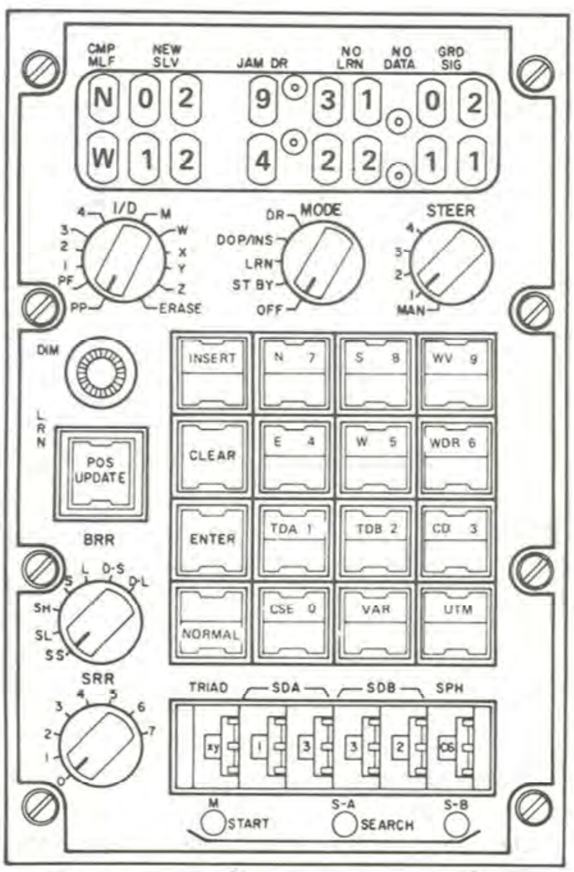
Figure 4-64. (Sheet 1 of 2)

loran control and indicators (AN/ARN-92)



B CONTROL INDICATOR, C-7417/ARN-92

DISPLAY FUNCTION



B CONTROL INDICATOR, C-7417/ARN-92

INSERT FUNCTION

Figure 4-64. (Sheet 2 of 2)

two or more pairs of Loran C or Loran D ground stations. The ground stations are geographically situated from each other to form a triad(master and two slave stations)configuration. These stations transmit a series of 100 kHz pulses at designated time intervals and at specific pulse repetition rates to provide fixes for airplanes within a designated area.

Transmitted Loran signals from the ground stations are received by the airplane's No. 1 HF antenna and applied to the Loran receiver via the antenna coupler. The coupler resonates the connected antenna at 100 kHz and amplifies the received signals to levels which enable low noise transmission to the receiver. The receiver accepts the Loran signals and automatically synchronizes gain control and time difference measuring programs to these signals. The navigational computer recevies data from both the receiver and control indicator and in turn supplies both input components with further data. The control indicator unit energizes the system and supplies the computer with basic and specific rates and latitude and longitude data. Further, true airspeed (TAS) is supplied by the manual AN/ARN-92 TAS control and heading is provided by the inertial flux gate through the adapter power supply. Velocity north and velocity east components are provided by the fire control system for rate aiding. Primary power from the airplane of 115-volt, 3 Ø, 400 Hz is applied to both the receiver and the computer from the left-hand ac bus (pilot's upper circuit breaker panel) and 28 volts is supplied from the left-hand dc bus. Twenty-six volt reference power is provided by aircraft 26 volt reference power. The Loran computer power protector is used to provide filtered 3 phase 115 volt 400 Hz power to the Loran computer.

Loran Computer Power Filter Unit.

To protect the computer during high input power surges, a toggle type three phase circuit breaker provides additional protection and allows removal of power when not required. Three pilot lamps indicate presence of aircraft power at the power protecfor input. It is located on the cargo compartment equipment rack (figure 4-17).

Control Indicator C-7417/ARN-92.

The control indicator, located at the navigator's console, operates the Loran navigational system, includes illuminated indicators that display latitude and longitude data, indicates the operating status of Loran system, energizes the Loran system and supplies the computer with basic and specific rates. Controls and indicators consist of control switches, input-output keyboard switches, dimmer controls, warning lights, and alpha-numeric gas tube/nixi light display.

MODE SWITCH.

The mode switch turns the system ON and selects the mode of operation. Switch positions and description are:

Switch Position	Description
OFF	System power off.
STBY	Standby position. Clock oven power on in receiver and computer.
LRN	Loran position. System power on. Computer using Loran for navigation when locked on to a Loran signal.
DOP/INS	Doppler/inertial position. System power on. Computer using inertial inputs for navigation.
DR	Dead reckoning position system power on. Computer using true airspeed, inserted wind, magnetic heading, and variation inputs for navigation.

I/D SWITCH.

The I/D(insert/display) switch is a 12-position rotary switch. The keyboard parameters displayed or inserted are relative to the position of the I/D switch. Switch positions, description, and INSERT remarks are:

Switch Position	Description	Switch Position	Description
PP	Present position	M	Loran master station
PF	Position fix	W	Loran slave W station
1	Destination 1	X	Loran slave X station
2	Destination 2	Y	Loran slave Y station
3	Destination 3	Z	Loran slave Z station
4	Destination 4	ERASE	Allows erasure of all chain parameters

STEER SWITCH.

The steer switch selects one of four destinations inserted on the insert/display switch.

Note

The insert/display switch must be in the PP position for the steer switch to provide steer destination data.

REPETITION RATE SWITCHES.

The basic repetition rate (BRR), specific repetition rate (SRR), select the Loran chain to be used.

TRIAD SWITCH.

The triad switch informs the computer which two slave stations of the chain selected should be used. (Selection should be based on best coverage of operating area.)

SEARCH DELAY SWITCHES.

Search delay A (SDA) and search delay B (SDB) select the lower limit of the search window in thousands of microseconds. SDA always relates to the first listed slave station of the selected TRIAD.

SPHEROID SWITCH.

The spheroid (SPH) switch allows the selection of spheroid base for universal transverse mercator (UTM) computations. The switch positions are as follows:

Switch Position	Spheroid
AN	Australian National
EV	Everest
BE	Bessel
IN	International
C8	Clarke 1880
C6	Clarke 1866

START SEARCH SWITCHES.

The three start search switches enable the receiver to search for master (M), slave A (S-A), and B (S-B) Loran stations. The slave stations searched for depend upon the setting of the SDA and SDB switches. The search routine is started from the SDA and SDB switch settings.

DIM CONTROLS.

The dim controls are concentric knobs, the large knob controlling the keyboard group intensity and the small knob controlling the gas tube display brightness. The control indicator panel lighting is controlled by the 5-volt lighting control.

WARNING LIGHTS.

The warning lights, located at the top of control indicator, are groups of incandescent lamps. Each light has an associated color relative to the degree of warning. The dead reckoning (DR) light is amber. The computer malfunction (CMP) MLF and no data (NO LATA) lights are red. The new slave (NEW SLV), jammed (JAM), no Loran (NO LRN), and ground signal (GRD SIG) lights are green.

POSITION UPDATE SWITCH.

The position update switch allows updating of the computer's dead reckoning (DR) program to the position and variation inserted in PF on the insert/display switch.

Note

TDA and TBD destination inserts are not recommended due to the possibility the ambiguity.

KEYBOARD.

The input-output keyboard group consists of an array of momentary pushbutton switches used to insert or display information from the computer. When inserting numbers, each number inserted moves across the display from right to left. The display is checked for correctness. Then the enter key is depressed to enter the inserted data into memory. If it is a display command, the parameters for the key depressed will be displayed. These keys and their functions are:

INSERT/DISPLAY Alternate action switch used to select either insert or display function. Insert function illuminates the top half and display function illuminates the bottom half of the split keys on the keyboard.

CLEAR Removes inserted parameters before the enter key is depressed. Blinks to indicate that computer will not accept data. Not used in display function.

ENTER Used to enter information into temporary memory. Entry of data is accomplished one line at a time.

HOLD/NORMAL Is an alternate action switch. HOLD will freeze all present position parameters selectable on keyboard except ETE. NORMAL allows continual update of present position data.

DISPLAY READOUT ASSEMBLY.

The display readout assembly (nixi lights) consists of two alpha display tubes and fourteen numeric display tubes. There are also two degree and two decimal tubes. From this unit, data is displayed in terms of two simultaneous seven decimal digits. The type of information being displayed is designated by an alphabetical character preceding the decimal number. Punctuation in terms of decimal points and angular degrees are provided according to the type of information being displayed.

AN/ARN-92 TAS Control.

The manual TAS input control contains a knob dial setting which is used to dial the aircraft's true airspeed. The dial has a calibrated linear range from 60 to 310 knots. The calibration limit is ± 10 knots. Lighting is provided and controlled by the panel lights control. TAS being supplied to the AN/ARN-92 computer may be read on the control indicator by depressing the TAS-MH key.

Normal Operation of the LORAN C/D Systems.

The control indicator has three basic functions: display, insert, and erase. Figure 4-64 shows the display and insert functions. In the figure, the active portions of the keys for the depicted function are visible. The display function is depicted with results of a self-test. The erase function is used to remove from the computer memory all station parameters (latitude, longitude, coding delay, and secondary phase correction) previously entered. Therefore, if any of the parameters of any complex is to be retained, this data must be re-inserted into the control indicator after the erase procedure. Operating procedures for the system consist of the following:

Control Indicator Operation.

To operate the control indicator, proceed as follows:

NAVIGATION COMPUTER SYSTEM TURN ON.

Turn on navigation computer system as follows:

Note

- Loran lock will be lost (NO LRN light will illuminate) if No. 1 and 4 engines are down-shifted to low-speed ground idle, or if auxiliary pump is turned on with No. 2 and 3 engines in low-speed ground idle. The computer power protector circuit breaker must be on.
- The control indicator mode switch may initially be placed in the ON (LRN) position, to insert information before elapsed warmup period.

1. Place control indicator mode switch to STBY position. In this position computer power is OFF, but the clock over power is applied. Allow approximately 5 minutes for the clock to stabilize.
2. Place control indicator mode switch to LRN position. This applies power to the system. If the computer is located in an accessible position, the elapsed time indicator may be observed. The indicator shall be running.
3. Set the INSERT/DISPLAY key to display function. The bottom half of the split keys will light up. Depress TEST KEY. The display shall show the configuration shown in figure 4-64 (display function) and all warning lights will be illuminated. Figure 4-65 show the symbols and numbers associated with the respective keys in the display and insert functions.

OPERATION OF THE HOLD/NORMAL KEY.

With the bottom (NORMAL) portion of the HOLD/NORMAL key lighted, the computer will continuously update the displayed data. Pressing the HOLD/NORMAL key will cause the top (HOLD) portion to be lighted and will freeze all the display values except ETE. With HOLD lighted, the computer continues to update parameters but displays only the frozen values. Data may be inserted with HOLD lighted. Pressing the HOLD/NORMAL key again will light the bottom (NORMAL) portion of the key and will cause the display to show current values.

PROCEDURE FOR OPERATING THE CLEAR KEY.

If the operator wishes to change parameters while he is in the process of insertion, he should depress the

loran controls display function operation

Keyboard Switch	Symbols Displayed on Alpha Tubes: Top Row	Bottom Row	Numeric Tube	Remarks
DISP			Display	Selects display function. Illuminates bottom half of split switches.
HOLD			HOLD	Will freeze displayed present position parameters selected on keyboard, except ETE-CSE.
LAT-LON	N or S	E or W	Latitude, Longitude	Displays the latitude and longitude of selected position of I/D switch.
GS-TR	G	T	Ground Speed, Track Angle	Present ground speed and track angle.
TDA-TDB	△	△	Time Differences A and B	Time difference of present position and selected destinations.
TEST	N	E	1234567 4567890	The results of the Computer self-test. Also, the seven warning lights will be illuminated while the test switch is depressed.
R-BRG	R	B	Range Bearing	Range and bearing from PP to selected destination.
ETE-CSE	T	C	Estimated Time Enroute, Course	Time enroute to selected destinations based on present GS and course inserted via keyboard.
TAS-MH	A	H	True Air Speed, Magnetic Heading	True airspeed from TAS control. Magnetic heading from inertial flux gate.
VAR	V	E or W	Magnetic Variation	Inserted variation.
CTE-ATD	R or L	D	Cross Track Error, Along Track Distance	Cross track error and along track distance from PP to selected destination based upon inserted course destination variation.
WV-WDR	V	D	Wind Velocity, Wind Direction	Displays wind parameters computed in Loran mode.
CD		C	Coding Delays	Displays coding delays for selected Loran complex. Secondary phase correction for the Master station cannot be displayed.
UTM	N or S	U	Northing or Southing Easting	Displays universal transverse mercator coordinates of present position, and selected destinations.

Figure 4-65. (Sheet 1 of 2)

loran controls insert function operation

Keyboard Switch	Alpha-Numeric Description	Remarks
INSERT	INSERT	Selects insert function. Illuminates top half of split keys.
CLEAR	CLEAR	Removes incorrectly inserted parameters before ENTER sw is depressed.
ENTER	ENTER	Enters word displayed into memory. The display will return to all zeros.
NORMAL	NORMAL	Allows the insertion of data into Computer. This sw should always be in this position, except to "freeze" displayed parameters.
N-7	North-Seven	The first time this sw is pressed, NORTH will be entered: After the first time, a seven will be entered.
E-4	East-Four	This sw is handled the same as N-7, above.
TDA-1	Time Difference A-One	This sw is handled the same as N-7, above.
CSE-0	Course – Zero	This sw is handled the same as N-7, above.
S-8	South-Eight	This sw is handled the same as N-7, above.
W-5	West-Five	This sw is handled the same as N-7, above.
TDB-2	Time Difference B-Two	This sw is handled the same as N-7, above.
VAR	Magnetic Variation	This sw informs Computer that the next sw pressed (E or W) will be direction of magnetic variation.
WV-9	Wind Velocity-Nine	This sw is handled the same as N-7, above.
WDR-6	Wind Direction-Six	This sw is handled the same as N-7, above.
CD-3	Coding Delay-Three	This sw is handled the same as N-7, above.
UTM	Universal Transverse Mercator	This sw informs Computer that next sw pressed (N or S, before northing: E before easting) will be parameter for the UTM. If an E is pressed, for easting, it will be displayed as a U; indicating UTM.

Figure 4-65. (Sheet 2 of 2)

clear key. This will wipe out all data inserted back to the last time the enter key was depressed. The display will also revert back to show all zeros. If the operator inserts VAR or UTM data and is not following the correct sequence, the clear key will start blinking. This indicates that data will not be accepted by the computer. The clear key should now be depressed which will stop the blinking and the control indicator is ready to accept correctly inserted data again.

PROCEDURE FOR DISPLAYING PARAMETERS.

Display parameters as follows:

1. Set insert/display key to DISPLAY.

2. Depress key showing the parameter wished to be displayed. The upper portion of the display will show the first parameter shown on the key, and the bottom portion of the display will show the second parameter shown on the key. The parameter displayed is relevant to the insert/display switch setting, except that inserted wind velocity, wind direction, and master station secondary phase correction cannot be displayed.

INSERTION OF STATION PARAMETERS.

Insert station parameters as follows:

1. Insert master station parameters as follows:

Note

The memory capacity of the computer is for three station complexes, with one master and four slave stations each. In order to insert a new station complex when the maximum capacity is stored, a stored station complex needs to be erased prior to entering the new station complex. Refer to Erase Procedure.

a. Set insert/display switch to M position.

b. Set BRR and SRR (repetition rate) switches to select desired station.

c. Set insert/display key to INSERT position.

d. Insert latitude by first depressing the N (north) or S (south) key, followed by numbers in left to right sequence.

e. Verify that the top row of the display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

f. Insert longitude by first depressing E (east) or W (west) key, followed by number in left to right sequence.

g. Verify that the bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

Note

If the master station secondary phase correction is not known, insert a 1.00.

h. Insert the master station secondary phase correction by first depressing CD (coding delay) key, followed by numbers in left to right sequence.

i. Verify that the top row of the display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key, then reinsert correct data and depress enter key.

2. To insert parameters for the slave stations (W, X, Y, Z), repeat steps b through g above, after setting the insert/display switch to applicable slave (W, X, Y, Z). Insert coding delay by first depressing coding delay (CD) key, followed by numbers in left to right sequence.

Note

The erase procedure removes from computer memory all station parmeters (LAT, LON, coding delay, and secondary phase correction) previously entered for all three complexes. Therefore, if any of the parameters of any complex is to be used, this data must be re-inserted into the control indicator, after the erase procedure.

ERASE PROCEDURE.

Perform erase procedure as follows:

1. Set insert/display to ERASE position.

2. Set insert/display key to INSERT position.

3. Depress N key.

4. Depress enter key. The NO DATA light will go on after depressing the enter key.

POSITION FIXING.

Perform position fixing as follows:

1. Insert true airspeed system position fixing, with latitude and longitude coordinates, as follows:

a. Set insert/display switch to PF position.

b. Set mode switch to DR position.

c. Set insert/display key to INSERT position.

d. Insert the position fix latitude by first depressing N (north) or S (south) key, followed by numbers in left to right sequence.

e. Verify that top row of display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

f. Insert the position fix longitude by first depressing E (east) or W (west) key, followed by numbers in left to right sequence.

g. Verify that bottom row of display contains correct data; then depress enter key. If data in bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

h. Depress position update key when location of the aircraft coincides as closely as possible with inserted latitude and longitude coordinates.

i. Set insert/display switch to PP position. The computer will compute present position based on TAS and heading inputs.

2. Insert true airspeed system position fixing, with time difference coordinates, as follows:

a. Set insert/display switch to PF position.

b. Set mode switch to DR position.

c. Set BRR and SRR (repetition rate) switches to select desired station.

d. Set triad switch to select desired triad.

e. Set insert/display key to INSERT position.

Note

To resolve ambiguity, the approximate latitude and longitude inserted must be closer to the actual position than to the alternate time difference intersection point.

f. Insert the approximate latitude by first depressing N (north) or S (south) key, followed by numbers in left to right sequence.

g. Verify that top row of the display contains correct data; then depress enter key. If data in the top tow is incorrect, depress clear key; then reinsert correct correct data and depress enter key.

h. Insert the approximate longitude by first depressing E (east) or W (west) key, followed by numbers in left or right sequence.

i. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

j. Insert position fix time difference A parameter by first depressing TDA key, followed by the numbers in left to right sequence.

k. Verify that top row of the display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

l. Insert position fix time difference B parameter by first depressing TDB key, followed by the numbers in left to right sequence.

m. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

n. Depress the position update key when location of the aircraft coincides as closely as possible with inserted time difference coordinates.

o. Set insert/display switch to PP position. The computer will compute present position based on TAS and heading inputs.

3. Insert true airspeed system position fixing, with universal transverse mercator coordinates, as follows:

a. Set insert/display switch to PF position.

b. Set mode switch to DR position.

c. Set SPH (spheroid) switch to select the desired spheroid.

d. Set insert display key to INSERT position.

e. Insert the position fix parameter for northing by first first depressing UTM (universal transverse mercator) key, the N (north) or S (south) key, followed by numbers in left to right sequence.

f. Verify that top row of the display contains correct data; then depress enter key. If data in top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

g. Insert the position fix parameter for easing by first depressing UTM key, then E (east) key, followed by numbers in left to right sequence. When E key is depressed, it will be displayed as a U. This indicates UTM.

h. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

i. Depress the position update key when location of the aircraft coincides as closely as possible with inserted UTM coordinates.

j. Set insert/display switch to PP position. The computer will compute present position based on TAS and heading inputs.

INSERTION OF DESTINATION DATA.

Insert destination data into the Loran system computer as follows:

1. Insert destination in latitude and longitude coordinates as follows:

a. Set insert/display switch to destination desired (1, 2, 3, or 4).

b. Set mode switch to LRN position.

c. Set BRR and SRR (repetition rate) switches to select desired station.

d. Set triad switch to select desired triad.

e. Set insert/display key to INSERT position.

f. Insert latitude of the destination selected by first depressing N (north) or S (south) key, followed by numbers in left or right sequence.

g. Verify that top row of the display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

h. Insert longitude of the destination selected by first depressing E (east) or W (west) key, followed by numbers in left to right sequence.

i. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

j. Insert magnetic variation of destination selected by first depressing variation key, then E (east) or W (west) key, followed by the numbers in left to right sequence. When E or W key is depressed, a V will appear on the upper display parameter tube and an E or W on the lower display parameter tube.

k. Verify that the display contains correct data; then depress enter key. If data is incorrect, depress clear key; then reinsert correct data.

2. Insert destination in time difference coordinates as follows:

a. Set insert/display switch to destination desired (1, 2, 3, or 4).

b. Set mode switch to LRN position.

c. Set BRR and SRR (repetition rate) switches to select desired station.

d. Set triad switch to select desired triad.

e. Set insert/display key to INSERT position.

Note

To resolve ambiguity, the approximate latitude and longitude inserted must be closer to the actual position than to the alternate time difference intersection point.

f. Insert the approximate latitude of destination selected by first depressing N (north) or S (south) key, followed by numbers in left to right sequence.

g. Verify that top row of the display contains correct data; then depress enter key. If data in the top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

h. Insert approximate longitude of the destination selected by first depressing E (east) or W (west) key, followed by numbers in left to right sequence.

i. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

j. Insert time difference A parameter of the selected destination by first depressing TDA key, followed by numbers in left to right sequence.

k. Verify that top row of the display contains correct data; then depress enter key. If data in top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

l. Insert time difference B parameter of selected destination by first depressing TDB key, followed by numbers in left to right sequence.

m. Verify that bottom row of the display contains correct data; then depress enter key. If data in the bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

n. Insert the magnetic variation of selected destination by first depressing variation key, then E (east) or W (west) key, followed by numbers in left to right sequence. When the E or W key is depressed, a V will appear on the upper display parameter tube and an E or W in the lower display parameter tube.

o. Verify that the display contains correct data; then depress enter key. If data is incorrect, depress clear key; then reinsert correct data and depress enter key.

3. Insert destination in universal transverse mercator coordinates as follows:

a. Set insert/display switch to destination desired (1, 2, 3, or 4).

b. Set mode switch to LRN position.

c. Set SPH (spheroid) switch to select desired spheroid.

d. Set triad switch to select desired triad.

e. Set BRR and SRR (repetition rate) switches to select desired station complex.

f. Set insert/display key to INSERT position.

g. Insert universal transverse mercator coordinates of desired destination by first depressing UTM key, then N (north) or S (south) key, followed by numbers in left to right sequence.

h. Verify that top row of the display contains correct data; then depress enter key. If data in top row is incorrect, depress clear key; then reinsert correct data and depress enter key.

i. Insert easting coordinates by first depressing UTM key, then E (east) key, followed by numbers in left to right sequence. When E key is depressed, it will be displayed as a U. This indicates UTM.

j. Verify that bottom row of the display contains correct data; then depress enter key. If data in bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

k. Insert the magnetic variation of selected destination by first depressing variation key, the E (east) or W (west) key, followed by numbers in left to right sequence. When the E or W key is depressed, a V will appear on the upper display parameter tube and E or W on the lower display parameter tube.

l. Verify that the display contains correct data; then depress enter key. If data is incorrect, depress clear key; then reinsert correct data and depress enter key.

INSERTION OF WIND DIRECTION AND VELOCITY.

1. Insert wind velocity parameters by first depressing WV key, followed by numbers in left to right sequence.
2. Verify that top row of the display contains correct data; then depress enter key. If data in top row is incorrect, depress clear key; then reinsert correct data and depress enter key.
3. Insert wind direction parameters by first depressing WDR key, followed by numbers in left to right sequence.
4. Verify that bottom row of the display contains correct data; then depress enter key. If data in bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

PROCEDURE FOR INITIATION OF RECEIVER SEARCH FOR REQUIRED STATION COMPLEX AND TRIAD.

Initiate receiver search for required station complex and triad as follows:

1. Set BRR and SRR (repetition rate) switches to select desired station.
2. Set triad switch to select desired triad.

Note

It is assumed that desired station constants have been inserted.

3. Set mode switch to LRN position.
4. The setting of insert/display switch and steer switch are inconsequential.

Note

The expected time differences are determined from the airplane's assumed present position. If the position of the airplane is somewhat vague, the slave delays should be set to the coding delays of the respective slaves.

5. Set SDA (slave delay A) switch approximately 1000 microseconds below the expected time difference for slave A. (As a rule, the first listed slave station of a triad is always A.)
6. Set SDB (slave delay B) switch approximately 1000 microseconds below the expected time difference for slave B.
7. Depress the start button for M (master station). When lock-on has been achieved by the receiver, the NO LRN (no Loran) and DR (dead reckoning) lights will go out.
8. When the receiver has settled, the ground signal light will extinguish, and the time differences and positioning from the receiver will be accurate.

NAVIGATION PARAMETER COMPUTATION.

Compute navigation parameters as follows:

1. Compute range and bearing to selected destination from present position as follows:

   a. Set insert/display switch to PP position.

   b. Set steer switch to MAN position.

   c. Set insert/display key to INSERT position.

d. Insert magnetic variation of present position by first depressing variation key, then E (east) or W (west) key, followed by numbers in left to right sequence. When the E or W key is depressed, a V will appear on the upper display parameter tube and an E or W on the lower display parameter tube.

e. Verify that the display contains correct data; then depress enter key. If data is incorrect, depress clear key; then reinsert correct data and depress enter key.

f. Set insert/display switch to desired destination position (1, 2, 3, or 4).

g. Set insert/display key to DISPLAY position.

h. Depress R-BRG key. The top row of the display will now display range, and bottom row will display bearing to destination selected on insert/display switch.

2. Use alternate method to compute range and bearing to selected designation from present position as follows:

Note

The following procedure is an alternate method that may be used to display range and bearing to selected destination.

a. Set insert/display switch to PP position.

b. Set steer switch to select desired destination.

c. Depress R-BRG key. The top row of the display will now display range, and bottom row will display bearing to destination selected on steer switch.

3. Compute along track distances and cross track error for a selected destination, using the computer inserted course, as follows:

a. Set insert/display switch to PP position.

Note

The DR mode may be selected for computing navigation parameters providing that the applicable paragraph under Position Fixing has been completed.

b. Set mode switch to LRN.

c. Set insert/display key to INSERT position.

d. Insert magnetic variation parameters for the present position by first depressing variation key, then E (east) or W (west) key, followed by numbers in left to right sequence. When the E or W key is depressed, a V will appear on the upper display parameter tube and an E or W on the lower display parameter tube.

e. Verify that the display contains correct data; then depress enter key. If data is incorrect, depress clear key; then reinsert correct data and depress enter key.

f. Set insert/display switch to desired destination position (1, 2, 3 or 4).

g. Insert course parameters by first depressing CSE (course) key, followed by numbers in left to right sequence.

h. Verify that bottom row of the display contains correct data; then depress enter key. If data in bottom row is incorrect, depress clear key; then reinsert correct data and depress enter key.

i. Set steer switch to MAN position.

j. Set insert/display key to DISPLAY position.

k. Depress CTE-ATD key. The display now shows cross track error in top row and along track distance in bottom row relative to insert/display switch position and selected course.

Control Indicator Warning Lights.

When illuminated, these lights indicate any single or combination of conditions noted below.

CMP MLF (COMPUTER MALFUNCTION) LIGHT.

The computer malfunction light will illuminate as follows:

1. Steady illumination: the internal computer-generated self-test cycle detects a malfunction in computer operation, the computer should not be trusted for correctness of any computer function.

2. Blinking illumination: 26 vac reference power voltage is not being provided.

Note

- If the computer malfunction light illuminates, turn computer OFF and back ON. If malfunction light persists, turn computer OFF to avoid damage. Steady light may indicate a momentary power fluctuation or an actual malfunction.
- If computer malfunction light illuminates, even momentarily, the station parameters should be checked for correctness. If any parameters are found to be incorrect, perform erase procedure; then reinsert station parameters.

NEW SLV (NEW SLAVE) LIGHT.

The new slave light will illuminate as follows:

1. The receiver is unable to lock on to one of the slave stations.

Note

The appropriate SDA and SDB switch positions should be 1000 microseconds less than the expected time differences and the convergence angle between the selected slave stations exceeds 15 degrees.

2. When new slave light illuminates, set the triad switch to a position causing the light to go out. Reset search delay switches (SDA and SDB) to appropriate positions, if required, and depress the start search buttons S-A and S-B.

DR (DEAD RECKONING) LIGHT.

The dead reckoning light will illuminate indicating that the computer has automatically gone over to dead reckoning mode of navigation when LRN mode is selected.

When the Loran receiver has again locked on to a new triad, the dead reckoning light will then go out, indicating that the computer has automatically gone back to loran mode.

The dead reckoning light will illuminate when Loran lock-on is lost for the following reasons:

a. When the jamming signal comes into the receiver while operating in the loran mode.

b. If a Loran transmitter malfunction has occurred, or if receiver power fails.

c. If the Loran receiver has lost lock-on due to signal strength.

JAM (JAMMING) LIGHT.

The jamming light will illuminate when the receiver is receiving very high noise loran signals. The computer should not be trusted for accuracies in the Loran mode of navigation.

NO LRN (NO LORAN) LIGHT.

The no Loran light will illuminate as follows:

1. The no Loran light illuminates if the receiver is not locked-on to the complete triad set into the controller, if the loran transmitter malfunctions or if receiver power fails.

Note

A loss of Loran lock-on may be caused by transmission exceeding 24 seconds on either HF radio.

NO DATA LIGHT.

The no data light illuminates if selected loran master station and triad parameters are incompletely entered.

GRD SIG (GROUND SIGNAL) LIGHT.

The ground signal light illuminates when the ground wave signal becomes available while the receiver is locked on the sky wave signal. It remains on until the receiver transfers lock-on to the ground wave.

FIRE CONTROL POWER SUPPLY SYSTEM.

The fire control power supply (FC power supply) is installed to provide 115-volt ac, 400 Hz, three-phase primary power for the tactical computer (ASN-91) and the inertial measurement set (IMS). (See figure 4-66.) This power is routed through the ASN-91 CMPTR circuit breakers and the SSIU circuit breakers located on the pilot's side circuit breaker panel and the IMS and ASN-90 circuit breakers located on the pilot's upper circuit breaker panel. The FC power supply provides single phase (C) primary power to the lineprinter through the printer circuit breaker on the pilot's upper circuit breaker panel and phase C excitation power to the 26 vac reference transformer, gyroscopic attitude reference system 2KW illuminator and the slave switching unit. The FC power supply consists of the following components: three (3) single phase static inverters and a three (3) phase synchronizer located in the cargo compartment equipment rack, (figure 4-32), a fire control battery and a battery charger and a FC power supply control panel located on the FCO overhead panel (figure 4-67). Aircraft power (28-volt dc) is supplied through the right-hand dc bus to the syncronizer and through the battery charger to power the three inverters. If aircraft power is lost or power falls below the voltage of the FC battery, the FC battery will automatically provide 24 volts dc to power the FC inverter. If the FC inverter fails, power from the essential ac bus will be automatically provided to power the fire control system. Two green bit lights are located on the front of each of the three static inverters: when both lights are illuminated, the inverter is operating normally. If the left light goes out, the voltage output of the inverter is out of limits (high or low) but the

fire control power supply block diagram

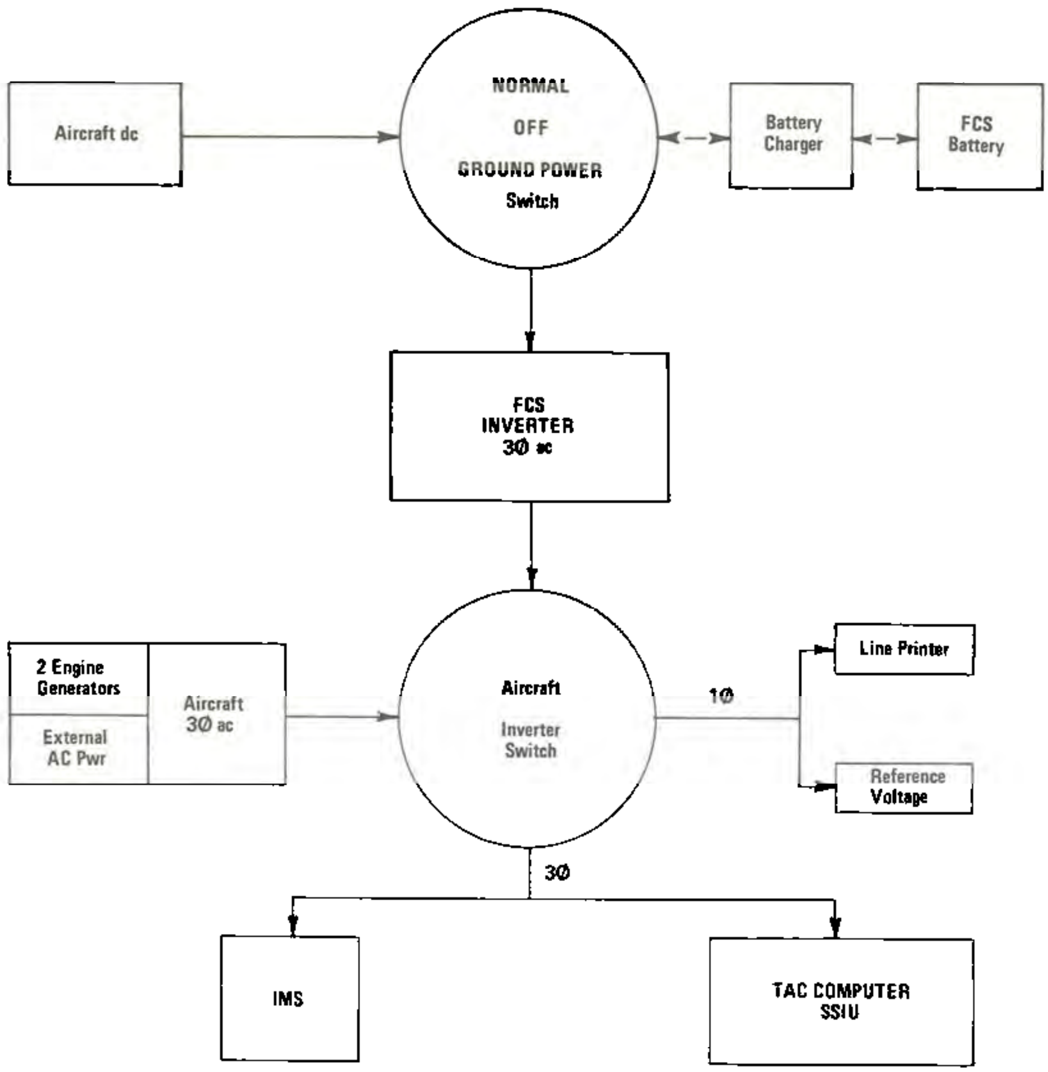


Figure 4-66.

system will continue to operate. If both lights go out, the inverter has failed and aircraft power will be automatically supplied through the fire control power circuit breakers on the pilot's side circuit breaker panel, to power the fire control system.

Reference power normally displayed for the FCS is phase C (115 volts (±) 5 ac at a frequency of 380 to 420 Hz). A selector switch is provided for the selection of either aircraft or inverter three-phase power. Phase A or B power can be monitored by pressing and holding the test ØA or B pushbutton. The frequency and voltage will be indicated on the respective meters on the FC power supply control panel.

An FC power supply control panel is installed on the FCO console. (See figure 4-67.) Selection of power source

fire control power supply system control panel

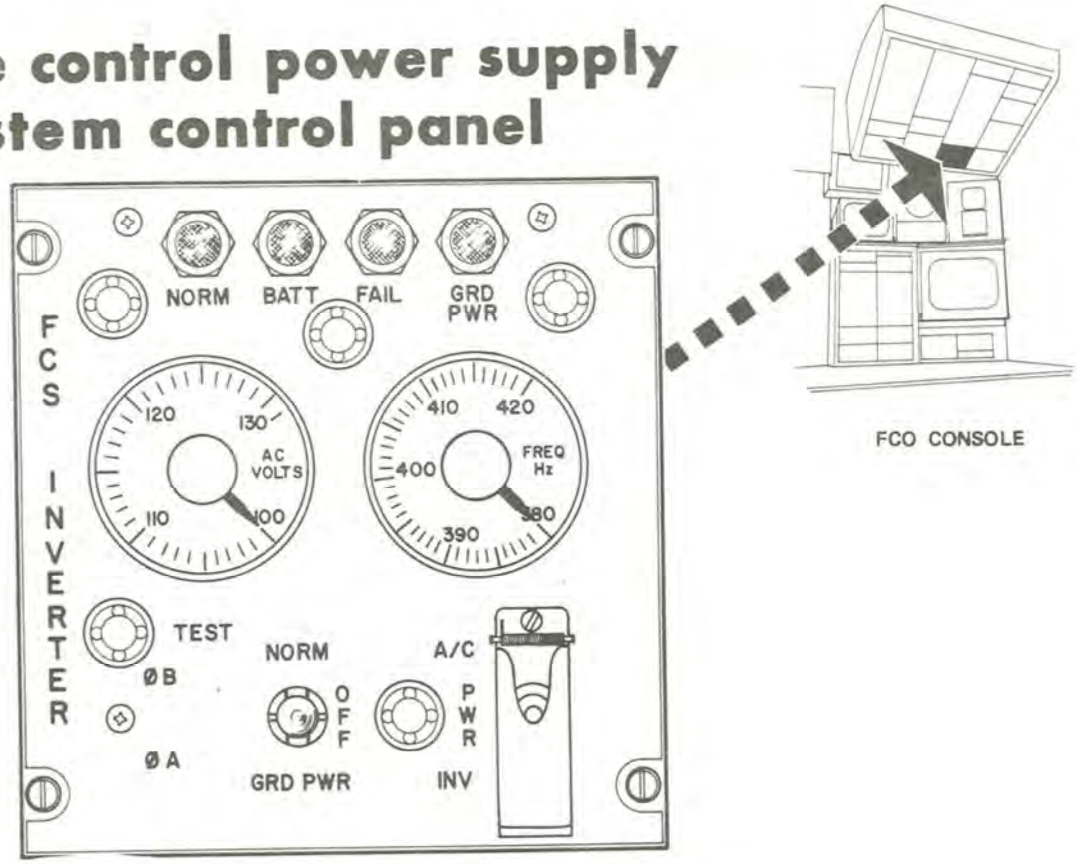


Figure 4-67.

is controlled by the PWR INV A/C, two-position switch. Operating modes, (NORM, GRD PWR, OFF) are controlled by a toggle switch. The panel also contains four indicators, (NORM, BATT, FAIL and GRD PWR), which display the operating status of the inverter system. The fire control systems operation is monitored by two meters mounted on the control panel. One meter checks the voltage (115 volt ± 5) and the other checks the frequency 380 to 420 Hz. Panel edgelighting is controlled by the 5-volt lighting control on the FCO console upper panel. The panel indicator lights receiver +28-volt dc from the dimmer bus and are controlled by the panel lighting CONTROL on the FCO console upper panel. Figure 4-69 shows the controls and functions.

Note

- If aircraft power is selected, the Normal-off ground power should be in the OFF position.
- If aircraft power is selected, power interruptions in excess of one half second may cause computer malfunctions. Situations of potential power interruptions are:

(1) Switching from ground power to aircraft power.

(2) When generators are brought on and off the line as engines are brought to low speed ground idle - back to normal.

fire control power supply system control panel

(AIRPLANES MODIFIED BY T.O. 1C-130-949)

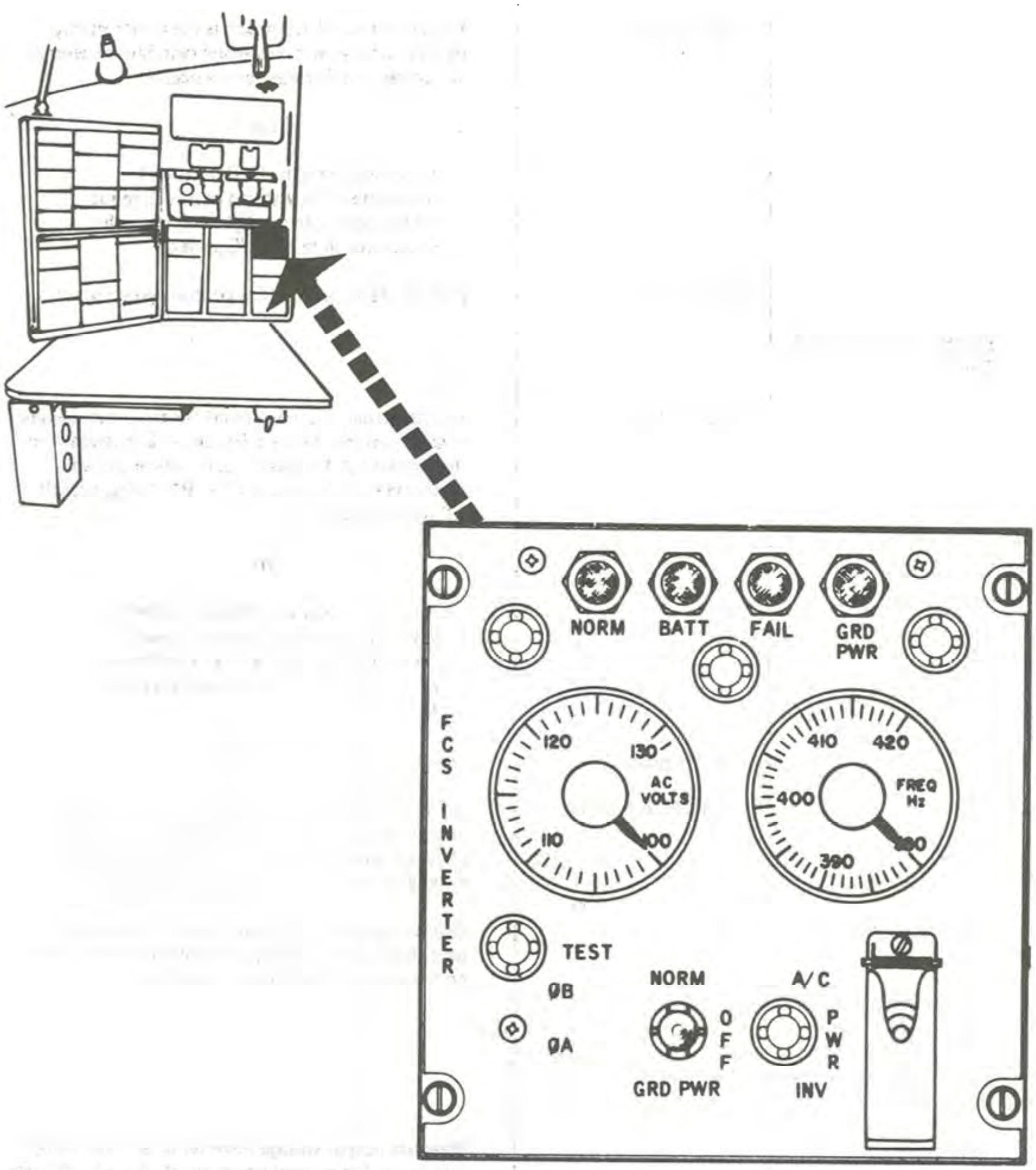


Figure 4-68.

fc power supply controls and functions

Control	Settings	Function
1. Power switch		Provides selection of the Fire Control Power Supply source (INV, A/C). An EMERG cover plate protects the switch.
	INV Position	Primary source of AC power is the power supply inverter system with automatic switching to aircraft AC power if an inverter failure occurs. **Note** If the inverter fails, FAIL light will illuminate and a warning horn will sound. To turn the horn and light off, place the power switch to the A/C position.
	A/C Position	Aircraft AC is used for fire control system power.
2. NORM-OFF-GRD PWR Switch		
	NORM Position	Selects normal operating mode for the power supply inverter system. Primary DC power is received from the aircraft's 28V power supply with automatic switching to an inverter BATTERY during aircraft DC power interruptions. **Note** The BATT indicator light will illuminate when the battery is supplying power. Excessive periods will drain the battery and cause power supply inverter system failure.
	OFF Position	Power supply inverters are OFF.
	GRD PWR Position	Aircraft DC power is provided for power supply inverter system. Used when continuous operation of the power supply inverter system is not critical to prevent total discharge of inverter battery.
3. TEST Pushbutton		Depressing permits reading ϕA or ϕB power outputs (inverter or aircraft). Measurements are given on the voltmeter and frequency meter.
Note When TEST pushbutton is released, the monitor meters will return to ϕC.		
4. Voltmeter		Measures output voltage (inverter or aircraft) being sent to the fire control power supply system. Normal power reading is 115 V $\pm$ 5. During normal operation ϕ C output voltage is measured. ϕA or ϕB voltages can be measured by depressing the TEST pushbutton.

Figure 4-69. (Sheet 1 of 2)

fc power supply controls and functions

Control	Settings	Function
5. Frequency Meter		Measures frequency (inverter or aircraft) being sent to the fire control power supply system. Normal operating frequency is 380 to 420 MHz. ϕC frequency is measured during normal operation. ϕA or ϕB frequency can be measured by depressing the TEST pushbutton.
6. NORM Indicator		Lights when Fire Control Power Supply System is operating in the normal mode.
7. BATT Indicator		Lights yellow when system is operating on battery. When normal power (28 V) is lost, the system is automatically operated by the battery.
Note: Battery power is supplied by the auxiliary 24 ampere hour battery located in the aircraft battery compartment. Approximately 7 min. of power is available. Note: When mode switch is in GRD PWR, the system will not operate from battery power.		
8. FAIL Indicator		Blinks red when output power reaches approximately 110 VAC. An intermittent audio signal also sounds. Lights a steady red when output reaches approximately 100 VAC. A steady audio signal also sounds. Also lights a steady red if complete or partial failure of inverter system occurs.
9. GRD Power		Illuminates when system is on ground power.

Figure 4-69. (Sheet 2 of 2)

GYROSCOPIC ATTITUDE REFERENCE SYSTEM. (3 AXIS GYRO)

The gyroscopic attitude reference system (figure 4-70) provided gyro-stabilized pitch, roll and azimuth flight reference signals. The system consists of an attitude reference system panel, a compass controller panel, three V-8 heading indicators, three auxiliary attitude indicators and a gyro platform. The control panels are located on the navigator's console. One V-8 heading indicator and one auxiliary attitude indicator are located at the navigator's console, IR/EWO console and the TV operator's console. The gyro platform is located on the floor under the IR operator's console. Pitch and roll signals are provided to the auxiliary attitude indicators and heading is provided to the V-8 heading indicators. The system can also provide back-up pitch, roll and heading to the fire control system if the IMS fails or the IMS mode control is OFF. Power for system operation is 115 vac 400 Hz and 26 vac. Overload protection is provided by four circuit breakers on pilot's upper circuit breaker panel and a tell-tale fuse on the 26 vac reference power panel.

Attitude Reference Systems Panel.

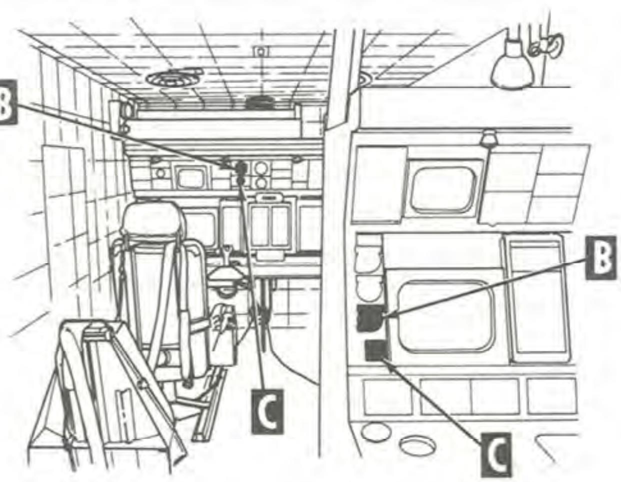
POWER SWITCH.

Used to apply power to the system.

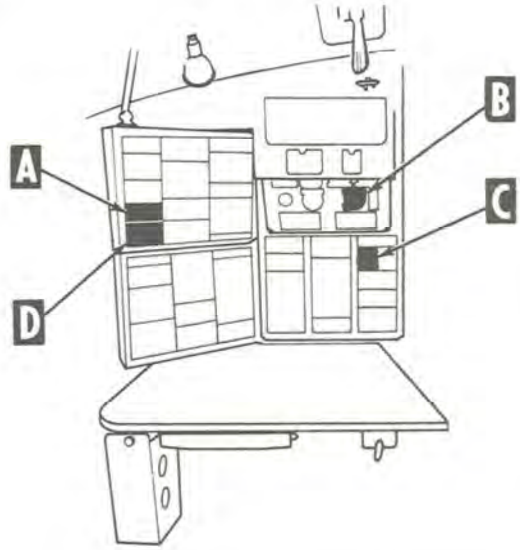
FAST ERECT PUSHBUTTON.

Not used.

gyroscopic attitude reference system (3 axis)



IR CONSOLE/TV CONSOLE

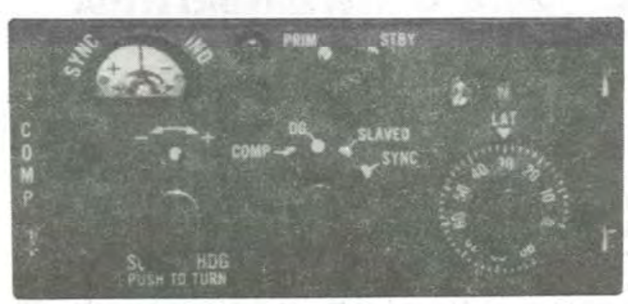


NAVIGATOR'S STATION

A ATTITUDE REFERENCE SYSTEM PANEL

B V-8 HEADING INDICATOR

C AUXILIARY ATTITUDE INDICATOR



D COMPASS CONTROLLER PANEL

Figure 4-70.

Compass Controller Panel.

PRIM-STBY SWITCH.

Not used.

SET HDG CONTROL.

Used to set DG heading. (Push to turn and spring loaded return).

MODE SWITCH.

In present configuration the DG mode is the only operational mode.

LAT CONTROL.

Used to provide latitude compensation in DG mode to reduce the apparent drift due to earth's rotation.

N-S SWITCH.

Used to select direction of latitude compensation. (Screwdriver adjustment)

SYNC IND METER.

In present configuration the SYNC IND meter is not used.

INERTIAL MEASUREMENT SET (IMS) (AN/ASN-90).

The inertial measurement set (IMS) (see figure 4-71) processes varied magnetic heading signals, gyro correction signals, and control discrete signals to develop acceleration data, magnetic and true heading data, and attitude data. See figure 4-72 for the IMS controls and functions. The acceleration data defines the instantaneous change in aircraft velocity along three mutually-perpendicular axes. The true heading data provides aircraft azimuth heading with respect to geographic north. The attitude data represents pitch and roll angles of the aircraft with respect to ground level. In addition, the IMS uses aircraft primary power through an internal power supply to furnish all ac and dc power required for operation.

Acceleration data, heading data, and attitude data represent navigational data (when supplied to other avionic systems) and permit the geographical position of the aircraft to be determined. The IMS develops navigational data from self-contained inertial sensors, which includes a vertical accelerometer, a two-axis accelerometer, and a two-axis displacement gyroscopes. The accelerometers are the primary source of information of the IMS. The gyroscopes function to establish and maintain a frame of reference for the accelerometers and also to furnish attitude and heading information.

Note

- A guarded maintenance test switch, located under the FCO table, provides simulated airborne condition. When the switch is down, normal operation is present. The UP position simulates airborne conditions. Once the system is in airborne condition, the system will no longer align itself or accept present position insertions. The guard must be down (switch down) for ground alignment to occur.
- Remote compass transmitter (flux valve) is installed in the right wing tip to provide a magnetic heading reference for inertial fire control and Loran systems through the IMS mode control.
- A touch-down relay switch informs the IMS the aircraft is airborne. This switch performs the same function as the maintenance test switch.

Normal Operations.

1. Check that circuit breakers are properly set.
2. Check that proper inverters are selected.
3. Place mode selector to GND ALIGN.

CAUTION

If IMS is to be operated for extended periods when avionics bay temperature exceeds 100°F, cooling air must be provided or degradation in performance will occur.

Note

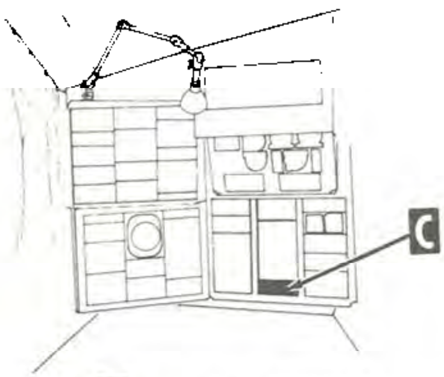
Insure addresses 01-16 are inserted in the NCP.

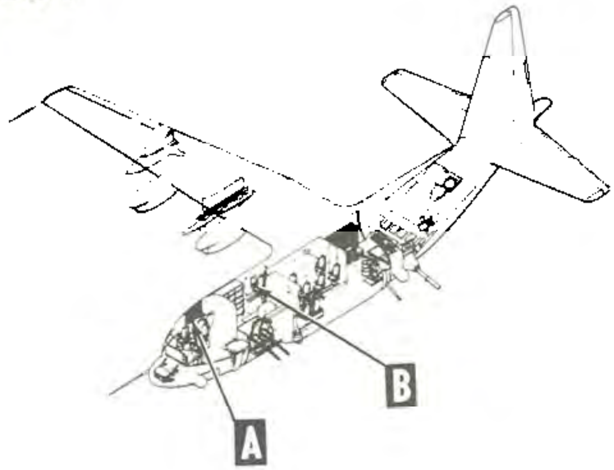
4. After approximately 2 minutes, observe that IMU status indicator on the navigation control panel changes from F (fail), or 2 (3 axis gyro), to U (unaligned).
5. After U is observed, insert present position via navigation control panel.
6. Approximately 10 minutes after present position is inserted, observe that system status changes from U (unaligned) to A (aligned).

Note

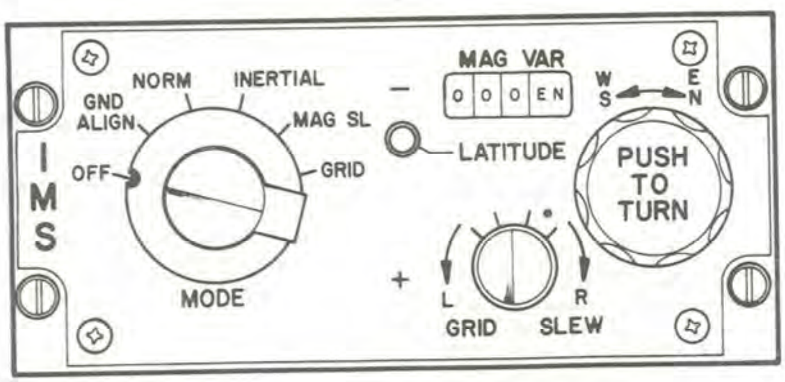
- With the IMS in NORM or inertial mode and an A (aligned) indication present, the IMU is ready to measure aircraft movement.
- During alignment, the aircraft must not be moved and personnel movement should be held to a minimum.

inertial measurement set

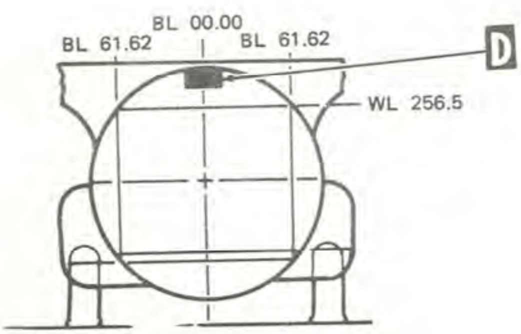




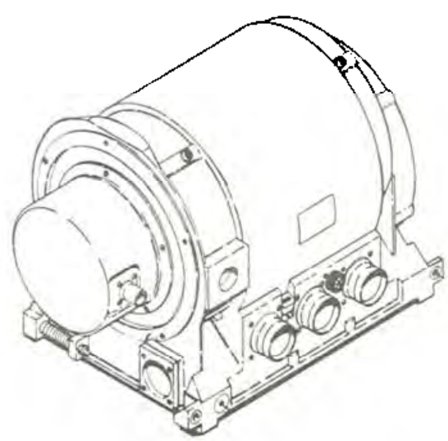
A NAVIGATOR CONSOLE



C INERTIAL MEASUREMENT SET CONTROL



B VIEW LOOKING FORWARD



D INERTIAL MEASUREMENT UNIT (IMU)

Figure 4-71.

inertial measurement set controls & functions

No.	Nomenclature	Type	Function
1.	MAG VAR/ LATITUDE	Drum Counter	Indicates manually entered value of latitude in grid mode and manually entered value of magnetic variation in all other operating modes.
2.	PUSH TO TURN	Knurled Knob	Turn to manually enter value of magnetic variation of latitude into MAG VAR/LATITUDE drum counter.
3.	GRID SLEW	Indicator Switch	During grid modes, enables manually slewing azimuth heading at fast or slow rate.
4.	LATITUDE	Indicator Lamp (yellow)	When lighted, indicates MAG VAR/LATITUDE drum is displaying latitude manually entered in counter.
5.	MODE	Selector Switch	Used for IMS operating mode (OFF, GRD ALIGN, NORMAL, INERTIAL, MAG SL or GRID).
6.	GND ALIGN		A 12 minute sequence aligns Inertial platform to inserted reference frame.
7.	NORMAL		Loran and Inertial position/velocity information are mixed via filtering influences.
8.	INERTIAL		Pure inertial reference frame with inertial error buildup with time.
9.	MAG SL		Inertial platform azimuth is slaved to flux valve heading plus or minus variation. INS initiates DR computations.
10.	GRID		Pure gyro mode similar to 3 axis gyro – platform is slewable.

Figure 4-72.

If time permits, after A (alignment) is attained, leave the mode selector on ALIGN. This will permit refinement of initial alignment. (Every 230 seconds a refined alignment is accomplished.)

Before allowing aircraft to move, place mode selector to NORM or INERTIAL.

Note

Once airborne, if alignment is lost, further alignment or realignment cannot be accomplished and an IMS DR mode must be used with frequent position updates.

Utilizing IMS As A Dead Reckoning (DR) Computer.

1. Place mode selector to GRID or MAG SL position.

Note

When GRID or MAG SL position is selected, the IMS is used for dead reckoning. Once GRID or MAG SL position is selected, NORMAL and inertial selection must not be used until a ground alignment is performed.

SL mode slaves the IMU to the mag flux valve heading via the adapter power supply. The INS uses the variation displayed on the IMS Control Panel, the inserted wind and pitot boom velocities for dead reckoning computations.

a. In the GRID mode, the grid heading is inserted via the grid slew control knob on the IMS Control Panel. Dead reckoning computations are dependent upon the accuracy of the inserted grid heading, grid wind, and latitude.

Auto-Cal Alignment.

The auto-cal alignment method (normally a maintenance function) performs a self-calibration of the IMU. Sixteen gyro drift rates for each IMU are computed at the factory. In time, due to wear and local condition changes, the first three critical gyro drift rates will change. The INS calculates the three changing drift rates for future IMS use.

Note

Approximately 45 minutes is required to complete the auto-cal alignment (12 minutes for the first 2 parameters, 30 minutes for the last).

1. Place mode switch to GND ALIGN.
   a. After U (unaligned) is indicated, insert present position.
2. Depress auto-cal pushbutton on adapter power supply located on the cargo compartment electronics equipment rack.
3. Monitor magnetic and true heading. Observe that platform slews 90 degrees from heading.
4. Approximately 42 minutes after A (alignment) is attained, record drift rates 01, 02 and 03.

Note

These drift rates will be used for future operations. Record new gyro parameters in the 781 forms.

5. Before moving airplane, set mode selector to NORM or INERTIAL. Use IMS to update present position by flyover or sensor position update only.

Note

- Keyboard insertion of present position will restart the INS alignment process.

- The pilot must be informed when aircraft goes above 70 degrees latitude. At 80 degrees latitude, the computer is inhibited and the platform must be in MAG SL or GRID (back-up) mode. The inserted position for Loran (MIX) must be used exclusively for updates and fire control solutions. If Loran fails, the IMS will update with the best estimate of inertial information.

FIRE CONTROL/NAVIGATION COMPUTER SET.

The fire control/navigation computer set furnishes navigation and attack guidance information. It interfaces with the aircraft systems, to compute present position, range and bearing to selected destinations (waypoints), ground track and wind data. It computes the orbital guidance data necessary to direct gunfire on selected targets. The results of these computations are presented on indicators and displays that are monitored by the pilot, copilot, navigator and fire control officer. (See figures 4-73 and 4-74.)

The fire control/navigation computer set is comprised of the following major components: the tactical computer; inertial measurement set; navigation control panel (NCP); fire control panels (FCP-1 and FCP-2); fire control display set; off nominal indicator; pitot boom; the sensors; and the trainable guns. The following subsystems provide parameters to the tactical computer for processing.

1. Inertial measurement set.
   a. (True course).
   b. (True groundspeed).
   c. (Pitch).
   d. (Roll).
   e. (Mag heading).
   f. (True heading).
2. Pitot boom.
   a. (True airspeed).
   b. (Angle of attack).
   c. (Side slip angle).
   d. (Baro altitude).
3. 3-Axis Gyro.
   a. (Pitch).
   b. (Roll).
   c. (Heading).
4. Loran (ARN-92).
   a. (Present position).
5. Laser range target/designator (LTD/R).
   a. (Slant range).
6. Sensors.
   a. Azimuth and elevation look angles.
7. Trainable guns.
   a. Azimuth and elevation pointing angles.

fire control system block diagram

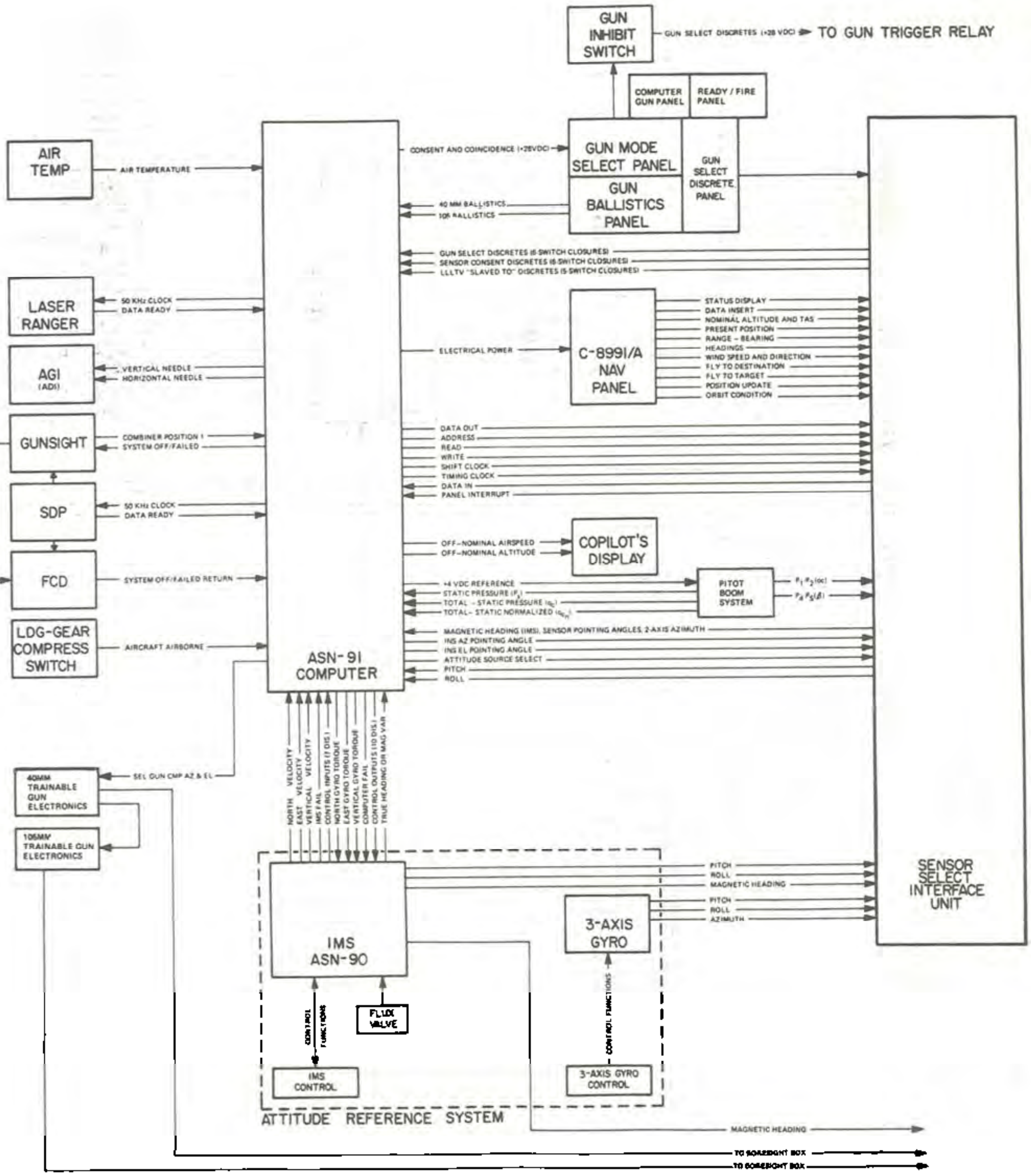


Figure 4-73. (Sheet 1 of 2)

fire control system block diagram

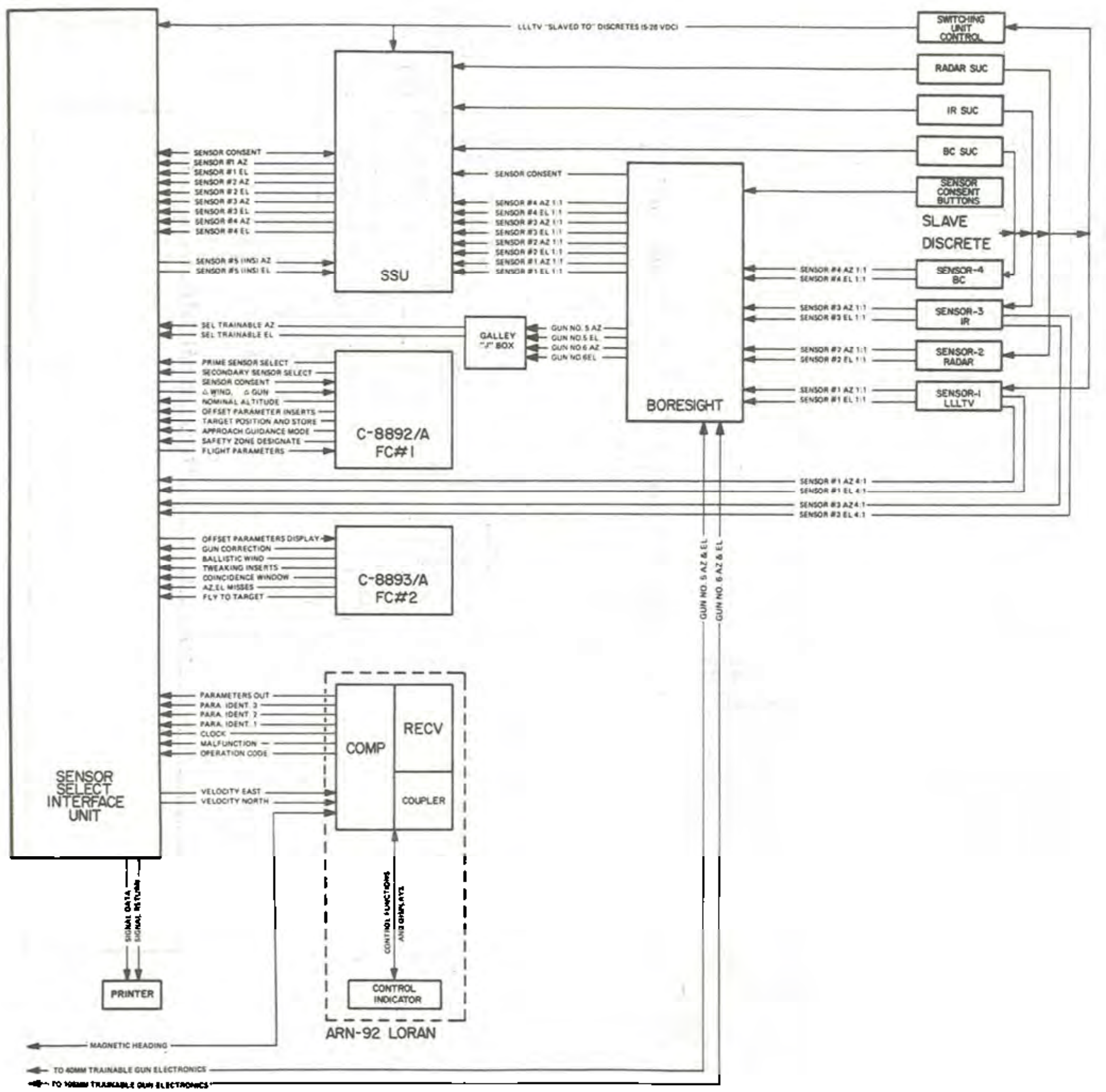


Figure 4-73. (Sheet 2 of 2)

navigation/fire control simplified data flow

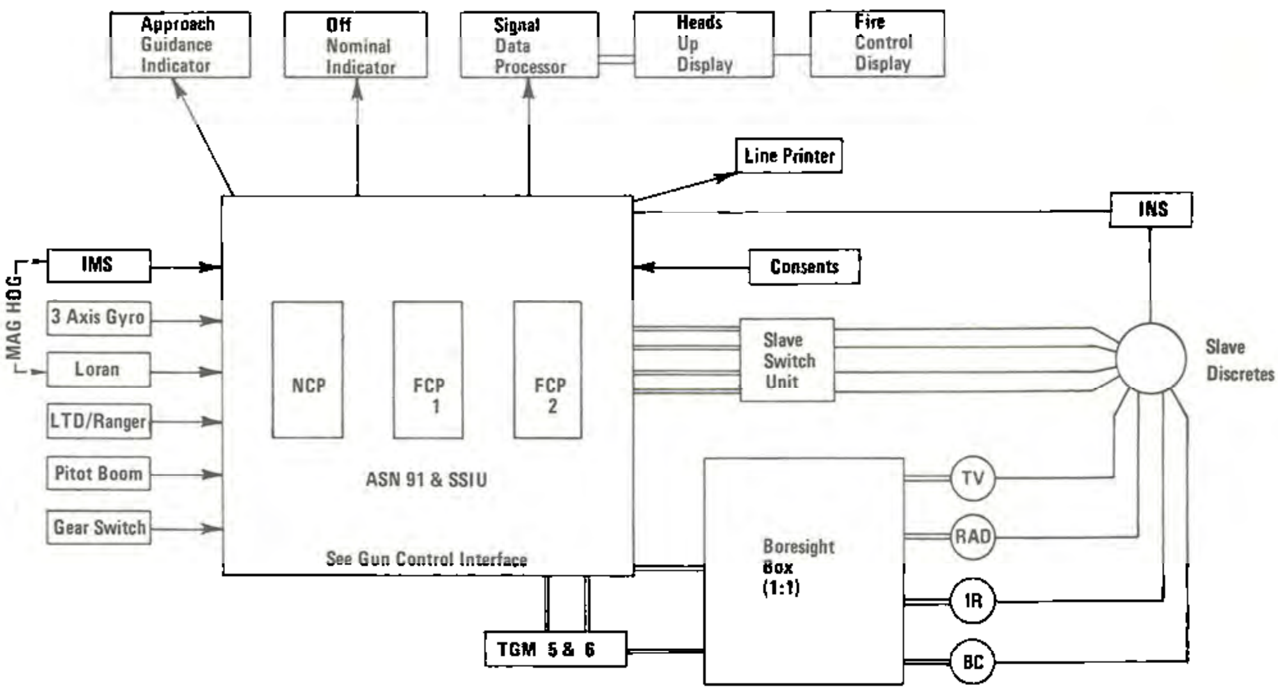


Figure 4-74.

TACTICAL COMPUTER (AN/ASN-91/V).

The tactical computer consists of a general purpose computer, a sensor select interface unit (SSIU) and power control units contained in a single housing. Included with the general purpose computer is a core storage element which contains a stored program. The general purpose computer operates under control of the stored program to accept and transmit data to and from the SSIU and the other components of the avionics system. The SSIU modifies the incoming and outgoing signals of the computer to provide a compatible analog interface with the other components of the avionics system. The front panel has an exhaust blower, elapsed time indicator, two mechanical fault indicators labeled PNL (DS1) and CPTR (DS2), and an indicator reset switch (SI). The PNL (DS1) is not operable. Should either or both fault indicator flags appear, the reset procedure is as follows: turn the power on using the computer power switch on the navigation control panel and depress reset (SI) on the computer.

Computer Coresum Fail Check.

It is possible that the memory may be altered during operation in a high EMI, power interrupt or high temp environment. This memory alteration means that the computer control program as present in the memory is not the same as initially loaded. If the program has been altered such that it cycles in an endless non-functional loop (times out), then the computer will lock all panel displays. In this case the computer system set and inertial system can provide no meaningful information until the program is reloaded.

If a portion of the program is altered to enable the computer to continue to operate in a degraded mode, the program's self test will present a "Coresum Fail" (≡) indication on the status window of the navigation panel and will indicate a memory alteration. In this case a functional check of navigation and FC capabilities should be performed to determine which portion(s) of the program has(ve) been altered and which portion(s) may still be reliable. It is possible, but not likely that some of the data tables used by the computer may be altered. The computer will continue to operate and no "Coresum Fail" indication will be given. The only indication will be incorrect presentation of information from the computer set. For this reason, the aircrew must always correlate the validity of the information from the computer. If the data presented is not reasonable, the aircrew should perform the navigation functional checks for a "Coresum Fail" indication.

If the aircraft is on the ground at the time the memory alteration is noticed, then the program should be reloaded before flight. The computer memory should be verified against a valid operational flight program configuration before the program is reloaded to determine possible causes of this memory alteration.

If several verified memory alters have occured in a computer consistently, then the computer should undergo full SSE tests by field maintenance.

Note

> Missions requiring accurate fire power should not be attempted if coresum fails in flight. Limited success may be achieved based on the following checks.

Functional Checks.

PANEL OPERATION:

The navigation panel and the two FC panels should be checked to see that the computer is recognizing and feeding correct display information. The FCO should note that the appropriate actions/displays occur and that the information is reasonable. This check can be used to simultaneously check other navigation FC functions.

1. Crosscheck between other instruments/equipment available such as Loran, 3 axis gyro, altimeter, compass and the tactical computer set information (PRE POS, M HDG, TAS, LORAN position, Pitch, Roll, and AGL). This provides a check on the navigation integrity of the computer set. The fire control capability requires further checks.

2. Check inserted data to determine it is the same as previously inserted.

HUD/FCD.

These checks are the most important for determination of continued computer use for fire control information.

1. CIP alignment - If the aircraft is flown exactly at the nominal orbit selected (ALT TAS & BANK) and no corrections (wind, wind tweak, or gun tweak) are entered into the fire control system, then the CIP should overlay the standby reticle as for that nominal. If not, then the following conditions must be checked:

   a. The gun used for this orbit (105MM, 40MM, 20MM or 7.62MM) must be set on the FCO's computer gun discrete control panel.

   b. The wind set in navigation panel is zero.

   c. The wind tweak is aero and the gun tweak for the prime sensor-gun selected combination is zero.

If the CIP is correct for the nominal (NC) mode, then a memory alternation can be suspected. This check should be performed anytime new nominals are selected.

2. CIP movement - With either pitot (NA) or inertial (NB) fire control mode selected, the off-nominal movement of the CIP relative to the standby reticle can be checked. Starting with the CIP overlaying the standby reticle, two of the three nominal conditions (ALT, TAS, Bank Angle) should be kept at nominal and the third should be varied to check CIP movement.

   a. With an increase in bank angle the CIP should move up. With a decrease it should move down. (In-relation to the ground, the symbols appear to move in the opposite direction.)

   b. With an increase in TAS, the CIP should move forward. With an decrease it should move aft.

   c. With an increase in altitude, the CIP should move down. With a decrease it should move up.

These movements of the CIP are relative to the standby reticle or to the FCD graticle reference. Some motion should be detected in the direction indicated. If these tests are met, there is a reasonable certainty that the mode tested (NA or NB) is reliable. If not, then the mode tested should not be used.

3. PA position - To check the PA on the HUD, find a target visible to the pilot. A sensor must be selected as primary and track the selected target. The pilot should then see the PA overlay the selected target if offset and moving target are both deselected. The pilot should change the orientation of the A/C to the target (change bank angle) and see that PA overlays the target as long as the sensor is tracking the target and is within the field of view limits of the HUD. IR and TV should be checked in this manner for reliability. In order to check a sensor which cannot visibily track the target, make that sensor prime and then slave it to another sensor which can visibly track the target.

Note

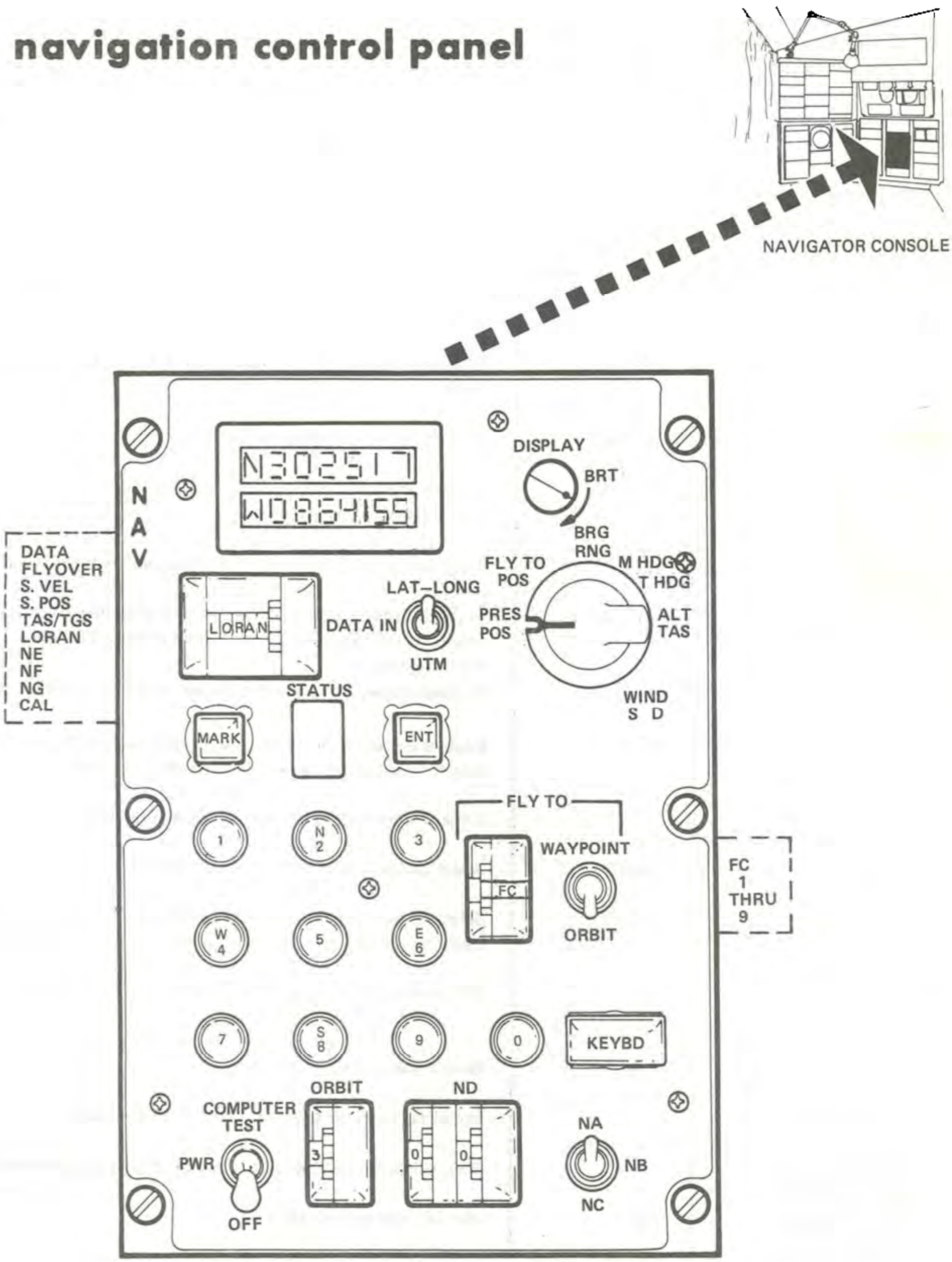
> TV and IR (if prime) may be slaved to BC or RAD if 4:1 resolvers are enabled.

NAVIGATION CONTROL PANEL (NCP) (C-8991/A).

The navigation control panel (figure 4-75) is hereinafter referred to as the NCP. The navigator and the fire control officer uses the NCP to select, control and display certain navigation data parameters. The NCP receives its electrical power and control signals from the computer. While the aircraft is on the ground, the NCP can be used to self-test the entire fire control/navigation computer set and portions of the fire control power supply system (FCPSS). During inflight operations, this panel will provide, upon request, ground position, range and bearing to a selected destination, altitude, airspeed, true ground speed, magnetic and true headings, and wind speed and direction.

Two types of guidance are available. Waypoint provides guidance directly to the selected destination. Orbit places the aircraft into geometry about a selected destination or sensor sight point. All bearings and directions are true. When the distance to destination is greater than 32 nautical miles the bearing to destination is great circle. From 32 nautical

navigation control panel



NAVIGATION CONTROL PANEL

Figure 4-75.

navigation panel controls and functions

Control or Indicator	Setting	Function
1. Data displays windows		Displays data selected by data thumbwheel, data toggle switch, and data rotary switch
2. DISPLAY BRT control		Controls display brightness
3. Data rotary switch	PRES POS	Enables display or entry of present position data
	FLY TO POS	Enables display or entry of selected destination position coordinates or display of FCP No. 2 fly to target position
	BRG-RNG	Enables display of ground range and true bearing to guidance point
	MHDG THDG	Enables display of magnetic and true heading data
	ALT-TAS	Enables display or entry of nominal-altitude, bank angle, and true airspeed
	WIND S-D	Enables display or entry of wind speed and direction
4. Data toggle switch	LAT-LONG	Enables display or entry of parameters as selected by data rotary switch. Position values will be displayed in latitude and longitude.
	DATA IN	Enables display or entry of data controlled by data thumbwheel
	UTM	Enables display or entry of parameters selected by data rotary switch. Position values will be displayed in UTM.
5. ENT switch		Used to insert new data into computer memory
6. FLY TO toggle switch	WAYPOINT	Select guidance to fly over position selected
	ORBIT	Selects attack position guidance to fly an orbit about a position based on primary sensor position (when within 8 miles of target)
7. FLY TO thumbwheel	FC	Selects fire control panel for control of guidance point
	1 thru 9	Selects destination guidance point
8. KEYBD switch		Initializes entry of selected data via panel keyboard
9. NA/NB/NC toggle switch (see FCS interface general for operation)	NA	Pitot velocity reference or backup inertial velocity reference
	NB	Inertial velocity reference
	NC	Nominal velocity reference

Figure 4-76. (Sheet 1 of 3)

navigation panel controls and functions

Control or Indicator	Setting	Function
10. ND thumbwheels		Left thumbwheel selects spheroid for UTM conversion. Right thumbwheel spare
11. ORBIT thumbwheel	0 thru 9	Selects code number to identify nominal orbit altitude/ bank angle/true airspeed condition to be flown
12. COMPUTER toggle switch	TEST	A guarded position that initiates computer self-test
	PWR	Connects power to computer
	OFF	Disconnects power to computer
13. Integer selector switches (10)		Selects alphanumeric data for panel display and entry into computer
14. MARK switch		Enables initiation of certain NCP functions
15. STATUS indicator		Displays indication system status change or coresum fail
16. Data thumbwheel	FLYOVER	Enables navigation system flyover position update
	S. VEL	Spare
	S. POS	Enables navigation system update using primary sensor position
	NF	Spare
	TAS/TGS	Enables display of true airspeed and true groundspeed
	LORAN	Enables display of LORAN present position and navigation system update using LORAN position
	NE	Provides system status word display
	CAL	Enables calibration of 4:1 resolvers
	NG	Spare
	DATA	Enables display or entry of data parameters.

Figure 4-76. (Sheet 2 of 3)

navigation panel controls and functions

Control or Indicator	Setting	Function
16 Data thumbwheel (cont)	DATA (cont)	01-03 IMU Auto Cal Values 04-16 IMU Data Constants *17 Pitch *18 Roll 19 Pitot Boom Cal Enable (±0) 20 Baro Reference 21-25 Pitot Boom Constants 26 Diogenes Correction N 27 Diogenes Correction E *28 Position Difference Mixed/INS N *29 Position Difference Mixed/INS E *30 Active Muzzle Velocity *31 Commanded Lag *32 Commanded Dep *33 TGM Resolver Lag *34 TGM Resolver Dep *35 Primary Sensor Azimuth *36 Primary Sensor Elevation *37 Laser Slant Range 38 Bank Angle (0)/Sensor-Gun (±0) 39 Continuous Wind Enable (±0) 40 Maint GND TGM Enable (±0) 41 TV/IR 4:1 Resolver Enable (±0) 42 Crosswind Guidance Disable (±0) 43 Real Time Clock *44 Last Restoration Address *45 Restored Bit Position *46 Total Restorations 47 Bit Restoration Disable (±0) *99 OFP TAG *Indicates for Display Only (Non-insertable)

Figure 4-76. (Sheet 3 of 3)

navigation panel operation procedures

No.		Task	Step	Action
I.	A.	Display Present Position in LAT/LONG coordinates	1. Set Data Toggle Switch to LAT/LONG	1. No action
			2. Set Mode Rotary Switch to PRES. POS.	2. Latest value of present position is displayed in LAT/LONG coordinates
	B.	Insert Present Position using LAT/LONG coordinates (see Note 1)	1. Same as A	1. Same as A
			2. Same as A	2. Same as A
			3. Depress KEYBD pushbutton	3. ENT light is illuminated and data windows are blanked
			4. Insert new coordinates using integer pushbuttons	4. Data is displayed as it is inserted
			5. Depress ENT pushbutton	5. New data is stored, ENT light is extinguished, data windows are blanked for 1 second, and new data is displayed
	C.	Manual Update of Present Position using LAT/LONG coordinates (Inflight Update)	1. Set Data Toggle Switch to LAT/LONG	1. No action
			2. Set Mode Rotary Switch to PRES. POS.	2. Latest value of present position is displayed in LAT/LONG coordinates
			3. Depress MARK pushbutton	
			4. Depress KEYBD pushbutton	4. ENT light is illuminated
			5. Insert new coordinates using integer pushbuttons (see Note 2)	5. Data is displayed as it is entered
			6. Depress ENT pushbutton	6. New data is stored, ENT light extinguished data windows blanked for 1 second, then new LAT/LONG of present position is displayed
II.	A.	Display Present Position in UTM coordinates	1. Set Data Toggle Switch to UTM	1. No action
			2. Set Mode Rotary Switch to PRES. POS.	2. Latest value of present position is displayed in UTM coordinates
	B.	Insert Present Position using UTM coordinates (see Note 1)	1. Set Data Toggle Switch to UTM	1. No action
			2. Set Mode Rotary Switch to PRES. POS.	2. Latest value of present position is displayed

Figure 4-77. (Sheet 1 of 13)

navigation panel operation procedures

No.	Task	Step	Action
II.	B.	3. Depress KEYBD pushbutton	3. ENT light is illuminated and data windows are blanked
		4. Insert new coordinates using integer pushbuttons (see Note 3)	4. Data is displayed as it is inserted
		5. Depress ENT pushbutton	5. New data is stored, ENT light is extinguished, data windows are blanked for 1 second, and new data is displayed
	C. Manual Update of Present Position using UTM coordinates (Inflight Update)	1. Set Data Toggle Switch to UTM	1. No action
		2. Set Mode Rotary Switch to PRES. POS.	2. Latest value of present position is displayed in UTM coordinates
		3. Depress MARK pushbuttons	
		4. Depress KEYBD pushbutton	4. ENT light is illuminated and data windows blanked
		5. Insert new present position in UTM (see Note 3)	5. Data is displayed as it is inserted
		6. Depress ENT pushbutton	6. New data is stored, ENT light extinguished, data windows are blanked for 1 second, then new UTM coordinates of present position are displayed
III.	A. Display FLY TO position in LAT/LONG	1. Set Data Toggle Switch to LAT/LONG	1. No action
		2. Set Mode Rotary Switch to FLY TO POS.	2. Coordinates of FC TGT selected on FCP No. 2 are displayed if FLY TO thumbwheel set to FC (See note 4), otherwise panel is blanked (See figure 4-96, index IV)
		3. Depress corresponding pushbutton (1-9) of desired FLY TO position	3. Coordinates of selected position are displayed
	B. Insert FLY TO positions using LAT/LONG coordinates	1. Set Data Toggle Switch to LAT/LONG	1. No action
		2. Set Mode Rotary Switch to FLY TO POS.	2. Coordinates of FC TGT selected on FCP No. 2 are displayed if FLY TO thumbwheel set to FC; otherwise panel is blanked

Figure 4-77. (Sheet 2 of 13)

navigation panel operation procedures

No.	Task		Step	Action
III.	B.		3. Depress corresponding pushbutton (1-9) of FLY TO position to be inserted	3. Coordinates of previously stored position are displayed
			4. Depress KEYBD pushbutton	4. ENT light is illuminated and data windows are blanked
			5. Insert new coordinates using integer pushbuttons	5. Data is displayed as it is inserted
			6. Depress ENT pushbutton	6. New data is stored, ENT light is extinguished, data windows are blanked
IV.	A.	Display FLY TO positions in UTM coordinates	1. Set Data Toggle Switch to UTM	1. No action
			2. Set Mode Rotary Switch to FLY TO POS.	2. Coordinates of FC TGT selected on FCP No. 2 are displayed if FLY TO thumbwheel set to FC (See note 4), otherwise panel is blanked (See figure 4-97, index IV)
			3. Depress corresponding pushbutton (1-9) of desired FLY TO position	3. Coordinates of selected position are displayed
	B.	Insert FLY TO positions using UTM coordinates	1. Set Data Toggle Switch to UTM	1. No action
			2. Set Mode Rotary Switch to FLY TO POS.	2. Coordinates of FC TGT selected on FCP No. 2 are displayed if FLY TO thumwheel set to FC; otherwise panel is blanked
			3. Depress corresponding pushbutton (1-9) of FLY TO position to be inserted	3. Coordinates of previously stored position are displayed
			4. Depress KEYBD pushbutton	4. ENT light is illuminated and data windows are blanked
			5. Insert new coordinates using integer pushbuttons	5. Data is displayed as it is inserted
			6. Depress ENT pushbutton	6. New data is stored, ENT light is extinguished, data windows are blanked

Figure 4-77. (Sheet 3 of 13)

navigation panel operation procedures

No.	Task	Step	Action
V.	A. Display ground range and bearing to FLY TO point/ target i. e. (Select a destination)	If FLY TO Toggle Switch is set to WAYPOINT then Range and Bearing to any stored position coordinates and can be displayed (regardless of primary sensor)	The approach guidance indicator will display resultant change.
		1. Set Data Toggle Switch to LAT/LONG or UTM	1. No action
		2. Set Mode Rotary Switch to BRG. RNG	2. No action
		3. FLY TO thumbwheel a. Set to desired position coordinate tag. b. If FLY TO thumbwheel is set to FC, set desired position coordinate tag on Fire Control Panel No. 2 FC TGT thumbwheel	3. Range displayed as nautical miles on the top window. Bearing displayed as degrees, minutes, and hundredths on the bottom window
		If FLY TO Toggle Switch is set to ORBIT then Range and Bearing are referenced to the primary sensor	The approach guidance indicator will display resultant change.
		1. Set Data Toggle Switch to LAT/LONG or UTM	1. No action
		2. Set Mode Rotary Switch to BRG. RNG	2. No action
		3. Select a primary sensor a. If INS is to be primary sensor: (1) Select INS as primary sensor on Fire Control Panel No. 1 (2) Set location tag in NCP FLY TO thumbwheel (a) Desired position coordinate tag (1-9) (b) Desired position coordinate tag (FC)	(2) Ground range and Bearing to presently selected location tag. Range displayed on top window as nautical miles when more than 8 miles from target or as feet when less than 8 miles from target. True Bearing displayed as degrees, minutes and hundredths on bottom window

Figure 4-77. (Sheet 4 of 13)

navigation panel operation procedures

No.	Task	Step	Action
V. (Cont)	A. (Cont)	1. Select Fire Control Panel No. 2 FC TGT thumbwheel (see figure 4-87, INDEX IV) (See Note 4)	
		b. If INS is not to be primary sensor: (1) Select Primary Sensor Fire Control Panel No. 1 (regardless of NCP/ FCP2 FLY TO thumb-wheel selections)	b. Ground range to target designated by primary sensor in feet on top window when less than 8 miles from target. True Bearing displayed as degrees, minutes, and hundredths on bottom window
	B. Insert Range and Bearing to target	Illegal	
VI.	A. Display Magnetic and True Heading	1. Set Data Toggle Switch to LAT/LONG or UTM	1. No action
		2. Set Mode Rotary Switch to MHDG/THDG	2. Latest value of magnetic and true heading is displayed. True heading displayed as degrees, minutes, hundredths on the bottom windows. Magnetic heading displayed as degrees, minutes on top windows.
	B. Insert Magnetic and True Heading	Illegal	
VII.	A. Display Nominals: Altitude Bank Angle, and True Airspeed.	1. Set Data Toggle Switch to LAT/LONG or UTM	1. No action.
		2. Set Mode Rotary Switch to ALT. TAS.	2. Display is blanked.
		3. Select desired set of nominals by depressing corresponding integer pushbutton (0-9).	3. Nominal conditions displayed. Altitude displayed in feet on top windows. Bank angle (left is minus) displayed on the first three digits of the bottom windows. The 4th digit on the bottom windows is blank. Airspeed displayed in knots on the last three digits of the bottom windows.
	B. Insert Nominals: Altitude, Bank Angle, and True Airspeed.	1. Set Data Toggle Switch to LAT/LONG or UTM	1. No action
		2. Set Mode Rotary Switch to ALT. TAS.	2. Display is blank
		3. Select desired set of nominals by depressing corresponding integer pushbutton (0-9).	3. Same as A.

Figure 4-77. (Sheet 5 of 13)

navigation panel operation procedures

No.	Task	Step	Action
VII.	B.	4. Depress KEYBD.	4. Display is blanked, ENT button illuminated.
		5. Enter Altitude, Bank Angle and Airspeed by depressing the integer pushbuttons.	5. Data is displayed as it is entered.
		6. Depress ENT pushbutton.	6. Data is stored, ENT light extinguished display is blanked.
VIII.	A. Display Present Fire Control Wind Magnitude and Direction. **Note** See NCP Data option 39	1. Set Data Toggle Switch to LAT/LONG or UTM.	1. No action.
		2. Set Mode Rotary Switch to WIND S. D.	2. Last fire control winds displayed. Velocity displayed in knots on the top window. Direction displayed in degrees, minutes, hundredths on the bottom windows.
	B. Display Continuously Computed Wind Magnitude and Direction.	1. Set Data Toggle Switch to LAT/LONG or UTM.	1. No action.
		2. Set Mode Rotary Switch to WIND S. D.	2. Last fire control winds displayed. Velocity displayed in knots on the top window. Direction displayed in degrees, minutes, hundredths on the bottom windows.
		3. Depress MARK pushbutton.	3. ENT button is illuminated. Continuously computed wind velocity and direction is displayed.
	C. Insert Computed Wind Velocity and Direction (to fire control).	1. Set Data Toggle Switch to LAT/LONG or UTM.	1. No action.
		2. Set Mode Rotary Switch to WIND S. D.	2. Last fire control winds displayed. Velocity displayed in knots on the top window. Direction displayed in degrees, minutes, hundredths on the bottom windows.
		3. Depress MARK pushbutton.	3. ENT button illuminated. Continuous computed wind velocity and direction is displayed.
		4. Depress ENT pushbutton.	4. ENT light extinguished. WINDS frozen for fire control and displayed as in A above.

Figure 4-77. (Sheet 6 of 13)

navigation panel operation procedures

No.	Task	Step	Action
VIII.	D. Insert Manual Wind Velocity and Direction.	1. Set Data Toggle Switch to LAT/LONG or UTM.	1. No action.
		2. Set Mode Rotary Switch to WIND S. D.	2. Last fire control winds displayed. Velocity displayed in knots on the top window. Direction displayed in degrees, minutes, hundredths on the bottom windows.
		3. Depress MARK pushbutton.	3. ENT button is illuminated. Continuous computed wind velocity and direction is displayed.
		4. Depress KEYBD pushbutton.	4. Display is blanked. ENT button illuminated.
		5. Enter wind velocity and direction by depressing integer pushbuttons.	5. Data displayed as entered.
		6. Depress ENT pushbutton.	6. Data is stored for fire control (and navigation if necessary), ENT light extinguished. Display inserted wind velocity and direction as in A above.
IX.	A. Display Data Insert Parameter (see special procedure requirements of data inserts for further information). (ABBR. Checklist.)	1. Set Data Toggle Switch to DATA IN.	1. No action.
		2. Set Data Thumbwheel to DATA.	2. Display is blanked.
		3. Select desired parameter address (01-99) by depressing corresponding integer pushbuttons. (See figure 4-76, sheet 3)	3. Corresponding stored data displayed.
	B. Insert Data Insert parameters (see Note 5).	1. Set Data Toggle Switch to DATA IN.	1. Display is blanked.
		2. Set Data Thumbwheel to DATA.	2. No action.
		3. Select corresponding address (01-99) of parameters to be inserted. (See Note 5.) (See figure 4-76, sheet 3)	3. Corresponding stored data displayed.
		4. Depress KEYBD pushbutton.	4. ENT light is illuminated and data windows are blanked.
		5. Insert new data using integer pushbuttons.	5. Data is displayed as it is inserted.

Figure 4-77. (Sheet 7 of 13)

navigation panel operation procedures

No.	Task	Step	Action
IX.	B.	6. Depress ENT pushbutton.	6. New data is stored, ENT light is extinguished, display is blanked.
X.	Flyover Update (Consecutive updates are permissible).	1. Set Data Toggle Switch to DATA IN.	1. Display is blanked.
		2. Set Data Thumbwheel to FLYOVER.	2. Present position latitude and longitude are displayed.
		3. Select desired prestored update FLY TO position by depressing appropriate integer pushbutton (1-9). (See Note 6.)	3. Selected FLY TO position LAT/LONG coordinates are displayed.
		4. Depress MARK pushbutton when aircraft is directly over update fixpoint.	4. ENT light is illuminated and position errors are displayed for navigator evaluation. (See Note 2.)
		TO ACCEPT DATA:	
		5. Depress ENT pushbutton.	5. Update correction is stored, ENT light is extinguished, and updated present position coordinates are displayed.
		TO REJECT DATA:	
		5. Change status of either Data Toggle Switch, Data Thumbwheel or Data Rotary Switch; depress KEYBD pushbutton or overrun display.	5. Display and program revert to normal operation.
XI.	Sensor Position Update (consecutive updates are permissible).	1. Set Data Toggle Switch to DATA IN.	1. Display is blanked.
		2. Set Data Thumbwheel to S. POS.	2. Primary sensor sightpoint latitude and longitude are displayed.
		3. Select desired update FLY TO position by depressing appropriate integer pushbutton (1-9). (See Note 6.)	3. Selected FLY TO position coordinates are displayed.
		4. Depress MARK pushbutton when primary sensor sightpoint overlays update fixpoint and primary sensor is giving consent.	4. ENT light is illuminated and position errors are displayed for navigator evaluation. (See Note 2.)

Figure 4-77. (Sheet 8 of 13)

navigation panel operation procedures

No.	Task	Step	Action
XI.		TO ACCEPT DATA:	
		5. Depress ENT pushbutton.	5. Update correction is stored, ENT light is extinguished, and updated primary sight-point coordinates are displayed.
		TO REJECT DATA:	
		5. Change status of either Data Toggle Switch, Data Thumbwheel or Data Rotary Switch; depresss KEYBD pushbutton or overrun display.	5. Display and program revert to normal operation.
XII.	Sensor Velocity Update – NOT USED		
XIII.	Display True Airspeed and Ground Speed.	1. Set Data Toggle Switch to DATA IN.	1. Display is blanked.
		2. Set Data Thumbwheel to TAS/TGS.	2. Display True Airspeed in knots on the top windows. Display ground speed in knots on the bottom windows.
XIV.	Manual LORAN Update (consecutive updates are permissible).	1. Set Data Toggle Switch to DATA IN.	1. No action.
	Note	2. Set Data Thumbwheel to LORAN.	2. Display current present position LAT/LONG.
	LORAN lockon valid for update only if all malfunction indicator lights are extinguished.	3. Depress any integer push-button (1-9).	3. Display current LORAN LAT/LONG.
		4. Depress MARK pushbutton.	4. ENT light is illuminated and position errors are displayed for navigator evaluation. (See Note 2.)
		TO ACCEPT DATA:	
		5. Depress ENT pushbutton.	5. Inertial LAT/LONG updated, ENT light extinguished and present position Loran/Inertial coordinates are displayed.
		TO REJECT DATA:	
		5. Change status of either Data Toggle Switch, Data Thumbwheel Switch, or Data Rotary Switch; depress KEYBD pushbutton or overrun display.	5. Display and program revert to normal operation.

Figure 4-77. (Sheet 9 of 13)

navigation panel operation procedures

No.		Task	Step	Action
XV.		Display System Status.	1. System status changed (not necessarily operator action.) 2. Set Data Toggle Switch to DATA IN. 3. Set Data Thumbwheel to NE.	1. If status has changed "C" will be displayed on the status window if not monitoring NE. 2. No action. 3. Status window will be blanked. System status displayed on bottom window. Status of IMS, 3-axis gyro, Loran, Pitot Boom airspeed and altitude are displayed as follows:

	Window 1	Window 3	Window 5	Window 7
	IMS/ 3 Axis	Loran	BARO	TAS
Aligned	A	L	A	S (Reliable)
Unaligned 3 Axis Gyro Fail	U 2 F	F	F	F (Fail)

Thermal Line Printer Status (in conjunction with above code display)

Window 1	Window 3	Window 5	Window 7
0 – IMS aligned 1 – IMS unaligned 2 – 3axis gyro 3 – Fail	0 – Reliable 1 – Fail	0 – Reliable 1 – Fail	0 – Reliable 1 – Fail

No.		Task	Step	Action
XVI.		Select Nominal Bank Angle. Altitude and True Airspeed orbiting conditions.	1. Select desired orbiting conditions on Orbit Thumbwheel (0-9).	
XVII.	A.	Select Guidance to fly orbit around active prime sensor target.	1. Select ORBIT on FLY TO Toggle Switch. 2. Select primary sensor	1. No panel action. 2. No panel action. Guidance provided to selected nominal orbit about target designated by primary sensors. Fire Control solution enables firing if required conditions are met.

Figure 4-77. (Sheet 10 of 13)

navigation panel operation procedures

No.	Task	Step	Action
XVII.	B. Select Guidance to fly orbit around selected destination or stored target.	1. Select ORBIT on FLY TO Toggle Switch. 2. Select INS Primary Sensor 3. Set FLY TO thumbwheel to desired destination (FLY TO position 1-9); if FC is selected, destination is controlled by FC TGT thumbwheels on FC Panel No. 2.	1. No panel action. Display on-off nominal indicator. 2. No panel action. 3. No panel action; Waypoint guidance is provided to FC TGT coordinates when A/C is more than 8 mi. from coordinates; orbit guidance is provided when aircraft is within 8 mi. of coordinates.
	C. Select guidance to fly directly to destination or stored target position.	1. Select WAYPOINT on FLY TO Toggle Switch. 2. Set FLY TO thumbwheel to desired destination tag (FLY TO position 1-9); if FC is selected, destination is controlled by FC TGT thumbwheels on FC Panel No. 2.	1. No panel action. **Note** Primary sensor selections have no effect. 2. No panel action. Waypoint guidance is provided to selected position coordinates.
XVIII.	Select Fire Control Mode. Note Automatic regressions are covered in XV.	1. Select desired position on 3 position toggle. They are as follows: NA-Pitot/INS Velocity reference. NB-INS Velocity reference. NC-Nominal Velocity reference.	1. No panel action, mode recognized by OFP.
XIX.	Select UTM Spheroid.	1. Set leftmost thumbwheel ND to desired spheroid setting. The correspondence is as follows: 0 – C6 4 – EV 1 – C8 5 – AN 2 – IN 6 – Not Used 3 – BE 7 – Not Used	1. No panel action. The proper values for semi-major axis and eccentricity of selected spheroid will be retrieved by OFP for UTM conversions.
XX.	Calibrate Pitot Boom.	1. Select NA for Fire Control 2. Set DATA 19 to non-zero	1. No panel action 2. The computation is initiated when ENT pushbutton is depressed. Non-zero Nr. is displayed.
		Note Fly normal orbit for approximately 410° then DATA 19 will return to zero. Address 21 and 25 will change to the corrected values. Check wind speed/direction; wind should be stable. This calibration is required only if the continuous wind, as displayed on the NAV Panel, varies more than three knots or five degrees around the orbit. Verify that the actual wind is not gusty or varying, that the pitot boom True Airspeed is reasonable, and that the inertial drift is not excessive. Failure to meet all of these factors will cause an erroneous calibration.	

Figure 4-77. (Sheet 11 of 13)

navigation panel operation procedures

No.	Task	Step	Action
XXI.	Enable Continuous Fire Control Wind	1. Set DATA 39 to non-zero.	1. Continuous wind will be used for Fire Control wind at altitude. Display of wind from mode rotary will show only continuous wind.
XXII.	A. 4:1 Resolver Enable	1. Set DATA 41 to non-zero.	1. 4:1 resolvers are used for primary sensor information from LLLTV and IR. **Note** 4:1 resolvers should not be used when performing a basic sensor alignment. After the alignment of the 1:1 resolvers is complete the 4:1 resolvers should be enable and then calibrated.
	B. Calibrate 4:1 Resolvers.	1. Set Data Toggle Switch to DATA IN.	1. Display is blank.
		2. Set Data Thumbwheel to Cal.	2. No action
		3. Select the primary sensor on Fire Control Panel No. 1 that is to be calibrated.	3. No action
		4. Depress MARK pushbutton	4. Corrections are displayed.
XXIII.	Disable Cross Wind Guidance	1. Set DATA 42 to non-zero.	1. Approach guidance for both BAAG and HSIAG will be offset only into the wind rather than with a cross wind component.
XXIV.	Perform Computer Self-Test	1. Set computer Toggle Switch to TEST and release. (See note 1.)	1. Test numerals displayed on NCP and FCPs. Off-Nominal indicator displays 5s. Merged symbology appears on FCD and HUD. All displays return to normal after approx. 20 seconds.

Note

1. This function can be performed only on the ground and will cause IMS status to revert from A to U.
2. If position errors exceed acceptable limits of 2^{0} 48.75', all 9s will be displayed for one second then display will blank for 1 second and the mode will be re-initialized.
3. "N" or "S" must be inserted for Northing value. "E" is not required for the Easting value.
4. If an invalid target is selected, the display will remain blanked. FC Target is considered invalid in this case.
   (Note: 201-215 are zero degrees north and east)
5. Some parameters are for display only.
6. If desired target coordinates are not available in prestored target location 1-9, the coordinates may be entered via procedure III-B or IV-B.

Figure 4-77. (Sheet 12 of 13)

NCP DATA OPTIONS
19. ZERO - No calibration in progress. NON-ZERO - Insertion of a non-zero number activates the pitot boom calibration. This calibration mates the pitot boom and the IMU to enable the computation of a consistent wind velocity and direction while in orbit. This calibration should be performed when the wind velocity or direction, in orbit, are varying and only in stable air with a normally functioning IMU. Approximately 400° of orbit are required at which time data 19 will zero and data 21 and 25 will automatically reflect the new values.
20. A value (inches of mercury) used to adjust the computer reference for mean sea level.
21. - 25. Constants for pitot boom installation and math solution for IMU drift rates. 21 and 25 may be mathematically calibrated and will automatically change on completion of a pitot boom calibration.
26. - 27. A value, entered in meters, used to correct a manual LORAN update for diogenes correction. Data 26 and 27 will zero after the update.
38. ZERO - Total bank angle displayed in the HUD and FCD. NON-ZERO - Sensor gun combination presently selected displayed in the HUD and FCD.
39. ZERO - Manually inserted NCP frozen wind used for fire control. NON-ZERO - The computed IMU/pitot boom wind is used for fire control.
40. Set to zero prior to using any trainable gun (Maintenance function only).
41. ZERO - IR and LLLTV 1:1 resolvers activated. NON-ZERO - IR and LLLTV 4:1 resolvers activated (must be zero during boresight box adjustment.)
42. ZERO - Provides approach guidance lead for pilot use with the trainable weapons. NON-ZERO - Upwind approach guidance only.
43. Time in hours, minutes and seconds. Correct time must be manually reset each time the tactical computer is turned on.
47. ZERO - Certain portions of the computer memory will be automatically restored if a bit is picked. NON-ZERO - Deactivates memory restoration.

Figure 4-77. (Sheet 13 of 13)

miles the bearing to destination is true rhumb line. At the 8 nautical mile point, if orbit guidance is selected, the bearing will be true rhumb line to a tangent point on the attack circle.

Switches on the NCP are used to enter selected destination, aircraft present position updates and, in certain cases, to enter wind. This data is displayed in the data window. Except for the computer self-test signal, all signals that are generated by positioning/activating the panel's controls are sent to the computer. The NCP controls and functions are shown in figure 4-76. NCP operation procedures are shown in figure 4-77.

FIRE CONTROL SYSTEM AND ASSOCIATED ELECTRONIC EQUIPMENT.

FIRE CONTROL OFFICER'S CONSOLE.

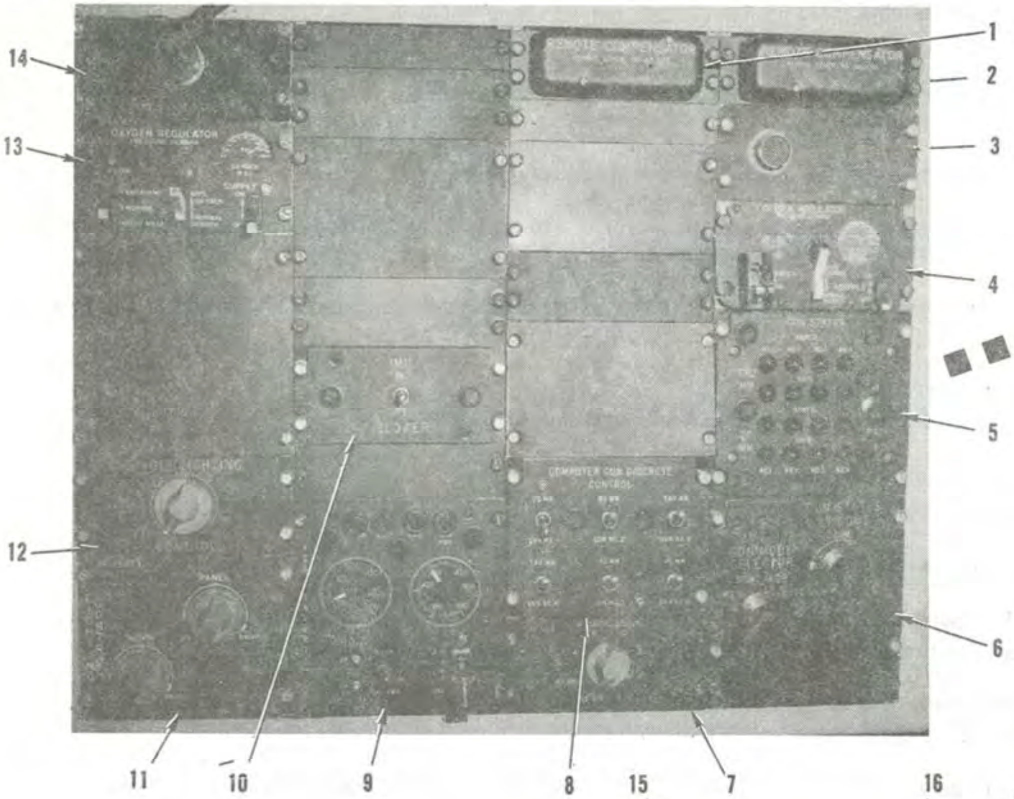
The fire control officer's console (see figure 4-78) provides the central control and monitoring of the fire control system. Figure 4-73 is a block diagram of the fire control system. The FCO can display information from any of the sensors (including azimuth and elevation look angles), monitor safe and arming status of the guns, tweak, select targets to be entered into the tactical computer, select print-out data from the tactical computer, and record video data from the LLLTV and IR systems.

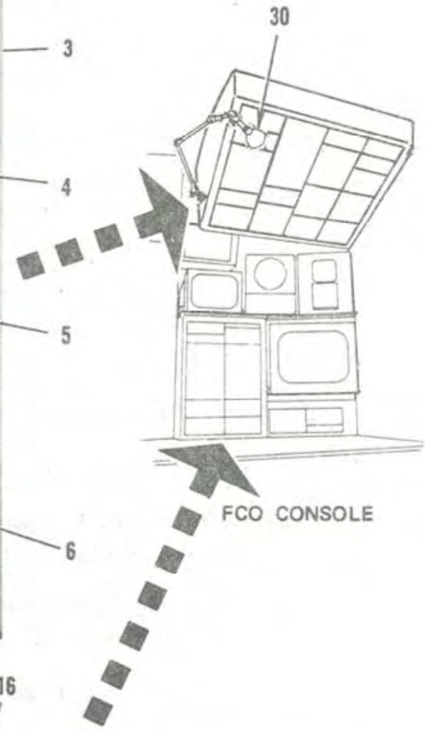
FIRE CONTROL SYSTEM INTERFACE GENERAL.

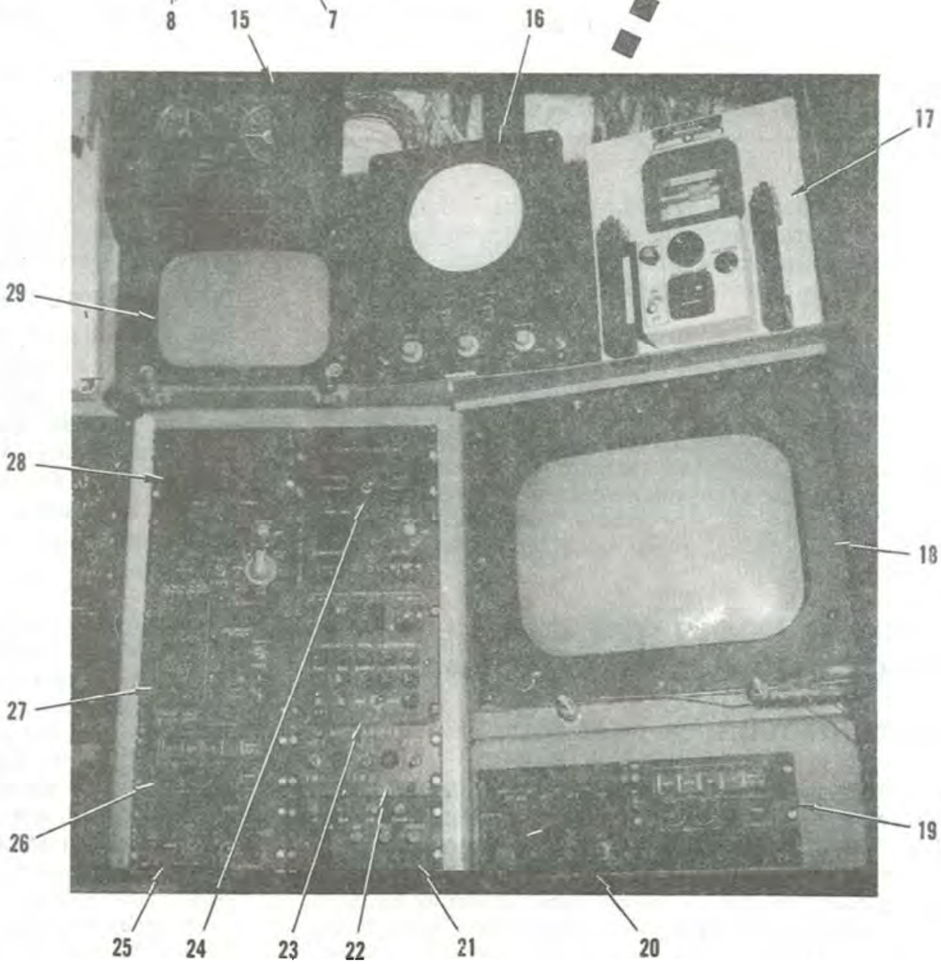
The tactical computer processes signals provided by subsystems as indicated in the fire control navigation computer set section and outputs solution signal to position symbology in the head up display and fire control display, to drive the off nominal indicator and the approach guidance indicator if AN/ASN-91 is selected on the pilots panel. In the trainable mode signals are also sent to position the trainable guns.

To employ the system the pilot must select AN/ASN-91 to present approach guidance on the AGI and the FCO must select the proper sensor primary. (See figure 4-48). Symbology will be displayed to place the aircraft on the attack circle. The use of the symbology displayed depends upon the position of the gun mode selector switch and the computer gun indicator switch. (See figure 4-86.) The FCO may select the INS as the prime sensor in which case guidance will be to a computer stored position rather than to a sensor sight point. The FCO may at any time store the coordinate of any sensor sight point if that sensor consent light is on. Each sensor can be automatically

fire control officer's console





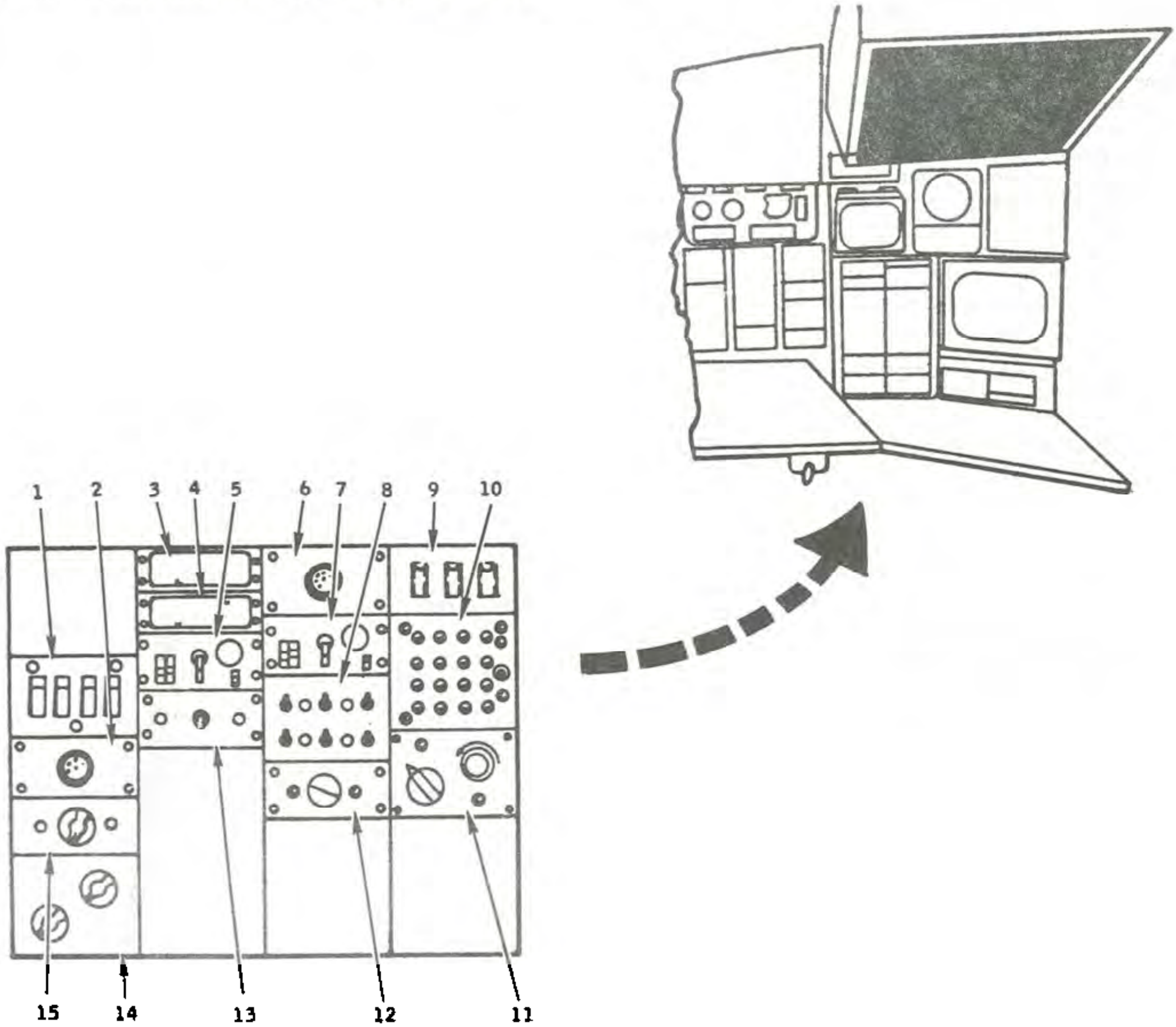


1. C-12 REMOTE COMPENSATOR
2. C-12 REMOTE COMPENSATOR
3. INSTR FCO INTERPHONE CONNECTOR
4. OXYGEN REGULATOR
5. GUN STATUS LIGHTS
6. GUN MODE SELECTOR AND GUN STATUS LIGHT CONTROL
7. BALLISTIC SELECTOR
8. COMPUTER GUN DISCRETE PANEL
9. FC POWER SUPPLY CONTROL
10. IMU BLOWER CONTROL
11. CONSOLE LIGHTING CONTROL
12. 5V LIGHTING CONTROL
13. INSTR OXYGEN REGULATOR
14. INSTR NAV INTERPHONE CONNECTOR
15. SLADS PANEL
16. FIRE CONTROL DISPLAY
17. THERMOCHROME PRINTER
18. 14" TV MONITOR
19. REMOTE CONTROL UNIT (14" MON)
20. INTERPHONE PANEL
21. MONITOR PANEL
22. MIC TRANSFER ASSY
23. FIRE CONTROL PANEL NO. 2
24. COMPUTER GUN INDICATOR
25. VIDEO RECORDER CONTROL
26. REMOTE CONTROL UNIT (8" MON)
27. FIRE CONTROL PANEL NO. 1
28. GUNFIRE INHIBIT SWITCH
29. 8" TV MONITOR
30. WORK LIGHT

Figure 4-78.

fire control officer's console

(AIRPLANES MODIFIED BY T.O. 1C-130-949)



1. FUEL GOVERNING CHECK TEST PANEL
2. INTERPHONE CONNECTOR
3. C-12 REMOTE COMPENSATOR
4. C-12 REMOTE COMPENSATOR
5. OXYGEN REGULATOR
6. INTERPHONE CONNECTOR
7. OXYGEN REGULATOR
8. COMPUTER GUN DISCRETE PANEL
9. INTERCOMM TRAINING PANEL
10. GUN STATUS LIGHTS
11. GUN MODE SELECTOR AND GUN STATUS LIGHT CONTROL
12. BALLISTIC SELECTOR
13. IMU BLOWER CONTROL
14. CONSOLE LIGHTING CONTROL
15. 5V LIGHTING CONTROL

Figure 4-79.

slaved to the look angles of any other sensor, to the offset point, or to a stored position through the INS. To fire a gun several panels are involved depending on the modes preferred. Figure 4-89 reflects the gunfire logic which is determined by the selections on the gun mode selector switch and the computer gun indicator switch. By inserting actual miss distance the FCO is able to perform an automatic tweak. The tweak resolves gun Δ and wind Δ which when incorporated into the position of the CIP allow ordnance impact on the target. The computer holds only one wind Δ but holds a gun Δ for use with each sensor gun combination.

The tactical computer bases all off nominal computations on nominal values of altitude, bank angle and true airspeed which must be manually inserted in the NCP.

One of 3 fire control computer modes can be chosen on the NCP (NA or NB is preferred).

1. NA pilot boom/inertial velocity. Full off nominal capability exists. If the pitot boom fails velocity will be provided by the inertial.

2. NB inertial velocity. Full off nominal capability exists.

3. NC nominal velocity. Nominal true airspeed and altitude must be maintained but off nominal bank angle still exists.

EQUIPMENT STATUS

	EQUIPMENT RELIABLE					
IMS (Aligned)	X	X				
IMS (Unaligned)			X	X		
3-Axis Gyro					X	X
Pitot Boom	X		X		X	
	↓	↓	↓	↓	↓	↓
	NA		NA		NA	
	NB	NB				
	NC	NC	NC	NC	NC	NC
	AUTOMATIC FIRE CONTROL AVAILABLE					

Note

Within mode selections, automatic regressions occur based on reasonability tests within the computer program.

FIRE CONTROL SYSTEM DISPLAY SET (AN/AVG-21).

The fire control system display set is an airborne system designed as an electronic aid to accomplish ground support and air-to-ground attack missions. The system consists of the following assemblies: a signal data processor (SDP), a heads-up display (HUD), a fire control display (FCD). Power requirements are 115 vac, 3 Ø, 400 Hz supplied by the left hand ac bus and 28 vdc from the main dc bus. Circuit breakers are located on the pilot's upper and copilot's lower circuit breaker panel.

Heads Up Display (HUD) And Fire Control Display (FCD).

The fire control system combines electronic and optical equipment to provide the pilot and fire control officer with a visual display of flight information in symbolic form at the HUD and FCD. The symbols represent information relating to the attack operation and include airplane attitude and heading, as well as target, tracking and aiming presentation. Flight command and situation are presented by moving symbols that are positioned in accordance with computation solved by the computer. Symbols in the HUD are restricted to those necessary for positioning the guns for firing. Additional symbology is displayed in the FCD for monitoring purposes by the fire control officer.

Figures 4-80 through 4-85 present HUD and display controls, functions and symbology.

SYMBOLOGY INTERFACE.

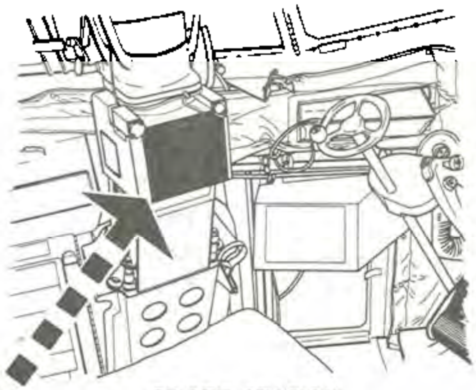
The CIP is the most complex symbol. See figure 4-87. All off nominal conditions are represented by the position of the CIP. Geometric slant range calculated from aircraft pitch/roll, primary sensor angles, target/sight point elevation and baro altitude is the basic reference point for the CIP. Ballistic wind, comprised of the NCP frozen wind and the wind Δ, gun Δ and air speed are also reflected in the position of the CIP. When in the fixed gun mode, the CIP represents the point on the ground the projectile would hit if the gun were fired now. This is true only when the present tweak gun Δ and wind Δ are correct. To hit the target in the fixed mode, the CIP and the primary aimline must be superimposed. In the trainable mode, the CIP is simply a reference point for the pilot. In this mode, the CIP and the aimline do not need to be superimposed to hit the target.

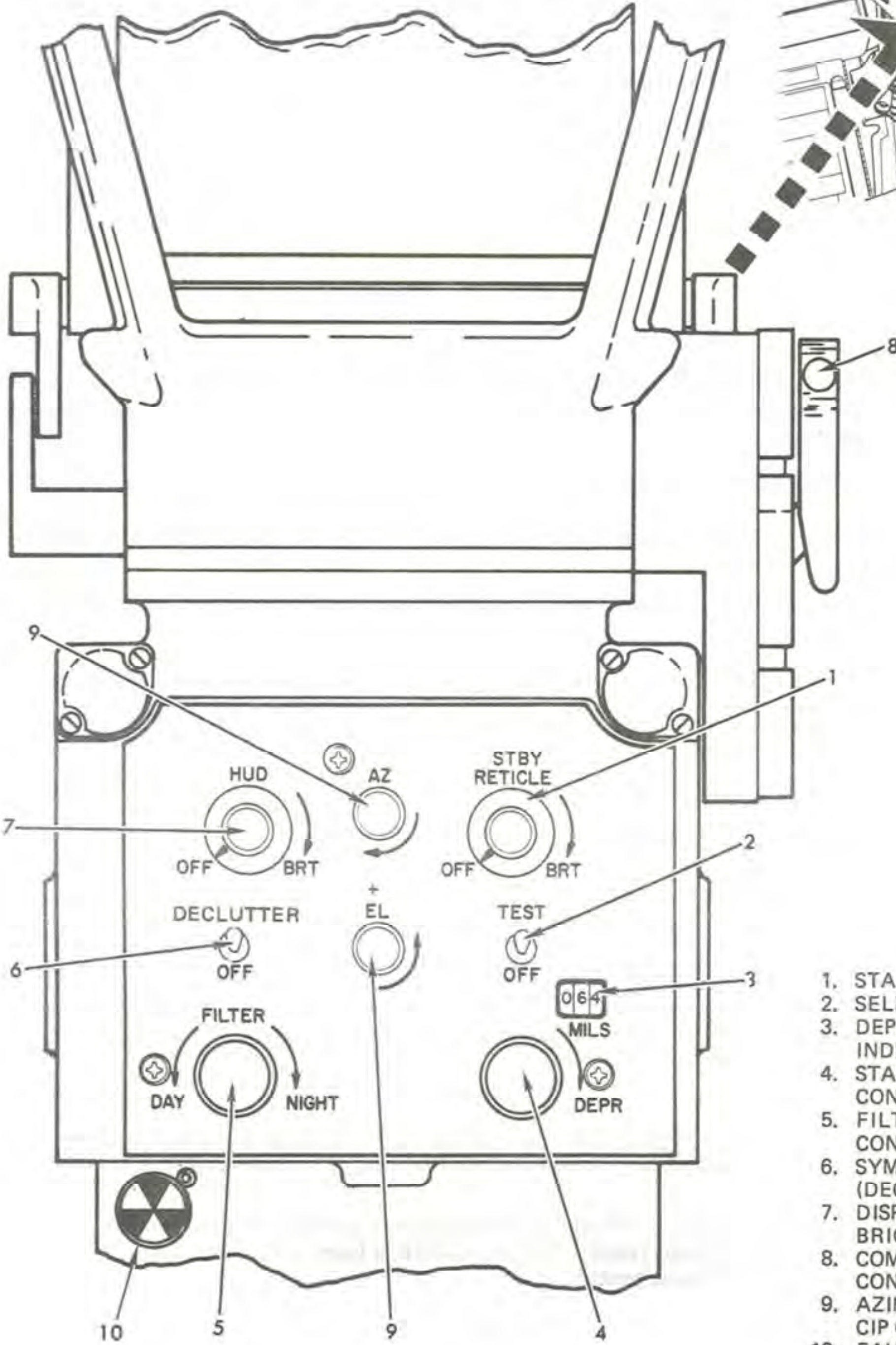
When cleared to fire, the primary aimline (PA) represents the target except when lead compution is activated. When the see button is depressed, the PA is positioned to lead a moving target for its speed and direction. Whenever the primary sensor is in consent.

Note

See button may or may not be illuminated when moving target mode is active. The PA overlying the PSS in the FCD ensures moving target mode is inactive. (See figure 4-94, INDEX XXXI).

heads-up display controls (pilot)





1. STANDBY RETICLE CONTROL
2. SELF TEST CONTROL SWITCH
3. DEPRESSION ANGLE MILLIRADIAN INDICATOR
4. STANDBY RETICLE DEPRESSION CONTROL
5. FILTER POSITION SELECTION CONTROL
6. SYMBOL REJECTION CONTROL (DECLUTTER)
7. DISPLAY SET POWER AND SYMBOL BRIGHTNESS CONTROL
8. COMBINER GLASS POSITION CONTROL
9. AZIMUTH AND ELEVATION MANUAL CIP CONTROLS
10. FAULT INDICATOR

Figure 4-80.

hud controls and functions

Control	Function
1. Standby control (STBY RETICLE)	OFF – Disconnects 28 VDC power standby reticle lamp; initial CW rotation energizes standby sight by connecting 28 VDC power; continued CW rotation increases the brightness of the standby sign symbol. BRT – Provides maximum brightness of the standby sight symbol.
2. Display set self test control (TEST)	TEST – Applies a self test command signal (28 VDC) to the data processor and the display units. (Also effects fire control display.) Failure of self test would be indicated by red (warning flags) on the default indicator of each unit (FCD, HUD, and Signal Data Processor.) OFF – Disconnects 28 VDC self test signal from display set.
3. Milliradian indicator three digit counter (MILS)	Indicates the depression angle of the standby reticle in elevation. There is a detent position at 42.5 milliradians which places the boresighting point at zero degrees when the combining glass is in the 7 degree detent.
4. Standby reticle depression control (DEPR).	Rotation from fully CCW position to DEPR adjusts the depression angle display from 000 to 210 milliradians. **Note** Rotation of the MIL DEPR knob will position the standby reticle in the center of the HUD display. The proper MILS setting depends on the sightline angle to the target in nominal geometry and will be provided by the FCO.
5. Filter position selection control (FILTER).	NIGHT – Positions red filter portion of blind over the CRT face for night operation. DAY – Removes red filter and positions cutout portion of blind over the CRT face permitting full light emission for day operation.
6. Symbol rejection control (DECLUTTER).	OFF – Permits display of the following symbols: heading indicator; off nominal bank angle; total bank angle; bank angle command scale. DECLUTTER – Removes the above symbols from the display. (Also effects fire control display.) **Note** DECLUTTER does not affect display of CIP and PA.
7. Display set power and symbol brightness control (HUD).	OFF – Disconnects 115 volts, 400 Hz to low voltage power supply of HUD; initial CW rotation connects 115 volts, 400 Hz to display unit power supply: continued CW rotation increases the brightness of CRT emitted symbol display.
8. Combiner glass position control (7, 18.5 and 30° detect position from top to bottom respectively).	When pressed, permits selection of 7,18.5 or 30° positions from top to bottom respectively for the combiner glass. When released, locks combiner glass in selected position. **Note** The three detent positions 7° (top), 18.5°, and 30° (bottom). The proper detent position will be determined by the sightline angle to the target in nominal geometry and will be provided by the FCO.
9. Azimuth and elevation manual computed impact point controls (AZ and EL).	Enables CIP adjustment in case of computer failure/regression or MANUAL MODE operation. CIP can be used as adjustable standby reticle if the computer fails, is turned off or when gun mode selector switch is in manual position. **Note** If the computer regresses to a fail mode, the gun selector mode switch must be changed to semi-automatic or manual mode to allow power to trigger applicable relay circuitry.
10. Fault Indicator	Displays results of unit self test.

Figure 4-81.

HUD and display symbology

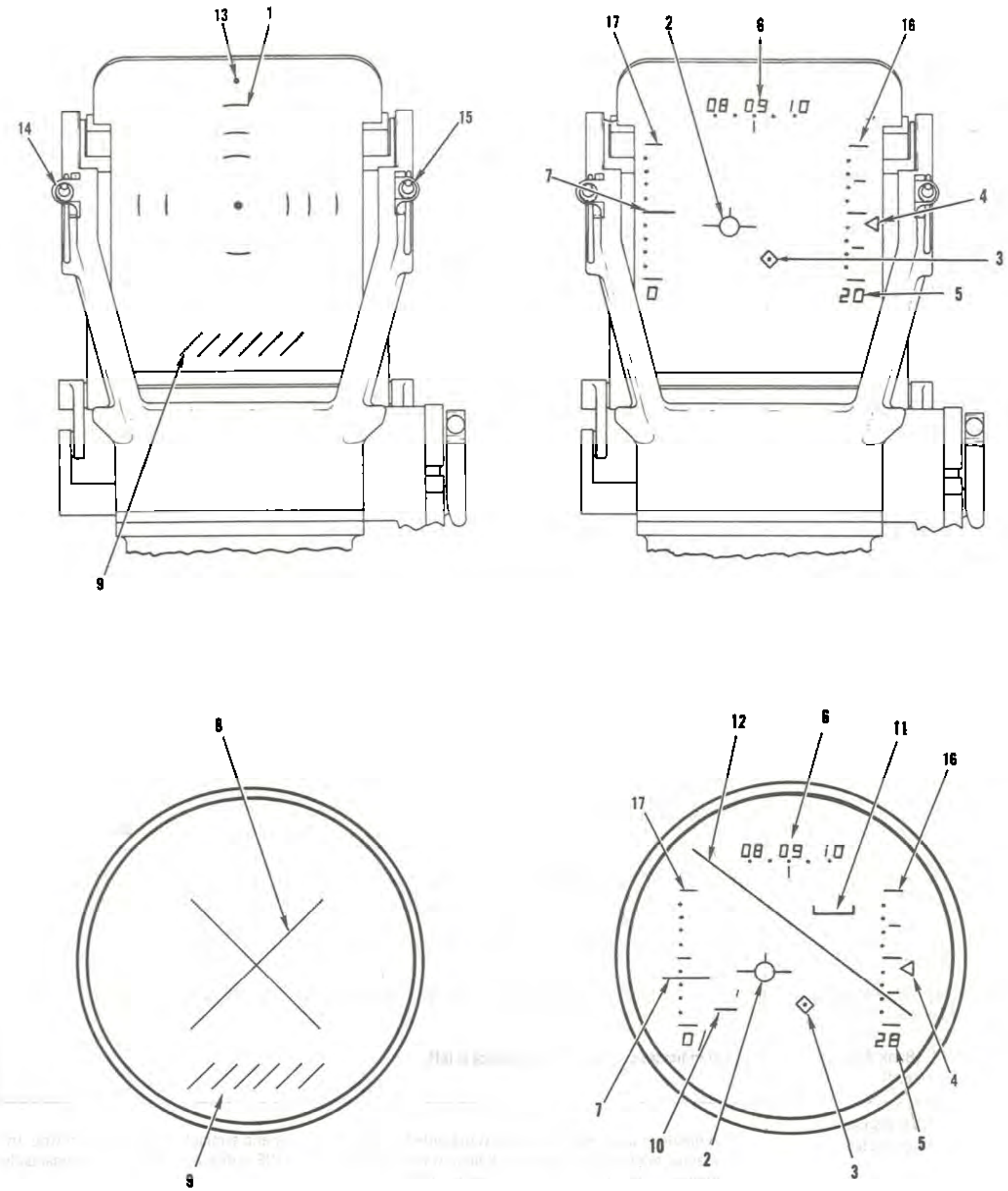


Figure 4-82.

HUD and FCD symbology

SYMBOLS	INDICATION
*1. STBY Reticle	Interrupted circles 25 mils apart used for manual fire.
2. CIP (Computed impact point)	10 mils diameter; 20 mils cross.
3. PA (Primary Aimline)	10 mils diamond; 1 mil dot
4. ONBA (Off Nominal Bank Angle) ± off nominal bank	Triangle (inscribed in 8 mils circle size). Indicates ON NOMINAL at center of scale.
5. TBA (Total Bank Angle/Sensor-Gun Identity	Numerals 8 x 5.4 mils selectable by navigator. a. Actual bank angle display. b. First nr denotes prime sensor; second number denotes weapon selected at computer gun discrete control (1-TV, 2-RADAR, 3-IR, 4-BC, 5-INS).
6. MHDG (Magnetic Heading)	8 x 54 mils numerals; lubber line 2 mils x 10 mils.
7. BAC (Bank Angle Command)	Pilot's AGI vertical guidance bar. Indicates on attack guidance at center of scale.
8. WARNING X	100 mils lines. Denotes when aircraft exceeds 49^0 bank angle.
9. Fire Inhibit Warning	25 mils lines. Indicates FCO has inhibited gunfire or that the trainable gun is not training within the box limits.
**10. PSS (Primary Sensor Sightline)	12 mils line. Represents the point on the ground the primary sensor is tracking.
**11. SSS (Secondary Sensor Sightline)	22 mils line, 5 mils uprights. Represents the point on the ground the secondary sensor is tracking.
**12. SL (Safety Line)	200 mils line. Generated perpendicular to an imaginary line between either the primary or secondary sensor and the primary aimline.
*13. 100 milradian boresight point	1 mil dot used only for boresight.
*14. Lamp (Sensor Consent)	Light "on" denotes prime sensor not consenting.
*15. Lamp (Coincidence Consent)	Light "on" denotes CIP not in coincidence with PA.
16. ONBA (Off Nominal Bank Angle)	One degree per unit. Low indicates increased bank. Center indicates nominal.
17. BAC (Bank Angle Command)	Low indicates correct attack guidance is left.

* For HUD display only.
** For FCD display only.

All symbology previously described is presented in both automatic and semiautomatic modes of fire. In the manual mode of fire, most symbology is removed. A manual CIP is displayed which can be manually positioned by the AZ and EL knobs on the HUD.

Figure 4-83.

fire control display controls (FCD)

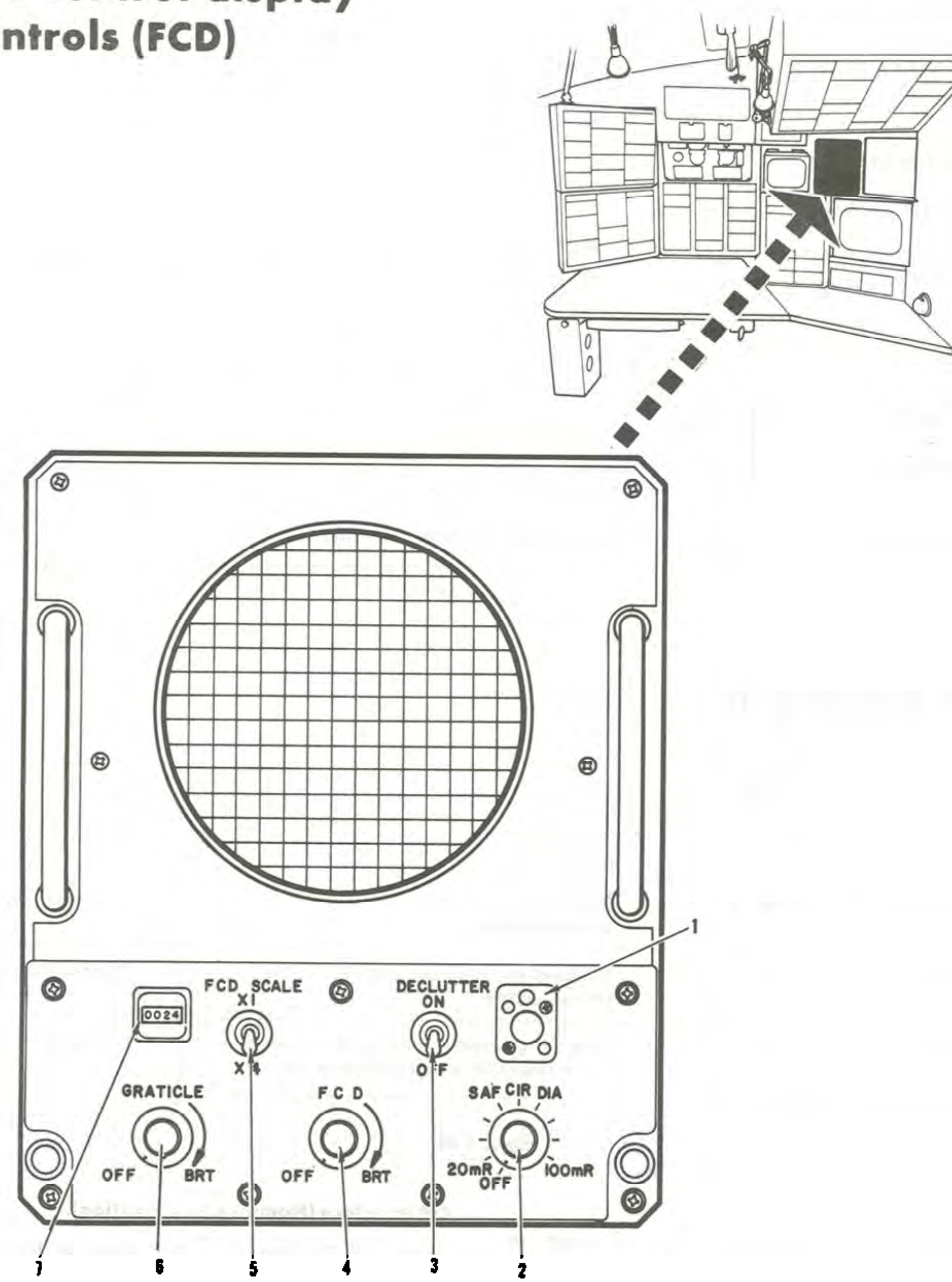


Figure 4-84.

fcd controls and functions

Control	Function
1. Fault Indicator	Displays result of self tests
2. Safety Circle (SAF CIR DIA)	Not used. Must be off.
3. DECLUTTER Switch	Not Used.
4. Brightness Control (FCD) (FCD POWER)	OFF – Disconnects 115 VAC power. Initial CW rotation energizes FCD by connecting 28 VDC. Continued CW rotation increases the brightness of the CRT. **Note** HUD must be on for power to be available to FCD.
5. FCD Scale	Not Used.
6. GRATICLE	Rotation from fully CCW position. BRT adjusts illumination of the grid on the FCD, OFF disconnects the 28 VDC power. 25 Miradian lines are etched in the face of the FCD.
7. Time Indicator	Records in hours the total operating time of the FCD.

Figure 4-85.

gun aiming interface

Gun Mode Selector	Computer Gun Indicator	CIP	PA
Manual	Fixed	Displaced manually by HUD AZ and EL knobs	Not Displayed
Semiautomatic	Fixed	Displaced by computer control. Not used to restrict gunfire.	Computer Displaced
Automatic	Fixed	Displaced by Computer control. Used to restrict gunfire.	Computer Displaced
Automatic	Trainable	False CIP generated by computer to simulate Fixed Mode CIP for pilot reference only.	Computer Displaced

Figure 4-86.

This allows ordnance impact on a moving target. In direct fire, the PA will overlay the primary sensor sight line (PSS). In off set, the PA will be displaced for the inserted offset distance and direction. In this case, the PA and the PSS would be separated by the offset distance. The PSS always represents the position on the ground that the primary sensor is tracking.

CIP Interface (Nominal Gun Position).

Major CIP displacement is as shown in figure 4-87. Minor corrections such as pitch, angle of attack and sideslip are also processed for adjustment of the CIP position. Heading and slant range are used to display the CIP in scale and orientation. HUD detent feedback to the computer places the CIP for appropriate detent.

symbology interface (fixed cip (Na mode))

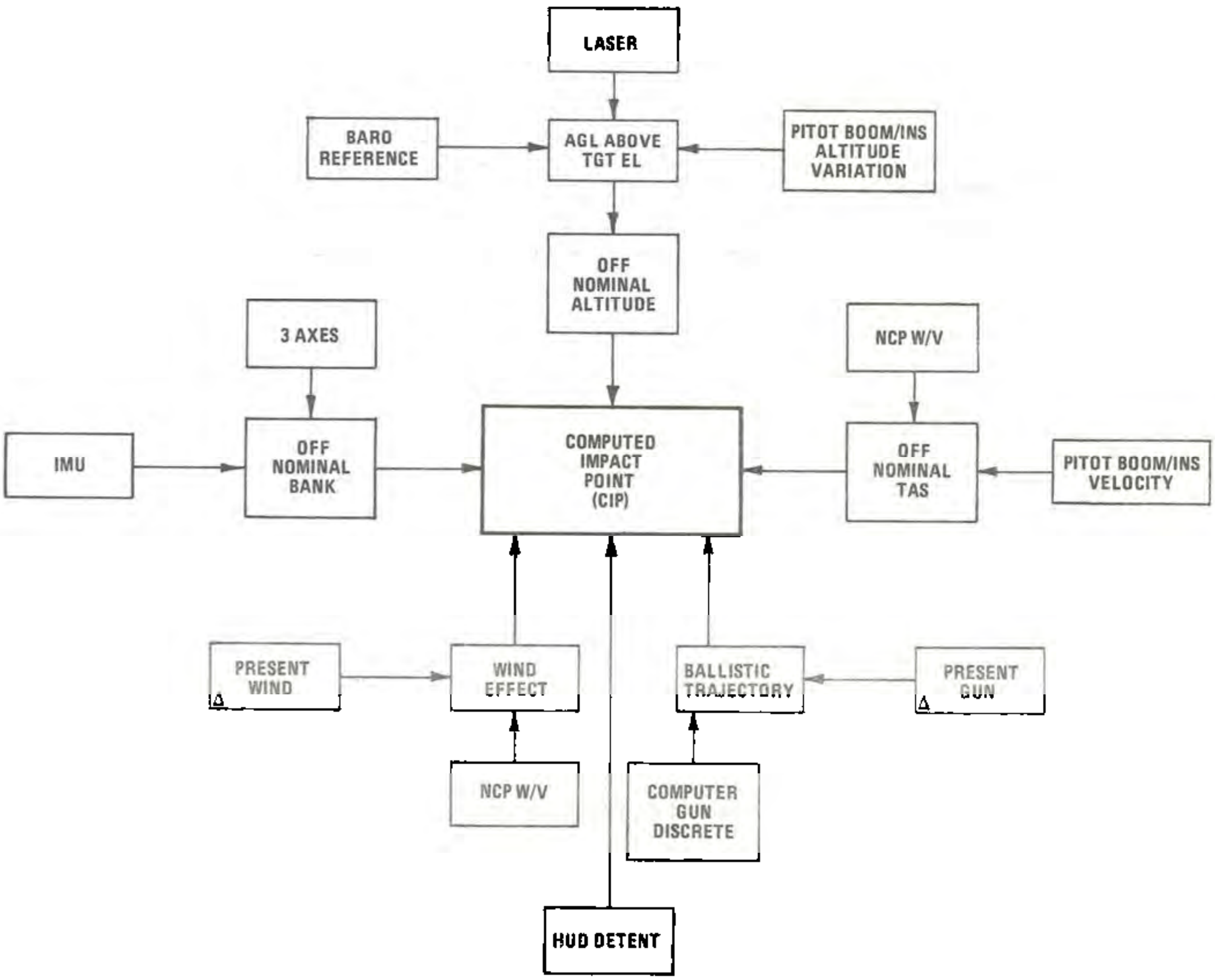


Figure 4-87. (Sheet 1 of 2)

symbology interface (pss,pa,sss)

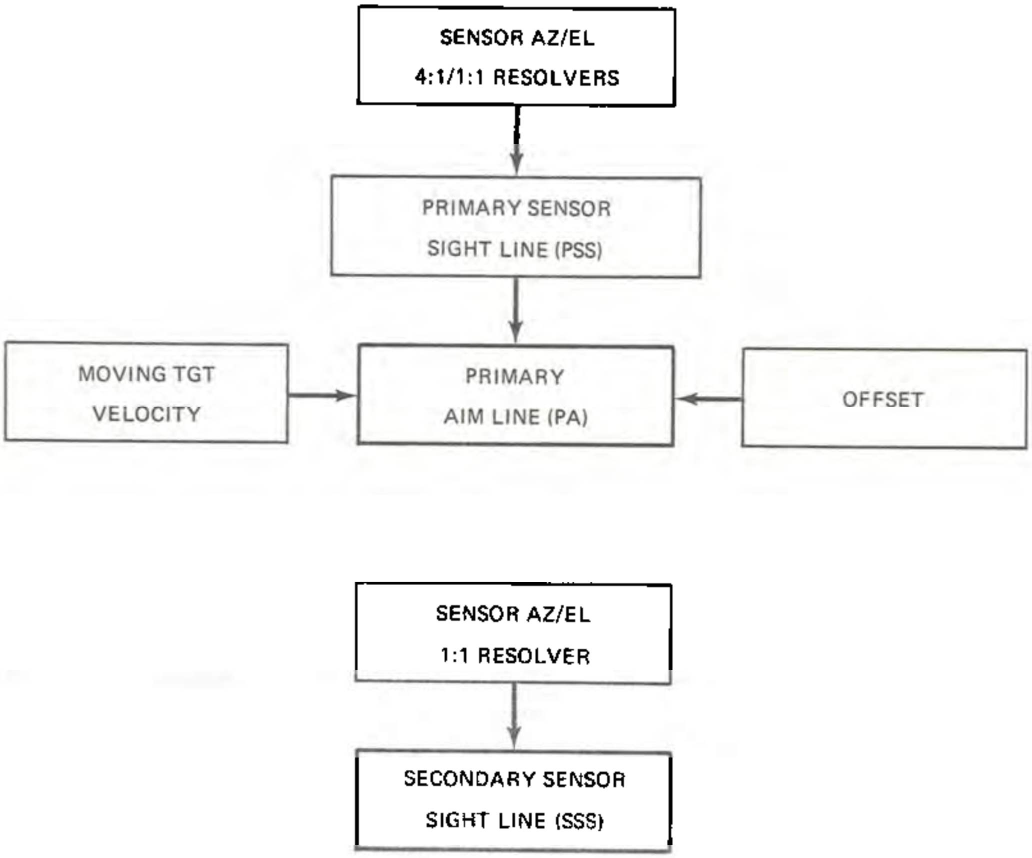


Figure 4-87. (Sheet 2 of 2)

SENSOR INTERFACE.

Sensor sightline (1:1) resolver angles are processed for fire control system use through the slave switching unit and boresight box. Additional (4:1) resolvers are provided the TV and IR sensor for improved accuracy in measuring angular movement. These may be enabled and calibrated to the 1:1 resolvers by NCP control procedures.

Several computer functions are enabled when in consent, but the most significant is provided when selected as primary sensor for gunfire consent. The TV, IR and BC have additional momentary consent buttons on their fire panels for use during trainable mode operations. An advisory ready fire light is provided for the sensor to track tight in the fixed mode and to indicate in the box and trigger depressed in the trainable mode.

BORESIGHT BOX.

The boresight box (see figure 4-88) is located in the galley equipment rack. Azimuth and elevation resolvers provide the adjustment to correct for alignment errors in the 1:1 resolvers for the TV/laser platform, APQ-150, IR set, and Black Crow and adjusts 105MM and 40MM TGMS resolver readouts. These adjustments permit accurate sensor information to be sent to the tactical computer. One turn on the bore-sight control is approximately 70 mils. The azimuth sensor controls, when turned clockwise, moves the primary aimline symbol forward in the FCD and HUD; counterclockwise moves the aimline aft. When the elevation sensor controls are turned clockwise, the aimline for the FCD and HUD is moved up; counterclockwise moves the aimline symbol down. Only qualified personnel should use the bore/sight box to adjust the aimline.

1. TV/laser platform - Adjusts azimuth and elevation input to the FC system.

2. APQ-150 - Adjusts azimuth and elevation for beacon tracking radar (BTR) inputs to the FC system.

3. IR set - Adjusts azimuth and elevation of IR inputs to the FC system.

4. Black crow (BC) - Adjusts azimuth and elevation of BC inputs to the FC system.

5. 40MM trainable weapons - adjusts weapon resolvers.

6. 105MM trainable weapons - adjusts weapon resolvers.

TARGET TRACK AND STORAGE.

The function of the target track and storage program is to combine data from the sensor platform, laser ranger,and inertial system for the purpose of determining target location information. Specific items include:

a. Sight point location calculation for INS position update from known fixpoint designated by a sensor.

b. Target storage from any sensor platform.

c. Synthetic pointing to stored target including synthetic pointing to sight point during temporary loss of sensor tracking.

The sight point latitude/longitude is calculated continually and available when desired for INS position update from known fixpoint designated by a sensor. The actual INS position updating is assumed to be performed externally to the TTS program. The sight point latitude/longitude is calculated by adding the relative position of the sight point with respect to the aircraft latitude/longitude provided by the NAV program. The calculations are performed continuously. Slant range is obtained from the laser ranger or from altitude above target.

When a specific FC target is chosen on fire control panel No. 2, azimuth and elevation to this are outputed for the purposes of approach guidance and providing slave signals to the sensors so that they can look in the vicinity of the stored coordinates. When the FC target number is set to 000 the slave signal channels are used to provide pointing information during temporary losses of sensor tracking. When in offset and FC target TGT is 999, slave signals are used to acquire the offset target.

Note

Sensor will have unreliable slaving if target is in excess of eight miles.

GUN AIMING INTERFACE.

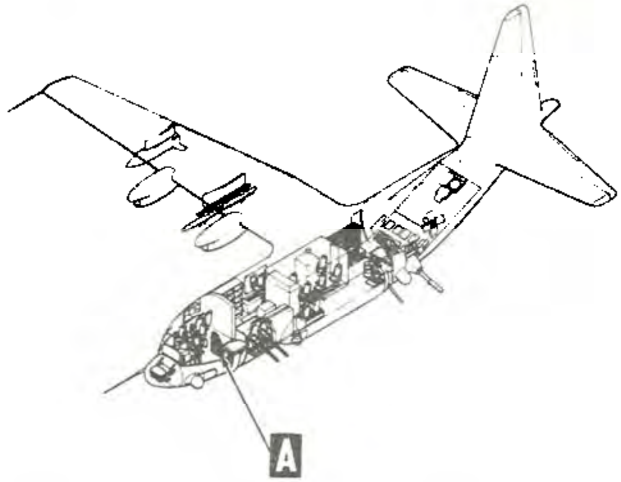
The FCO must have complete understanding and positive knowledge of switch configurations in order to provide safety monitoring of the expected impact point. PA and CIP symbols may not reflect actual gun alignment. The gun position must be directed or controlled by the FCO. The gun mode selection will determine how the gun is to be positioned and the computer gun indicator selection determines the mode of the TGM slaving. Nominal positioning requires either manually positioning and locking of the weapon or slaving the TGM hydraulically to fixed nominal angles.

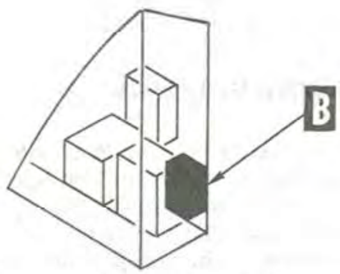
MANUAL gun mode selection. The gun must be positioned to nominal lag and depression angles. The pilot should fly the aircraft as close as possible to nominal geometry and use visual reference (windage) for aiming. The standby reticle and manually adjustable CIP symbol generated by the signal data processor is provided for pilot assistance.

SEMI-AUTO gun mode selection. The gun must be positioned to nominal lag and depression angles. The pilot should align the aircraft air mass position such that the computer generated CIP is aligned with the computer generated target symbol (PA) for accurate aiming reference. All inputs are used in the symbology which results in accurate representation for off nominal situations. See figure 4-87 for nominal weapon position CIP inputs.

AUTOMATIC gun mode selection. The primary purpose of automatic mode is to use the computer to test the alignment prior to fire and include computer fire enable in the gunfire logic. Two distinct aiming modes are available depending upon whether the weapon is positioned to nominal angles (FIXED) or allowed to train within the box (trainable). In FIXED, the computer program assumes the weapon position is nominal and the symbology is the same as in SEMI-AUTO. The pilot must satisfy the computer in alignment (coincidence) and stability (fixed rate) before the computer will pass the fire pulse.

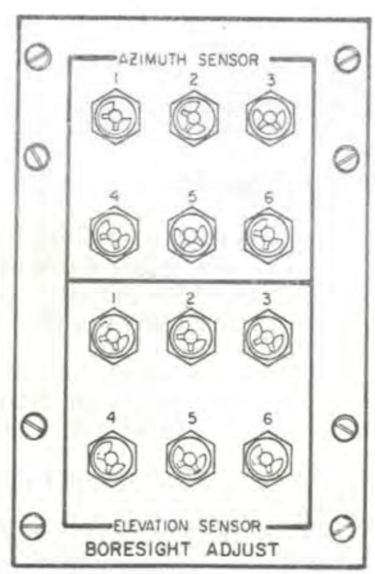
boresight box





A GALLEY EQUIPMENT RACK

1. MULTISENSOR PLATFORM ADJUST
2. APQ-150 ADJUST
3. IR SET ADJUST
4. BLACK CROW ADJUST
5. 40MM TRAINABLE GUN
6. 105MM TRAINABLE GUN



B BORESIGHT ADJUST PANEL

Figure 4-88.

Note

Nominal angles will be commanded to the TGM if manual or semi-automatic gun mode is selected.

By selecting TRAINABLE mode, the computer controls the weapon within the box limits set in FCP No. 1. The computer slaves the TGM to computed lag and depression angles such that the computed impact point is superimposed on the target symbol (PA). Because the true CIP would be superimposed on the PA anytime the alignment was within the box limits, a nominal CIP (simulation) is generated for pilot reference during the attack sequence. A computer activated inhibit symbol is displayed anytime the TGM is at a box limit. All symbols in the HUD and the CIP in the FCD will flash if the TGM resolver feedback or trainable rate test is not met.

The computer gun indicator panel provides the FCO control of the TGM selected on the computer gun discrete panel. Actual position may be confirmed by the illumination of the green slaved indicator and calling up TGM resolver angles (FD) on FCP No.1. A fire enable indicator illuminates if all computer required limits are met. By selecting FIXED TGM mode, the active TGM is hydraulically slaved to the nominal position. Gun position can be confirmed by the starrett gage readings.

WARNING

If TRAINABLE is not selected, the computer is programmed to assume the weapon selected is correctly positioned to nominal lag and depression angles.

GUNFIRE INTERFACE.

Gunfire requirements depend primarily on the pilot/FCO desires for equipment configuration (i.e., type weapon, gun mode, trainable slaving mode and computer limitations). Operational procedures will dictate proper configuration for the type weapon. Figure 4-89 reflects basic gunfire requirements and fire enable logic required for automatic gun mode.

The gun mode selector located on the FCO console is used to select one of three gunfire mode.

MANUAL - See figure 4-89 for gunfire logic. The minimum arming sequence is required and the symbology is restricted to those generated by the signal data processor and set by the pilot.

SEMI-AUTO - Gunfire logic is the same as manual but computer generated symbology is displayed for aiming reference.

WARNING

Manual and semi-auto gun modes do not incorporate computer program safety limits or temporary stored tolerances as prerequisites to fire.

AUTOMATIC - The gunfire logic also requires computer fire enable which is based on limits set in the computer, primary sensor consent and the positioning mode of the weapon. See figure 4-89 for computer fire enable logic.

Note

If a TGM is selected then the same gun must be selected on both the computer gun discrete panel and the gun control panel. Only one trainable weapon may be selected at one time or fire enable will not be passed.

Basic requirement for fire enable in automatic are CONSENT, COINCIDENCE, and RATE.

CONSENT - Sensor computer interface includes a consent circuit to indicate confirmation of the sight point identification.

CAUTION

The RAD automatically issues consent when locked on. The INS is always IN consent.

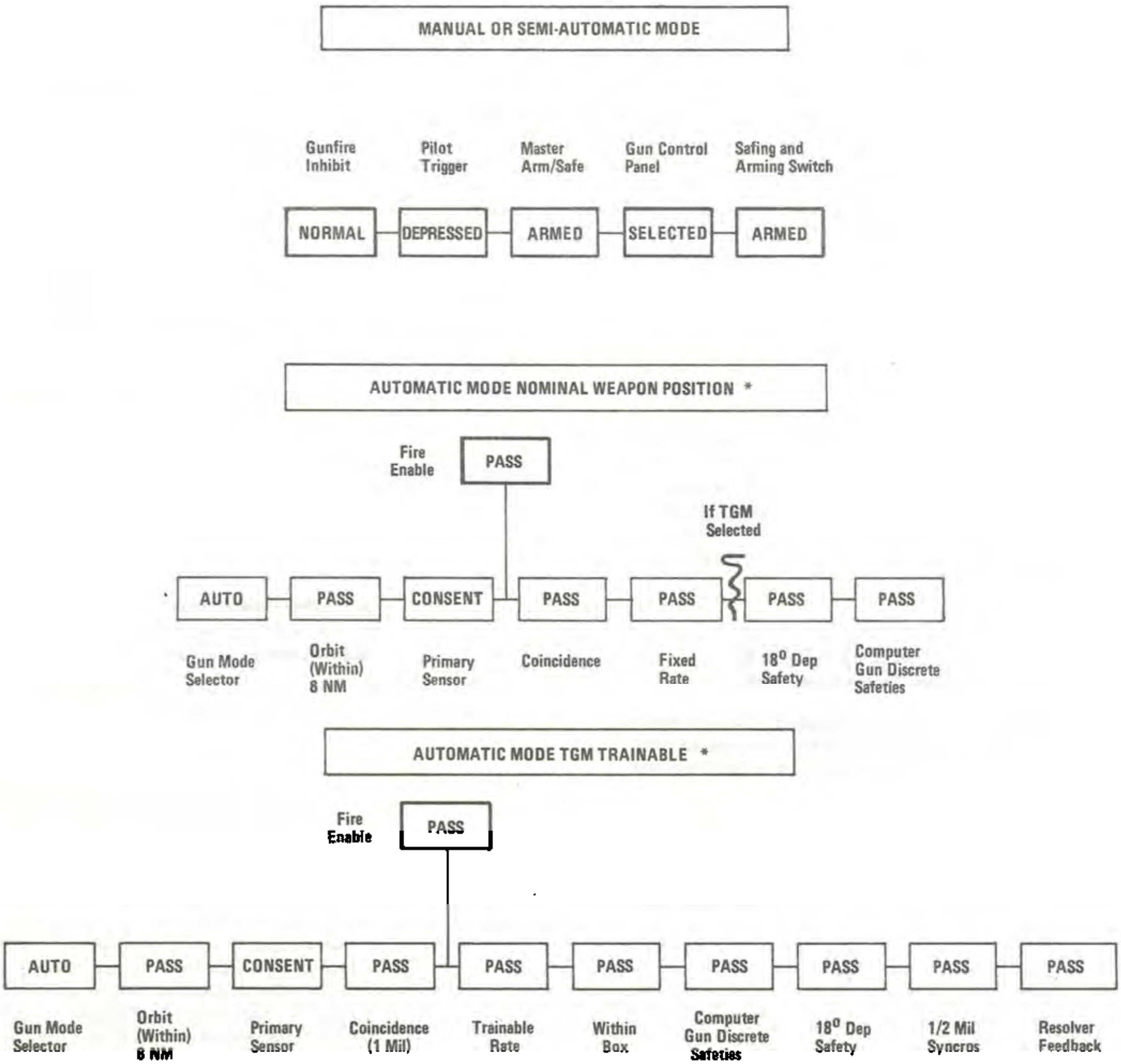
COINCIDENCE - Set by the FCO on FCP No. 2. This is a tolerance limit in mils computed between the PA and CIP. In the trainable mode, it must be set to 1 or more and reflects the slaving of the TGM to the commanded angles.

RATE - Set by the FCO, via FCP No. 1. As a tolerance limit in hundredths of degrees per second to limit the rated velocities imparted to the projectile due to dynamic forces inherent in the fire control solution. By limiting the rate prior to gunfire, a continued stable platform is assumed through the projectile departure time (a delay of approximately 0.3 seconds). The computer holds the fire pulse approxmately 0.2 seconds to insure gunfire.

TRAINABLE WEAPON RESTRICTIONS.

See trainable gun mounts for TGM control modes.
Specific limitations are programed for use with the TGMs. The gunfire diagnostic printout may be used to check the cause for failure to pass a fire enable in the automatic gun mode.

gunfire logic



*Manual or Semi-Automatic mode requirements must also be met.

Figure 4-89.

Note

- Neither TGM will slave nor fire at less than 18-degree depression. This may cut off a top portion of the trainable mode box.

- Neither TGM will fire unless the computer gun discrete and gun control selections agree and only one TGM is selected.

- If a TGM is not selected on the computer gun discrete a commanded angle of 1-degree lag and 18-degree depression is programmed.

Specific limitations for the 105MM cannon are noted as follows. These affect insertion of FE data on FCP 2.

Note

- The No. 6 TGM is restricted during preflight to 25° depression to prevent slaving the muzzle into the ramp.

- The No. 6 TGM is restricted during all operations to depress below 15 degrees prior to slaving in lag to prevent slaving the cage into the ammo storage rack.

THERMOCHROME TELEPRINTER (TT-521/ARC-96).

The thermochrome teleprinter (see figure 4-90) provides a permanent record, alpha-numeric decoded printout. It is used to print-out stored targets, changes in system status, and selected information relating to solutions of fire control problems. The printed record appears in sequenced line format on 3-inch wide thermochrome paper. The maximum line lengthis 26 characters. See illustrations listed below:

STATUS - Figure 4-77 (Sheet 10)

TGT STORAGE - Figure 4-94 (Sheet 4)

DIAGNOSTIC PRINT - Figure 4-91

A window in the front panel permits the reading of printed copy one line after printing takes place. As a message is completed, it can be removed from the unit by depressing the line-feed button on the front panel. The teleprinter uses 115 vac single phase, 400 Hz supplied from the right-hand ac bus. Circuit protection is provided by circuit breakers on the pilot's upper circuit breaker panel. Power ON-OFF is accomplished by actuation of power switch on front of printer.

FIRE CONTROL PANEL NO. 1 (FCP-1) (C-8992/A).

Fire control panel No. 1 (FCP-1) figure 4-92 is located on the FCO's console. This panel permits the FCO to select, control and display certain fire control parameters pertaining to targets. This information includes altitude above target, target slant range and position, aircraft angle-of-attack and side slip. These controls also provide for the manual entry of fire control, target, and sensor data into the computer memory. This data is updated once per second and is also updated when new data is entered into the computer memory. Sensor status and a tag code for the last stored target are also displayed on this panel. Fire control panel No. 1 is also used to highlight particular target data, select either bank angle approach guidance or horizontal situation indicator approach guidance, reference the safety zone to the primary or secondary sensor, and indicate that the CIP symbol is fixed in position on the HUD. Data to be displayed is controlled by the data thumbwheel and the data rotary switch. Fire control panel No. 1 controls and functions are shown in figure 4-93. Operating procedures are shown in figure 4-94. See figure 4-94 for printer output parameters.

Thumb Wheel Values.

FA. Rate limits. Set table in degrees and hundreds of degrees. In the automatic mode the computer will not pass a gunfire signal if the fixed rate limit is exceeded. In the trainable mode the computer will not pass a gunfire signal if the trainable rate is exceeded.

a. Upper window - FIXED RATE. In the automatic mode the rate limit for movement of aircraft alignment with respect to the primary sensor tracking point. (The CIP with respect to the PA.)

b. Lower window - TRAINABLE RATE. In the trainable mode the rate limit for movement of the TGM with respect to the primary sensor tracking point.

FB. Trainable box limit azimuth and elevation. The box is positioned around the nominal (FF) position. The TGM will train only within the box and will stop when the box limit is reached and inhibit symbol will be displayed in the HUD/FCD.

FC. Computer commanded gun lag and depression angles. In trainable these angles represent where the TGM should be pointing when slaved.

FD. TGM resolver feedback lag and depression angles. These angles are where the TGM is pointing and are aligned through the boresight box. Random values are displayed when TGM is not displayed.

FE. Ground boresight TGM lag and depression angles. The angles to which the TGM may be slaved on the ground. Inactivated by the touchdown switch when the aircraft is airborne.

thermochrome teleprinter

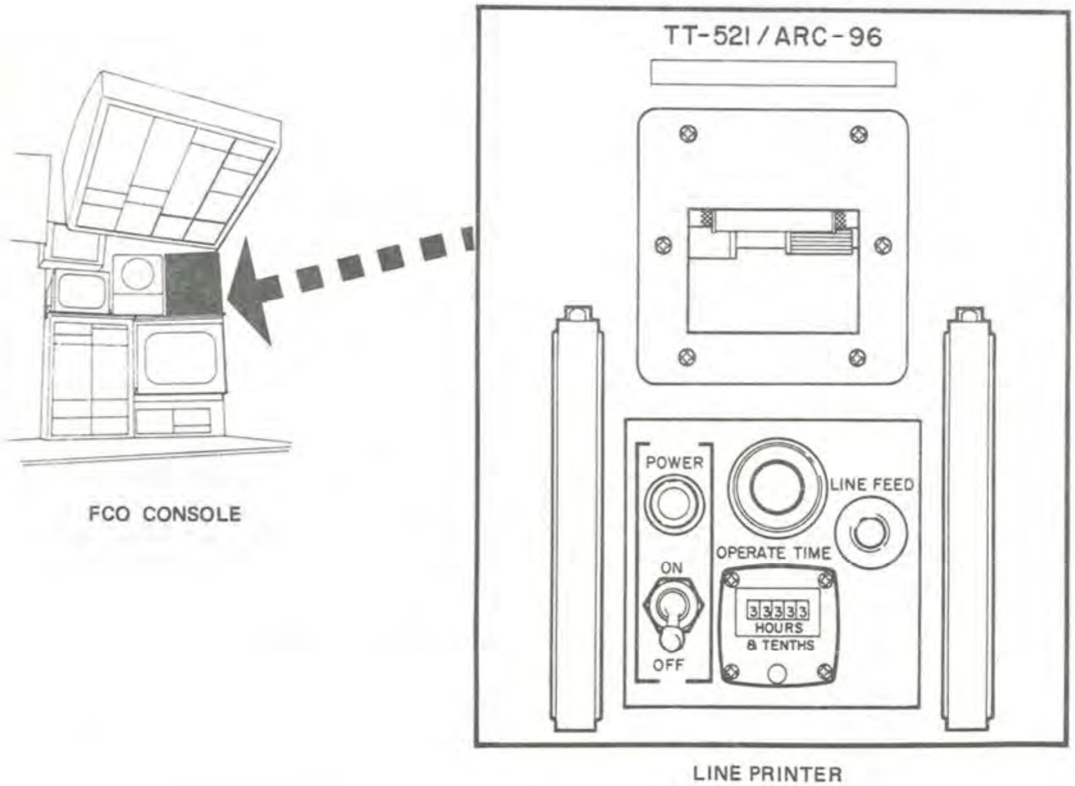


Figure 4-90.

firing diagnostic printout

LITERAL	DESCRIPTION
TIME	real time
S/G	primary sensor no./gun selected
ORBIT	0 if in orbit guidance and within 8 mi. of tgt; 1 if not
CONS	0 if primary consent on; 1 if not
COINC	0 if coincidence met; 1 if not
RATE	0 if rate limit met; 1 if not
AUTO	0 if in auto mode; 1 if not
BOX	0 if in box; 1 if not
18	0 if not at limit; 1 if at 18 degree dep limit.
SLAVE	0 if half mil discrete on; 1 if not
FDBK	0 if feedback passed; 1 if not
5/6	0 if TGM selections are not mixed; 1 if mixed.

Note

The printout will be based on the conditions existing at the time the PRNT button is depressed.

Figure 4-91.

fire control panel no. 1

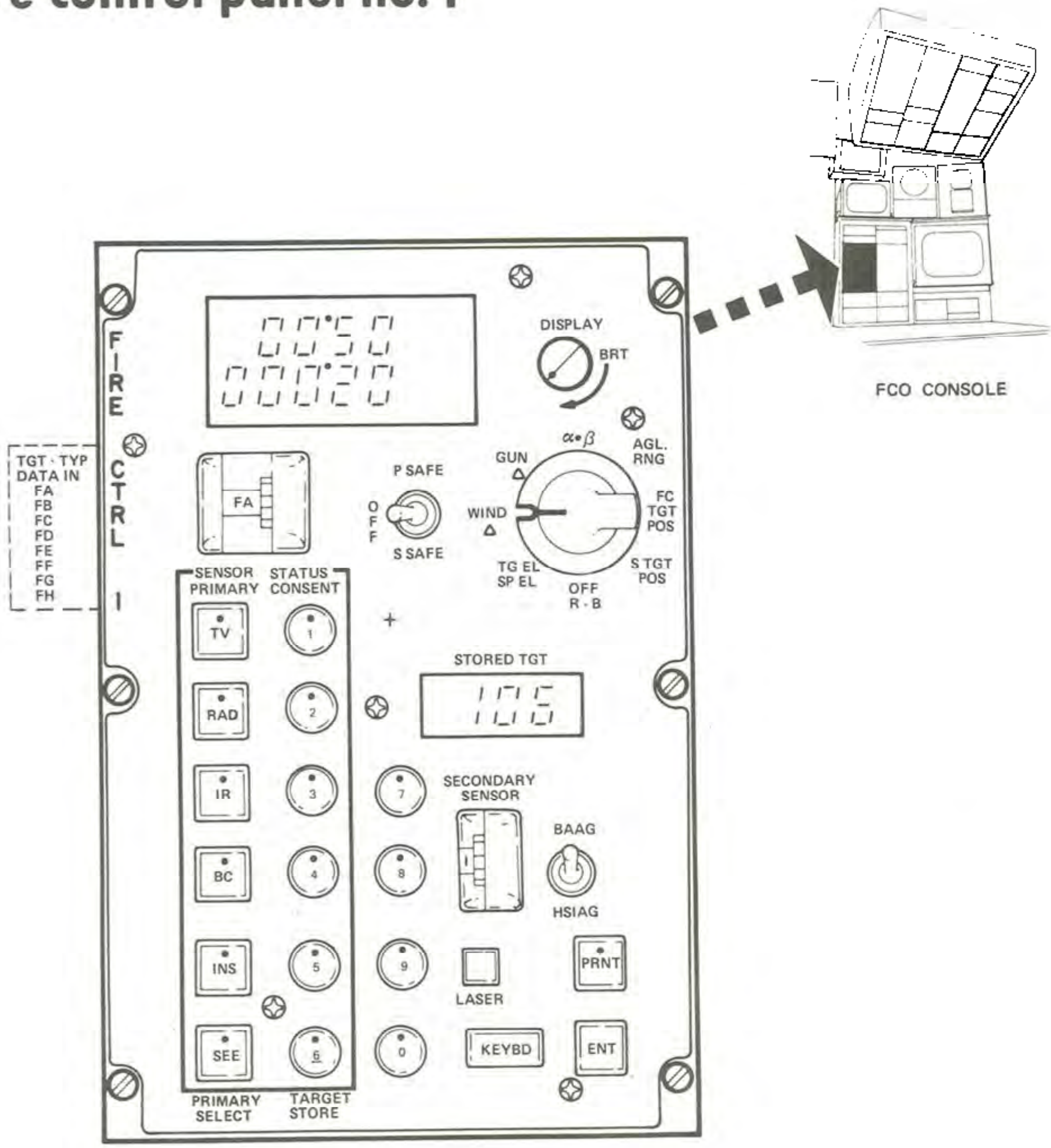


Figure 4-92.

FF. Nominal gun lag and depression angles. Depends upon the nominal orbit selected on the NCP, gun selected on the computer gun discrete panel and type ammo on the ballistic selector.

FG. Display of moving target speed in knots and true direction.

FH. Safety line distance in meters from selected safe sensor.

fire control panel no. 1 control and functions

No.	Control or Indicator	Setting	Function
1.	Data display window		Displays data selected by data thumbwheel and data rotary switch.
2.	Safety zone toggle switch	P SAFE	Selects primary sensor for safety zone reference.
		OFF	Extinguishes safety zone reference.
		S SAFE	Selects secondary sensor for safety zone reference.
3.	DISPLAY BRT control		Controls display brightness.
4.	Data rotary switch	TG EL – SP EL	Enables display or entry of target elevation and sight point elevation data. (Also WAY POINT elevations.)
		WIND Δ	Enables display or entry of wind Tweak corrections for fire control.
		GUN Δ	Enables display or entry of gun tweak corrections.
		Alpha – Beta	Enables display of sideslip angle Beta and angle of attack Alpha.
		AGL – RNG	Enables display of altitude above target and slant range to target.
		FC TGT POS	Enables display of fire control target position coordinates.
		S TGT POS	Enables display of latest stored target position coordinates.
		OFF R·B	Enables display or entry of offset range and bearing data.
5.	STORED TGT indicator		Displays latest stored target tag code.
6.	SECONDARY SENSOR thumbwheel	0 thru 9	Selects secondary sensor (1-TV, 2-RAD, 3-IR, 4-BC, 5-INS).
7.	Approach guidance toggle switch	BAAG/HSIAG	Selects Bank Angle Approach Guidance or Horizontal Situation Indication Approach Guidance.
8.	Indicator		Indicates Fire Control situation utilizing Laser range.
9.	PRNT switch		Causes specific Fire Control data table to be printed by printer.
10.	ENT switch		Used to insert new data into computer memory.
11.	KEYBD		Initializes entry of selected data.
12.	Integer selector switches (10)/status consent (5)		Initiates sensor target position storage and selects target type code. Switches 1 thru 5 also display sensor consent status. Selects numeric data for panel display and entry into computer.
13.	SENSOR STATUS PRIMARY SELECT switch indicators (5)	TV, RAD, IR, BC, INS	Selects and indicates primary sensors.
14.	Lead computation	SEE	Enables lead computation.
15.	Data thumbwheel	TGT – TYP	Data rotary switch controls data displayed on upper data indicator. Sensor status is displayed.
			Enables FC TGT storage.
		DATA IN	Enables display and entry of selected data.

Figure 4-93. (Sheet 1 of 2)

fire control panel no. 1 control and functions

No.	Control or Indicator	Setting	Function
15	Data Thumbwheel (Cont)		
		FA	(UW) Fixed mode rate limit (LW) Trainable mode rate limit
		FB	(UW) TGM box limit AZ (LW) TGM box limit EL
		FC	* (UW) Commanded lag (data 31) * (LW) Commanded dep (data 32)
		FD	* (UW) TGM resolver lag (data 33) * (LW) TGM resolver dep (data 34)
		FE	(UW) TGM GND boresight lag (LW) TGM GND boresight dep
		FF	* (UW) Nominal gun lag * (LW) Nominal gun dep
		FG	* (UW) Moving target speed * (LW) Moving target direction
		FH	* (UW) SZ (LW) Safety zone distance (meters) UW – Upper window LW – Lower window * – Indicates for display only (non-insertable)

Figure 4-93. (Sheet 2 of 2)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
I.	A. Display Fire Control Wind Correction	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to WIND Δ	2. Active PRESENT values of wind velocity and heading deltas are displayed.
	B. Insert Fire Control Wind Correction	1. Set FCP1 Thumbwheel to DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to WIND Δ	2. Active PRESENT values of wind velocity and heading deltas are displayed.
		3. Depress KEYBD pushbutton.	3. Display is blanked and ENT light is illuminated.
		4. Insert new data using integer pushbuttons. (True bearing/magnitude.)	4. Data is displayed as it is entered.
		5. Depress ENT pushbutton.	5. New data is stored, ENT light is extinguished, display is blanked for 1 second, and new data is displayed.
II.	A. Display Sensor/Gun Fire Control Correction	1. Set FCP1 Thumbwheel to DATA-IN.	1. Data windows are blanked.
		2. Set Mode Rotary Switch to GUN. Δ	2. No action.
		3. Select address of desired sensor-gun combination. First integer denotes sensor selected (1-5), second integer denotes associated gun (1-6).	3. Previously stored data is displayed.
	B. Insert Sensor/Gun Fire Control Correction	1. Set FCP1 Thumbwheel to DATA-IN.	1. Data windows are blanked.
		2. Set Mode Rotary Switch to GUN.	2. No action.
		3. Select address of data to be stored for sensor-gun combination. First integer (1-5) and second integer (1-6).	3. Previously stored data is displayed.
		4. Depress KEYBD pushbutton.	4. ENT light is illuminated and data windows are blanked.
		5. Insert new data using integer pushbutton.	5. Data is displayed as it is entered.
		6. Depress ENT pushbutton.	6. New data is stored, ENT is extinguished, display is blanked.
III.	A. Display Angle-of-Attack and Sideslip Angle.	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.

Figure 4-94. (Sheet 1 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
III.		2. Set Mode Rotary Switch to $\alpha \cdot \beta$.	2. Latest computed values of angle-of-attack and sideslip angle are displayed. α is displayed as degrees and minutes on the bottom window, β displayed as degrees, minutes on the top window.
	B. Insert Angle-of-Attack and Sideslip Angle.	1. Illegal.	
IV.	A. Display Altitude above Target and Slant Range to Target.	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to AGL · RNG.	2. Latest computed values of altitude above target and slant range to target are displayed.
	B. Insert Barometric Altitude.	1. Set FCP1 Thumbwheel to DATA-IN.	1. No action.
	Note	2. Set Mode Rotary Switch to AGL · RNG.	2. Latest computed value of altitude above target and range are displayed.
	• Results in no off nominal altitude capability.	3. If Barometric Altitude from Pitot Boom is not reliable, depress KEYBD pushbutton.	3. ENT light illuminated, display is blanked.
	• This capability intended as a backup if Air Data System and Laser fails. A zero value must be inserted in order to reactivate Air Data System altitude and Laser Ranger target/sightpoint elevation.	4. Enter Barometric Altitude via integer pushbuttons.	4. Data is displayed on top window as it is entered.
		5. Depress ENT pushbutton.	5. ENT light extinguished, display is blanked for 1 second and altitude minus inserted target elevation/slant range are displayed on top and bottom windows respectively.
V.	Display Coordinates of a stored Fire Control Position.	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.
		2. Select desired target address on FC Target Thumbwheels on Fire Control Panel No. 2.	2. No action.
		3. Set Mode Rotary Switch to FC TGT POS.	3. Coordinates of selected target position are displayed. (Degrees and minutes LAT/LONG.)
VI.	Display FC stored target coordinates on Navigation panel window.	1. Refer to steps IIIA and IVA of NAVIGATION PANEL OPERATION PROCEDURES.	
VII.	Display Coordinates of latest stored Target Position.	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to S TGT POS.	2. Coordinates of latest stored target position are displayed (degrees and minutes LAT/LONG).

Figure 4-94. (Sheet 2 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
VIII.	A. Display Offset Range and True Bearing	1. Set FCP1 thumbwheel to DATA-IN or TGT-TYP.	1. No action.
		2. Set Rotary Switch to OFF R • B	2. Offset Range, in meters, displayed in upper window and bearing, in degrees, displayed in lower window.
	B. Insert Offset Range or True Bearing	1. Set FCP1 thumbwheel to DATA-IN.	1. No action.
		2. Set Rotary Switch to OFF R • B.	2. Offset range and bearing displayed.
		3. Depress KEYBD pushbutton repeatedly until desired window blanks (upper window for range and lower window for bearing).	3. Desired window blanks; other window maintains display of present value.
		4. Using the integer pushbuttons enter the desired range in meters or bearing in degrees. Unlike other data entry no leading or trailing zeroes are required.	4. Data is displayed as entered by pushbuttons.
		5. Depress ENT pushbutton.	5. Display blanks and displays both offset range and bearing.
	C. Insert Offset Range and True Bearing.	Not allowable. Offset Range and bearing must be inserted separately.	
IX.	A. Display Target Elevation and sight-point Elevation.	1. Set FCP1 Thumbwheel to TGT-TYP or DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to TGEL. SPEL.	2. Previously stored target elevation and sight-point elevation are displayed.
	B. Insert Target Elevation and sight-point Elevation.	1. Set FCP1 Thumbwheel to DATA-IN.	1. No action.
	Note	2. Set Mode Rotary Switch to TGEL. SPEL.	2. Previously stored data is displayed.
	Target elevation will become same as sight point elevation when DIRECT is selected on fire control panel No. 2.	3. Depress KEYBD pushbutton.	3. ENT light is illuminated and data windows are blanked.
		4. Insert new data using integer pushbuttons.	4. New data is displayed as it is inserted.
		5. Depress ENT pushbutton.	5. New data is stored, ENT light is extinguished, display is blanked for 1 second, and new data is displayed.
	C. Display Elevation for prestored destinations 1-9.	1. Set FCP1 Thumbwheel to DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to TGEL. SPEL.	2. Current target elevation and sight-point elevation are displayed.

Figure 4-94. (Sheet 3 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
IX.		3. Depress integer pushbutton to select destination number (1-9).	3. Elevation of the prestored destination is displayed.
	D. Insert Elevation for prestored destinations 1-9.	1. Set FCP1 Thumbwheel to DATA-IN.	1. No action.
		2. Set Mode Rotary Switch to TGEL. SPEL.	2. Current target elevation and sight-point elevation are displayed.
		3. Depress integer pushbutton to select destination number (1-9).	3. Elevation of the prestored destination is displayed.
		4. Depress KEYBD pushbutton.	4. Display is blanked, ENT light illuminated.
		5. Insert elevation via integer pushbuttons.	5. Elevation data displayed as it is entered.
		6. Depress ENT pushbutton.	6. Data accepted and stored, ENT extinguished, display for 1 second, current target elevation and sight-point elevation displayed.
X.	Select Primary Sensor.	1. Depress desired Primary Select pushbutton. (Hold at least one second.)	1. Selected pushbutton will illuminate, the light of any previously selected primary sensor pushbutton will be extinguished.
XI.	Display Sensor Consent Status.	1. Set FCP1 Thumbwheel to TGT-TYP or FA thru FH. Note Incomplete storage of sensor sight line will cause all integers to remain illuminated.	1. Corresponding integer pushbutton of sensors in consent will be illuminated.
XII.	Store Sensor Sightline. **Note** Initiates printer format listed below.	1. Set Thumbwheel to TGT-TYP (sensor must be in consent).	1. No action.
		2. Depress consent pushbutton of target to be stored.	2. Integer pushbuttons (0-9) are illuminated.

Printer Targeting Format Legend

LITERAL	DESCRIPTION
TIME	Time from NAV DATA 43
TGT#	Target number
TS TT	Targeting Sensor – Target Type
T LAT	Target Latitude
T LON	Target Longitude

SENSOR CODE NUMBER: 8000 – TV, 4000 – RAD, 2000 – IR, 1000 – BC, 0800 – IMS

Figure 4-94. (Sheet 4 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
XII. (Cont)		3. Insert target type by depressing appropriate integer pushbutton (1-9). **Note** Sensor does not have to be primary.	3. Coordinates of ground point or sensor sightline are stored, and target type is stored, 3 digit tag code indicated on STORED TGT windows is incremented and integer pushbutton illumination reverts to (1) above.
XIII.	Select Bank Angle Approach Guidance or HSI Approach Guidance.	1. Set BAAG-HSIAG Toggle Switch to desired setting.	1. No panel action.
XIV.	Select Secondary Sensor.	1. Set Secondary Sensor Thumbwheel to desired setting. (1-5 only.)	1. No panel action. Secondary sensor is displayed.
XV.	Select Safety Zone Reference.	1. Set Safety Zone Toggle Switch to desired setting. (P SAFE, OFF, S SAFE)	1. No panel action; safety zone line on Fire Control Display is positioned normal to a line between the selected sensor and primary aimline symbols. It disappears when OFF position is selected. Safety zone distance relative to selected sensor symbol can be changed on Fire Control Panel data thumbwheel FH position.
XVI.	Initiate Diagnostic Printout	1. Insure that the printer power switch is ON.	1. Printer power on green indicator light should be illuminated.
		2. Depress PRNT pushbutton at the time when all conditions required to fire should be met. **Note** If several conditions are not met then successive diagnostic prints will show which condition is never met.	2. Diagnostic printout is provided by the printer IAW figure 4-81. Conditions required for firing which are not met will be designated by a "1".
XVII.	Display Ground Coordinates of Primary Sensor Sightline. **Note** See NAV control panel items III and IV display FLY-TO position.	1. Select 000 on FC TGT Thumbwheels on FCP2.	1. No action.
		2. Set FCP1 Thumbwheel to TGT-TYP.	2. No action.
		3. Set Mode Rotary Switch to FC TGT POS.	3. Ground coordinates of primary sensor sightline.
XVIII.	Display LASER Status. **Note** Laser operating and TV consent on.	1. No action required. Laser valid, slaved to primary sensor and used in fire control.	1. Laser light illuminated. AGL and target elevation change.
		2. Laser not valid, or laser not slaved to prime, or not used in fire control.	2. Laser light extinguished.

Figure 4-94. (Sheet 5 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
XIX.	Display Fixed and Trainable Gun Rate Limits	1. Set FCP1 Thumbwheel to FA.	1. Fixed gun rate limit displayed in upper window and trainable gun rate limit displayed in lower window. Display is in degrees, tenths of degrees and hundredths of degrees per second.
XX.	Insert Fixed Gun or Trainable Gun Rate Limits	1. Set FCP1 Thumbwheel to FA.	1. Rate limits displayed.
		2. Depress KEYBD pushbutton repeatedly until desired window blanks (upper window for fixed gun rate and lower window for trainable gun rate).	2. Desired window blanks; other window maintains display of present value.
		3. Enter desired value using integer pushbuttons.	3. Data is displayed as entered by pushbuttons.
		4. Depress ENT pushbutton.	4. Display blanks and then displays both fixed and trainable gun rate limits.
XXI.	Display Trainable Gun Box Azimuth and Elevation Limits	1. Set FCP1 Thumbwheel to FB.	1. Trainable Gun Box Az and El limits displayed in upper and lower windows respectively. Display is in degrees and minutes.
XXII.	Insert Trainable Gun Box Azimuth or Elevation Limits.	1. Set FCP1 Thumbwheel to FB.	1. Trainable Gun Box Az and El limits displayed.
		2. Depress KEYBD pushbutton repeatedly until desired window blanks (upper window for Box Az and lower window for Box El).	2. Desired window blanks; other window maintains display of present value.
		3. Enter desired value using integer pushbuttons.	3. Data displayed as entered by pushbuttons.
		4. Depress ENT pushbutton.	4. Display blanks and then displays both Box Az and El limits.
XXIII.	Display Trainable Gun Commanded Angles	1. Select gun 5 or 6 on FCO Gun Discrete Panel.	1. Computer sends position commands to gun 5 or 6.
		2. Set FCP1 Thumbwheel to FC.	2. Trainable Gun Commanded Az and El displayed in upper and lower windows respectively. Display is in degrees and minutes.
XXIV.	Display Trainable Gun Actual Position.	1. Select gun 5 or 6 on FCO Gun Discrete Panel.	1. Computer selects resolver signals from gun 5 or 6.
		2. Set FCP1 Thumbwheel to FD.	2. Trainable gun actual Az and El displayed in upper and lower windows respectively. Display is in degrees and minutes.

Figure 4-94. (Sheet 6 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
XXIV. (Cont)			**Note** Selected gun must be set to something other than OFF on LWCP or signal to computer will be open circuit and cause display of random numbers.
XXV.	Display Trainable Gun Ground Boresight Azimuth and Elevation Angles	1. Set FCP1 Thumbwheel to FE.	1. Trainable Gun Ground Boresight Az and El Angles displayed in upper and lower windows respectively. Display is in degrees and minutes.
XXVI.	Insert Trainable Gun Ground Boresight Azimuth or Elevation Angles.	1. Set FCP1 Thumbwheel to FE.	1. Trainable gun ground boresight Az and El angles displayed.
		2. Depress KEYBD pushbutton repeatedly until desired window blanks (upper window for Az and lower window for El).	2. Desired window blanks; other window maintains display of present value.
		3. Enter desired value using integer pushbuttons.	3. Data displayed as entered by pushbuttons.
		4. Depress ENT pushbutton.	4. Display blanks and then displays both ground boresight Az and El angles. **Note** With No. 6 gun selected, the boresight Az will automatically be set to zero unless a boresight El of at least 15^0 is in the computer.
XXVII.	Display Gun Nominal Az and El Angles.	1. Insert the desired nominal altitude, bank angle and true airspeed via the NAV Panel.	1. No action.
		2. Select the desired nominal on the ORBIT thumbwheel of the NAV Panel.	2. No action.
		3. Select the desired gun on the FCO Gun Discrete Panel.	3. No action.
		4. If guns 5 or 6 are selected set the ballistic select panel for the desired ballistics.	4. No action.
		5. Set FCP1 Thumbwheel to FF.	5. Gun Nominal Az and El are displayed in upper and lower windows respectively. Display is in degrees and minutes.

Figure 4-94. (Sheet 7 of 8)

fire control panel no. 1 operating procedures

No.	Task	Step	Action
XXVIII	Activate Moving Target Mode	1. Depress SEE pushbutton on FCP1 until it illuminates. Moving target speed and direction may be displayed by setting FCP1 thumbwheel to FG. (Confirm with FCD)	1. Primary Aimline will separate from primary sensor sightline on FCD by amount of moving target lead when primary sensor consent is on.
XXIX.	Deactivate Moving Target Mode	1. Depress SEE pushbutton on FCP1 until its light is extinguished.	1. The primary aimline will overlay primary sensor sightline on FCD.
XXX.	Display Moving Target Speed and Direction (Primary sensor consent on)	1. Depress SEE pushbutton.	1. Primary aimline will separate from primary sensor sightline on FCD.
		2. Set FCP1 Thumbwheel to FG.	2. Moving target speed in knots displayed in upper window and moving target heading in degrees true heading displayed in lower window.
XXXI.	Display Safety Zone Distance	1. Set FCP1 Thumbwheel to FH.	1. Letters SZ displayed in upper window. Safety zone distance in meters displayed in lower window.
XXXII.	Insert Safety Zone Distance	1. Set FCP1 Thumbwheel to FH.	1. Same as above.
		2. Depress KEYBD pushbutton.	2. Upper window maintains SZ. Lower window blanks.
		3. Enter desired value of safety zone distance using integer pushbuttons.	3. Data is displayed in lower window as entered by pushbuttons.
		4. Depress ENT pushbutton.	4. Display blanks and then displays SZ in upper window and safety zone distance, in meters in lower window.

Figure 4-94. (Sheet 8 of 8)

fire control panel no. 2

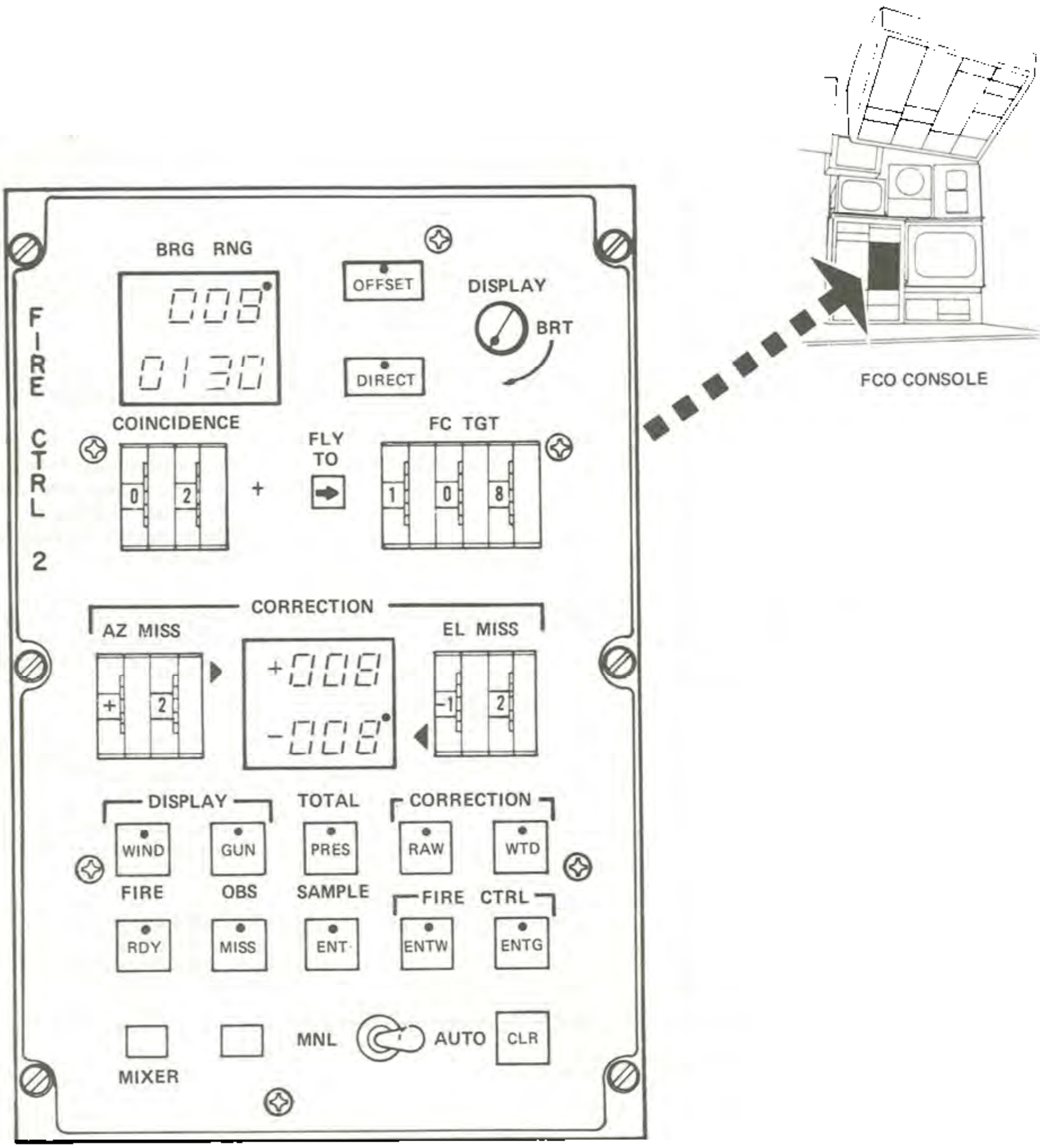


Figure 4-95.

FIRE CONTROL PANEL NO. 2 (FCP-2) (C-8993/A).

Fire control panel No. 2 (FCP-2) (figure 4-95) is located on the FCO's console. The controls are used by the FCO to select, control, and display parameters pertaining to gun calibration and gun-sensor and wind corrections. During inflight operations, this panel provides offset parameters and automatic gun tweaking capability, interfaces and is powered by the computer. Fire control panel No. 2 controls and functions are shown in figure 4-96. Operating procedures are shown in figure 4-97.

fire control panel no. 2 controls and functions

No.	Control or Indicator	Setting	Function
1.	BRG-RNG indicator		Displays offset range and bearing as entered by fire control panel No. 1. When DIRECT is selected and offset parameters are not 0, the offset parameters flash once per second.
2.	OFFSET switch		Enables offset range and bearing parameters selected by fire control panel No. 1.
3.	DIRECT switch		Enables direct fire and flashing display of offset range and bearing when parameters are not zero.
4.	DISPLAY BRT control		Controls display brightness.
5.	COINCIDENCE thumbwheel	00 thru 99	Selects desired coincidence window radius (milliradians).
6.	FLY TO indicator		Indicates that the guidance point used by the computer is derived from target tag code on FC TGT thumbwheels. If tag code is unassigned the FLY TO indicator will flash.
7.	FC TGT thumbwheel	000 thru 999	Selects target tag code for desired FLY TO ground point.
8.	CORRECTION indicator		Displays data selected by pushbuttons – wind, gun, pres, raw, and WTD.
9.	DISPLAY GUN switch	AUTO	Enables display of selected gun correction parameters by CORRECTION indicator.
		MNL	Allows manual gun Δ adjustment.
10.	DISPLAY WIND switch	AUTO	Enables display of selected wind correction parameters by CORRECTION indicator.
		MNL	Allows manual wind Δ adjustment.
11.	TOTAL PRES switch		Enables display of wind Δ or gun Δ presently being used for fire control.
12.	CORRECTION WTD switch		Displays current solution of tweak algorithm.
13.	CORRECTION RAW switch		1. Allows display of computed miss. 2. Allows display of what the CORRECTION WTD values will become if the SAMPLE ENT switch is pressed.
14.	FIRE RDY switch indicator		Alerts computer to use next gun fire pulse as a tweak sample. Indicator turns on when switch is pressed.

Figure 4-96. (Sheet 1 of 2)

fire control panel no. 2 controls and functions

No.	Control or Indicator	Setting	Function
15.	OBS MISS switch indicator		Illuminated at computed impact time.
16.	CORRECTION AZ MISS thumbwheel	±(0 thru 49)	AUTO – Selects observed azimuth miss distance (milliradians). MNL – Selects adjustment of PRES GUN Δ azimuth and PRES WIND Δ speed.
17.	CORRECTION EL MISS thumbwheel	± (0 thru 49)	AUTO – Selects observed Elevation miss distance (milliradians). MNL – Selects adjustment of PRES GUN Δ elevation and PRESS WIND Δ direction (degrees).
18.	SAMPLE ENT switch- indicator		Enables entry of observed MISS thumbwheel data into Tweak algorithm. Indicator is extinguished when switch is pressed.
19.	FIRE CTRL ENTG switch-indicator		AUTO – Replaces PRES GUN Δ with WTD GUN Δ MNL – Adds MISS thumbwheel value to PRES GUN Δ
20.	FIRE CTRL ENTW switch-indicator		AUTO – Replaces PRES WIND Δ with WTD WIND Δ MNL – Adds MISS thumbwheel values to PRES WIND Δ
21.	CLR switch		Clears tweak algorith and zeroes correction WTD values.
22.	AUTO/MNL toggle switch	AUTO	Selects automatic computer calculation of gun and wind tweak corrections.
		MNL	Allows direct adjustment of PRES GUN Δ and WIND Δ values.
23.	Right light		Spare
24.	Left light		ON indicates LORAN/Inertial mixer operating.

Figure 4-96. (Sheet 2 of 2)

fire control panel no.2 operating procedures

No.	Task	Step	Action
I.	A. Display Offset Bearing and Range	1. No operator steps required. **Note** These parameters cannot be inserted via FCP2. Offset range and bearing must be entered via FCP1.	1. Offset parameters entered via keyboard on FCP1 are displayed on BRG-RNG windows. This display is continuous if OFFSET mode is selected and flashing at a once per second rate if DIRECT mode is selected and a non-zero offset has been entered.
II.	A. Select Offset mode of operation.	1. Depress OFFSET pushbutton.	1. Offset displayed on BRG-RNG indicator is added to primary sensor sightline to obtain primary aimline. Fire control solution and approach guidance are then based on point designated by primary sensor plus ground offset rather than just on point designated by primary sensor. When OFFSET selected (and non-zero offset entered), the BRG-RNG indicator will change from a flashing display to a continuous display.
	B. Select Direct mode of operation.	1. Depress DIRECT pushbutton.	1. Offset displayed on BRG-RNG indicator is no longer used in determining primary aimline position. Fire control solution and approach guidance are based on point designated by primary sensor. When DIRECT selected (and non-zero offset entered), the BRG-RNG indicator will change from a continuous display to a flashing display.
III.	Insert Target Coincidence	1. Set Coincidence Thumbwheels to desired setting (00-99)	1. No panel action; data is used by OFP.
IV.	A. Select Fire Control Target FLY TO Position.	1. Select desired target tag code on FC TGT Thumbwheels [only 000 (sightpoint), 001-009 (prestored), 101-120 (sensor stored tgt.), and 999 offset (aimpoint) are valid tag code settings].	1. No action.
		2. Set FLY TO Thumbwheel on Navigation Panel to FC	2. FLY TO light will illuminate (indicator will flash if invalid tag code selected); synthetic INS angles sent to SSU are based on selected coordinate position; FC TGT POS displayed on FCP1 based on selected coordinate position; NAV Panel Range and Bearing and FLY TO guidance based on selected coordinate position.

Figure 4-97. (Sheet 1 of 5)

fire control panel no.2 operating procedures

No.	Task	Step	Action
IV.	B. Select INS Pointing Angles to Last Consented Primary Aimpoint	1. Set FC TGT thumbwheels on FCP2 to 000.	1. Any sensor slaving to INS will point to the position tracked by the last primary sensor to consent. The accuracy of these angles are dependent on the accuracy of the INS System. If the primary sensor remains in consent then these angles should continuously point at the same position as the primary sensor.
	C. Select INS Pointing Angles to Target Offset From Last Consented Primary Aimpoint	1. Set FCT TGT thumbwheels on FCP2 to 999.	1. Any sensor slaving to INS will point to the position tracked by the last primary sensor to consent plus the amount of offset selected. Thus a sensor slaved to INS with 999 selected should track the point where rounds are expected to impact. If no offset is being used then 999 gives the same operation as 000.
V.	Auto Tweak	1. Select AUTO position on MNL-AUTO Toggle Switch.	1. No action.
		2. Depress CLR pushbutton only if algorithm is to be cleared. After depressing CLR pushbutton, depress ENT G and ENT W only if present ballistic corrections are to be zeroed.	2. ENT W and ENT G lights are extinguished; tweak algorithms is re-initialized. RDY, MISS, ENT lights extinguished.
		3. Depress FIRE RDY pushbutton	3. FIRE RDY and RAW lights illuminated, correction window displays all zeroes.
		4. Fire round from selected gun. (Positive indication of gun fire pulse passed IACW logic) (See figure 4-79)	4. FIRE RDY light extinguished at gun fire pulse, OBS MISS light is illuminated at estimated impact and expected miss is displayed. Computed azimuth miss displayed on top, elevation miss displayed on the bottom correction display windows.
		5. Dial observed azimuth miss and elevation miss into thumbwheels. **Note** Thumbwheels must be moved to enter miss. TO REJECT DATA: 6. Data may be rejected at any time up to this point by returning to step 3 to repeat above procedure. a. Return to step 2 to clear algorithm. TO ACCEPT DATA:	5. Miss information entered temporarily into algorithms and result displayed on correction display windows if RAW selected. OBS MISS light extinguished and SAMPLE ENT light illuminated.
		7. Depress SAMPLE ENT pushbutton.	7. Observed miss entered into permanent tweak algorith. SAMPLE ENT light extinguished. If five samples have been previously entered into the permanent algorithm for this sensor/gun combination, the ENTG and ENTW will be illuminated. Display blank for 1 second and display corrections.

Figure 4-97. (Sheet 2 of 5)

fire control panel no.2 operating procedures

No.	Task	Step	Action
		TO RESTART FOR ADDITIONAL SAMPLES	
		8. Return to step 3 (depress FIRE RDY).	8. See step 3.
		TO ENTER CORRECTION WTD INTO PRESENT FIRE CONTROL SOLUTION.	
		a. Depress ENTG pushbutton.	a. WTD gun corrections replace PRESENT gun corrections in fire control. ENTG light and display blank for 1 second, corrections remain displayed on correction windows.
		b. Depress ENTW pushbutton.	b. WTD wind corrections replace PRESENT wind corrections in fire control. ENTW light and correction display blank for 1 second. Corrections remain displayed on correction window.
VI.	Manual Gun Δ Adjustment	1. Select MNL position on MNL. AUTO Toggle Switch.	1. Extinguish RAW, WTD, FIRE RDY, OBS MISS and SAMPLE ENT lights. Illuminates PRES light.
		2. Depress GUN pushbutton.	2. Extinguish WIND and ENTW lights. Illuminate GUN and ENTG lights; Present sensor/gun correction used in fire control solution displayed on correction windows.
		3. Dial desired amount of change to present values on correction Thumbwheels.	3. No action.
		4. Depress ENTG pushbutton.	4. Correction windows and ENTG light blanked for 1 second. Sum of present and thumbwheel settings becomes new present and is displayed on correction windows.
VII.	Manual Wind Δ Adjustment	1. Select MNL position on MNL. AUTO Toggle switch.	1. Extinguish RAW, WTD, FIRE RDY, OBS MISS, and SAMPLE ENT PRES light illuminated.
		2. Depress WIND pushbutton.	2. Extinguish GUN and ENTG light. WIND and ENTW light illuminated. Present wind correction used in Fire Control solution displayed on correction windows.
		3. Dial desired amount of change to present values on correction Thumbwheels.	3. No action.
		4. Depress ENTW pushbutton.	4. Correction windows and ENTW light blanked for 1 second. Sum of present and thumbwheel setting becomes new present and is displayed on correction windows.

Figure 4-97. (Sheet 3 of 5)

fire control panel no.2 operating procedures

No.	Task	Step	Action
VIII.	Display Raw Wind Parameters		
		1. Set MNL-AUTO Toggle Switch to AUTO position.	1. No action.
		2. Depress WIND pushbutton.	2. No action.
		3. Depress RAW pushbutton.	3. Correction window displays what the wind output of tweak algorithm will be if the actual miss on AZ MISS and EL MISS thumbwheels is entered into algorithm by depressing ENT pushbutton (ENT must be illuminated to allow entry). If ENT has already been depressed then WTD is identical to RAW.
IX.	Display weighted wind Parameters	1. Set MNL-AUTO Toggle Switch to AUTO position.	1. No action.
		2. Depress WIND pushbutton.	2. No action.
		3. Depress WTD pushbutton.	3. Correction window displays wind output of tweak algorithm for all shots entered since last CLR.
X.	Display Present Wind Parameters.	1. Depress WIND pushbutton.	1. No action.
		2. Depress PRES pushbutton.	2. Correction window displays tweak delta wind speed (knots) and direction (degrees) presently being used in the Fire Control solution.
XI.	Display Raw Gun Parameters.		
		1. Set MNL-AUTO Toggle Switch to AUTO position.	1. No action.
		2. Depress GUN pushbutton.	2. No action.
		3. Depress RAW pushbutton.	3. Correction window displays what the sensor/gun output of tweak algorithm will be if the actual miss on AZ miss and EL miss thumbwheels is entered into algorithm by depressing ENT pushbutton (ENT must be illuminated to allow entry). If ENT has already been depressed then WTD is identical to RAW.
XII.	Display weighted Gun Parameters.	1. Set MNL-AUTO Toggle Switch to AUTO position.	1. No action.
		2. Depress GUN pushbutton.	2. No action.
		3. Depress WTC pushbutton.	3. Correction window displays sensor/gun output of tweak algorithm for all shots entered since last CLR.

Figure 4-97. (Sheet 4 of 5)

fire control panel no.2 operating procedures

No.	Task	Step	Action
XIII.	Display present Gun Parameters.	1. Depress GUN pushbutton. 2. Depress PRES pushbutton.	1. No action. 2. Correction window displays tweak sensor/gun delta (milliradians Az and milliradians El) being used in the Fire Control solution for present primary sensor and selected gun.

Note

1. Either GUN light or WIND light will be illuminated, depending on which is depressed. Either RAW, WTD or PRES will be illuminated depending on which one is depressed. At any time during the TWEAK procedure the operator may observe either GUN or WIND PRES, RAW or WTD corrections by depressing the desired pushbuttons.
2. Once the ENTG and ENTW lights are illuminated they will remain illuminated until the tweak is cleared. They will be blanked for 1 second when depressed.

Figure 4-97. (Sheet 5 of 5)

SENSOR AND ASSOCIATED ELECTRONIC EQUIPMENT.

The sensor angle display system is independent of the fire control system and is a backup for the (automatic) sensor slaving system. (See equipment power panel figure 4-51.)

SENSOR ANGLE DISPLAY (PILOT AND FCO).

A sensor angle display panel (see figure 4-98) is located on the pilot and FCO consoles. The panel consists of an azimuth meter, elevation meter and a rotary switch. The meters display selected sensor angle information in elevation and azimuth. The rotary switch allows selection of desired sensor. Power is provided through the sensor angle display power switch on the navigator's console. The sensor angle display panel light control is located outboard of the pilot's station and contains a dimmer control.

SENSOR ANGLE DISPLAY (EWO, IR, TV).

Three sensor angle display panels (see figure 4-99) are located in the airplane: one at the EWO, IR and TV stations. The panel contains azimuth and elevation meters which display absolute azimuth and elevation angles of the sensor near the panel; relative azimuth and relative elevation meters display relative angles from that sensor to the selected sensor; and relative sensor select switch allows selection of the desired sensor. A sensor operator may approximately align his sensor with another by selecting the other sensor on his relative sensor select switch and moving his sensor in the indicated direction until the relative azimuth and relative elevation meters are zeroed. Power is provided through the sensor angle display switch on the electrical equipment switch panel located on the navigator's console.

Note

The system has a tolerance of ± 6 degrees and should be used for reference purposes only.

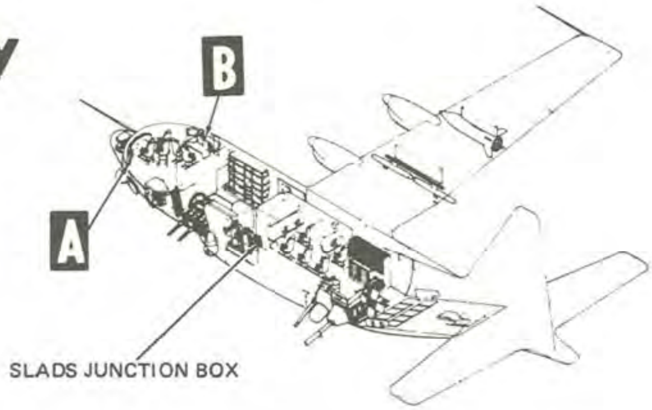
SENSOR SLAVING SYSTEM.

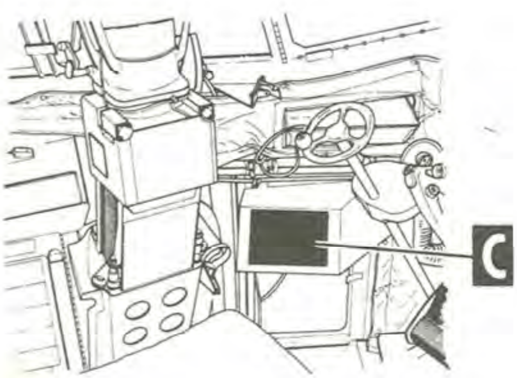
The sensor slaving system enables the individual sensor operator to automatically drive (slave) his sensor head to the looking point of any other aircraft sensor. While in the slave mode, the sensor platform is driven by the signals produced by the selected sensor tracking handle. This automatic slaving feature allows rapid and accurate target validation and/or hand-off operation between sensors. When target validation is accomplished, the sensor operator can select local command of his platform and target hand-off operation can be made. Power for the slave switching unit is provided by the right-hand ac bus and essential ac bus (115 vac 400 Hz and the main dc bus 28 vdc). Circuit protection is provided by circuit breakers on the front panel of the SUU and on the pilot's upper circuit breaker panel, pilot's side circuit breaker panel, and copilot's lower circuit breaker panel.

Slave Switching Unit (SSU).

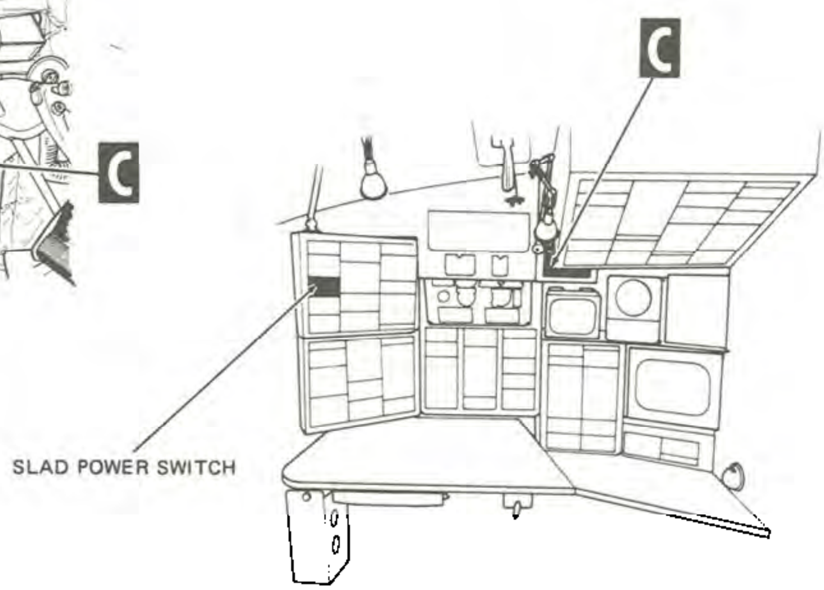
The slave switching unit (SSU) (see figure 4-100) is located on the left side of the flight deck in the galley equipment rack. This unit contains provisions for six relay/amplifier modules and two relay modules. The relay/amplifier modules provides relay logic and synchro power amplification to enable slaved positioning of sensor platform. The relay module provides switching functions used exclusively for slaved control of the non-sensor platform. The power supply module within the SSU provides regulated 28 ± 0.8 (nominal

sensor angle display (pilot and fco)

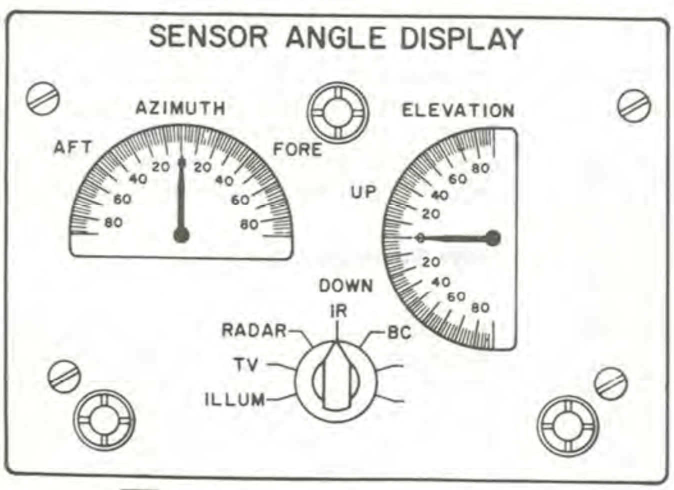




A PILOT'S STATION



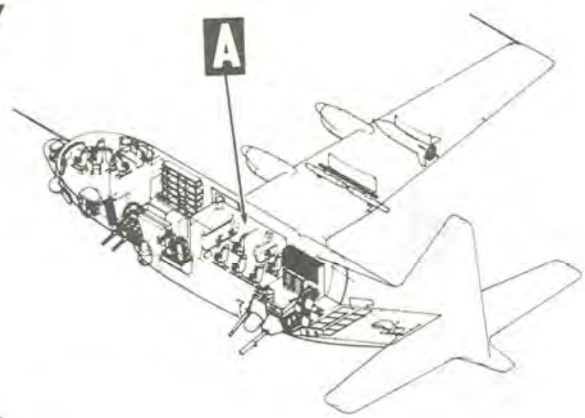
B NAV/FCO CONSOLE

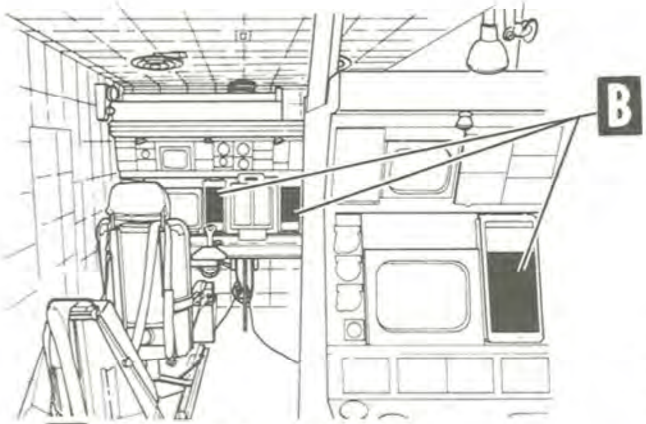


C PILOT'S/FCO SAD INDICATOR

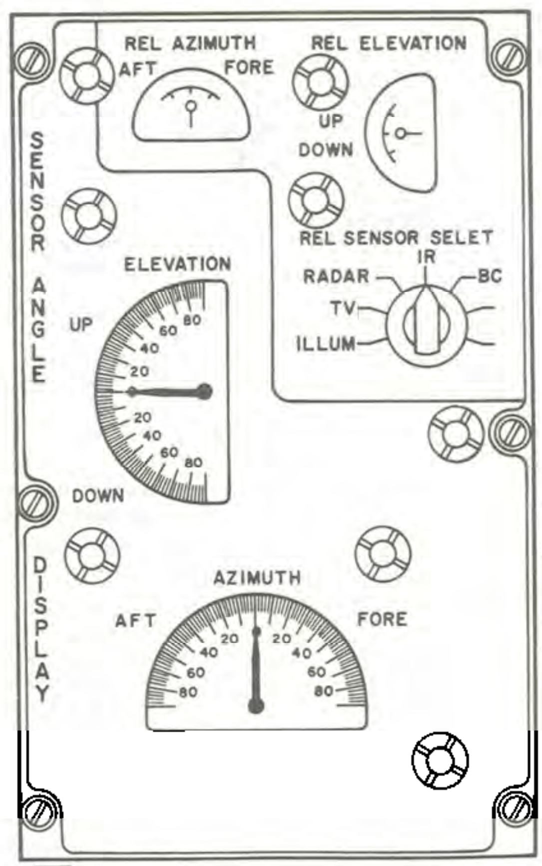
Figure 4-98.

sensor angle display (ewo, ir, tv)





A IR, EWO & TV CONSOLES



B EWO/IR AND TV SAD INDICATOR

Figure 4-99.

slave switching unit

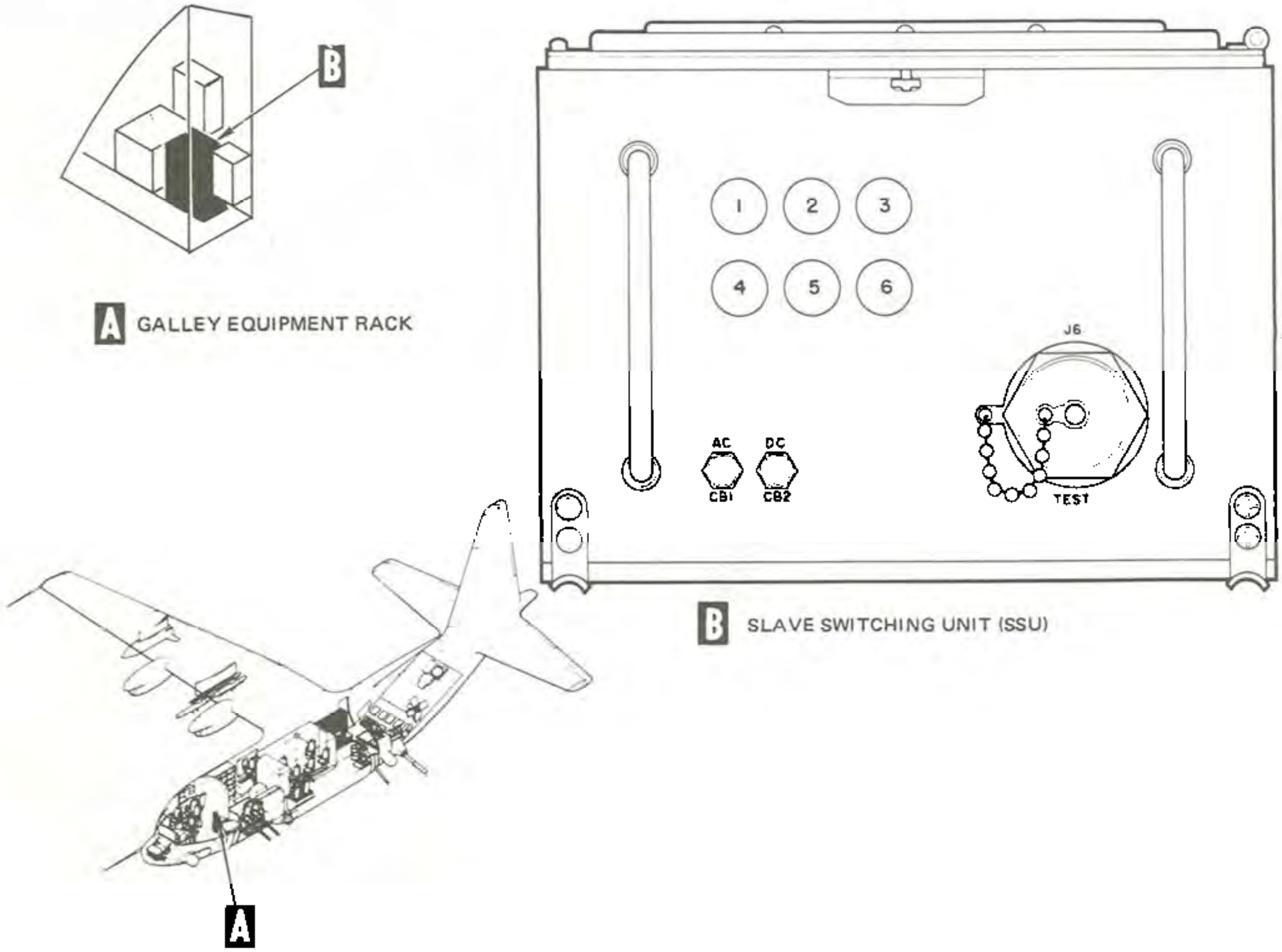


Figure 4-100.

28 vdc) power for operation of the relay/amplifier modules. Power for the slaving system is controlled through the SSU switch located on the navigator equipment power panel.

Control Switching Unit (CSU).

The control switching unit (see figure 4-101) consists of an indicator assembly, six interchangeable switch assemblies, and a lens kit. The light and TV controls are at the TV operators position and the radar (APQ-150) and BC controls are at the EWO position.

The IR control is at the IR position. The indicator assembly illuminates to identify an individual control unit with its assigned platform. The switch assembly accepts operator commands for local or slaved control of aircraft platforms. The six identical switch assemblies provide for local/slave command of six platforms, each switch having an engraved lens. The engraved lens placard indicates the switch function (local or slave control-mode sensor assignment).

Built-in-test equipment (BITE) indicator lights are located on the front of the slave switching unit. Notice lights when applying power. If one of the lights remains on, it indicates that there has been a power failure to the SSU or that one of the relay/amplifier modules has failed internally. This may affect the slaving capability of the system.

CAUTION

If one of the lights comes on, the SSU must be isolated by pulling the AC and DC circuit breakers on the SSU. If sensor look angle interface is needed for tactical operations, the SSU power switch on the NAV console must be left on.

control switching unit

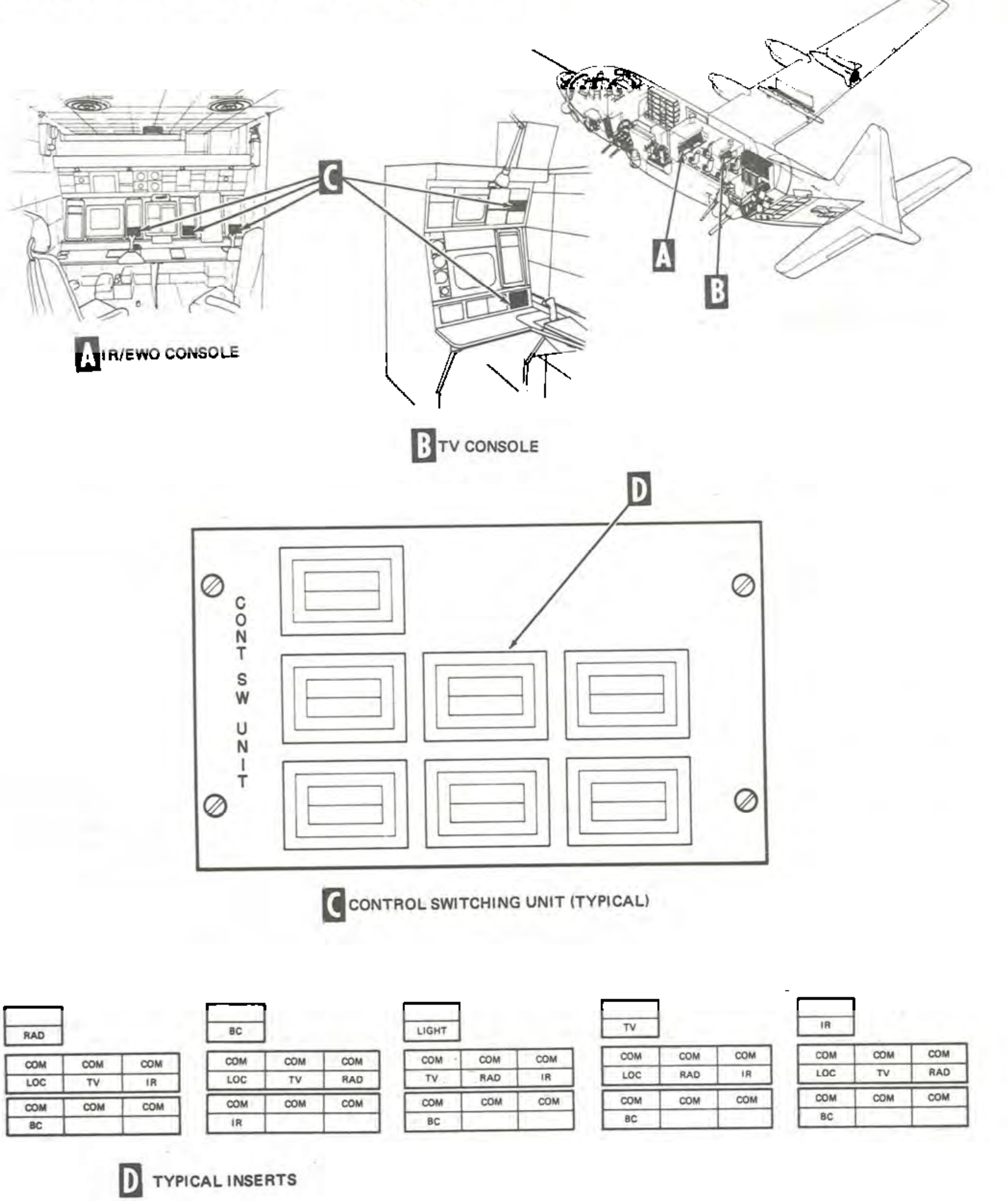


Figure 4-101.

The control switching unit allows the sensor operator to slave (azimuth and elevation motion) his sensor to any of the other sensors or the inertial navigation system (INS).

Note

> If the SSU fails, pull the SSU ac and dc circuit breakers. The SSU switch on the navigator's console must be in the ON position. This permits sending inputs to the tactical computer for use by the fire control system. The mission can be safely continued.

The slave switching unit power must be on for the sensor operators to be able to test their individual switching unit control for proper slaving operation.

Normal Operation.

Local or slaved operation of the platforms is implemented through the slave switching unit by actuation of pushbutton switches located on the front panel of each control switching unit control. Operational control status (local mode/slave mode) is annunciated on illuminated split screen indicators associated with each switch. Operation of the system is basically the same from any sensor operator position.

Local control of the sensor platforms is performed by operator manipulation of the sensor platform joystick. Any of these sensor platforms may be placed in the local command mode on an individual basis at the discretion of each sensor station operator. Actuation of the COM/LOC (Command/Local) switch (SI) on switching control units No. 1, 2 and 3 will illuminate the command switch to indicate the transmitting mode of the sensor platform. The command/local switch is not available at the light control unit.

Slaved control of the sensor platform is enabled by actuation of switches on control units for TV, IR, RAD and BC. Switch actuation at the control unit outputs a control-line signal to the slave switching unit which initiates the relay switching functions required for platform-to-platform slaving. On control units for TV, IR, and BC control switch actuation of the slave control mode also outputs a slaving-command signal to the platform electronics, causing the platform to operate in a receiver capacity. One or several platforms may be slaved to another platform, even if the platform slaved to is not in a local-control mode. For example, the 2 KW light can be slaved to the TV, the TV slaved to the IR and the IR slaved to the BC. The BC tracking handle will be driving all of the platforms. When one of the three platforms is in the local-control mode, any or all of the remaining platforms may be slaved to the looking point of that sensor.

Note

- When slaving to the INS, the sensor platform will slave to the FC TGT set in FC panel No. 2.
- The APQ-150 does not output control line signal unless it is locked on to and is tracking a beacon.

CAUTION

> No two platforms will be slaved simultaneously to each other.

Note

- The 2 KW light platform has no control stick for independent light platform movement and can only be electrically moved by slaving to a sensor. The TV operator can slave the light platform to any sensor.
- If the SSU fails, pull the SSU ac and dc circuit breakers. The SSU switch on the navigator's console must be in the ON position. This permits sending inputs to the tactical computer for use by the fire control system. The mission can be safely continued.

VIDEO SWITCHING GROUP (OA-8627(V)/ASQ-145(V)).

The video switching group is made up of the video switching unit (SA-1784/ASQ-145(V)) and the remote control unit (C-8767/ASQ-145(V)).

Video Switching Unit (VSU).

The video switching unit, located on the top aft portion of the cargo compartment electronic equipment rack (figure 4-32) provides for video distribution to all five (5) monitors, the IR viewer, and the video recorder. In addition the VSU generates the TV gray scale presentation, TV video electronic reticles and the AAQ-7 range readout. Overload protection is provided by a circuit breaker on the cargo compartment dc distribution panel.

Remote Control Unit (RCU).

The remote control units, figure 4-103, activate the video switching unit, select the video to be supplied each monitor, and control the various reticles presented on the monitors. An RCU is associated with each monitor in the aircraft.

The gray scale button allows the presentation of a ten (10) shade black-to-white (presented left to right) gray scale on a monitor. This is used to adjust the contrast and brightness on the monitors. It also acts as a check to determine if the monitor and/or the video switching unit are functioning properly. Either the NTV or the WTV must be operating for the gray scale generator to function. Circuit protection is provided by circuit breakers located on the cargo

rcu controls and functions

Control	Description	Function
1. PWR Switch	Pushbutton switch	Applies power to the RCU and the VSU.
2. VIDEO Switches	Pushbutton switches	Permits the selection of wide TV (WTV), narrow TV (NTV), infrared (IR) video or the GRAY SCALE. The one remaining button is not used at the present time.
3. RETICLE buttons	Pull-on potentiometers	Pulling a knob out applies either a dot quad (DQ) or crosshair (CH) reticle to the video. Turning the knobs varies the color of the reticles from black to white.

Figure 4-102.

compartment dc circuit breaker panel and on the video switching unit. A list of controls and functions associated with the RCU is provided in figure 4-102. When the AN/AAQ-7 laser illuminator is operating, a range readout is displayed in the upper left corner of each monitor on which NTV video is being viewed. This range readout is the slant range from the aircraft to the center of the range gate in kilofeet (example 12, 1 is twelve thousand one hundred) and is accurate to plus/minus 100 feet (in C camera gate width only). The TV operator's 14-inch RCU crosshair control must be out (the crosshair being displayed) for the range indication to appear on any monitor. The range indication is updated once every second and will appear on video tape if the FCO has NTV selected on his 14-inch RCU.

TELEVISION MONITORS (IP-1071/U(8 INCH) AND IP-1072/U (14 INCH).

The TV and fire control consoles contain a 14-inch and an 8-inch monitor and the IR console contains an 8-inch monitor. Each monitor has two front panel controls; one for power/brightness and one for contrast. (see figure 4-103.)

Controls are recessed on the bottom of the units (hand-adjustable) for horizontal hold, vertical hold, and height. The monitors contain an implosion panel to protect the operator from flying glass should the picture tube implode. The monitors operate from 115-volt, 400-Hz ac and 28-volt dc through the circuit breaker panels at the TV and IR consoles. The breakers for the fire control officer's monitors are on the copilots side circuit breaker panels. Each monitor has a single circuit breaker and a 75 ohm/high toggle switch on the rear. The switch should be in the 75 ohm position.

VIDEO TAPE RECORDER (AN/AXH-2).

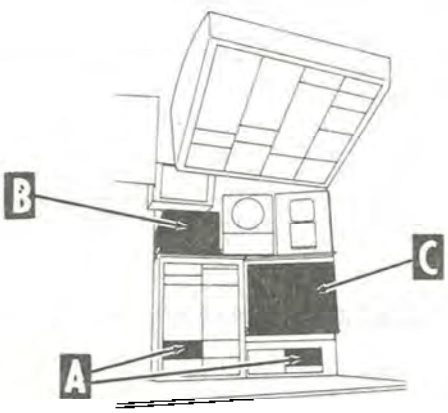
Video imagery from either LLLTV camera (WTV or NTV) or the IR set can be recorded on the video tape recorder. (See figure 4-104.) The recorder is located on the TV console in the booth. The FCO can set the video tape control panel (C-8768/AXQ-10) to start either manually or automatically when the guns are fired. In addition, an override switch has been provided on the back side of the TV console which gives recorder control to the booth operators when the video recorder off-standby switch is in STBY and the stop-receiver switch is in STOP. The video recorder control panel also allows the FCO to record only his microphone audio or selected audio. The video information that is selected for the FCO's 14-inch monitor is recorded. The recorder has approximately a 25-minute supply of tape. Power is supplied from the essential dc bus and essential ac bus. Circuit protection is provided by circuit breakers located on the TV console and the copilot's side circuit breaker panel.

Operation.

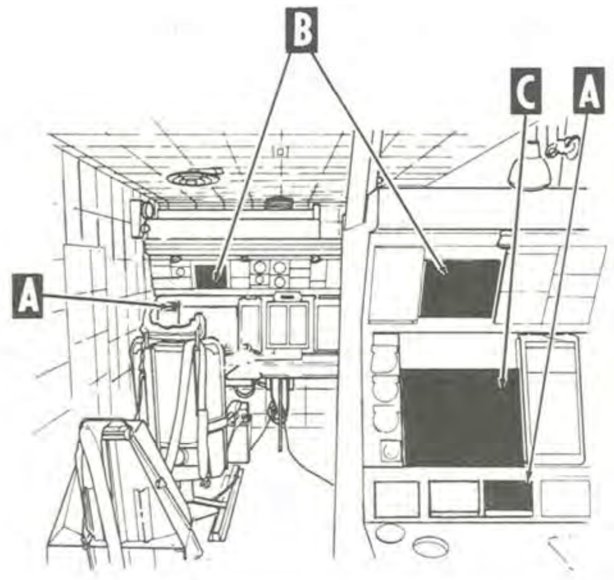
To operate, perform the following steps:

1. Set circuit breakers at the TV console, copilots side panel, and FCO circuit breaker panel.
2. Set off-standby switch to STBY. (Power light will illuminate.)

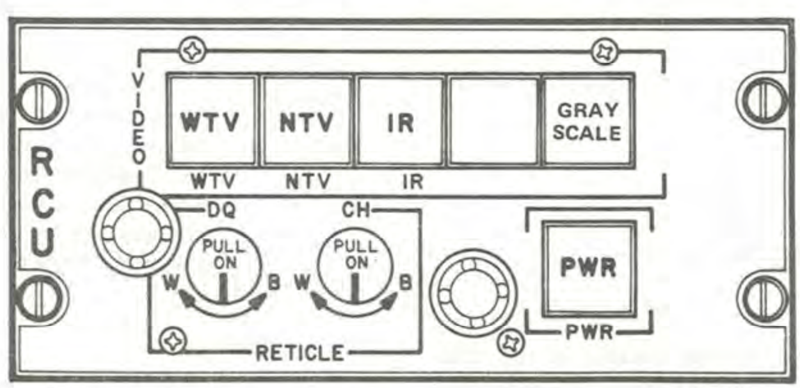
television monitor equipment



FCO CONSOLE



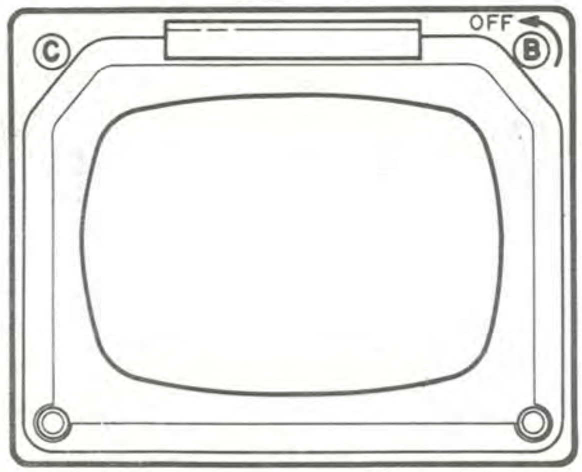
IR CONSOLE / TV CONSOLE



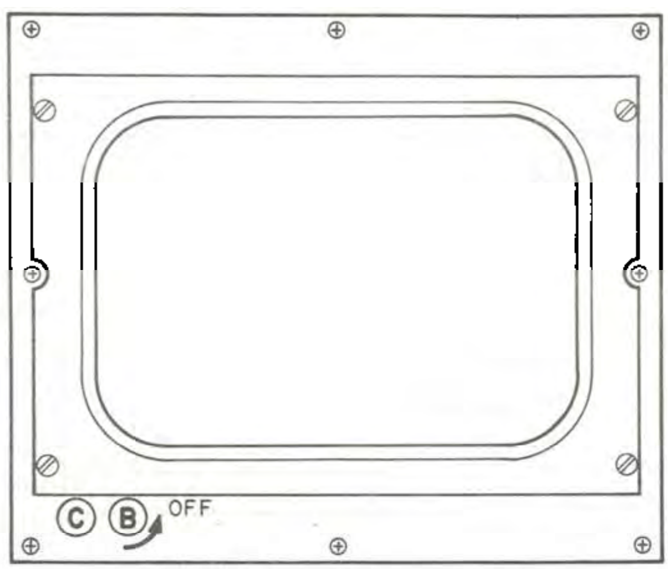
A REMOTE CONTROL UNIT

Figure 4-103. (Sheet 1 of 2)

television monitor equipment



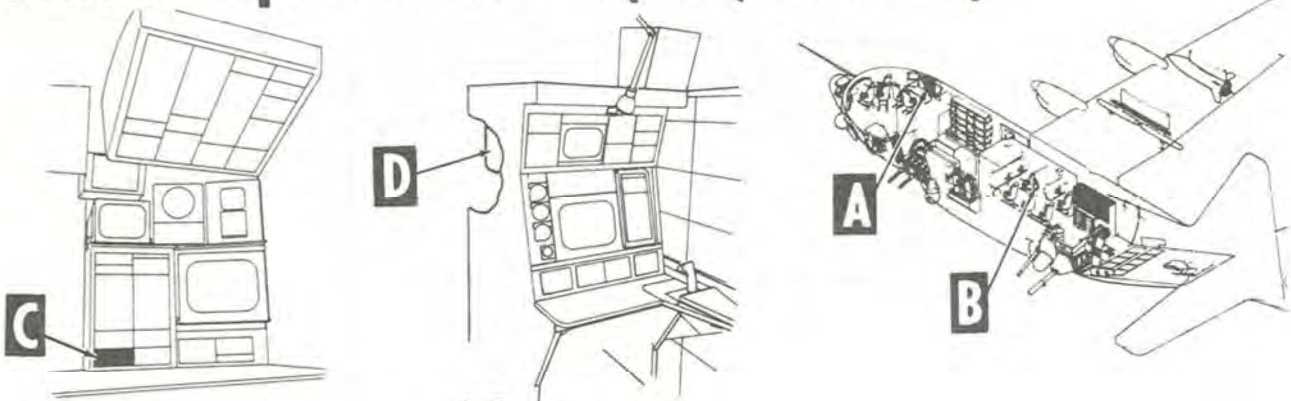
B 8-INCH MONITOR



C 14-INCH MONITOR

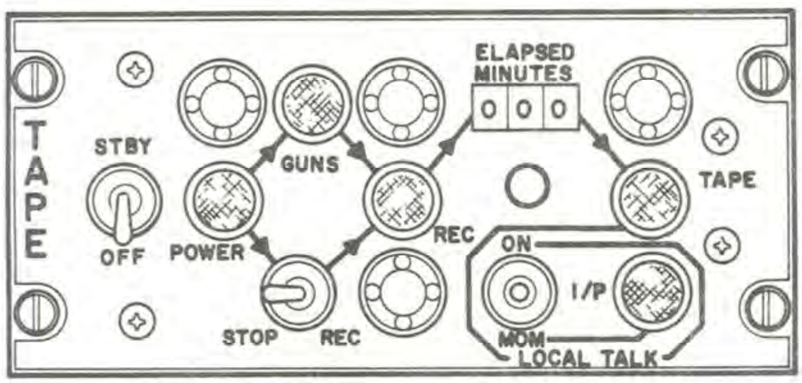
Figure 4-103. (Sheet 2 of 2)

video tape recorder (AN/AXH-2)

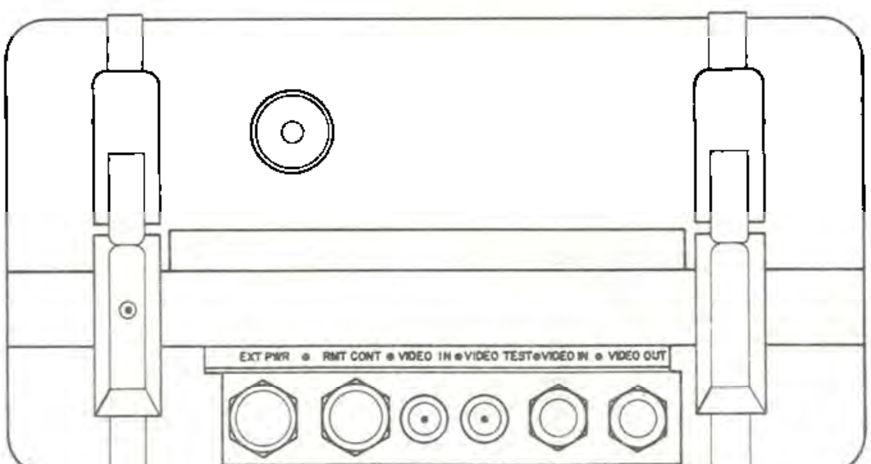


A FCO CONSOLE

B TV CONSOLE



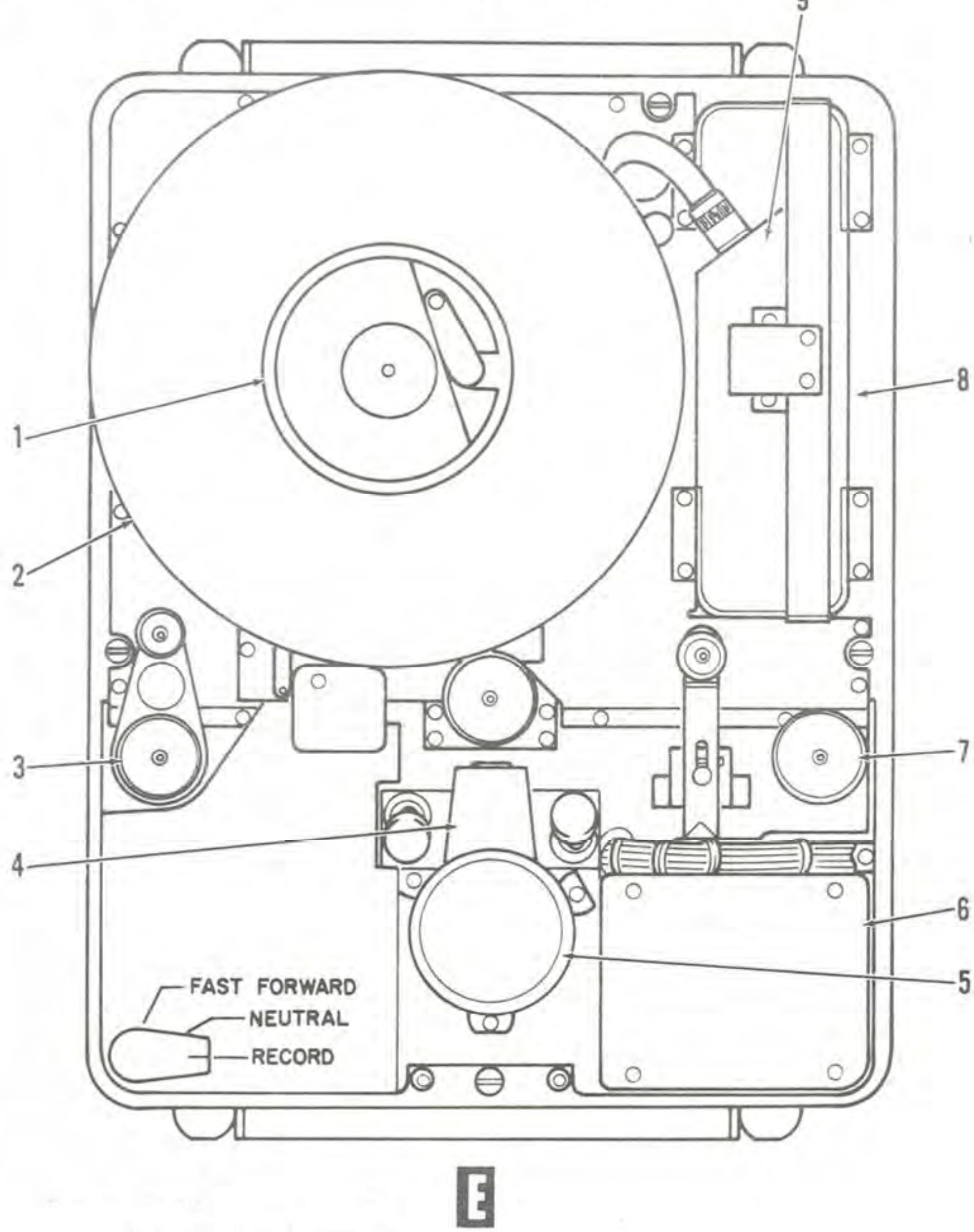
C VIDEO TAPE CONTROL PANEL



D VIDEO TAPE
(SEE DETAIL E FOR INTERIOR VIEW)

Figure 4-104. (Sheet 1 of 2)

video tape recorder (AN/AXH-2)



1. REEL HUB ASSEMBLY
2. REELS
3. TAPE GUIDE
4. SCANNING ASSEMBLY SADDLE
5. SCANNING ASSEMBLY
6. HEAD DRIVER BOX ASSEMBLY
7. TAPE GUIDE
8. REEL FRAME ASSEMBLY
9. POWER SUPPLY

Figure 4-104. (Sheet 2 of 2)

3. Set the override switch on the back of the TV console to the UP position.

Note

The TV console circuit breakers (3ϕ) on the pilot's side circuit breaker panel must be in to provide ac power to the TV console.

4. Load tape recorder:

   a. Set the recorder mode switch to NEUTRAL.

   b. Thread the tape on recorder (instructions are inside the video recorder top cover).

   c. Set recorder mode switch to RECORD.

5. Set override switch on the back of TV console to DOWN position.

6. Press counter reset button.

7. To initiate manual record mode, set stop-receiver switch to REC. (REC light will illuminate.)

8. To initiate the automatic record mode, one of the guns must be fired. The recorder is in this mode anytime the off-standby switch is in STBY. (GUNS and REC lights will illuminate.)

9. Set stop-receiver switch to stop the recorder in the manual record mode. In the automatic record mode, the recorder will stop 30 seconds after the last gun has fired; however, the recorder can be stopped sooner by moving the off-standby switch to OFF. After the REC light goes out, wait 5 seconds before returning the switch to the STBY position.

10. With the local talk switch in the I/P position whatever the FCO hears in his headset will be recorded when the recorder is running. To record only the FCO's microphone signal, set the local talk switch to the ON or MOM (momentary) position.

11. The tape light will illuminate when the recorder has exhausted the tape supply. It will also illuminate when the override switch on the back of the TV console is in the up (guard up/switch up) position.

Note

To conserve video tape, the FCO should continuously monitor the video recorder when recording. Five seconds of recording time is lost each time the recorder is cycled on or off.

12. To change the tape:

   a. FCO should put the stop-receiver switch in the STOP position and off-standby switch in the STBY position.

   b. Repeat steps 3 through 5.

TELEVISION OPERATOR'S CONSOLE.

The TV console (see figure 4-105) is located at the aft, right side of the booth and contains controls for the wide and narrow angle cameras for the low light lever television (LLLTV, AN/AXQ-10(V)), the laser illuminator (AN/AAQ-7), the TV/laser platform (AN/AJQ-24A) the 2 KW searchlight (AN/AVQ-17), the laser target designator/ ranger (AN/AVQ-19) and the right wing dispenser (SUU-42A/A). The 8 and 14-inch monitors display the information from either TV camera and/or IR set. The type of imagery displayed is selected on a remote control unit of the video distribution system. The LLLTV cameras, laser illuminator and LTD/R heads are mounted on the TV/laser platform and controlled by a TV/laser platform hand control (joystick). The laser illuminator provides supplemental illumination to the LLLTV. Azimuth and elevation angles of the LLLTV and other sensors are displayed on the sensor angle display panel (SAD). The control switching unit allows the TV operator to slave (azimuth and elevation) the TV platform to any of the other sensors or the inertial navigation system (INS). The 2 KW searchlight is used for target illumination in either a visual or covert mode. The ready/fire panel is used in conjunction with the trainable mode of fire.

Circuit breaker protection for the console is provided by circuit breakers located on the pilot's side circuit breaker panel and the copilot's lower circuit breaker panel.

STABILIZED TRACKING SET (AN/AJQ-24A).

The stabilized tracking set (see figure 4-106) consists of a gyro stabilized platform, a servo electronic unit and a platform control unit. The gyro stabilized TV/laser platform is located under the flight deck extension and houses two low light level television cameras, a laser target designator/ ranger head, and a laser illuminator head. (The TV/laser platform is also referred to as the multisensor platform and the mount.) It is stabilized in elevation and azimuth movement under all aircraft flight conditions within range of the platform's freedom of movement. The elevation gimbal can be moved from +5 degrees to -70 degrees about the horizontal. The azimuth gimbal can be moved ± 65 degrees in azimuth about the platform's nominal zero reference. The platform can be operated in the manual and slave modes. In manual mode, it follows rate signals produced by the platform hand control.

The TV/laser platform hand control is a stationary grip handle with a movable thumb switch. The thumb switch is pressure sensitive and will cause the TV/laser platform to move at a rate proportional to the pressure. The relationship between the platform movement rate and the thumb pressure is controlled by the sensitivity control.

TV operator's console

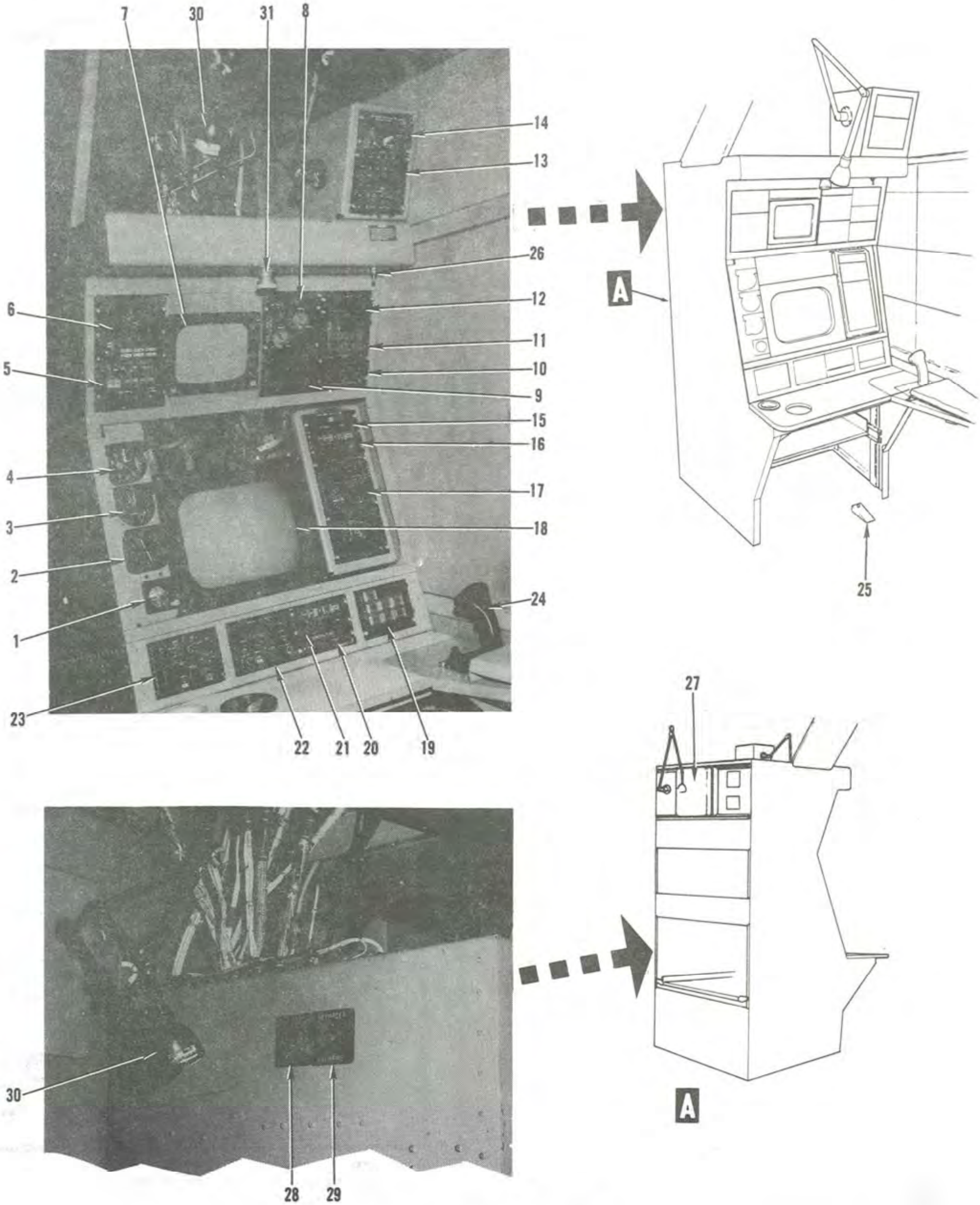
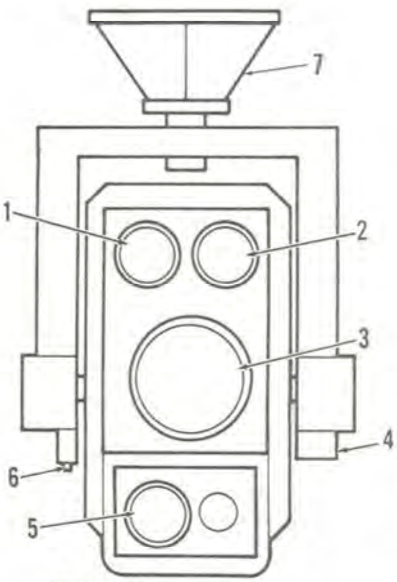


Figure 4-105. (Sheet 1 of 2)

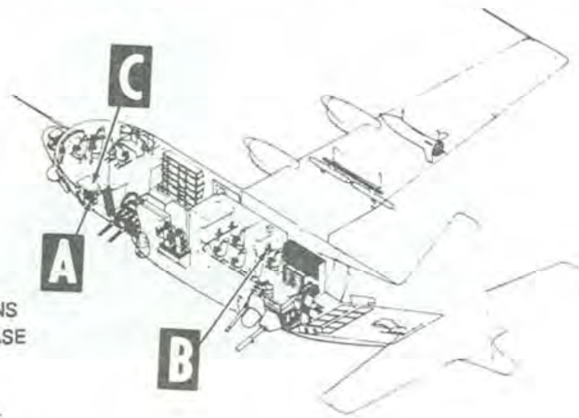
1. ATTITUDE INDICATOR (3-AXIS GYRO)
2. HEADING INDICATOR
3. INDICATED AIRSPEED INDICATOR
4. ALTIMETER
5. LASER TARGET DESIGNATOR/RANGER CONTROL PANEL
6. CLOCK
7. 8" TV MONITOR
8. LIGHTING CONTROL
9. INTERPHONE
10. 2KW SEARCHLIGHT CONTROL PANEL
11. 2KW SEARCHLIGHT CONTROL SWITCHING UNIT
12. 2KW SEARCHLIGHT ALIGNMENT UNIT
13. CIRCUIT BREAKER PANEL
14. OXYGEN REGULATOR
15. RT WING SUU-42A CONTROL SWITCH
16. REMOTE CONTROL UNIT (14" MON)
17. SENSOR ANGLE DISPLAY PANEL
18. 14" TV MONITOR
19. CONTROL SWITCHING UNIT (TV)
20. READY/FIRE CONTROL PANEL
21. REMOTE CONTROL UNIT
22. LASER ILLUMINATOR CONTROL PANEL
23. TV/LTD CONTROL PANEL
24. TV/LASER PLATFORM CONTROL UNIT
25. MICROPHONE FOOTSWITCH
26. CONSOLE LIGHT SWITCH
27. VIDEO RECORDER/POWER SUPPLY
28. RECORDER WORKLIGHT SWITCH
29. RECORDER OVERRIDE
30. WORKLIGHT
31. CONSOLE LIGHT

Figure 4-105. (Sheet 2 of 2)

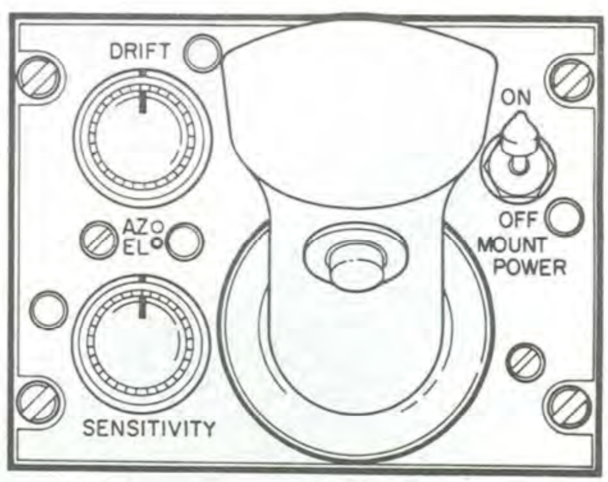
stabilized tracking set



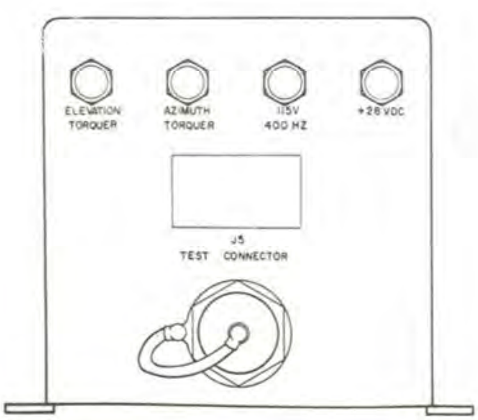
1. WIDE ANGLE TV LENS
2. LASER ILLUMINATOR
3. NARROW ANGLE TV LENS
4. ELEVATION DOG RELEASE
5. LTD/R
6. LN_2 VENT PORT
7. AZIMUTH DOG RELEASE



A TV/LASER PLATFORM



B TV/LASER PLATFORM CONTROL UNIT



C SERVO ELECTRONIC UNIT

Figure 4-106.

During preflight the operator should check for proper balance of the platform by manually releasing the elevation dog (elevation locking mechanism). If the platform is properly balanced with all lens covers off and the WTV filter on, it should hold near the mid position of the elevation travel. If it does not hold notify maintenance to adjust the balance weights.

Power requirements are 115 vac, 3-phase, 400-Hz and 28 vdc supplied from the essential ac bus and right-hand dc bus. Circuit breakers are located on the cargo compartment dc circuit breaker panel, pilot's side circuit breaker panel, and the servo electronics unit.

Operation.

1. Ensure all circuit breakers are depressed.
2. Check platform for proper balance.

Note

The balance of the multi-sensor platform is critical to the proper operation of the equipment. The balance weights of the platform should be adjusted so that the platform will hold near the mid position in its elevation travel.

3. Ensure the area around platform is clear of personnel and obstructions.
4. Select local command (LOC) on the TV control switching unit.
5. Mount power switch ON.

Note

Allow approximately 30 seconds for gyros to reach operational speed and uncage.

6. Wait for mount operate light on TV/LTD control panel to illuminate.
7. Set the sensitivity controls (AZ and EL) to desired position.
8. Set drift controls (AZ and EL) to the desired position.

Note

There should be no interaction between the drift and sensitivity controls.

9. Use platform hand control.

Shutdown Procedures.

1. Mount power switch OFF.

Note

To prevent disabling the automatic caging operation, do not pull any circuit breakers on the servo electronics unit.

2. When the system completes its automatic caging operation, the mount operate light will extinguish.

LOW LIGHT LEVEL TELEVISION SET (LLLTV) (AN/AXQ-10(V)).

The low light level television set provides the operators with a real-time visual data.The LLLTV set consists of two TV cameras, two camera electronics units, a control panel and filter set. The two cameras (a wide angle and a narrow angle) are mounted on the TV/laser platform. The narrow angle camera is equipped with a filter wheel which automatically positions a neutral density (ND) filter in front of the camera any time the control switch is set for daylight narrow TV (NTV) operation. The NTV is also equipped with a remote focus control which is operated from the TV console. Two camera electronic units, one for each camera, are located on the flight deck extension above the platform. The two units are identical except for an additional printed circuit board in the narrow angle TV unit that is used to interface the NTV, the laser illuminator, and the video switching unit. The two LLLTV cameras are controlled by the TV/LTD control panel in the TV console. (See figure 4-107.) This panel also controls the NTV filter wheel which provides a selection of filters for the NTV camera. The filter set contains a ND5 day light filter for the WTV, a GAAS filter for the WTV when using laser illumination, a WTV lens, the various lens caps, and AAQ-7 laser dewar caps.

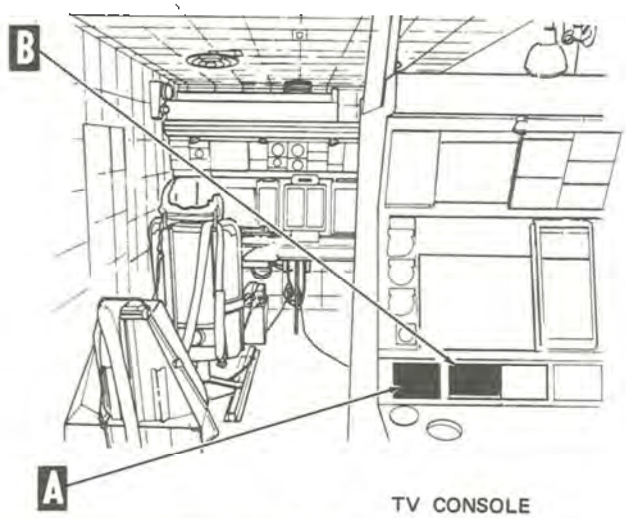
Video signals from the TV cameras, the infrared set (AN/AAD-7) and the laser illuminator range signal from the NTV are applied to the video switching unit located on the cargo compartment electronics rack. Remote control units (RCU) on the FCO, IR and TV operator consoles allow the operator to select either TV or IR imagery for display on the appropriate TV monitors. Video selected for the FCO's 14-inch monitor can be recorded on the video tape recorder. In addition the RCU's can be used to provide a gray scale presentation on the monitors.

Circuit protection is provided by circuit breakers located on the TV operator console circuit breaker panel and on the two electronic boxes located on the flight deck extension.

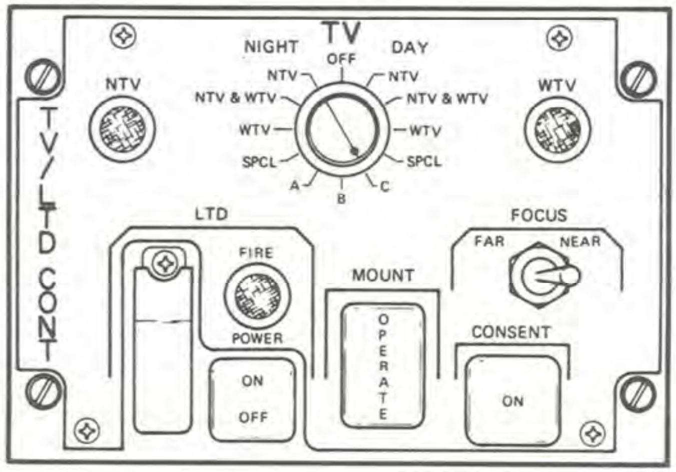
CAUTION

During daylight the ND 5 filter must be used with the WTV camera lens and must be manually installed. When the LLLTV is not in use, the lens covers should be installed. Covers should be removed for flight on which the LLLTV will not be used, as covers can be lost in flight.

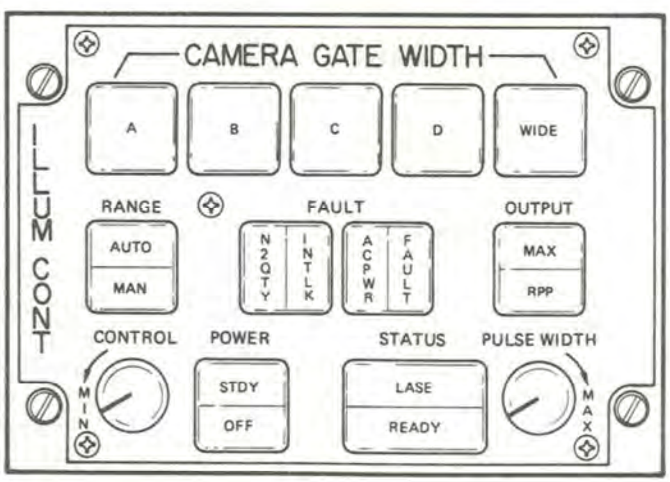
LLLTV equipment



TV CONSOLE



A TV/LTD CONTROL PANEL



B LASER ILLUMINATOR CONTROL PANEL

Figure 4-107.

WARNING

Due to moderate turbulence around the TV/laser platform, extreme care must be taken when the TV lens covers/filters and laser covers are installed or removed during flight. The person performing the installation/removal should be secured to the airplane and a safety observer should be present during the entire operation until T.O. 1C-130(A)E-507 is accomplished.

Note

At the higher light levels, a honeycomb pattern may appear on the monitors (caused by light saturation of the intensifier). This pattern does not indicate damage or abnormal operation of the equipment.

When viewing a large amount of light at night, the camera intensifier may be over-driven. Rapid blanking recovery can be obtained by directing camera away from the light. Figure 4-108 gives a list of LLLTV controls and functions. Figure 4-109 shows the TV control knob positions.

System Parameters.

The wide field of view TV camera (WTV) can be used with either a 20 degree or a 15 degree lens. Storage for the lens that is not in use is provided in the filter set case. The desired lens should be installed by sensor maintenance personnel before flight. Parameters for the wide angle camera are as follows:

a. Diagonal field of view (FOV)	20° ≈ 350 mils 15° (260 mils)
b. Horizontal FOV	16° ≈ 280 mils 12° (210 mils)
c. Vertical FOV	12° ≈ 210 mils 9° (160 mils)

Parameters for the narrow angle camera are as follows:

a. Diagonal FOV	3.5° ≈ 61.0 mils
b. Horizontal FOV	2.8° ≈ 49.0 mils
c. Vertical FOV	2.1° ≈ 36.6 mils

Parameters for the reticles are as follows:

a. Narrow FOV	Two crosshairs, crosshatched at 5 mil intervals.
	Dot quad, 2.5 mils across (4 centered dots, each dot 1/4 mil diameter)
b. Wide FOV	Two crosshairs, crosshatched 30 (20) mil intervals. Magnification is approximately 6 (4) to 1 from wide FOV to narrow FOV. Four small corners near center of picture mark the area that will appear on the narrow angle presentation. Dot quad, 15 (10) mils across, 4 centered dots each 1.5(1.0)mils diameter. (Numbers in parentheses are for 15° FOV lens.)

Operation.

WARNING

Do not remove unit covers on camera, camera electronics or monitors. High voltages are present in these units.

CAUTION

Never point a TV camera at the sun even if camera is turned off. During daylight do not turn cameras on unless a neutral density filter is used. At night do not aim cameras at any bright light source. Serious damage to the intensifier and/or the vidicon tube may result from too much light.

Note

Operators should remember that even though the narrow TV is pointed away from a bright light, the light may still be in the wide TV field of view.

When the LLLTV sensor system is not in use, set controls to the following positions:

1. TV/LTD control panel
   - a. TV power - OFF
   - b. LTD power - OFF
   - c. Fire switch - OFF
   - d. Consent - OFF
2. TV/laser platform:
   - a. Mount power switch - OFF
3. Remote control units (RCU) (5)
   - a. Power switch - OFF
   - b. Video pushbuttons - As required/GRAY SCALE

LLLTV controls and functions

Control	Description	Function
1. NTV light	Green push to test light	Indicates NTV camera is selected.
2. WTV light	Green push to test light	Indicates WTV camera is selected.
3. TV control knob	Rotary switch	Controls power to both TV cameras and selects filter positions for NTV. (See figure 4-109).
4. FOCUS Switch	Center off momentary switch	Controls focus adjustment for the NTV.
5. CONSENT button	Internally illuminated (yellow) buttontype switch	Provides operator interface with the aircraft fire control system and indicates that "consent" has been given. For fixed gun firing only.
6. MOUNT OPERATE light	Green Light	When illuminated indicates that TV/Laser platform can be operated; when extinguished indicates that platform has completed automatic caging sequence and is stowed in -65 degree azimuth and 0 degree elevation position.
7. LTD POWER switch	Internally illuminated (white and green) pushbutton switch	Switch should be turned ON at start of mission and left ON for entire mission.
8. LTD red guarded switch	Guarded toggle switch	Used in conjunction with START LASING button on Laser Control Panel. In order to fire laser the platform must be ON and pointed outside aircraft so that safety limit switches are not engaged.
9. FIRE LIGHT	Red Press-to-test light	Illuminates when red guarded fire switch is in up position.

Figure 4-108.

TV control knob positions

POSITION OF OUTSIDE KNOB	POSITION OF INSIDE KNOB	CAMERA IN USE	NARROW FILTER
OFF	ANY (A, B, or C)	NONE	SHUTTER
DAY – NTV	ANY (A, B, or C)	NTV	ND5
DAY – WTV	ANY (A, B, or C)	WTV	SHUTTER
DAY–WTV + NTV	ANY (A, B, or C)	NTV and WTV	ND5
DAY–SPEC	A	NTV and WTV	SHUTTER
DAY–SPEC	B	NTV and WTV	ND3*
DAY–SPEC	C	NTV and WTV	ND4*
NIGHT–NTV	ANY (A, B, or C)	NTV	CLEAR
NIGHT–WTV	ANY (A, B, or C)	WTV	SHUTTER
NIGHT–NTV + WTV	ANY (A, B, or C)	NTV and WTV	CLEAR
NIGHT–SPEC	A	NTV and WTV	SHUTTER
NIGHT–SPEC	B	NTV and WTV	SHUTTER
NIGHT–SPEC	C	NTV and WTV	SHUTTER

** The ND-4 filter allows ten times more light to enter the intensifier than the ND-5. The ND-3 filter allows ten times more light to enter the intensifier than the ND-4.*

Figure 4-109.

c. DQ and CH controls - Pushed in

4. Monitors

a. Brightness control - OFF (counterclockwise) (Use caution; knob shaft is brittle.)

5. TV/laser platform

a. Lens covers (5) - Installed

For normal operation, perform the following steps:

1. Ensure all circuit breakers are depressed

2. Remove camera lens covers. (Install filter as required.)

CAUTION

Never remove a TV camera lens cover or a daylight filter from a camera lens when the camera is turned on. The sudden change in light level can seriously damage intensifier fier and/or vidicon tube.

WARNING

Due to turbulence around the multi-sensor platform, extreme care must be exercised when TV lens covers/filters and laser covers are installed or removed in flight. The person performing the installation/removal should be secured to the airplane and safety observer should be present during the entire operation until T.O. 1C-130(A)E-507 is accomplished.

3. Mount power switch - ON

4. RCUs - ON/Set

CAUTION

Operator will insure that LLLTV cameras are pointed away from any light source including those inside the aircraft before turning the LLLTV on.

5. Monitors - ON

6. TV power - Reference figure 4-108

7. RCUs - GRAY SCALE

8. Monitors - Adjust as required

Note

The vertical hold, horizontal hold and height controls are located on the recessed panel at bottom of the monitor chassis.

a. If picture is horizontally unstable, adjust horizontal hold control

b. If picture height is abnormal, adjust height control.

c. If picture is rolling vertically, adjust vertical hold control.

9. When mount operate light illuminates, use platform hand control to slew TV/laser platform.

10. On the remote control unit, select desired video by pressing WTV, NTV, or IR pushbutton.

11. Adjust focus on NTV as required.

12. To produce a dot-quad or crosshair reticle during WTV or NTV operation, pull out DQ or CH control. Rotate control to vary reticle shade from black to white.

13. After sighting a possible target, slew field of view until the target is centered in the reticle dot quad. If reticle is not centered on the monitor, the dot squad must still be superimposed on the target. The reticle center represents the boresight point of the TV. (If not centered, it can be moved by maintenance personnel.)

14. Press the consent switch on the TV/LTD control panel when tracking a target. Consent must be ON before the pilot can fire in the auto mode or before target storing can be accomplished with the tactical computer. (Consent will remain OFF when firing in the TRAINABLE mode.)

15. Adjust sensitivity and drift controls on the platform hand control unit as necessary to facilitate ease of tracking.

16. Before landing, return switches and controls to OFF.

17. After landing, install TV and laser lens covers.

LASER ILLUMINATOR (AN/AAQ-7).

The solid state laser is a liquid nitrogen cooled, gallium arsenide laser illuminator which consists of a laser head, an electronic control amplifier (ECA), a liquid nitrogen dewar, and a control panel. (See figure 4-110.) The laser illuminator provides covert illumination for the NTV. The unit operates in a pulse mode and by gating the NTV image intensifier significant improvement is achieved to the video imagery. The TV/laser platform must be positioned within the laser safety limits to operate the laser illuminator.

The power requirement is 28 vdc supplied from the right-hand dc bus. Circuit breaker protection is provided by breakers on the cargo compartment dc circuit breaker panel, the TV console circuit breaker panel and on the electronic control amplifier (located on the flight deck extension).

WARNING

Permanent eye damage can occur from viewing the laser illuminator or the reflected laser beam at a distance of less than 80 feet. The area in front of the crew entrance door should be cleared and a guard posted before operation of the laser illuminator is attempted without the lens cap in place.

CAUTION

The laser illuminator may be operated for 5 minutes or less with the lens cap in place. Sufficient time for the lens cap to cool to ambient temperature should be allowed before operation is attempted again. Serious damage to the laser may occur if the paint on the lens cap burns or scorches and energy is reflected back into the lens.

System Parameters.

Max. Output Power (Nominal):	28 watts
Operating Wavelength:	0.86 microns
Pulse Repetition Rate:	13.12kHz± 1.313kHz

laser illuminator (AN/AAQ-7)

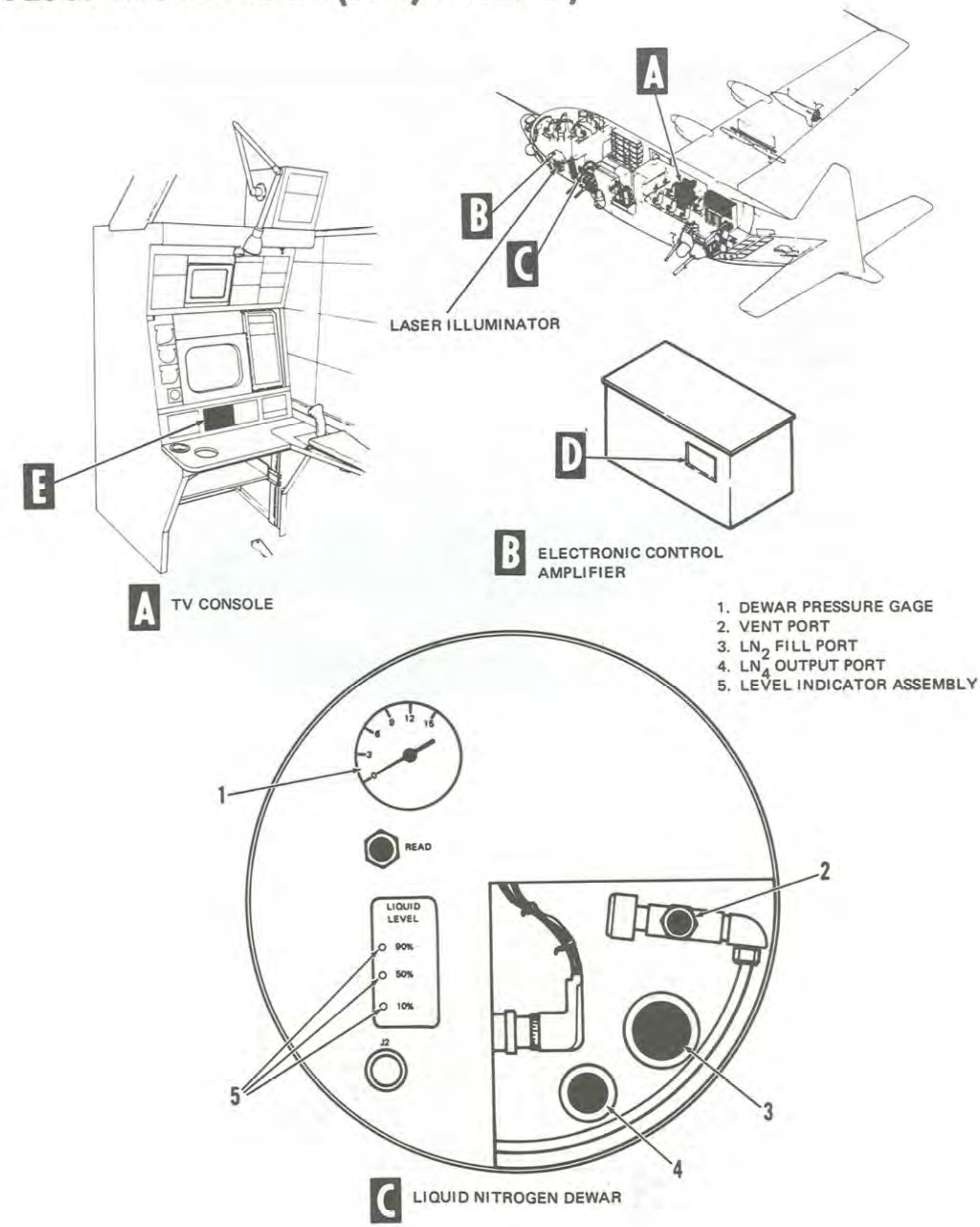
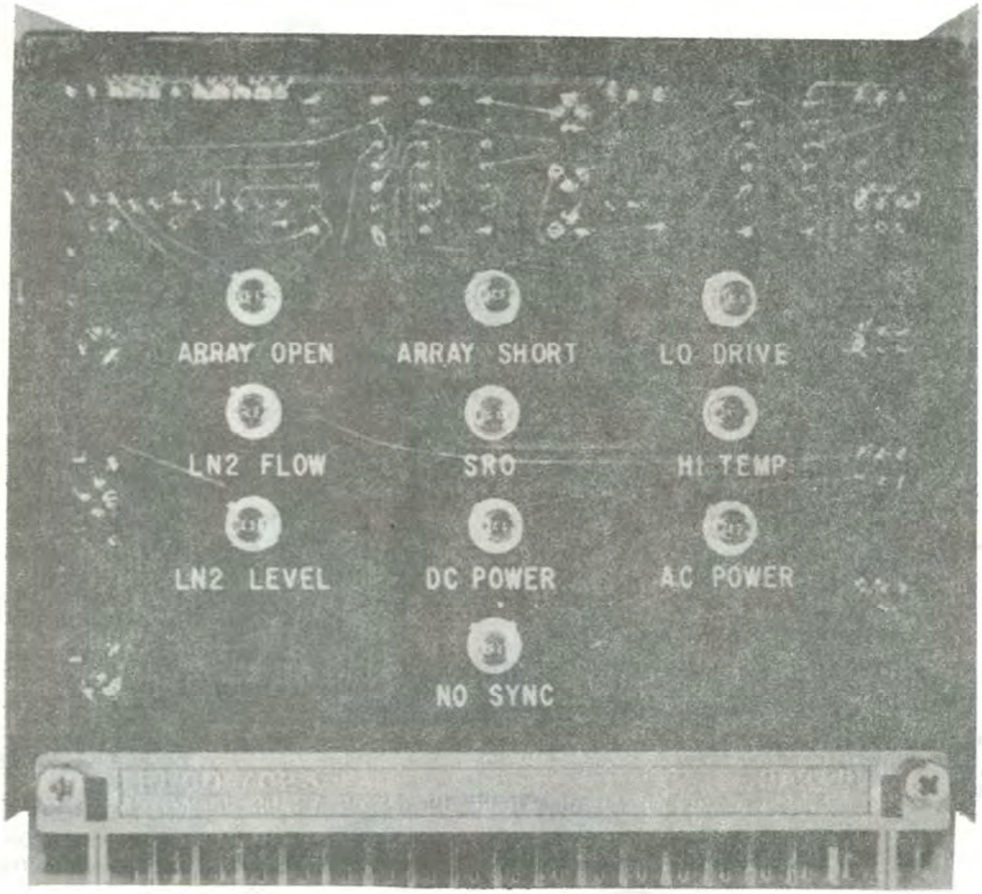
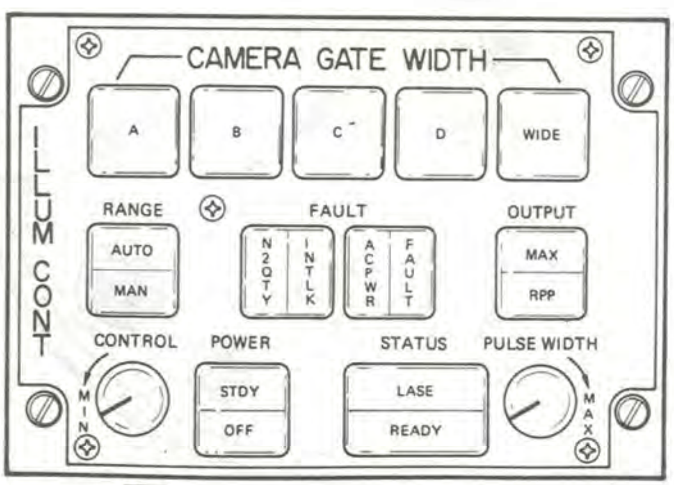


Figure 4-110. (Sheet 1 of 2)

laser illuminator (AN/AAQ-7)



D FAULT INDICATOR PANEL



E LASER ILLUMINATOR CONTROL PANEL

Figure 4-110. (Sheet 2 of 2)

Pulse Width:	1.00 to 0.25 microseconds
Field of Illumination:	2.8° (49.0 mils) Horizontal 2.1° (36.6 mils) Vertical
System Operating Temperature:	100 to 135° Kelvin
Liquid Nitrogen Supply:	26 liters
Liquid Nitrogen Usage Rate:	3 liters of liquid nitrogen per hour at max power
Liquid Nitrogen Evaporation:	2 1/2 liters of liquid nitrogen per day.

Note

- The laser head is mounted on the TV/laser platform so that its field of illumination matches the narrow LLLTV camera field of view.

- Because the laser illuminator operates at a wavelength of 0.86 microns and the LTD/R operates at a wavelength of 1.06 microns, both lasers may be operated simultaneously without interfering with each other. Laser guided bombs will guide only on the LTD/R output.

Laser illuminator controls and functions are shown on figure 4-111.

The auto range gate function should keep the range gate centered automatically under all but the most rapid platform motions. The auto range may break lock due to a sudden bright light or an imbalanced return situation such as land/water contrast, i.e., land on top half of scope and water on bottom half. If the range gate breaks lock it will automatically initiate a search around the slant range selected on the manual range control. The search will start three thousand feet more than the selected slant range and continue until three thousand feet less than the selected slant range. The search function will then reverse itself and search outward until it is three thousand beyond the selected slant range. Each 6,000 foot scan will take one second. In auto search the picture will blink twice each second until system acquires range gate.

For most operating conditions the B, C, and D positions of the camera gate width should be used. The position selected will depend on the atmospheric conditions, the slant range, and the depression angle of the sensor. The intensifier pulse widths for the respective laser control camera gate widths are A (0.5 in microseconds) B (1.0) C (2.0), D (3.0), and WIDE (38.1).

Under most conditions the WIDE position of the camera gate width should not be used. This position operates the camera gate at a 50 percent duty cycle and allows much of the backscattered energy to enter the camera reducing the scene contrast. Wide position will work very well on a clear night. The camera is gating in this position and the range indication will appear, but will not be accurate (approximately 9,000 feet in error). In addition unless it is very hazy and/or training the A position of the camera gate width should be avoided. This position employs a very narrow gate pulse that causes the image intensifier to defocus slightly causing a small loss of resolution.

When the laser illuminator is not in use, set illuminator control panel controls to the following positions:

1. POWER - OFF
2. RANGE - MAN
3. OUTPUT - RPP
4. PULSE WIDTH - MIN (full counterclockwise)
5. CAMERA GATE WIDTH - C
6. Lens Cap - Installed

Operating Procedures.

1. Remove lens cap and place in lens filter case.
2. Insure liquid nitrogen dewar is pressurized to at least 6 psi and is 50 percent full for one mission and 90 percent full for two missions. If the dewar pressure is less than 6 psi, it is often possible to raise the pressure by turning the system to STBY. This activates an internal heater in the dewar which will increase the liquid nitrogen evaporation rate thereby increasing the gas pressure in the dewar.
3. Circuit breakers checked -
   a. Laser illuminator electronic control amplifier
   b. Cargo compartment dc distribution panel
   c. TV console circuit breaker panel
4. TV/LTV control panel - NTV on

   (DAY NTV/NIGHT NTV as required)
5. Illuminator control panel -
   a. Power - STDY (READY light should illuminate in 10 - 15 minutes). If no cool down within 30 minutes, system will not operate.
   b. Status - LASE (as required). Lasing will be interrupted when the TV/laser platform engages a limit switch and will automatically start lasing again when limit switch is disengaged.
   c. Output - RPP (MAX if required)

AN/AAQ-7 controls and functions

Control	Description	Function
1. POWER switch	Internally illuminated (White/ green) pushbutton switch	In OFF position all power removed from laser. In STDY position laser starts cool down.
2. STATUS Switch	Internally illuminated (Green/ red) pushbutton switch	READY light illuminates when laser is cooled down. Depressing switch initiates lasing, LASE portion of switch illuminates. Depressing switch during lasing returns it to the READY state.

Note

Lasing cannot be imitiated until the STATUS switch is depressed after the READY light has illuminated.

Control	Description	Function
3. OUTPUT Switch	Internally illuminated (Green) pushbutton switch	In MAX position laser emits maximum power. In RPP (Range Proportional Power) laser output varies according to slant range and the setting of the PULSE WIDTH control. Min pulse time is .25 microseconds/ MAX pulse time is 1.00 microseconds.
4. PULSE WIDTH knob	Rotary potentiometer	Varies laser pulse width and power when OUTPUT control is in the RPP position.
5. FAULT indicators	Lights	

a. N2 QTY – Indicates dewar is less than 10% full. Approximately one hour of operating time remaining.

b. INTLK – Indicates lasing has ceased due to TV/Laser platform engaging limit switches. Limits are minus 14 degrees to plus 44 degrees azimuth; plus 3.5 degrees to minus 64 degrees elevation, ± 6 degrees.

c. AC PWR – Indicates aircraft DC power has exceeded 30 volts or fallen below 22 volts. When this occurs shut down all laser and TV equipment.

d. FAULT – Indicates self-monitoring circuits have detected an undesirable condition(s). Lasing will not start or will stop if condition(s) is damaging to the unit. Type of fault is displayed behind the window on the electronic control amplifier on the flight deck extension. (See figure 4-110.) The FAULIT light illuminates when the system is turned on and may remain on four up to five minutes after the READY light illuminates. If the FAULT light is still illuminated after this time a legitimate fault exists and the diagnostic panel on the laser electronic unit should be checked.

Control	Description	Function
6. RANGE Switch	Internally illuminated (Green) pushbutton switch	In MAN the CONTROL knob isused to adjust the range gate. In AUTO the range gate is controlled automatically and will re-acqûire if the gate breaks lock.
7. RANGE CONTROL Knob	Rotary potentiometer	Varies range gate when RANGE switch is in the MAN position.
8. CAMERA GATE WIDTH selectors switches	Internally illuminated (Green) pushbutton switches	Allows operator to select A, B, C, D or WIDE gate widths.

Figure 4-111.

dewar controls and indicators

Control	Description	Function
1. Dewar pressure	Pressure gauge	Indicates pressure inside dewar.
2. READ button	Spring loaded pushbutton switch	Depressing READ button applies internal dewar battery power to level sense circuit in dewar.
3. LIQUID LEVEL indicators	Light emitting diodes (LED)	When READ button is depressed indicators show quantity of liquid nitrogen in dewar. Accuracy of indicators is 90%, 24 (+2, -1) liters; 50%, 15 (+4, -3) liters, 10%, 4 (+2, -1) liters.

Figure 4-112.

d. Camera gate width - A, B, C, D or WIDE (as required)

e. Range - MAN (adjust range control for proper setting)

f. Range - AUTO

g. TV operator 14 inch RCU - CH RETICLE on

6. Before landing power to OFF.

7. After landing, install lens cover.

A list of the dewar controls and indicators is shown in figure 4-112.

If none of the level sense indicators illuminate and the dewar is known to have liquid nitrogen in it, the indicators can be checked by disconnecting the plug on the right side of the level sense assembly and pushing the read button. This should illuminate all the indicators. Normal operation of the system requires bleed off of nitrogen gas, from a valve located at the base of the TV mount. The indication of bleed off will be a noise similar to a small fog horn and a vapor may appear.

LASER TARGET DESIGNATOR/RANGER (AN/AVQ-19).

The laser target designator ranger (LTD/R), (see figure 4-113), is an electro-optical device that measures range to selected targets and provides target designation for the laser guided weapon system. The LTD/R determines target range by transmitting a pulse of laser energy aimed at the target, receiving reflected energy from the target and converting the time from transmission to reception into range. This range information is utilized by the tactical computer to solve navigator/FCS problems. The LTD/R includes a power supply unit, a control-indicator unit, and a receiver-transmitter unit. Power is supplied from the essential ac bus and right-hand dc bus. A circuit breaker is located on the pilot's side panel and a current limiter is located in the cargo compartment dc distribution box. Laser safety limits are installed on the TV/laser platform to prevent lasing inside the airplane. Additional safety switches are located on the TV console.

See figure 4-114 for the LTD/R controls and functions.

WARNING

Extreme caution must be taken when operating the LTD/R. The laser beam can cause serious eye damage, or blindness, if it enters directly, or is reflected into the eyes. Do not direct the beam at personnel or at objects with a reflective surface during checkout.

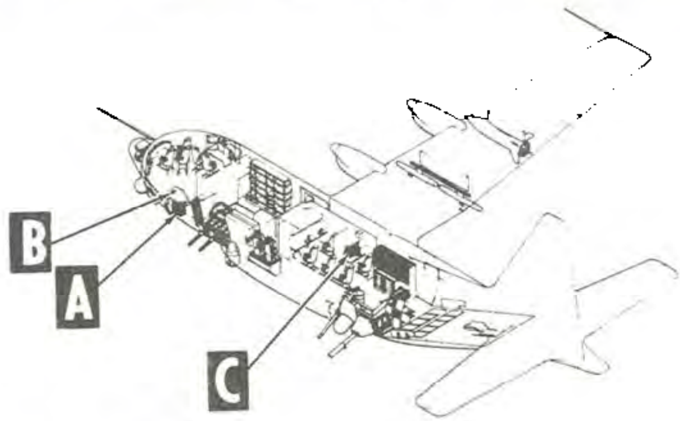
Operating Procedures.

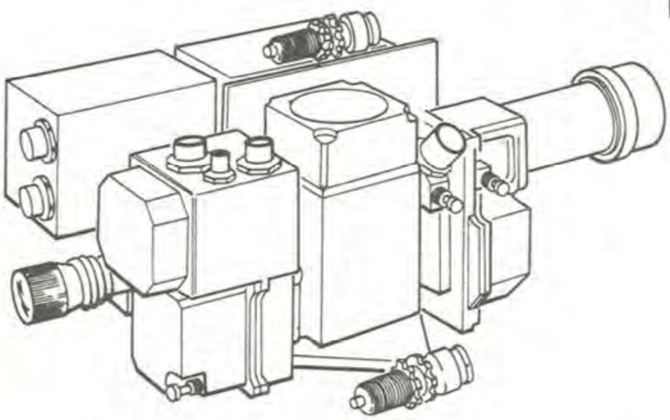
WARNING

Serious eye damage or blindness may result if the energy of the LTD/R is beamed, either directly or indirectly, into the eyes from a distance of less than 16,000 feet. If the laser does not stop lasing when the laser safety limits are reached, turn laser OFF.

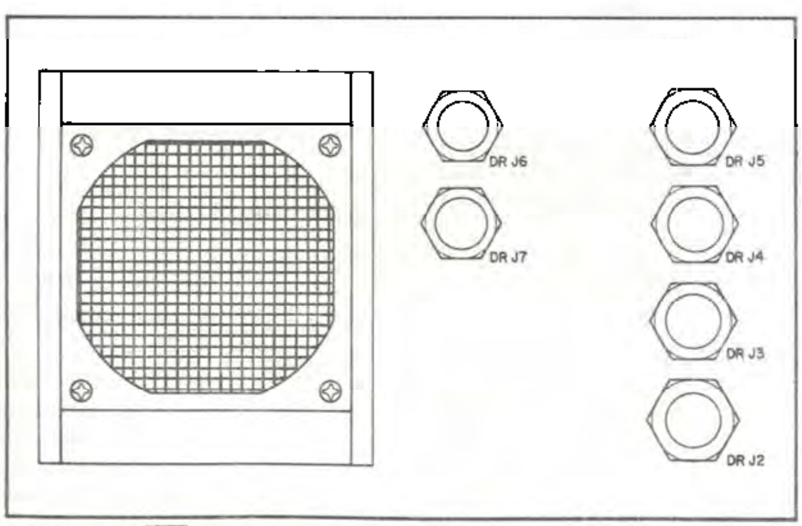
1. Ensure both laser caps are removed.

laser target designator/ranger (AN/AVQ-19)





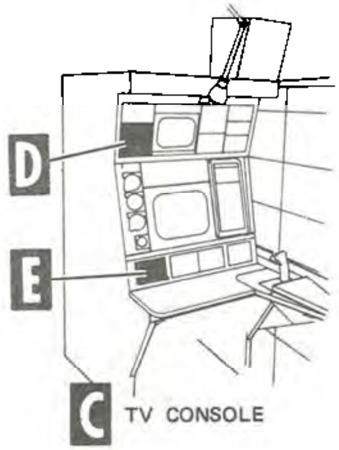
A LASER RECEIVER-TRANSMITTER UNIT

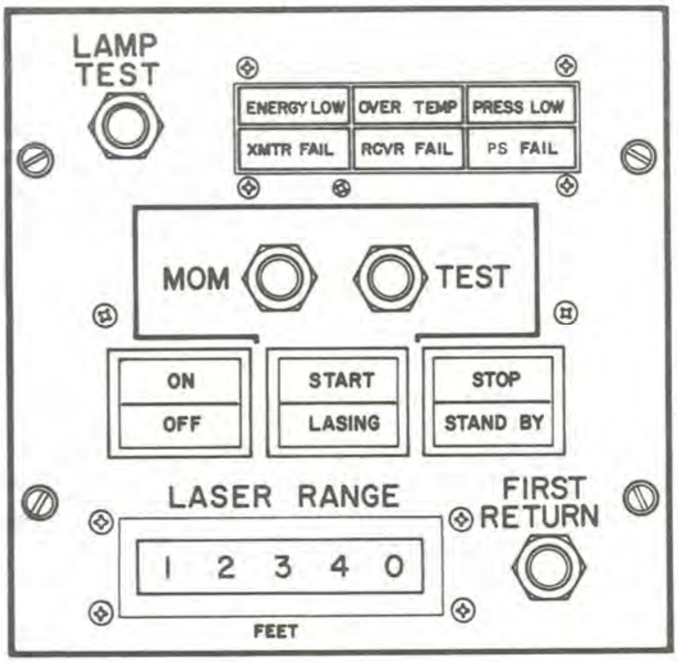


B LASER POWER SUPPLY UNIT

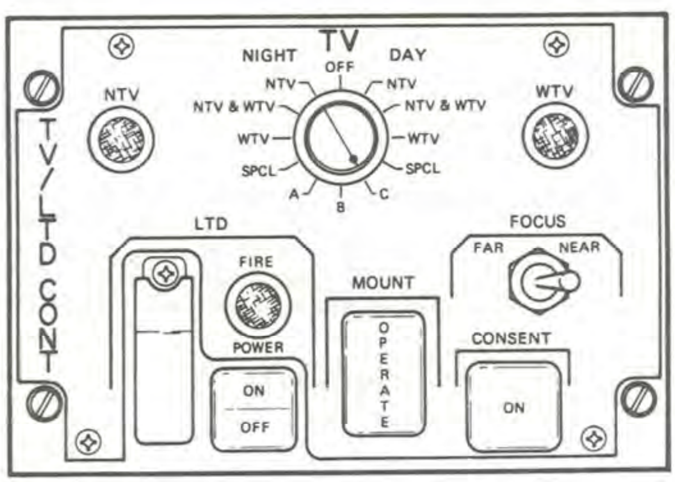
Figure 4-113. (Sheet 1 of 2)

laser target designator/ranger (AN/AVQ-19)





D LASER CONTROL INDICATOR PANEL



E TV/LASER CONTROL PANEL

Figure 4-113. (Sheet 2 of 2)

LTD/R controls and functions

Control	Position	Function
1. ON/OFF switch	Depress ON	System to standby, ON illuminates, Start position of START/Lasing switch illuminates, STOP/STAND BY switch illuminates.
ON/OFF switch	Depress OFF	System Off. OFF illuminates with 28 VDC present.
2. START/LASING switch	DEPRESS	System starts lasing; red LASING position of switch flashes.
3. STOP/STAND BY	DEPRESS	Stops lasing; system returns to standby.
4. MOM	DEPRESS	Fires laser while switch is depressed.
5. TEST (functions only if system is lasing)	DEPRESS	Generates simulated range of 40,380 ft (if current range is less than 40,380 ft), or 19,900 ft (if range is greater than 19,900 and FIRST RETURN switch depressed.)
6. FIRST RETURN	DEPRESS	System selects first return pulse for range of computation.
7. LAMP TEST	DEPRESS	Illuminates all front panel lights except OFF. LASER RANGE will display 88880.
8. LASER RANGE	Distance to target	2,000 ft is minimum range and 60,000 ft maximum, 20 ft is the smallest range interval. Display will hold the last range for 15 seconds. If system is on and TV pedestal is pointed outside the aircraft, 0 on the LASER RANGE display indicates 115-volt 400 Hz is applied to the system.
9. XMTR FAIL	Failure in transmitter section	Do not designate for Laser Guided Bombs (LGB's) Ranging can continue if range displayed on the C-D Unit appears reasonable, if not shut unit off.
10. RCVR FAIL	Failure in receiver section	No ranging can be done but designating still possible.
11. PS FAIL	Failure in power supply	Same as "XMTR FAIL".
12. ENERGY LOW	Output of the laser is less than 30 millijoules	Same as "XMTR FAIL".
13. PRESS LOW	Nitrogen pressure low	Unit will not lase, shut unit off.
14. OVER TEMP	Unit has overheated	Unit will not lase, shut unit off. Turn unit on in five minutes. If OVER TEMP light is still on, shut unit off. If the light is not on, operation for a short time is possible.

Figure 4-114.

2. Ensure TV/laser platform is pointed out from aircraft.

3. Turn system on by depressing and releasing on-off switch on the laser control panel (ON illuminates).

4. Depress start-lasing switch (LASING illuminated).

5. Depress LTD power on-off switch on the TV/LTD control panel ON (ON illuminates).

6. Turn LTD guarded fire switch on the TV/LTD control panel ON (lasing light on the laser control panel cycles from bright to dim).

Note

If more than one target reply is being received, the laser range display will indicate the last target received prior to reaching its maximum range of 60,000 feet.

7. To stop lasing, turn the red-guarded LTD fire switch OFF (lasing light on the laser control panel will cease blinking).

8. To turn system off:

   a. Depress the on-off switch on the laser control panel (OFF illuminates).

   b. Insure the LTD fire switch (red-guarded) on the TV/LTD control panel is OFF (Down).

   c. Depress the LTD power on-off switch on the TV/LTD control panel OFF (OFF illuminates).

9. After landing, install lens caps on both the laser receiver and transmitter.

LTD/R Ground Operational Check.

The ground operational check provides a quick check of the LTD/R in an area unsafe for laser operation. The ground operational check is performed using the following steps.

1. Mount power ON

2. When mount operate light illuminates, point the TV/laser platform out from the aircraft.

3. Ensure laser power/fire switches located on the TV/LTD control panel are OFF.

WARNING

The LTD/R need not and should not be lasing to perform the following checks. Serious eye damage or blindness may result if the energy of the LTD/R is beamed, either directly or indirectly into the eyes from a distance of less than 16,000 feet.

4. Initiate check by depressing and releasing ON-OFF switch located on the laser control panel. Observe that ON portion of switch is lit.

5. Check that malfunction indicators are not lit.

6. Check (with approximately a 0-degree azimuth and -20-degree elevated set on TV/laser platform) that the laser range display reads "0."

7. Depress lamp test switch and observe that all lights except OFF are lit and the laser range is displaying 88880.

8. Check safety limit switches by watching for the "0" to extinguish on the laser range display as the TV platform is moved through and the laser limits (azimuth limits 44 degrees fwd, 14 degrees aft $\pm$6 degrees) (elevation limits 3 1/2 degrees up, 64 degrees down $\pm$6 degrees).

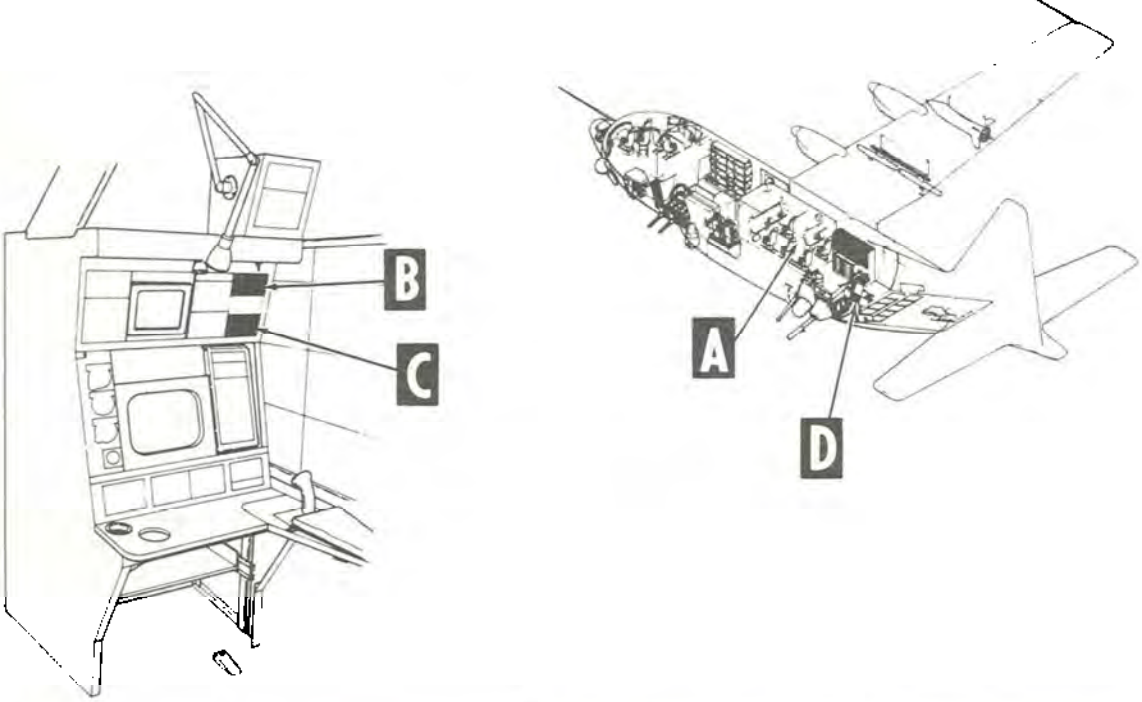
9. On-off switch - Depress (OFF illuminates).

2 KW SEARCHLIGHT SET (AN/AVQ-17).

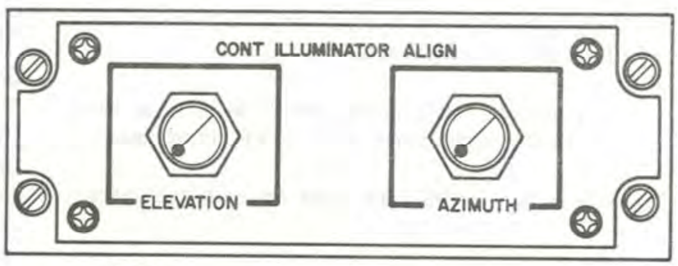
The 2 KW searchlight set (see figure 4-115) is located in the aft cargo section of the airplane. The control panel is located at the TV console. The system provides visual and infrared (IR) light source to illuminate targets on the ground. The system generates 40,000 lumens output in the spectrum from 0.25 to 2 microns with a lamp power of 2.2 KW. The system consists of a searchlight, mounted on a platform and a remote searchlight control. Power is supplied from the essential ac bus, left-hand ac bus, right-hand ac bus and left-hand dc bus. Circuit protection is provided by circuit breakers on the pilot's upper and side circuit breaker panel and cargo compartment dc circuit breaker panel; a current limiter in the cargo compartment on the light platform, and on the searchlight.

The main component of the searchlight set is a 2 KW xenon light. A collector mirror, mounted behind the lamp, collects and directs lamp energy in a uniform 6° beam. Searchlight cooling is provided by a blower. Either an IR filter assembly or visual cover assembly must be mounted on the front of the searchlight. A telescope is attached at the top of the searchlight for boresighting. Mounted on the rear is an elapsed time indicator to indicate the total hours the searchlight lamp has been operating.

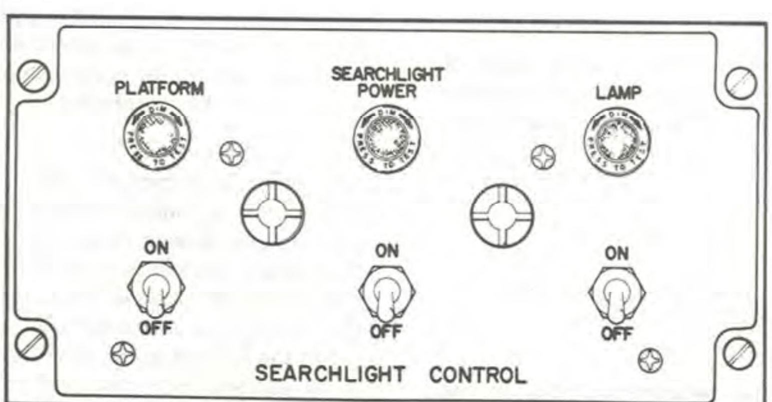
2 kw searchlight system (AN/AVQ-17)



A TV CONSOLE



B ILLUMINATOR ALIGNMENT UNIT



C SEARCHLIGHT CONTROL

Figure 4-115. (Sheet 1 of 2)

2 kw searchlight system (AN/AVQ-17)

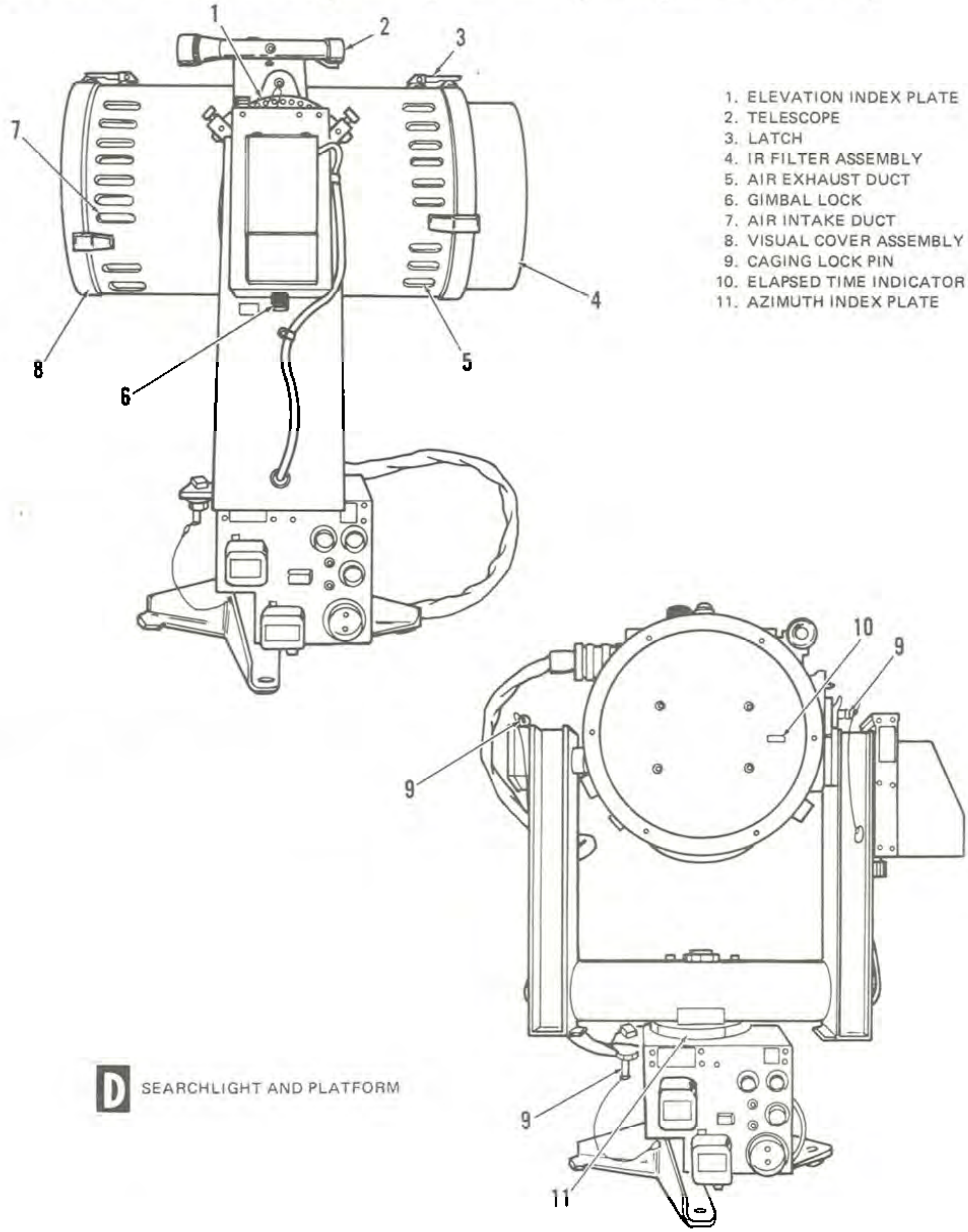


Figure 4-115. (Sheet 2 of 2)

The searchlight platform provides the elevation and azimuth gimballing for the attached searchlight. The searchlight as installed in the aircraft may be positioned through 0° up to 30° down in elevation and ± 15° in azimuth (about the platform's nominal zero reference). The platform operates in slave mode only. Adjustable, cushioned mechanical stops on each axis prevent over-travel. AC and dc circuit protection is provided by circuit breakers on the searchlight pedestal. A list of controls and functions for the 2 KW searchlight panel is shown on figure 4-116.

Operating Procedures.

Platform gimballing is controlled by separately installed equipment; therefore slewing procedures are not included. All other operations of the searchlight are controlled by the searchlight control panel.

The system is turned on as follows:

WARNING

- The xenon lamp is of extreme high intensity. Never look directly into the light when it is on unless protective welder's goggles are worn. At present there is no operational requirement to turn the 2 KW searchlight ON while on the ground.
- The xenon lamp, located inside the searchlight, has a potential for explosion. It is mandatory that personnel working around the lamphouse assembly (when filter on visual housing is removed) wear protective face shields, gloves, and outer clothing.
- 20,000 volts are present when lamp is started.

CAUTION

The ballast assembly will not be properly cooled if the searchlight is operated without either the visual housing or IR filter installed.

WARNING

The IR filter should be positioned in front prior to take-off if it will be used during the mission. Slip stream wind blast inflight makes changing of this filter very hazardous.

2 kw searchlight controls and functions

Control	Description	Function
1. PLATFORM	ON/OFF switch	Energizes or de-energizes platform power circuits. The green Press-to-test indicator lamp illuminates when platform power circuits are energized; extinguishes when circuits are de-energized.
2. SEARCHLIGHT POWER	ON/OFF switch	Energizes or de-energizes searchlight power circuits. The green-press-to-test indicator lamp illuminates when searchlight power circuits are energized; extinguishes when de-energized.
3. LAMP	ON/OFF switch	Energizes or de-energizes remainder of searchlight electrical circuits and xenon lamp. The amber-press-to-test indicator lamp illuminates when xenon lamp is on.

Figure 4-116.

CAUTION

Ensure that the locking pins are fully installed. Failure to accomplish this will leave the light loose in the mount on takeoff.

1. Remove caging lock pins and stow in clips.
2. Place platform switch to ON. Observe that the green indicator lamp illuminates.

Note

The drive motors in the platform are equipped with slip clutches and can be driven continuously without damage.

3. Place searchlight power switch to ON. Observe that the green indicator lamp illuminates.

Note

The circuitry is constructed so that the lamp will not operate until searchlight power on/off switch has been turned ON.

CAUTION

- If lamp does not light within 5 seconds of actuating lamp switch to ON, immediately turn switch to OFF. Wait 15 seconds and attempt another start.
- Do not turn xenon lamp ON and OFF unnecessarily. Each ignition of the lamp is equal to one half-hour of operation.

4. Place lamp switch to ON. Observe that the amber indicator lamp illuminates.

System Shutdown Procedure.

1. Place lamp switch to OFF. Observe that the amber indicator lamp extinguishes.

Note

After turning lamp switch OFF, wait approximately 30 seconds before placing the searchlight power switch to the OFF position.

IR/EWO CONSOLE (2-MAN).

The IR/EWO console (see figure 4-117) is located at the forward bulkhead of the booth. The infrared (IR) operator's equipment, controls and indicators are located on the left portion of the console. The IR operator controls and monitors the IR set. IR monitoring is provided by the 14-inch IR viewer. Position of the IR receiver is adjusted by a gimbal control. Azimuth and elevation angles are displayed on the sensor angle display panel. The switching control unit allows the IR operator to slave (azimuth and elevation motion) the IR set to any of the other sensors or the inertial navigation system (INS). The 8-inch monitor can display TV or IR imagery. The type of imagery displayed is selected by the remote control unit of the video display system.

The electronic warfare officer's (EWO) equipment, controls and indicators are located on the right portion of the IR/EWO console. The EWO operates black crow (AN/ASD-5), beacon tracking radar (AN/APQ-150), the AN/ALR-69, the TRIM 7A, the AN/ALQ-87 ECM equipment and the AN/ALE-40(V) countermeasures dispenser. Azimuth and elevation angles are displayed on the sensor angle display panel. The switching control unit allows the EWO to slave the ASD-5 and/or the APQ-150 (azimuth and elevation motion) to any of the other sensors or the inertial navigation system (INS).

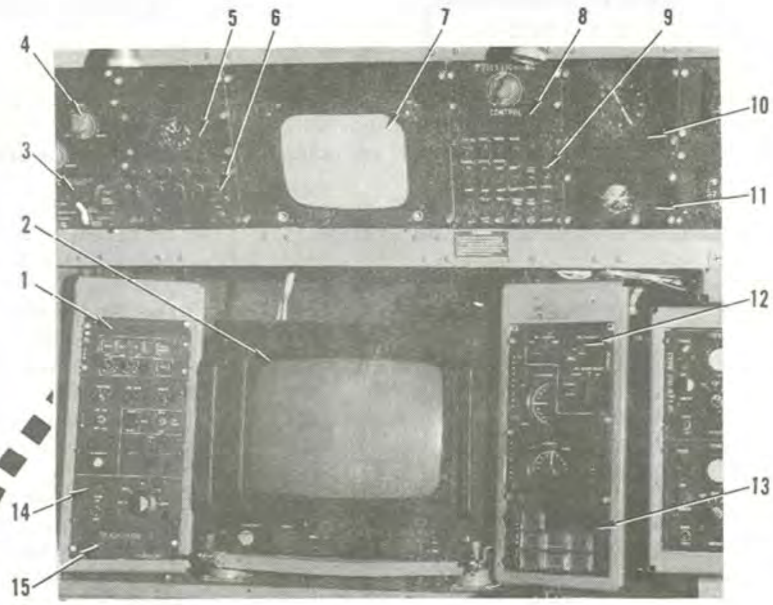
Ready fire panels are provided for both the IR and EWO operators and are used in conjunction with the trainable mode of fire. An explanation of this panel is provided under armament and associated equipment, this section.

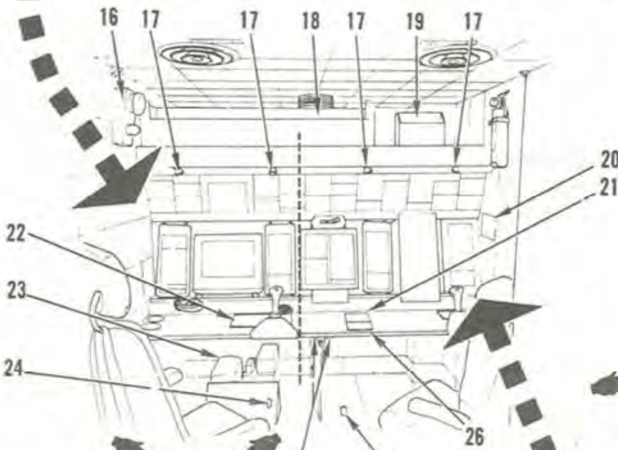
INFRARED DETECTING SET (AN/AAD-7).

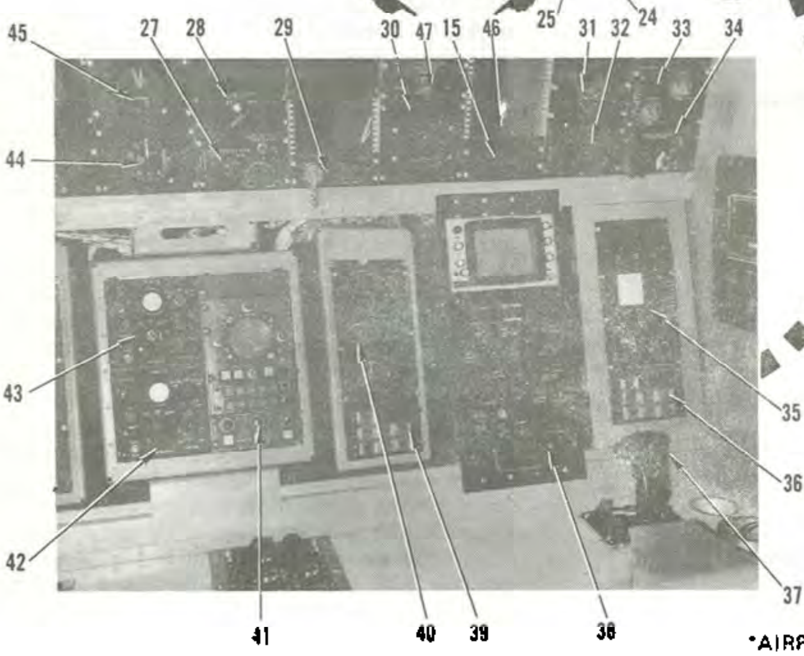
The infrared detecting set (IDS), (see figure 4-118) is an airborne infrared surveillance system which provides visual presentations fo terrestrial objects over which the viewer is flying. The AN/AAD-7 is a passive system in that it senses an object by detecting the infrared energy radiated by that object. Wavelengths of infrared radiation are longer than visible light and shorter than microwaves, ranging from 0.7 to several hundred microns. All objects radiate infrared energy; the amount of energy radiated depends on the temperature of the object and its emissivity. Infrared radiation travels at the speed of light. As infrared energy passes through the atmosphere, some energy is lost through atmospheric scattering or absorption. The amount lost depends on the radiation wavelength and particles in the atmosphere (smoke, haze, fog or moisture). Infrared radiation is detected by detectors which change their resistance according to the number of photons absorbed. The detectors are transducers that convert infrared energy to an electrical signal which is amplified and processed to produce a representation of the detected radiation. For controls and functions see figures 4-119 through 4-121.

IR/EWO console

1. 8" REMOTE CONTROL UNIT
2. IR VIEWER
3. OXYGEN REGULATOR
4. LIGHTING CONTROL
5. CLOCK
6. INTERPHONE CONTROL
7. 8" TV MONITOR
8. 5-VOLT LIGHTING CONTROL
9. CIRCUIT BREAKER PANEL
10. ATTITUDE INDICATOR (3-AXIS GYRO)
11. HEADING INDICATOR (3-AXIS GYRO)
12. SLADS PANEL (IR)
13. SLAVE CONTROL (IR)
14. IR CONTROL
15. READY/FIRE PANEL
16. ALARM/BELL LIGHT
17. CONSOLE LIGHTS
18. TECH ORDER STORAGE RACK
19. TAPE STORAGE BOX
20. INTERVALOMETER





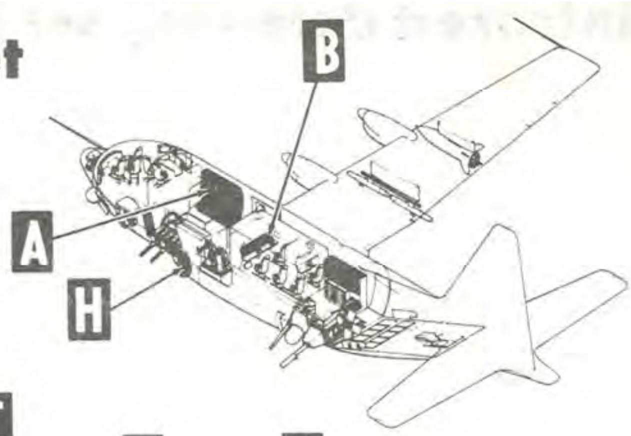


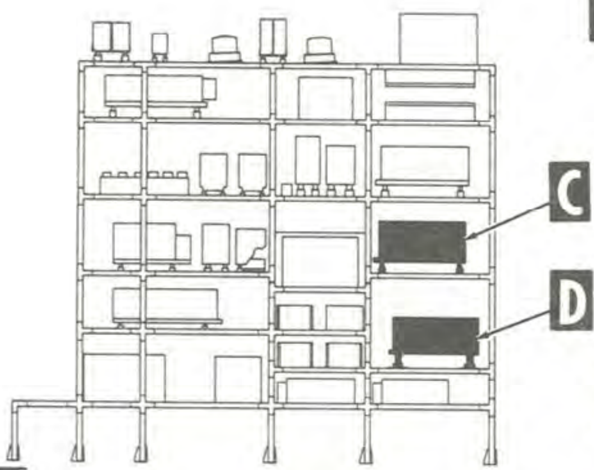
21. ECM POD SYNC CONTROL
22. GIMBAL POSITION CONTROL
23. 3-AXIS 2 GYRO (PALLET)
24. MICROPHONE FOOT SWITCH
25. UTILITY LIGHTS
26. ECM POD CONTROL
27. TEMPERATURE CONTROL PANEL
28. CEILING LIGHTS CONTROL
29. TEST RECEPTACLE
30. AUDIO CONTROL R-1854 (DEACTIVATED)
31. CLOCK
32. INTERPHONE
33. LIGHTING CONTROL
34. OXYGEN REGULATOR
35. BEACON TRACKING RADAR CONTROL DISPLAY (AN/APQ-150)
36. SLAVE CONTROL (BTR)
37. STABILIZED PEDESTAL CONTROL (BC)
38. BC CONTROL/DISPLAY (AN/ASD-5) AND PAVE MACE
39. SLAVE CONTROL (BC)
40. SLADS PANEL (BC)
41. SWITCHING UNIT (AN/ALR-69)
42. TRIM L/R CONTROL
43. TRIM N/T CONTROL
44. ALTIMETER
45. TRUE AIRSPEED INDICATOR
46. AN/ALE-40(V) PROGRAMMER
47. AN/ALE-40(V) DISPENSE SWITCH

*AIRPLANES MODIFIED BY T.O. 1C-130(A)H-503

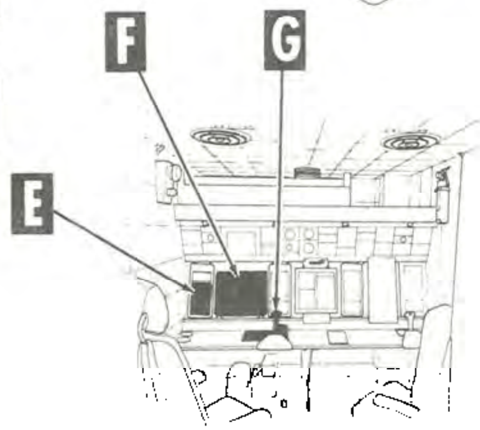
Figure 4-117.

infrared detecting set (AN/AAD-7)



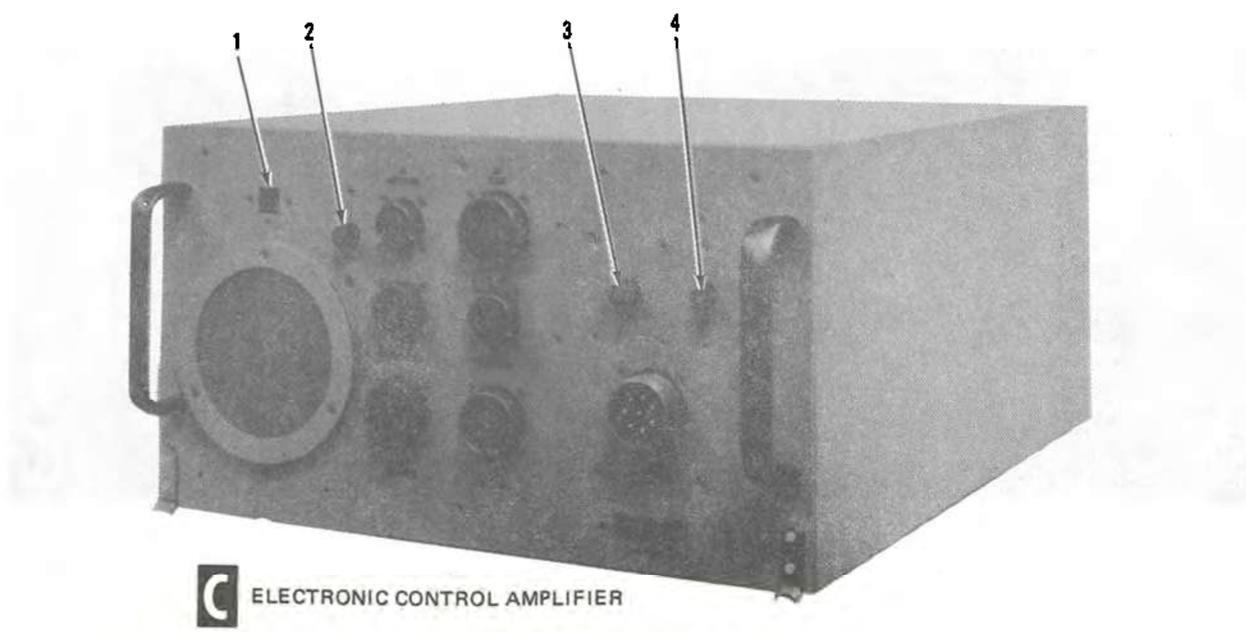


A CARGO COMPARTMENT ELECTRONICS RACK



B IR STATION

1. M1 METER
2. CB3 CIRCUIT BREAKER
3. CB2 CIRCUIT BREAKER
4. CB1 CIRCUIT BREAKER

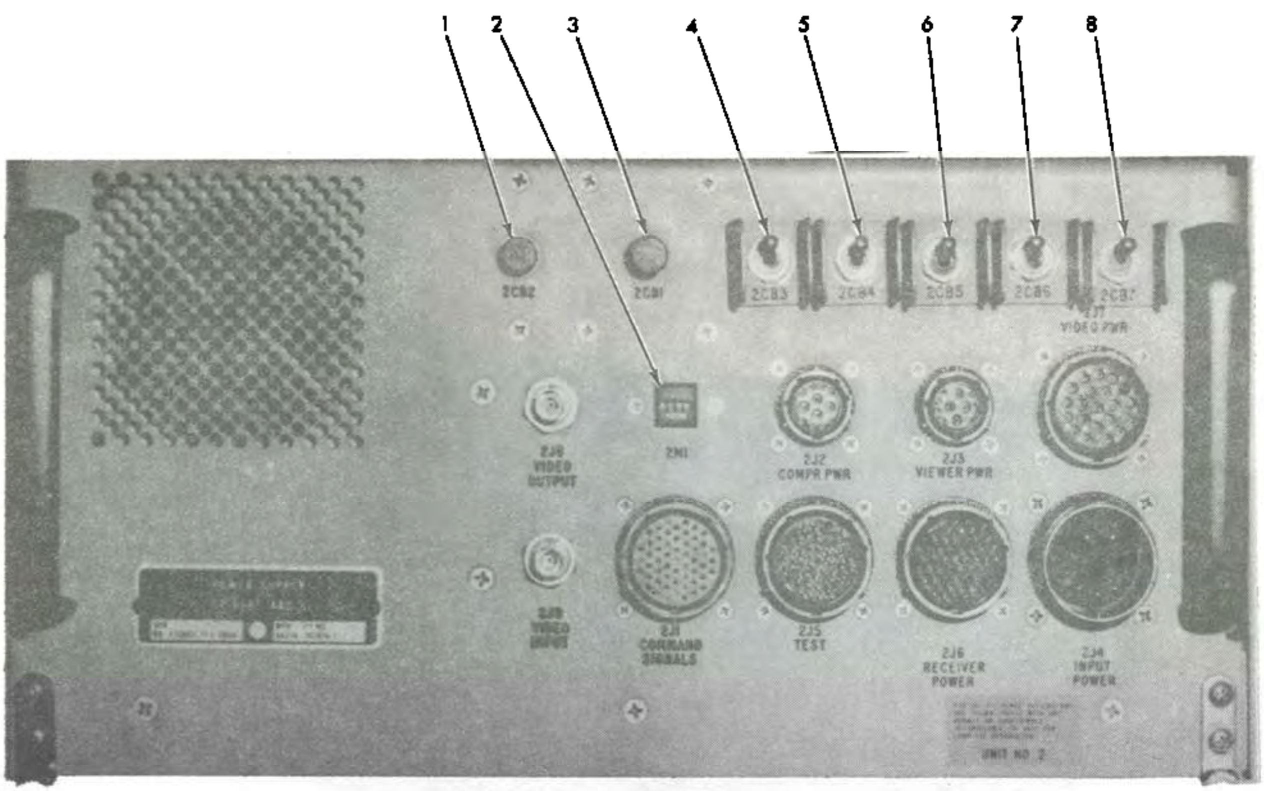


C ELECTRONIC CONTROL AMPLIFIER

Figure 4-118. (Sheet 1 of 6)

infrared detecting set (AN/AAD-7)

1. 2CB2 CIRCUIT BREAKER
2. 2M1 METER
3. 2CB1 CIRCUIT BREAKER
4. 2CB3 TOGGLE SWITCH CIRCUIT BREAKER
5. 2CB4 TOGGLE SWITCH CIRCUIT BREAKER
6. 2CB5 TOGGLE SWITCH CIRCUIT BREAKER
7. 2CB6 TOGGLE SWITCH CIRCUIT BREAKER
8. 2CB7 TOGGLE SWITCH CIRCUIT BREAKER

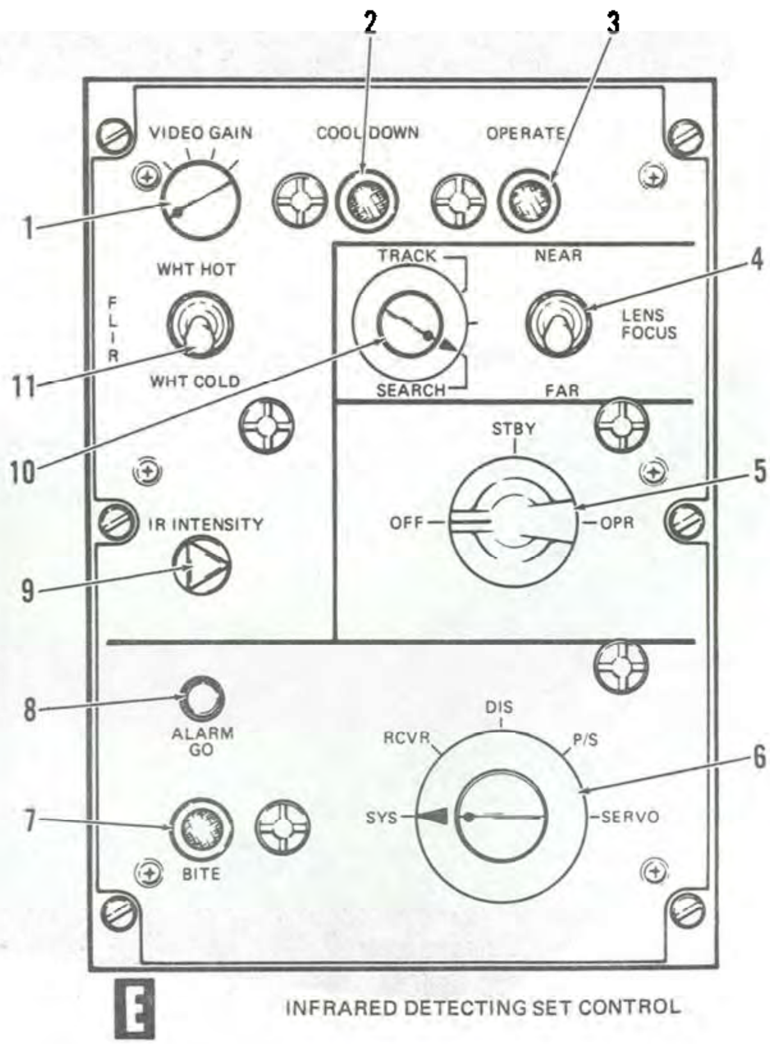


D POWER SUPPLY

Figure 4-118. (Sheet 2 of 6)

infrared detecting set (AN/AAD-7)

1. VIDEO GAIN
2. COOLDOWN LAMP
3. OPERATE LAMP
4. FOCUS SWITCH
5. IDS MODE SELECT SWITCH
6. BITE SWITCH
7. GO LAMP
8. ALARM BUTTON
9. IR INTENSITY
10. FOV SELECT SWITCH
11. POLARITY SWITCH

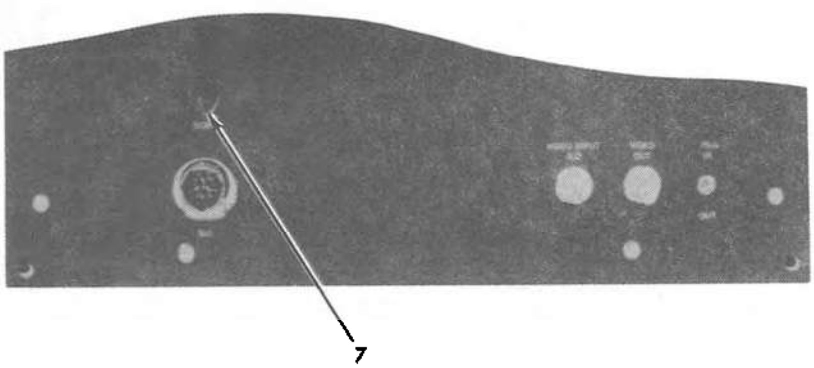


INFRARED DETECTING SET CONTROL

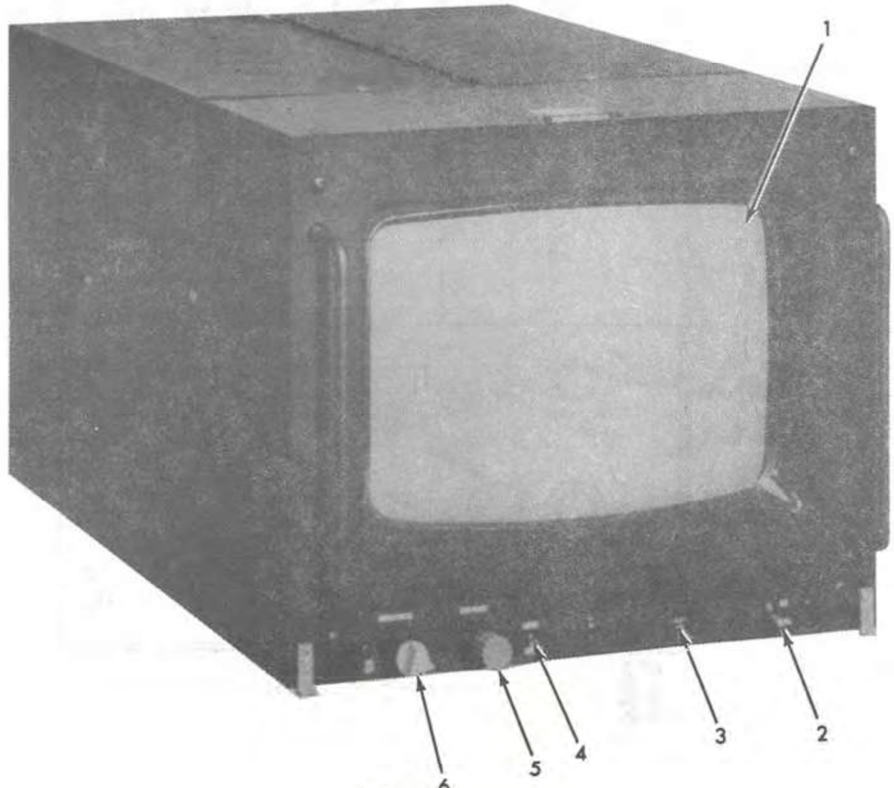
Figure 4-118. (Sheet 3 of 6)

infrared detecting set (AN/AAD-7)

1. VIDEO DISPLAY CATHODE RAY TUBE
2. 0.8/FULL SWITCH
3. METER (HOURS)
4. HORIZONTAL HOLD CONTROL
5. CONTRAST CONTROL
6. BRIGHTNESS CONTROL
7. CIRCUIT BREAKER



REAR VIEW

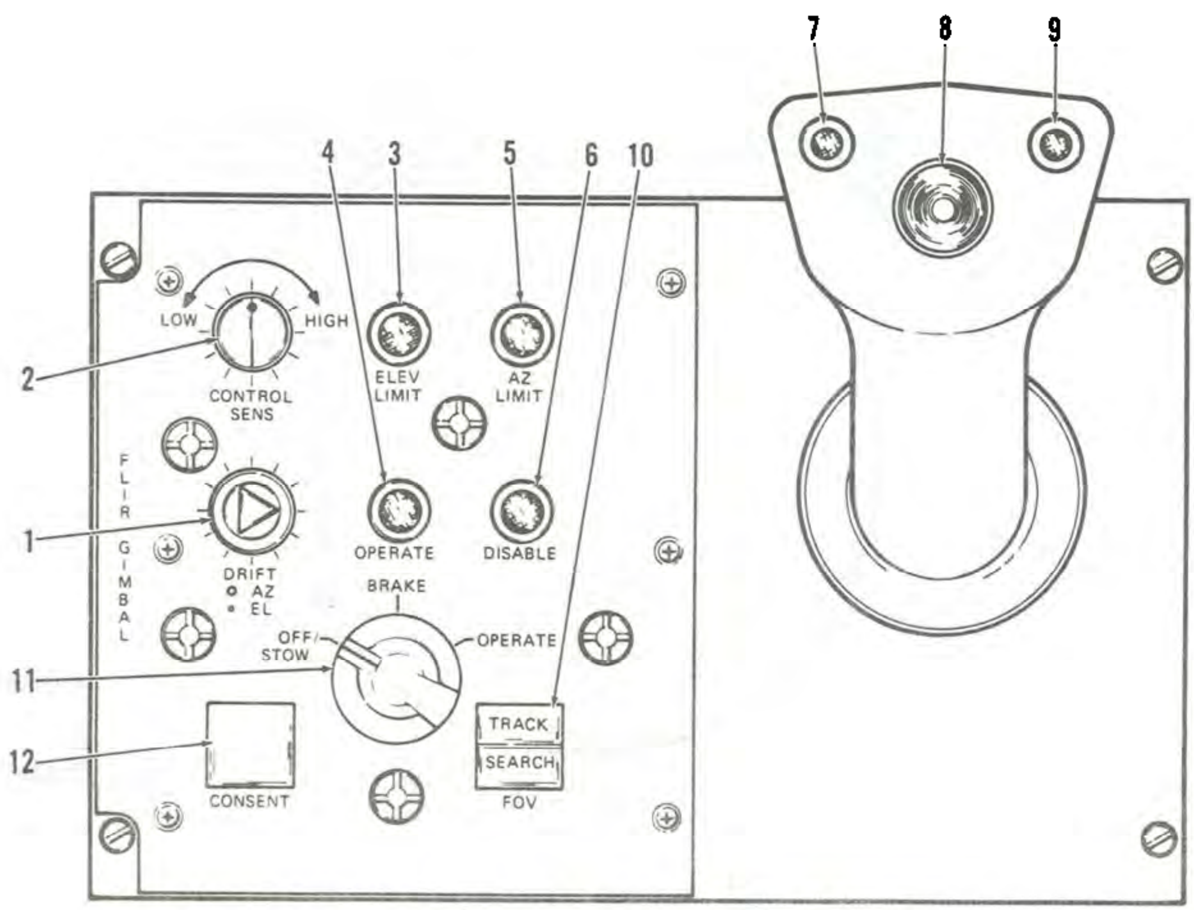


F INFRARED VIEWER

Figure 4-118. (Sheet 4 of 6)

infrared detecting set (AN/AAD-7)

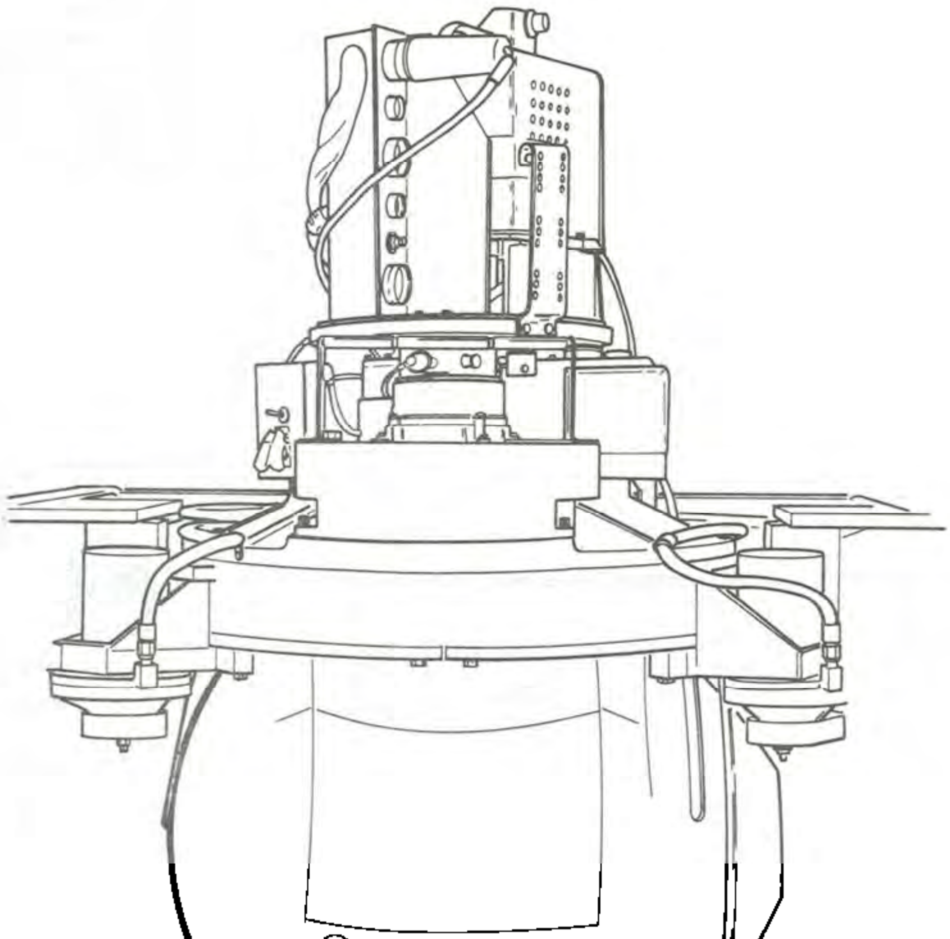
1. DRIFT CONTROL
2. CONTROL SENS CONTROL
3. ELEVATION LIMIT LAMP
4. OPERATE LAMP
5. AZ LIMIT LAMP
6. DISABLE LAMP
7. HAND CONTROL BUTTON SWITCH
8. HAND CONTROL SLEW BUTTON
9. HAND CONTROL STANDBY LAMP
10. REMOTE FOV SELECT SWITCH
11. GIMBAL MODE SELECT SWITCH
12. CONSENT SWITCH



G GIMBAL POSITION CONTROL

Figure 4-118. (Sheet 5 of 6)

infrared detecting set (AN/AAD-7)



H INFRARED DETECTOR UNIT

Figure 4-118. (Sheet 6 of 6)

The IDS utilizes optical means to focus the infrared energy onto the detectors. The electronic signal received from the transducers is amplified and processed by electronic circuitry within the infrared receiver for viewing on a cathode ray tube (CRT) in the infrared viewer. Major components of the system are an electronic control amplifier, power supply, gimbal position control, (IDS) control, IR viewer, and receiver group. Power of 28 vdc and 115 v, 400 Hz, 3 ∅ ac is supplied through the main dc bus an right-hand ac bus. Overload protection is provided by circuit breakers on the cargo compartment dc circuit breaker panel, circuit breakers on the pilot's upper circuit breaker panel, and on the IR power supply and amplifier, located on the cargo compartment electronics equipment rack.

The gimbal hand control is a stationary grip handle with a moveable thumb switch. The thumb switch is pressure sensitive and will cause the IR platform to move at a rate proportioned to the pressure. The relationship between the platform movement rate and the thumb pressure is controlled by the sensitivity control.

System Parameters.

1. Parameters for search field of view (FOV) are as follows:

a. Diagonal FOV	15° ≈ 260 mils
b. Horizontal FOV	12° ≈ 210 mils
c. Vertical FOV	9° ≈ 160 mils

2. Parameters for the track field of view are as follows:

a. Diagonal FOV	3.75° ≈ 65.6 mils
b. Horizontal FOV	3.00° ≈ 52.5 mils
c. Vertical FOV	2.25° ≈ 39.4 mils

3. Parameters for the reticles are as follows:

a. TRACK FOV	Two crosshairs, cross-hatched at 5 mil intervals.
	Dot quad, 2.5 mils across.
b. SEARCH FOV	Two crosshairs, cross-hatched at 20 mil intervals. Magnification is approximately 4 to 1 from the SEARCH FOV to the TRACK FOV.
	Dot quad, 10 mils across.

Operating Procedures.

Ground Operation.

1. Before turning set on, place controls on IDS control panel as follows:
   a. Mode select switch OFF.
   b. Built-in-test equipment (bite) switch to SYS.
   c. Set polarity switch to WHT HOT.
   d. Set field of view select switch to REMOTE.
2. Check system circuit breakers for on/in condition (power supply, electronic control amplifier and main ac and dc circuit breaker panels) and that connecting cables are secure.
3. Set gimbal mode select switch to BRAKE position. If amber standby lamp on hand control illuminates, wait until it extinguishes and green operate lamp illuminates before proceeding to step 4 (usually within 7 minutes). If amber standby lamp does not illuminate and green operate lamp is illuminated, wait 30 seconds before proceeding to step 4. Azumith and elevation limit lamps may illuminate when BRAKE position is selected.

Note

If the amber standby lamp does not extinguish after 30 seconds with an ambient temperature of 25° C ± 5°, maintenance should be called.

4. Sound scanner alarm (hold for 5 seconds)

WARNING

After sounding scanner alarm, wait 5 seconds before operating gimbal control. Personal injury can result if personnel are in contact with the gimbal at time of gimbal movement.

CAUTION

- If the hand control standby lamp illuminates momentarily or not at all when the gimbal mode select switch is set to BRAKE, wait 30 seconds before switching to OPERATE.
- Gimbal should remain in the stowed position during engine start, taxi, takeoff, and landing to protect the receiver window against flying objects.

infrared viewer controls and functions

	Control	Description	Function
1.	VIDEO DISPLAY	Cathode ray tube	Provides a visual display for the operator.
2.	0.8/FULL SWITCH	Switch Toggle	Used to shrink CRT raster so that edges may be seen during TV camera alignment.
3.	METER (Hours)	Meter	Used to indicate total elapsed running time of the set in hours
4.	VERT HOLD	Potentiometer	Used to adjust vertical syne of viewer unit.
5.	HORIZ HOLD	Potentiometer	Used to adjust horizontal sync of viewer unit.
6.	BRIGHTNESS CONTROL	Potentiometer	Used to control brightness of viewer CRT.
7.	CONTRAST CONTROL	Potentiometer	Used to control contrast control of viewer unit.
8.	POWER CIRCUIT BREAKER	CB on rear of viewer	Power protection.

Figure 4-119.

5. Set gimbal mode select switch to OPERATE.
6. Check gimbal movement and limits (elevation +20 degrees, -75 degrees, azimuth -58 degrees, +90 degrees). The forward mechanical limit is 140 degrees; however, only 90 degrees forward is considered useable for acquisition and tracking.
7. Check limit lights.
8. Set gimbal mode select switch to BRAKE.

CAUTION

The IDS mode select switch should not remain in STBY or OPR position during ground operations for over 45 minutes with the wheel well fairing door installed or overheating of the cooling compressor could result.

9. Set IDS mode select switch to STBY.
10. Check all indicator lamps using press-to-test method. All lamps should illuminate.
11. Set IR viewer controls as follows:
    a. Contrast control to mid-range
    b. Brightness control to mid-range
    c. 0.8-full switch to FULL
12. Perform bite test as follows:
    a. IDS mode select switch to operate (it is not necessary to have cool down to run the bite test).
    b. Check system position of bite switch for go lamp illumination. (There is a built-in time delay of 30 to 60 seconds for the display when the IDS mode select switch is set to operate. If no illumination of the go lamp, isolate defective unit; then continue with normal turn-on procedure. The system may still be usable.)
    c. IDS mode select switch OFF.
    d. Gimbal mode select switch-OFF.

NORMAL OPERATION.

Note

It is recommended that the IDS mode select switch be turned to STBY or OPERATE only after either NO. 1 and 2 or No. 3 and 4 engines are on speed and generators are set.

1. IDS mode select switch to STBY.
2. Gimbal mode select switch to BRAKE.
3. When cool down light illuminates, place IDS mode select switch to OPR.

Note

Cool down normally occurs within 20 minutes. If cool down lamp does not illuminate within 45 minutes, continue with normal turn-on procedure after noting discrepancy. The system may still be usable depending on quality of displayed image.

infrared detecting set controls and functions

Control	Description	Function
1. VIDEO GAIN	Rotary Switch 4 position	Used to provide four different video gain settings. Gain controls gain of all video amplifiers simultaneously
2. COOL DOWN LAMP	Push to test lamp	Used to provide cool down indication when detectors have reached operating temperature
3. OPERATE LAMP	Push to test lamp	Used to indicate when OFF/STBY/OPR switch is set to OPR position
4. FIELD OF VIEW SELECT SWITCH	Rotary Switch Positions: Track	Used to select narrow field of view (FOV)
	RMT	Used to allow remote FOV selection at the Gimbal position control
	SEARCH	Used to select wide field of view (FOV)
5. MODE SELECT SWITCH	Rotary Switch Positions:	
	OFF	Used to remove power from Infrared Set (except gimbals)
	STBY	Applies power to begin cool down cycle
	OPR	Applies power to all circuits (except gimbals)
6. BITE SWITCH	Rotary Switch Positions:	
	SYS	Used to monitor test voltage or BITE circuitry for all units simultaneously for go conditions
	RCVR, DIS, P/S, SERVO	Used to monitor BITE test voltage on an individual basis to isolate defective LRU's
7. GO LAMP	Push to test lamp	Indicates go condition when lighted
8. IR INTENSITY	Potentiometer control	Adjusts video amplifier gating voltage (video background level)
9. ALARM SWITCH	Pushbutton switch, spring loaded	Used to ring warning bell on aircraft to warn gimbal is going to be slewed
10. FOCUS SWITCH	Toggle switch, spring loaded, center-off	Used to adjust optical focus in track or search mode
11. POLARITY SWITCH	Toggle switch	Used to switch video polarity so that hot targets appear white or black on viewer depending on switch position

Figure 4-120.

gimbal position controls and functions

Control	Description	Function
1. DRIFT Control	Dual potentiometer controls	Controls azimuth and elevation drift
2. CONTROL SENS Control	Potentiometer control	Adjusts the sensitivity of the azimuth and elevation slew button on hand control
3. ELEV LIMIT	Push to test lamp	Indicates when receiver reaches elevation limit
4. OPERATE	Push to test lamp	Indicates when the system is on and gyros are warmed up
5. AZ LIMIT	Push to test lamp	Indicates when receiver reaches azimuth limit
6. DISABLE	Push to test lamp	Indicates that disable switch located on gimbal is set to up position (ON)
7. HAND CONTROL BUTTON SWITCH	Push to close switch	Enables operator to talk on interphone regardless of intercom switch position
8. HAND CONTROL SLEW BUTTON	Dual axis potentiometer control	Provides operator control for elevation and azimuth gimbal movements
9. HAND CONTROL STANDBY LAMP	Indicator lamp	Indicates that system is on and gyros are in warm-up phase. When lamp goes off, hand control slew button is operable and gimbal position green, operate light illuminates
10. REMOTE FOV SELECT SWITCH	Lighted switch	Used by operator to select TRACK or SEARCH MODES when Set Control is set for remote (RMT) operation. (From gimbal control)
11. GIMBAL MODE SELECT SWITCH	Rotary Switch Positions:	
	OFF/STOW	Used to place gimbals in stow position followed by automatic removal of gimbal power
	BRAKE	Used to lock gimbals in fixed position
	OPERATE	Used to allow normal operator control with hand control
12. CONSENT SWITCH	Lighted switch	Used to provide operator interface with aircraft fire control system

Figure 4-121.

CAUTION

Gimbal should remain in the stowed position during engine start, taxi, take-off and landing to protect the receiver window against flying objects (The gimbal mode select switch may be set to OPERATE just after lift-off when there is little danger of flying objects).

4. Set gimbal mode select switch to OPERATE.

5. Slew gimbals until field of view is centered on a distant object and adjust sensitivity and drift controls as desired.

6. Adjust contrast, brightness, IR intensity and video gain controls to obtain optimum display.

Note

VHF, UHF, and tacan radio transmissions from the aircraft may cause interference on the IDS video display in the form of shaded spokes.

7. Set polarity switch from WHT HOT to WHT COLD to verify that polarity reversal of image is achieved on the display.

8. Depress the remote field of view select switch on the gimbal control panel to ensure lens are switching.

9. Operate video gain adjustment to verify that display imagery of objects with small temperature differentials can be improved or degraded with this adjustment.

10. Set look angle at desired position. For checkpoint navigation enroute to mission search area, a fixed look angle can be selected by placing the gimbal control in the BRAKE position and releasing the slew button.

11. Select SEARCH on the remote FOV select switch to locate large targets/area navigating.

12. After sighting possible target, slew field of view until the reticle on viewer exactly intersects the selected target or target area. Then, set remote FOV select switch to TRACK. Even if the reticle is not centered on the viewer it must still be superimposed on the target because it represents the boresight point of the IDS. (If not centered, it can be moved to the center of the viewer by maintenance personnel.)

13. Press consent switch on gimbal control panel when exactly tracking the target within the reticle. Consent must be ON before the pilot can fire in the auto mode or before target storing can be accomplished with the tactical computer. (Consent will remain off when firing in trainable mode.)

14. Adjust the azimuth and elevation drift controls on the gimbal control panel as necessary to keep the target within the reticle or facilitate ease of tracking.

15. If go indicator should extinguish and the system appears to be malfunctioning, recheck the bite system to isolate the defective unit.

16. If all or a few of the detector banks disappear from the viewer recheck the toggle switch circuit breakers on power supply unit, one or more of them may have been inadvertently switched off (down).

17. If the field of view should stick in either search or track, switch field of view, utilizing the FOV select switch on IDS control panel. If it remains stuck, only maintenance personnel can correct the malfunction.

Note

When flying, if the image on the viewer cannot be brought into sharp focus with the focus switch, the problem may be due to excessive atmospheric attenuation. To determine, slew the gimbals to the up and forward position (near stow) to view the fixed mirror. If the system is working properly, focus can be optimized in both fields by focusing for sharpest image of the IR detector array. If, after focusing, the ground targets still cannot be viewed properly, the problem is atmospheric attenuation.

SYSTEM SHUTDOWN.

1. Set gimbal mode select switch to OFF/STOW. Crosscheck azimuth/elevation limit lights and sensor angle display panel to ensure stow position is attained. Power will be automatically removed from the gimbal control once the stow position is attained.

2. Set IDS mode select switch to OFF.

DIRECTION FINDER SET, AN/ASD-5 (BLACK CROW).

The Black Crow (DF set) is an electronic sensor which searches for and tracks targets appearing to the left of the airplane. It is comprised of: (see figure 4-122)

1. Antenna pedestal group.
2. Power supply.
3. Data processor.
4. Control and display unit.
5. Calibrate generator.
6. Servo electronics unit.

Description of Components.

ANTENNA PEDESTAL GROUP.

The antenna pedestal group is comprised of three units:

The antenna pedestal assembly is located on the left side of the nose wheel well. It consists of an antenna array, an antenna mount, and a pedestal interconnected to form a gimballed motor-driven antenna steering platform. The platform can be controlled remotely in both azimuth and elevation to provide target direction information. The entire assembly is enclosed by a radome. The antenna is horizontally and vertically polarized.

The servo electronic unit in the nose wheel well receives dc position control signals and amplifies them to the power level required to drive the azimuth and elevation gimbal torque motors.

The manual controller, located at the EWO position provides the means of manually directing the antenna in azimuth and elevation. It contains a two-axis, four-directional button mounted on a hand grip controller.

POWER SUPPLY.

The power supply is located below the flight deck in the electronic equipment section. The power inputs from the airplane power source are single phase 115 vac, 400 Hz, and 28 vdc. Regulated dc voltages are obtained from four power supply modules located inside the power supply.

DATA PROCESSOR.

The data processor, located on the antenna pedestal mount, generates video azimuth and elevation signals for the control and display indicator.

CONTROL AND DISPLAY UNIT.

The control and display unit, located at the EWO console, provides the EWO with a visual display of target location and an audio signal through the interphone system. It receives the signals from the data processor and conditions them to produce a CRT dot cluster target display, automatic antenna tracking drive signals, an audio tone, and timing signal for target gating. The display shows antenna azimuth and elevation with respect to airplane fire control boresight; and target position with respect to antenna electrical boresight.

CALIBRATE GENERATOR.

The calibrate generator is located in the nose wheel well on the antenna pedestal mount assembly. It develops a test signal that appears as a target dot cluster on the CRT screen to check for proper system alignment (boresight) or as a DF set gain check.

Modes of Operation.

The DF set has three modes of operation:

1. Search
2. Manual track
3. Auto track

In SEARCH mode, the antenna sweeps back and forth automatically between programmable azimuth limits. Changes in elevation of this sweep have to be made manually, using the manual controller. Targets will appear as small dot clusters within or slight outside the antenna position reference frame.

(MNL) manual TRACK is the mode usually used in initial target acquisition. In this mode, changes in both azimuth and elevation have to be made manually using the manual controller. Once a target has been acquired, it may be tracked either manually or automatically depending upon various conditions and the operator's desires.

AUTO TRACK mode can be used to track the target if the target is located within the angle gate and strong enough to exceed the threshold. Manual tracking may be accomplished in the AUTO TRACK mode by manually overriding the auto track function. Depending upon the settings of the angle gate and threshold adjust controls, the authority of the auto track control loop may be too great to override. The EWO then has the option of switching to manual track or readjusting the angle gate and threshold adjust controls to permit manual override in the AUTO TRACK mode. When the DF set is tracking a target, target bearing information is fed to the airplane's fire control system.

For additional information see T.O. 1C-130(A)H-1-3.

Controls and Indicators.

DF set controls and indicators are located on the control and indicator unit and on the manual controller (figure 4-123). Circuit breakers protecting BC power circuits are located in the cargo compartment and copilot's upper circuit breaker panels, the power supply unit, and the servo electronics unit. Five circuit breakers are accessible in flight. During normal operation, the BC operator's right hand remains on the manual controller; his left hand remains free to operate the other controls.

CONTROL UNIT.

SYSTEM POWER - In the On position, the system power switch applies single-phase 400Hz airplane power to the control and display unit and to the four dc power supplies in the power supply package. Regulated dc voltage from the

df set component locations

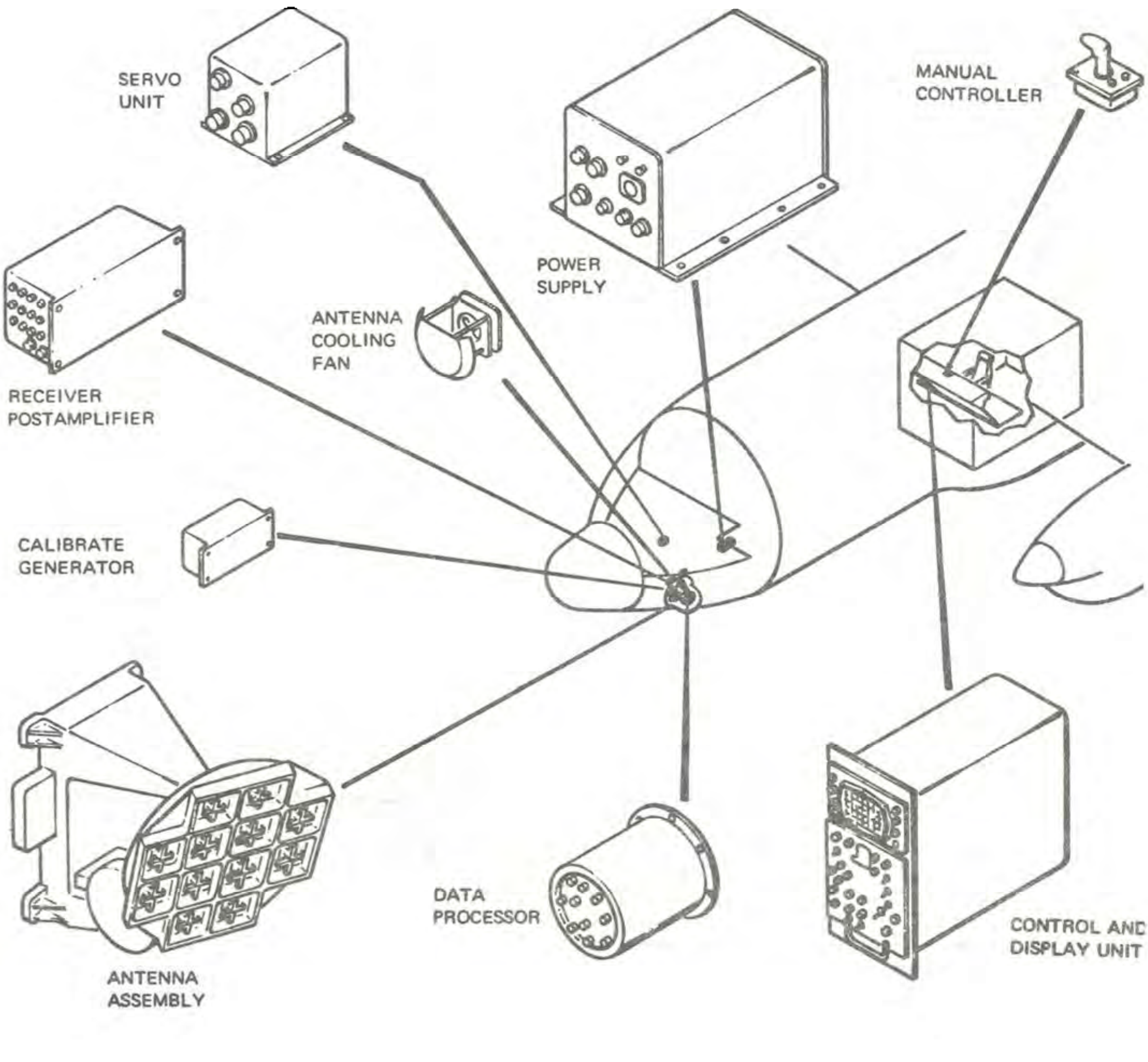


Figure 4-122.

direction finder set (AN/ASD-5)

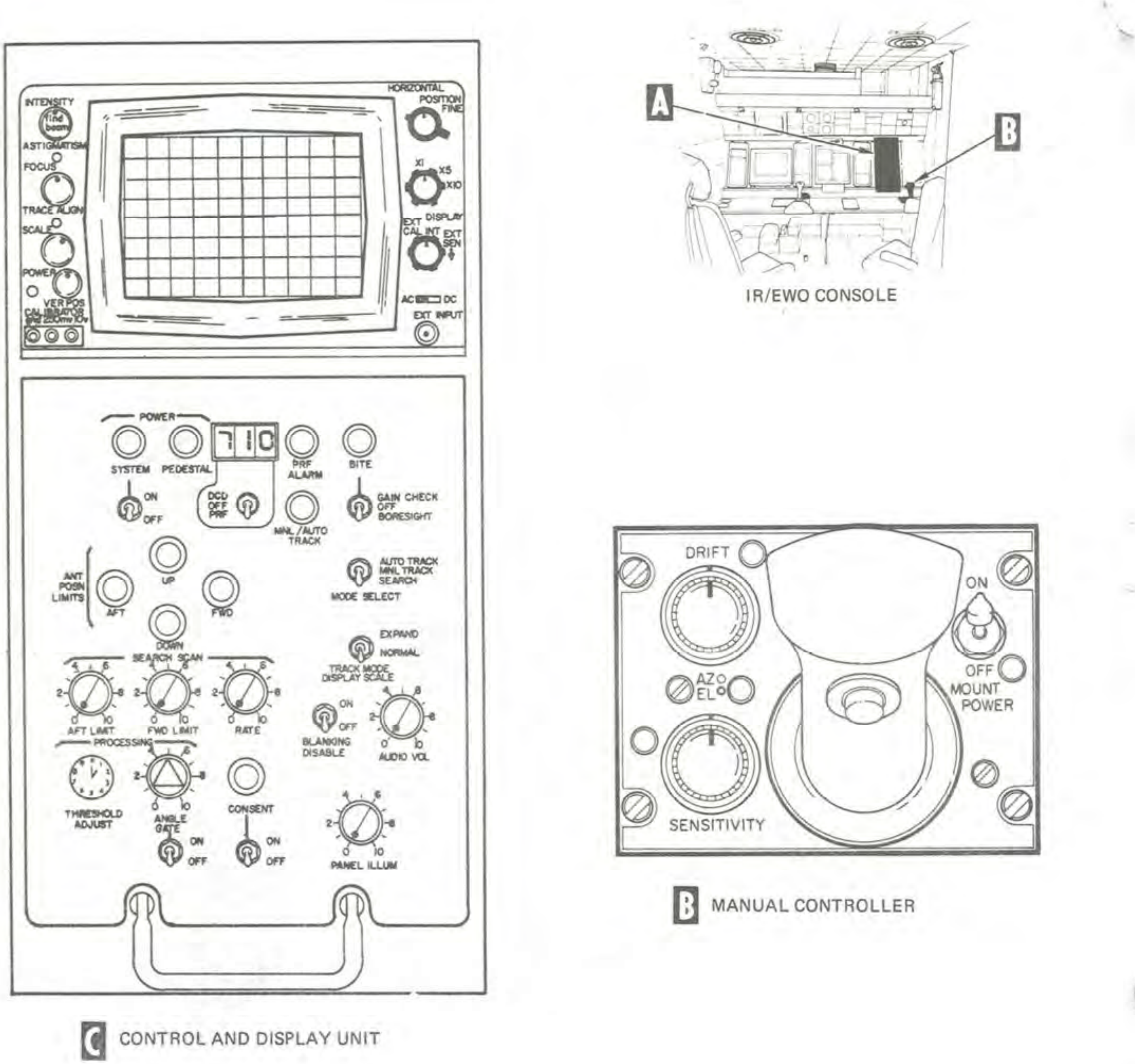


Figure 4-123.

power supply is applied to all DF set components with the exception of the antenna pedestal, servo electronics unit and manual controller. The system power lamp, located above the system power switch, lights green and the power lamp on the oscilloscope lights green.

PEDESTAL POWER lamp - The pedestal power lamp lights green a maximum of 1 minute after the mount power switch on the manual controller is placed to ON. The delay allows sufficient time for the antenna pedestal to uncage and the rate gyros to come up to speed. The pedestal power lamp remains lighted for 15 seconds after the mount power switch is set to OFF, while a related time delay holds power on the pedestal until the antenna drives to the cage position.

Cathode ray tube - The CRT provides the EWO with two visible displays simultaneously.

1. Antenna position - The whole CRT screen represents the movement envelope of the antenna. The antenna reference square shows where in the envelope the antenna is positioned.

2. Target position - The central portion of the CRT screen represents the antenna field of view, 18 degrees by 18 degrees. The dot cluster shows where on the antenna the signal is being received.

BITE - The BITE (built-in-test equipment) switch is three-position, center-off, toggle switch used to operate the calibrate generator for checkout and troubleshooting. In the BORESIGHT position, the calibrate generator produces a signal on the CRT screen at the boresight position (screen center). In the GAIN CHECK position, the calibrate generator produces a signal dot cluster on the CRT screen one centimeter to the right and one centimeter below the antenna boresight. With the BITE switch in either BORESIGHT or GAIN CHECK, the BITE lamp lights amber. Use of BORESIGHT or GAIN CHECK does not prevent external signals from being displayed as dot clusters on the CRT screen in the normal manner.

TRACK MODE DISPLAY SCALE - The track mode display scale switch is a two-position toggle switch used to select a normal or expanded scale on the CRT display. In NORMAL, the CRT scale is 3 degrees per centimeter; in EXPAND, 1 degree per centimeter. The expanded scale reduces the antenna field of view display, but gives optimum target resolution and discrimination when targets are close together. In EXPAND, only the video of the target display is affected. The target audio presentation is not changed; therefore, a target can be heard while the dots may be off the scope. The display of the antenna reference square is not affected. With the BITE switch in GAIN CHECK and track mode display scale in NORMAL, the dot cluster will appear one centimeter to the right and one centimeter below boresight. With the BITE switch in GAIN CHECK and track mode display scale in EXPAND, the dot cluster will be 3 centimerers right and 3 centimeters below boresight.

MODE SELECT - The mode select switch is a three-position toggle switch used to select the BC operating mode of TRACK, MNL TRACK, or SEARCH.

BLANKING DISABLE - This switch should be in the OFF position for all operations except troubleshooting and system check.

CONSENT - The consent switch is a two-position, ON-OFF, toggle switch used to indicate to the NAV/FCO that a target is being tracked by the DF set. With the consent switch ON, the consent lamp lights green. (With BC selected in FCOs control switching unit (CSU) turning the consent switch OFF will store the target coordinates in the INS.) In the auto gun mode, consent ON provides a control signal to FCS enabling the guns to fire.

ANGLE GATE switch - The angle gate switch is a two-position, ON-OFF, toggle switch used to display an angle gate reference square on the CRT screen, instead of the antenna position reference square. Target dot clusters falling within the angle gate reference square can be auto tracked if they meet signal strength requirements. Target dot clusters falling outside the angle gate reference square cannot be auto tracked.

ANGLE GATE potentiometer - The angle gate potentiometer controls the electrical size of the angle gate. The size of the angle gate reference square represents the electrical angle gate limits and can be adjusted from 0 to 18 degrees in diameter.

SEARCH SCAN AFT LIMIT and FWD LIMIT - The AFT LIMIT and forward limit knows control the size of the azimuth angle through which the antenna sweeps in SEARCH mode of operations.

SEARCH SCAN RATE - The search scan rate potentiometer controls the antenna sweep rate in SEARCH mode. Sweep rate is variable from 0 to 30 degrees per second, increasing with clockwise rotation of the knob.

THRESHOLD ADJUST - The threshold adjust potentiometer controls the processing threshold level of the data processor by establishing the signal strength a received signal must exceed in order to be processed by the DF set. In so doing, this control establishes sensitivity of the BC. The threshold is adjustable from noise saturation to a level greater than 50 db. The threshold level decreases with clockwise rotation of the knob, thus increasing the sensitivity and admitting weaker signals.

AUDIO VOL - Clockwise rotation of the knob increases the audio signal level that is applied to the interphone.

PANEL ILLUM - The panel illuminator potentiometer varies the brightness of the control panel illuminating lamps.

PRF ALARM - The PRF alarm lamp lights red when a signal having a specific pulse repetition rate is received by the set. The specific rate is set by maintenance.

MNL/AUTO TRACK - When the manual auto track lamp is lighted steady amber, the received signal is capable of providing usable auto track data. When the lamp flickers or remains out, the target signal is not capable of providing suitable auto track data. In the latter case, the target must be manually tracked.

ANT POSN LIMITS (AFT, FWD, UP, DOWN) - The antenna position limit lamps light whenever the antenna reaches the mechanical limit switch positions.

DISPLAY UNIT.

INTENSITY - This knob controls the intensity (brightness) of the CRT screen display not including target dots.

FIND BEAM - Pushbutton mounted inside the intensity knob. If the centering controls are so maladjusted that the antenna reference frame is off the CRT, pressing the find beam will bring the frame onto the scope. This will indicate to the EWO which direction the frame is displaced, so he will know where to initiate corrections.

FOCUS - This knob controls the sharpness of the CRT display.

SCALE - This potentiometer controls the illumination of the oscilloscope reticle.

VERT POS - This vertical position knob adjusts the vertical position of the CRT display

HORIZONTAL POSITION - This knob is the coarse adjustment of the horizontal position.

FINE - This ring knob (with ears) is used to fine adjust the horizontal position of the CRT trace.

MAGNIFIER CONTROL - This control has no function for the DF set and must be left in the X10 position.

DISPLAY - This control has no function for the DF set and must be left in the EXT CAL position.

EXT INPUT - The external input switch is not used in DF set operation and must be left in the AC position.

MANUAL CONTROLLER.

MOUNT POWER - The mount power switch is a two-position, ON-OFF, toggle switch. In the ON position, it applies a pedestal command signal to the servo electronics unit, thereby uncaging the antenna and activating the servo electronics unit power. When the mount power is set to OFF, removal of the pedestal command signal causes the antenna to cage at the airplane boresight axis. Sixty seconds (maximum) after the mount power switch is set to ON, the pedestal power lamp on the control and display unit lights green. Fifteen seconds after the mount power switch is set to OFF, the pedestal power lamp goes out.

THUMB SWITCH - The thumb switch is a two-axis, four-directional switch located on the manual controller handgrip used to control antenna position in azimuth and elevation.

DRIFT - The drift control consists of two knobs mounted one within the other. The outer knob provides antenna drift compensation in azimuth; the inner knob, in elevation.

SENSITIVITY - The sensitivity control consists of two knobs mounted one within the other. The outer knob controls the rate of antenna movement in azimuth; the inner knob, in elevation.

Pave Mace. (DCD/OFF/PRF).

A Pave Mace readout is supplied on the front of the ASD-5, just below the CRT. The readout is in the form of illuminated numerals which will be interpreted by the EWO. Immedi-below the Pave Mace readout is a three-position, center-off, toggle switch. Setting the toggle switch to decorder readout display (DCD) yields the EWO information decoded from TEMIG beacons. Setting the toggle switch to the PRF position yields the EWO the last three digits of the PRF of any signal being tracked.

For additional information see T.O. 1C-130(A)H-1-3.

Operating Procedures.

The operating instructions provided in this section are suggested as a normal method of tracking and acquiring a target. Other equally suitable methods and techniques may exist. The use of alternate techniques depends greatly upon operator experience and upon environmental conditions and tactical circumstances that prevail at the time of operation.

POWER TURN-ON.

Turn on power to the DF set as follows:

1. Verify following initial conditions:

Control or Switch	Condition
Oscilloscope MAGNIFIER	X10
Oscilloscope DISPLAY	EXT CAL
Oscilloscope EXT INPUT	AC
Manual Controller MOUNT POWER	OFF
SYSTEM POWER	OFF
BITE	OFF
MODE SELECT	MNL TRACK
TRACK MODE DISPLAY SCALE	NORMAL
BLANKING DISABLE	OFF
CONSENT	OFF
ANGLE GATE	5
SEARCH SCAN RATE	Fully CW
SEARCH SCAN FWD LIMIT	Fully CW
SEARCH SCAN AFT LIMIT	Fully CCW

2. Set system power switch to ON.
3. Adjust intensity scale and focus controls.
4. Set BITE switch to BORESIGHT.
5. Adjust threshold adjust control and verify that manual/track lamp lights and that boresight signal dot cluster is centered about antenna boresight signal level.
6. Adjust audio volume control knob for desired signal level.
7. Set BITE switch to GAIN CHECK and check that dot cluster down 1 centimeter and to the right 1 centimeter.
8. Set BITE switch to OFF.
9. Set mount power switch to ON. Wait 60 seconds and observe that pedestal power lamp lights.
10. Using manual controller thumb switch, position antenna position reference frame to center of CRT screen. Release manual controller thumb switch. Verify that antenna position reference frame does not drift. If antenna position reference frame drifts, adjust azimuth and elevator drift controls to stop antenna position reference frame from drifting.
11. Cage antenna until ready to start search mode operations by setting mount power switch to OFF.

SEARCH MODE OPERATING PROCEDURE.

Perform search mode as follows:

1. Set mount power switch to ON.
2. Set search scan controls for desired scan limits and rate.
3. Rotate threshold adjust control until approximately one noise pulse per second appears on CRT screen.
4. Set mode select switch to SEARCH.
5. Using manual controller, vary elevations as antenna automatically sweeps elevation line.

Note

Target indications in search mode operation appear as target dot clusters either within or slightly outside antenna position reference frame.

6. Once target is selected, switch mode select switch to MNL TRACK while target dot cluster is within or slightly outside antenna position reference frame.
7. Manually position antenna so that target dot cluster is coincident with antenna boresight reference.
8. Set mode select switch to AUTO TRACK.

Note

Target dot cluster must be within angle gate limits as set by angle gate control knob in order for auto track to function. Weak or intermittent targets may have to be manually tracked.

9. Set consent switch to ON.

TRACK MODE OPERATING PROCEDURE.

Operate track mode as follows:

1. Manually position antenna so that target dot cluster is coincident with antenna boresight reference.

Note

Target dot cluster must be within angle gate limits as set by angle gate control knob in order for auto track to function.

2. Set mode select switch to AUTO TRACK. Manual/auto track lamp should be lit.

Note

Weak or intermittent targets may have to be manually tracked.

3. Set consent switch to ON. Consent lamp should light.

Note

If during track mode operations target is lost and search mode is re-entered, set consent switch to OFF.

4. Observe target dot cluster. Cluster should be either centered about antenna boresight or moving towards antenna boresight.

5. If target dot cluster does not move towards antenna boresight, override auto track operation using manual controller and manually position target dot cluster at antenna boresight.

6. If target dot cluster appears to represent more than single target, initiate multiple target operating procedure.

7. If antenna drifting is suspect, perform following:

   a. Set mode select switch to MNL TRACK.

   b. Observe antenna position reference square. If antenna is drifting, adjust azimuth and elevation drift control knots on manual controller to eliminate drift.

   c. Using manual controller position target dot cluster at antenna boresight.

   d. Set mode select switch to AUTO TRACK.

   e. Set track mode display scale switch to EXPAND. If operation is not suitable in expand scale, return to normal track mode scale.

MULTIPLE TARGET OPERATING PROCEDURE.

If during track mode operation a target dot cluster appears to be generated by more than one target, initiate multiple target operating procedure as follows:

1. Set track mode display scale switch to EXPAND.

Note

Under this condition it is recommended that DF set operator maintain expanded display during multiple target operations to maintain optimum resolution discrimination.

2. Examine target dot clusters to determine if more than one target is represented.

Note

If target dot cluster represents only one target, return to normal scale and continue auto track operations.

3. If target dot clusters represent multiple targets, set mode select switch to MNL TRACK.

4. Using manual controller, position antenna so that single target dot cluster is centered about antenna boresight reference.

5. Set angle gate switch to ON.

6. Using angle gate control knob, adjust angle gate limits so that gate reference square just borders area of selected target dot cluster.

7. Set angle gate switch to OFF.

8. If required, manually center selected target dot cluster about antenna boresight.

9. Set mode select to AUTO TRACK.

Note

Weak of intermittent targets may have to be manually tracked.

SHUTDOWN PROCEDURE.

Shutdown DF set as follows:

1. Set mode select switch to MNL TRACK.

2. Set mount power switch to OFF. Within 15 seconds, antenna position reference frame should be centered about aircraft boresight reference and pedestal power lamp should go out.

CAUTION

Damage to the system can occur if system power is turned off before the mount power light goes out.

3. After antenna position reference frame stops at position centered about aircraft boresight reference and pedestal power lamp goes out, set system power switch to OFF.

PAVE MACE DECODER OPERATION.

See T.O. 1C-130(A)H-1-3.

BEACON TRACKING RADAR SYSTEM (AN/APQ-150).

The radar system (see figure 4-124) is a beacon tracking radar set which searches for, acquires, and tracks I-band beacons appearing on the left of the aircraft. It is comprised of two major components: receiver-transmitter, RT-1031/APQ-150, and control-indicator, C-8802/APQ-150. The receiver-transmitter, which contains the antenna system, transmitter, receiver, and signal processor circuits is mounted on the left side of the aircraft aft of No. 5 gun, and is covered by a fiberglass radome. The control-indicator is located in the booth at the electronic warfare officers position and contains the B scope for display of data, the system controls and built-in-test circuitry and displays. The set is designed for field applications such as target location for close-support. Power is supplied by the left-hand ac bus and by the left-hand dc bus. Circuit breakers are located on the cargo compartment dc circuit breaker panel, and on the pilot's circuit breaker panel. For controls and functions, see figure 4-125.

Operating Parameters.

a. Transmitter (Magnetron)

Frequency	9375 ± 5mHz
Power output	5 KW (min)
Pulse width	0.5 μs
PRF	800 pps

b. Receiver

Frequency	9310 mHz (center)
If center frequency	60 mHz
If band width (-3db)	16 mHz (min)

c. Antenna

Beam width	4.5 degrees
Gain	28 db (min)

d. Range

2000 ft to 10NM

MANUAL MODE.

When the manual mode of operation is used, the radar set must be manually operated to obtain target acquisition. Ground transponder replies are displayed on the control-indicator crt. The antenna sector scans (spiral) a 20 degree area, each scan cycle requiring approximately 4 seconds.

TRANSPONDER REPLY CODES.

When the radar set interrogates a ground transponder, the transponder replies with a preset coded transmission. The first reply pulse is the transponder position. The distance between the first and second pulse indicates the transponder reply code. The code being two less than the distance between pulses. Since the maximum range of the radar is 10 miles, the second pulse of transponder codes 8, 9, and 10 cannot be displayed, and the second pulse of codes 2 through 7 can be displayed only if the range to the transponder is short enough to permit displaying of the second pulse.

TRANSPONDER REPLY CODES

Code	First Pulse to Second Pulse Separation (Nautical Miles)
1	One pulse only
2	4
3	5
4	6
5	7
6	8
7	9
8	10
9	11
10	12

STANDBY MODE.

The standby mode of operation places the radar set in an operational ready state (after a 60 second delay). The radar is fully operable with exception of the transmitter. The range gate, which consists of two dots, will be displayed and may be increased or decreased in range using the range slew control. The antenna may be moved with the antenna position control.

AUTOMATIC MODE OF OPERATION.

When the mode switch is set to AUTO, the antenna begins a linear scan of 50 degrees in elevation and the set can achieve target acquisition automatically. During operation in the AUTO MODE the range gate is automatically controlled by acquisition control circuits and the range slew switch no longer has control of the range gate. The gate remains near the 10-nautical mile graticule until a target is displayed within the acquisition range of 2000 feet to 10 nautical miles at which time the range gate will momentarily bracket the target. If the code is correct, automatic acquisition will be obtained and the range gate will remain bracketed over the target. While in AUTO MODE it is possible for the set to operate with either a linear antenna scan or a sector scan. Sector scanning will occur anytime target acquisition is lost for any reason other than the operator inhibiting tracking. When the operator inhibits tracking, the antenna search returns to linear scan.

Operating Procedures.

Starting Procedure.

1. Set 28-volt circuit breaker control to ON.
2. Set mode control to STBY.

CAUTION

If the amber IND FAULT indicator light illuminates and remains lit after turn on, turn the mode switch to OFF and do not turn the set back on. Damage to the set may occur.

Note

- If the amber RTR FAULT indicator light illuminates after initial turn on, recycle the mode switch to OFF and back to STBY to clear the fault. If the fault cannot be cleared, turn the set OFF.
- After approximately 60 seconds, the radar set is ready for operation in any operating mode.

PRELIMINARY CONTROL SETTINGS.

The following control settings place the radar set in a readiness condition required for full operation in any operating mode.

1. Set PANEL ILLUM to desired brightness of panel markings.
2. Set SCALE ILLUM to desired graticule illumination.
3. Set IF GAIN fully clockwise.
4. Increase range slew until range gate (two spots) is centered on display crt.
5. Adjust display INTEN control to obtain a sharp, well-defined display.

WARNING

Damage to the eyes can be caused by the microwave power being radiated from the antenna. When transmitter is on, do not look directly at antenna; stand at least 10 feet from the antenna. Do not radiate within 35 feet of fuel trucks.

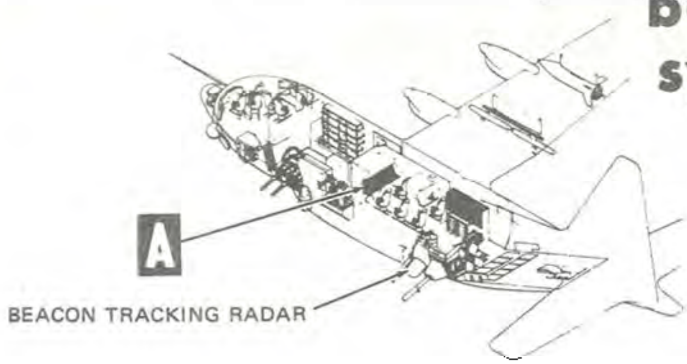
Note

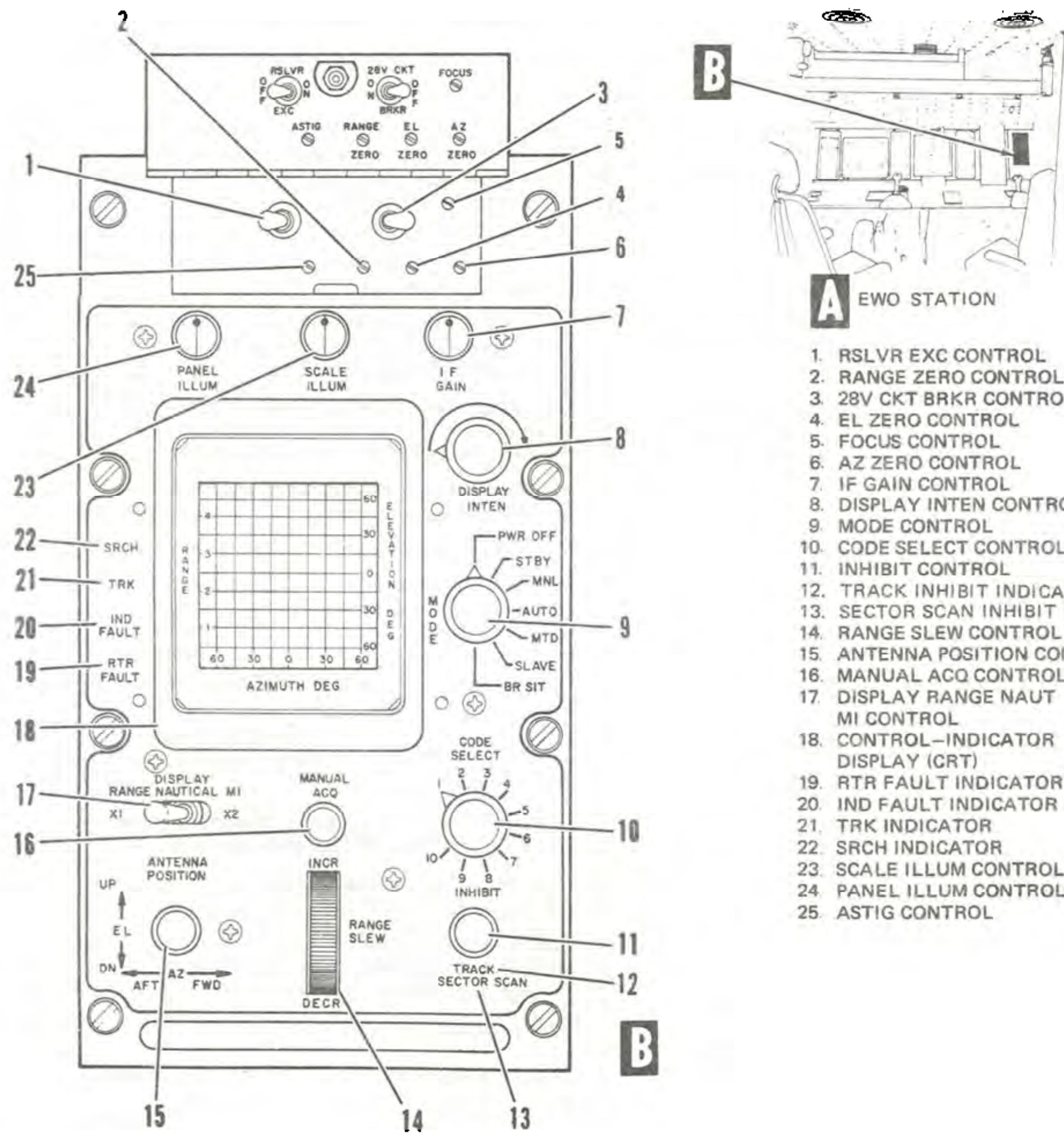
When trying to acquire a radar transponder with the AN/APQ-150 radar the navigation radar (AN/APN-59B) should be placed to either STBY or OFF. Leaving the navigation radar in a transmitting mode, will cause over-interrogation of the transponder and could make acquisition of the transponder impossible.

Manual Target Acquisition Procedure.

1. To obtain target acquisition using code 1 (single pulse), perform the following steps:
   a. Set mode switch to MNL. Note the range and angular position of target transponder operating in code 1.
   b. Set code select control to code 1.
   c. Set antenna position control as follows:
      (1) Adjust AZ-AFT/FWD until target is centered within the 20 degree azimuth scan area.
      (2) Adjust EL-UP/DN until target transponder just disappears. Note degree of elevation angle mark at center of the scan.
      (3) Set the antenna position at the halfway point of the noted angles.
   d. Adjust range slew control setting until target transponder is bracketed within the range gate. The target should be centered within the range gate.
   e. Press manual acquisition pushbutton. Confirm target acquisition as follows:
      (1) Antenna scanning stops.
      (2) Search indicator (green) extinguishes.

beacon tracking radar system (AN/APQ-150)





1. RSLVR EXC CONTROL
2. RANGE ZERO CONTROL
3. 28V CKT BRKR CONTROL
4. EL ZERO CONTROL
5. FOCUS CONTROL
6. AZ ZERO CONTROL
7. IF GAIN CONTROL
8. DISPLAY INTEN CONTROL
9. MODE CONTROL
10. CODE SELECT CONTROL
11. INHIBIT CONTROL
12. TRACK INHIBIT INDICATOR
13. SECTOR SCAN INHIBIT INDICATOR
14. RANGE SLEW CONTROL
15. ANTENNA POSITION CONTROL
16. MANUAL ACQ CONTROL
17. DISPLAY RANGE NAUT MI CONTROL
18. CONTROL–INDICATOR DISPLAY (CRT)
19. RTR FAULT INDICATOR
20. IND FAULT INDICATOR
21. TRK INDICATOR
22. SRCH INDICATOR
23. SCALE ILLUM CONTROL
24. PANEL ILLUM CONTROL
25. ASTIG CONTROL

Figure 4-124.

beacon tracking radar controls and functions

No.	Control Indicator	Setting	Function
1.	RSLVR EXC control	ON	When MODE control is set to STBY, it connects azimuth and elevation resolvers to external system.
2.	RANGE ZERO control	RANGE	Aligns start of range sweep with zero graticle.
3.	28 V CKT BRKR control	ON	Applies external source of 28 VDC to radar set.
4.	EL ZERO control		Adjusted in boresight mode only. Aligns elevation angle mark with ELEVATION 0 DEG graticle.
5.	FOCUS control		Provides focus for crt display.
6.	AZ ZERO control		Adjusted in boresight mode only. Aligns azimuth angle mark with AZIMUTH 0 DEG graticle.
7.	IF GAIN control		Provides manual gain of receiver except when tracking.
8.	DISPLAY INTEN control		Adjusts the desired crt display intensity.
9.	MODE control	STBY	Applies operating power and selects operating mode. Places radar set in operational ready state (after 60-second) delay so that full operation can be initiated without delay.
		MNL (manual tracking)	The radar set is fully operational. The antenna scans a 20° area. The radar must be manually operated to obtain target acquisition.
		AUTO (automatic tracking)	Radar set is fully operational and can have linear or spiral antenna scan. Radar set will achieve target acquisition automatically.
		MTD (microwave target designator)	Allows radar set antenna position to be controlled by an external on-board equipment. A portion of the rf power is supplied to an omni-directional antenna.
		SLAVE	Allows position of radar antenna to be controlled by other sensors and equipment aboard the aircraft.
		BRSIT (Boresight)	Drives the antenna to zero-zero position.
10.	CODE SELECT CONTROL		Selects transponder reply code that enables the radar set to acquire the ground located transponder. Control setting must correspond to desired ground transponder code setting. In position 1, the radar set will acquire a responding transponder independent of the transponder code.
11	INHIBIT control		When pressed, inhibits function as indicated by illuminated TRACK or SECTOR SCAN indicators, located directly below the control.
12	TRACK indicator		When lit (amber), indicates function of radar set to be inhibited, if INHIBIT switch is pressed.
13	SECTOR SCAN indicator		When lit (amber), indicates sector scan function of radar set is inhibited if INHIBIT switch is depressed.
14	RANGE SLEW control		Used in conjunction MANUAL ACQ control to acquire target lock-on conditions INCR – increases range of range gate. DECR – decreases range of range gate.
15.	ANTENNA POSITION control	UP	Used to position antenna up (maximum +20° maximum).
		DN	Used to position antenna down (-70° maximum).
		FWD	Used to position antenna forward (+70° maximum).
		AFT	Used to position antenna aft (-70° maximum).

Figure 4-125. (Sheet 1 of 2)

beacon tracking radar controls and functions

No.	Control Indicator	Setting	Function
16.	MANUAL ACQ control		Used in manual mode, with range gate centered about the target, target acquisition is achieved by pressing the MANUAL ACQ switch.
17.	DISPLAY RANGE NAUT MI control	X1 X2	Selects 5 mile range. Selects 10 mile range.
18.	Control-indicator display (crt)		Displays target range, range gate and angular position of antenna (azimuth and elevation with respect to aircraft centerline.
19.	RTR FAULT indicator		When lit (amber), indicates malfunction in receiver transmitter unit.
20.	IND FAULT indicator		When lit (amber), indicates malfunction in control indicator unit.
21.	TRK indicator		When lit (green), indicates radar set has achieved target acquisition.
22.	SRCH indicator		When lit (green), indicates radar set is searching in either sector scan (spiral) or the linear scan modes.
23.	SCALE ILLUM control		Adjusts brightness of display graticle.
24.	PANEL ILLUM control		Adjusts brightness of backlit control indicator panel.
25.	ASTIG control		Adjusts astigmatism.

Figure 4-125. (Sheet 2 of 2)

(3) Track indicator lights (green).

(4) Track inhibit indicator lights (amber).

Note

- The antenna position cannot be controlled by the antenna position control once target acquisition is complete and the set is tracking.
- The elevation position of the antenna may be assumed to be correct if the target transponder is displayed on the control-indicator display. If the radar set does not hold acquisition when the manual acquisition pushbutton is depressed, repeat step c.

f. Confirm that the target transponder is operating in code 1 by slowly rotating code select switch sequentially through code position 2 through 10, and pressing manual acquisition pushbutton for each code. If the radar set loses acquisition and returns to sector scanning, and does not regain acquisition at any code except code 1, the transponder is operating in code 1.

g. If it is desired to lose acquisition, select a code other than 1, or if the track inhibit indicator is lit (amber), press the inhibit pushbutton.

2. To obtain target acquisition using double pulse code, perform the following steps:

a. Note the range and angular position of the target transponder's first pulse.

b. Set code select switch to desired code (1 through 10).

c. Adjust elevation of antenna position control until target transponder is centered within 20 degrees of the antenna scan area.

d. Adjust range slew control until target transponder first pulse is bracketed within the range gate. The target should be centered within the range gate.

e. Press manual acquisition and confirm target acquisition as follows:

(1) Antenna sector scanning stops.

(2) Search indicator (amber) extinguishes.

(3) Track indicator lights (green).

(4) Track inhibit indicator lights (amber).

f. If it is desired to lose acquisition, set code selector to a code other than the desired code. If the track inhibit indicator is lit (amber), press the inhibit pushbutton.

Automatic Target Acquisition Procedure.

WARNING

Because the acquisition control circuits examine all targets when using AUTO MODE, the use of code 1 (single pulse) should not be used. In code 1 the radar set can acquire any code target and track either pulse of the reply.

1. Set the mode switch to AUTO and observe the following:

   a. Search mode is linear scan.

   Note

   When in AUTO MODE and tracking acquisition is lost, the antenna goes into spiral scan. If this occurs, place the mode control to STBY; then reposition mode control to AUTO or press the inhibit button if the sector scan lamp is lit.

   b. Search indicator is lit (green).

   c. Track indicator is extinguished.

   d. Track inhibit indicator is extinguished.

   e. Sector scan inhibit indicator is extinguished.

2. Set code select switch to desired code.

3. Adjust antenna position control until target transponder is located. If the target transponder is within the look-angle of the antenna, automatic acquisition will occur. Observe for following:

   a. Search indicator is extinguished.

   b. Track indicator is lit.

   c. Track inhibit indicator is lit.

   d. Antenna scanning stops.

4. If the target transponder is in the look-angle of the antenna and acquisition does not occur, check that correct code is selected. If correct, radar set is malfunctioning. If not, select correct code and repeat step 3.

5. If the target transponder is not within the look-angle of the antenna, set antenna position at approximately +40 degrees as indicated by the azimuth angle mark. Acquisition will occur when interrogated by the radar set.

6. If it is desired to release the radar set from an acquired target transponder, perform one of the following steps:

   a. Press the inhibit pushbutton and hold until the transmitted beam moves away from and no longer interrogates the transponder. When released, operation resumes as in step 1.

   b. Operate the code select switch to any other position except code 1. Observe that following occurs:

      (1) Antenna begins sector scanning.

      (2) Search indicator lights.

      (3) Sector scan inhibit indicator lights.

      (4) Track indicator extinguishes.

      (5) Track inhibit indicator extinguishes.

   Note

   If linear scanning is desired, press the inhibit pushbutton. The sector scan indicator extinguishes and linear scanning begins.

   c. Set mode switch to STBY.

Operating Instructions for MTD Mode.

1. Set mode switch to MTD. Presence of azimuth and elevation marks on the control-indicator crt indicates that radar set is producing the system trigger signal.

2. Observe that the azimuth and elevation angle marks track with the remote equipment, in degrees, as the remote equipment operator changes antenna position.

Operating Instructions for the Slave Mode.

1. Set mode switch to SLAVE. Presence of azimuth and elevation marks on the control-indicator crt indicates that radar set is producing the system trigger signal.

2. Observe that azimuth and elevation angle marks track with the remote equipment, in degrees, as the remote equipment operator changes antenna position.

Operating Instruction for the Boresight Mode.

1. Set mode switch to BR SIT.

2. Observe that azimuth and elevation angle marks are present on the controller-indicator crt display.

3. Observe that azimuth angle mark coincides with 0 elevation DEG graticule. If not, adjust azimuth ZERO control for coincidence.

4. Observe that elevation angle mark coincides with 0 elevation DEG graticule. If not, adjust elevation ZERO control for coincidence.
5. If external on-board system alignment is to be checked, set RSLVR EXC switch to ON. When test is completed, return RSLVR EXC switch to OFF.

Stopping Procedure.

1. To prevent radar set transmissions without deenergizing the system, rotate mode switch to STBY.

Note

STBY maintains the radar set in a ready state.

2. To completely deenergize the radar set, rotate mode switch to PWR OFF.

Note

In PWR OFF, the antenna moves to 0 azimuth degrees and -65 degrees where it is mechanically locked.

STORE DISPENSER (SUU-42A/A).

The 16-store dispenser, figure 4-126, is pod mounted on the right and left outboard wing stations. The right pod normally contains 16 flares for target illumination and the left pod normally contains 16 chaff cartridges for countermeasures. Each pod has the capability of holding a wide variety of munitions including MK-24 and LUU-series flares, chaff cannisters, etc. Empty, each dispenser weighs 394 pounds and, fully loaded (16 stores at 27 pounds each), 826 pounds. The system consists of one arming control, two firing controls, junction box, and two wing pods each mounted on a MAU-12B/A rack. Each pod contains an intervalometer that advances to launch the next cannister each time a firing impulse is sent to that pod. Each tube in the pod has a lock-out switch that prevents the forward cannister from being launched if the aft cannister is still in the tube. The dispenser arm switch located on the copilot's side of the flight control pedestal is used to arm both the SUU-42A/A system and the AN/ALE-20 system. A dispense/safe switch for the right wing dispenser is provided at the TV operator's console for dispensing the right wing cannister.

The chaff control panel located at the electronic warfare officer's (EWO) station is provided to dispense the cannisters on the left wing. See figure 4-126 for controls and functions. The launch switch is used to fire a cannister when the switch is put in the FIRE position. The intervalometer is used to preset the half time interval between cannister launchings. The intervalometer setting controls are Sec., 0.1 Sec., .01 Sec. The preset number is half interval. A setting of 2.50 seconds on the intervalometer means 5.00 seconds between cannister releases. The ripple/manual toggle switch is used to control whether the cannisters are released continuously up to eight in the RIPPLE position or individually as the switch is toggled in the MANUAL position.

The home switch pushbutton is used to reset a rotary relay to the first firing pulse position. The ripple mode, the reset switch must be depressed back to the first position. A dimmer control is provided to control the panel edgelighting.

Two jettison switches are provided on the pilot's side circuit breaker panel just aft of the guarded alarm bell switch to enable the pilot to jettison the SUU-42A/A pods separately. The power for the left guarded switch comes from the MAU-12 left circuit breaker and the power for the right guarded switch is from the right MAU-12 circuit breaker. Power for the jettison switches is supplied from the battery bus.

WARNING

Do not walk directly beneath the SUU-42A/A dispenser or stand directly behind a dispenser loaded with live munitions.

CAUTION

Do not operate the SUU-42A/A dispenser at intervals faster than one launch per second to avoid possible structural damage to the wing caused by exciting natural structural frequencies.

CAUTION

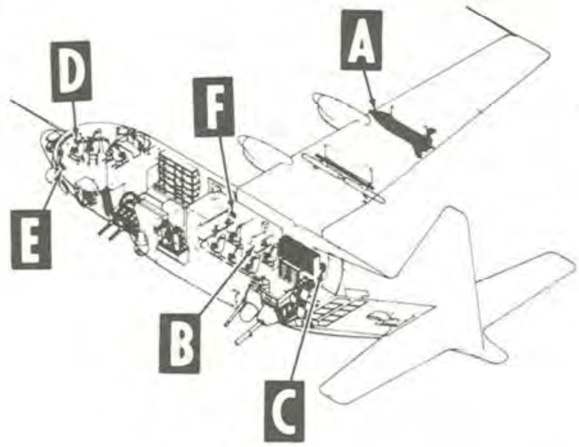
Turn launch switch to the OFF position before depressing the home switch to avoid the possibility of rapidly firing the stores and causing damage to the wing.

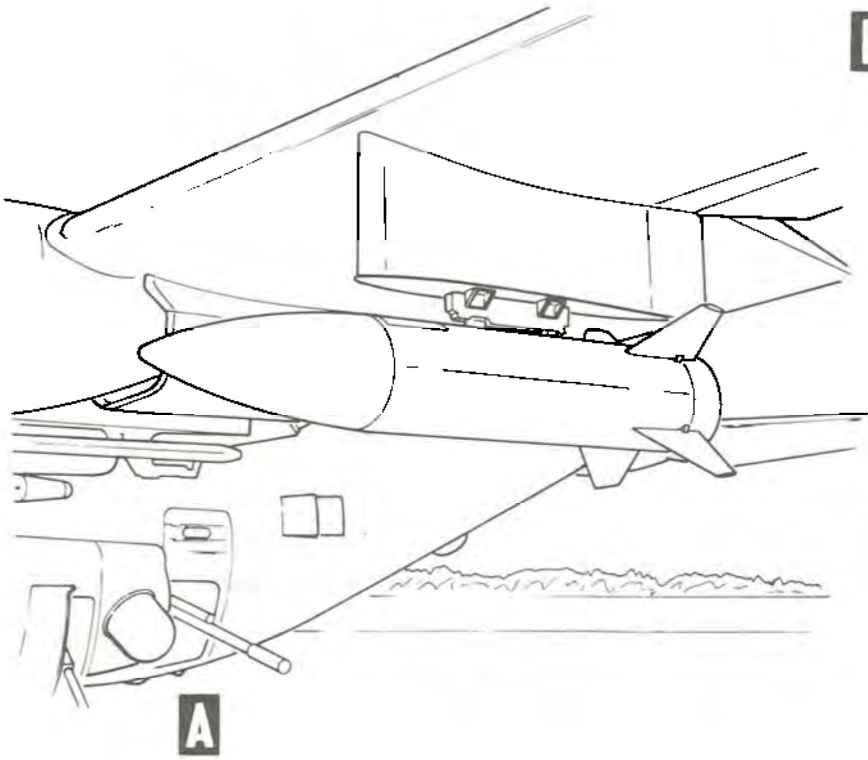
Note

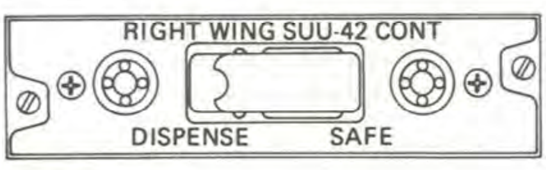
The SUU-42A/A pods can be jettisoned in flight or on the ground regardless of the position of the master arm switch.

The system receives power through four circuit breakers located on the cargo compartment dc circuit breaker panel at fuselage station 245. The circuit breakers are marked INTERVALOMETER POWER, SUU-42 LEFT WING, SUU-42 RIGHT WING, and FLARE ARMING POWER. The flare arming power circuit breaker applies 28 vdc power to the dispensers arm switch located on the copilot's side of the flight control pedestal. The landing gear touchdown relay interrupts power to the system to prevent inadvertent flare ejection while the aircraft is on the ground. The flare system junction box located forward of the right rear crew door, includes separate switches to override the landing gear touchdown relay for each dispenser. These switches must be in the NORMAL (down) position except for ground maintenance.

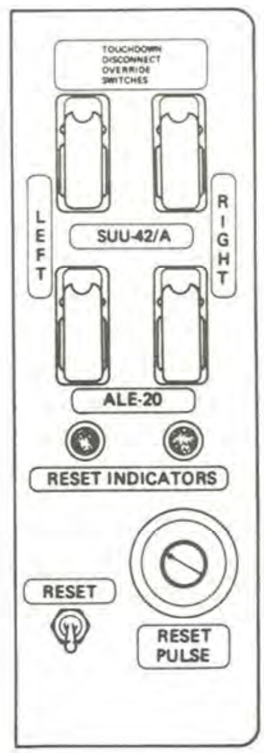
store dispenser components (SUU-42A/A)







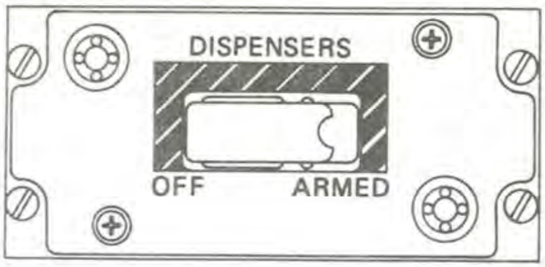
B DISPENSE – SAFE SWITCH



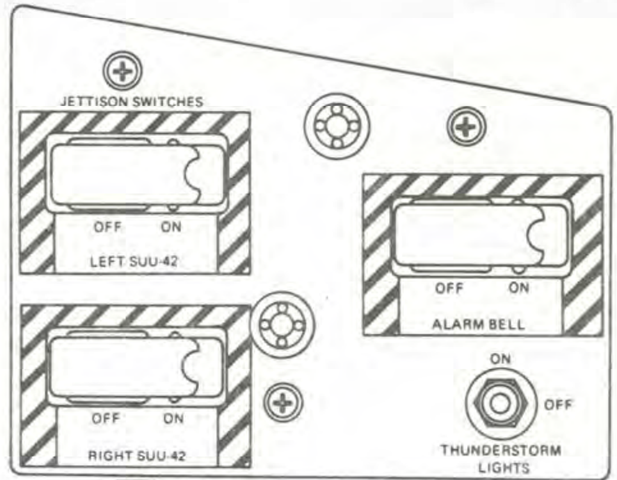
C FLARE SYSTEM JUNCTION BOX

Figure 4-126. (Sheet 1 of 2)

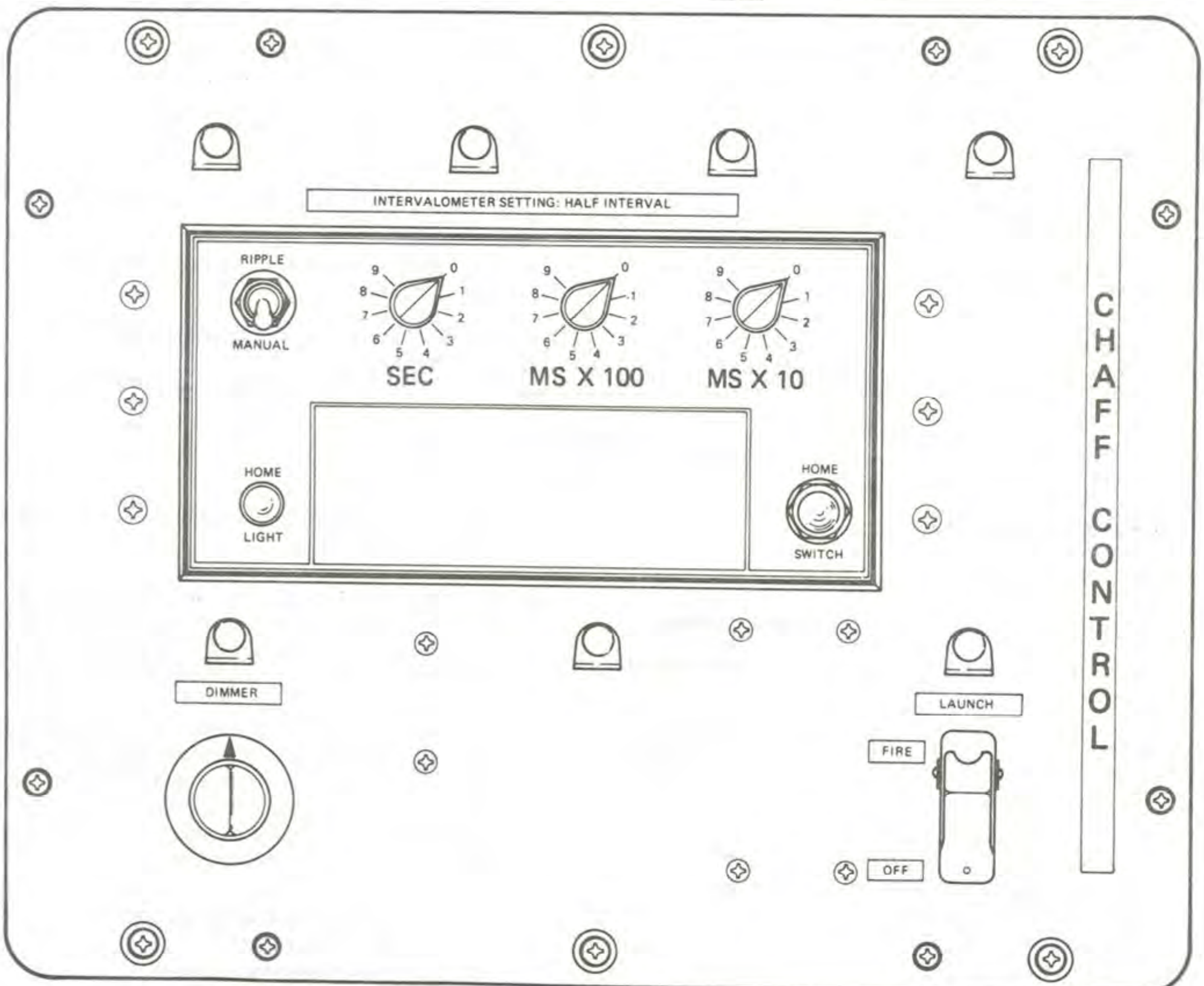
store dispenser components (SUU-42A/A)



D FLARE MASTER ARM SWITCH



E JETTISON SWITCHES



F INTERVALOMETER

Figure 4-126. (Sheet 2 of 2)

SUU-42A/A controls and functions

Control	Description	Function
DISPENSERS OFF/ ARMED Switch	Flare Master Arm Switch	Master Arm switch to control the SUU-42A/A Dispenser and ALE-20 Flare Ejector Systems.
JETTISON OFF/ON Switches	Jettison switches for Left and Right SUU-42A/A pods.	LEFT SUU-42 – Provides for jettisoning of left wing dispenser pod. RIGHT SUU-42 – Provides for jettisoning of right wing dispenser pod.
RIGHT WING SUU-42 CONT DISPENSE/ SAFE Switch	Right wing SUU-42A/A dispense switch.	Provides TV Operator with a means of dispensing stores (flare, etc.) from the right wing dispenser pod.
RIPPLE/MANUAL Switch.	Ripple or Manual mode switch.	RIPPLE – Releases stores continuously at time intervals determined by INTERVALOMETER SETTING control. MANUAL – Releases stores individually (not timed).
INTERVALOMETER SETTING HALF INTERVAL Switches	Ripple mode Intervalometer timing release switches.	Used to preset the half-time interval between store launchings. SEC – 1 to 9 seconds. MS X 100 – 1 to 9 milliseconds times 100. MS X 10 – 1 to 9 milliseconds times 10.
HOME SWITCH	Home Switch push-button.	Used to reset the rotary relay to the first firing pulse position.
LAUNCH FIRE/ OFF Switch	Left wing SUU-42A/A dispense switch	Provides a means of dispensing stores (flare, etc.) from the left wing dispenser pod.
DIMMER Control	Edge panel light dimmer control	Provides for varying the intensity of the edge panel lights on Chaff Control Panel.
HOME LIGHT Indicator	Home light indicator	Provides a light indication when rotary relay is reset to the first firing pulse position.

Figure 4-127.

Operating Procedures.

RIGHT WING SUU-42A/A.

1. Depress the two SUU-42A/A circuit breakers.
2. Place the dispenser arm switch on the flight control pedestal to ARM.
3. At the TV operator's station, lift the red guard on the right wing SUU-42 control and place the momentary on switch to DISPENSE.

Note

The switch has to be actuated each time a flare is dispensed.

LEFT WING SUU-42A/A

1. Depress the three SUU-42A/A circuit breakers.
2. Place the dispenser arm switch on the flight control pedestal to ARM.
3. At the EWO station depress the home switch until the HOME light comes on.
4. For individual flare bursts place the manual ripple switch to MANUAL, lift the red guard on the switch marked LAUNCH, and place to the FIRE position. One flare will be dispensed each time the switch is actuated.
5. For continuous operation, place the manual/ripple switch to RIPPLE, set the timing one half interval desired, and place the red guarded launch switch to FIRE. The dispenser will launch flares at the selected one half interval until the launch switch is turned off or the dispenser has fired eight stores.

CAUTION

Do not exceed a minimum setting of 1 second firing interval which would be a setting on the intervalometer of 0.5 seconds.

COUNTERMEASURES DISPENSER SYSTEM (AN/ALE-40(V))

The dispenser system (see figure 4-127.1) is a countermeasures dispensing set for tactial aircraft that gives the aircraft a capability to dispense chaff against terminal threat radars. The dispensing set is lightweight and modular. It provides self protection against radar-controlled threats.

The system consists of two dispense switches and one programmer located at the EWO station, three EMI filters located aft of the right paratroop door, two EMI filters located aft of the left paratroop door, four dispensers located forward of the air deflector door, four dispensers located below the 2 kw searchlight, and two dispensers located aft of the rear cargo door.

The programmer is located on the upper center of the EWO console. It contains the controls and circuitry used to generate programmed fire commands to the dispensers. Selection and initiation of the programmer's options shown below illustrate the range of settings available for each mode (chaff burst count, burst interval in tenths of a second, chaff salvo count, salvo interval in seconds). The "C" count setting stands for continuous, and the "R" interval setting stands for random (3, 5, 2, 4, 3, 5, etc.).

Note

One burst consists of five chaff cartridges fired at the same time.

The chaff programs available are burst and salvo.

The burst options available are: Burst count (number of cartridges x 5) - 1, 2, 3, 4, 6, 8. Burst interval (seconds) - 0.1, 0.2, 0.3, 0.4

The salvo options available are: Salvo count (number of burst programs) - 1, 2, 4, 8, C. Salvo interval (seconds) - 1, 2, 3, 4, 5, 8, R.

The chaff program function produces a sequence of salvos in which BURST COUNT position specifies the number of chaff cartridges x 5 to be fired per burst, BURST INTERVAL position determines the interval in seconds between each set of five chaff cartridges firing in a burst, SALVO COUNT position defines the number of times the burst sequence will be accomplished, and SALVO INTERVAL position presets the interval in seconds between consecutive salvos (see figure 4-127.2).

Note

Once a program has been initiated do not set programmer salvo count position to a lower setting until entire program has run.

The dispense switches are located on the upper left side of the EWO console. These are spring loaded switches which are held in the NORMAL position. The left switch is marked single dispense. This switch dispenses one burst (5 chaff cartridges) regardless of the program setting. The other switch is marked CHAFF PROGRAMMER. This switch initiates a full program according to what is set in the programmer. The chaff programmer switch has no function during a program cycle and will not initiate another program until the present program is finished.

The EMI filters located aft of each paratroop door, filter all signals and power inputs to the dispensers. One filter controls two dispensers. Each filter has a safety pin which disconnects power and grounds the system. Located aft of each filter is the associated power switch labeled RESET/OPERATE. OPERATE position applies power to the system. RESET position resets the system to the first firing position and should not be set to RESET until termination of the chaff mission. RESET position disconnects power to the system. This switch also functions as a circuit breaker.

Note

EMI filter switches should automatically switch to OPERATE when the safety pins are removed. Insert pins to SAFE the system. Select RESET at termination of the mission.

There are ten dispensers located on the AC-130H; four on the left side, four on the right side, and two in the tail. Each dispenser holds thirty chaff cartridges for a total of three hundred cartridges per airplane. There are five sequencers switches colocated with the dispensers. Each sequencer switch operates two dispensers. Normal firing order consists of two cartridges from the left side, two cartridges from the right side, and one cartridge from the tail for each burst. Switch 3 on the sequencer switch is not functional. The system is wired for 1X1 cartridges.

Circuit breaker protection for the system is located on the DC circuit breaker panel on the cargo side of FS 245. There are four circuit breakers; ALE-40 master, ALE-40 tail disp, ALE-40 left disp, and ALE-40 right disp. This applies 28v DC to the system from the main DC bus.

countermeasures

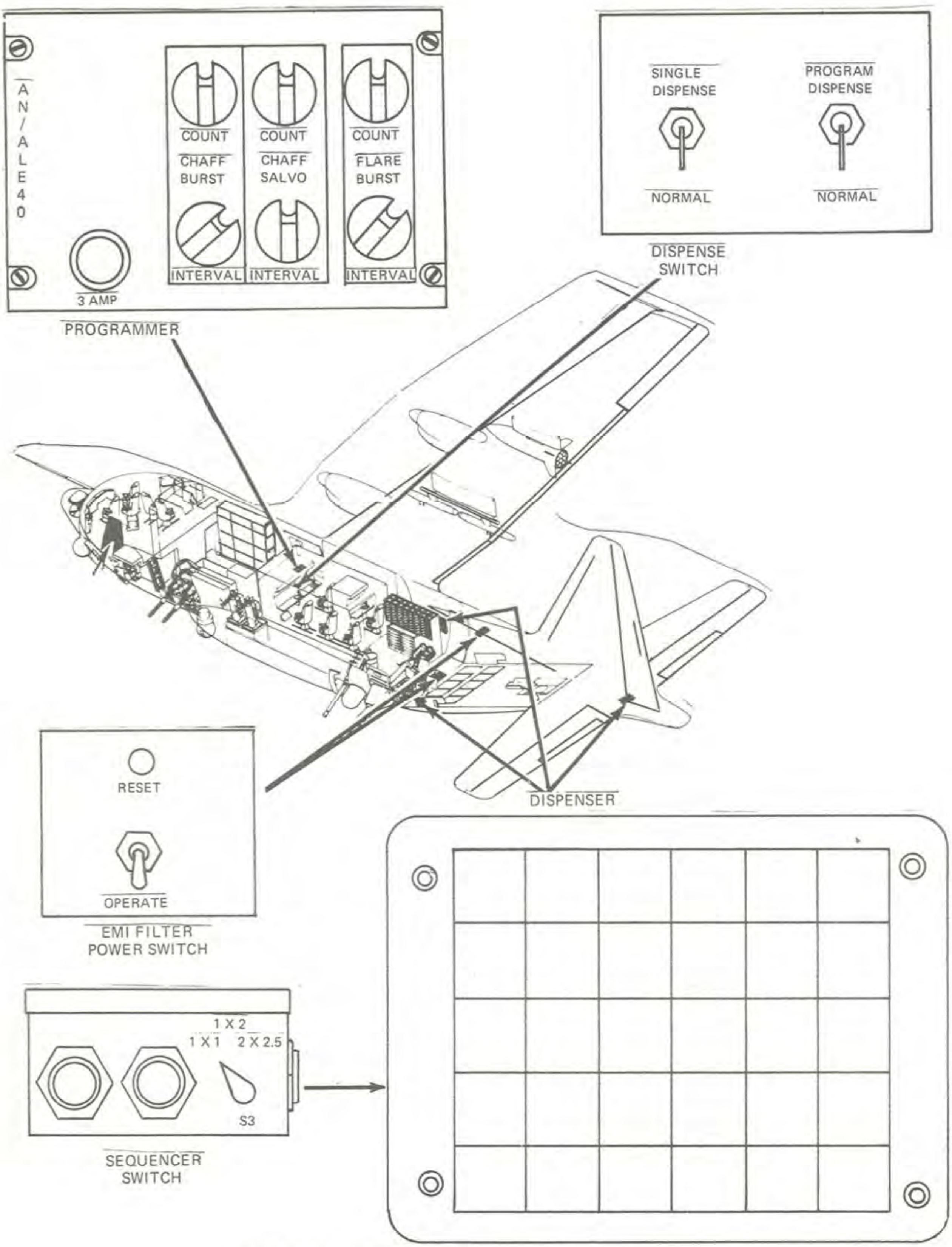
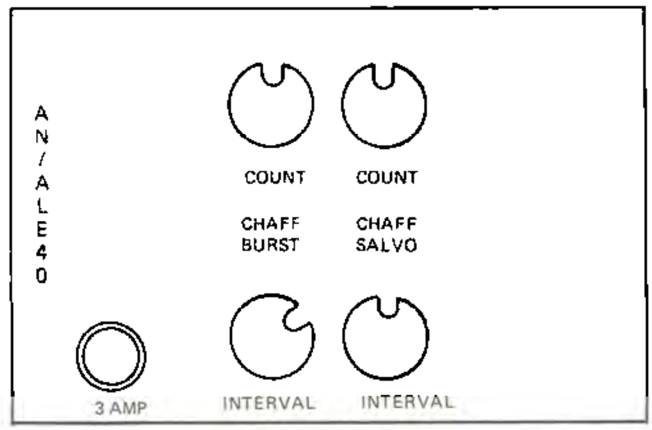


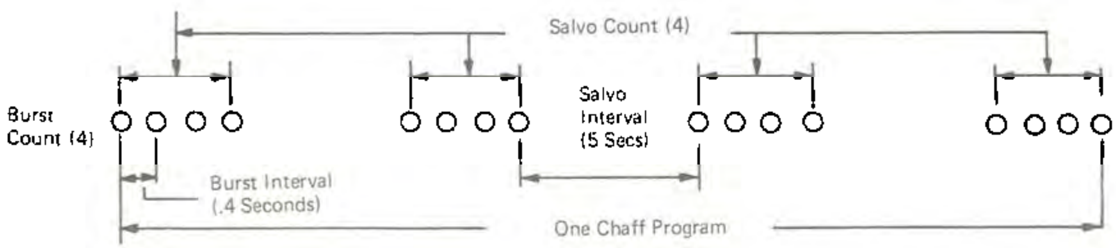
Figure 4-127.1 Countermeasures Dispenser (AN/ALE 40(V) Components

chaff program

Program Selection

4 Salvos - 5 Second Separation
4 Unit Burst - .4 Seconds
Between Units





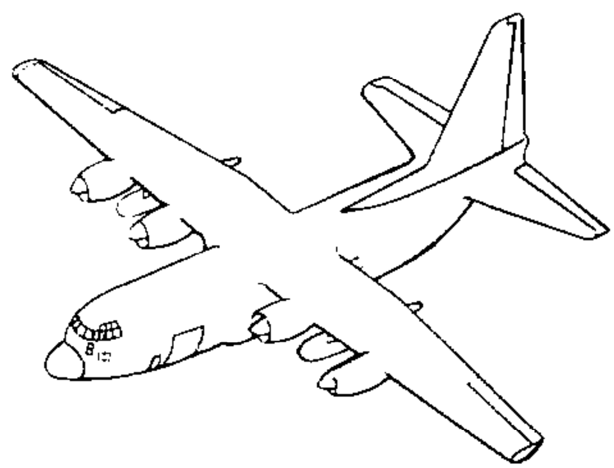
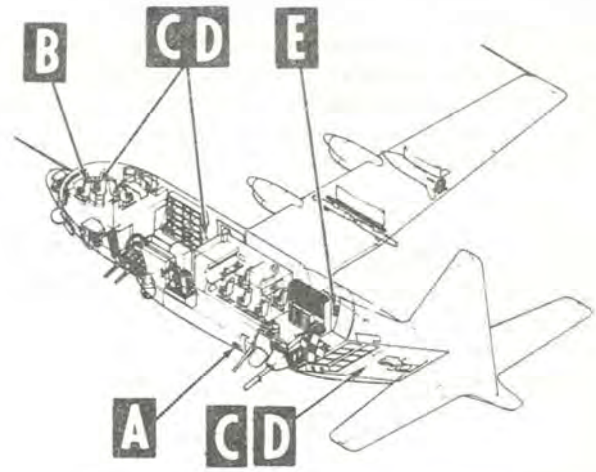
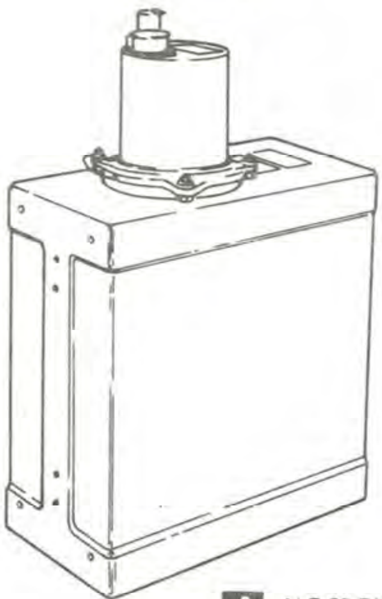


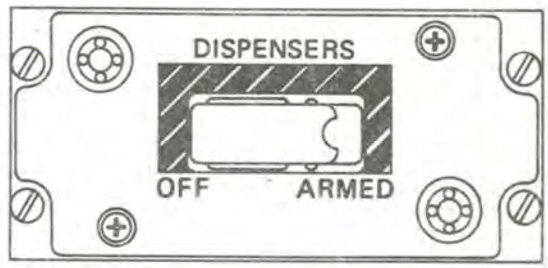
Figure 4-127.2 Chaff Programs

flare ejector system (AN/ALE-20)





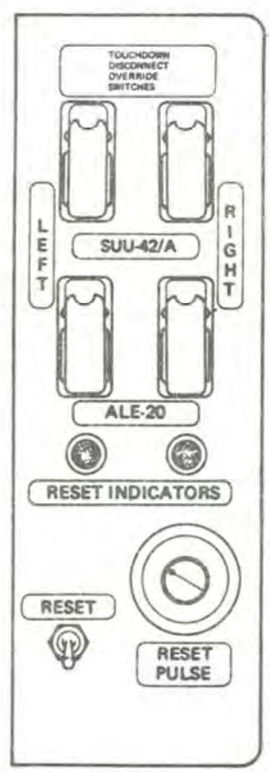
A ALE-20 DISPENSER (TYP 2 PLACES)



B FLARE MASTER ARM SWITCH

C SAFE/ARM SWITCH CONTROL PANEL

D FIRING SWITCH



E FLARE SYSTEM JUNCTION BOX

Figure 4-128.

FLARE EJECTOR SYSTEM (AN/ALE-20).

The ejector system (see figure 4-128) is an airborne countermeasures system designed to deceive infrared guidance used in certain types of missiles. Deception is accomplished by ejecting flares having an infrared energy component greater than the aircraft infrared signature.

The system consists of firing controls, a junction box, two stepping switches and two companion flare ejector cases. The firing controls consists of a dispensers arm switch (also used for the SUU-42A/A) located on the copilot's side of the flight control pedestal, safe/arm switches and companion hand-held switches located at three operator stations - engineer (E), right scanner (AG), and illuminator operator (IO) stations. See figure 4-129 for controls and functions.

One stepping switch and flare ejector case is located in the aft end of each main landing gear wheel well. One AN/ALA-17 flare set is inserted in each ejector case and contains 16 single flare bursts. In operation, each time one of the three firing controls is actuated two flares will be dispensed, one from the right wheel well ejector case and one from the left. No provision is made to jettison the AN/ALA-17 flare sets. In event of a flare fire, the ejector case is designed to contain an accidental fire in the AN/ALA-17 flare set.

The system receives power through three circuit breakers located on the cargo compartment dc circuit breaker panel (Fus Sta 245). The ALE-20 dispenser power 30 amp circuit breaker provides 28 vdc to the dispenser motor circuit and firing relay contacts. The ALE-20 flare dispenser 5 amp circuit breaker provides 28 vdc to the safe/arm switches and hand-held firing switches at the three power operator stations. The flare arming power circuit breaker applies 28 vdc to the dispenser arm switch located on the copilot's side of the flight control pedestal. The landing gear touchdown relay interrupts power to the system to prevent inadvertent flare ejection while the aircraft is on the ground. The flare system junction box, located forward of the right paratroop door, includes separate switches to override the landing gear touchdown relay for each dispenser. These switches must be in the NORMAL (down) position except for ground maintenance.

Operating Procedures.

1. Depress the three AN/ALE-20 dc circuit breakers.
2. Place the dispenser arm switch on the flight control pedestal to ARM.
3. Place the red-guarded switch at the E station, AG station and/or the IO station to the ARM position.

Note

The safe-arm switch at each position acts as a safety device for the hand-held trigger co-located with it and has no effect on the status of the other stations.

4. Depress the hand-held firing mechanism.

AN/ALE-20 controls and functions

Control	Description	Function
DISPENSERS OFF/ ARMED Switch	Flare Master Arm Switch	Master Arm switch to control the ALE-20 Flare Ejector and SUU-42A/A Dispenser Systems.
ALE-20 DISPENSER SAFE/ARM Switch	ALE-20 Safe/Arm Control Switch	Provides an arming control for the ALE-20 Flare Dispenser System.
TOUCHDOWN RELAY OVERRIDE SWITCHES	SUU-42A/A and ALE-20 Touch Down Override Switch Panel	SUU-42 – Provides a means of override for the SUU-42A/A when aircraft is on ground. ALE-20 – Provides a means of override for the ALE-20 when aircraft is on ground. RESET LAMPS – Indicates when ALE-20 stepping switches are in first position. RESET Knob – Used to position ALE-20 stepping switch through operating positions. RESET Switch – Held in "UP" position while RESET Knob is rotated.
ALE-20 Firing Switches	Hand-Held Firing Switches for ALE-20	Used to dispense two flares (one each) from left and right flare ejector cases.

Figure 4-129.

Note

The trigger on the finger side of the mechanism and the thumb switch must be depressed simultaneously to fire flares.

ARMAMENT AND ASSOCIATED EQUIPMENT.

The armament system provides weapons firepower against a selected ground target determined by the sensor operators and fire control officer. There are six guns on the aircraft which are manned by five airborne gunners. (One also acts as scanner/observer.) The guns are located on the left side of the aircraft. The aiming of the guns is accomplished by flying the aircraft into an orbit around the target and maintaining a course determined by the digital fire control system. Armament control (see figure 4-144) provide remote status and control of each gun, safing and arming, operating mode, and panel light control.

7.62MM GUNS (MXU-470/A GUN MODULE).

Two 7.62MM machine gun modules (see figure 4-130), are installed in the No. 3 and 4 gun positions. Each module consists of a GAU-2B/A, 7.62MM aircraft machine gun, linkless ammunition storage and feed system, battery power supply, electrical control package and stand. The battery power supply provides operating voltage for the electric drive assembly to drive the gun and feed system which supplies ammunition to the gun. Each gun module is operated from a remote location and is capable of firing 3000 or 6000 rounds of 7.62MM ammunition per minute. The gun is mounted to the upper cover of the machine gun module by two recoil adapters and a rear mounting ball. The recoil adapters are secured to the cover by two quick-release pins. A loading sector is provided to be installed in place of the safing sector to prevent damaging the gun bolts when the gun is rotated opposite to the firing direction during loading of the gun module.

The storage drum assembly capacity is 2000 rounds of 7.62MM ammunition. The counter records cumulative total of rounds cycled through the gun module (total rounds on module) and a total of rounds remaining in the module (rounds in module). The number of rounds in the drum is automatically set into the counter when the drum is being loaded. A switch in the counter (full drum switch) will automatically stop the power loading operation when the drum is full of ammunition. Another switch in the counter (last round switch) terminates firing when the drum is empty.

The loader link switch assembly which contains two switches is located at the rear of the upper cover. The switches are actuated by the loader detent pin to prevent the gun from being fired when the loader is not in the firing position and to permit power loading to be accomplished when the loader is in the load position.

Control Assembly.

The control assembly contains the circuitry necessary for operating the gun module (firing, gun clearing, battery charging and power loading). A panel on the front contains the power loading control, power indicator lamp, safing switch, the battery charging control indicators and test points.

Battery Assembly.

The battery assembly is mounted to the bracket below the control assembly. The battery is recharged by power supplied from the aircraft.

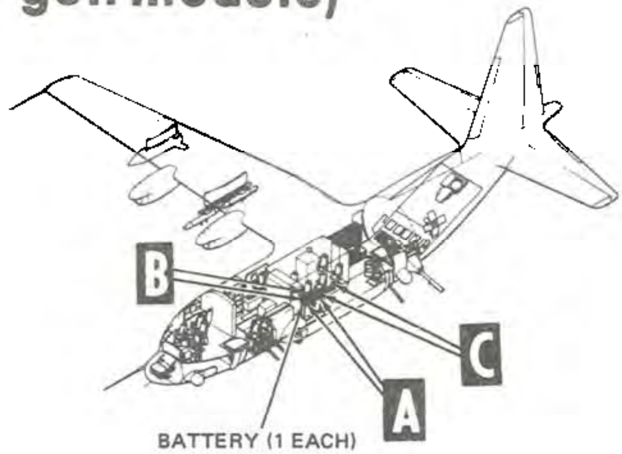
7.62MM Gun Firing Cycle.

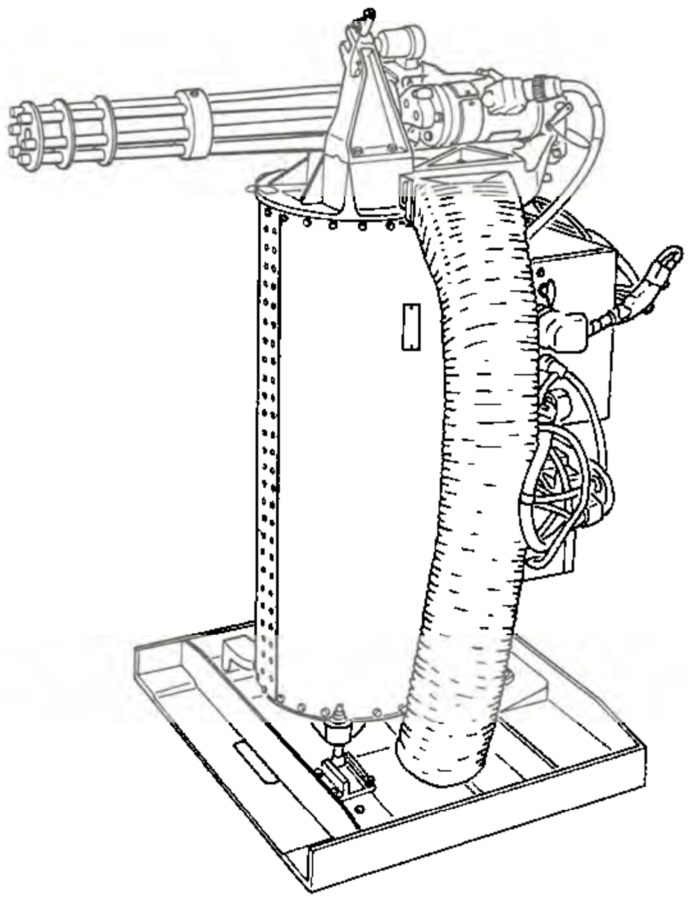
The firing cycle begins when mechanical power is applied to the forward gear of the rotor assembly. The rotor assembly and barrels rotate counterclockwise (viewed from the rear). As the rotor assembly turns, the roller on the outer surface of each bolt assembly follows the elliptical cam path formed in the inner surface of the gun housing assembly. Each bolt assembly, in turn, picks up a cartridge from the guide bar fingers.

The continuing camming action on the bolt assembly roller moves the bolt assembly and cartridge forward to chamber the cartridge in the barrel. As the cartridge is chambered, the bolt assembly roller reaches the forward dwell portion of the eliptical cam. The cartridge is chambered by the bolt assembly traveling forward along the elliptical cam path. The bolt head is allowed to rotate by the bolt head helix camming into the cam path on the bolt subassembly. The firing pin tang travels along the S-shaped groove in the rotor assembly until it strikes the cocking shoulder. As the rotation of the bolt head continues, the firing pin is held in position by the two locking pins in the bolt head. Once the bolt head is in the proper position for firing, the locking pins force the firing pin tang off the cocking shoulder allowing the firing pin to travel forward and strike the cartridge.

After the cartridge has fired, the bolt assembly remains locked until the projectile has traveled through the barrel and gas pressure in the barrel is reduced. At the end of the forward dwell of the elliptical cam path, the bolt assembly roller enters the reverse segment of the path. The bolt head unlocks. Further travel of the bolt assembly roller along the reverse segment moves the bolt assembly to the rear and extracts the spent cartridge case from the barrel. A lip on the face of the bolt head holds the spent case until it is cammed out by the guide bar and ejected. The bolt assembly continues to follow the elliptical cam path into position to receive another cartridge. At this point the bolt assembly has completely cycled through the elliptical cam path. All six bolt assemblies repeat this cycle while power is applied to the front gear of the rotor assembly.

7.62MM guns (MXU-470/A gun module)

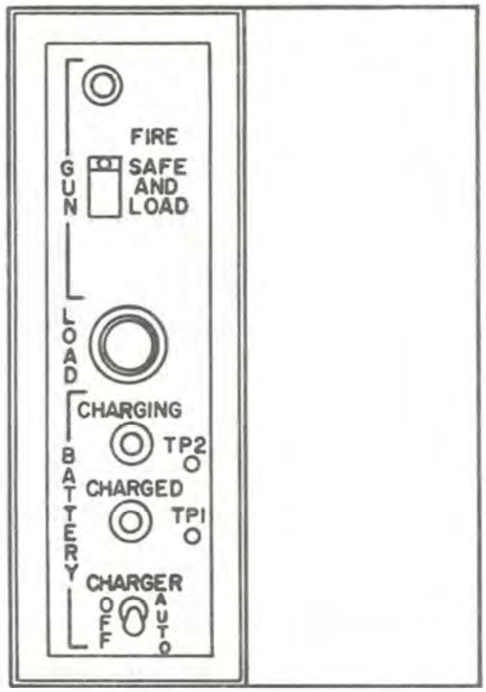




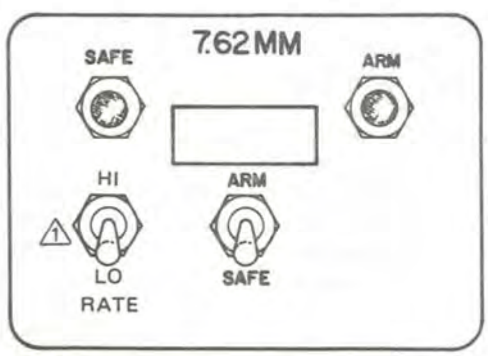
A GUN POSITIONS #3 AND #4

Figure 4-130. (Sheet 1 of 2)

7.62 MM guns (MXU-470/A gun module)



B CONTROL ASSEMBLY



C SAFING AND ARMING SWITCH

⚠1 AIRPLANES MODIFIED BY T.O. 1C-130-949.

Figure 4-130. (Sheet 2 of 2)

20MM AUTOMATIC GUN (M61).

Two 20MM automatic guns (figure 4-131) are installed in the No. 1 and 2 gun positions. The gun firing and status circuits allow monitoring of individual weapons during loading, arming operation and firing. The control panels contain the circuitry necessary to fire the guns, maintain firing rate, apply motor brake and put the guns in auto-clearing mode. Ammo storage is provided by 2 cans located aft of the 20MM guns.

The M61 automatic gun has six rotating barrels that fire electrically primed 20MM ammunition at 2500 rounds per minute. During each 1/6th revolution, a round is fed, chambered, fired, extracted and ejected. Firing voltage (320 vdc) is applied to the round when the respective barrel is rotated to the firing position.

The bolt assembly transports the round from the feeder to the firing chamber, locks the round in the firing position, transmits firing voltage to the primer in the round and transports the empty case to the guide bar and case ejection chute. The case ejection chute guides empty cases or dummy rounds ejected from the lower left side of the weapon. The feeder is mounted to the lower right side of the gun housing and secured to the gun. The feeder feeds and guides the rounds into the extractor lip of the bolts which chamber the rounds, and incorporates declutching features which allow the gun to be cleared without cycling live ammunition through the weapons and ejecting it.

Battery Assembly.

Two rechargeable batteries located below the MXU-470 gun modules are used to drive the 20MM guns and are recharged from aircraft power through the gun control unit.

20MM Gun Firing Cycle.

The firing cycle begins when power is applied simultaneously to the firing contact and the drive unit. Viewed from the rear, the rotor revolves counterclockwise; the main cam guides the bolt assembly forward along the rotor and upward relative to the housing chambering the round. The locking cam in the front (dwell portion) of the main cam forces down the bolt shaft assembly to lock the bolt in the front well of rotor to fully chamber the round, simultaneously, as the bolt passes the insulated portion of the contact cam it depresses the firing pin cam, moving the firing pin into firing position. The insert (electrical contact) comes in contact with the firing pin cam firing the round at approximately the 1 o'clock position.

After the round is fired, the bolt remains locked through the locking cam period while the projectile travels through the barrel and the barrel pressure is reduced. The projectile may leave the end of the barrel at any point in the 50-degree arc depending upon rate of fire and ammunition characteristics.

The unlocking cams in the housing lifts the bolt shaft, thus, retracting the bolt locking block and unlocking the bolt.

As the cam drives the bolt rearward, the empty case is extracted from the barrel chamber by the bolt assembly backward along the rotor and downward relative to the housing until the guide bar cams the empty case out of the bolt extractor lip and ejects it at approximately the 7 o'clock position through the case ejection chute. The bolt then travels along the rear cam dwell area and into position for the next round. At this point the bolt assembly has completely cycled through the elliptically shaped main cam. All six bolts repeat this cycle until power is cut off to the weapons and the drive unit brakes stop the rotor.

Built into the firing circuit is a combination mechanical and electrical interlock. One function of the interlock is to prevent the firing cam pin in the bolt from being thrown out of the bolt body by centrifugal force. The second function is to provide a means of preventing the round from firing if, for some reason the locking block is not depressed into the locking well when the bolt is in the firing position. If the bolt shaft is in the unlocked position, the small tip on the back of the contact stop assembly rides against the side of the bolt shaft. The contact stop prevents the firing cam pin from being depressed far enough to cam the firing pin into contact with the round. The current is conducted through the rear tip of the contact stop to the bolt shaft and is shorted out to the weapon.

When the shaft is in locked position, the small tip can enter a vertical slot in the bolt shaft. The firing cam pin can then be depressed far enough to cam the firing pin into contact with the round; the contact stop assembly is cammed backward so that only the insulated portion is in contact with the bolt shaft. The current passes through the firing pin cam and firing pin to fire the round.

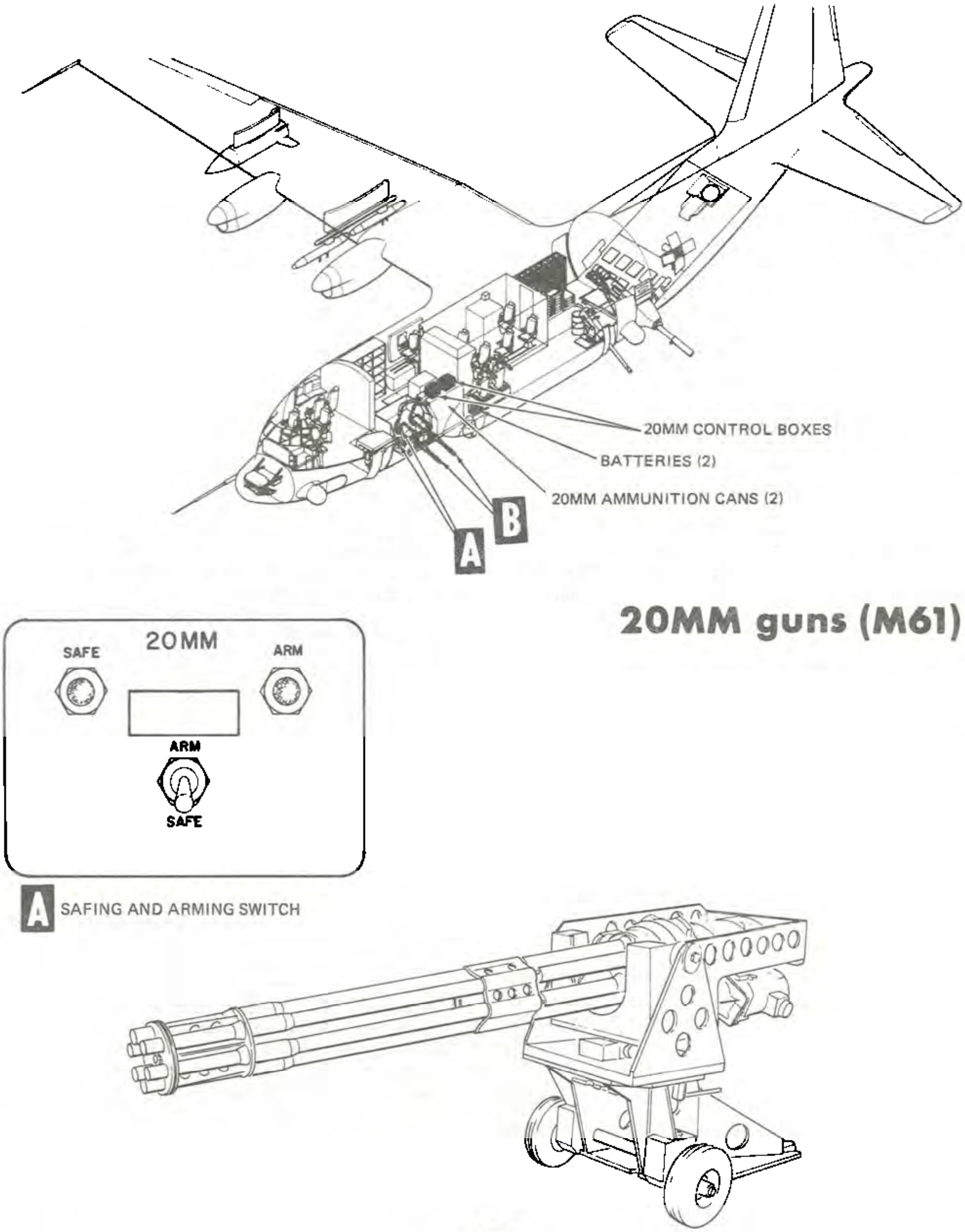
Recoil forces are transmitted from the bolt and locking block through the rotor to the housing ball bearing on the front of the rotor and to the housing and the recoil adapters.

Clearing Cycle.

During the clearing cycle a 28-volt dc signal is fed from the 20MM control box to the feeder solenoid mounted on the feeder. This signal actuates the solenoid which stops the feeder rotation for a period of 0.6 of a second. This allows the rounds to stop in the feeder and the rounds that have passed through the feeder to be fired.

After the feeder solenoid on the feeder declutches, the gun continues to rotate, and firing volting is maintained 0.4 of a second to fire those rounds which have been fed into the gun. This action completely clears the gun of all rounds.

20MM guns (M61)



A SAFING AND ARMING SWITCH

B GUN POSITIONS #1 AND #2

Figure 4-131.

TRAINABLE GUN MOUNTS (TGM).

These systems include, a stable mounted gun plate, a movable yoke and mount, and controlling electrical and hydraulic equipment. The azimuth and elevation movement are hydraulically powered by linear actuators, and controlled by electrohydraulic servo valves. Aimpoint information from the target sensor is processed by the fire control system, and routed to the weapon. The 40MM mount can be moved manually from +1 to -29 degrees elevation and +2 to -13 degrees azimuth. The 105MM mount can be moved manually from 0 to -40° elevation and 0 to -20° azimuth. In normal airborne operation, 105MM elevation movement is limited by software to a range of -18 to -40 degrees. In TRAINABLE mode, the TGM is slaved to the primary sensor within the azimuth/elevation limits inserted in the FCP. After firing, the TGM continues to drive for 0.2 seconds and then will stop for 2.5 seconds to allow the gun to recoil. The TGM is ground checked by slaving to ground boresight angles inserted in the FCP.

Systems Equipment.

In addition to the mount, the trainable systems consist of control electronics units, (CEU) loaders weapon control panels (LWCP) and the hydraulic systems. These three portions of the systems are discussed in the following paragraphs.

CONTROL ELECTRONICS UNIT (CEU).

There is a separate CEU for each trainable mount. The CEU consists of a box containing three circuit card assemblies, a power supply, and an elapsed total time indicator. All mount movements are controlled by this unit through the rotary switch on the loader's weapon control panel.

LOADER'S WEAPON CONTROL PANEL (LWCP).

The primary purpose of the LWCP is to enable the operator to set and monitor the desired mode of operation for the mount. A separate LWCP is provided for each trainable mount. (See figure 4-133.) One rotary switch is provided to adjust the azimuth synchro and another to adjust the elevation synchro during boresight alignment. A prime power circuit breaker controls the 28 vdc power to the LWCP. A nullmeter, toggle switch, and three monitor jacks are provided to verify that the gun moves to the commanded gun angles. Maximum meter deflection is 2.4 mils. A dimmer control enables the edgelighting on the LWCP to be adjusted. The power on lamp is lit whenever the rotary switch is in any mode other than OFF. The 105MM LWCP hydraulics active lamp is lit in the STOW and LOAD modes. The 40MM/105MM LWCP hydraulic active lamp is lit in the SLAVE mode with an appropriate selection on the (FCO) computer gun discrete panel. The lamp indicates that the hydraulics are electrically enabled only. The 105MM/LWCP has two load position adjust controls located on the panel. A mode control switch is provided to select the mode of operation. The mode control switch on the 105MM LWCP has five positions: STOW, ALIGN, OFF, SLAVE and LOAD. The mode control switch on the 40MM LWCP has three positions: ALIGN, OFF and SLAVE.

Figure 4-134 shows the LWCP controls and functions.

Power for the trainable systems is provided from two panels. The 28 vdc power is controlled by a 5 amp circuit breaker for each system located on the aft fuselage circuit breaker panel (Fuselage Station 673). The 26-volt 400Hz power is provided by a lamp fuse located on the 26-volt reference power panel which is located behind the engineer's station.

HYDRAULIC SYSTEMS.

The trainable gun mounts receive hydraulic power from the aircraft utility system. A filter and priority valve has been added for protection. The priority valve will isolate pressure in the utility system when pressure in the system drops below 2,250 psi. The TGM hydraulic systems consist of azimuth and elevation manifolds for each mount, three hydraulic actuators for the 105MM mount, two hydraulic actuators for the 40MM mount, two hand pumps and a reservoir, various valves and miscellaneous hydraulic lines. Three manual shut-off valves, master, azimuth and elevation, are included with each mount to isolate it from the aircraft system in case of a hydraulic leak. The trainable systems can also be isolated by turning on the utility isolation valve. In case of a line or component failure in either TGM, the mounts can be positioned manually.

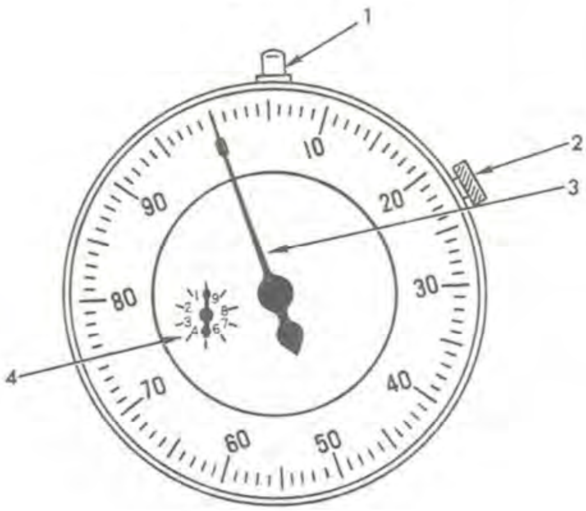
Manual Operation of Mounts.

In order to manually adjust either mount, two rotary hand pumps, two manual selector valves and a fluid reservoir have been included in the hydraulic system - one pump and valve per circuit. The manual selector valves have three positions; 105MM, OFF and 40MM. These valves are used to select the mount to be moved and should remain off except when the manual system is in use. Direction of pump rotation determines the direction in which the gun is moved. Manual transfer valves (in assemblies of two) have been included in both lines leading from a pump to actuator in order to isolate the actuators. Caution must be taken to insure that aircraft hydraulic power has been removed from the system before operating these hand pumps. Otherwise, pressure is applied to both sides of these valves simultaneously. In this condition, the valve ball will become cocked, causing damage to the valve and fluid to leak into the reservoir from the aircraft supply. (The reservoir serves only to replace lost fluid.)

Azimuth And Elevation Gauges.

The azimuth and elevation (starrett) gauges are mounted on the gun axis to indicate gun position to the nearest mil. A 100 mil pointer indicates gun angle to the nearest 100 mils and a one mil pointer indicates gun angle to the nearest mil. The pick off plunger may be pulled to check the operation of the gauge and to reset the plunger.

azimuth and elevation (starrett) gauge



1. PICK-OFF PLUNGER
2. SET LOCK
3. ONE MIL POINTER
4. 100 MIL POINTER

Figure 4-132.

LWCP Modes of Operation.

SLAVE MODE.

The SLAVE mode is the mode normally used when firing on a target. The weapon receives position commands from the FCS, and the gun tracks the calculated line-of-fire as defined by the primary target sensor and computer calculated off-nominal conditions, in TRAINABLE mode (FIXED mode, the TGM is slaved to a fixed position). The TGM can slew approximately 100 mils per second.

LOAD MODE.

The purpose of the LOAD mode on the 105MM LWCP, is to move the gun into a position which is convenient for reloading the gun. If the load position is to be changed, the change is made with the load position adjust controls on the LWCP. The load position controls provide a 0 to -20 degrees adjustment in azimuth and -18 to -26 degrees adjustment in elevation. The hydraulics are energized for only 2 seconds after LOAD position is selected. When the 2 seconds have elapsed, the input to the servo amplifiers is removed, and the power to the lock valves is removed. The latter action causes the lock valves to close, thus locking the gun in place. Note that the change in position cannot be seen at the time of knob adjustment unless it occurs during the initial 2 seconds into the mode. The airborne gunner must switch out of the mode LOAD and then return before he can actually witness the new load position.

STOW MODE.

The purpose of the STOW mode on the 105MM LWCP, is to position the gun so it will not interfere with aircraft operation during the take-off and landing phases. This mode is selected by placing the LWCP's mode control switch in the STOW position. A 10-second timer in the CEU allows the gun to drive approximately zero degrees in azimuth and elevation. The stow mode is normally selected to lock the gun hydraulics in the gun's zero position prior to turning off the electronics.

ALIGN MODE.

This mode is needed so that the line-of-fire of the guns and FCS can be adjusted with respect to each other without energizing the hydraulics system. This mode is used by flight-line maintenance only and should not be utilized unless long-range ground boresight is being accomplished.

OFF MODE.

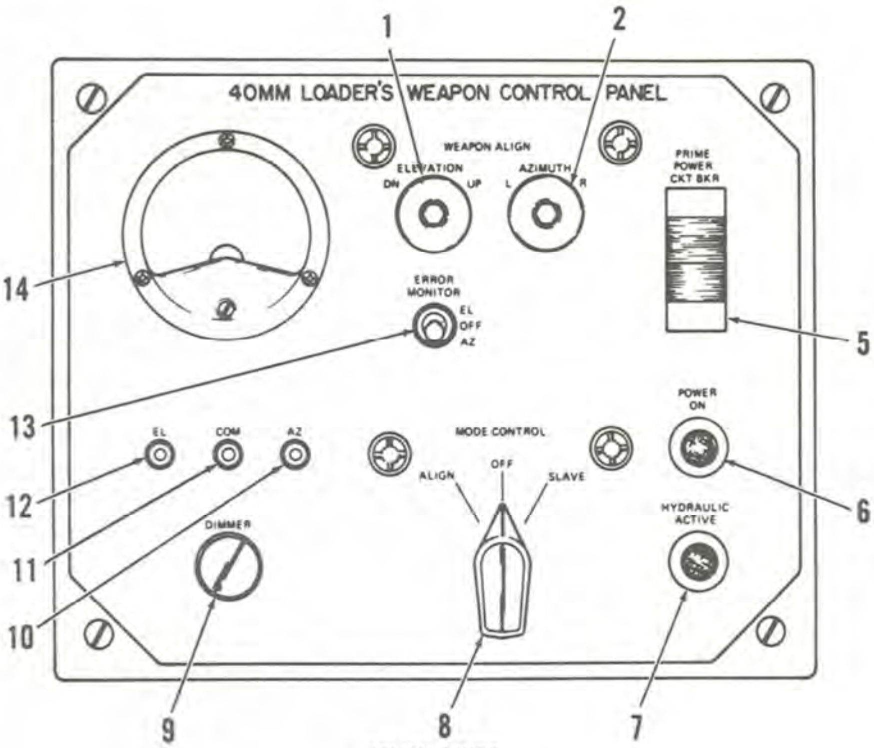
When the OFF mode is selected, the 26-volt, 400Hz and 28-vdc power is removed from the electronics CEU. The gun hydraulic actuators can be moved using the rotary hand pumps in this mode. Verify that the master shut-off valve is OFF before using the hand pumps.

40MM AUTOMATIC GUN (M2A1 MODIFIED).

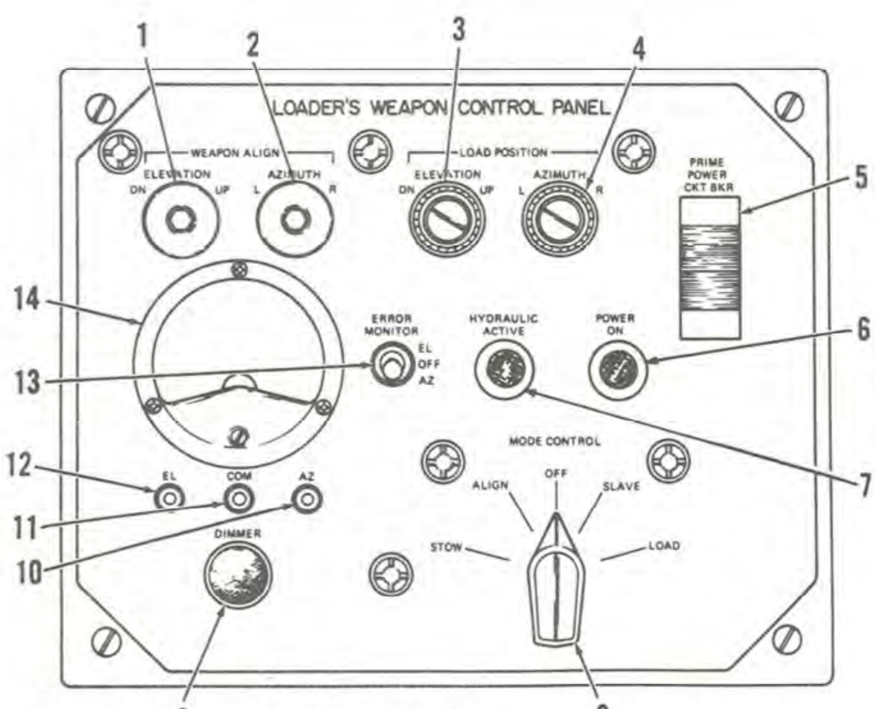
One modified 40MM automatic gun (figure 4-133) is installed in the No. 5 gun position. Ammunition storage is provided by an ammunition storage rack, located on the right-hand side of the aircraft between the operator's compartment and paratroop door. Ammunition is manually fed to the gun. The gun firing and status circuits allow monitoring of the weapon during loading, arming operations, and firing. The control panels contain necessary circuitry for firing the gun.

The gun is recoil operated and has a vertical sliding breechblock. The gun is capable of firing 100 rounds per minute of fixed-type ammunition in rapid bursts of automatic fire. The gun has a percussion-type firing mechanism and a cone-type flash hider (conical cylinder on the muzzle end of the gun tube). The

loader's weapon control panels(LWCP)



40MM LWCP



105MM LWCP

1. WEAPON ALIGN ELEVATION (ADJUSTMENT)
2. WEAPON ALIGN AZIMUTH (ADJUSTMENT)
3. LOAD POSITION ELEVATION (CONTROL)
4. LOAD POSITION AZIMUTH (CONTROL)
5. PRIME POWER CKT BKR
6. POWER ON (LAMP)
7. HYDRAULICS ACTIVE (LAMP)
8. MODE CONTROL (SELECTOR)
9. DIMMER CONTROL
10. AZ TEST JACK
11. COM TEST JACK
12. EL TEST JACK
13. ERROR MONITOR (SWITCH)
14. ERROR MONITOR (METER)

Figure 4-133.

lwcp's controls and functions

Control	Function
1. WEAPON ALIGN ELEVATION Adjustment	Adjusts elevation CDX rotor to null out elevation servo loop error.
2. WEAPON ALIGN AZIMUTH Adjustment	Adjusts azimuth CDX rotor to null out azimuth servo loop error.
3. LOAD POSITION ELEVATION Control	Permits elevation load position changes from -18 to -25° (± 1).
4. LOAD POSITION AZIMUTH Control	Permits azimuth load position changes from 0 to -19° (± 1).
5. PRIME POWER CKT BKR	Provides on-off control and 5 amp protection of 28-vdc prime power.
6. POWER ON Lamp	Indicates 28-vdc prime power is applied to TGM.
7. HYDRAULICS ACTIVE Lamp	Indicates when gun positioning servo loops are enabled.
8. MODE CONTROL Selector	Sets system into desired mode of operation.
9. DIMMER Control	Controls intensity of panel lamp illumination.
10. AZ Test Jack	Test points to monitor azimuth and elevation servo loop error signals.
11. ERROR MONITOR Switch	Applies azimuth or elevation servo loop error signals to ERROR MONITOR meter.
12. ERROR MONITOR Meter	Null meter which measures azimuth and elevation servo loop error signals.

Figure 4-134.

firing selector lever prevents the gun from being fired, allows single rounds to be fired, or permits automatic firing.

Firing Cycle.

Following is a description of the recoil action of the firing cycle:

1. First stage. (See figure 4-136.)

a. Immediately after firing, the barrel, breech ring and loader tray begin to recoil. Pressure from the rammer releasing lever is relieved by a projection on the loading tray, permitting the center catch lever to rise. For the first few inches of recoil, the outer crank is rotated by the cam surface of the slide operating cover, causing the firing pin to be withdrawn into the breech block.

b. As recoil continues, the breech ring outer crank continues to be rotated by the cam surface and the breech inner crank begins to lower the breechblock and actuate the breechblock outer cocking lever; thus; cocking the firing pin. The inner cocking lever plunger engages the inner cocking lever, holding the firing pin against the compressed firing pin spring.

c. As the loader tray moves to the rear, the feed rod rollers enter inclined grooves on the sides of the loader tray. This raises the feed rods that carry feed pawls over the next cartridge in the loader. The stop pawls also prevent cartridges from rising. Pawls on the front of the loader tray are depressed by passing under lugs that extend to the side of the catchhead assembly.

2. Second stage. (See figure 4-137.)

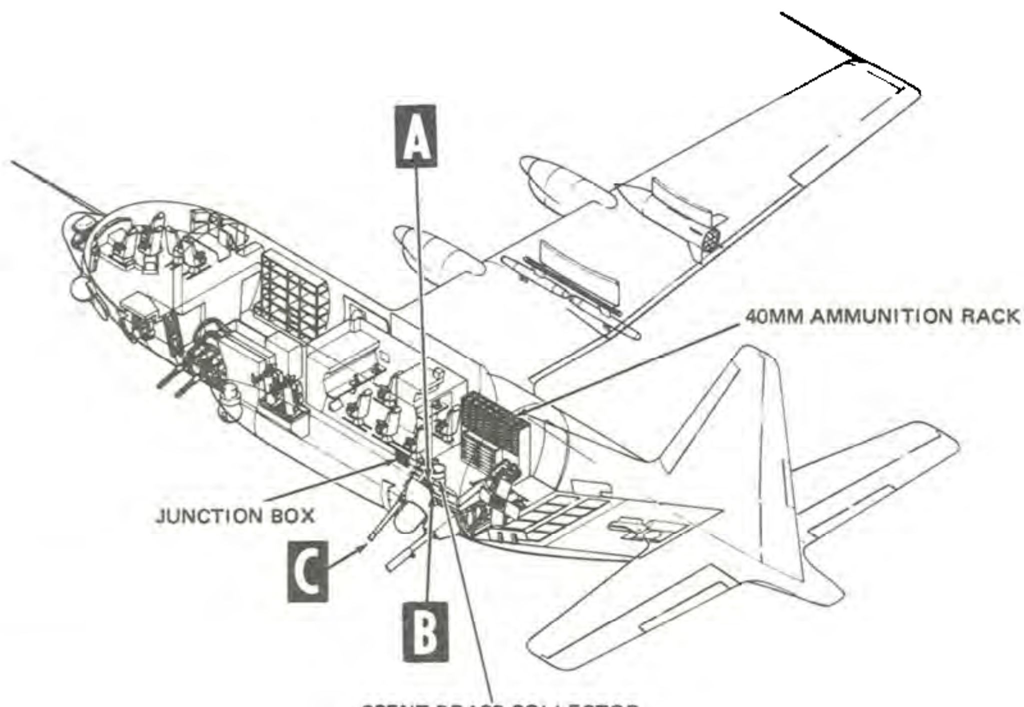
a. When the breechblock has been partially lowered into the slides in the breech ring, the feed rods, holders and pawls are near the extreme up position and the rammer shoe is over the rammer catch lever. At this time, the loader tray is clear for ejection of the empty casing.

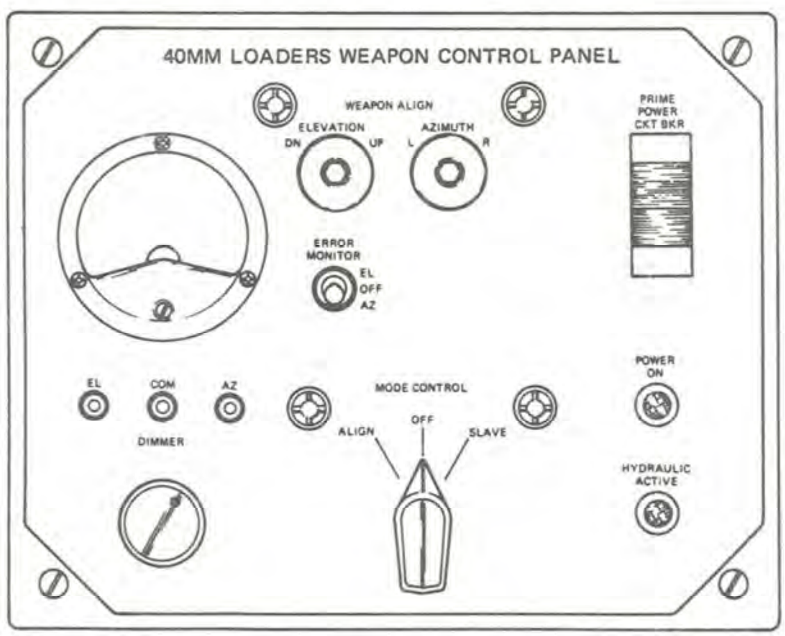
b. When the breechblock descends, projections at the bottom front of the breechblock strike toes on the extractors rotating them to the rear; thus catching the rim of the cartridge case and ejecting it.

3. Third stage. (See figure 4-138.)

a. As the gun nears the end of the recoil action, the empty cartridge case has been ejected and the breechblock reaches its lowest position. The feed

40MM automatic gun (M2A1 modified)

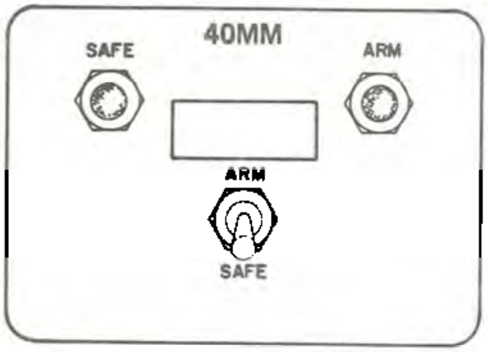




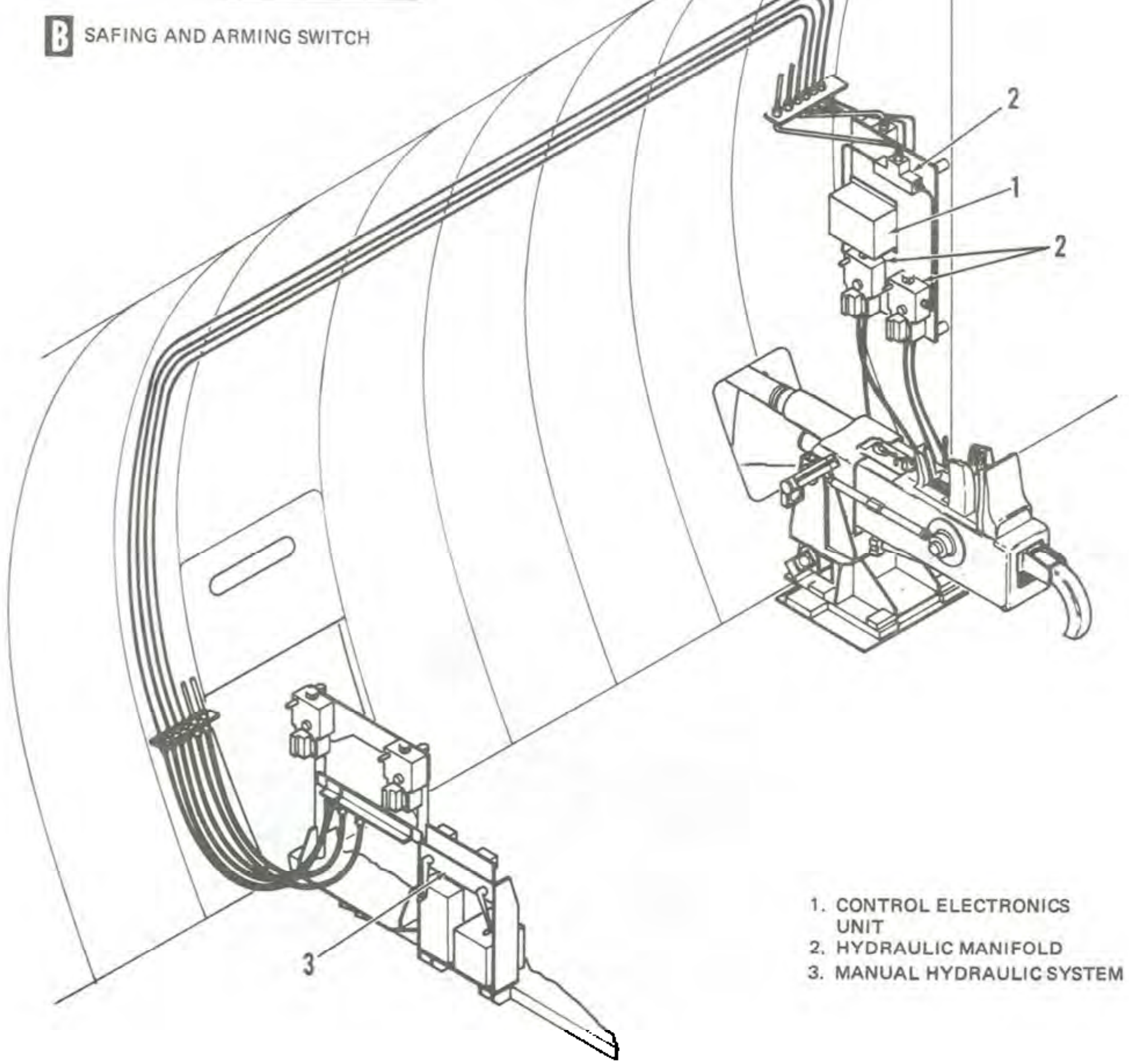
A LOADER'S WEAPON CONTROL PANEL

Figure 4-135. (Sheet 1 of 2)

40MM automatic gun (M2A1 modified)



B SAFING AND ARMING SWITCH

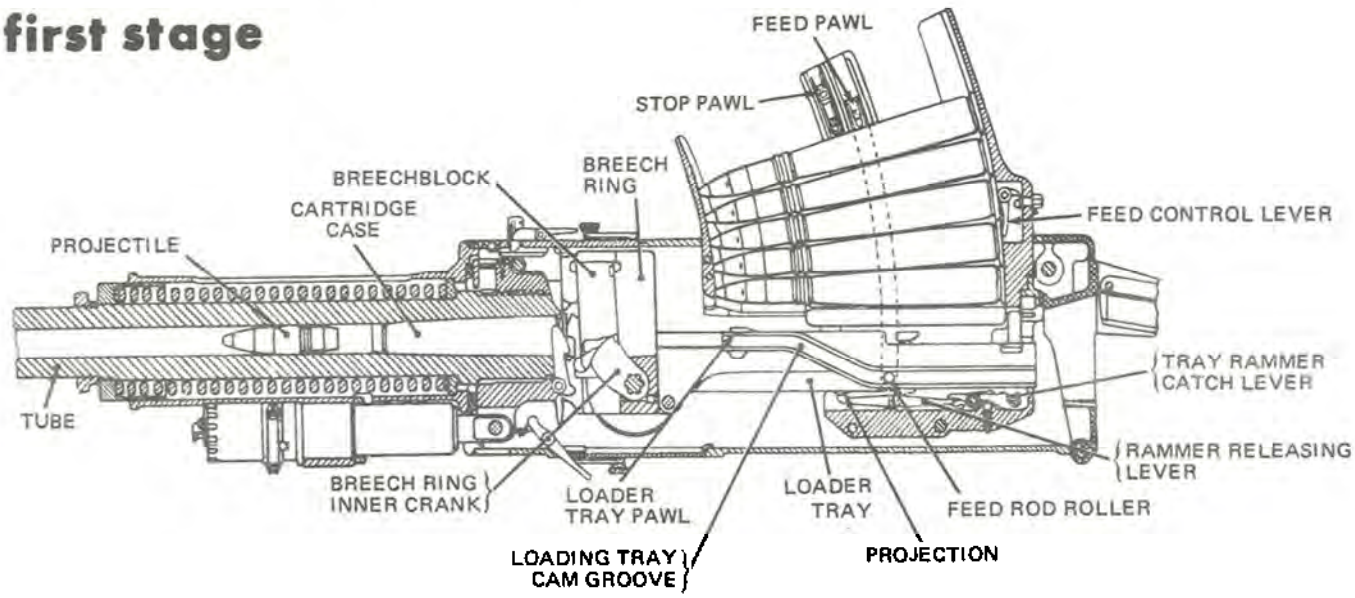


C GUN POSITION NO. 5

Figure 4-135. (Sheet 2 of 2)

40MM gun firing cycle

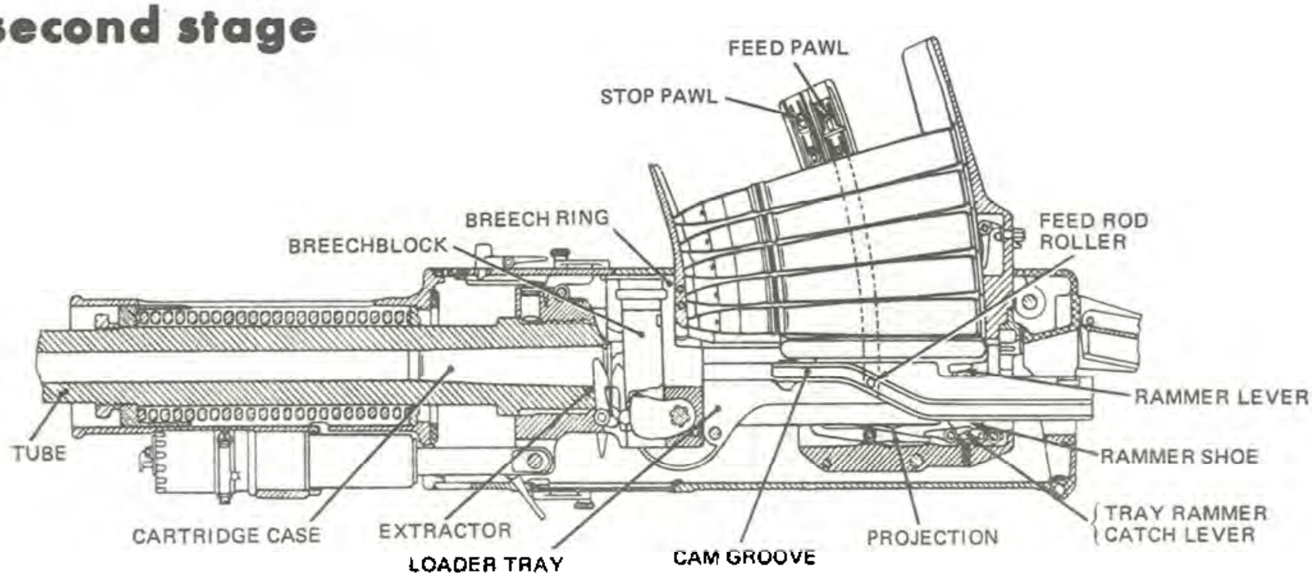
first stage



AUTOMATIC FIRING CYCLE–FIRST STAGE–GUN FIRING.

Figure 4-136.

second stage

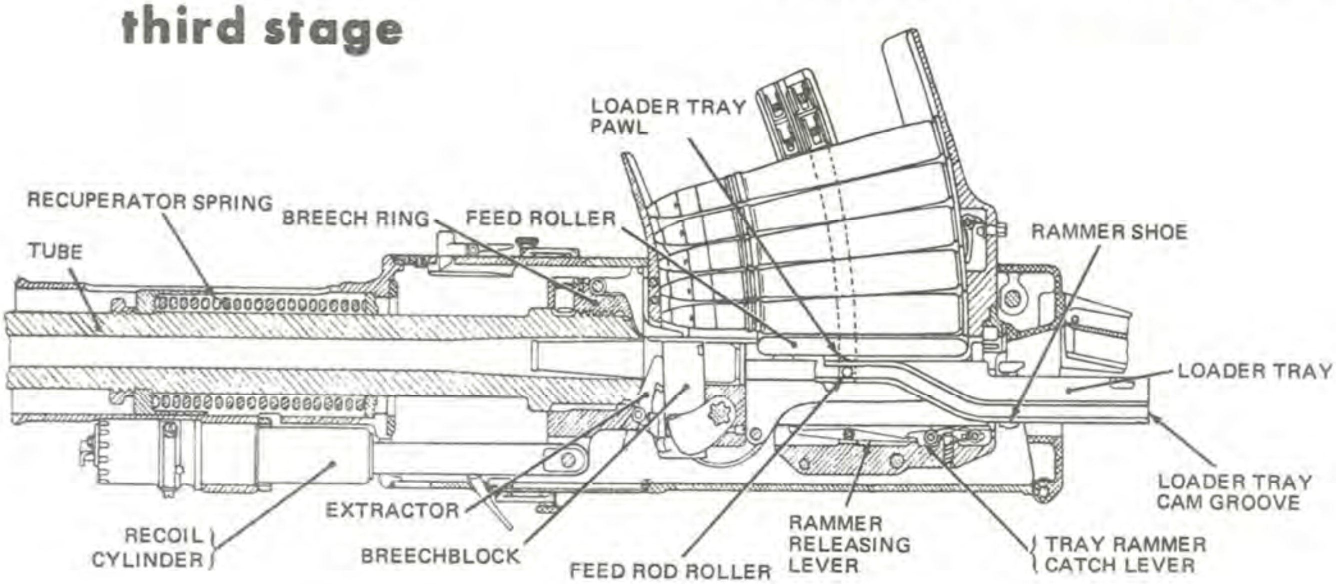


AUTOMATIC FIRING CYCLE–SECOND STAGE–BREECHBLOCK BEING LOWERED.

Figure 4-137.

40MM gun firing cycle

third stage



AUTOMATIC FIRING CYCLE–THIRD STAGE–BREECHBLOCK LOWERED AND CARTRIDGE CASE EXTRACTED.

Figure 4-138.

pawls are fully raised and the recoil has been stopped by action of the recuperator spring and the recoil cylinder; and the hook shaped head of the extractors are over notches on top of the breechblock.

The following is a description of the counterrecoil action of the firing cycle:

4. Fourth stage. (See figure 4-139.)

a. Under pressure of the recuperator spring, the barrel, breech ring and loader tray start moving into battery position and the breechblock moves up, by action of the breech closing spring, until stopped by the extractors. The tray rammer catch lever engages the rammer shoe, holding the rammer shoe and compressing the rammer spring as the battery position is attained. Ammunition in the automatic loader holds the feed control to the rear.

Note

The trigger rammer catch lever is not engaged if the firing mechanism is depressed and the fire selector switch is set to AUTOMATIC FIRE.

b. As the loader tray moves forward, the loader tray pawls engage lugs on the side of the feed roller catchhead assembly. This rotates the catchhead as the feed rod rollers enter a declined portion of the cam grooves. Cartridges are engaged by the feed pawls, forcing them down so that the lowest cartridge rotates the feed rollers as it passes through them, dropping onto the loader tray and into the rammer levers. A cam slot, on top of the loader tray forces the head of the rammer levers in as they grip the rim of the cartridge.

5. Fifth stage. (See figure 4-140.)

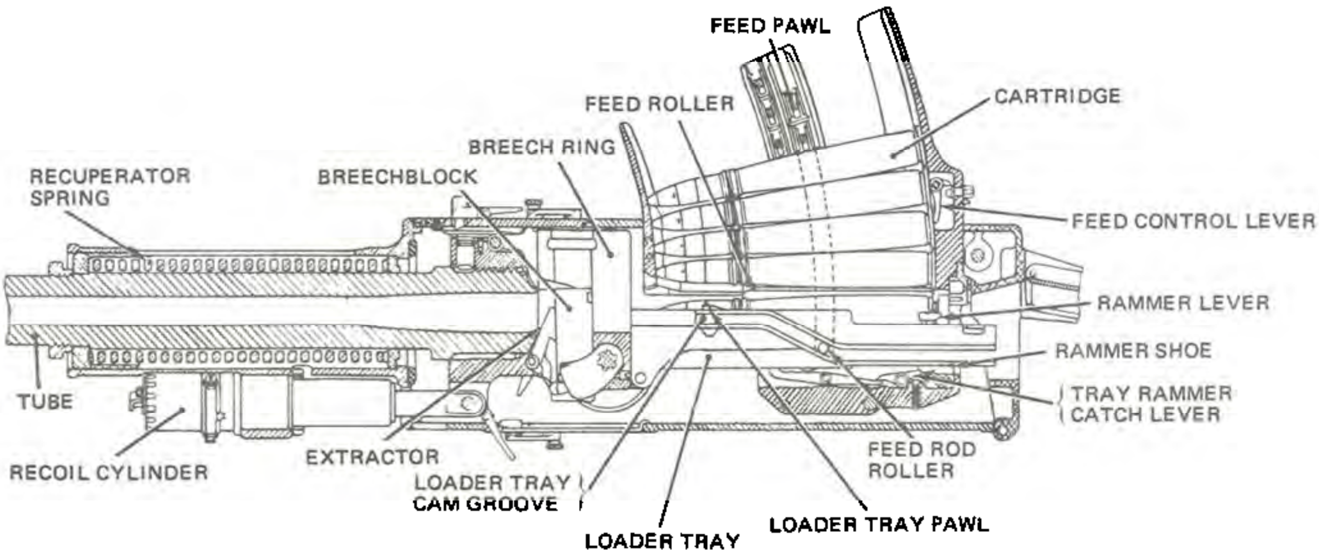
a. Catchheads relock the feed rollers as the feed rollers complete a quarter-turn and the catchheads are returning to normal by action of the tension springs. Approaching the end of the firing cycle, projections on the bottom of the loader tray trip the rammer releasing lever, freeing the rammer shoe from the rammer catch lever.

b. As the rammer spring pulls the rammer shoe forward, carrying the cartridge with it, the rammer nears the end of travel and the cam slots on top of the loader tray force the rammer levers outward, releasing the cartridge. The cartridge is then thrown forward, through a U-shaped channel (on top of the breechblock) into the gun chamber.

6. Sixth stage. (See figure 4-141.)

a. After the cartridge passes through the top of the breechblock, the rim of the cartridge engages the extractors, pulls them forward and releases the breechblock. The breech closing spring then forces the breechblock up and its beveled front surface forces the cartridge into the chamber.

fourth stage



AUTOMATIC FIRING CYCLE–FOURTH STAGE–CARTRIDGE ON LOADER TRAY.

Figure 4-139.

b. As the breechblock reaches its highest position, the right inner crank contacts the inner cocking lever plunger and moves it to the left. This releases the inner cocking lever and permits the firing pin to be thrust forward by the firing spring, firing the cartridge.

Figure 4-142 shows a complete firing cycle of the 40MM gun.

105MM CANNON (M102).

One 105MM cannon (see figure 4-143) is intalled in the left paratroop door. Ammunition storage is provided by racks located on the right hand side of the aircraft between the operator's compartment and the right paratroop door. Additional racks are installed forward of the operator's compartment. Each round of ammunition must be loaded individually by hand.

Cannon.

The cannon tube is screwed into the breech ring and is mounted in the recoil sleigh assembly. Cannon firing and status circuits allow monitoring of weapon during loading, arming, and firing operations. The control panels contain necessary circuitry for firing the weapon.

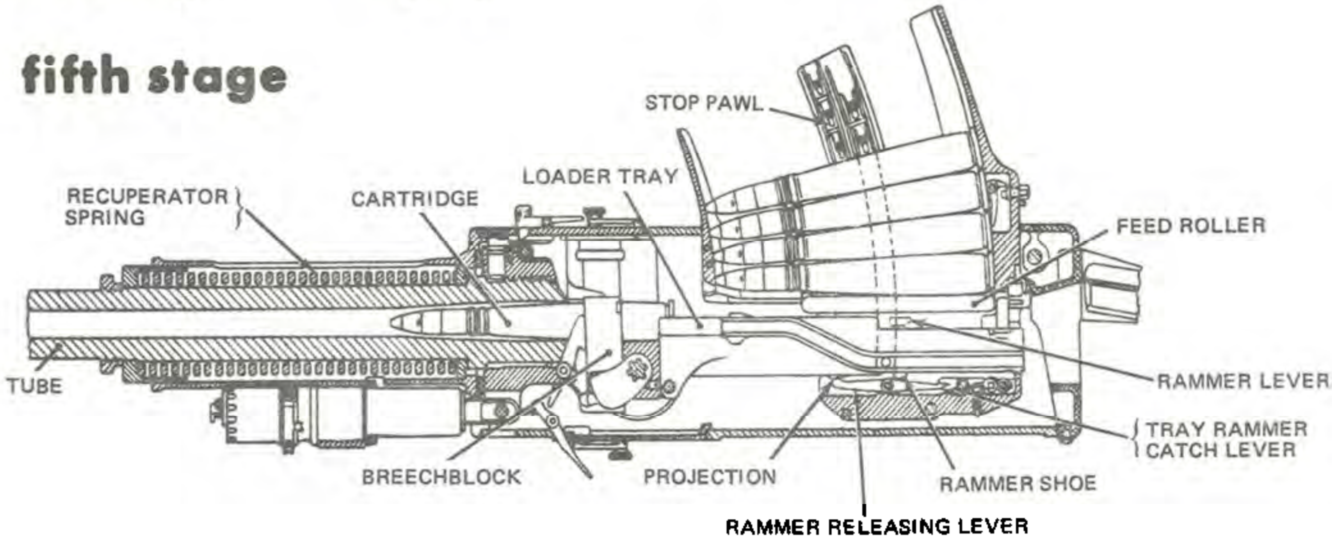
The breech mechanism is housed in the breech ring and is composed principally of the breechblock operating handle, operating crank and shaft, extractors and cocking lever. The breechblock houses the percussion mechanism which is also considered a part of the breech mechanism.

The breechblock is a vertical sliding wedge and is manually operated by means of the breechblock operating handle.

When the handle is unlatched and rotated to the rear, the breechblock drops, moves the extractors to the rear extracting the fired cartridge case. The downward motion of the breechblock also cocks the percussion mechanism. The extractors remain in the rearward position to lock the breechblock in the open position. When a round is inserted in the chamber, the extractors are pushed forward unlocking the breechblock, and allowing the operating handle to be rotated forward, closing the breech. A coil spring assists in raising the breechblock. When the breechblock is completely closed, the operating handle engages and is locked in the closed position by a catch located in the operating handle stop.

40MM gun firing cycle

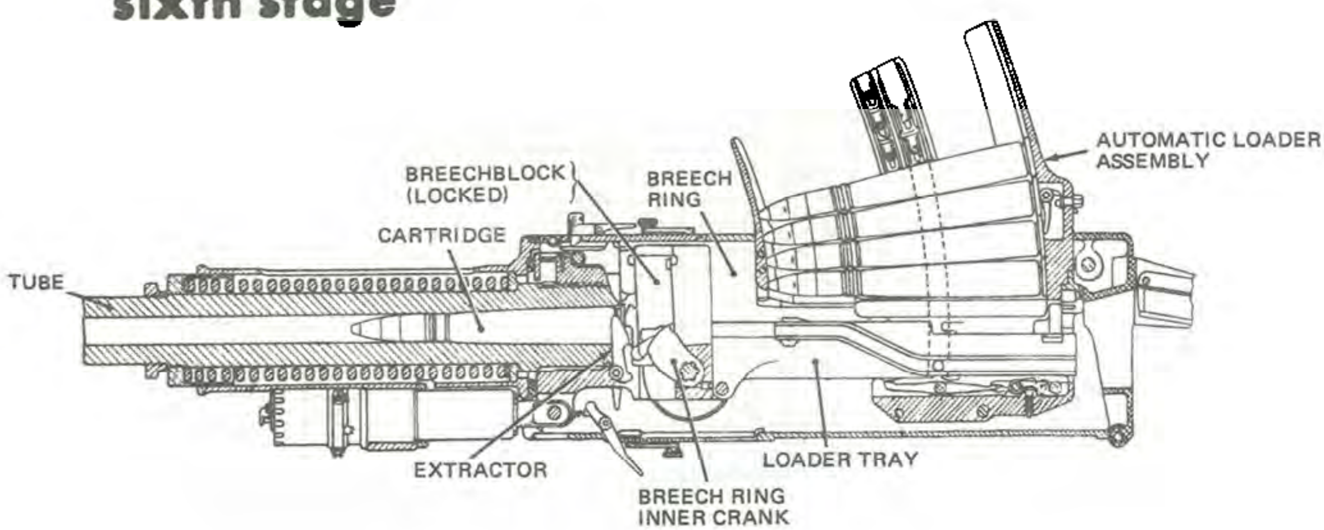
fifth stage



AUTOMATIC FIRING CYCLE—FIFTH STAGE—CARTRIDGE BEING RAMMED.

Figure 4-140.

sixth stage



AUTOMATIC FIRING CYCLE—SIXTH STAGE—CYCLE COMPLETED AND GUN IN ACT OF FIRING.

Figure 4-141.

complete 40MM gun firing cycle

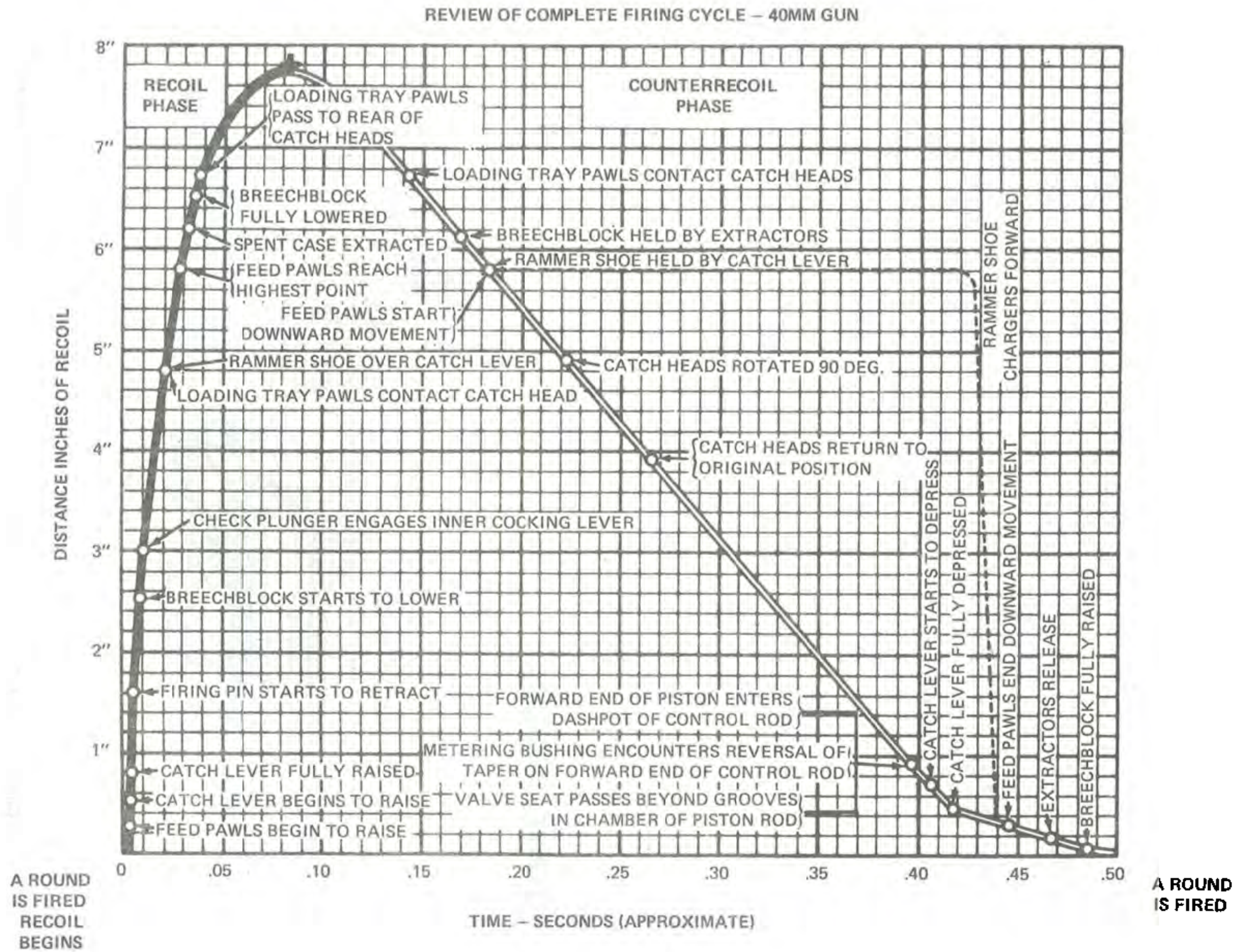
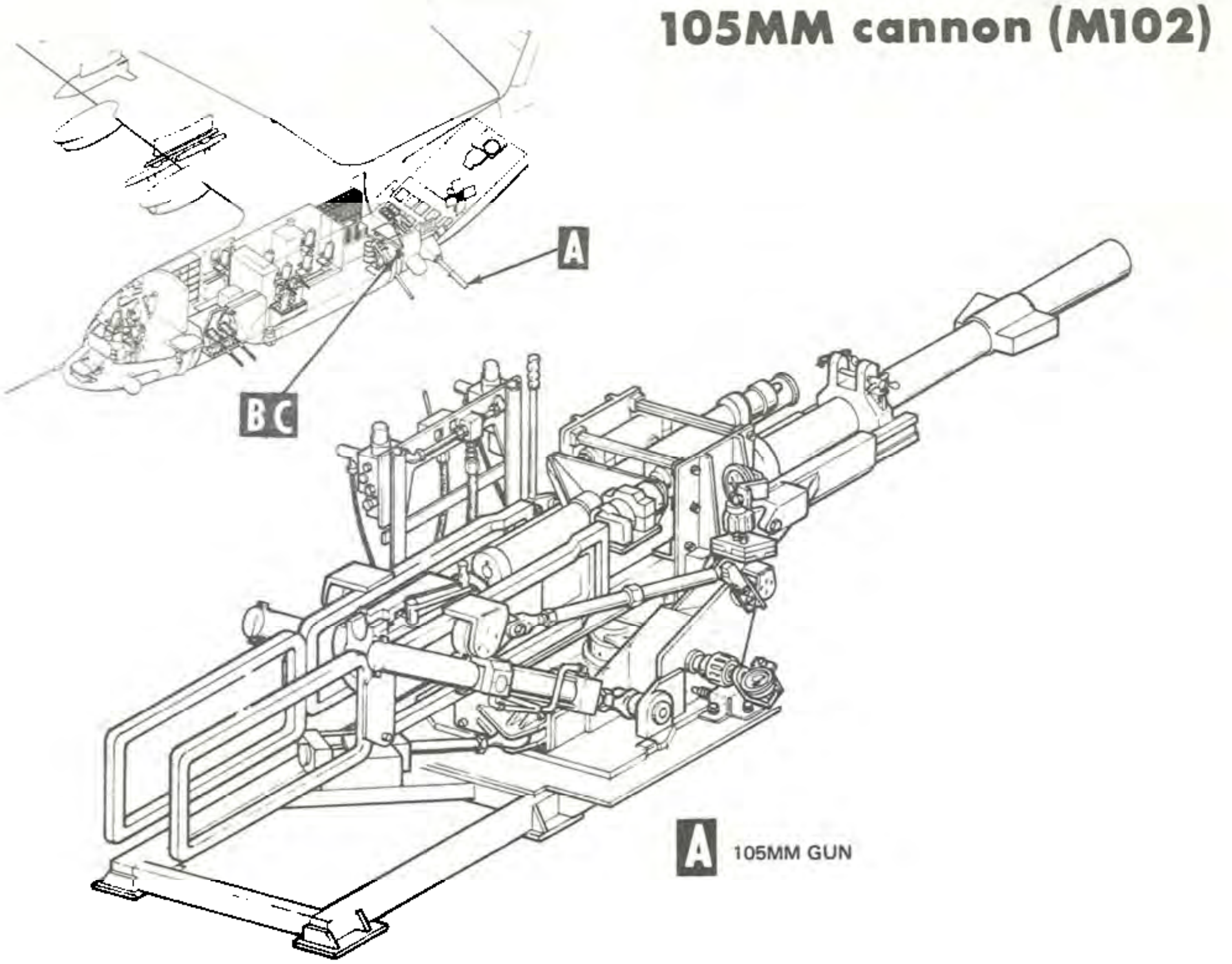
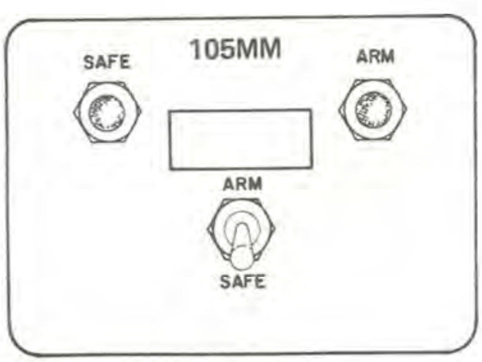


Figure 4-142.

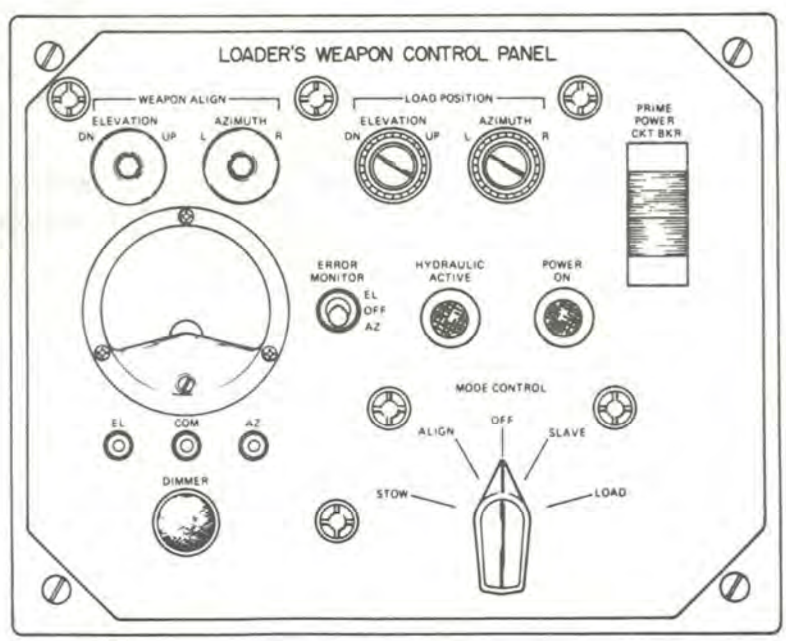
105MM cannon (M102)



A 105MM GUN



B SAFING AND ARMING SWITCH



C LOADER'S WEAPON CONTROL PANEL

Figure 4-143.

Recoil Mechanism.

The recoil mechanism is composed of the recoil sleigh assembly, the recuperator cylinder, and the recoil cylinder. These parts, together with the cannon which is securely locked to the sleigh assembly, are known as the recoiling parts. The recoil mechanism serves to absorb the energy and shock of firing by gradually checking and stopping the rearward motion of the recoiling parts. It returns them into battery position during counterrecoil, provides proper buffing action to prevent slamming, and holds them in battery position by force of compressed nitrogen in the recuperator cylinder. It is of the hydropneumatic, recoil type, employing a floating piston to separate the recoil oil from the nitrogen gas.

The recoil mechanism is designed to operate properly when correct recoil oil reserve is forced into the system so as to separate the floating piston diaphragm from the regulator, thereby transmitting the pressure of the nitrogen gas through the floating piston to the oil column. The pressure of the recoil oil acting on the recoil piston holds the recoiling parts in the battery position. Correct recoil oil reserve exists when the end of the oil index indicator rod is flush with the front face of the recuperator cylinder front head. Whenever, the amount of reserve oil is less than that prescribed, a rod attached to the diaphragm moves forward with the floating piston diaphragm to cause the indicator rod to protru , indicating insufficient reserve oil. Sufficient operational oil reserve is present when the indicator protrudes five-thirty-seconds of an inch (or less) from the regulator housing; however, proper oil reserve should be established at the first opportunity.

Buffer Striker Plate Assembly (BSPA).

The purpose of the BSPA is to reduce the magnitude of the counterrecoil shock to the aircraft frame. The BSPA consists of two spring return adjustable hydraulic shock absorbers (snubbers) mounted on the gun box. A striker plate is mounted on the sleigh assembly. Near the completion of the counterrecoil stroke, the striker plate engages the twin snubbers, which in turn ease the gun back into the battery position.

Tube Retraction System.

The tube retraction system consists of a double action, hand operated, hydraulic piston pump and single actuator. Its function is to place the cannon in a recoiled position and hold it there.

ARMAMENT CONTROLS.

Figure 4-144 shows the marking and location of all armament controls.

Pilot's Trigger.

The pilot's trigger is located on the left side of the pilot's control wheel. When this switch is depressed (other switches also in proper position), the guns can be fired.

Master Arm Switch Panel.

The master arm switch is located in the flight control pedestal and provides 28 vdc to the master arm relay. The guns cannot be fired unless this switch is in the ARM position.

Gunfire Inhibit Control. (FCO Console).

Placing switch to INHIBIT, prohibits firing of all guns.

Gun Control Panel. (E Station).

The gun control panel controls 7.62MM, 20MM, 40MM and 105MM guns. Each gun has an arm-safe switch, an arm indicator, and a safe indicator. The arm indicator lights red when guns are armed; safe indicators light green when in SAFE. Two rate switches select a HI or LOW rate of firing for 7.62MM guns.

Gun Control Panel Lighting. (E Station).

Controls light intensity of arm/safe indicators on gun control panel and safing and arming assemblies.

Gun Status Panel. (FCO Console).

Armed indicators light red when guns are ARMED. Safe indicators light green when guns are SAFE. Light intensity is controlled by the gun status light control on the gun mode selector panel directly below the gun status panel.

Safing And Arming Assembly. (Cargo Compartment Near Each Gun).

Permits airborne gunner to stop firing of a gun. The arm indicator lights red when the switches on the safing and arming assembly, master arm panel, and gun control are in the ARM position. The safe indicator lights green when any of the above switches are on SAFE and the guns cannot be fired.

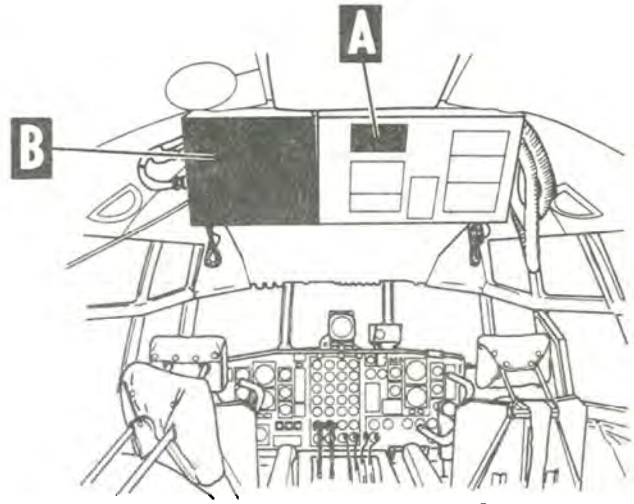
Gun Mode Selector.

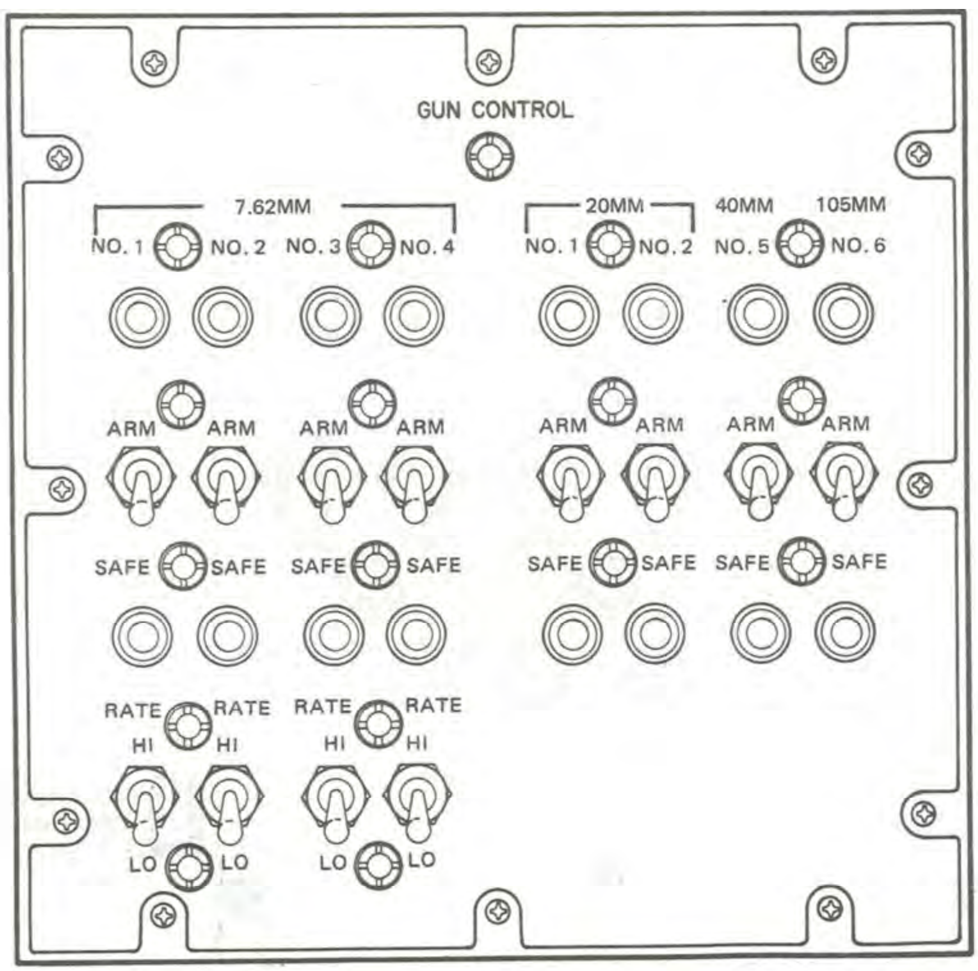
Allows selection of gunfire requirement options. Selections also affect display symbology and weapon aiming modes.

MANUAL and SEMI AUTOMATIC modes require minimum control requirements for gunfire impulse. (See figure 4-89.)

armament controls

A GUN CONTROL PANEL LIGHTS

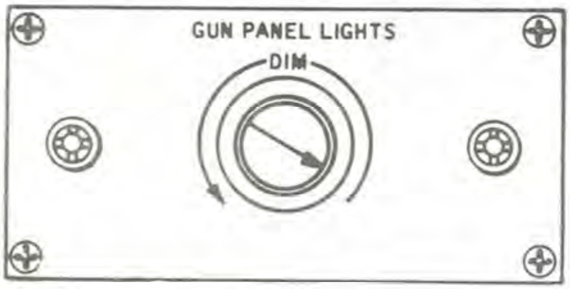




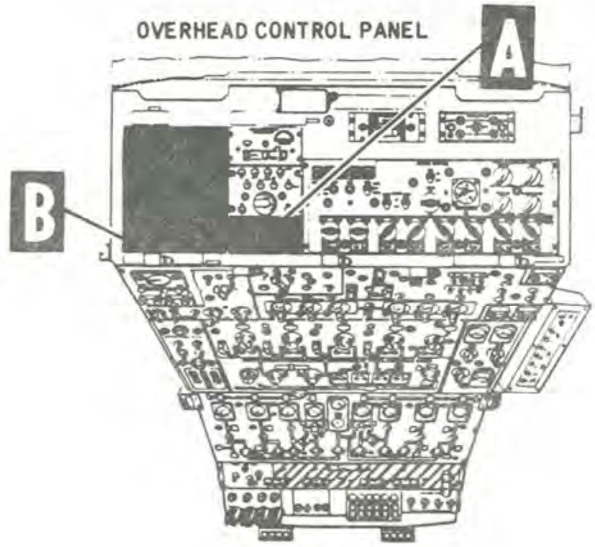
B GUN CONTROL PANEL

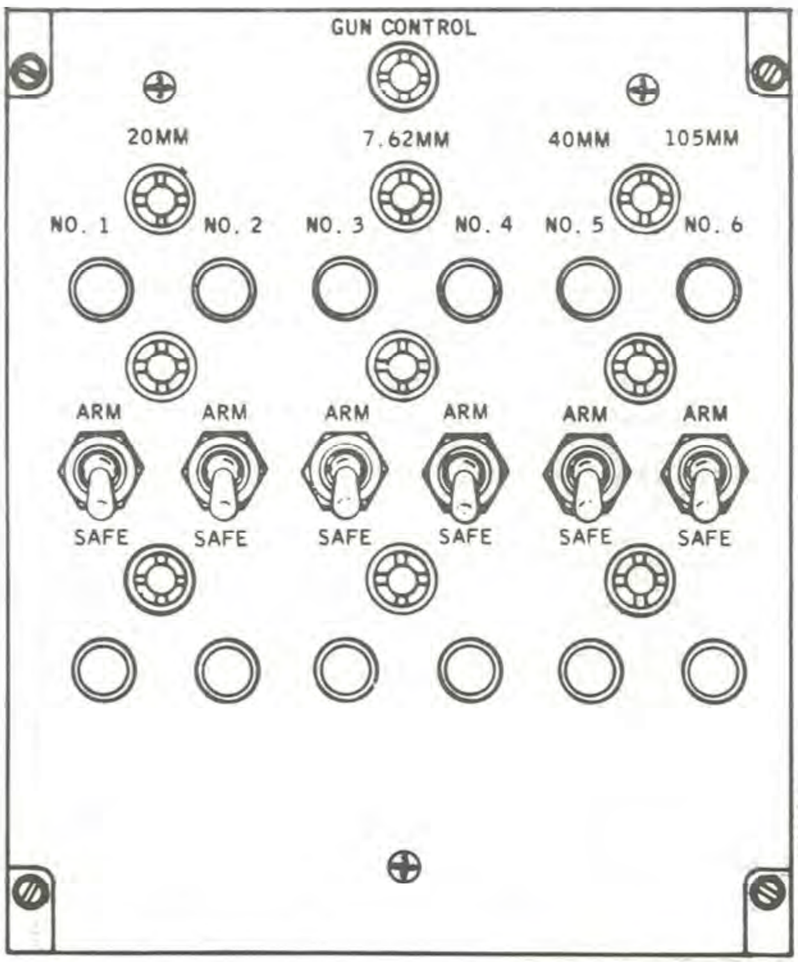
Figure 4-144. (Sheet 1 of 6)

armament controls



A GUN CONTROL PANEL LIGHTS



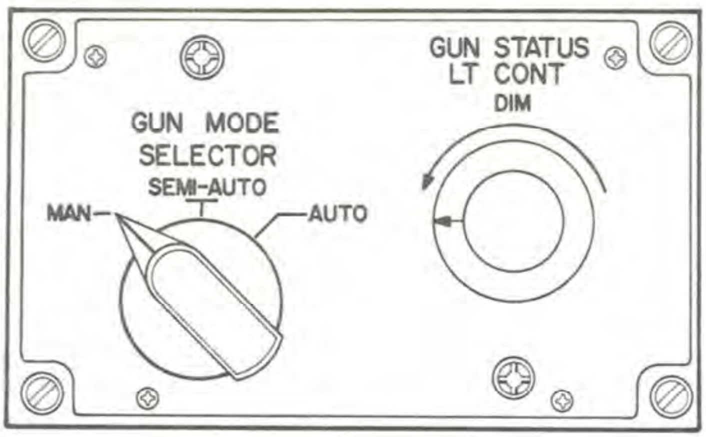


B GUN CONTROL PANEL (AIRPLANES MODIFIED BY T.O. 1C-130-949)

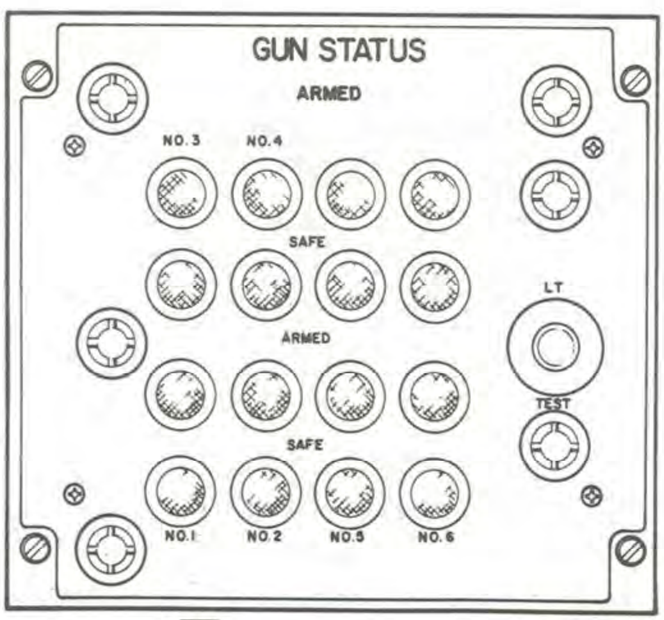
Figure 4-144. (Sheet 2 of 6)

armament controls

FCO CONSOLE



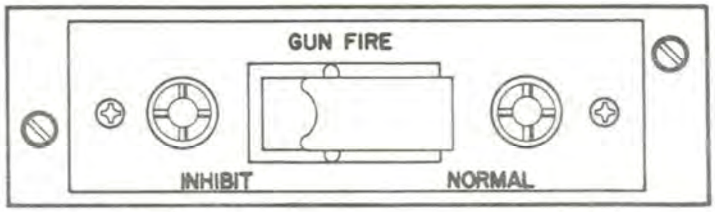
C GUN MODE SELECTOR PANEL



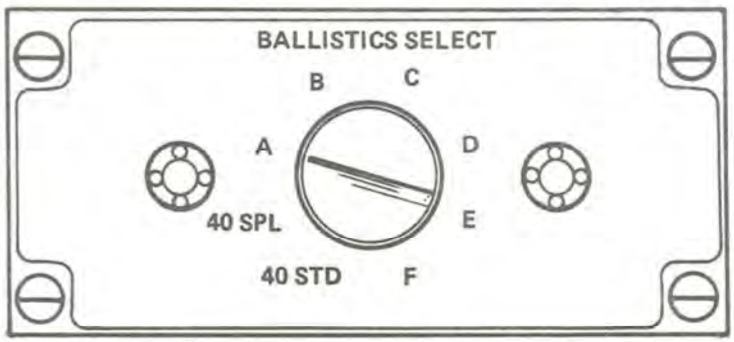
D GUN STATUS PANEL

Figure 4-144. (Sheet 3 of 6)

armament controls



E GUNFIRE INHIBIT SWITCH PANEL

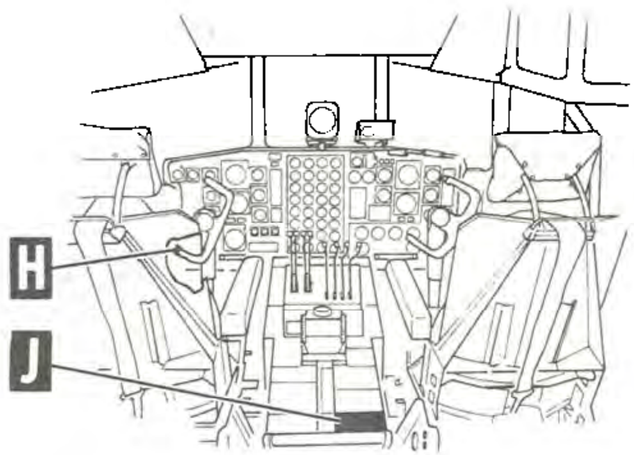


F BALLISTICS SELECTOR PANEL

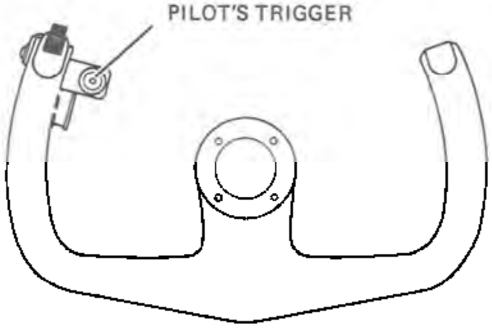
G COMPUTER GUN DISCRETE CONTROL PANEL

Figure 4-144. (Sheet 4 of 6)

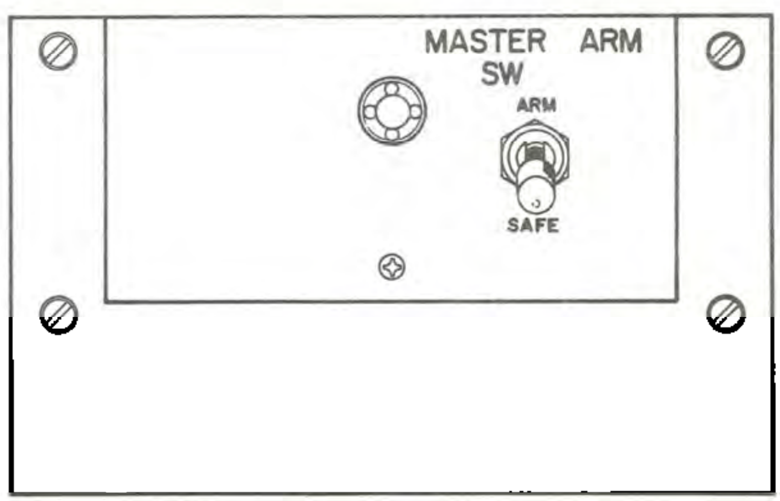
armament controls



FLIGHT CONTROL PEDESTAL



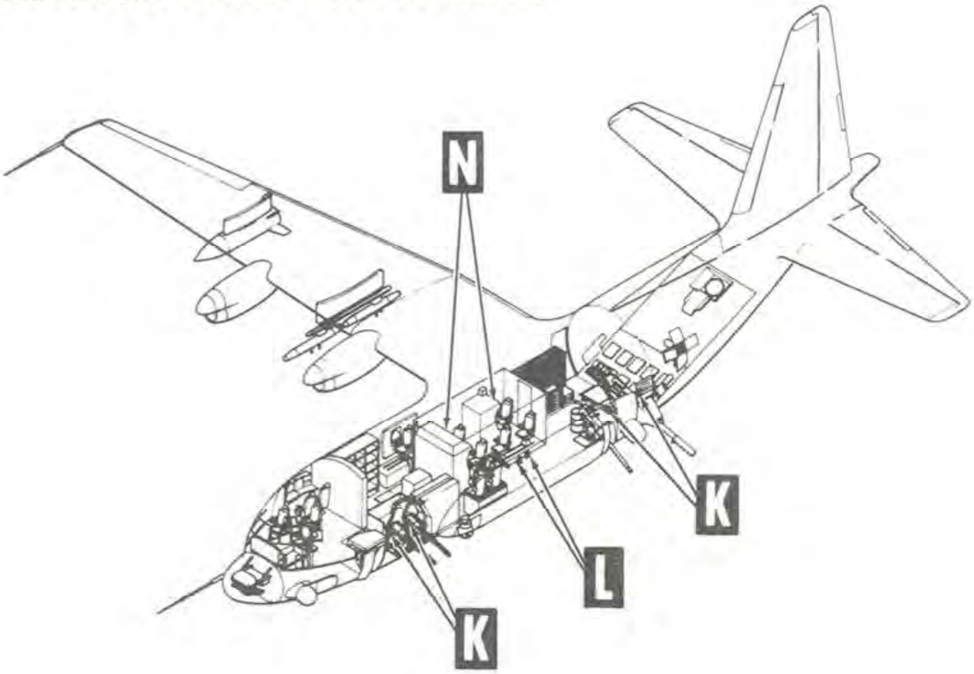
H CONTROL COLUMN

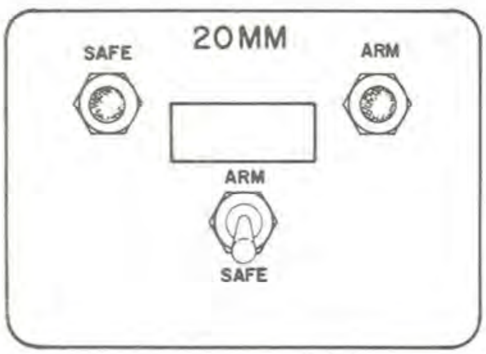


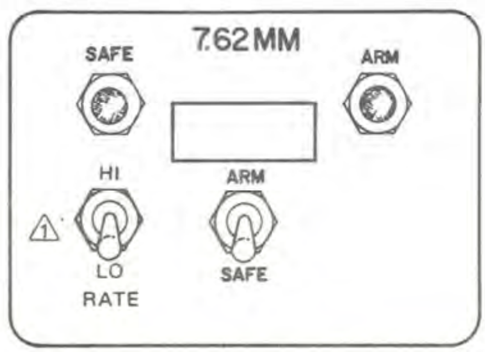
J MASTER ARM SWITCH PANEL

Figure 4-144. (Sheet 5 of 6)

armament controls



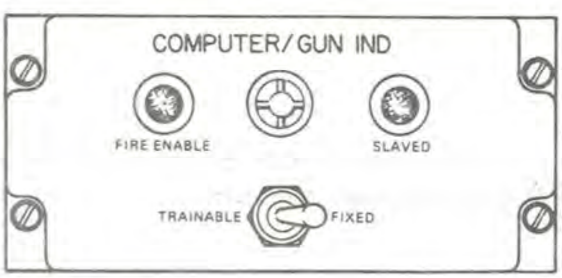




K SAFING AND ARMING (20MM, 40MM AND 105MM TYP)

L RATE, SAFING, AND ARMING (7.62MM)

1 AIRPLANES MODIFIED BY T.O. 1C-130-949.



M COMPUTER/GUN INDICATOR CONTROL PANEL

N READY/FIRE CONTROL PANEL

Figure 4-144. (Sheet 6 of 6)

AUTOMATIC mode requires additional computer fire enable in order to pass gunfire impulse. See figure 4-89 for computer fire enable requirements.

Note

If the gun mode selector is positioned to MANUAL or SEMIAUTO, nominal commanded angles will be discreted for the selected TGM.

TRAINABLE GUN INTERFACE.

Computer Gun Discrete Control. (FCO Console).

Provides ballistics to FC computer for type gun selected, and electronic control for the loader's weapon control (LWCP). Priority for computer discrete is the highest caliber weapon selected. The present gun delta used will be for the highest number weapon selected.

Note

In trainable operation if type weapon selected on the gun control panel (E) and on the computer gun discrete panel are not the same, or if No. 5 and No. 6 guns are selected simultaneously, the computer will not issue a gun fire discrete signal.

Ballistic Selector Panel. (FCO Console).

Inputs type of ammunition (40MM or 105MM) to the tactical computer which provides ballastic programming for the FCS. If the ballastics selector is set in conflict with the computer gun discrete control, the computer discrete control has priority and assumes standard ballastics.

Ballastic switch positions:

40 STD	40MM HE
40 SPL	40MM MISCH
A, D, E, F	105MM HE
B	105MM WP
C	105 ANTI-PERSONNEL

Computer/Gun Indicator. (FCO Console).

Selects FIXED or TRAINABLE mode for TGM selected. In FIXED the weapon is slaved to computer commanded lag/depression angles. In TRAINABLE, the TGM is slaved to primary sensor, corrected for ballistics and flight variable. A green slaved indicator lights when the TGM servo is within 1/2 mil of commanded angles. An amber FIRE ENABLE lights whenever computer firing conditions are satisfied.

Note

No effect in manual or semi-automatic gun mode.

Ready/Fire Control Panel. (TV, IR, EWO STA).

Provides an amber light to sensor operators. In FIXED mode (all weapons) the light is lit whenever the primary aimline (PA) and computed impact point (CIP) are within limits set into fire control system. In TRAINABLE mode, the light is lit when the PA and CIP are within limits set into the fire control system and the pilot is depressing consent (trigger). The pushbutton on the panel is used to issue momentary consent when in trainable mode.

AFT CARGO DOOR AND RAMP SYSTEM.

Normal operation of the door and ramp is achieved by hydraulic pressure supplied through the auxiliary hydraulic system (figure 4-145); alternatively, the operating pressure can be supplied in an emergency by handpump connected to the reservoir of the auxiliary hydraulic system. Control of the system is accomplished electrically or manually from a ramp control panel, located aft of the right paratroop door.

Note

The system provides an alternate pressure to extend the nose gear in emergencies, and to provide emergency brake hydraulic pressure.

AFT CARGO DOOR AND RAMP CONTROLS.

Aft Cargo Door Control Switch.

An aft cargo door control switch is located on the ramp control panel (figure 4-146) aft of the right paratroop door. This three-position (CLOSE, NEUTRAL, OPEN) toggle switch, spring-loaded to the NEUTRAL position, controls the normal ground operation of the aft cargo door. When the switch is held in the OPEN position, the aft cargo door control valve is energized by 28-volt dc power through the ramp and ADS control circuit breaker on the aft fuselage junction box. The control valve directs hydraulic pressure to the open side of the aft cargo door actuating cylinder to open the aft cargo door. As the door reaches the open position, it engages the aft cargo door uplock assembly which latches mechanically. When the switch is held in the CLOSE position, hydraulic pressure is directed to the aft cargo door uplock cylinder which unlatches the uplock. The control valve also directs pressure to the close side of the aft cargo door actuating cylinder, and the door swings downward to the closed position and locks in place. When the switch is released, the aft cargo door circuit de-energized and the valves return to a neutral position.

Ramp Control Switch.

A ramp control switch is located on the ramp control panel (figure 4-146) aft of the right paratroop door. This three-position (RAISE, NEUTRAL, LOWER) toggle switch, spring-loaded to the NEUTRAL

aft cargo door and ramp hydraulic system

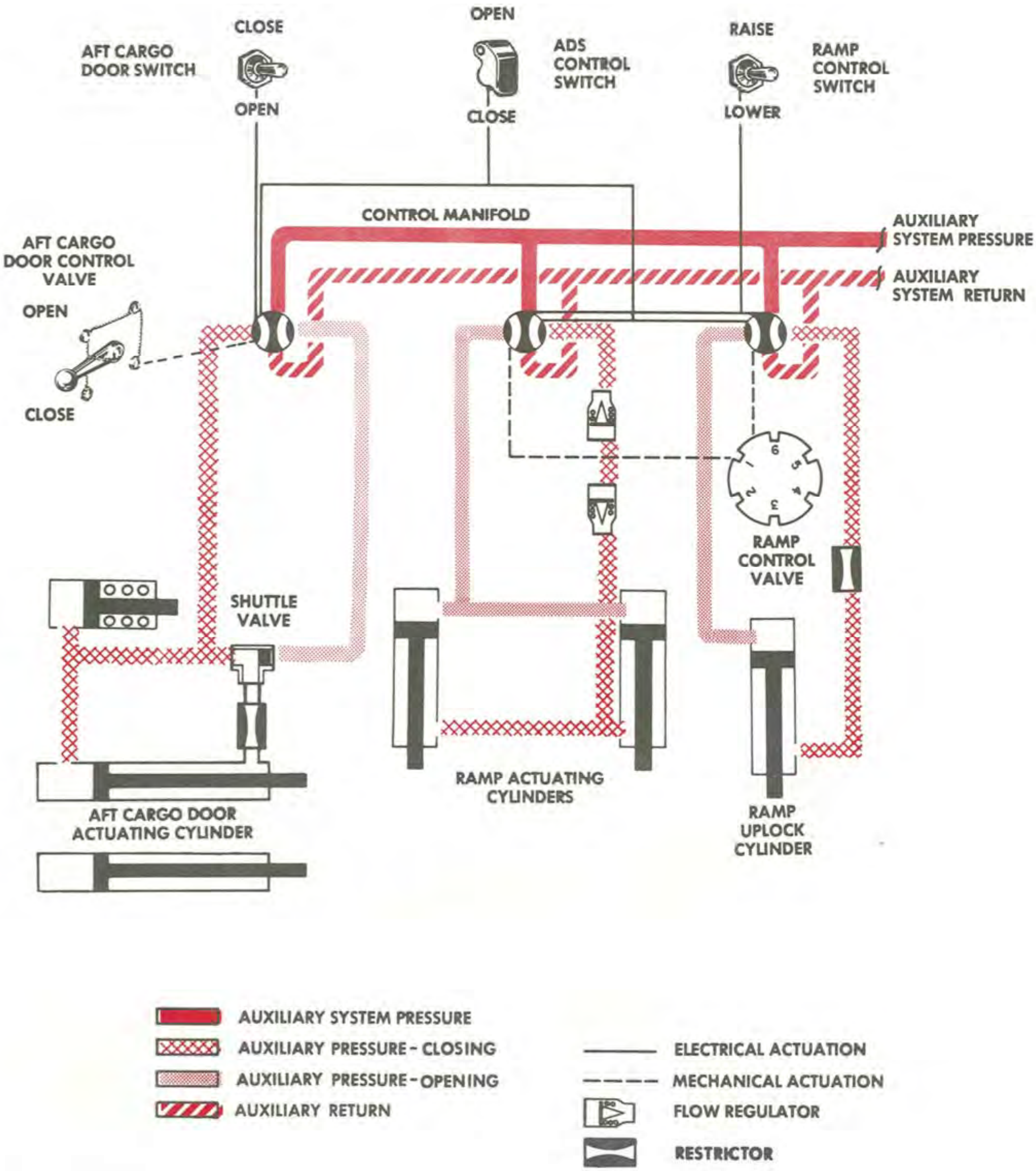


Figure 4-145.

aft cargo door and ramp controls typical

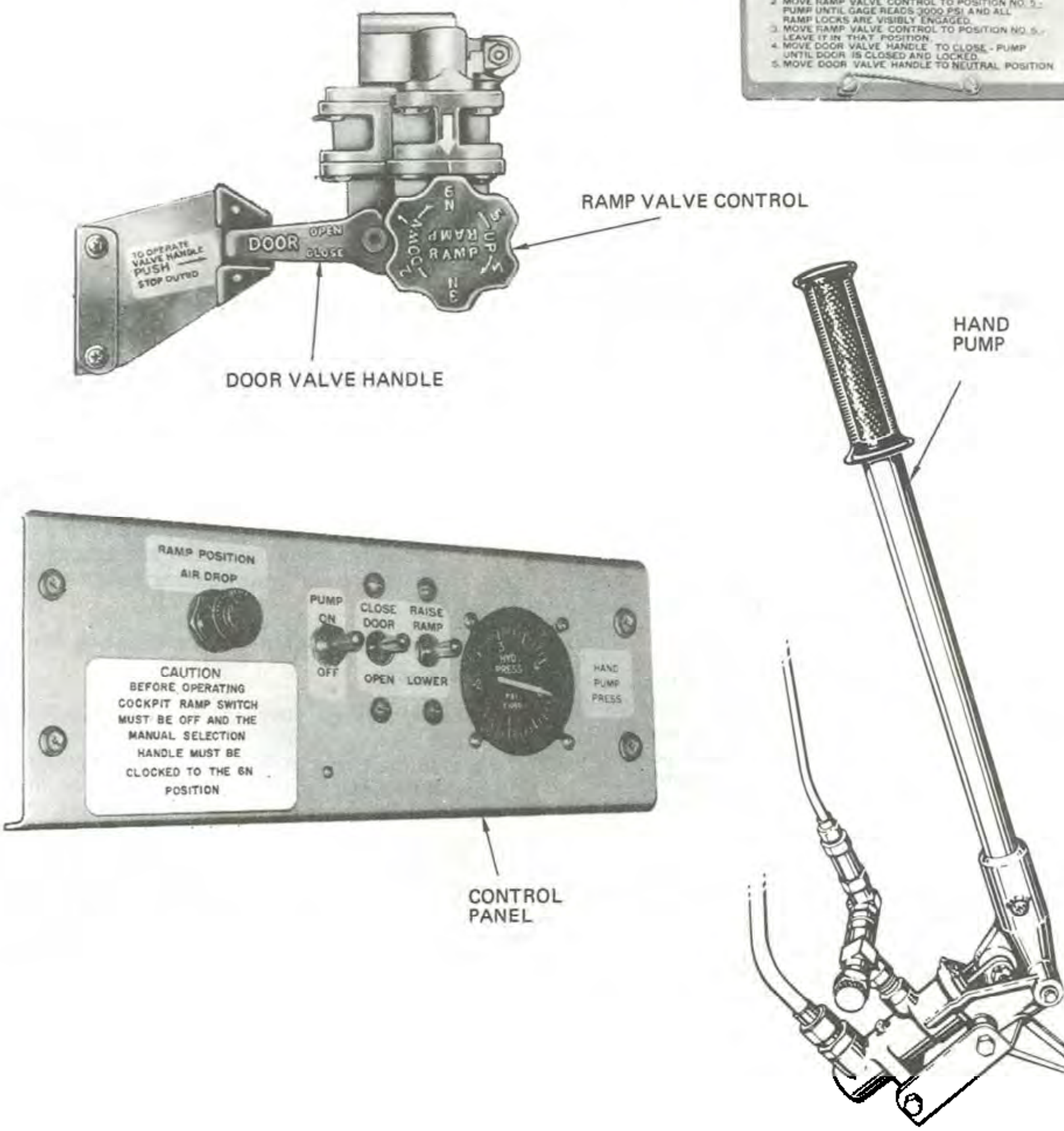


Figure 4-146.

position controls the normal ground operation of the ramp. When the switch is held in the LOWER position, the ramp control valve is energized by 28-volt, dc power through the ramp and ADS control circuit breaker on the aft fuselage junction box. The control valve directs hydraulic pressure to the up side of the ramp actuating cylinders and to the uplock side of the ramp uplock control valve, until the uplock is unlatched. The hydraulic pressure then is directed to the down side of the ramp actuator cylinders to lower the ramp. When the switch is held in the RAISE position, the ramp control valve directs hydraulic pressure to the up side of the ramp actuating cylinders to raise the ramp. At the same time, pressure is directed into the unlock side of the ramp uplock control valve to unlock the ramp uplock until the ramp is raised into the normal raised position. Pressure then is directed to the lock side of the ramp unlock control valve to lock the ramp in place. When the switch is released, the ramp circuit is deenergized, and the valves return to a neutral position.

Ramp Manual Control Knob.

The ramp manual control knob (figure 4-146) is a rotary selector located above the ramp control panel.

It may be set to any of six numbered positions: DOWN -1 (unlock) and 2 (lower); N (neutral -3; UP - 4 (raise) and 5 (lock); N (neutral) 16. These settings of the knob manually position the system valves which control flow, supplied either from the handpump or the auxiliary hydraulic system electric pump, to and from the ramp actuating and ramp uplock cylinders. When the knob is placed in position 1, hydraulic pressure is directed to the up side of the ramp extension cylinders to raise the ramp off the up locks; then pressure is directed to the unlock side of the ramp uplock cylinder to unlatch the ramp uplocks. When the knob is moved to position 2, pressure is directed to the down side of the ramp actuating cylinders to lower the ramp. Position 3 on the selector knob is a neutral position. When the knob is moved to position 4, pressure is directed to the up side of the ramp actuating cylinders to raise the ramp. Position 5 directs pressure to the lock side of the ramp uplock cylinders to lock the ramp in the closed position. Position 6 on the selector knob is a neutral position; the knob should be left in this position when the ramp is closed and not being operated.

Aft Cargo Door Manual Control Valve Handle.

The aft cargo door manual control valve (figure 4-146) has three positions: OPEN, NEUT (center), and CLOSE. When the handle is set to OPEN, the valve directs hydraulic pressure, either from the handpump or the auxiliary hydraulic system electric pump, to the up side of the door actuating cylinder, thus raising and opening the door. On reaching the fully open position, the door is secured by a spring-loaded uplock. When the handle is set to CLOSE, hydraulic pressure, either from the handpump or the auxiliary system electric pump, is first directed by the valve to the uplock cylinder to release the uplock engagement of the door, and then is directed to the down side of the door actuating cylinder to lower and close the door. Setting the handle in the NEUT (center) position shuts off hydraulic pressure to the door operating system and leaves the control valve in a position from which it can be actuated by selection at the aft cargo door control switch.

WARNING

- Caution must be taken when using the manual control valve handle to open/close aft cargo door. The valve handle must be placed in the up position to open the aft cargo door.
- The aft cargo door manual control valve handle and the ramp manual control knob must always be placed at the NEUT position when manual operation is not desired, otherwise the door and ramp may open or close when the auxiliary hydraulic pump is turned on.

Auxiliary Hydraulic System Handpump.

The auxiliary system handpump (figure 4-146), just below the ramp control panel, provides an alternative pressure source to operate the aft cargo door and ramp in an emergency.

Note

The handpump can also be used to provide alternative pressure to operate the nose gear for emergency extension and emergency pressure for main landing gear brakes.

Aft Cargo Door Uplock Emergency Manual Releases.

The aft cargo door uplock manual releases (figure 4-147) are mechanical levers intended for emergency use in the event of failure of the hydraulic system to release the spring-loaded uplock. The levers, connected by a system of cables and pulleys to the door uplock mechanism, is mounted on the outboard side of the tubular strut between the toilet and urinal, aft of the left paratroop door. The levers normally stowed in the vertical (locked) position, pivots forward and downward when pulled to release the door uplock mechanism. The levers resume the vertical position when it is released.

Auxiliary Hydraulic System Pump Switch.

A two-position (ON, OFF) toggle switch, located on the ramp control panel, is used to turn the auxiliary hydraulic system electrically-driven pump on and off.

aft cargo door uplock manual release

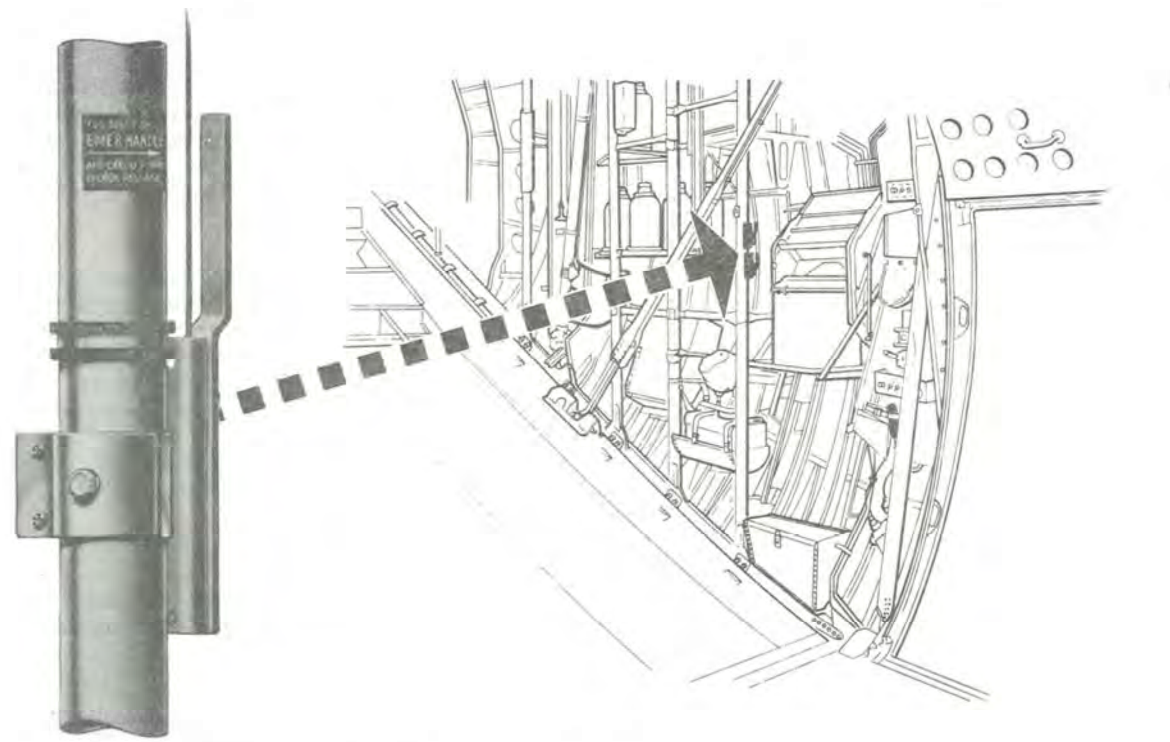


Figure 4-147.

Note

If this switch is in the ON position the auxiliary pump cannot be turned off from the cockpit.

Aft Cargo Door and Ramp Indicators.

Indicators are provided to show auxiliary hydraulic system pressure, engagement of the cargo door in the uplock mechanism, and open positions of the ramp and door for airdrop operations. The pressure indicators are a gage on the ramp control panel and another on the hydraulic control panel; the door and ramp position indicators are lights on the ramp control panel; and the uplock engagement indicator is a mechanically operated metal flag, illuminated by a red inspection light, attached to the aft cargo door uplock mechanism.

PRESSURE GAGES.

The pressure gages, one mounted on the ramp control panel (figure 4-146) and the other on the hydraulic control panel on the copilot's instrument panel, register the pressure of the auxiliary hydraulic system. The gage located on the ramp control panel is direct indicating, while the one on the copilot's instrument panel is electrically operated. The gage on the ramp control panel, although registering the system pressure supplied either by the electric-driven pump or the handpump, is intended primarily for use during handpump operations and is identified as such on the panel.

RAMP POSITION AIRDROP LIGHT.

A ramp position airdrop light is located on the ramp control panel (figure 4-146) aft of the right paratroop door. It is a press-to-test light which illuminates when the ramp is in the airdrop position and the aft cargo door is open and locked. It is energized by 28-volt dc power through the ramp circuit breaker on the aft fuselage junction box. This press-to-test light will not illuminate when pressed unless the aft anchor arm supports are in the STOWED (raised) position.

RAMP AND DOOR OPEN LIGHT.

A ramp and door open light is located on the flight control pedestal. This push-to-test light illuminates when the aft cargo door is fully open and the ramp is lowered to the AIRDROP position. This light is energized through the ramp circuit breaker on the aft fuselage junction box.

AFT CARGO DOOR UPLOCK INDICATOR.

The aft cargo door uplock indicator is a black metal flag with a yellow circle. The flag is attached to the uplock mechanism so that when the aft cargo door is open and locked in the up position, the flag will swing down to provide a visual indication. The flag is springloaded to return to the masked position whenever the aft cargo door is not locked in the up position. A red inspection light is installed to illuminate the flag indicator. This light is controlled by a two-position (ON, OFF) toggle switch on the aft fuselage junction box and another switch on the forward public address control panel.

Interlock Provisions.

An electrical interlock system is installed to prevent inadvertent damage to the aft cargo door and ramp while operating the illuminator and/or LAU-74/A. When the ramp door is in the full up position, a microswitch is actuated which provides a ground for a relay, energizing the relay and routing power to the drop solenoid of the ramp control valve. When the ramp is full down and the illuminator/LAU-74/A is deployed, a microswitch is actuated, providing a ground for a second relay which makes power available for illuminating the lamps. Another interlock provision will not allow the ramp to be raised unless the illuminator is retracted. Power for operation of the interlock system is supplied from the battery bus. Circuit breaker protection is located on the pilot side circuit breaker panel and the cargo compartment dc circuit breaker panel.

AFT CARGO DOOR AND RAMP OPERATION.

The aft cargo door and ramp can be operated by either the electrically driven pump or handpump of the auxiliary hydraulic system. The valves can be positioned by electrical selection or manual selection.

Operation of Aft Cargo Door and Ramp with Electrically-Driven Pump Pressure.

Operation of the aft cargo door and ramp, using pressure from the electric-driven pump in the auxiliary hydraulic system, can be accomplished through the switches on the ramp control panel (figure 4-146).

CAUTION

The ramp and door control switch must be set to OFF, and the ramp manual control knob, above the ramp control panel must be set at the 6N (neutral) position before operating the pump switch on the ramp control panel.

With the pump switch set to ON, the aft cargo door is opened by holding the aft cargo door control switch in the OPEN position until the door is fully opened and retained by the uplock; the ramp then is moved to the desired position by holding the ramp control switch at LOWER.

Note

The ramp can be stopped at any position by releasing the ramp control switch. The cargo door will free-fall back to the closed position if the door control switch is released prior to the moment the door reaches the up-and-locked position.

The ramp is closed by holding the ramp control switch in the RAISE position until the ramp is up and locked.

CAUTION

Prior to raising the ramp, insure that all ramp locks are retracted.

Note

When being raised, the ramp can be stopped in any position by releasing the ramp control switch.

The door is closed by holding the cargo door switch to the OPEN position and pulling both the aft cargo door manual releases until the uplocks are released. After the uplocks are released, hold the cargo door switch to the CLOSE position until the door is closed and locked. (This procedure requires two people.)

Manual Operation of Aft Cargo Door and Ramp Handpump Pressure.

The aft cargo door and ramp can be operated manually through the auxiliary hydraulic pressure system by means of the handpump (figure 4-144) located below the ramp control panel. An instruction plate for handpump operation of the ramp and cargo door is installed on the side of the fuselage above the ramp control panel.

CAUTION

Before manual handpump operation, check that the pump switch on the ramp control panel is at the OFF position.

To open the aft cargo door and lower the ramp by use of the handpump, proceed as follows.

1. Move the aft cargo door manual control valve handle to OPEN, and operate the handpump until the door is up and locked.
2. Move the aft cargo door manual control valve handle to the NEUT (center) position.

3. Move the ramp manual control knob to the No. 1 (unlock) position; operate the handpump until the handpump pressure gage on the ramp control panel shows 3,000 psi and all the ramp locks are visibly disengaged.

4. Move the ramp manual control knob to the No. 2 (lower) position. Operate the handpump until the ramp is lowered and the handpump pressure gage registers 500 psi.

5. Move the ramp manual control knob to the 3N (neutral) position. Leave the knob in this position while loading and unloading.

CAUTION

Do not use the ramp for loading or unloading when the handpump pressure gage on the ramp control panel shows less than 500 psi. Serious damage may result if the locking action of the ramp cylinders is lost because of insufficient hydraulic pressure.

To close the aft cargo door and raise the ramp by using the handpump, proceed as follows:

6. Check that the pump switch, on the ramp control panel, is at the OFF position.

7. Move the ramp manual control knob to the No. 4 (raise) position, and operate the handpump until the ramp is fully closed.

8. Move the ramp manual control knob to the No. 5 (lock) position. Operate the handpump until the handpump pressure gage registers 3,000 psi and all ramp locks are visibly engaged.

9. Move the ramp manual control knob to 6N (neutral), and leave it in that position.

10. Move the aft cargo door manual control valve handle to OPEN position. Operate the handpump until the pressure gage reads a minimum of 500 psi, pull the aft cargo door uplock manual release to the unlock position, and move the manual control valve to NEUT. Door will free-fall.

11. Move the aft cargo door manual control valve handle to CLOSE, and operate the handpump until the door is locked.

12. Move the aft cargo door manual control valve handle to the NEUT (center) position. The handle does not have a positive stop at the NEUT (center) position, so it should be checked to ensure that it has not been inadvertently moved beyond this setting.

AIR DEFLECTORS.

An air deflector door, located on the right side of the fuselage just forward of the right paratroop door, forms the rear section of the main landing gear wheel well fairing. This air deflector opens approximately 15.5 inches to serve as a wind break for bailout. A three-position (OPEN, OFF, CLOSE) air deflector switch, located on the copilot's paratroop panel (figure 1-6), controls the air deflector. This switch has a guard that can be closed to cover the switch in either the OFF or CLOSE position. A warning light above the switch illuminates when the door is not completely closed. Placing the air deflector door control switch to the CLOSE position will cause the air deflector door to close. An emergency open switch is located forward of the right paratroop door for opening the air deflector door from the cargo compartment. The door cannot be closed from this position. The air deflector switch receives 28-volt dc power from the main dc bus through the paratroop air deflector circuit breakers on the copilot's lower circuit breaker panel.

The left paratroop air deflector has been removed from the aircraft; however, a fixed air deflector is located at each of the following positions: LLLTV/Laser, the six guns positions, GTC intake, 2 KW illuminator, and just forward of the aft scanner's bubble, a close-out deflector is located above the 105MM gun.

AERIAL REFUELING SYSTEM (AIRPLANES MODIFIED BY T.O. 1C-130-949)

The universal aerial refueling receptacle/slipway installation (UARRSI) shown in figure 4-148 contains the receptacle to provide the AC-130H with the capability for receiving fuel while airborne from tanker-type airplanes. The UARRSI unit is flush-mounted on top of the fuselage just aft of the overhead control panel in the flight deck area. The intake fuel line from the unit receptacle is routed aft and overhead to the right side through the 245 bulkhead and through a motor operated air refueling valve at FS 508 and to the wing spar area where it connects to the single point refuel manifold. The connection makes it possible to fill all of the airplane fuel tanks from the aerial refuel receptacle in the same manner as using the single point refueling system for ground servicing. The system is controlled from an aerial refuel panel located on the aft end of the overhead control panel at the engineer's station. The UARRSI door assembly is controlled by a T-handle located at the aft end of the UARRSI unit. The unit is enclosed in a pressure box to maintain cabin pressurization integrity.

AERIAL REFUELING SYSTEM COMPONENTS.

The major components within the UARRSI unit are the signal amplifier, slipway door and door control mechanism, door actuation cylinder and spring assemblies, hydraulic control

UARRSI unit

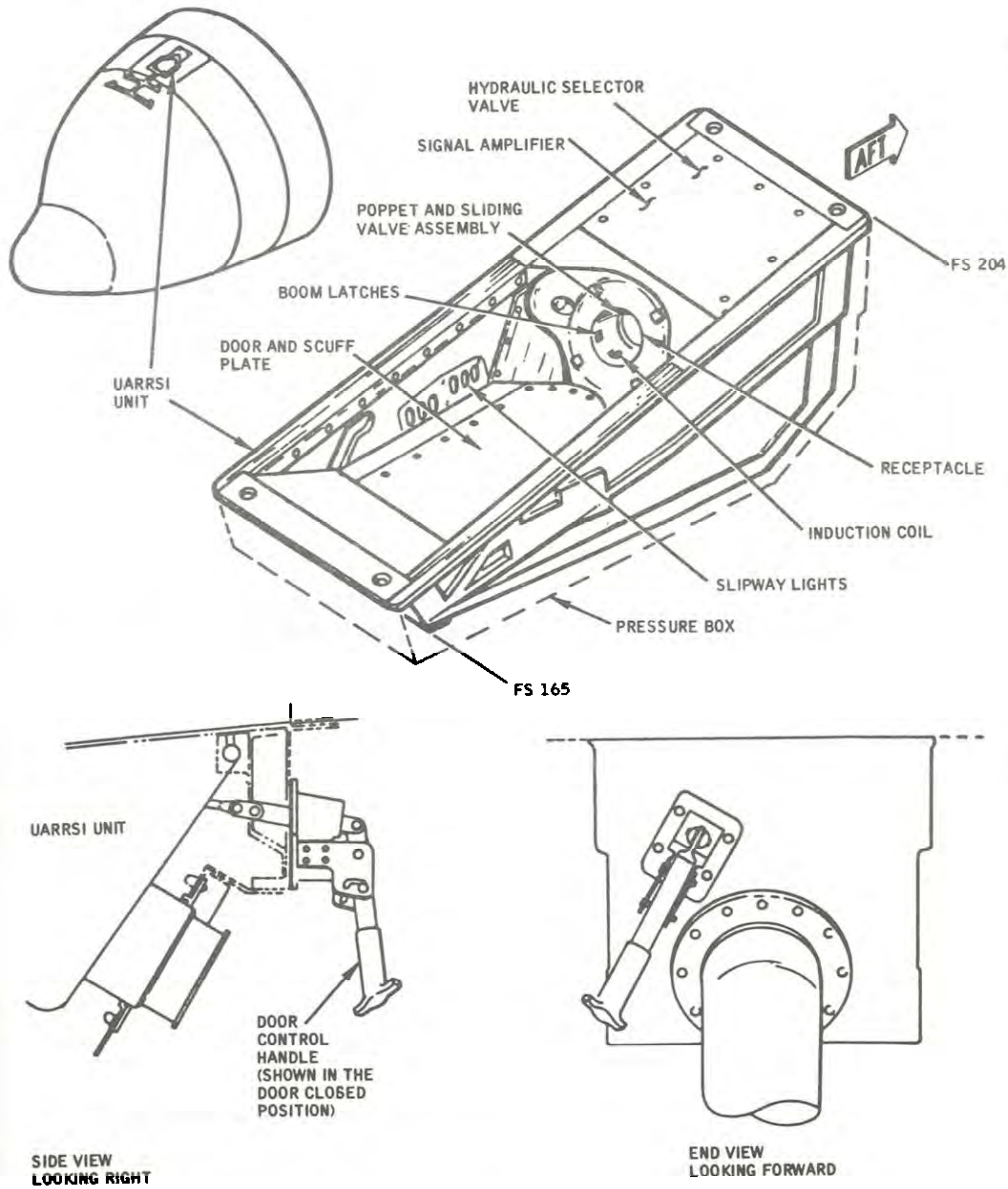


Figure 4-148.

valve, latch cylinder, the induction coil, and the boom receptacle with the boom latches, poppet and sliding valve mechanism.

Signal Amplifier.

The signal amplifier, within the aft portion of the UARRSI unit, provides the logic control and indications required for boom coupling and disconnect. The amplifier is entirely solid state, requires no warmup time and always comes on in the ready mode.

UARRSI Door and Door Control Mechanism.

The UARRSI door is normally opened and closed by hydraulic pressure but is spring loaded for opening in the event of a hydraulic system failure. The door opens forward and down into the UARRSI recess to expose the receptacle and slipway lights. In open position, the door serves as the boom slipway. Door operation is controlled by the T-handle located at the aft end of the pressure box. To open the door, the T-handle is pushed upward slightly to clear a closed slot, then forward and then slightly down into an open slot. During this movement, the T-handle turns counterclockwise about an eighth of a turn. When moved forward and down, the action unlatches the door mechanically to allow the door to open. The door is closed only by hydraulic pressure. Hydraulic pressure is routed to the unit from either the auxiliary hydraulic system or the utility hydraulic system, selectable by a hydraulic system toggle switch on the aerial refuel panel. To close the door, reverse the action of the T-handle. The closing action loads the spring (tension).

When the door is unlocked the door unlocked indicator on the aerial refuel panel will illuminate. When the door is open and locked and the air refuel panel amplifier switch is in NORM or OVRD, the three reception ready indicators will illuminate. When closed, the indicators are extinguished.

Slipway Lights.

Two groups of three lights each are located on each side of the slipway to provide slipway and receptacle illumination when the door is open. The lights are integral components of the UARRSI unit. Refer to exterior lighting for operational information.

Boom Receptacle.

The boom receptacle components are the sliding valve, poppet, and boom latch assemblies. The sliding valve is held in the closed position against the poppet by a spring and is depressed aft (open) as the boom enters the receptacle to allow fuel transfer. When depression is complete the boom latches extend to secure the boom in place. The latches are electrically controlled and hydraulically operated to lock the boom in place when electrical power and hydraulic pressure is present in the UARRSI unit. The latches retract to release the boom when electrical power and hydraulic pressure is present at the UARRSI unit when any one of the following occurs:

1. Actuated by a disconnect signal from any one of three disconnect switches on the receiver.

Note

> The latches will also retract if the reset button on the aerial refuel panel is depressed while in contact.

2. Actuated automatically by an aerial refueling pressure disconnect switch in the air refuel line if the fuel pressure exceeds 85 psi.

3. Actuated by a disconnect signal from the tanker boom operator.

4. Automatically when the boom exceeds its envelope limits by boom limit switches, or by brute force when the pullout force of approximately 5400 pounds is applied.

Refueling operation is possible without the boom latched in place using a method call stiff boom operation. This method calls for the boom operator to maintain a boom extension pressure to keep the boom forced into the receptacle.

Induction Coil.

The induction coil recessed in the lower lip of the receptacle mates with a similar coil in the tanker boom when the boom is in place. The coils provide the links of intercommunication and other signal data passed from one airplane to the other.

CONTROLS AND INDICATORS.

The controls and indicators for the aerial refueling system are located on the aerial refuel panel figure 4-149 located on the engineer's overhead panel, with parallel operated system indicators located overhead at the pilot's and copilot's positions, a parallel boom disconnect capability located on the pilot's and copilots control wheels and the UARRSI unit T-handle door control.

The engineer's overhead panel was rearranged to accommodate the aerial refuel panel and retain the previously mounted panels and switches. The functions of the controls and indicators are as follows:

PWR Switch.

The power switch is a two position ON-OFF toggle switch that receives power through the UARRSI circuit breaker to provide operating power for the tank shutoff valves, the line and sump drain valves, and the aerial refuel panel indicators for press-to-test function.

aerial refuel panel and pilot's status indicators

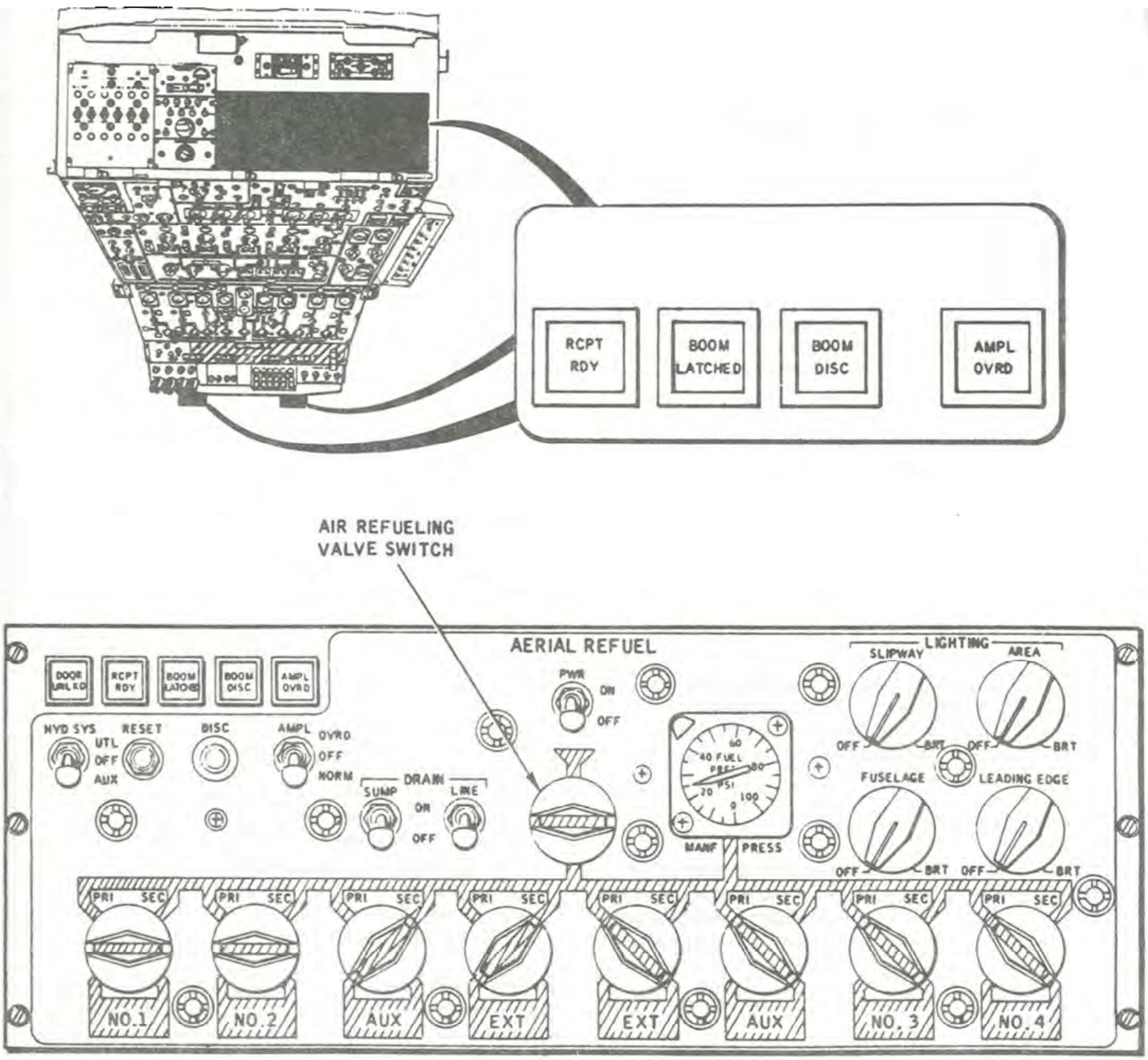


Figure 4-149.

AMPL Switch.

The amplified switch is a three position (NORM-OFF-OVRD) toggle switch used to set the amplifier in normal, off, or override modes. In OFF, the amplifier is deactivated. In NORM position, power from the UARRSI power circuit breaker is supplied to the signal amplifier to operate both the signal and intercommunication circuits and to the line drain, hydraulic system and aerial refueling valve switches. In OVRD position, power is supplied to the line drain, hydraulic system, and aerial refueling valve switches; the signal circuits of the amplifier are overridden, and only the intercommunication circuitry is energized.

HYD SYS Switch.

The hydraulic system switch is a three position UTL-OFF-AUX toggle switch. This switch provides a selection of either the auxiliary or the utility hydraulic systems as the source of hydraulic pressure for the UARRSI door and boom latch operation. When positioned to either AUX or UTL, hydraulic pressure will extend the latches to secure the refueling boom when inserted in the receptacle, and, when any one of the boom disconnect switches are depressed, retracts the latches to release the boom. When in OFF position, pressure from both systems is isolated from the UARRSI. The amplifier switch must be in the NORM or OVRD position for this switch to provide power for hydraulic valve operation.

Air Refueling Valve Switch.

The air refueling valve switch is a two-position switch used to control the air refueling valve. When the switch knob is in horizontal position, the air refueling valve is closed, and when the knob is aligned with the flow schematic, the air refueling valve is open. The amplifier switch must be in NORM or OVRD for the switch to receive power.

Tank Control Valve Switches.

These eight switches are three position (PRI, SEC and closed) tank switches. When positioned to PRI, the primary tank solenoid of the associated tank switch is energized and the fuel flow to the tank will be cutoff automatically by the primary float. When in SEC position, the secondary solenoid is energized and the secondary float is used to cut-off fuel flow into the tank. When in off position (knob horizontal), the tank valves are closed. The valves operate on 28 vdc from primary and secondary tank solenoid auxiliary, external, and mains circuit breakers when the power switch on the aerial refuel panel is in ON position.

MANF PRESS Gage.

The manifold pressure gage provides pressure indication of the fuel pressure in the refueling manifold. It operates on 26 vac single phase, 400 Hz power through a fuel pressure transmitter powered directly from the fuel pressure indicator dump fuse on the pilot's lower circuit breaker panel and is not affected by the position of the aerial refuel panel power switch.

Line and Sump Drain Switches.

Line and sump drain switches are two position (ON-OFF) toggle switches. Placing the sump switch to ON opens a sump drain valve allowing residual fuel to drain overboard. Placing the line switch to ON opens the off-load, air refueling, and the line drain valves, and energizes the drain pump and drain valve to pump residual fuel into No. 3 tank. After an air refuel operation, place the line drain switch to ON before actuating the sump drain switch. The line drain takes about 8 minutes. In OFF position all valves close and the pump stops.

DISC Switch.

When the disconnect switch is depressed, a disconnect signal is supplied to the signal amplifier, the tanker and the boom receptacle latches retract to release the boom.

Reset Pushbutton Switch.

When the reset switch is pressed, it momentarily interrupts power to the amplifier to reset the amplifier to reset the amplifier in the ready mode.

CAUTION

Inadvertent depression of the reset switch during contact will retract the boom latchs and could cause a disconnect.

AMPL OVRD Indicator (Amber).

Push-to-test indicator that illuminates when the amplifier switch is in OVRD position.

Door Indicator (Amber).

The door unlocked indicator is a push-to-test indicator that illuminates when the UARRSI door is not in the fully closed and locked position. The indicator receives power from the UARRSI circuit breaker through the door closed/locked limit switch, and is not dependent on the position of the aerial refueling panel power switch.

RCPT RDY Indicator (Blue).

The reception ready indicator is a push-to-test indicator that illuminates when the UARRSI is ready to receive the tanker boom. The reception ready indicator will illuminate when the amplifier is in ready mode and the UARRSI door is open and locked.

CAUTION

If the amplifier switch is in the OVRD position, the reception ready indication only means the door is not closed and locked.

Boom Latched Indicator (Green).

The boom latched indicator is a push-to-test indicator that illuminates when the refueling boom is fully inserted into the receptacle and the hydraulic latches have engaged.

Boom Disc Indicator (Amber).

The boom disconnect indicator is a push-to-test indicator that illuminates when the boom has withdrawn from the receptacle.

Lighting Controls.

There are four lighting controls to provide on-off and dimming control of lighting for air refueling operation. Refer to Lighting Systems paragraph for lighting details.

Pilots and Copilot's UARRSI Status Indicators.

The pilot's and copilot's UARRSI status indicators Figure 4-149, operate in electrical parallel with the same indicators on the aerial refuel panel. The indicators operate on essential dc power through the UARRSI power circuit breakers when the amplifier switch is in NORM or OVRD position. Dimming is controlled by the caution lights switch on the pilot's side shelf, and the press-to-test feature receives power directly from the essential dc bus and is independent of the aerial refuel panel power switch setting.

Control Column Disconnect.

The autopilot control wheel release switches provide a disconnect signal for the boom when the amplifier switch is not OFF. When the pilot's or copilot's control wheel disconnect switch is depressed, a 28 vdc signal is routed to the signal amplifier in the same manner as the disconnect switch on the air refueling panel.

Door Control T-Handle.

The T-handle is used to open and close the UARRSI slipway door. When pushed full forward and into an open slot, the door opens. When pushed full aft and into a closed slot, the door will close. Hydraulic pressure is required to close the door but not for opening operation.

OPERATION.

Refer to T.O. 1-1C-1-29 for the aerial refuel system normal and emergency operating procedures.

SINGLE POINT REFUELING AND DEFUELING SYSTEM.

A single point refueling and defueling system enables all normal refueling and defueling operations to be accomplished through a single receptacle located in the aft end of the right wheel well fairing. All tanks may be serviced through the system. Controls and indicators for the system are on the refueling control panel (figure 4-150) located immediately above the receptacle.

When refueling, fuel enters the tanks by way of the refueling manifold, and a dual float valve, solenoid operated refueling shutoff float valves on airplanes modified by T.O. 1C-130-949, in each tank shuts off the flow when the tank is filled to its single point refueling capacity. Defueling and ground tank-to-tank fuel transfer is accomplished by running the tank boost pumps and the auxiliary and external tank pumps. Defueling flow is through the crossfeed manifold, through the ground transfer valve to the refueling manifold, and out the single point refueling/defueling receptacle.

The fuel dump pumps may be used for defueling. The pumps are controlled from the flight station fuel control panel. Defueling flow, when using the dump pumps, is through the dump line to the refueling manifold and out the single point refueling/defueling receptacle. On these airplanes, a surge suppressor is located in the refueling line to prevent damage to the fuel system components. A surge suppressor pressure gage is located behind the right air deflector door.

SINGLE POINT REFUELING AND DEFUELING SYSTEM CONTROLS.

Except for the pump switches, which are located on the fuel control panel and are used to operate the tank pumps during defueling operations, all the single point refueling and defueling controls are on the refueling control panel (figure 4-150) above the fueling receptacle on the right wheel well fairing. These controls comprise a master switch, a selector switch, a fuel quantity gage for each of the tanks, and a ground transfer switch.

Note

An off-load valve switch is provided.

Master Switch.

A master switch for the single point refueling system is located on the refueling control panel (figure 4-150). The switch is a six-position (DRAIN, DEFUEL, OFF, PRE-CHK SEC, REFUEL & GRD TRANS, PRE-CHK PRIM) rotary type by which the system function

single point refueling control panel

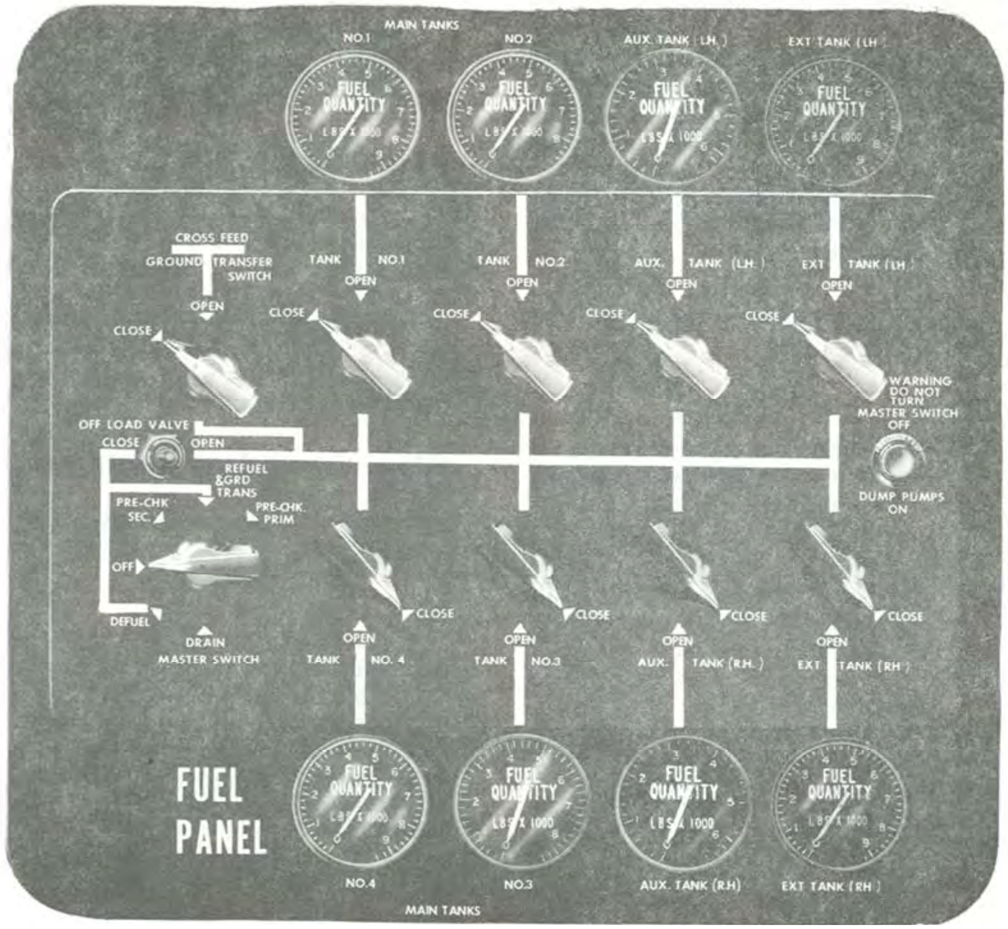


Figure 4-150.

is selected. Placing the master switch in the REFUEL & GRD TRANS position supplies power to the tank selector switches and the ground transfer switch, permitting selective (OPEN, CLOSE) operation of the tank fill valves and the ground transfer valve. Placing the master switch in the DEFUEL position supplies power to operate the ground transfer valve only. The tank valves cannot be opened when the master switch is in the DEFUEL position. Placing the switch in either the PRE-CHK PRIM position or the PRE-CHK SEC position interrupts power to a solenoid in the tank fill valves, closing the fill valves and simulating a tank-full condition, thus providing a check on the automatic operation of the tank fill valves. In both the PRE-CHK PRIM and the PRE-CHK SEC positions, power is supplied to the ground transfer switch, permitting operation of the ground transfer valve. In the DRAIN position, power is supplied to open the drain valve and to operate the drain pump. Power is also supplied directly to the ground transfer valve, bypassing the ground transfer switch, to close the valve. In the OFF position, power is supplied directly to the ground transfer valve, closing the valve; and to the tank selector switches, rendering the switches inoperative. In all positions except OFF, the fuel quantity gages are energized. The refueling system operates from 28-volt dc from the main dc bus through the refueling panel circuit breakers on the copilot's lower circuit breaker panel.

Tank Selector Switches.

Tank selector switches are located on the single point refueling control panel (figure 4-150). The switches are two-position (OPEN, CLOSE) rotary type that supply power to the primary and secondary solenoids of the tank valves. The master switch must be in the REFUEL AND GRD TRANS position before the switches will operate the tank valves.

Ground Transfer Switch.

The ground transfer switch, located on the single-point refueling control panel (figure 4-150), is a two-position (OPEN, CLOSE) rotary type used to control the ground transfer valve. The master switch must be in the DEFUEL, PRE-CHK SEC, REFUEL & GRD TRANS, or PRE-CHK PRIM position before the ground transfer valve will operate. When the master switch is in the OFF or DRAIN position, the ground transfer switch is bypassed, and the ground transfer valve is energized to the closed position.

Single Point Refueling (SPR) Panel (Airplanes Modified by T.O. 1C-130-949).

The single point refueling panel, on airplanes modified to T.O. 1C-130-949, is shown in figure 4-151. Note that the master switch PRE-CHK PRIM and PRE-CHK SEC switch positions have been changed to PRIM and SEC and a fuel flow line connects both positions to the REFUEL AND GRD TRANS position. The PRI and SEC positions provide for individual ground test of each tank refuel shutoff float valve solenoid. Inoperative tank refuel shutoff float valves substantially restrict an air refueling procedure. The ground check of each primary and secondary condary tank refuel shutoff float valve solenoid is mandatory, prior to a flight during which aerial refueling operation is anticipated. If a valve is found to be inoperative, maintenance must be accomplished prior to the flight. A refueling instruction placard reflecting the modified procedure for ground servicing is mounted on the SPR door panel.

Off-Load Valve Switch.

The off-load valve switch, located on the single point refueling control panel (figure 4-150). is a two-position (CLOSE, OPEN) toggle type used to control the off-load valve when the fueling control master switch is in any position except OFF and DRAIN. When the fueling master switch is in the OFF position, the off-load valve switch is bypassed and the off-load valve is energized to the closed position. When the fueling master switch is in the DRAIN position,power is supplied to open the off-load valve in either position of the off-load valve switch.

Fuel Quantity Gages.

A fuel quantity gage, for each fuel tank, is installed on the fueling control panel (figure 4-150). All the gages, which indicate tank fuel quantity in pounds, are energized when the fueling control master switch is at any setting other than OFF. The gages are powered through the fuel quantity-totalizer circuit breaker on the pilot's lower circuit breaker panel.

REFUELING AND DEFUELING PROCEDURES.

Note

At times it may be necessary for the flight crew to perform refueling and defueling operations. Refer to T.O. 1C-130B-2-2 for instructions pertaining to these operations.

PARATROOP DOOR.

A paratroop door is installed on each side of the fuselage just forward of the ramp. The door is unlocked by a handle located in the center of the door. After the latch pins are released, the door is raised manually with an inward and vertical movement. The door is held in the open position by a spring-loaded latch which must be released manually before the door can be closed.

MISCELLANEOUS EQUIPMENT.

MOVING TARGET INDICATOR/RADAR NAVIGATION SET (AN/APN-59B).

The air-to-ground moving target indication processor referred to as MTI is an addition to the radar navigation set (AN/APN-59B). (See figure 4-59.) The MTI cancels non-moving targets and displays moving targets on the IP-268 indicator, located on the pilot's main instrument panel and the navigator's console. The moving target appears on the indicator as a bright solid dot. In open terrain, the dot repeats progressively down or across the indicator. In dense terrain, the target may appear intermittently due to being hidden from the radar by hills, trees and obstacles. The moving targets may be displayed with or without the ground fixed targets in the background. Controls and functions are shown in figure 4-153.

Note

To obtain maximum performance of the MTI, the AN/APN-59B radar must be in good operating condition. The radar controls must be set properly and the antenna sector scan controls set so that the antenna is directed at the target.

The sector scan control (antenna) is mounted on the navigator's console. The antenna control provides adjustment of sector width and bearing of the sector center with respect to the airplane heading.

Normal Operation.

Perform the following steps:

1. Set the controls on the AN/APN-59B radar control panel as follows:

   a. RANGE (NM) control - 3-30/1 or 3-30/5.

single point refueling control panel

(AIRPLANES MODIFIED BY T.O. 1C-130-949)

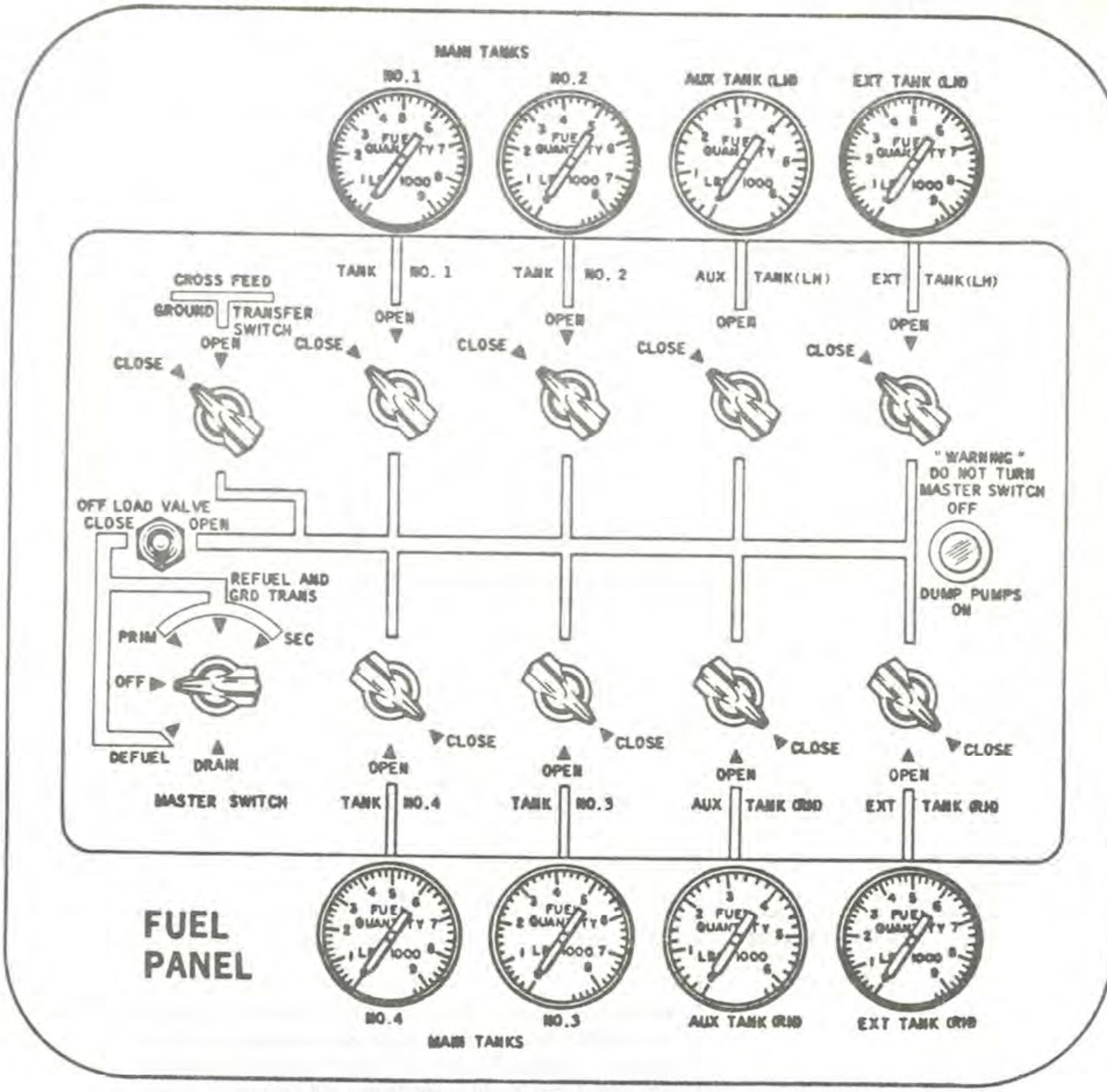


Figure 4-151.

moving target indicator control panel

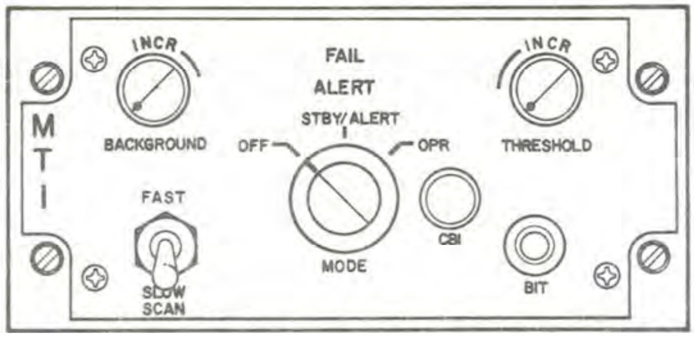


Figure 4-152.

mti controls and functions

Control or Indicator	Setting	Function
1. MODE	OFF	MTI OFF
	STANDBY/ ALERT	MTI processes moving target video. When a target(s) appears within 10 miles, ALERT light illuminates.
	OPER	Enables target within 10 miles to be displayed on APN-59B indicator.
2. THRESHOLD	CW	FULL CW displays maximum MTI video and minimum voice feedback.
Note Setting the GAIN control on the APN-59B radar control panel will cause excessive noise feedback.		
3. BACKGROUND control		Blends APN-59B video with MTI video so that target's relationship to surrounding terrain is displayed.
Note The BACKGROUND control should be turned to full ccw when searching for targets.		
4. BIT control		Performs an end-to-end check of AGMTIP. With BIT button depressed and MODE control in OPER, bright evenly spaced, ½ mile video bands are displayed for approximately 11 miles on the indicator. The video bands should be continuous and a minimum of video and/or noise feedback should be present between these bands. The FAIL indicator should not light during a BIT check.
Note When performing a BIT check, the BACKGROUND control must be at full ccw and the THRESHOLD control to full cw.		
5. FAIL/ALERT indicator		Illuminates when a moving target appears on video display. FAIL indicator lights when the supply monitor detects an incorrect voltage, video bands not present, or video not present between bands.

Figure 4-153.

b. Function switch - SEARCH.

c. Scan selector - L or R.

Note

To operate the MTI, the AN/APN-59B should be in L or R (slow) scan.

d. HDG SEL control - As required.

e. GAIN control - As required for normal map.

f. TILT control - Set to illuminate target area.

g. STAB switch - ON.

h. STC control - As required.

i. BEARING switch - REL.

j. PATTERN switch - As required.

k. IAGC switch - OFF.

l. FTC switch - OFF.

2. Set controls on synchronizer control panel as follows:

a. RANGE DELAY control - OFF.

b. RANGE MKS control - OFF.

3. Set controls on IP-268 indicator as follows:

a. FOCUS control - As required.

b. INT control - As required.

4. Set controls on AGMTIP control panel as follows:

a. Set MODE control as follows:

(1) Taxi and take-off - STBY/ALERT.

(2) During mission - STBY/ALERT. When alert indicator lights (MTI targets are displayed), turn to OPER mode.

(3) Completion of mission - OFF.

b. BACKGROUND control - As required when mode control is in OPER.

c. Threshold control - Turn to full clockwise position. Adjust counterclockwise until optimum video is displayed.

d. FAST/SLOW scan control - Not used.

e. BIT control - Depress BIT pushbutton when AGMTIP check is desired.

Emergency Shutdown Procedure.

Emergency shutdown procedure for the AGMTI processor depends on the location of the operator at the time of the emergency. If the operator is located next to the set control, perform the following step:

1. Place mode switch to OFF.

2. If the circumstances allow, disengage circuit breakers CB1, CB2 and CB3 on the AGMTI processor.

AIRBORNE ILLUMINATION LIGHT SET (40 KVA) (AN/AVQ-8).

The airborne light set (illuminator) is a completely self-contained xenon arc lamp system bolted to the aft cargo ramp. (See figure 4-154.) Two 20 KW xenon lamps are used and are capable of visible and infrared modes of operation. Beam spread resulting from the collected radiation from each lamp is continuously variable between 20 and 40 degrees. Transformer-rectifier (TR) and heat exchanger units are permanently mounted on the frame, and the lamp house and gimbaling support assemblies are installed on shock-mounted tubes to allow the illuminator to be extended and aimed in flight. These motions are remotely controlled and permit the beam to be rotated + 15 degrees about the pitch axis, and from +10 to -90 degrees about the roll axis. Power required for system operation is 200/115-VAC 400 Hz supplied through circuit breakers on the cargo compartment circuit breaker box and the 40 KVA (AVQ-8) circuit breaker box in the cargo compartment.

Remote Control Console.

The remote control console is located in the sound proofing above the navigator's station. See figure 4-154 sheet 2 of 3 and 4-155 for controls and functions.

Aft Panel Controls.

The aft control panel is located on the stationary portion of the illuminator assembly. See figure 4-150 sheet 3 of 3 and 4-153 for controls and functions.

Pressure Gages.

There are five pressure gages in front and above the aft panel. P1 gage indicates accumulator preload air pressure. P2 gage indicates coolant head pressure. P3 and P4 gages indicate coolant pressure to lamp V and lamp F respectively. P5 gage indicates coolant pressure to the optics.

Normal Operation of the Airborne Illumination Light Set.

WARNING

Intense visible light, ultraviolet, and infrared radiations are emitted from the lamps. Use eye protection during operation. Do not look into the beam.

1. Prior to operation:
   a. Remove zoom dust covers.
   b. Disengage turnbuckle from yoke clevis.
   c. Engage all system circuit breakers.
   d. Set control select switch on aft control panel to AFT.
   e. Open airplane door and ramp.
2. Set carriage drive, roll drive, and pitch drive brakes to power positions.
3. Set main power to ON.
5. Check that no interlocks indicators are illuminated.
6. Start lamps by switching lamp F and/or lamp V switches to start/reset.
7. Set control select switch to FWD to operate remote control only.
8. To retract the illuminator, hold carriage drive switch in RETRACT position.

airborne illumination light set (40 kva) (AN/AVQ-8)

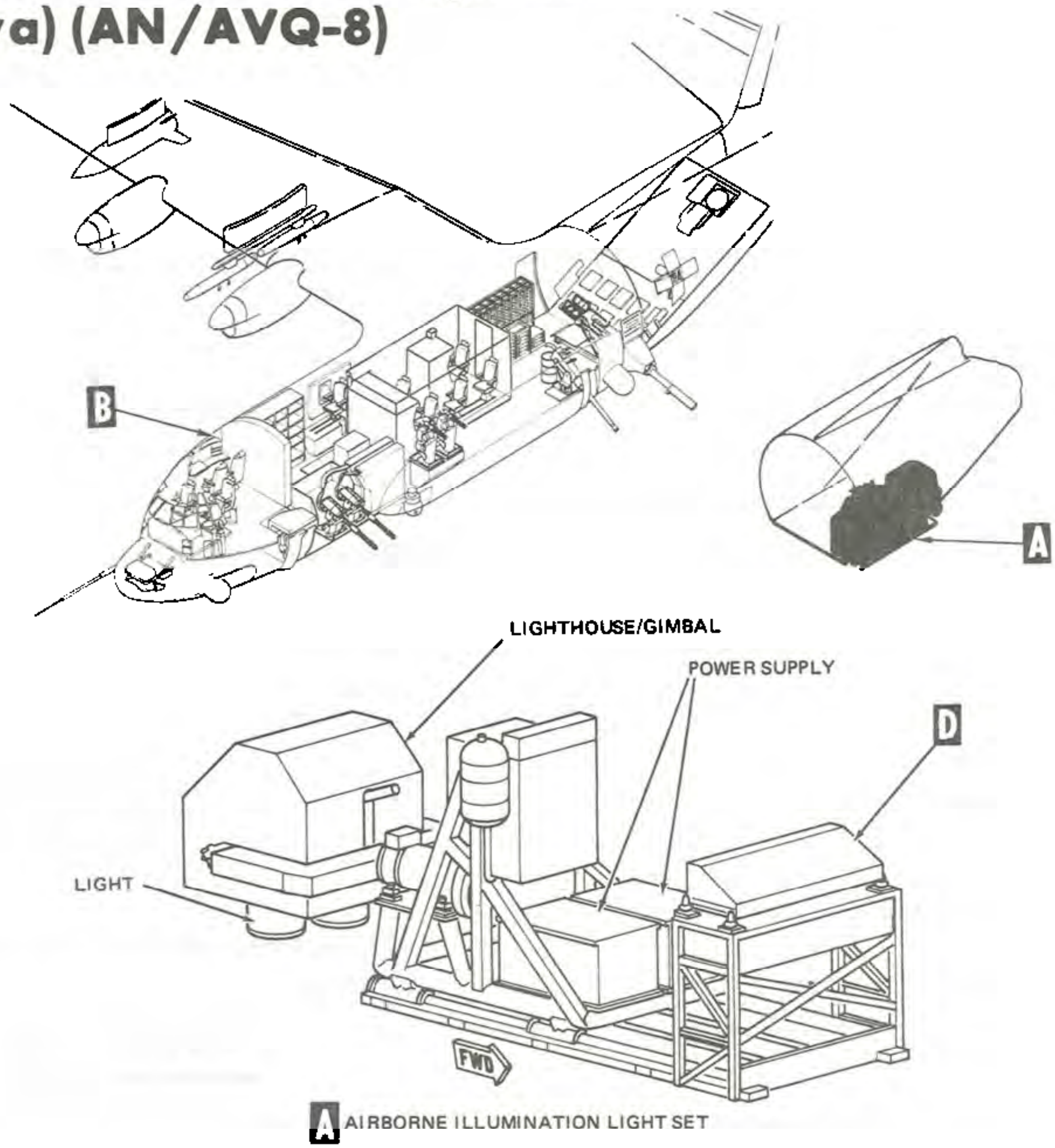
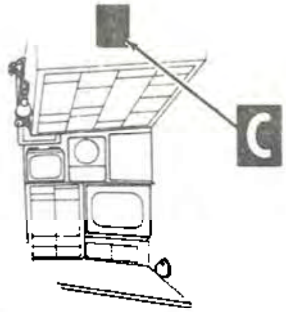
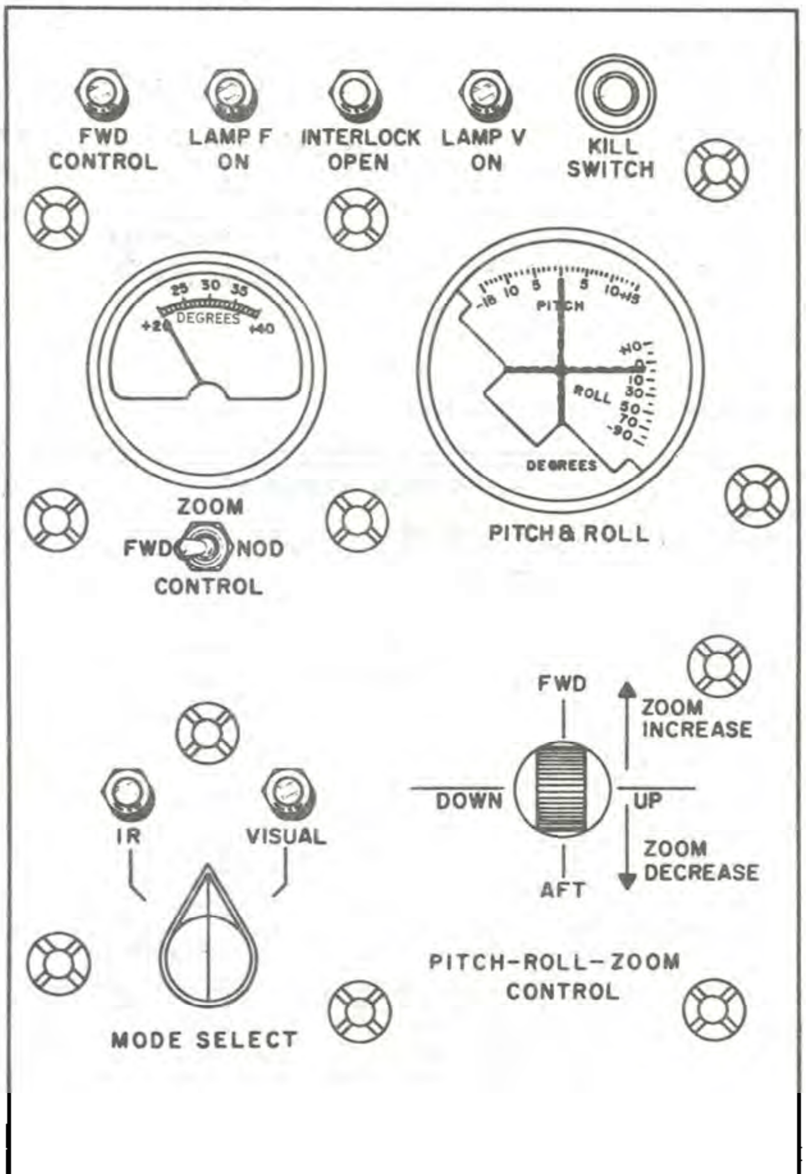


Figure 4-154. (Sheet 1 of 3)

airborne illumination light set (40 kva) (AN/AVQ-8)



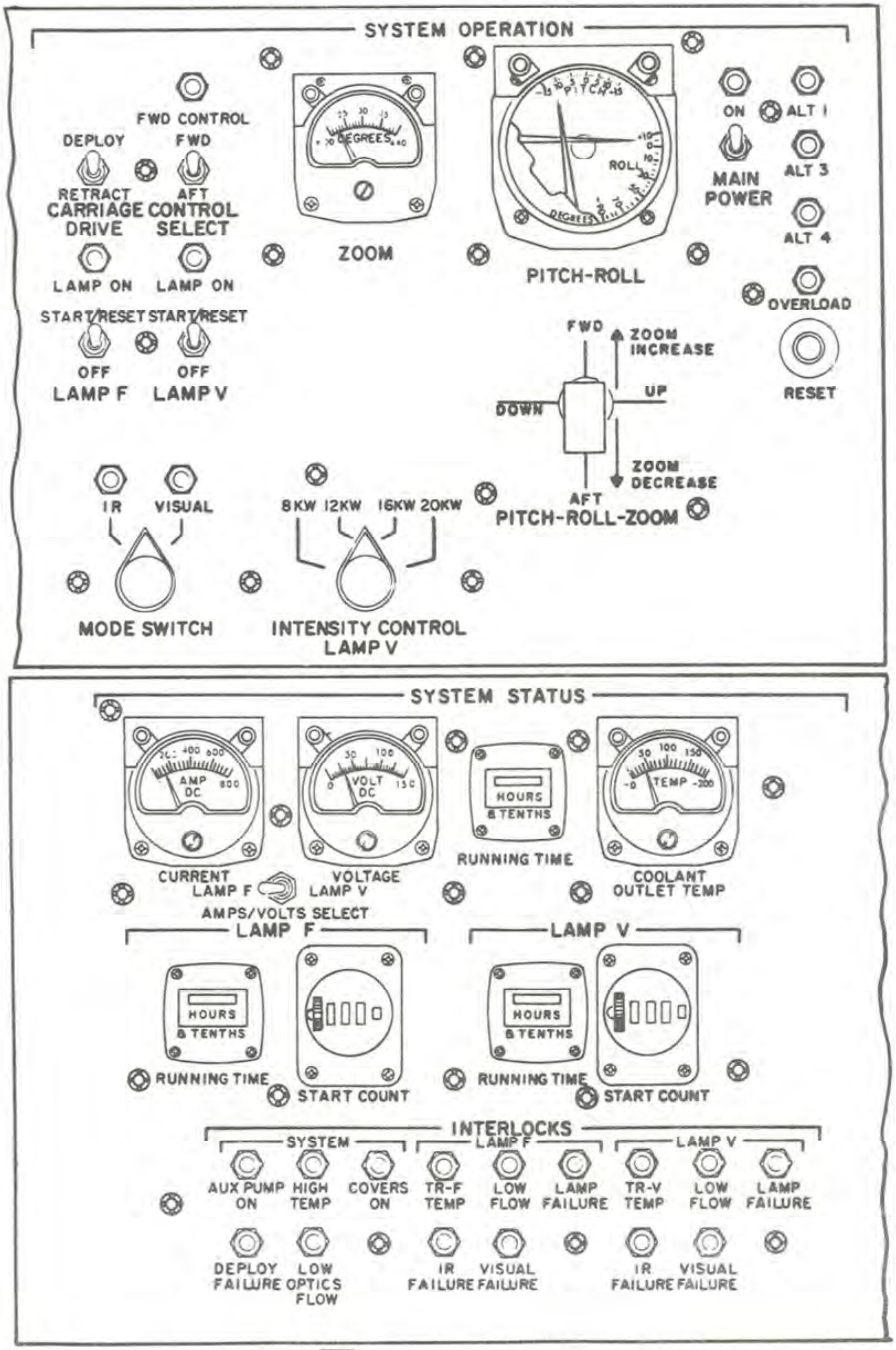
B FCO CONSOLE



C REMOTE CONTROL

Figure 4-154. (Sheet 2 of 3)

airborne illumination light set (40 kva) (AN/AVQ-8)



D ILLUMINATOR CONTROL

Figure 4-154. (Sheet 3 of 3)

40 kva remote panel controls and functions

Control	Function
FWD CONTROL indicator	Indicates forward control panel has control of illuminator.
LAMP F ON Indicator	Indicates that lamp F is illuminated.
FWD/NOD control	Transfers control of the illuminator to either the remote control panel or the NOD operator.
INTERLOCK OPEN indicator	Illuminates when any interlock circuit is open.
LAMP V ON indicator	Indicates lamp V is illuminated.
KILL SWITCH control	Kills lamp F and lamp V.
ZOOM Position indicator	Indicates zoom position.
PITCH & ROLL indicator	Indicates position of illuminator.
MODE SELECT control	Selects infrared or visual illumination mode of operation.
PITCH ROLL & ZOOM CONTROL switch	This four-position (FWD/AFT/UP/DOWN) switch controls positioning of illuminator.
IR Mode indicator	Indicates IR (infrared) mode of operation.
VISUAL Mode indicator	Indicates visual illumination mode of operation.
Darklight Dimmer	Controls intensity of panel edgelights.

Figure 4-155.

40 kva aft panel controls and functions

Control	Function
CURRENT	Indicates DC amperage of either the F or V lamps.
VOLTAGE	Indicates voltage of either the F or V lamps.
SYSTEM STATUS/ RUNNING TIME Meter	Starts when power is applied to the illuminator by the main power On switch.

Figure 4-156. (Sheet 1 of 3)

40 kva aft panel controls and functions

CONTROL	FUNCTION
COOLANT OUTLET TEMP	Indicates coolant outlet temperature.
AMPS/VOLTS SELECT	This two-position toggle switch is used to select either lamp F or lamp V for indication on the current and voltage indicators.
LAMP F/RUNNING TIME meter	Indicates lamp F operating time.
LAMP F/START COUNT	When a pulse is sent to lamp F, this indicator will record the event.
LAMP V/RUNNING TIME Meter	Indicates lamp V operating time.
LAMP V/START COUNT	When a pulse is sent to lamp V, this indicator will record the event.
AUX PUMP ON	Indicates the system coolant is below 45°F and the auxiliary pump and heater are in operation.
HIGH TEMP	Indicates the system coolant exiting from the heat exchanger is above 150°F. When illuminated, both TR packages are turned off, both running time meters are stopped, and all lamp On indicators are extinguished.
COVERS ON	Indicates lamp covers are installed.
DEPLOY FAILURE	Indicates the illuminator is not extended. When this indicator is illuminated, the lamps cannot be started and the pitch and roll mechanism is inoperative.
LOW OPTICS FLOW	Indicates the total coolant flow is below safe level of operation. When illuminated, both TR packages are turned off, both running time meters are stopped, and all lamp On indicators are extinguished.
LAMP F/TR-F TEMP	Indicates the temperature of the fixed TR package is over the safe limit of operation. When illuminated, the fixed TR package and fixed lamp On indicator are turned off and the fixed lamp running time meter is stopped.
LAMP F/LOW FLOW	Indicates the water flow through the fixed TR package is below the safe level of operation. When illuminated, the fixed TR package is turned off, the fixed lamp On indicator extinguishes, and the fixed running time meter is stopped.
LAMP F/LAMP FAILURE	Indicates the mode change of the fixed lamp from visual to IR has not been completed. The interlock switch has not been tripped. When illuminated, the fixed lamp cannot be illuminated.
LAMP F/VISUAL FAILURE	Indicates the mode change of the fixed lamp has not been completed. The interlock switch has not been tripped. When illuminated, the fixed lamp cannot be started.
LAMP V/TR-V TEMP	Indicates the temperature of the variable TR package is over the safe limit of operation. When illuminated, the TR package is turned off, the variable lamp On indicator extinguishes, and the variable lamp running time meter is stopped.
LAMP V/LOW FLOW	Indicates the water flow through the variable TR package is below the safe level of operation. When illuminated, the variable TR package is turned off, the variable lamp On indicator is extinguished, and the variable lamp running time meter is stopped.
LAMP V/LAMP FAILURE	Indicates the variable lamp did not illuminate and the start/reset switch must be actuated again.
LAMP V/IR FAILURE	Indicates the mode change of the variable lamp from visual to IR has not been completed. The interlock switch has not been tripped. When illuminated, the TR unit is turned off.
LAMP V/VISUAL FAILURE	Indicates the mode change of the variable lamp from IR to visual has not been

Figure 4-156. (Sheet 2 of 3)

40 kva aft panel controls and functions

CONTROL	FUNCTION	CONTROL	FUNCTION
	completed. The interlock switch has not been tripped. When illuminated, the variable lamp cannot be illuminated and the TR package is turned off.	LAMP F	This switch is used to start lamp F by momentarily placing switch in the start/reset position. If the lamp does not start, momentarily place switch in start/reset position again. A maximum of three pulses in 3 seconds is provided to start the lamp.
CARRIAGE DRIVE	Controls extension and retraction of the illuminator.	LAMP F/ LAMP ON	Indicates lamp F illumination.
CONTROL SELECT	This two-position (FWD/AFT) toggle switch allows transfer of control of the illuminator to either the remote or aft control panels.	LAMP V	This switch is used to start lamp V by momentarily placing switch in the start/reset position. If the lamp does not start, momentarily place switch in start/reset position again. A maximum of three pulses in the 3 seconds is provided to start the lamp.
FWD CONTROL	Indicates that command of the system is from the remote control panel.	LAMP V/ LAMP ON	Indicates lamp V illumination.
ZOOM POSITION	Indicates zoom position.	MODE SWITCH	Selects either infrared (IR) or visual illumination (visual) mode of operation.
PITCH-ROLL	Indicates pitch and roll angles, in degrees, of the illuminator.	IR MODE	Indicates infrared mode of operation is selected.
MAIN POWER	This two-position toggle switch energizes and deenergizes the system.	VISUAL MODE	Indicates visual illumination mode of operation is selected.
ON	Indicates system is in operation.	LAMP V INTEN-SITY CONTROL	Selects either 8KW, 12KW, 16KW, or 20KW light intensity of the lamp V.
ALT 1	Indicates No. 1 alternator power is available to the system.	PITCH-ROLL-ZOOM	Controls positioning of illuminator.
ALT 3	Indicates No. 3 alternator power is available to the system.	DARKLIGHT DIMMER	Controls intensity of panel edgelights.
ALT 4	Indicates No. 4 alternator power is available to the system.		
RESET	This switch is used to reset the system to receive alternator power after an alternator overload condition has occurred.		

Figure 4-156. (Sheet 3 of 3)

9. Set main power switch to OFF.
10. Disengage all system circuit breakers (after main pump stops).
11. Replace dust covers.

Emergency Operation of the Airborne Illumination Light Set (Alternator Power Failure).

1. Set main power switch on aft control panel OFF.
2. Set roll drive brake in manual.
3. Attach wrench to manual roll drive. Turn counterclockwise until lamphouse yoke is rolled to +10-degree position and meets roll stop.
5. Remove pitch brake cover. Disengage brake by turning knurled knob clockwise with fingers until seated.
6. Attach pitch wrench to manual pitch drive. Turn clockwise until lamphouse is pitched -15 degrees aft and meets end stop. Replace pitch wrench.
7. Engage brake by turning knurled knob 1 1/2 turns counterclockwise from seated position. Replace pitch brake cover.
8. Set carriage drive brake in manual.
9. Attach wrench to manual carriage drive. Turn clockwise until carriage is fully retracted and meets end stop. Replace wrench.
10. Place carriage drive brake in power.

FLARE LAUNCHER (LAU-74/A).

The flare launcher system (see figure 4-157) is an airborne self-contained mechanical electro-pneumatic launching device. The system consists of a four tube semi-automatic store launcher, a control panel and a pneumatic subsystem. Operating power (28 vdc) is supplied to the system through a circuit breaker on the cargo compartment dc circuit breaker panel and the battery bus circuit breaker panel.

The launcher consists of a basic frame assembly enclosing four storage chutes into which the flares are loaded. At the bottom of each chute is a free piston actuator which serves to eject the flares from the launcher. The flares are fed to the actuator by gravity. The actuator is a longitudinally-slotted cylinder containing a free piston. An arm on the piston engages the flare, and launching is accomplished as pneumatic pressure forces the piston through the cylinder. After firing, pneumatic pressure returns the piston to the original firing position. The launcher automatically arms the flare during the launch cycle; the safety pin is pulled, and the ignition sequence is triggered simultaneously as the flare is ejected from the launcher. The launcher is mounted on the right side of the cargo ramp and has a capacity of 24 flares, six flares in each chute.

CAUTION

To preclude damage to the flare launcher, the ramp must be full up prior to closing the ramp cargo door.

Control Box.

The control box is located forward of the right paratroop door. The control provides remote operation of the launcher system. Controls and indicators are on the front panel of the unit. The power ON indicator lamp illuminates when power is applied to the control. The power ON/OFF switch controls electrical power to the control and launcher, except jettison circuit power. The jettison circuit power is controlled by the flare emergency power circuit breaker on the battery bus circuit breaker panel and flare launcher circuit breaker on the cargo compartment dc circuit breaker panel. The panel lights control is used to adjust the panel lighting level. The jettison ON/OFF switch (a covered toggle switch) allows the operator to activate jettison sequence. The four ready lights illuminate when flares are in the launch position. The flares pushbutton switches are used to fire the free piston.

Jettisoning.

The launcher can be jettisoned by any one of three jettison modes: automatic, operator or pilot initiated, and manual. Automatic jettison will occur as a result of an extreme temperature rise within or immediately adjacent to the launcher. Both electrical and pneumatic pressure are required to complete the sequence. The jettisoning sequence is initiated by the activation of one or more heat detectors which are located on the front and rear faces of the launcher. When a detector is activated it energizes a jettison delay relay and a warning horn installed on the launcher.

Although the horn sounds immediately, the relay has a built-in 2-second delay. At the end of two seconds, the relay energizes a second circuit and this results in the detonation of an explosive bolt located in the jettison actuator. As the explosive bolt shears, pneumatic pressure within the launcher actuator forces the launcher along the rails and out of the aircraft. A lanyard is provided for automatic separation of the power cable from the launcher upon jettisoning.

The illuminator operator or pilot can initiate jettison of the system by actuating the jettison switch on the

flare launcher (LAU-74/A)

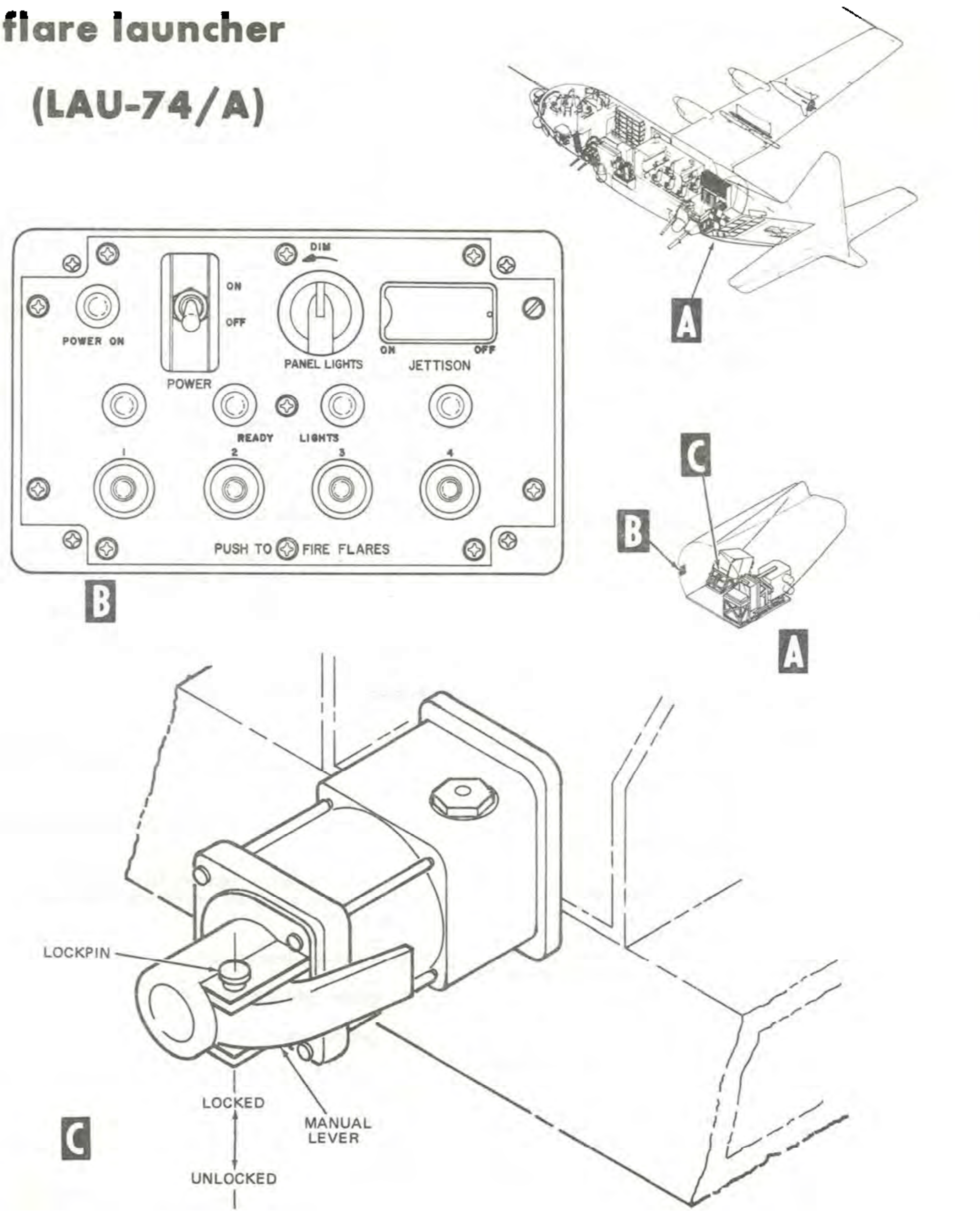


Figure 4-157.

control box or the jettison switch located on the pilot's side panel. The sequence of jettisoning is identical to that of automatic jettisoning.

Manual jettisoning is accomplished by upward movement of the manual jettison handle located on the launcher. As the handle is moved, a locking pin is withdrawn releasing the launcher from the arm guide. The launcher is then pushed from the aircraft.

Normal Operating Procedures.

This paragraph contains those instructions necessary to operate the launcher in all possible modes. Additionally, the theory of launcher operation is described.

WARNING

- Aft cargo door will be open anytime flares are stored in the launcher if pneumatic valves are open or the electrical cable is connected.

- Except when isolating a malfunctioning ejector, the four ejector shutoff valves must remain open at all times.

Note

Unless otherwise stated, all controls and indicators mentioned in the following steps are on the control box panel.

1. Jettison switch OFF and safetied.
2. Check that ejector manual lever lockpins (four places) are in locked positions.
3. Check that ejector shutoff valves are open (four places).
4. Remove shorting plug and install power cable.
5. Remove launcher jettison safety pin.
6. Open the jettison/system reservoir shutoff valves by turning knobs fully counterclockwise.
7. Place selector valve ON.
8. Verify that pressure gage indicates 3075 psi + 75 for system and 1200 psi for jettison.
9. Set power switch to ON.
10. Verify that power on indicator light is illuminated.
11. Verify that launch and jettison system pressure on lights are illuminated.
12. Verify that ready lights 1, 2, 3, and 4 are illuminated.
13. To launch a single store, depress selected push-to-fire flares pushbutton for which the corresponding ready light is illuminated.
14. To launch a series of stores, depress ready-indicated push-to-fire flares pushbuttons sequentially so that chutes are emptied as evenly as practicable. To permit pneumatic system recovery, allow a minimum of 5 seconds to elapse before depressing the push-to-fire flares pushbutton.
15. To salvo-launch two, three or four stores, simultaneously, depress ready - indicated push to fire flares pushbuttons. To permit pneumatic system recovery, allow a minimum of 5 seconds to elapse before depressing the same push-to-fire- flares pushbutton.

Automatic Jettison.

If any of the fire detector switches close, the horn will sound immediately. Two seconds later, the launcher will be driven aft on the mounting rails by the pneumatic jettison actuator.

Semi-Automatic Jettison.

To voluntarily jettison the launcher assembly by use of the pneumatic system, place the jettison switch on the control box panel or pilot's jettison switch to ON. The horn will sound immediately. Two seconds later, the launcher assembly will be driven aft on the mounting rails by the pneumatic jettison actuator.

Pneumatic Jettison.

Pneumatic jettison of the launcher assembly is accomplished either automatically or by voluntary action. In either case, jettisoning is electrically initiated and pneumatically actuated.

Pneumatic jettisoning requires that the following conditions prevail:

1. Flare launcher jettison, flare and illuminator door interlock and flare emergency power circuit breakers IN.
2. Aft cargo door open.
3. Power cables connected.
4. Jettison reservoir shut-off valve open.
5. Jettison system pressure ON indicator illuminated.
6. Safety pin removed.

Manual Jettison.

Manual jettisoning of the launcher assembly is a last-resort procedure and is employed only if jettisoning cannot be accomplished as stated in the paragraph Pneumatic Jettison. Manual jettisoning requires that the launcher assembly be hand-pushed aft and overboard. To release the launcher assembly so it can be pushed, lift upwards on the manual jettison lever located on the forward end of the launcher assembly.

Manual Operation.

For so long as adequate pneumatic pressure exists (750 PSI), stores may be launched by manually operating the ejectors in the event of total electrical power loss, or of total or partial failure of the launcher electrical system.

WARNING

To avoid possible personal injury and damage to the launcher, do not manually operate an ejector unless visual inspection confirms that the store to be launched is properly emplaced.

An ejector is manually actuated by pressing the ejector manual lever lockpin down to the unlocked position and by then pressing the ejector manual lever; and, in the event of partial launcher electrical system failure wherein the applicable control box panel ready light is operating, stores may be launched in accordance with the paragraph Normal Operation with the exception that ejector manual levers are substituted for control box panel push-to-fire flares pushbuttons.

Electrical power loss or launcher electrical system failure that results in the loss of one or more control box panel ready light indications requires that the operator shall visually verify correct placement of the store in the breech before pressing the ejector manual lever of any ejector for which no ready light indication is present. He shall verify that the store to be launched is aligned with the launch tube and that the store is positioned so as to be properly engaged by the ejector piston arm.

Shutdown.

At the conclusion of a flight or mission, shut down the launcher as follows:

1. Set control box panel power switch to OFF.
2. Close both reservoir shutoff valves by turning the knobs fully clockwise.
3. Set launcher assembly selector valve to OFF. (Bleed air pressure to zero.)
4. Disconnect power cable connector and install shorting plug.
5. Install jettison safety pin.

Emergency Operation.

1. Close the selector valve.
2. Close all four ejector shutoff valves.
3. Observe pressure gage. If a continuing pressure loss is no longer indicated, open the selector valve. Close the open shutoff valve on the launch reservoir by turning the knob fully clockwise.
4. Set the ejector shutoff valves at open, one at a time, observing the pressure gage each time a shutoff valve is opened. A decrease in pressure will be indicated on the pressure gage when the shutoff valve for the leaking ejector is set at open.
5. Set the shutoff valve for the leaking ejector at closed, and set the shutoff valves for the other three ejectors at open and open reservoir shutoff valve.
6. If pressure depletion is corrected, resume normal operation in accordance with the paragraph Normal Operation, but avoid push-to-fire flares pushbutton controlling the disabled ejector.
7. If the cause of pressure depletion is not isolated or corrected, launch operations must be terminated when the launch system supply system pressure gage indicates less than 750 psi.

WINDSHIELD WIPERS.

Two electrically-operated windshield wipers are installed: stalled: one on the pilot's windshield panel and one on the copilot's windshield panel. The speed of the windshield wipers is controlled by a six-position (PARK, OFF, SLOW, 2, 3, FAST) rotary-type windshield wiper control switch on the copilot's side shelf. The windshield wipers are powered by 28-volt dc power from the main dc bus through the windshield wiper circuit breakers on the copilot's lower circuit breaker panel. The wipers are ineffective at speeds above approximately 180 KIAS.

TOILET FACILITIES.

Toilet facilities consist of one chemical toilet and one urinal. The toilet is a fixed-type, located aft of the left paratroop door. The urinal is located aft of the left paratroop door.

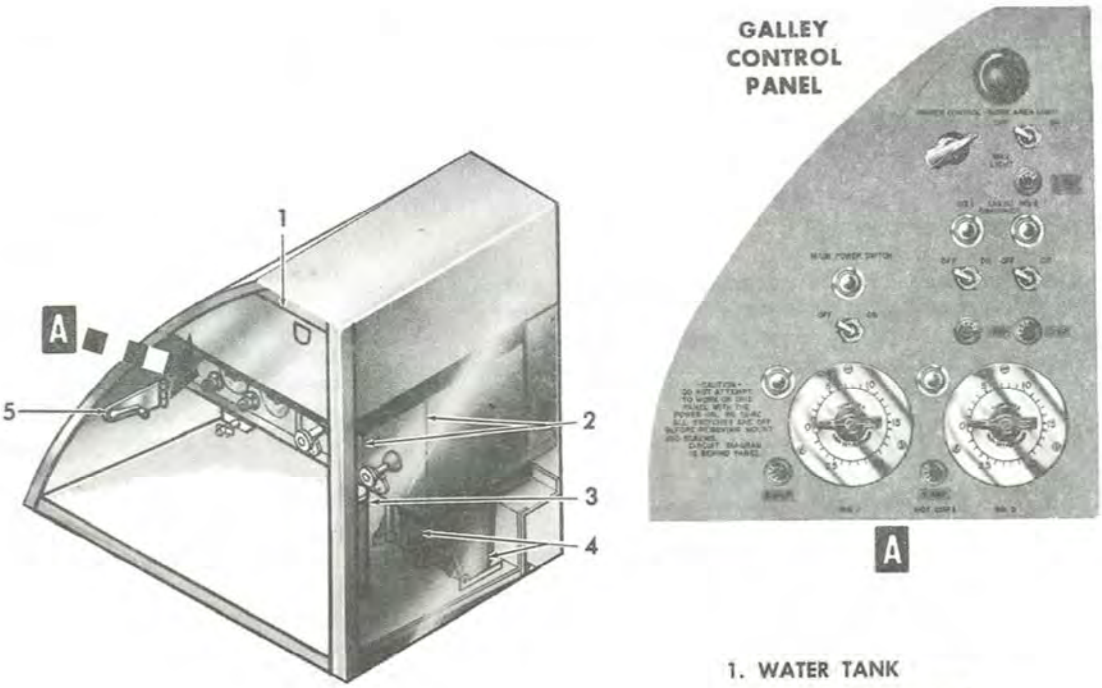
GALLEY EQUIPMENT.

The flight crew galley (figure 4-158) is located on the left side of the flight deck near the crew entrance. It is provided with the following facilities:

1. A water tank connected by a tube to a pushbutton-type water spigot.

2. Two 2-gallon liquid containers with electrical heating elements for keeping liquids hot.

galley



1. WATER TANK
2. LIQUID CONTAINERS
3. CUP DISPENSER
4. FOOD WARMING CUPS
5. CAN OPENER

Figure 4-158.

3. A cup dispenser.

4. Two food warming cups.

5. A 1.5-gallon sink.

6. A wall-mounted can opener.

7. Galley work area and switch panel lights.

The galley is also equipped with an electrical switch panel which incorporates the following:

1. A two-position (ON, OFF) main power switch and indicator light.

2. Two timers and two indicator lights for the food-warming cups.

3. Two two-position (ON, OFF) switches and two indicator lights for the liquid containers.

4. A two-position (ON, OFF) switch and a dimmer control for the galley work area light.

5. Cartridge fuses for the work area light, liquid containers, and food-warming cups.

Additional liquid containers and cup dispensers are installed in the cargo compartment aft of the paratroop doors. The galley is powered by 115-volt ac from the left-hand ac bus through the cargo compartment and flight deck circuit breakers on the pilot's upper circuit breaker panel.

LADDERS.

One maintenance ladder, and one paratroop door ladder is provided. The maintenance ladder has no specific area in which to be stowed.

PROTECTIVE COVERS.

Protective covers for the engine tailpipes are stowed in a container attached to the left side of the cargo compartment near the aft cargo door. Covers for the engine inlet air ducts are stowed on the left side of the cargo compartment aft of the crew entrance door. Protective covers for the pitot tubes are stowed in the miscellaneous stowage container.

AIRCRAFT/ARMOR/BALLISTIC CURTAINS.

Armor plating and ballistic felt is installed in the aircraft for personnel security and protection of some vital aircraft components. (See figure 4-159.)

aircraft armor/ballistic curtains

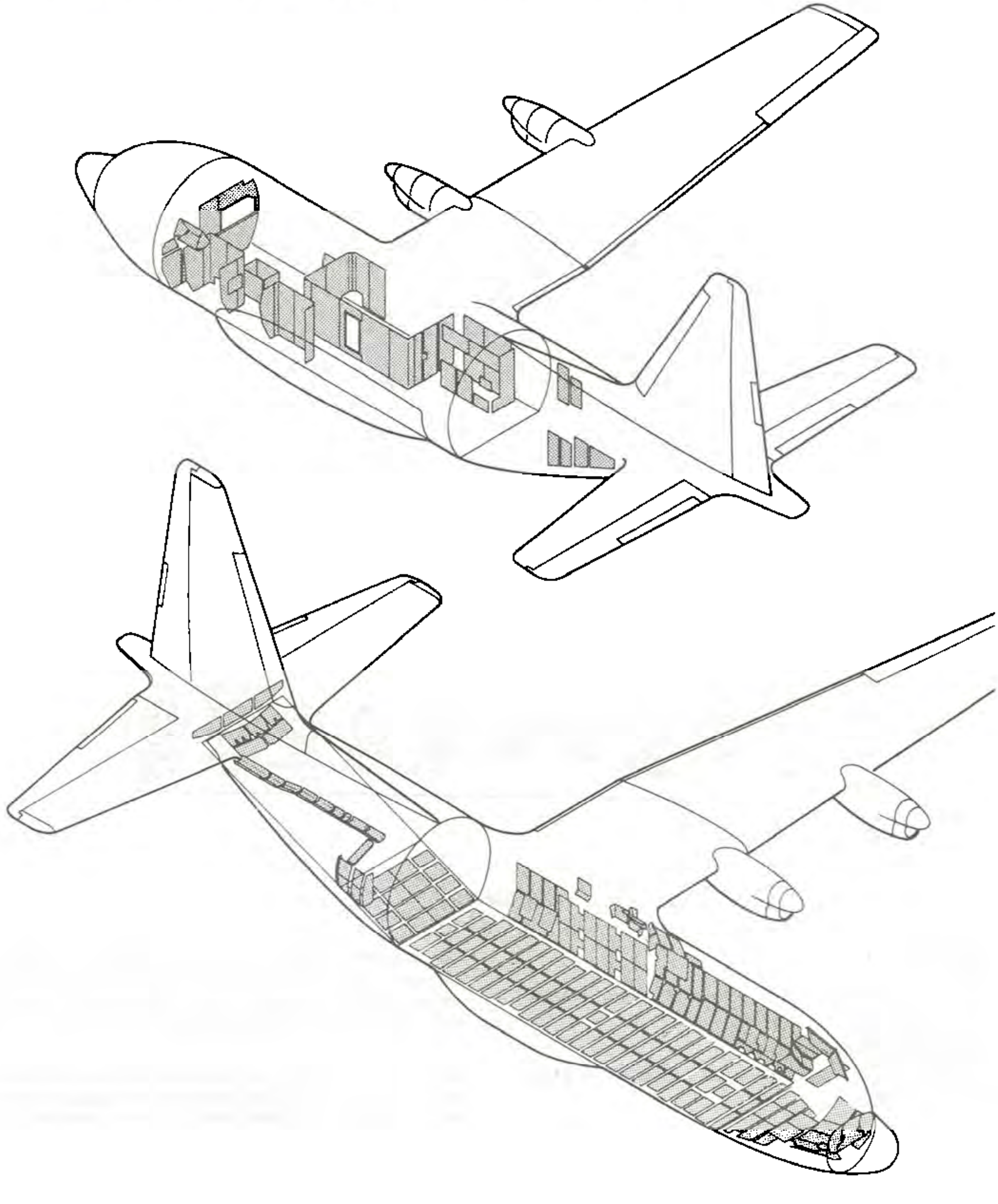


Figure 4-159.

life history recorder system (MXU-553/A) (LHR)

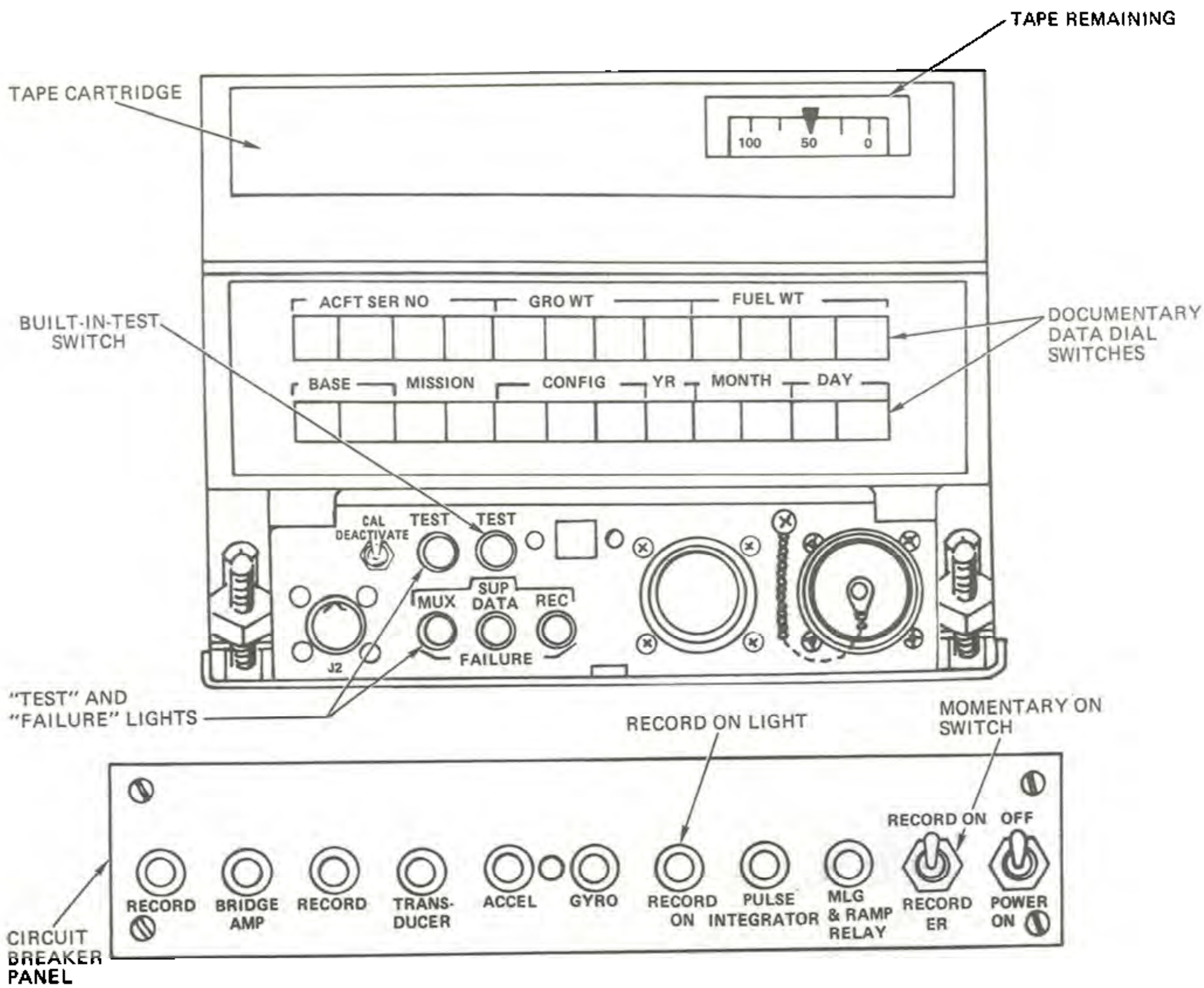


Figure 4-160.

ALARM BELLS.

For a description of the alarm bells, see Emergency Equipment in Section I.

SEXTANT CASE.

The sextant case is located on the bottom of the galley equipment rack.

LIFE HISTORY RECORDER SYSTEM (MXU-553/A) (LHR).

A life history recorder system (LHR) is installed which will obtain structural stress and airplane usage data for the purpose of more accurately predicting life expectancy of the airframe in support of the aircraft structural integrity program (ASIP). The recorder is located on the right side of the fuselage just aft of FS245.

The system consists of airborne elements: A recorder, converter-multiplier and various airplane sensors. Parameters monitored by these sensors are airspeed, altitude, normal acceleration, control surface positions, cabin pressurization, pitch and yaw rates, strain at various locations and certain taxi related parameters. 115-volt ac power is supplied to the recorder from the main ac bus through an ASIP/LHR circuit breaker located on the copilot's upper circuit breaker panel. Twenty-eight-volt dc power is supplied to the recorder from the main dc bus through an ASIP/LHR circuit breaker located on the copilot's upper circuit breaker panel.

Documentary Data Switches.

Twenty-four documentary data thumbwheel type switches, accessible through the lower hinged door, are provided to manually dial in pertinent documentary data (figure 4-160). Data is manually dialed in, by the flight crew, prior to taxiing for take-off and again after landing and all taxiing has been completed. These switches are grouped in sets to record data as follows:

a. AIRCRAFT SERIAL NUMBER. Dial in the last four digits of the aircraft serial number.

b. AIRCRAFT GROSS WEIGHT. When gross weight is 100,000 pounds or greater, dial in the first four digits of gross weight. When gross weight is less than 100,000 pounds, the first digit dialed in will be zero; then dial in first three digits of gross weight (before and after flight).

Note

First digit will always be zero if gross weight does not exceed 99,999 pounds.

c. FUEL WEIGHT. Enter fuel weight in hundreds of pounds, excluding fuselage tank fuel. When fuel weight is 10,000 pounds or greater, the first digit dialed in will be zero; then dial in first three digits of fuel weight. When fuel weight is less than 10,000 pounds, the first two digits dialed in will be zero; then dial in first two digits of fuel weight (before and after flight).

d. BASE OF ASSIGNMENT. Dial in zero, zero (00).

e. MISSION. Dial in zero, zero (00) since the mission will be automatically obtained from recorded data.

f. CONFIGURATION. Dial in 081 for AC-130H planes.

g. DATE: YR - MONTH - DAY. Dial in the zulu date on which the flight takes place. For single digits on month and day, precede the number with a zero.

Recoder Tape Cartridge.

A removable recorder tape cartridge with a capacity to record 15 hours of data, is contained within the recorder. This tape cartridge is removed when full and shipped to the data processing facility. Installation/removal of the tape cartridge is accomplished by opening the upper hinge door of the recorder and depressing the center spring lock. If it is determined that inadequate tape remains for the flight, remove the existing cartridge and replace with a fresh one. Tape remaining may be read directly from the cartridge, in percent of usable hours, through a window (figure 4-160) located on the front of the recorder unit.

Power Switch and Momentary On Switch.

A two-position (ON, OFF) switch is installed on the circuit breaker panel below the recorder. A spring-loaded/momentary on switch is installed next to the power switch (some airplanes).

Built-In-Test Button.

A press-to-test button located on lower front of the recorder, is used to allow the system to perform a self-test (figure 4-160). When the button is pressed, the recorder will self-test.

Indicator Light.

There are four indicator lights on the lower front of the recorder (figure 4-160). These lights are decaled TEST, MUX, SUP DATA amd REC. The function of the test light while illuminated is to indicate the recorder is performing a self-test. The function of the MUX, SUP DATA, and REC lights if illuminated is to indicate that the system has a malfunction and to isolate the malfunction. A power on indicator light labeled RECORD ON is located on the circuit breaker panel and remains illuminated during recorder operation.

Operational Checkout of The Recorder System.

The operational checkout of the recorder will be accomplished by the flight crew after dialing in the pertinent data. Accomplish system check as follows:

a. Ensure tape cartridge is installed properly by firmly pressing the left and right hand corners of cartridge. Ensure remaining tape is adequate for flight.

b. Ensure all pertinent data has been dialed into the recorder.

c. Close both doors on the recorder and latch securely. The tape cartridge door must be closed as recorder will not operate because a built-in switch is closed by the upper door.

Note

CAL/DEACTOVATE switch on the recorder should remain in DEACTIVATE (up) position at all times

d. Ensure all circuit breakers are closed. Press to test record on light. Position the ON/OFF power switch to ON. Position the momentary on switch to the up position until the record on light remains illuminated.

e. Press TEST, MUX, SUP DATA, and REC lights for light bulb check. Approximately 30 seconds after power switch has been turned on, the red test light will illuminate. This light indicates that an automatic built-in-test (BIT) is being accomplished. This test light will last for approximately 20 seconds and will go out. If MUX, SUP DATA and REC lights do not illuminate, recorder system is now in a go condition.

Note

The system should be allowed to operate throughout the taxi, take-off, flight and landing regimes with no further attention.

f. If the MUX, SUP DATA, or REC FAILURE light should illuminate, position the on/off power switch to OFF. Check for three possible problems: (1) tape cartridge not installed, (2) zero percent remaining in tape cartridge, or (3) tape cartridge access door in the recorder not properly latched. Correct applicable problem. Then position the on/off power switch to ON. Position the momentary switch to the up position unitl the record on light remains illuminated. If the MUX, SUP DATA, or REC FAILURE light still illuminates, recorder system is still in a go condition. Report specific illuminated light in 781 log for system checkout.

UNDERWATER ACOUSTIC LOCATOR BEACON (SOME AIRPLANES).

An underwater acoustic beacon, located in the cargo compartment, overhead and forward of the center wing section, will transmit a 37.5 kHz signal when immersed in water. This unit provides a positive means of pinpointing the exact underwater location of downed aircraft in the event of a loss over water.

LET-DOWN CHART HOLDERS (AIRPLANES MODIFIED BY TCTO 1C-130-982).

A lighted let-down chart holder is installed in the center of the pilot's and co-pilot's control wheel. Two knobs located on the lower front side of the holder regulate the intensity of the light and receive 28-volt dc power from the main dc bus through the pilot's CKT BKR on the co-pilot's lower circuit breaker panel.

SCROLL CHECKLIST HOLDERS (AIRPLANES MODIFIED BY TCTO 1C-130-982).

A lighted scroll checklist holder is installed on the right outer edge of the co-pilot's glare shield. The light is controlled by a rheostat type switch and received 28-volt dc power from the essential dc bus through the liquid oxygen low level circuit breaker on the co-pilot's lower circuit breaker panel.

A lighted scroll checklist holder is installed on the flight engineer's overhead panel. A mounting bracket is installed on the back of the pilot's seat so that the scroll checklist may be moved to a more workable position while in use. The light is controlled by a rheostat type switch and receives 28-volt dc power from main dc bus through the flight mech & navigator utility light circuit breaker on the co-pilot's lower circuit breaker panel.

SECTION V

operating limitations

TABLE OF CONTENTS

INTRODUCTION.

This airplane has certain well-defined limitations to its operation. Maximum performance requires careful consideration of these limitations. The instrument marking illustration (figure 5-1) and the engine and propeller limitations illustrations (figure 5-2) contain certain limitations which are not repeated in text. This fact should be remembered when using this section. A summary of limitations is shown in figure 5-7.

MINIMUM CREW REQUIREMENTS.

The minimum crew required to operate this airplane is a pilot, copilot, and engineer. Additional crewmembers may be added, as required, at the discretion of the commander.

INSTRUMENT MARKINGS.

Note

The markings shown in this section are for flight station indications and are not to be confused with limits shown in the maintenance manuals.

Flight and engine instrument markings are shown in figure 5-1 and are not repeated in text.

ENGINE AND PROPELLER LIMITATIONS.

Operating time limits, allowable observed turbine inlet temperature ranges, oil temperature, oil pressure, engine speed, propeller governing, and starter operation limits, respectively, are tabulated in figure 5-2 and are not repeated in text.

Note

All limits given in figure 5-2 are flight station indicated limits and are not to be confused with maintenance manual limits.

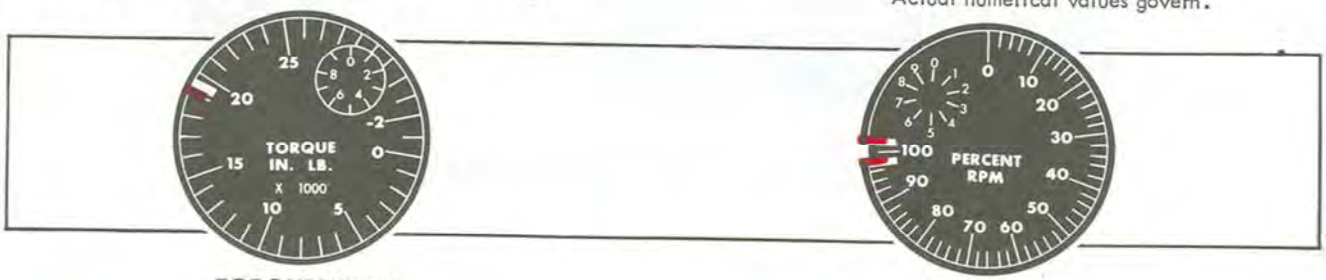
FUEL.

The fuel recommended for the T56 engine is Specification MIL-T-5624, JP-4. If JP-4 fuel is not available, certain other fuels may be used as alternates or emergency fuels. (See figure 5-3.) Mixing of these fuels with each other or with NATO equivalents of these fuels is permissible. In this case, the mixture will be considered as the grade which predominates in the mixture, and all operations will be in accordance with the operating instructions for that grade.

instrument markings

NOTE

Instrument markings should reflect the corresponding numerical values. Actual numerical values govern.

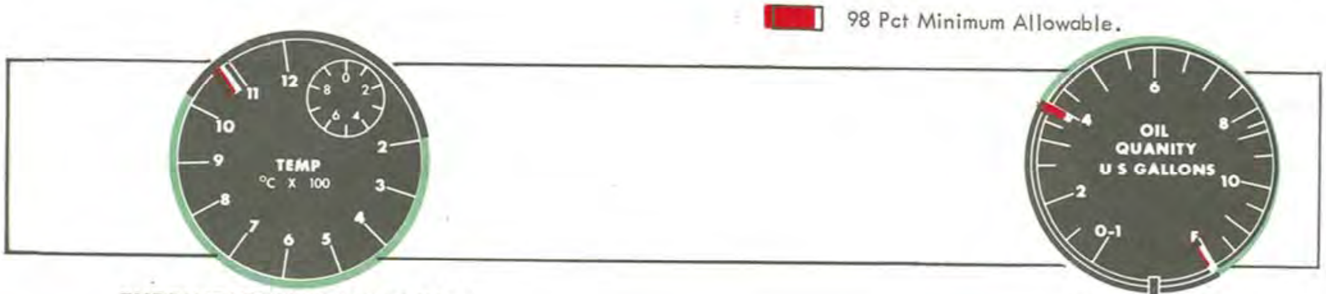


TORQUEMETER

- 19,600 In. Lb. Maximum Allowable

TACHOMETER

- 102 Pct Maximum Allowable.
- 98 Pct To 102 Pct Normal.
- 98 Pct Minimum Allowable.

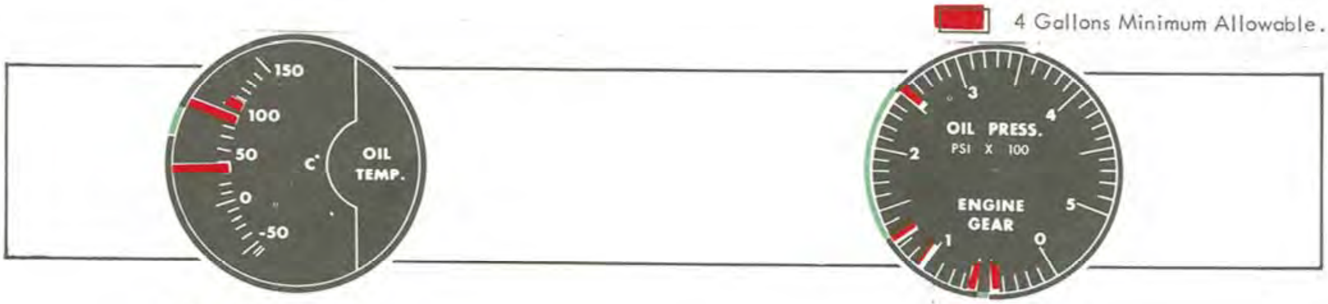


TURBINE INLET TEMPERATURE

- 1083° C Maximum Allowable.
- 200°C To 1010° C Normal (Continuous).

OIL QUANTITY

- 12 Gallons Maximum.
- 4-12 Gallons Normal.
- 4 Gallons Minimum Allowable.



OIL TEMPERATURE

- 100°C Taxi Maximum. (30 Min.) And Inflight 5 - Minute Maximum
- 85°C Maximum Continuous.
- 60°C To 85°C Normal.
- 40°C (And Increasing) Minimum Allowable.

FUEL GRADE JP-4

OIL PRESSURE

Both Power Section And Gear Section Oil Pressure Are Indicated On This Instrument: Power Section Pressure By The Front Pointer; Gear Section Pressure By The Rear Pointer.

GEAR SECTION

- 250 PSI Maximum Allowable – Except Start And Warmup (250 PSI May Be Exceeded During Start And Warmup With Ambient Temperature Below 15°C)
- 150 PSI To 250 PSI Normal
- 150 PSI Minimum Allowable (100% RPM, Oil Temp. Normal)

POWER SECTION

- 100 PSI Maximum Allowable – Start And Warmup
- 60 PSI Maximum After Warmup
- 50 PSI To 60 PSI Normal
- 50 PSI Minimum Allowable (100% And Above With Oil Temp. Normal)

Figure 5-1. (Sheet 1 of 5)

instrument markings

NOTE

The markings on this instrument are for preflight reference only. Inflight low-pressure warning is supplied by the pressure warning lights on the fuel control panel. However, boost pump pressure may be checked with this instrument at any time.

FUEL PRESSURE TEST INDICATOR

- 40 PSI Maximum Allowable Aux and Ext Tanks.
- 28 PSI - 40 PSI Normal - Aux and Ext Tanks.
- 28 PSI Minimum Allowable Aux and Ext Tanks.
- 24 PSI Maximum Allowable - Main Tanks.
- 15 PSI - 24 PSI Normal - Main Tanks.
- 15 PSI Minimum Allowable - Main Tanks.

AUX AND EXT TANKS

AIR SPEED

Note: Disregard the Banded Pointer and refer to the Airspeed Limitations in this section.

FLAP POSITION

- Radial; 145 Knots Maximum Allowable With Full Flaps.
- The Banded Pointer Constantly Indicates The Structural Speed Limit At Sea Level.
- The White Pointer (Not Shown) Shows Indicated Air Speed
- △ .64 Limiting Mach Number
- Flaps 50% Down
- Flaps 100% Down

Figure 5-1. (Sheet 2 of 5)

instrument markings

CABIN DIFFERENTIAL PRESSURE GAGE

- (Red) 15.8 In. Hg. Maximum Allowable
- (Green) -1.2 In. Hg. To 15.8 In. Hg. Normal
- (Red) -1.2 In. Hg. Minimum Allowable

HYDRAULIC PRESSURE (AUXILIARY)

- (Red) 3, 500 PSI Maximum Allowable Pressure
- (Green) 2, 900 To 3, 300 PSI Normal.

FREQUENCY METER

- (Red) 420 Cycles Maximum Allowable.
- (Green) 380 Cycles To 420 Cycles Normal.
- (Red) 380 Cycles Minimum Allowable.

VOLTMETER (AC GENERATORS AND INVERTERS)

- (Red) 125 Volts Maximum Allowable.
- (Green) 110 Volts To 125 Volts Normal.
- (Red) 110 Volts Minimum Allowable.

DC VOLTMETER

- (Red) 30 Volts Maximum Allowable.
- (Green) 25 To 30 Volts Normal.
- (Red) 25 Volts Minimum Allowable.

AMMETERS (SPINNER ANTI-ICING, SPINNER DE-ICING, AND BLADE DE-ICING)

- (Red) 90 Amps Maximum Allowable.
- (Green) 65 Amps To 90 Amps Normal.
- (Red) 65 Amps Minimum Sufficient.

AC LOADMETER

DC LOADMETER

- (Red) 1.03 Maximum Allowable.
- (Green) 0 To 1.03 Normal.

NOTE

ATM Generator 1.0 max load with cooling air, 0.66 max load without cooling air, or if outside air temp is above 40° C (104 ° F).

- (Red) 1.05 Maximum Allowable.
- (Green) 0 To 1.05 Normal

Figure 5-1. (Sheet 3 of 5)

instrument markings

NOTE

All Hydraulic Instrument Markings Are For Static System Conditions.

NORMAL BRAKE PRESSURE

- (Red) 3,500 PSI Maximum Allowable.
- (Green) 2,900 PSI To 3,200 PSI Normal.
- (Yellow) 2,250 PSI Minimum Pressure, One Brake Application Remaining.

BRAKE EMERGENCY PRESSURE

- (Red) 3,500 PSI Maximum Allowable Pressure.
- (Green) 2,900 To 3,300 PSI Normal.
- (Yellow) 2,900 PSI Minimum Pressure, One Brake Application Remaining.

RUDDER BOOSTER PRESSURE (UTILITY AND BOOST)

- (Red) 3,500 PSI Maximum Allowable Pressure (15% To 100% Flaps).
- (Red) 1,600 PSI Maximum Allowable Pressure (0% To 15% Flaps).
- (Green) 2,900 To 3,200 PSI Normal. (15% To 100% Flaps)
- (Green) 1,100 PSI To 1,400 PSI Normal (0% To 15% Flaps).
- (Yellow) 1,400 PSI To 1,600 PSI Caution (0% To 15% Flaps).

HYDRAULIC PRESSURE (UTILITY AND BOOST)

- (Red) 3,500 PSI Maximum Allowable.
- (Green) 2,900 PSI To 3,200 PSI Normal.

NOTE

The normal range is based on the following conditions: 100% RPM, all flight controls in neutral, suction boost pumps ON, and no system actuation. Pressure as low as 2550 psi may be experienced in low speed ground idle and is acceptable as long as the normal limits are attained as specified above.

HYDRAULIC PRESSURE EMERGENCY HYDRAULIC SYSTEM

- (Red) 3500 PSI Maximum Allowable Pressure
- (Green) 2900 To 3300 PSI Normal
  Pump Operating Limits:
  1 minute under full load
  30 minutes under no load

NOTE

When either of these limits is reached, cool pump for 15 minutes.

Figure 5-1. (Sheet 4 of 5)

instrument markings

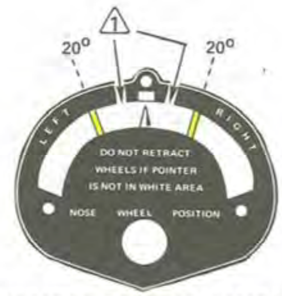
LIQUID OXYGEN QUANTITY

25 Liters (Full)

2.5 Liters (Minimum For Normal Use).

NOTE

IN CASE OF EMERGENCY, OXYGEN USAGE MAY BE CONTINUED UNTIL SYSTEM IS EMPTY.



NOSE WHEEL POSITION INDICATOR

⚠1 TURN LIMIT WHEN GROSS WEIGHT EXCEEDS 155,000 POUNDS OR TAXI SPEED IS 20 KNOTS OR HIGHER REGARDLESS OF RUNWAY TERRAIN CONDITIONS.

FIRE EXTINGUISHER SYSTEM PRESSURE GAGE

600 To 640 PSI Normal Pressure At 70 F.

FIRE EXTINGUISHER SYSTEM PRESSURE GAGE READINGS

Temperature		Gage Reading			
		Minimum		Maximum	
DEG C	DEG F	CB	DB	CB	DB
-7	20	535	490	605	570
-1	30	545	510	615	590
4	40	555	530	625	610
10	50	565	550	635	625
16	60	575	565	645	645
21	70	585	580	655	660
27	80	595	595	665	675
32	90	610	610	680	685
38	100	620	620	690	695
43	110	635	630	705	710
49	120	645	640	715	720
60	140	675	660	745	735
82	180	705	675	775	750

Figure 5-1. (Sheet 5 of 5)

engine and propeller limitations

ENGINE LIMITS

ENGINE CONDITION	TIT °C	RPM %	OIL PRESSURE (PSIG) R/G △1	OIL PRESSURE (PSIG) P/S △1	OIL TEMP °C △7	MAXIMUM INDICATED TORQUE IN-LB
GROUND OPERATION						
START LIMITS	See sheet 2.		Positive oil pressure indication by 35% RPM		100 -54 △6	
LOW SPEED GROUND IDLE (start position)		75.5 69	250 △2 50	100 (warmup only)	100 For 30 minutes (flight idle and below) then 85 60 to 85 -54 △6	Minimum until oil temperature is above 0°C
NORMAL SPEED GROUND IDLE (start position)		102 94	250 △2	60		
MAXIMUM REVERSE (0°)		106 96			100 Maximum for 30 minutes then 85	
FLIGHT IDLE (34°)		100.5 92.5	150 △3	50 △4	0	4,500 maximum at oil temperature 0 to +40°C.
TAKE-OFF						
TAKE-OFF 90° throttle position (5 minutes max)	1083 1067	102 98	250 150	100 (warmup only) 60 50	100 for 5 minutes, then: 85 60 - 85 40 and increasing	19,600
FLIGHT OPERATION						
MILITARY (30 minutes)	1049	102	250	100 (warmup only) 60	100 for 5 minutes, then: 85	19,600
CLIMB	1010				60 - 85	19,600
MAXIMUM CONTINUOUS	1010	98	150 △5	50	40 and increasing	**NOTE** During airstart, 4,500 is maximum at oil temperature of 0 to 40°C

NOTE

△1 Under stabilized conditions, allowable fluctuation is ± 10 PSI for the power section and ± 20 PSI for the reduction gear section.

△2 250 PSI may be exceeded during start and warmup with ambient temperature below 15°C.

△3 Operation below 150 PSIG when RPM is below 100 percent is permitted if 150 PSIG can be maintained at 100 percent RPM.

△4 If pressure is below 50 PSIG at low-speed ground idle, condition is acceptable provided pressure is within limits at 100 percent RPM.

△5 A pressure down to 130 psig is permissible during flight only as necessary to complete mission commitments.

△6 -54 for MIL-L-7808 oil.
-40 for MIL-L-23699 oil.

△7 When oil temperature exceeds 100° for any time duration, an entry will be made in the Form 781.

Figure 5-2. (Sheet 1 of 2)

engine and propeller limitations

OVERTEMPERATURE OPERATION

STARTING OVERTEMPERATURE

CONDITION	ACTION REQUIRED
TIT exceeds 830°C (excluding momentary overshoot and peak at 94% rpm)	Record in Form 781.
TIT exceeds 850°C (excluding momentary peak at 94% rpm)	Discontinue the start and record in Form 781. One restart is permitted after cooling to below 200°C TIT. If TIT exceeds 850°C on second start, discontinue start and record. Restart is not recommended.
TIT exceeds 965°C	Discontinue the start and record in Form 781. (An overtemperature inspection is required).

A torch other than normal enrichment burst requires an overtemperature inspection.

POWER ACCELERATION PEAK

Exceeds 1083°C for more than 5 seconds or exceeds 1175°C momentarily.

Reduce power to hold temperature within limits. Record in Form 781. (Overtemperature inspection required before next flight).

STARTER OPERATING LIMITS

1 minute ON, 1 minute OFF, 1 minute ON, 1 minute OFF, 1 minute ON, 30 minutes OFF

Release starter switch at 60% RPM.

PROPELLER GOVERNING LIMITS

NORMAL LIMITS (Normal Or Mechanical Operation) 98.0 - 102.0 percent.

If a stable RPM cannot be maintained, excluding allowable cyclic variations of plus (+) and minus (-) 0.5% (total of 1%), refer to PROPELLER FAILURES in section III. (Cyclic variation of plus (+) and minus (-) 0.5% is actually 1/2% on either side of a stable RPM for a total of 1%.)

PROPELLER AUXILIARY PUMP OPERATING LIMIT

1 minute ON, 1 minute OFF, not to exceed 2 minutes operation in any 30 minute period

NOTE

Underscored values on sheet 1 denote limits; values not underscored on sheet 1 denote normal operating values. All limits on this figure are flight station limits and are not to be confused with maintenance manual limits.

Figure 5-2. (Sheet 2 of 2)

The following defines fuel categorizations:

1. Recommended Fuel: A fuel which has been determined through engine qualification to satisfactorily perform in affected engines under all conditions.

2. Alternate Fuel: A fuel which can be used with a possible loss of efficiency. The use of this fuel might result in increased maintenance or overhaul cost. Limitations of significant nature such as reduced rate of climb, altitude, range, etc., properly places a fuel in the alternate rather than recommended category.

3. Emergency Fuel: A fuel which will cause significant damage to the engine or other systems; therefore, its use is limited to a one-time flight.

The following fuels are listed in order of preference:

1. Recommended Fuel: Specification MIL-T-5624, JP-4.

2. Alternate Fuels:

   a. Specification MIL-T-5624, JP-5.
   b. High flash point kerosene (JP-5 type and JP-8 type).
   c. Kerosene fuels, and Jet A and Jet A-1.

3. Emergency Fuels: Aviation gasoline (leaded grades) 80/87, 100/130, 115/145 not containing TCP.

See figure 5-3 for applicable specifications and NATO symbols for fuels that may be used in the T56-A-15 engine.

CAUTION

- NATO fuels F-30 and F-42 should not be used if mission requirements necessitate ground operation in temperatures below -34°F. NATO fuels F-34 and F-44 should not be used if temperatures below -53°F is anticipated, during ground operation.

- The presence of even relatively small quantities of TCP results in severe erosion, scaling, and pitting of the first stage turbine nozzle vanes and the turbine inlet thermocouples. Automotive gasoline is not acceptable due to the common use of TCP and a variety of other undesirable additives. The use of aviation gasoline containing tetraethyl lead (grades 80/87, 100/130, and 115/145) must be held to a minimum due to the heat absorbing quality of the lead coating which is deposited in the turbine section. If engines have operated an accumulated total of 50 hours on emergency fuels, the hot section of the engine must be inspected. Damage derived from use of alternate fuels will be determined during the next scheduled phase inspection. When aviation gasoline is used, decreased lubrication of all fuel components can be expected. Further, continued use of aviation gasoline will result in engine power loss and decreased engine operating efficiency.

- To avoid fuel freezing, fuel temperature should not be lower than 6°F above the freeze point defined in figure 5-3. The fuel temperature should be considered to be equal to the indicated OAT (stagnation temperature). If the OAT drops below the above limit, the airplane should be moved to an area where temperatures are higher.

The engine power available when using alternate or emergency fuels is not affected in electronic fuel scheduling since a specific turbine inlet temperature is scheduled for each throttle position. However, external temperature datum valve adjustment may be necessary for consistent engine starts when using alternate or emergency fuels.

CAUTION

When attempting a start with JP-5 and kerosene type fuels at ambient temperatures below -37°C (-35°F), the TIT and rpm should be closely monitored since stall and over-temperature may be experienced during the start.

Note

Refer to T.O. 42B1-1-14 for additional fuel usage data.

fuel availability chart

	MILITARY SPECIFICATION	FUEL GRADE	NATO SYMBOL	FREEZE POINT °F	COMMERCIAL DESIGNATION
RECOMMENDED FUELS					
	MIL-T-5624	JP-4	F-40	-72	
ALTERNATE FUELS					
HIGH FLASH POINT KEROSENE	MIL-T-5624	JP-5	F-44	-51	
		JP-5B	F-42	-40	
				-58	JET B
	MIL-T-83133	JP-8	F-34	-58	
KEROSENE			F-34	-40	JET A
			F-34 F-35 △2	-55	JET A-1
EMERGENCY FUELS					
LEADED AVIATION GASOLINE (NOT CONTAINING TCP)	MIL-G-5572	80/87	F-12	-76	AvGas 80/87
	MIL-G-5572	100/130	F-18	-76	AvGas 100/130
	MIL-G-5572	115/145	F-22	-76	AvGas 115/145

NOTE

1. FUELS LISTED FROM TOP TO BOTTOM IN ORDER OR PREFERENCE.

△2 CONTAINS FUEL SYSTEM ICING INHIBITOR (FS11).

Figure 5-3.

HIGH RATES OF CLIMB.

High rates of climb may create a fuel boiling-venting problem. The rate of climb should be restricted to the values shown in the following table, depending on the fuel used and the fuel temperature. (All figures estimated.)

Type of Fuel	Fuel Temperature, Start of Mission	Rate of Climb
JP-4	Up to 125° F	Not restricted.
JP-5, JP-8	Up to 135° F	Not restricted.
JP-4	125° to 135° F	Max rate of climb to 29,000 ft. Above 29,000 ft, 300 ft/min.
Aviation gasoline or JP-3	80° to 90° F	Max rate of climb to 30,000 ft. Above 30,000 ft, 300 ft/min.
Aviation gasoline or JP-3	90° to 100° F	Max rate of climb to 24,000 ft. Above 24,000 ft, 300 ft/min.
Aviation gasoline or JP-3	100° to 110° F	Max rate of climb to 18,000 ft. Above 18,000 ft, 300 ft/min.
Aviation gasoline or JP-3	110° to 120° F	Max rate of climb to 14,000 ft. Above 14,000 ft, 200 ft/min.

When using high vapor pressure fuels, JP-3 and aviation gasoline, loss of fuel can be incurred during climb by boil-off due to volatility, and by slugging. Slugging occurs as a result of fuel frothing and departing vapors entraining large quantities of froth while spewing from the vents. Foaming tendencies are aggravated by high vapor pressures, low ambient pressures, high initial fuel temperatures, and high rates of climb.

Note

The presence of small quantities of aviation gasoline in turbine fuel can trigger foaming.

Loss of fuel due to boil-off and slugging should occur in a relatively short period following arrival at boiling altitude. All such losses should be assumed to occur during climb. As with JP-4, JP-5 turbine fuel is characterized by low volatility; therefore, boil-off and slugging are considered unlikely. However, JP-3 and aviation gasoline have relatively high volatility, and boil-off and slugging are likely to occur under normal operating conditions.

The following table demonstrates the estimated loss of range due to boil-off when using JP-3 or aviation gasoline:

Fuel Temperature	Approximate Loss of Range When Climbing to These Cruise Altitudes 25,000 Ft.	35,000 Ft.
125° F	12 percent	20 percent
110° F	8 percent	15 percent
90° F	3 percent	10 percent
70° F	0 percent	5 percent

EFFECT OF ALTERNATE FUEL ON RANGE.

The BTU content per pound of all fuels does not vary significantly; therefore, the range will depend primarily on the pounds of fuel aboard.

AIRSPEED LIMITATIONS.

The limiting airspeed for a mission is interrelated with the cargo weight and maneuver load factors required for the mission and the gust load that may be encountered in turbulence. Recommended and maximum airspeeds are shown on figure 5-4. These speeds are referenced to specific fuel-cargo combinations on the Weight Limitations Chart and to the allowable maneuver load factors. Any cruise speed up to the recommended speed may be utilized up to and including moderate turbulence.

Note

Operation in the areas between recommended speed limits and maximum speed limits is permissible for initiating penetrations from 20,000 feet at 250 knots provided the corresponding maneuver load factors are not exceeded.

The airplane should not be operated in conditions of severe turbulence because gusts can be encountered that may impose excessive loads. However, if flight in severe turbulence cannot be avoided, flight should be flown at 65 knots above power-off stalling speed to a maximum of 180 knots. (See figure 6-1.)

Never exceed the following indicated airspeeds for the condition noted:

1. Flaps extended:

Percentage	Airspeed (knots)
10	220
20	210
30	200
40	190
50	180
60	165
70	155
80	150
90	145
100	145

2. Landing gear extended:

Do not exceed 165 knots with the landing gear extended.

3. Aft cargo door and/or ramp open:

Do not exceed 150 knots with the ramp open. Do not exceed 185 knots when the ramp is closed and the aft cargo door is open.

4. Paratroop air deflectors:

Do not exceed 150 knots when operating the paratroop air deflectors or with the air deflectors extended regardless of whether the paratroop door is open or closed.

5. Paratroop door:

Do not exceed 150 knots when operating the paratroop door.

6. Landing lights extended:

Do not exceed 165 knots with landing lights extended.

7. Painted flight control surfaces:

Do not exceed 250 knots when any flight control surface is painted, unless the following has been accomplished:

a. The underside of the ailerons and elevators and either side of the rudder have been stenciled as follows:

CAUTION

Subsequent repainting restricted to minor touch-ups unless performed at depot level.

OR

Only minor touch-up is authorized. Repaint in accordance with T.O. 1C-130B-2-2.

8. Fuel distribution.

CAUTION

If the total fuel in both external tanks exceeds 9,355 pounds in combination with less than 25,000 pounds of internal wing tank fuel, do not exceed 290 KIAS.

9. Landing gear doors removed.

Note

Flight with the doors removed will be accomplished only when authorized or directed by the major command concerned.

Maximum speed 200 KIAS. Flight is only permitted with the various doors removed in the following manner.

Main Landing Gear	All doors of the affected wheel well must be removed.
Nose Landing Gear	(1) Both forward and aft doors removed, or (2) aft nose door removed with forward door installed.

CAUTION

Flight is not permitted with the forward nose gear door removed with the aft door installed.

GUN AND STORES LIMITATIONS.

CAUTION

- Do not fire any of the guns when the external fuel tanks are installed.

- Do not fire 40MM or 105MM guns at depression angles less than 320 mils or 18 degrees to prevent muzzle blast damage to the left wing trailing edge structure and flaps.

- Do not fire 40MM and 105MM guns simultaneously or 40MM at a firing rate in excess of 100 rounds per minute to prevent exciting dynamic structural response modes of the fuselage structure.

- Do not operate the SUU-42 dispenser at intervals faster than one launch per second to avoid possible structural damage to the wing caused by exciting natural structural frequencies.

- When two ALQ-87 stores are carried on each side, they shall be located on the fore and aft centerline store stations on the MER.

- When three ALQ-87 stores are carried on each side, the third store shall be located on one of the remaining available forward store locations.

- Do not fire 40MM guns when recoil exceeds 8.3 inches to prevent excessive pressures in the recoil cylinder and excessive stresses elsewhere in the mechanism.

CAUTION

- Do not fire 105MM gun when recoil exceeds 49 inches to prevent excessive pressures in the recoil cylinder and excessive stress elsewhere in the mechanism.

- During ground operations when moving 105MM gun in elevation, do not allow gun blast suppressor to contact ground, maximum 28 degrees/500 mils.

ACCELERATION LIMITATIONS.

Never exceed the structurally-safe maneuver load factor for the applicable flight conditions and for the airplane load distribution. The limit load factor for fuel load and cargo load combinations is given in the Weight Limitations Chart (figure 5-4.) Do not exceed 60-degree angle of bank. The airplane is equipped with an accelerometer for the determination of g loading. Since feel is often misleading, particularly when the pilot's attention is diverted or distracted, abrupt and unnecessary maneuvering must always be avoided.

LOAD FACTORS.

A load factor is the ratio of the load imposed on the object to the weight of the object. It is expressed in terms of g. 1.0g being 1 times the weight of the object. The letter "g" stands for gravity, the accelerating pull the earth exerts on all objects. Since gravity is an acceleration, it is easy to understand that other types of acceleration also can produce load factors. The accelerations in which the pilot is most interested occur as a result of changes in his flight path, such as turns, pull-ups, and touchdowns on landings.

Because the airplane structure (particularly the wings) can only withstand certain maximum forces acting on it, it is necessary to limit the number of g (the load factor) which may be safely applied. A load factor in excess of these safety limits may result in structural damage to the airplane.

Note

The wing load factors on the weight limitations charts are valid only when the fuel sequence in Fuel Management, Section VII, is followed.

WARNING

The maximum maneuver load factor, regardless of cargo load, with any flap extension is 2.0g.

WEIGHT LIMITATIONS.

Airplane weight limits may be divided into two categories - gross weight limits and limits on cargo-fuel weight combinations. Taxi and landing gross weights are limited by landing gear strength, and take-off gross weight is limited primarily by wing strength, performance, and handling characteristics. Cargo-fuel combinations, as functions of airspeed, maneuver load factor, and degree of atmospheric turbulence, are limited by wing strength.

GROSS WEIGHT LIMITS.

Airplane gross weight limits are summarized in the following table for the conditions indicated.

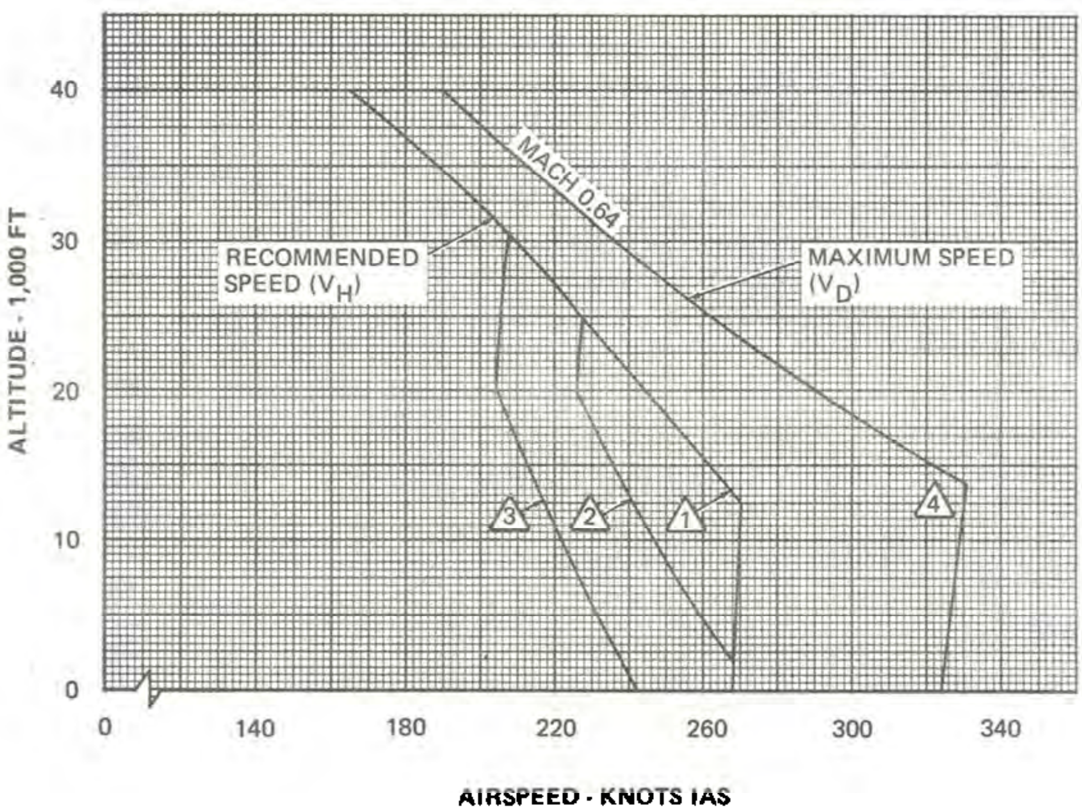
CONDITION	GROSS WEIGHT — POUNDS		MAXIMUM RATE OF SINK
	PYLON TANKS ON	PYLON TANKS OFF	
MAXIMUM TAXI			
RECOMMENDED	155,000	153,390	
EWP	175,000	173,390	
MAXIMUM TAKEOFF			
RECOMMENDED	155,000	153,390	
EWP	175,000	173,390	
INFLIGHT ONLOAD	175,000	175,000	
MAXIMUM LANDING			
RECOMMENDED	155,000	153,390	300 fpm
EWP	175,000	173,390	300 fpm
NORMAL LANDING	130,000	130,000	540 fpm

limit flight speed vs altitude chart

MODEL: AC-130H
ENGINES: T56-A-15

DATE: JUNE 1969

DATA BASIS: CATAGORY II FLIGHT TEST

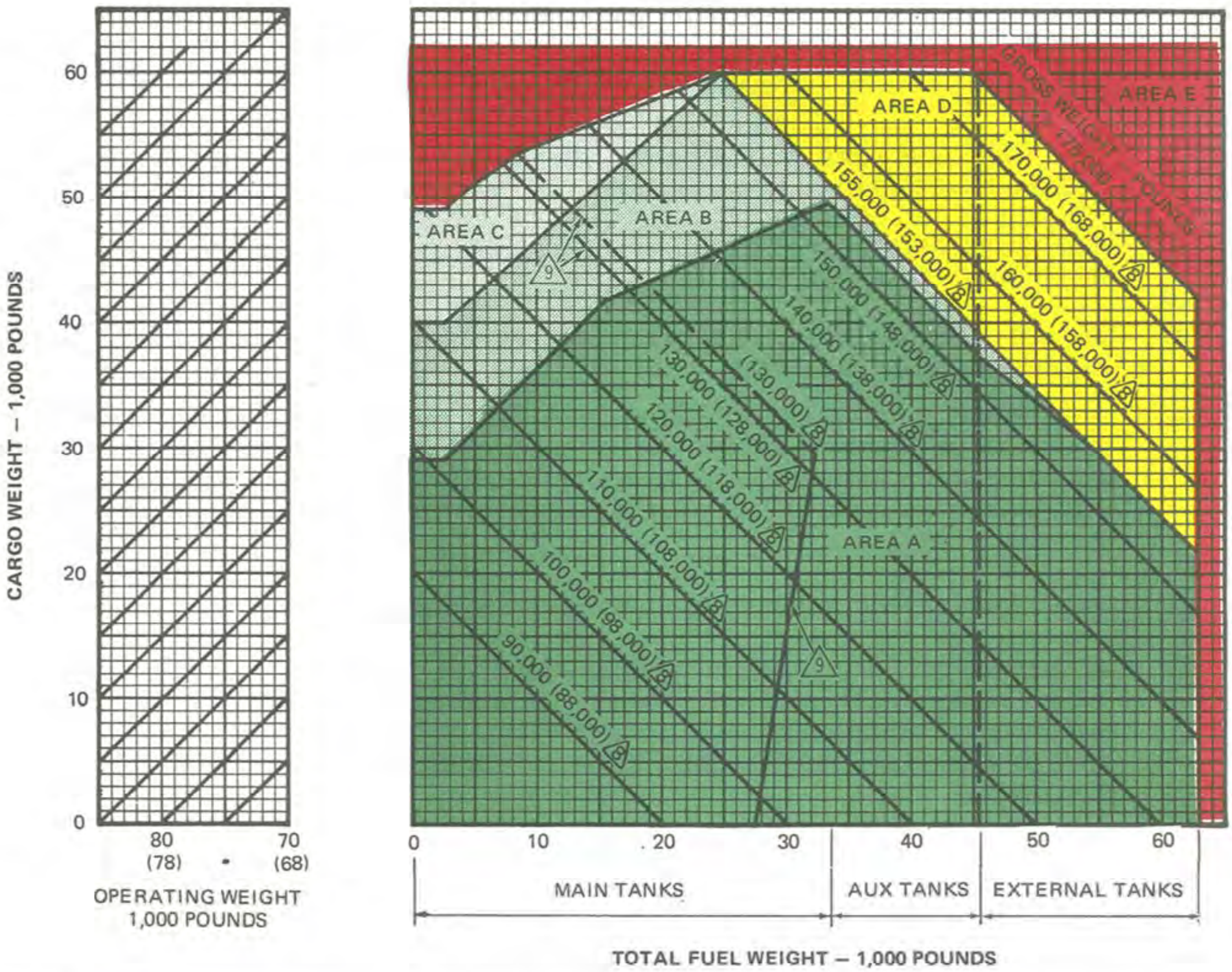


NOTE

REFER TO FIGURE 5-4 (SHEET 3 OF 3) FOR RECOMMENDED SPEED AND MAXIMUM SPEED NOTES.

Figure 5-4. (Sheet 1 of 3)

weight limitations chart



AREA A – RECOMMENDED – CARGO – FUEL COMBINATIONS FOR 3.0G MANEUVER LOAD FACTOR WITH V_H NOTE 1 OF SHEET 3.

AREA B – RECOMMENDED – CARGO – FUEL COMBINATIONS FOR 2.5G MANEUVER LOAD FACTOR WITH V_H NOTE 2 OF SHEET 3.

AREA C – RECOMMENDED – CARGO – FUEL COMBINATIONS FOR 2.5G MANEUVER LOAD FACTOR WITH V_H NOTE 3 OF SHEET 3.

AREA D – CAUTIONARY – PERMISSIBLE AT LOAD FACTORS UP TO 2.25G WITH V_H NOTE 3 OF SHEET 3.EXCEEDING THE LIMIT LOAD FACTOR OR PERMISSIBLE AIRSPEED CAN RESULT IN STRUCTURAL DAMAGE TO THE AIRPLANE. OBSERVE THE FOLLOWING GROUND LIMITATIONS: (1) TAXIING, SMOOTH PAVEMENT ONLY. (2) BRAKING, AVOID ABRUPT OR UNEVEN BRAKING. (3) PIVOTING, NOT ALLOWED. (4) TURNING, ALLOWED WITHOUT BRAKING.

AREA E – NOT RECOMMENDED – THE RESTRICTION ALSO INCLUDES INFLIGHT AIR REFUELING FUEL ONLOAD.

Figure 5-4. (Sheet 2 of 3)

RECOMMENDED SPEED.

1. V_H – MANEUVER LOAD FACTOR LIMITS ARE – 1.0g TO 3.0g. USE WITH AREA A.

2. V_H – MANEUVER LOAD FACTOR LIMITS ARE 0.0g TO 2.5g. USE WITH AREA B.

3. V_H – MANEUVER LOAD FACTOR LIMITS ARE 0.0g TO 2.5g FOR AREA C AND 0.0g TO 2.25g FOR AREA D.

MAXIMUM SPEED

4. V_D – MANEUVER LOAD FACTOR LIMITS ARE 0.0g TO 2.5g FOR AREAS A, B, AND C. FOR AREA D THE MANEUVER LOAD FACTOR LIMITS ARE 0.0g TO 2.25g.

5. FOR THUNDERSTORM OPERATION, REDUCE AIRSPEED TO 65 KNOTS ABOVE POWER – OFF STALL SPEED NOT TO EXCEED 180 KIAS.

6. NORMAL PENETRATIONS UP TO 250 KNOTS IAS ARE PERMISSIBLE IN SMOOTH TO MODERATELY TURBULENT AIR BELOW 20,000 FEET.

7. THIS FIGURE IS BASED ON THE FUEL MANAGEMENT PROCEDURES IN SECTION VII AND ON THE STANDARD DAY DENSITY OF JP-4 (6.5 POUNDS/GAL.). DO NOT REFUEL THE AIRPLANE TO ITS VOLUME CAPACITY WITH JP-5 (STANDARD DAY DENSITY OF 6.9 POUNDS/GAL.) SINCE THE MAXIMUM PERMISSIBLE FUEL WEIGHT WILL BE EXCEEDED. (REFERENCE FUEL QUANTITY DATA TABLE, SECTION I.).

8. WEIGHTS IN PARENTHESES ARE FOR PYLON TANKS-OFF CONFIGURATION.

9. NORMAL LANDING AND FUEL LIMITATIONS APPLY TO AIRPLANES WITH UNMATCHED MAIN GEAR STRUTS. HOWEVER, LANDINGS SHOULD BE RESTRICTED TO THE MINIMUM NUMBER REQUIRED. THE LIMITS SHOWN ARE THE MAXIMUM WEIGHT/FUEL COMBINATIONS FOR MAXIMUM LANDING RATE OF SINK OF 540 FPM PROVIDED NEITHER OUTBOARD TANK EXCEEDS THE FOLLOWING FUEL LIMITS:

   A. 6,600 POUNDS WITH "SOFT" MLG STRUTS AT 515 PSIG OR "STANDARD" MLG STRUTS AT 215 PSIG.
   OR

   B. 5,420 POUNDS WITH "STANDARD" MLG STRUTS AT 285 PSIG.

   C. THESE LIMITING FUEL WEIGHT VALUES MUST BE DECREASED BY THE WEIGHT OF THE SUU-42 SYSTEM WHEN INSTALLED. NOTE THAT THE WEIGHT OF AN EMPTY SUU-42 WITH PYLON AND RACK IS 538 POUNDS. A FULL LOAD OF FLARES WOULD ADD ANOTHER 432 POUNDS FOR A TOTAL WEIGHT OF 970 POUNDS FOR A FULLY LOADED SUU-42. NO CORRECTIONS ARE NECESSARY FOR IR SHIELDS THAT MAY BE INSTALLED.

   IF ANY OF THESE LIMITS IS EXCEEDED, MAXIMUM LANDING RATE OF SINK IS 300 FPM. SOME AIRPLANES ARE EQUIPPED WITH THE "STANDARD" MLG STRUTS AND SOME AIRPLANES ARE EQUIPPED WITH THE "SOFT" MLG STRUTS.

10. THE ZERO FUEL WEIGHT OF THE AC-130H GUNSHIP MAY BE INCREASED TO A MAXIMUM OF 120,000 POUNDS. HOWEVER, THIS INCREASE MUST BE DUE TO INSTALLATION OF ENGINE EXHAUST SHIELDS AND LOADED SUU-42 AT WING STATION 550.

Figure 5-4. (Sheet 3 of 3)

CAUTION

Emergency war planning (EWP) gross weights are not for peace time operation unless approved by the major air command.

Maximum Taxi Gross Weight.

Observe the limitations given in Taxi and Ground Limitations of this section.

Maximum Take-off Gross Weight.

Take-off gross weights must take into account the available runways, surrounding terrain, airfield elevation, atmospheric conditions, mission requirements, and the urgency of the mission.

Note

Gross weights exceeding those required for the mission will result in unnecessary risk and wear of the airplane.

Landing Gross Weights.

The airplane is designed to be able to land at any gross weight up to the maximum for take-off provided limiting relationships between landing gross weight, contact rate of sink, and fuel weight are observed. The airplane is designed for a maximum contact rate of sink of 540 feet per minute at gross weights up to the normal landing gross weight with the fuel weight limitations given on the Weight Limitations Chart, figure 5-4. The airplane may be landed at a contact rate of sink of 300 feet per minute at the maximum landing gross weight, which is equal to the maximum take-off gross weight, or with capacity fuel.

Note

- Although the airplane can be landed at the maximum landing gross weight (EWP), it is recommended that fuel be dumped to reduce gross weight to the maximum landing gross weight (recommended).
- The service life of the airplane will be increased if fuel is managed so that landings are made with no fuel in the external tanks.

WEIGHT LIMITATIONS CHART.

The Weight Limitations Chart, figure 5-4, presents graphically the cargo carrying capability of the airplane as a function of fuel weight, maneuver load factor, airspeed, and operating weight. The chart is divided into several areas which represent varying cargo capabilities with varying airspeeds, given on sheet 1 of the same figure, and varying maneuver load factors. The chart shows, for a given cargo weight, the minimum fuel weight at which a selected maneuver load factor and airspeed may be utilized, with a further reduction in fuel weight requiring a reduction in maneuver load factor and/or airspeed.

Operating Weight Effects.

The cargo carrying capability of the airplane is determined for a specific operating weight which includes crew, oil, unusable fuel, and standard equipment, but does not include cargo and usable fuel. Since the operating weight of the individual airplanes will vary because of special equipment, variations in standard equipment, modifications, and other factors, the cargo weight must be adjusted accordingly by a pound-for-pound trade-off; that is, if 2000 pounds of special equipment are added to an airplane, the cargo capability is reduced by 2000 pounds. To facilitate accounting for a range of operating weights, an operating weight scale is shown on the left side of the Weight Limitations Chart.

Note

Gunship equipment can be considered as cargo weight to determine fuel load and maneuver load factor limitations. For example, an operating weight of 105,000 pounds could be composed of a combination of theoretical operating weight of 80,000 pounds with a fixed cargo weight of 25,000 pounds. Any other combinations that represent the actual operating weight of the aircraft are acceptable for chart use within the limitation of the chart scales.

Fuel Distribution Effects.

The Weight Limitations Chart and the Limit Flight Speed Chart are based on JP-4 fuel at the standard day density of 6.5 pounds per gallon used, according to the fuel sequence given under Fuel Management in Section VII. Under these conditions, the outboard tank contains 715 pounds more fuel than the inboard tank. This fuel differential is reduced to zero when the SUU-42 is installed, either loaded or unloaded. No additional restriction is required for the IR shield installations.

CAUTION

Each outboard fuel tank is restricted to its full capacity less the weight of the SUU-42 system plus flares, if installed. No correction is required for the IR shield installations.

Note

The maximum zero fuel weight is 120,000 pounds. In order not to exceed the maximum taxi gross weight of 153,390 pounds for a 120,000 pound zero fuel weight, the fuel load will be limited to 33,000 pounds and will be distributed as follows:

Outboard Total	11,500#
Inboard Total	10,000#
Auxiliary Total	11,500#
Basic Mission Total	33,000#

For flight, this distribution helps reduce wing upbending by maintaining a spanwise center of gravity of the fuel that is outboard of the center of lift on the wing. Increasing or decreasing the differential fuel weight between the outboard and inboard tanks increases or decreases the cargo capability shown on the Weight Limitations Chart. Fuel carried in the auxiliary and external tanks decreases the cargo capability because of their spanwise location.

CAUTION

It is not recommended that the airplane be flown with less fuel in the outboard tanks than in the inboard tanks. The airplane should be flown with the outboard tanks empty only as an emergency measure.

For landing, wing downbending considerations limit the rate of sink to 300 feet per minute with capacity fuel except on substandard airfields. For rates of sink from 300 to 540 feet per minute, fuel weights are limited to those shown on the Weight Limitations Chart. Fuel in the outboard tanks is limited, as shown in the Weight Limitations Charts, at landing rates of sink exceeding 300 feet per minute.

Note

- Do not exceed the usable fuel weights per tank shown in the Fuel Quantity Data Table, section I.

- The service life of the airplane will be increased if missions are planned so that landings are made without fuel in the external tanks.

Recommended Loading Areas.

The Weight Limitations Chart has three areas of recommended cargo-fuel combinations, provided the associated limits on maneuver load factor and airspeed are observed. These recommended areas are shown in different shades of green. Area A encompasses those cargo-fuel combinations for which the maximum maneuver load factor is 3.0g at speeds up to the highest recommended speed, V_H ⚠1. Increasing the cargo weight to the cargo-fuel combinations in areas B or C requires that the maximum maneuver load factor be reduced to 2.5g. As the cargo weight is increased, it is also necessary to reduce the recommended speed to preclude excessive forces due to turbulence, with a reduction to V_H ⚠2 for area B and V_H ⚠3 for area C.

Cautionary Landing Areas.

The cautionary area on the Weight Limitations Chart, Area D, which is shown in yellow, encompasses those cargo-fuel combinations which are permissible for Emergency War Planning purposes, but which require extra caution to avoid damaging the airplane. For Area D, the recommended speed is V_H ⚠3, and the maximum maneuver load factor is 2.25g. Limitations given in Taxi and Ground Limitations of this section must be observed.

Loading Area Not Recommended.

The red area, area E, of the Weight Limitations Chart is composed of cargo-fuel combinations which present a high degree of risk of structural damage. Under conditions of extreme emergency when the risk of damage to the airplane is secondary, the Commander will determine if the degree of risk warrants operation of the airplane at loadings appearing in the red zone. Fuel weights in the red area on the right of the chart represent a high risk of damage to the wing structure during ground operation. Cargo weights in the red area at the top of the chart represent a high risk of damage during flight; if used, the maximum maneuver load factor is 2.0g and flight through severe turbulence is prohibited. Exceeding the maximum gross weight shown on the chart imposes a high risk of damage to the landing gear and supporting structure during taxi.

Note

Whenever flights are conducted at weights shown in the red area of the chart, entry in Form 781 is required.

Using The Chart.

The following examples illustrate the use of the Weight Limitations Chart. Example 1 illustrates the use of the charts to determine recommended cargo weight when gross weight is limited by field length and fuel weight is established by mission requirements. Example 2 illustrates the method of determining recommended airspeed and maneuver load factor when cargo and fuel weights are established by mission requirements. Example 3 shows the determination of minimum fuel at flight termination to attain a required airspeed and maneuver load factor. Example 4 shows the effect of fuel management differing from that defined in Section VII.

Example 1.

Problem: Determine the amount of cargo which can be carried when field length restricts gross weight to 140,000 pounds and the mission requires 45,000 pounds of fuel and a 3.0g maneuver load factor. The operating weight is 74,000 pounds and pylon tanks are on.

Solution: Enter sheet 2 of figure 5-4 on the fuel weight scale at 45,000 pounds, and move vertically until the gross weight line of 140,000 pounds is reached. Then, move horizontally to the left until the minimum operating weight line is reached. From this point, move parallel to the diagonal line (that runs from the minimum operating weight to the maximum operating weight) until the operating weight of 74,000 pounds is reached. Then, move horizontally to the left, and read the cargo weight of 21,000 pounds permissible for the mission.

Example 2.

Problem: Determine the maneuver load factors and airspeeds recommended for a mission transporting 40,000 pounds of cargo with a required fuel load of 35,000 pounds. The operating weight is 73,000 pounds and pylon tanks are on.

Solution: Enter sheet 2 of figure 5-4 at 73,000 pounds on the operating weight scale. Move vertically up to the line for 40,000 pounds of cargo. From this point, move parallel to the diagonal operating weight guidelines to the minimum operating weight. Then move horizontally to the right until the fuel weight of 35,000 pounds is reached. This point is in area A; therefore, for the early portion of the mission, the maximum maneuver load factor is 3.0g and the recommended speed is V_H [1]. When fuel burns off to 18,500 pounds, area B is entered and the recommended load factor is reduced to 2.5g and the recommended speed is reduced to V_H [2]. If the flight is continued until the fuel weight becomes less than 6,000 pounds, area C is entered, and the recommended speed is further reduced to V_H [3], although the recommended maximum load factor remains 2.5g.

Example 3.

Problem: For a mission requiring that 30,000 pounds of cargo be transported at the recommended speed V_H [1], determine the minimum amount of fuel required at flight termination and the maximum fuel at take-off. The operating weight is 75,000 pounds and pylon tanks are on.

Solution: : Enter sheet 2 of figure 5-4 at 75,000 pounds in the operating weight scale. Move vertically up to the line for 30,000 pounds of cargo. Then move parallel to the diagonal operating weight guidelines to the minimum operating weight. Then move horizontally to the right to the edge of area A. From this point, move vertically down and read the minimum fuel weight of 8,700 pounds at the termination point. Also, continue to move horizontally to the right across area A to the edge. Then, move vertically down to read the maximum fuel of 48,300 pounds of fuel for take-off.

Example 4.

Problem: Determine the amount of cargo that may be carried on a mission requiring a maneuver load factor of 3.0g when a landing at an intermediate stop must be made with 22,000 pounds of fuel, 6,000 pounds of which will be in the auxiliary tanks as a safety measure. The operating weight is 74,000 pounds and pylon tanks are on.

Solution: Enter sheet 2 of figure 5-4 at the fuel weight of 16,000 pounds (22,000 -6,000 = 16,000 pounds) which will be in the main tanks at the intermediate stop. Move vertically up to the edge of area A and read a gross weight of 128,000 pounds, which is the maximum gross weight for a load factor of 3.0g with 16,000 pounds of fuel in the main tanks. Move diagonally downward at this gross weight until intersecting the 22,000-pound fuel line. From this point move horizontally to the left until the minimum operating weight is reached. Then move parallel to the diagonal operating weight lines until the operating weight of 74,000 pounds is reached. From this point move horizontally to the left, and read the cargo weight of 32,000 pounds permissible for the mission.

CENTER OF GRAVITY LIMITATIONS.

The location of the center of gravity for any gross weight configuration, determined from T.O. 1-1B-40, Handbook of Weight and Balance Data, must fall within the percent of the mean aerodynamic chord (MAC) shown on the center of gravity limitations charts (figure 5-5). These limitations represent the combined structural, aerodynamic, and control limitations that must be observed to obtain safe and effective airplane performance. For information and method of calculating the airplane center of gravity, refer to T.O. 1C-130A-9, Cargo Loading Handbook, and T.O. 1-1B-40, Handbook of Weight and Balance Data.

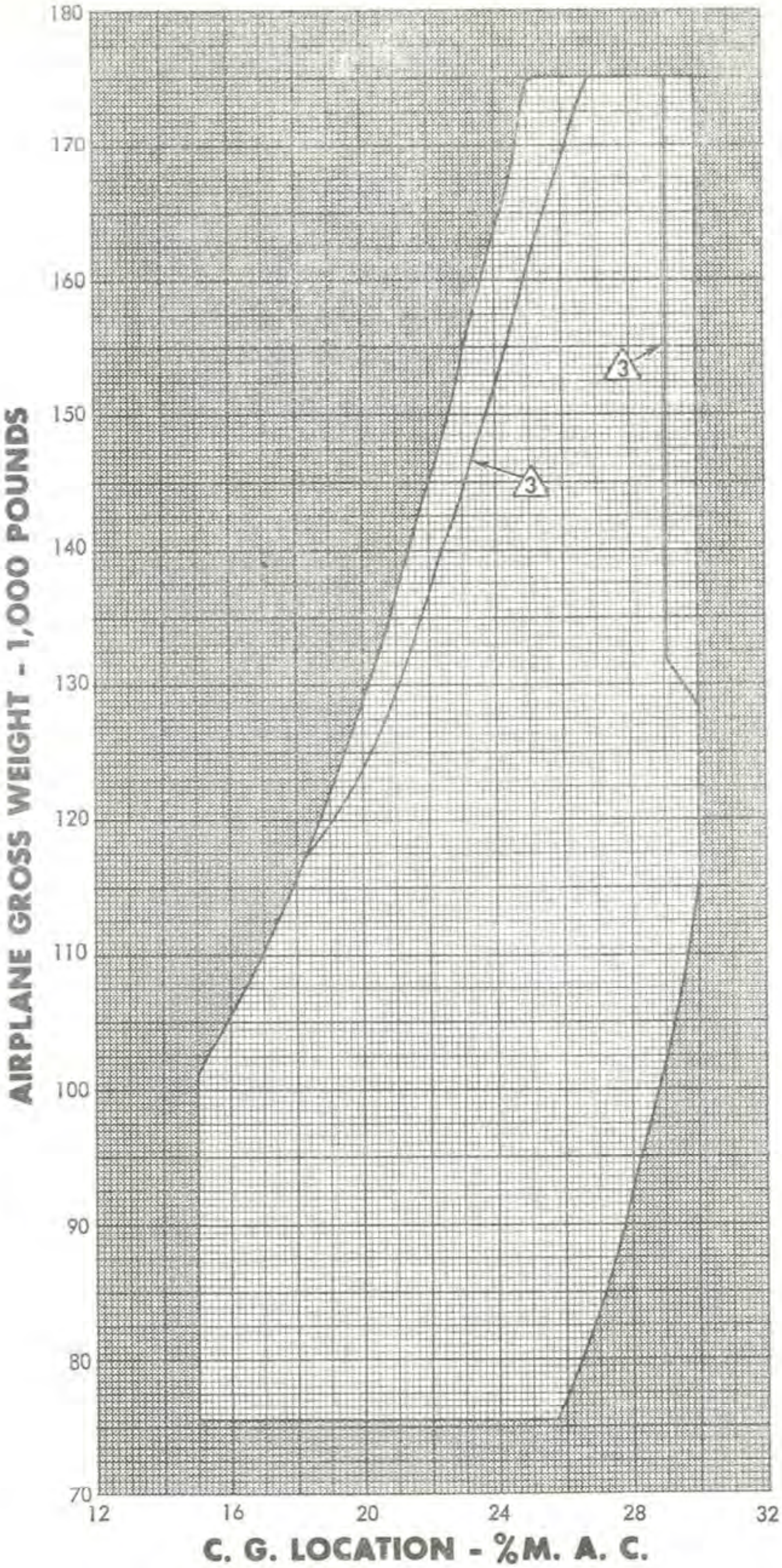
PROHIBITED MANEUVERS.

Aerobatics of any kind (including those that produce a negative g condition), intentional spins, excessively nose-high stalls, steep dives, and any other maneuvers resulting in excessive accelerations are strictly prohibited. Do not exceed a 60-degree angle of bank with flaps retracted or a 45-degree angle of bank with flaps extended. Do not make hard rudder kicks that result in large angles of yaw.

RAMP LOADING LIMITATIONS.

Loading of cargo on the ramp may impose restrictions on the CG range. The ramp loading limitations are contained in T.O. 1C-130A-9.

center of gravity limitations



RECOMMENDED

NOT RECOMMENDED

NOTE

1. LOAD SUFFICIENTLY BEHIND THE FORWARD C.G. LIMIT SO THAT WEIGHT REDUCTION THROUGH FUEL CONSUMPTION WILL NOT BRING C.G. LOCATION OUT OF ALLOWABLE RANGE.
2. THIS CHART IS APPLICABLE FOR ALL CARGO WEIGHTS WITHIN LIMITS OF WEIGHT LIMITATION CHARTS.

△3 C.G. LIMIT IF FUEL IS CARRIED IN EXTERNAL TANKS.

Figure 5-5.

TAXI AND GROUND LIMITATIONS.

CAUTION

- When operating at forward areas and substandard airfields and mission completion is not jeopardized, outboard engines may be shutdown during taxi to curtail FOD. If outboard engines are shutdown, auxiliary hydraulic pump should be turned on.

- Avoid turns with brakes locked on one side to prevent damage to the tires on the main landing gear and supporting structure. Avoid braking in turns at any taxi speed, since damage to the nose landing gear and supporting structure may result. If hard braking is required during a turn, record it in Form 781.

At gross weights up to 155,000 pounds taxiing over rough terrain should be avoided. If this is unavoidable, extreme caution must be exercised and very low taxi speeds observed. Do not exceed the following taxi speeds, regardless of runway conditions.

5 knots with nose gear deflected 60 degrees.
20 knots with nose gear deflected 20 degrees.

Note

For taxi limitations on rough terrain airfields, see Substandard Airfield Operations.

For emergency war planning gross weights, 155,000 to 175,000 pounds observe the following taxi limitations:

1. Taxi and take-off are permissible only on surfaces where qualities of smoothness and freedom from dips, depressions, and holes are comparable to those of a major air base.
2. Maximum taxi speed is 10 knots.
3. Taxi shortest distance possible.
4. Use minimum braking during all taxi operations.
5. Do not use brakes while turning.
6. Limit nose gear steering angle to 20 degrees.
7. Avoid abrupt or uneven application of brakes.
8. Pivoting is not permitted.
9. Towing and jacking are not permitted.

Note

On aircraft equipped with standard struts and airplanes at gross weights above 155,000 pounds, inflate main gear struts to 285 psig and the tires as shown in the maintenance manual.

GROUND FLOTATION CHARACTERISTICS CHART.

The ground flotation characteristics chart (figure 5-6) is provided for generalized operational planning. This chart permits matching the load that the airplane imposes on an airfield to the strength capability of the airfield. Ground flotation characteristics are correlated for the following five methods of evaluating airfield/runway strength.

FOOTPRINT LOADING (PRESSURE).

For operational planning purposes footprint loading is the same as tire inflation pressure. Figure 5-6 shows tire pressure values versus gross weights for normal operation from either high strength airfields or marginal strength airfields.

UNIT CONSTRUCTION INDEX (UCI).

UCI values are used to determine relative flotation characteristics of comparative airplanes and are seldom used in operational planning.

EQUIVALENT SINGLE WHEEL LOAD (ESWL).

Values of ESWL are determined from the geometry of the multiple wheeled landing gears, the number and size of the tires, and the airplane gross weight. Where airfield strength data are given in terms of ESWL, values of UCI and LCN can be calculated from these values of ESWL when required.

LOAD CLASSIFICATION NUMBER (LCN).

When LCN airfield strength data are used (primarily outside the United States) the data shown on the ground flotation chart can be used to estimate the capability of the airplane to operate from a given airfield.

CALIFORNIA BEARING RATIO (CBR).

Values of CBR shown in figure 5-6 represent the required airfield surface hardnesses for operation of the airplane in terms of gross weight and number of passes. Only unpaved surfaces (dirt, grass, gravel, coral, etc.) can be evaluated in terms of CBR.

ground flotation characteristics

AIRCRAFT GROSS WEIGHT (POUNDS)	HIGH STRENGTH AIRFIELDS PRESSURE (PSI)	MARGINAL STRENGTH AIRFIELDS PRESSURE (PSI)
	MAIN TIRE 20.00 -20/ -22PR	
UP TO 90,000	55 ± 5	47 ± 5
90,001 – 100,000	64 ± 5	53 ± 5
100,001 – 110,000	73 ± 5	59 ± 5
110,001 – 120,000	82 ± 5	65 ± 5
120,001 – 130,000	91 ± 5	72 ± 5
130,001 – 140,000	100 ± 5	78 ± 5
	MAIN TIRE 20.00 -20/ -26PR	
UP TO 90,000	63 ± 5	57 ± 5
90,001 – 100,000	69 ± 5	60 ± 5
100,001 – 110,000	75 ± 5	63 ± 5
110,001 – 120,000	81 ± 5	66 ± 5
120,001 – 130,000	87 ± 5	69 ± 5
130,001 – 140,000	93 ± 5	72 ± 5
140,001 – 160,000	105 ± 5	78 ± 5
160,001 – 175,000	114 ± 5	83 ± 5

NOTE

1. FOR SOFT FIELD OPERATION REDUCE THE VALUE OF ESWL AND UCI BY 10 PERCENT.
2. ON AIRPLANES EQUIPPED WITH STANDARD STRUTS, IF OPERATION ABOVE 155,000 POUNDS IS REQUIRED, INFLATE THE MAIN GEAR STRUTS TO 285 PSIG. REFER TO MAINTENANCE MANUAL FOR SERVICING INSTRUCTIONS. ON AIRPLANES EQUIPPED WITH SOFT STRUTS NO CHANGE IN STRUT PRESSURE IS REQUIRED.
3. ON AIRPLANES, AT WEIGHTS ABOVE 155,000 POUNDS INFLATE TIRES TO THE HIGH STRENGTH AIRFIELDS PRESSURE (PSI).
4. LCN ARE BASED ON LOWER TIRE PRESSURE WITH TIRE DEFLECTION APPROXIMATELY 39 PERCENT ASSUMING RIGID PAVEMENT STIFFNESS OF L-30 AND FLEXIBLE PAVEMENT THICKNESS OF 20 INCHES OVER CBR 6.
5. SOIL STRENGTH IS BASED ON LOWER INFLATION PRESSURE.

COMPARATIVE AIRCRAFT DATA		
AIRCRAFT	WEIGHT (LB)	UCI
C-47	33,000	18
C-119	74,000	26
C-54	82,000	27.2
C-124	170,000	30.2
P-2	64,900	33.2

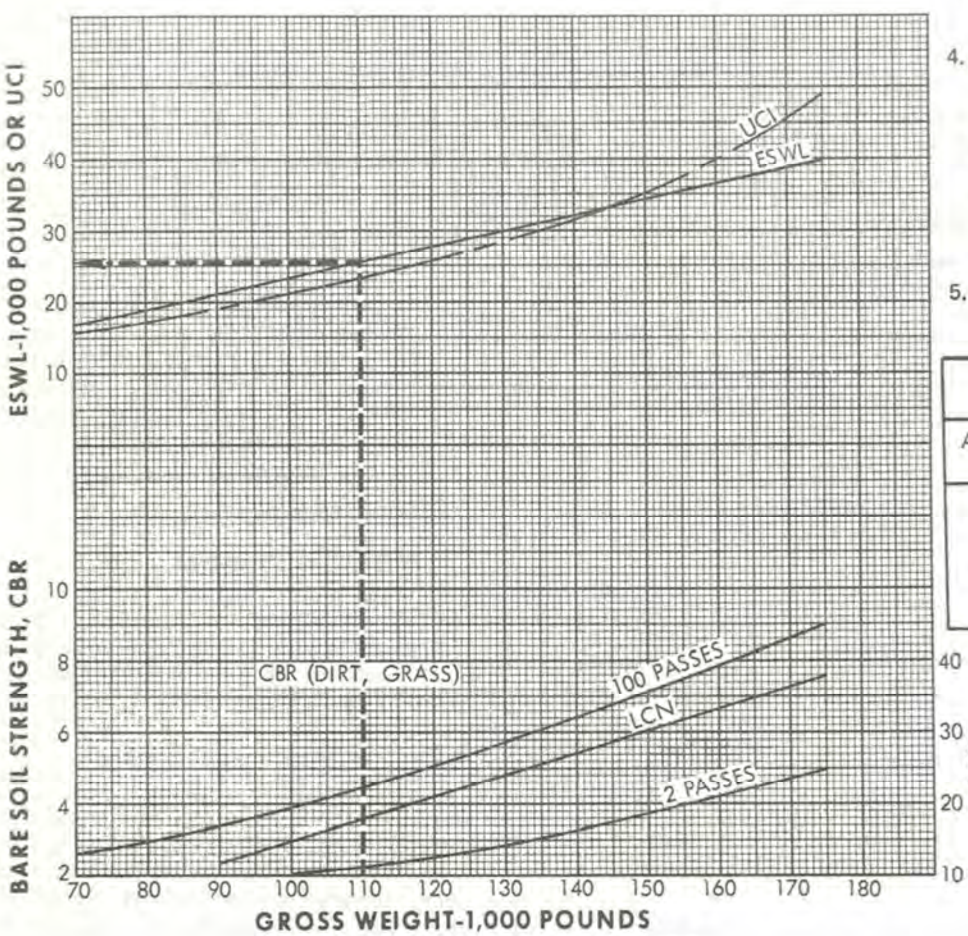


Figure 5-6.

AIRFIELD CONDITIONS.

High Strength Airfields.

Where airfield/runway strength data are available in terms of any of the methods shown in figure 5-16, the chart should be used as a guide to airfield-airplane compatibility. Where airfield/runway data are not available, the airplane can operate satisfactorily from most smooth, relatively hard-surfaced airfields. Permanent type (paved) airfields listed in the USAF/USN Flight Information Publications are adequate for most operations. For normal operation, tire pressure for a nominal tire deflection of 35 percent is recommended as shown by the high strength airfield data in figure 5-6.

Marginal Strength Airfields.

This category includes marginal strength airfields, temporary airfields such as airfields with minimum surfacing, or unsurfaced airfields such as would be encountered at forward area airfields used in airhead operations or airfields in remote areas of the world. The minimum soil strength required for operation of C-130 type airplanes is within the CBR values of 3 to 5. Operational feasibility on unsurfaced airfields depends upon the type soil, soil moisture content, and operational frequency. For marginal strength airfields, a tire deflection of 39 percent is used.

CAUTION

Do not exceed 39 percent tire deflection.

Using The Chart.

Example 1.

Given: A C-130 type airplane is required to operate into an unsurfaced airfield with a gross weight of 110,000 pounds.

Find: Footprint loading and ESWL for soft field operation.

Solution: Enter figure 5-6 for 20/26 PR tire at 110,000 pounds for marginal strength airfields and read 63 psi for main landing gear tire inflation pressure. Where the vertical line representing 110,000 pounds gross weight crosses the ESWL line read 25,000 pounds; then reduce this valve by 10 percent for soft field operation to obtain a final ESWL value by 10 percent for soft field operation to obtain a final ESWL value of 22,500 pounds.

Example 2.

Given: A C-130 type airplane is required to operate into an airfield with an LCN of 25.

Find: Footprint loading and maximum gross weight for unpaved runway operation.

Solution: Enter figure 5-6 on the horizontal line representing an LCN value of 25; where this line crosses the LCN line, proceed vertically down from this point to read a maximum gross weight of 133,000 pounds. From the tire inflation data (figure 5-6) for 20/26 PR tires at 133,000-pound gross weight on marginal strength airfields, read a main landing gear tire inflation pressure of 72 psi.

Example 3.

Given: A C-130 type airplane is required to operate into a thinly surface marginal strength runway where C-130 type airplanes have never been operated. C-119 airplanes have operated into this runway.

Find: The allowable gross weight which will impose the same load on the runway as the C-119 airplanes.

Solution: Read a UCI of 26 for the C-119 airplanes. Enter the left side of the chart at a UCI of 26 and proceed horizontally to the UCI line. Then proceed vertically downward to read 121,000-pound gross weight. From the chart (figure 5-6) also read the tire pressure of 69 psi for operation on a marginal strength runway.

SUBSTANDARD AIRFIELD OPERATIONS.

Substandard airfield operations generally imply operating on other than paved airfields. In general, the loading on the airplane is more severe while operating on substandard airfields. Operation from substandard airfields may be critical, and the following instructions are to minimize the chance of damaging the airplane:

1. The external tanks must be empty.

2. Taxi at minimum speed (approximately 10 knots or less).

3. Minimize braking if porpoising results.

4. Service main gear tires as shown on Ground Flotation Characteristics chart in this section.

5. On airplanes equipped with standard struts, service main gear struts to 285 psig. On airplanes equipped with soft struts no charge in struts pressure is required.

6. Minimize nose gear loads by use of elevator during take-off and landing rollout.

LANDING GEAR LIMITATIONS.

On airplanes with cracked main landing gear vertical track support beams (FS528, FS577, and FS588) the following instructions will be followed to preclude further progression of cracks in these areas. Also, the airplane may be flown only under the conditions listed below.

a. Affected airplane may be flown if the crack, from intersection of outboard flange and web to one of outboard bolt holes, has not progressed out of first bolt hole.

CAUTION

If any crack has progressed beyond the first bolt hole, airplane will be returned to home station (empty). The airplane will then be grounded until repaired.

b. Airplanes with known cracks are restricted to local training flights unless released for operational missions, by Warner Robins ALC, on an individual basis by serial number. If inspection reveals or causes suspicion that crack has progressed out of bolt hole, airplane should be inspected by ultrasonic means at the nearest base having the necessary equipment. On local training flights the landing gear will be inspected after every fourth landing for possible crack progression.

c. Airplanes released for operational missions with known cracks not extending beyond the first bolt hole will be inspected after each landing by non-destrictuve inspection means. If NDI equipment is not available, a visual inspection will be made.

Note

Red grease pencil mark can be used for reference mark.

d. Affected airplanes released for operational missions are subject to the following additional conditions:

(1) Maximum gross weight of 155,000 lbs will not be exceeded under any conditions. Bulk loads will be carried in lieu of high density loads, whenever possible. Landing gross weight will not exceed 75 percent of maximum allowable gross weight.

(2) Operations from substandard airfields or minimum ground run landing will not be made.

(3) Extreme caution will be taken during taxiing and towing. Maximum turn angle of nose wheel during towing will be 60 degrees right or left from center. All turns will be made with widest possible radius.

FAILURE OF PORK CHOP FITTINGS.

A pork chop fitting failure may be indicated inflight by a slow loss of pressurization.

The following restrictions are imposed on AC-130H aircraft, except aircraft with less than 6000 flight hours and aircraft that have been inspected in accordance with T.O. 1C-130A-6WC-15 (work cards 2-010 and 2-011), provided that no cracks were discovered:

a. Cabin pressurization is restricted to 10 inches of mercury or 5 psi pressure differential.

b. The aircraft may not be flown more than 1500 hours after discovery of a cracked pork chop fitting.

c. Refer to T.O. 1C-130A-9 for loading restrictions.

summary table of limitations

NOTE

REFERENCE SHOULD BE MADE TO APPLICABLE DISCUSSIONS WITHIN THIS SECTION FOR THE VALUES SHOWN BELOW.

WEIGHTS - POUNDS

CONDITION	PYLON TANKS ON	PYLON TANKS OFF	
MAXIMUM TAXI			
RECOMMENDED	155,000	153,390	
EWP	175,000	173,390	
MAXIMUM TAKEOFF			
RECOMMENDED	155,000	153,390	
EWP	175,000	173,390	
INFLIGHT ONLOAD	175,000	175,000	
MAXIMUM LANDING			
RECOMMENDED	155,000	153,390	300 FPM RATE OF SINK
EWP	175,000	173,390	300 FPM RATE OF SINK
NORMAL LANDING	130,000	130,000	540 FPM RATE OF SINK

SPEEDS - KNOTS INDICATED AIRSPEED

FLAPS EXTENDED:	
10%	220
20%	210
30%	200
40%	190
50%	180
60%	165
70%	155
80%	150
90%	145
100%	145

LANDING GEAR EXTENDED	165
LANDING LIGHTS EXTENDED	165
AFT CARGO DOOR	185
RAMP OPEN	150
PARATROOP AIR DEFLECTORS OPEN	150
PARATROOP DOOR (OPENING OR CLOSING)	150
THUNDERSTORM OPERATION	65 KNOTS ABOVE POWER OFF STALL SPEED NOT TO EXCEED 180 KIAS
MAXIMUM TIRE ROTATION (SEE T.O. 4T-1-4)	
PAINTED CONTROL SURFACES	250

SYSTEM LIMITS

FUEL

MAIN TANK BOOST PUMP PRESSURE	MIN 15 PSI - MAX 24 PSI
AUX AND EXT TANK BOOST PUMP PRESSURE	MIN 28 PSI - MAX 40 PSI

HYDRAULIC

UTILITY SYSTEM	NORMAL 2900 TO 3200 PSI - MAX 3500 PSI
BOOSTER SYSTEM	NORMAL 2900 TO 3200 PSI - MAX 3500 PSI
AUXILIARY SYSTEM	NORMAL 2900 TO 3300 PSI - MAX 3500 PSI
RUDDER BOOST:	
0 - 15% FLAPS	NORMAL 1100 TO 1400 PSI - MAX 1600 PSI
15 - 100% FLAPS	NORMAL 2900 TO 3200 PSI - MAX 3500 PSI

EMERGENCY HYDRAULIC SYSTEM:
NORMAL 2900 TO 3300 PSI — MAX 3500 PSI

PUMP OPERATING LIMITS:
FULL LOAD — 1 MINUTE
NO LOAD — 30 MINUTES

ACCUMULATOR PRELOAD

UTILITY SYSTEM	1500 PSI±100	NORMAL BRAKE	1500 PSI ± 100
BOOSTER SYSTEM	1500 PSI±100	EMERGENCY BRAKE	1000 PSI ± 100
AUXILIARY SYSTEM	300 PSI	EMERGENCY SYSTEM	300 PSI

PRESSURIZATION

CABIN DIFFERENTIAL PRESSURE	MIN -1.2 IN HG - MAX 15.8 IN HG

OXYGEN

FULL	25 LITERS
MINIMUM FOR NORMAL USE	2.5 LITERS

Figure 5-7. (Sheet 1 of 2)

summary table of limitations

STARTER

1 MIN ON, 1 MIN OFF; 1 MIN ON, 1 MIN OFF; 1 MIN ON, 30 MIN OFF
RELEASE STARTER SWITCH AT 60% RPM.

PROPELLER AUXILIARY PUMP

1 MIN ON, 1 MIN OFF, NOT TO EXCEED 2 MINUTES OPERATION IN 30 MINUTE PERIOD.

ELECTRICAL

FREQUENCY	MIN 380 CPS – MAX 420 CPS
AC VOLTS (GENERATOR AND INVERTER)	MIN 110 VOLTS – MAX 125 VOLTS
DC VOLTS	MIN 25 VOLTS – MAX 30 VOLTS
AC LOAD:	
ON GROUND (BRUSHLESS)	MAX CONTINUOUS 0.625
ON GROUND (BRUSH TYPE)	MAX CONTINUOUS 0.25
IN FLIGHT	MAX CONTINUOUS 1.050
DC LOAD	MAX CONTINUOUS 1.030
PROP DE-ICING	MIN SUFFICIENT 65 AMPS – MAX 90 AMPS
BATTERY VOLTAGE	MIN 21 VOLTS

GUN LIMITS

40 MM:

MINIMUM DEPRESSION ANGLE – 320 MILS OR 18 DEGREES
MAXIMUM FIRING RATE – 100 ROUNDS PER MINUTE
MAXIMUM ALLOWABLE RECOIL – 8.3 INCHES

105 MM:

MINIMUM DEPRESSION ANGLE IN FLIGHT – 320 MILS OR 18 DEGREES
MAXIMUM DEPRESSION ANGLE ON GROUND – 500 MILS OR 28 DEGREES
MAXIMUM ALLOWABLE RECOIL – 49 INCHES

Figure 5-7. (Sheet 2 of 2)

SECTION VI

flight characteristics

TABLE OF CONTENTS

INTRODUCTION.

The airplane is designed for operation from small airfields and emergency airstrips. In this, and in all other areas of flight operations including formation and instrument flying, the airplane has satisfactory flight characteristics. The outstanding and most useful characteristic in all ground and flight operating conditions is the capability of the airplane for rapid acceleration and its immediate and precise response to power and control applications.

STALLS.

Note

During turns, different indicated airspeeds will be presented by the pilot's and copilot's airspeed indicators. The difference increases with bank angle and can be as much as 10 KIAS at 45 degrees bank angle. This is because the static-sources located in the wing tip probes are not manifolded and provide independent static sources for the pilot's and copilot's airspeed indicators. The indicator to the inside of the turn always reads lowest; i.e., the pilot's airspeed indicator reads lower during a left turn and the copilot's indicator reads lower during a right turn. When the aircraft approaches stall speed in a turn, the airspeed indicator to the inside of the turn will read lower and should be used as the primary airspeed indicator. Power off stalling speeds for typical configurations and flight altitudes are given in figure 6-1.

Stall warning occurs in the form of airframe buffeting. The margin of airspeed between initial warning and actual stall is from 2 to 5 knots in the landing configuration and comfortably greater in all other configurations. There is little or no stall warning with gear and flaps retracted at flight idle power. Power-off stalling speeds for typical configurations and flight attitudes are given in figure 6-1. Use care to avoid accidental stalls. Should a stall be entered, it is recommended that recovery be made as follows:

1. If in level flight, immediately drop the nose. Apply symmetrical power to limit loss of altitude. Use ailerons and rudder to counteract any wing-dropping tendency. Move controls smoothly, avoiding abrupt actions. Avoid diving the airplane, and avoid abrumpt or accelerated pull-up after recovery.

WARNING

Do not raise flaps during recovery due to the resulting increase in sink rate and stall speed.

2. If in climbing or banked attitude, immediately drop the nose, level the wings, and apply symmetrical power to limit loss of altitude. Move controls smoothly, and avoid abrupt actions. Avoid diving the airplane, and avoid abrupt or accelerated pull-up after recovery.

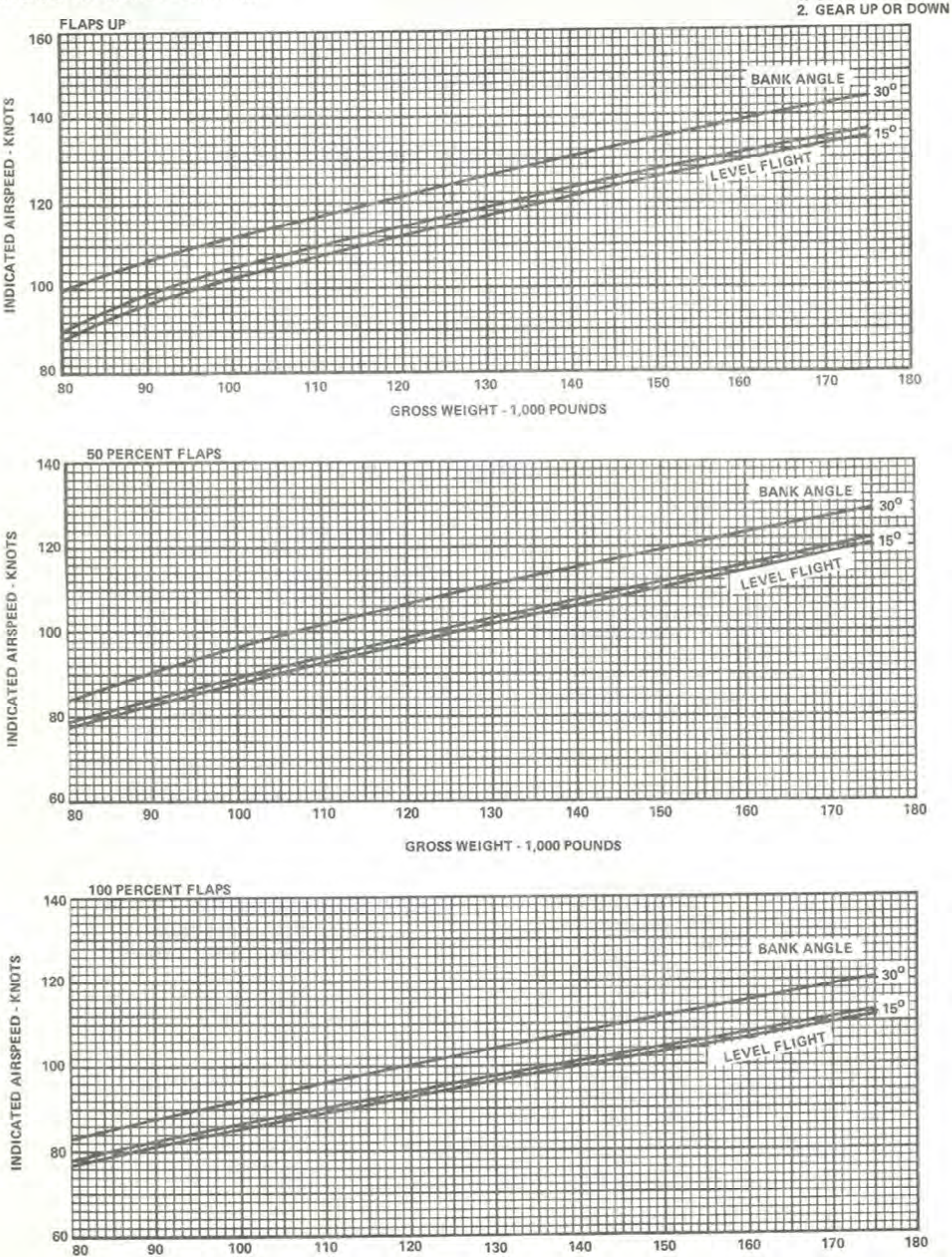
3. Heavy gross weight cruise configuration stalls may be accompanied by fish-tailing of the airplane and lightening of rudder and elevator control forces. Recovery

power - off stalling speeds

MODEL: AC-130H
T56-A-15 ENGINES
DATE: AUGUST 1973
DATA BASIS: CATEGORY II FLIGHT TEST

NOTES

1. OUT OF GROUND EFFECT
2. GEAR UP OR DOWN



GROSS WEIGHT - 1,000 POUNDS

Figure 6-1.

should be made by abruptly applying nose down elevator and reducing power to flight idle.

PRACTICE STALLS.

Any practice in stall entry and recovery should be made at light weights and with the cargo compartment empty. Practice at a minimum altitude of 10,000 feet above the ground. Do not delay recovery beyond the point of stall break. Avoid abrupt control movements, and avoid any control action that may result in sudden attitude change or in excessive acceleration or buffeting.

The following conditions adversely affect stall characteristics and/or performance and should be taken into consideration prior to any practice stall training.

a. High power settings.

b. Asymmetric power.

c. One or more engines producing negative torque or causing a negative torque signal.

d. Retrimming or continually trimming the elevator nose up during stall entry.

e. Changing flap deflection during stall entry or recovery.

f. Increasing power during stall entry.

g. Practicing stalls at too low an altitude or over an overcast.

h. High fuel weights - low cargo weight conditions.

i. After center of gravity position.

WARNING

Clean-configuration stalls should be discontinued at the onset of buffet. Power-on stalls should not be attempted because of the excessively nose-high attitude required.

SPINS.

Spins are a prohibited maneuver, and should never be intentionally entered. Accidental spins can be prevented by immediate recovery from any stall condition. If a spin is accidentally entered, it is anticipated that a normal recovery for multiengine airplane will be effective. Reduce power to flight idle, apply full rudder opposite the direction of the spin and ailerons against the spin and hold until rotation stops, hold elevator control forward of the neutral position. When rotation stops, immediately return rudder and aileron to neutral. Perform dive recovery. As in any maneuvering flight proper care should be taken to avoid exceeding the structural limits of the airplane by a sudden pull-up.

FLIGHT CONTROLS.

The flight controls are designed to be operated with hydraulic boost on at all times. With boost on, the airplane can be controlled without undue effort by the pilot under any reasonable load, flap, and power combinations. Lighter stick forces are encountered in the power approach configuration with aft center of gravity loadings. At airspeeds below 100 knots in the power approach configuration, a less positive roll stability effect is experienced. In case of complete failure of the hydraulically powered control systems, the airplane can be controlled by careful manipulation of the trim tabs.

WARNING

- Landing under these conditions will be marginal if turbulence or crosswinds are encountered.

- Do not deliberately turn off properly functioning boost control in flight. To do so may result in an uncontrollable attitude change and acceleration.

LEVEL-FLIGHT CHARACTERISTICS.

The range between slow- and high-speed flight is unusually large, but control and stability are normal for any trimmed condition. During landing at light gross weights, the airplane has a tendency to float due to the large wing area, the propeller blade angle, and the flight idle horsepower.

MANEUVERING FLIGHT.

Maneuvering flight within the category of acrobatics is prohibited. Do not make hard rudder kicks that result in large angles of yaw. Normal maneuvers may be accomplished with moderate pilot effort, since control movement is assisted by the boost system. There are no conditions of normal maneuvering flight which will produce a reversal of control pressures, and maneuvers can be accomplished with ease. In executing turns under combat conditions, remember that 60 degrees is the maximum bank angle. The recommended speed for minimum-radius turns is the best climb speed at that altitude.

FIN STALL.

WARNING

Fin stall maneuvers are prohibited.

If the airplane is maneuvered to abnormally high sideslip angles (15-20 degrees), a fin stall resulting in large yawing transients and a loss of directional stability can be encountered. This is an unusual flight maneuver and will not result from power transients, gusts, wake turbulence or execution of normal flight maneuvers. The fin stall condition is more likely to occur during abnormally high left rudder input maneuvers if held until fin buffet occurs. Fin stall can be achieved at all speeds between stall speed and approximately 170 knots in all flap configurations with power on. The susceptibility of encountering the fin stall condition is greatest at low speed with high power. Consequently, under these conditions rapid yawing maneuvers can be produced with (1) relatively low abrupt rudder inputs or (2) abnormally high rudder deflections. As the airplane attitude approaches the critical sideslip angle, heavy vertical fin buffet will develop.

WARNING

Sideslip angles beyond onset of buffet are prohibited.

WARNING

If the aircraft is allowed to proceed into sideslip angles beyond the onset of buffet, a wing may stall resulting in loss of lateral and directional stability from which it may be extremely difficult to recover. This could lead to the possible loss of the aircraft.

Note

Sideslip maneuvers increase drag and reduce lift, therefore, degradation in climb performance will be experienced and loss of airspeed may be experienced.

FIN STALL RECOVERY.

Fin stall recovery must be initiated at the onset of buffet and can be accomplished by one of these ways:

a. Returning the rudder to neutral.

b. Rolling to a wings level attitude.

c. Retarding all throttles toward "Flight Idle".

Note

If flight conditions permit, pushing the nose down will assist in recovery. Ensure that adequate flying speed is maintained at all times.

Note

If fin stall is entered it will require approximately 50 to 100 pounds rudder pedal force to return the rudder to neutral.

WARNING

- If rudder boost unit is suspected to have failed in a hard-over position, verify that cockpit control matches the hard-over maneuver being experienced. If verified, turn the rudder control boost switches to OFF. Expect that greatly increased forces will be required to move the control for which the hydraulic assistance has been turned off. Use of asymmetric power and increasing airspeed will assist in recovery from this position.

- Abrupt push-over to a negative g condition with flaps either up or down should be avoided. This type of maneuver will result in a reduction in maneuvering longitudinal stability, in tnat the angle of pitch-down and the negative g condition continue to increase even after the stick direction has been reversed. After movement of the stick toward the former position is begun, there is a time lag before the airplane starts to reverse its pitching motion. Final recovery from the maneuver requires considerable pull force. This is due to the large pitching inertia of the airplane and the longitudinal rotational effect on the hinge moments of the elevator. These characteristics could result in an excessive negative load factor, an uncomfortable nose-down attitude, and an excessive positive load factor due to an abrupt recovery.

DIVING.

Conduct dives or descents within the airspeed limitations given in Section V. Avoid abrupt pull-ups at any time.

SECTION VII

systems operation

TABLE OF CONTENTS

INTRODUCTION.

The descriptions and operating instructions contained in this section are for systems which are peculiar to those airplanes or systems that require emphasis. In some cases the information given overlaps that given in the general description of the system concerned. In other cases, instructions are given which do not appear elsewhere in the manual.

PROPULSION SYSTEMS CHECKS.

ELECTRONIC FUEL CORRECTION.

Electronic fuel correction is controlled by the TD control valve through operation of the temperature datum control valve switches on the flight control pedestal. Refer to Section I for description of the TD valve and switches.

Locking the TD valve provides these advantages:

During the landing approach, locking the TD valve before the throttles are retarded should give more equal power distribution on all engines.

In the event of a TD control malfunction causing rpm and temperature fluctuations, locking the TD valve may stop the fluctuation.

During formation flying, locking the TD valve will prevent a crossover bump in changes of horsepower.

Do not lock the TD valve under the following condition:

During power transients; wait for the engine to stabilize at new power setting.

Ground Checkout of the Temperature Datum Control System.

Advance the throttles and observe the turbine inlet temperature change as electronic fuel controlling is reached (as indicated by the electronic fuel correction lights going out). The turbine inlet temperature at this point, when normal, will be 800°C to 840°C.

If the TIT does not change when electronic fuel controlling is reached, proceed as follows:

1. Symmetrical throttles - Approximately 850°C TIT.
2. Engine bleed air valve switch (engine to be checked) - CLOSE.
3. All anti-icing and de-icing switches - OFF.
4. Propeller and engine anti-icing master switch - MANUAL.
5. Engine inlet duct anti-icing switch (engine being checked) - ON.

The TIT should rise slightly and then return to the previous setting. If the TIT does not return to the previous setting, the electronic temperature controlling system has malfunctioned.

6. Engine inlet duct anti-icing and propeller and engine anti-icing master switches - OFF/AUTO.
7. Engine bleed air valve switches - OPEN.
8. Throttles - As required.

CAUTION

If the temperature controlling system has failed and the mission dictates, place the TD valve switch for that engine to the NULL position. If the TIT stabilizes, continue operation, monitor TIT closely as maximum TIT can often be exceeded at advanced throttle settings. If the malfunction persists, other engine systems are at fault. Maintenance action is required prior to flight.

PROPELLER NORMAL GOVERNING RE-INDEXING.

Since propeller operation is more stable in flight than on the ground, re-indexing, when necessary, should be performed during stable flight conditions. However, if normal governing is out of limits or fluctuating on the ground, this procedure should be performed before considering the condition discrepant. During the re-indexing procedure, the time elements and step must be closely followed in correct sequence or the procedure may not be effective. If the first attempt to re-index proves ineffective, the entire procedure should be carefully repeated before the airplane is returned to maintenance.

Re-indexing Procedure.

Note

Run-up area wind conditions may cause excessive rpm fluctuations and may also affect re-indexing procedures.

If this procedure is performed on the ground, all throttles must be set 8,000 to 9,000 inch-pounds torque. This will assure that the propellers are governing.

1. Place all propeller governor control switches to MECH GOV.
2. Select a master engine and wait 20 seconds.
3. Hold the propeller resynchrophase switch to RESYNC position while performing steps 4 and 5.
4. Place all propeller governor control switches to NORMAL and wait 20 seconds.
5. Place the synchrophase master switch to OFF.
6. Release the propeller resynchrophase switch to NORMAL and wait 20 seconds.

ENGINE STARTING.

USE OF FUEL ENRICHMENT.

During the engine starting cycle, if fuel enrichment is used, the fuel enrichment system furnishes unmetered fuel to the temperature datum valve to supplement normal flow through the fuel control. When fuel enrichment is used, enrichment starts at 16 percent rpm and lasts only until fuel manifold pressure reaches approximately 50 psig.

Note

If the engine does not start on the first attempt, the drip valve should drain all excess fuel in the engine overboard when the start is discontinued. If the drip valve fails to drain the excess fuel it is advisable to turn the fuel enrichment switch OFF for the second starting attempt and motor the engine with the condition lever in GROUND STOP, to eliminate the accumulated fuel from the engine to preclude a hot start or torching.

Characteristics of the starts will vary somewhat, however. With fuel enrichment off, light-off occurs between 22.0 and 26.5 percent rpm and several seconds will probably elapse between maximum turbine starter driven rpm and light-off. Touching may occur also when starting with fuel enrichment normal light-off occurs between 19.0 and 27.0 percent rpm with rapid engine acceleration. If a stalled start takes place, it can be noted by rpm lag at about 40 percent rpm and sharp TIT increase. When the engine is still hot from previous operation, stalled starts are more

normal engine starting sequence

% ENGINE RPM (APPROXIMATE)	ACTION	CONTROLLED BY
0 - 94%	TEMPERATURE DATUM CONTROL NORMALLY LIMITS TIT TO 830°C DURING START.	SPEED-SENSITIVE SWITCH
0 - 94%	5TH AND 10TH STAGE COMPRESSOR BLEEDS OPEN	SPEED-SENSITIVE VALVE
-	ELECTRONIC FUEL CORRECTION LIGHT ON	THROTTLE AND ELECTRONIC FUEL CORRECTION SWITCH
16%	FUEL SHUTOFF OPENED	SPEED-SENSITIVE SWITCH
16%	FUEL ENRICHMENT ON	SPEED-SENSITIVE SWITCH AND FUEL ENRICHMENT SWITCH
16%	FUEL PUMPS IN PARALLEL OPERATION	SPEED-SENSITIVE SWITCH
16% AND UP	DRIP VALVE CLOSED	SPEED-SENSITIVE SWITCH AND PRESSURE
16%	IGNITION ON	SPEED-SENSITIVE SWITCH
50 PSIG FUEL MANIFOLD PRESSURE	FUEL ENRICHMENT OFF	MANIFOLD PRESSURE SWITCH
60%	STARTER RELEASED	START SWITCH RELEASE BY PILOT
65%	FUEL PUMPS IN SERIES OPERATION	SPEED-SENSITIVE SWITCH
65%	IGNITION OFF	SPEED-SENSITIVE SWITCH
94%	5TH AND 10TH STAGE COMPRESSOR BLEEDS CLOSED	SPEED-SENSITIVE VALVE
94%	TIT LIMITED BY TEMPERATURE DATUM CONTROL	SPEED-SENSITIVE SWITCH
94%	TD VALVE TAKE CAPABILITY CHANGES FROM 50 PERCENT TO 20 PERCENT	SPEED-SENSITIVE SWITCH

Figure 7-1.

likely to occur with fuel enrichment on. After an unsuccessful attempt to start the engine with fuel enrichment on, the next attempt should be made with fuel enrichment off.

NORMAL ENGINE STARTING SEQUENCE.

During a normal start, provided normal procedures (Section II) have been followed, the actions listed in figure 7-1 will take place automatically. An examination of this sequence of actions will be helpful in understanding the overall operation of any start.

FUEL MANAGEMENT.

Fuel management is accomplished at the fuel control panel (figure 1-27), which is located overhead within reach of both pilots and the engineer. Fuel routing is governed by fuel tank selection and crossfeed valve positioning. Fuel gages on the panel indicate quantities in each tank, and a totalizer indicates total fuel remaining. An additional check of fuel quantity may be made by keeping a log based on engine fuel flow and time.

CAUTION

When the airplane is parked with the fuel tanks more than three quarters full, all crossfeed valves should be closed. Otherwise, low tanks may be overfilled by slow transfer of fuel through the boost pump check valve bleed orifice from the crossfeed manifold.

Note

Fuel tank gages should be read while airplane attitude is within ±3 degrees roll and 0 degree nose-up pitch to obtain most reliable readings. Because fuel tanks are located in the wings, it is important to maintain a balanced weight, within 1,500 pounds, between the left and right wing, except auxiliary tanks may differ so that one auxiliary tank is empty and one auxiliary tank is full provided the main and external tanks are equally distributed. However, the distribution should never vary more than 1,000 pounds between each pair of symmetrical main or external tanks. At least 715 pounds more fuel should be maintained in the outboard tanks than in the inboard tanks. This differential is not necessary if the SUU-42 system is installed, either loaded or unloaded. If fuel weight becomes unbalanced through varied rates of consumption or from having one engine shut down, periodic trimming is required.

FUEL FLOW.

Design of the airplane allows tank-to-engine or crossfeed fuel flow. Tank-to-engine routing is normally used at all times when fuel is being taken from the main tanks. Crossfeed is used when using fuel from the auxiliary or external tanks, when trimming a tank, or in other special uses. Boost pump operation is recommended at all times to ensure adequate engine supply pressure. Refer to figure 1-23 for the fuel system schematic diagram.

Fuel System Positive Flow Check.

A fuel system positive flow check for those tanks containing fuel will be made during the Before Taxi or Taxi checklists and will be initiated with all boost pumps off.

Open all tank crossfeed valves, and leave the crossfeed separation valve closed. If the auxiliary tanks contain fuel, position the auxiliary boost pumps to ON. Observe all low pressure lights out and monitor TIT and fuel flow for contamination for at least 1 minute. Position auxiliary boost pumps OFF, or close auxiliary crossfeed valves if auxiliary pump operation is required. If the external tanks contain fuel, position the forward boost pump switches to ON. Observe all low pressure lights out and monitor TIT and fuel flow for at least 1 minute. Position the forward boost pump switches to OFF. Close all tank crossfeed valves, and deplete pressure.

Take-off.

To obtain the correct fuel flow for take-off:

1. All crossfeed valves - CLOSED
2. All main tank boost pumps - ON

Climb and Cruise.

With external tanks installed the normal fuel tank usage is external, auxiliary and main for short range missions and auxiliary, external and main for long range missions. Without external tanks, normal fuel tank usage is auxiliary and main. On short range missions, it is recommended that fuel be used from the external tanks before the auxiliary tanks to prevent landing with fuel in the external tanks. When opening main tank crossfeed valves, observe fluctuation of fuel pressure for indication that the valve has opened. Monitor TIT, torque, and fuel flow for approximately 1 minute.

CAUTION

The auxiliary tanks must be used prior to the main tanks in order to maintain the inflight airspeed and weight limitations shown in Section V.

Since the external tank boost pumps have a higher pressure than the main tank boost pumps, they will supply the engines with fuel until empty.

CAUTION

- When fuel quantity of any main tank is less than 1000 pounds, the engine being fed by that tank will be placed on crossfeed operation.
- When operating with less than 6000 pounds of total fuel in the main fuel tanks, place the crossfeed valve switch to OPEN and the boost pump switch to ON for all tanks containing fuel; place the crossfeed separation valve switch to OPEN.

Fuel Tank Trimming.

To take fuel from a heavy tank:

1. Crossfeed valve (heavy tank) - OPEN
2. Crossfeed separation valve - OPEN
3. Crossfeed valve (light main tank of tanks)-OPEN
4. Boost pump (light main tank or tanks) - OFF

When trimming is complete:

5. All boost pumps - As Required
6. All crossfeed valves - As Required
7. Crossfeed separation valve - CLOSED

Approach and Landing.

The crossfeed valve switches may be left in the OPEN position for approach and landing provided all main tank boost pump switches are in the ON position and the crossfeed separation valve switch is in the CLOSED position.

FUEL TRANSFER (AIRPLANES MODIFIED BY T.O. 1C-130-949).

Fuel transfer between main, auxiliary, or external wing tanks may be accomplished as follows:

1. Crossfeed and bypass switches - CLOSED.
2. Auxiliary and external pump switches - OFF.
3. Aerial refueling power switch - ON.
4. Fuel dump switch(es) - ON.

Note

Select tank(s) to be defueled and place appropriate fuel dump switch(es) to ON. Verify fuel pressure increases.

5. Tank fill valve(s) - PRI or SEC.

Note

Select tank(s) to be refueled and place appropriate tank fill valve(s) to PRI or SEC. Verify fuel pressure decreases.

6. Monitor fuel quantity for the applicable tanks.

When the desired quantity of fuel has been transferred, proceed as follows:

7. Tank fill valve(s) - CLOSED.

Note

Verify fuel pressure increases.

WARNING

Failure of the manifold pressure to increase in the CLOSED position indicates an open tank fill valve.

8. Fuel dump switch(es) - OFF.
9. Aerial refueling power switch - OFF.

USE OF WHEEL BRAKES.

It is absolutely necessary that airplane brakes be treated with respect. Although the anti-skid system will give consistently shorter landing rolls on dry runways, it should not be used to its maximum potential to make all landings as short as possible. To minimize brake wear, the following precautions should be observed insofar as practicable:

1. Use extreme care when applying brakes immediately after touchdown or at any time there is considerable lift on the wings if the anti-skid system is

inoperative. A heavy brake pressure can result in locking the wheels more easily if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the airplane is on the wheels. A wheel once locked in this manner will not unlock when the load is increased, as long as brake pressure is maintained. Brakes, by themselves, can merely stop the wheel from turning. Stopping the airplane is dependent on the friction of the tires on the runway. There are two reasons for this loss of braking effectiveness in a skid. First, the immediate action is to scuff the rubber, tearing off little pieces which act like small rollers under the tire. Second, the heat generated starts to melt the rubber and the molten rubber acts as a lubricant. Therefore, if one pair of wheels is locked during application of brakes, there is a tendency for the airplane to turn away from the locked wheels, and further application of brake pressure to those wheels will offer no corrective action. Since the coefficient of friction goes down when a wheel begins to skid, it is apparent that a wheel, once locked, will never free itself until brake pressure is reduced.

2. Anti-skid systems are intended to prevent skids at high speeds under light wheel loads. Therefore, brakes may be applied immediately after touchdown, with anti-skid, but this should be done only when definitely necessary. The anti-skid system will function to prevent tire skidding if it is operating properly; however, it is not designed to perform as a completely automatic braking system. Continuous braking from the point of touchdown will result in considerable overworking of the anti-skid system in addition to causing excessive wear and extreme heating of the brakes.

3. If maximum braking is required after touchdown, lower the nose as soon as possible, and apply the brakes. Reverse thrust should be used whenever possible.

4. For short-field landings, a single, smooth application of the brakes with constantly increasing pedal pressure is most desirable.

5. If maximum braking has been used in landing, it is recommended that the gear be left extended after subsequent take-off for a minimum of 15 minutes before retraction or before another braked landing is attempted. The parking brakes should not be set if the airplane is parked subsequent to such a landing, and the airplane should be taxied using the minimum amount of brakes necessary for safety.

WARNING

Failure to cool the brakes could result in a tire explosion and damage to the airplane.

6. The full landing roll and propeller reversing should be used at all times to minimize the use of brakes. After normal landings where the brakes are not used and only checked during landing ground roll, allow 10 minutes cooling time preceding the next take-off to account for brakes used during taxi. This is required because critical field length increases due to brakes being above ambient temperature. If the runway is much longer than critical field length, the 10-minute cooling time may be omitted.

7. At the first indication of brake failure or after the brakes have been used excessively or hot brakes are suspected, have the fire department crash crew make an inspection of the brakes and tires as brake fires are possible. Maximum braking during landing at heavy gross weight is the most likely case where hot brakes should be suspected. Do not taxi into crowded parking areas or set the parking brake when the brakes are overheated. Peak temperatures occur in the brake assembly (tri-metallic or single disc) from approximately 1 to 5 minutes and in the wheel and tire assembly (magnesium or aluminum) from approximately 20 to 30 minutes after a maximum braking operation. If maximum brakes are used, record in Form 781. Do not taxi or tow the airplane for at least 15 minutes after overheated brakes have been cooled.

WARNING

All personnel other than those in the fire department should evacuate the immediate area. The area on both sides of the wheel will be cleared of personnel and equipment for at least 300 feet. Do not approach the main wheel area when extreme temperatures due to excessive braking are suspected. If conditions require personnel to be close to an overheated wheel or tire assembly, the approach should be from the fore or aft only.

8. Do not drag the brakes while taxiing. Use the brakes as little as possible for turning the airplane on the ground.

9. Release the parking brakes as soon as possible after the wheel chocks are in place.

WARNING

After any full anti-skid braking operation (maximum effort landing, aborted take-off, engine-out/flaps up landing, etc.), assure adequate brake/tire cooling prior to further aircraft operation. Approximate cooling time for the brake is 60 minutes.

BUDDY AND WINDMILL TAXI START.

Note

Buddy starts should have priority over a windmill taxi start and may be used to start an engine if it cannot be started by normal procedures. Buddy and windmill taxi starts should be used only when authorized or directed by the major air command concerned.

BUDDY STARTS.

Buddy starts are defined as an engine start utilizing the propeller airblast of another airplane to effect engine starting.

Note

Align the airplane as nearly as possible into the wind and observe caution in Engine Runup in Section II.

1. Assure the ramp area is free of any objects that might cause FOD.
2. Inspect engine to be started as necessary to assure maximum safety.

CAUTION

Prior to attempting a buddy start because of a defective starter, assure that the starter or starter shaft is removed, as it may remain engaged with resultant damage to the starter, engine or airplane.

3. Place condition lever to FEATHER until the blade cuff is in line with the island on the spinner base.
4. Position airplane with the engine to be started approximately 10 feet behind the starter airplane.
5. Set parking brakes.
6. Place chocks fore and aft of each forward MLG wheel.
7. Brief crews of special signals that will be used during starting and position ground observers for visual sighting from each cockpit and each other.
8. Perform Normal Procedures checklists through Before Starting Engines checklist with the following exceptions:
   a. Propeller cuff lined up with island on spinner base.
   b. Place throttle in FLIGHT IDLE.
   c. Leave chocks in place.
9. Close all doors, window, and hatches.
10. Condition lever run; leave bleed air valve closed until engine is on speed.
11. Front airplane, upon signal from rear airplane, increase power to 900°C TIT or 15,000 inch-pounds torque (whichever occurs first) on all engines.
12. If propeller rotation does not begin, request 18,000 inch-pounds torque or maximum power (whichever occurs first) on front airplane.
13. After propeller rotation starts, observe normal start sequence and at 60 percent rpm; place throttle to GROUND IDLE.
14. Signal front airplane to reduce power.

Note

- If constant acceleration fails to occur prior to 16 percent rpm, move condition lever to FEATHER position momentarily and return to RUN, increased rpm and acceleration should occur. Do not move condition lever towards FEATHER after 16 percent rpm unless a stop start situation exists.
- In the event above procedures are ineffective, starting may be attempted by pre-setting propeller blade angles at an intermediate position between alignment with spinner base island and the full feather position and/or changing airplane position to offset propeller alignment approximately 6 feet. Continue start as outlined above.

WINDMILL TAXI START.

Note

Use of the following procedure is not recommended when operating the airplane at gross weight above 135,000 pounds.

CAUTION

Prior to attempting a windmill taxi start because of a defective starter, assure that the starter or starter shaft is removed, as it may remain engaged with resultant damage to the starter, engine or airplane.

The following procedure can be used to start an engine if it cannot be started by normal procedures. It should be used only if mission requirements dictate. Complacency or operational abuse should not be allowed to result from the knowledge of this unusual capability. A dry runway length of 7,000 feet or more is recommended to assure safety in accomplishing a windmill taxi start.

1. Inspect engine to be started as necessary to assure maximum safety.

2. Perform the Before Take-Off checklist to assure that all controls and switches are in the proper position.

3. Enrichment - On.

4. Set wing flap lever to 15 percent.

NOTE

This will provide full rudder boost pressure without inducing extra drag and operating lift at low speeds. Auxiliary hydraulic pump will be on to have positive braking action if emergency brakes should be selected.

5. Place the throttle in the FLIGHT IDLE position.

6. Align the airplane on the runway with the parking brakes set. Place condition lever to FEATHER until the blade cuff is in line with the island on the spinner base.

7. Place the condition lever in the RUN position. Leave bleed air switch CLOSE until after engine is on speed.

8. Advance the throttles to FLIGHT IDLE for the operating engines; then advance the throttles on the symmetrical engines to maximum power. Release the brakes and increase power on the other operating engine as directional control becomes available through coordinated use of nosewheel steering and rudder. The copilot should monitor the control column, maintaining positive pressure on the nose wheel. The pilot should maintain control of nose-wheel steering, throttles, and rudder.

9. The propeller should begin to rotate and a normal lightoff should occur. As RPM steadily increases above 40 percent, retard all throttles to GROUND IDLE. Reverse symmetrical on-speed engines and apply brakes as required to stop the airplane. The engine should accelerate and come on speed as the airplane is stopped. Monitor engine instruments as for a normal start.

WARNING

Torque on the engine being started should be monitored closely to assure that the propeller is in the ground range prior to moving the throttle out of ground idle.

CAUTION

If RPM has not increased above 40 percent, airspeed may be maintained at 100 KIAS until 4, 000 feet of runway remains.

10. Resume normal operation beginning with the Starting Engines Checklist.

CAUTION

Successive windmill taxi runs with repeated braking applications will result in hot brakes, decreased braking efficiency, and/or wheel well fires.

HYDROPLANING.

When the aircraft lands or takes off on a wet or damp runway, hydroplaning may be encountered. Hydroplaning is a condition where the landing gear tire is either partially or totally supported by a thin layer of water or slush covering the runway surface. If hydroplaning occurs, the pilot may have difficulty stopping the aircraft and/or maintaining directional control. There are three types of hydroplaning: dynamic, viscous, and reverted rubber. Dynamic hydroplaning will occur at high ground speeds and water depths as small as 0.10 inch. Given the necessary speed, tire pressure, and water depth, hydroplaning will occur and continue until aircraft speed is reduced to a point that the water pressure between the tire and runway no longer equals the tire pressure. At this point, tire spin up will begin and traction will increase.

For viscous hydroplaning to occur, a much thinner water film (0.03 inch) will cause viscous hydroplaning to occur on smooth runway surfaces at speeds lower than those in the dynamic situation. This type of hydroplaning may perpetuate itself at low speeds if the thin water layer is not broken by an irregular surface. In this type of hydroplaning also, there is very little the pilot can do except try to maintain directional control and decelerate with aerodynamic surfaces until the airplane has slowed to a point where traction returns.

The third type, reverted rubber, is very much like a dry skid and can occur on a damp runway with no visible standing water. Reverted rubber hydroplaning is caused by the tremendous heat from overbraking; the tire rubber changes properties and closes the tire grooves, trapping the moisture under the tire, and reducing the contact with the pavement. However, proper braking procedures can essentially prevent this type of hydroplaning.

SECTION VIII

crew duties

TABLE OF CONTENTS

INTRODUCTION.

Each flight crewmember has duties other than the main duties covered in Normal Procedures, Section II. These additional duties are prescribed in this Section.

Note

- Refer to T.O. 1-1C-1-29 for procedures incident to inflight refueling operations.
- Crewmembers should check/set their oxygen systems and, if their use is anticipated, their individual interior lights and clocks prior to initiating their respective checklists.

PILOT.

Insures that a thorough inspection of the airplane and all equipment is properly conducted in sufficient time prior to departure to permit correction of discrepancies without incurring delays. (The checklists for the pilot, copilot, and engineer are covered in detail in Sections II and III.) Plans the mission by analyzing information concerning its nature, the expected weather over the misssion route, and special instructions. Prepares or supervises the preparation of the flight plan and clearance. Supervises and coordinates the activities of the crewmembers during flight planning and preparation. Inspects, or supervises the inspection of, the exterior of the airplane, giving special attention to the mechanical and structural soundness of the turboprop power plant, cargo doors, and control surfaces. Determines that the weight and center of gravity are within prescribed limits. Inspects personally all items of bail-out, ditching and survival equipment. Operates controls to start and test engines, and to taxi, take-off, land, and maintain airplane in flight under varying conditions of weather, daylight and darkness, and combat conditions on long, medium, or short-range missions. Monitors turboprop power plant operation for proper indications of turbine inlet temperature, rpm and torque. Monitors operation of pressurization system to insure safety of airplane and personnel. Directs engineer's operation of assigned controls and the employment of navigational and communications equipment by the navigator and copilot. Ensures that required flight logs, records, and maintenance forms are prepared.

COPILOT.

Assists pilot in planning mission by obtaining pertinent weather forecasts, intelligence reports, maps, and other documents. Upon instructions from pilot, assists navigator in plotting the mission route and calculating the route information and fuel requirements. Assists the pilot in performing the exterior and interior inspection of the airplane, or performs inspections upon instructions of the pilot. Assists the pilot in operating controls and equipment on the ground and in flight. Operates the airplane on the ground and in flight upon instructions from the pilot. Prepares the flight log in the absence of a navigator and prepares required records and maintenance forms. Operates the communications equipment and assists the pilot in navigating the airplane in the absence of a navigator.

ENGINEER.

Operates system controls and regulates electrical system. Operates fuel system and regulates fuel management. Operates bleed air system, controls cabin air to provide proper ventilation, pressurization and temperature. Operates anti-icing and de-icing systems. Starts gas turbine compressor and air turbine motor to provide auxiliary power as required. Operates external light panel. May operate aft cargo door and ramp in flight. Observes engine instruments, system indicators, and control devices. Continuously monitors turbine inlet temperature, tachometer, and torquemeter indicators and reports unusual conditions to the pilot. Monitors fuel flow, temperature, pressure and quantity indicators, electrical voltage and loads, circuit breaker panels and cabin pressure control and altitude indicators. Observe fire overheat and warning light indicators. Reports abnormal conditions to pilot and recommends or completes corrective action as briefed. Maintains power plant cruise control and performance log/plan. Computes airplane weight and balance when required. Performs the aircrew visual inspections. Inspects the airplane for flight preparedness and continuation, turbo-prop engines for general condition of compressor inlet/turbine exhaust blades and systems for absence of fuel and oil leaks. Ascertains that the airplane and engines have not exceeded limits. Records limitations exceeded. Troubleshoots malfunctioning of the airplane systems in flight. May supervise airplane servicing and the removal and replacement of such components as starters, generators, flight control surfaces, propellers, pressure transmitters and oil filters. May assign repair work to ground crew members; reviews work for completion and accuracy. Instructs and may evaluate subordinates in engineer duties and procedures.

NAVIGATOR.

The navigator attends pre-mission briefing, assimilates mission data, and is thoroughly familiar with the functions and performance of the navigation systems, sensor systems, and fire control system. He has the responsibility for enroute navigation, aircraft positioning in the target area, traffic separation, and the successful operation of his assigned avionic subsystems. He clears the pilot to fire and assists the fire control officer in the performance of his duties as safety officer. He aides the fire control officer in evolving a coordinated mission plan of attack in the operation of the fire control subsystem and the computation of ballistic wind and gun/sensor alignment errors. He is responsible for the preparation of the mission report and attends post-mission debriefings. The following checklists will be assigned to the navigator by the pilot. Items in this checklist that appear in Section II of this manual will be accomplished by the navigator.

NAVIGATOR'S CHECKLIST.

Tasks that are followed by a letter in parenthesis indicate another crewmember with whom that specific task must be coordinated. Items in quotes indicate that a response is required. On checklist challenges that required the same response by the navigator and the fire control officer, the navigator will make the verbal response for both positions on interphone, the fire control officer will remain silent. These responses are preceded by an asterisk.

PREPARATION FOR FLIGHT.

1. Mission planning — Complete
   a. Frag order — Checked
   b. Flight plan — Completed
   c. Fuel planning — Complete, if required
   d. Maps — Mission essential information plotted
      (1) Courses

(2) Reporting points	
(3) Intelligence	
2. Time hack	Obtained
3. Weather/mission briefing	Attended
4. Professional, personal, and survival equipment	Checked

INTERIOR (POWER OFF).

1. Form 781	Checked
2. ASN-91 computer fault flag	Checked
a. Normal – black	
b. Fault - red	

Note

With fault indication turn computer ON and depress reset button. If flag does not reset, call maintenance.

3. Loran power filter	ON
4. Cargo compartment circuit breaker panel	Checked
5. Mode II IFF	Set
6. Life preserver	Checked (as required)
7. Parachute	Checked
8. Navigation publications	Checked
9. Navigator's circuit breakers and fuses	Checked
10. IMU/pitot boom data points available.	Checked
11. Radio altimeter	OFF
12. Fire control power supply	OFF/INVERTER
a. NORM-OFF-GRD power switch – OFF	
b. A/C–INVERTER switch – INVERTER	
13. Oxygen system	Checked

14.	Equipment power switches	
	a. SLADS – OFF	
	b. SSU – OFF	
	c. X-band beacon – OFF	
15.	Attitude reference system	OFF
16.	ADF No. 1	OFF
17.	Radios	OFF
18.	Nose radome anti-icing	OFF
19.	Doppler Computer function switch	OFF
20.	Doppler power switch	OFF
21.	Search radar	OFF/Set
	a. Range switch – 3/30-5	
	b. Function switch – OFF	
	c. Gain – CCW	
	d. Range MK/delay – CCW/OFF	
	e. HDG MK/range 3-30 – CW	
	f. INT (intensity) – CCW	
22.	MTI	OFF/Set
	a. BACKG control – CCW	
	b. Mode switch – OFF	
	c. Threshold control – CCW	
23.	Loran	OFF
	a. TAS control – CCW	
	b. Mode switch – OFF	

24. Navigation control panel — OFF
25. IMS mode control switch — OFF/Set
    a. Mode switch — OFF
    b. Local mag. var — Set
26. Clock — Set

INTERIOR (POWER ON).

Note

- Due to time required for equipment warm-up and operational checks, the navigator may be required to check several systems in close sequence when performing the Interior (Power On) checklist. All applicable Power On checklist items will be completed prior to flight.
- During inertial alignment, personnel movement aboard the airplane must be held to a minimum. To ensure a good alignment approximately 16 minutes are required prior to selecting Inertial or Normal mode.

1. Lights — Set
2. Interphone panel — Set
3. Fire control power supply system — ON, checked, set
    a. NORM — OFF-GRD PWR switch — NORM
    b. PWR switch — INV
    c. A, B, and C phases — Checked (115 vac $\pm$ 5 vac) (400 $H_z \pm$ 20 H_z)

Note

- If aircraft power is selected, the NORM-OFF-GRD power switch should be in the OFF position.
- If aircraft power is selected, power interruptions in excess of one-half second may cause computer malfunctions. Situations of potential power interruptions are:

    Switching from ground prior to aircraft power.

    When generators are brought on and off the line as engines are brought to low speed ground idle - back to normal.

4. IMU blower — ON
5. 26 vac reference power fuses — Checked
6. Equipment warm-up — initiated
    a. LORAN mode switch: LRN (Start Search Buttons — Depressed)

b. IMS control — GND ALIGN

CAUTION

If IMS is to be operated for extended periods when avionics bay temperature exceeds 100°F, cooling air must be provided or degraded performance will occur.

c. Radio altimeter — ON

d. SLADS — ON

e. SSU — ON

(1) Power switch — ON

(2) Lights — Checked

CAUTION

If one of the five indicator lights does not illuminate when the ac circuit breaker is pulled or if one of the lights comes on in flight, the SSU must be isolated by pulling the ac and dc circuit breakers on the SSU. The SSU switch on the navigator's console can be left in the ON position to allow inputs to the tactical computer and fire control system.

f. Attitude reference system — ON

g. Radios — ON

h. Doppler power switch — SLEW

i. Search radar — STDBY

7. Navigation control panel — Set/ON (FCO)

a. Computer switch — POWER

b. Lights — Adjusted

c. Computer switch — Test/Checked (FCO)

(1) NCP & FCPS — Checked

(2) FCD — Checked

d. Gunfire inhibit switch — Checked (FCO) INHIBIT/NORMAL

e. Data — Checked/Set as required

(1) Data 01-03 (auto-cal data) — Checked/Set

(2) Data 04-16 (drift rates) — Checked/Set

(3) Data 17-99 — Checked as required

f. Present position (after status U) — Inserted

g. Mission parameters — Checked - Set

(1) Nominals — Inserted

(2) Waypoints — Inserted

h. Status — Monitored

Note

Periodically monitor system status, TAS/TGS and M HDG/T-HDG for IMS misalignment or failure to align.

8. C-12 compass systems — Checked/Set

a. N-S switch — Local hemisphere

b. Latitude knob — Local latitude

c. Mode selector switch MAG-DG — As required

d. Cross-check with standby compass for proper orientation — Checked

e. Check position of synchronization needless to insure systems are synchronized — Checked

9. Radar pressurization system — Checked/Normal

Note

Set system for 40 in. of mercury; check that a minimum of 38 in. is maintained for 10 minutes.

CAUTION

Do not exceed 41 in.of mercury. An increase in pressure may be experienced if the radar system is on, due to an increase in temperature within the system.

10. Search radar — Checked/ON

WARNING

Before placing the function switch in SEARCH, BEACON, or WARN, make sure all personnel are clear of the antenna radiation hazard area. Avoid directing the energy beam toward inhabited structures, personnel or areas where airplanes are being refueled/defueled.

WARNING

If personnel are in the area or refueling or defueling operations are taking place in the vicinity of the airplane, the radar system check will be completed during runup.

AFTER WARMUP OF THREE MINUTES:

a. Function switch – SEARCH

b. Test meter – Checked

(1) Line – 0.6 ± 0.08 and steady

(2) MAG – 0.65 ± 0.35 and steady

(3) MIXER 1 and 2 – 0.60 ± 0.30 and steady

(4) AFC 1 and 2 – 0.60 ± 0.30 and steady

c. SCAN – L, R, PPI or SECTOR

d. INT (intensity) control – Set (go to full intensity for approximately 30 seconds until sweep appears, then decrease to a faint sweep).

e. HDG MK/RANGE 3-30 – Adjusted

f. GAIN control – Set

Note

Use tilt control in conjunction with gain control to adjust for best presentation.

g. Bearing switch – Checked/REL

11. MTI — Checked if required/OFF

Note

To obtain maximum performance of the MTI the APN-59B radar must be in good operating condition. The radar controls must be set properly and the antenna scan controls set so that antenna is directed at the targets.

a. MODE switch – OPR

b. THRESHOLD control – CW

c. BACKGROUND control – CCW

d. BIT check – Completed

(1) BIT button – Depressed

(2) FAIL light – Out

(3) Radar indicator – Observed

12. Search radar — OFF

    a. INT and GAIN controls – CCW

    b. SCAN control – OFF

    c. FUNCTION switch –OFF

13. LORAN — Checked/STBY

Note

Do not leave in LRN during engine start.

    a. Lights – Set

    b. System test – Checked/Depressed

        (1) All status lights – ON

        (2) Nixies display – N1234567 E4567890

    c. BRR/SRR controls – Set

        (1) Basic and specific pulse rate for LORAN chain – Set

    d. TRIAD, SDA, SDB, SPH thumbwheels – Set

    e. LORAN station parameters – Checked/Inserted

    f. Destination data (as required) – Inserted

    g. Position fix, wind, and variation – Inserted

    h. MODE switch — STBY

14. Attitude reference system — Checked/Set

    a. Mode switch — DG

    b. Hemisphere — Set

    c. Latitude indicator — Set

    d. V8 Heading indicator — Set

    e. Attitude indicator — Checked

        (1) Off flag — Checked

        (2) Horizon — Set

15. Radios — Checked/OFF

    a. ADF No. 1 (after 5 min warn up) Checked/OFF

CAUTION

Do not tune ADF in ADF Position.

    b. FM No. 1 — Checked/OFF

    c. HF No. 2 (After 1 min warm up) — Checked/OFF

WARNING

A radiation hazard exists at the HF radio antenna during the transmit mode. Insure that no personnel are working on top of the airplane during HF radio transmission.

16. Doppler computer

    a. Stage 1 and 2 track — Set

    b. Distance — Set -

    c. Cross track — Set

    d. NAV/DROP switch — NAV

17. Doppler radar — Checked/OFF

    After warm up of one minute:

    a. G/S switch — Set/165 KTS

    b. Drift switch — Set/0°

    c. Land-Sea switch — As Required

18. Radio altimeter — Checked/OFF

19. Periscopic sextant, mount and alignment — Checked(As required)

20. IMS mode control switch (after status A) — INERTIAL

Note

Inertial may be selected any time after the IMU is aligned (A status). It is recommended that a sterile period of not less than 8 minutes be observed immediately prior to selecting Inertial.

21. Interphone — Set

    a. Selector switch — INPH

    b. Hot MIC listen — ON

    c. Monitoring switches — As required

BEFORE STARTING ENGINES.

1. HOT MIC	"Set"	P,CP,E,N,TV,IO
a. Listen — ON		
b. Isolation switches — OFF		
2. Forms and publications	Checked	
3. Lights	Set	
4. Oxygen	Set	
5. Before starting engines checks	*"Complete"	E,N,TV,IO,CP

BEFORE TAXI.

1. LORAN mode switch	LRN	
2. Compass systems and attitude indicators	"Checked/Set (State heading of No. 1)"	N,P,CP,TV

Note

Compare No. 1 and 2 compass headings. State heading of No. 1 compass.

a. NCP true heading/MAG heading — Checked

b. C-12 No. 1 — Checked

c. C-12 No. 2 — Checked

d. Attitude reference system — Set

3. Radios, radar, and IFF	ON/Standby/Code set	

Note

- Set Mode II IFF if required.
- A loss of Loran lock-on may be caused by transmission exceeding 24 seconds on either HF radio.

4. Altimeters	"Set (state setting)"	CP,P,N,TV

Note

Compare altimeter reading against field elevation.

WARNING

It is possible to set an altimeter in error by 10,000 feet. This happens when the barometric set knob is continuously rotated after the baroscale is out of view. The knob can be rotated until eventually the numbers will reappear in kollsman window from the opposite side. If the correct altimeter setting is then established, the altimeter will read in error by approximately 10,000 feet. As a preflight check, special attention should be given to the altimeter to make sure that the 10,000 foot pointer (counter-indicator) is indicating correctly.

5. Before taxi checks	"Complete"	E,N,FCO,TV,IO,CP

TAXIING.

1. Flight instruments	"Checked"	P,CP,N,TV

a. C-12 compass systems movement — Checked

b. Attitude reference system — Checked

c. BDHIs movement — Checked

d. NCP true heading/MAG heading — Checked

BEFORE TAKE-OFF.

1. Search radar — Set

Note

For best results, avoid using the WARNING function, the 100/20, or the 240/30 ranges for the first 10 minutes of operation.

2. Doppler radar — Set
   a. Power switch – SLEW (at least 1 minute prior to take-off)
3. Radio altimeter — ON, Adjusted
4. Nav, Fire control panels — Set
   a. FLY TO thumbwheel – FC
   b. FLY TO toggle switch – As required
   c. ORBIT thumbwheel – Set/As required
   d. SENSOR STATUS PRIMARY SELECT – INS/As required (FCO)
   e. FC TGT – Set/As required (FCO)
5. Clearance — Copied, Checked
6. Departure procedures coordinated with pilot — As required
7. Lights — Dim (as required)
8. Safety belt and shoulder harness — Fastened, Unlocked

Note

Seat will be facing forward and full right to allow an unrestricted passageway between the NAV position and the E position.

9. ARN-92 position update — Completed
10. Flyover update — Completed, As required
11. Before take-off checks — *"Complete" — E,N,FCO,TV,IO,CP

AFTER TAKEOFF.

1. Doppler radar power switch — ON (above 40 feet absolute altitude)
2. Interphone panel — As required
3. Take-off time and fuel remaining — Noted
4. LORAN TAS control — Set
5. Radome anti-icing — Set (as required)

6. X-Band beacon	Set (as required)	
7. IMS mode control switch	Set (NORMAL or INERTIAL)	
8. IMU blower	OFF	
9. After take-off checks	*"Complete"	E,N,TV,IO,CP

AIRBORNE SENSOR/WEAPON ALIGNMENT.

1. Navigation control panel — "Set" — N

   a. Baro reference — Reset (As required)

Note

NAV will cross check AGL with radio altimeter and computed ALT.

   b. FLY TO thumbwheel — FC

   c. FLY TO toggle switch — Orbit

   d. ORBIT thumbwheel — Required nominal

   e. MANUAL REGRESSION switch — Set (as required)

   f. Current wind — Inserted (as required) (check INS wind for stability)

2. Flaps — Set (P)

   a. Pitch — Checked

Note

Insure firing platform has 2 degrees or less nose up attitude.

3. Search Radar/MTI — Set

Note

- Set search radar to standby to avoid interference with APQ-150 radar.
- High gain settings on the APN-59B will cause excessive noise feedback to MTI
- The MTI threshold control should be adjusted CW as far as possible for maximum operating efficiency. MIT BACKGROUND control full CCW when searching for targets.

4. 1:1 Resolvers — Aligned (FCO)

   a. 1:1 Resolver — Selected

5. 4:1 Resolvers (TV, IR) — Calibrated (as required) (FCO, P)

   a. 4:1 Resolvers — Enabled

   b. Primary sensors — Selected

c. 4:1 Resolvers — Calibrated

6. Wind	Inserted, Checked	
a. Wind — Zeroed		
b. Wind — Inserted		
(1) HUD/FCD — Checked (P) (FCO)		
c. Current wind — Inserted (state W/V)		
7. Pitot boom auto cal	Enabled, Completed (If required)	

Note

Pilot should maintain a constant bank angle. One orbit and approximately 30 degrees, data insert 19 will zero out and pitot boom will be calibrated. Data inserts 21 and 25 values will change automatically. INS wind should be constant around orbit.

8. Sensor position update	Accomplished (As required)	

PRE-STRIKE.

1. Navigation control panel	"Set"	N
a. Baro reference — Reset (as required)		
b. FLY TO thumbwheel — FC		
c. FLY TO toggle switch — ORBIT		
d. ORBIT thumbwheel — Required Nominal		
e. MANUAL REGRESSION switch — Set (as required)		
f. Current wind — Inserted (as required)		
2. Search radar/MTI	As required	
3. Curtains	Secured (E)	
4. Pre-target briefing	"Completed"	N
a. Heading — Briefed		
b. ETE/ETA — Briefed		
c. Minimum safe altitude — Briefed		
d. TACAN location of target — Briefed (if applicable)		
5. Flaps	Set (CP)	
a. Pitch — Checked		
6. Lights	Set	
7. Pre-strike checks	"Complete"	E,N,FCO, TV,IO,CP

STRIKE.

1. Navigation control panel	Checked/Reset (FCO)	
2. Attitude reference system	Checked/Reset (as required)	
3. C-12 Compass systems	Checked/Reset (as required)	

POST-STRIKE.

1. C-12 Compass systems	Checked/Reset	
2. Attitude reference system	Checked/Reset	
3. Navigation control panel	Set	
a. FLY TO thumbwheel – As required		
b. FLY TO switch – WAYPOINT/As required		
4. Search radar/MTI	As required	
5. Forms and reports	Completed	
6. Post-strike checks	*"Complete"	E,N,TV,IO,CP

BEFORE LANDING PATTERN.

1. Crew briefing	Monitored	
2. Periscopic sextant	Stowed	
3. X-Band beacon	OFF	
4. Altimeters	"Set/State setting"	CP,P,N,TV
5. Lights	Set (as required)	
6. Before landing pattern checks	*"Complete"	E,N,TV,IO,CP

BEFORE LANDING.

1. HOT MIC	Set	
a. Listen – ON		
b. Isolation switches – OFF		
2. Radome anti-icing	OFF	
3. Search radar	Set	
a. Antenna stab switch – OFF		
4. IMU blower	ON	
5. Approach	Monitored	
6. Seat	Facing forward and full right	
7. Safety belt and shoulder harness	Fastened, unlocked	
8. Doppler radar power switch	SLEW (prior to touchdown)	
9. Before landing checks	*"Complete"	E,N,TV,IO,CP

AFTER LANDING.

1. Unnecessary equipment — Set
   a. Doppler radar power switch and computer — OFF
   b. LORAN — OFF
   c. ADF No. 1 — OFF
   d. HF No. 2 — OFF
   e. FM No. 1 — OFF
   f. Radio altimeter — OFF
2. Search radar — OFF/Standby

Note

Prior to turning the scan switch OFF and turning the radar to standby or OFF, insure the copilot has turned the intensity down on pilot's repeater scope.

3. Anti-icing panels — Set
   a. Radome anti-icing — OFF
4. After landing checks — "Complete" — E,N,CP

ENGINE SHUTDOWN.

1. Navigation equipment — "OFF" — N
   a. Navigation control panel — OFF
   b. IMS MODE switch — OFF

Note

Do not turn the FC power supply OFF until the ASN-90 and ASN-91 have been turned off.

2. Fire control power supply — "OFF" — N
   a. NORM — OFF - GRD PWR switch — OFF
   b. PWR switch — INV
3. Electrical switches — OFF
   a. Attitude reference system — OFF

CAUTION

Do not turn off the Attitude Reference System until the airplane has come to its final stop. To preclude possible damage to the system, the airplane should not be moved for 40 minutes after the Attitude Reference System is turned off.

   b. SSU — OFF

c. SLADS — OFF

d. Lights — OFF

e. IMU blower — OFF

4. Oxygen regulators	OFF, 100%	
5. Engine shutdown checks	*"Complete"	E,N,TV,IO,CP

BEFORE LEAVING THE AIRPLANE.

1. Mode II IFF	Cleared

IR OPERATOR.

The IR operator has the responsibility of preflighting, operating and monitoring the infrared system. He attends pre-mission briefings, studies target information and assists the navigator and fire control officer as required. He must be thoroughly familiar with the functions and performance of the IR system and its relation to other systems. During flight, he activates the IR system, then searches, locates and tracks the target. When selected as primary sensor, he provides guidance to the fire control system for the target. He coordinates with other sensor operators and the fire control officer in the validation of targets and the assessment of battle damage inflicted upon the target. He records and reports malfunctions of equipment, for which he is responsible, to the aircraft commander. He attends maintenance, operations and intelligence debriefings as required. Items in this checklist that appear in Section II will be accomplished by the IR operator.

IR OPERATOR'S CHECKLIST.

Tasks that are followed by a letter in parenthesis indicate another crewmember with whom that specific task must be coordinated. The TV operator will answer all checklist responses for the booth. The IR operator will answer asterisked responses (*) if a TV operator is not aboard.

PREPARATION FOR FLIGHT.

1. Mission planning	Completed

Note

IR operator will assist the navigator and fire control officer in preparation and assimilation of target data, maps and charts. He will also study the target area for the mission.

2. Professional, personal and survival equipment	Checked
3. Mission/weather briefing	Attended

EXTERIOR (POWER OFF).

1. Form 781	Checked
2. Receiver group (shroud/sphere)	Checked

Note

Check the entire assembly for security and general condition. Ensure that the unit is intact and there is nothing visibly wrong with the assembly which will prevent it from functioning properly (i.e. missing screws, rivets or damaged metal).

3. Helium pressure (120 ± 20 psi)	Checked

INTERIOR (POWER OFF).

1. Lights	Set
2. Clock	Set, Wound
3. 8" Monitor	OFF
4. Two man console circuit breakers	Checked
5. Gimbal mode select switch	OFF/STOW
6. IDS control panel	Set
a. Field of view select switch — RMT	
b. Mode select switch — OFF	
c. BITE switch - SYS	
7. Remote control unit	OFF
8. Oxygen system	Checked
9. Flight deck circuit breakers	Set
10. Cargo compartment circuit breakers	Checked
a. DC circuit breaker panel	
b. Electronic equipment rack circuit breakers	
(1) Power supply circuit breakers	
(2) Electronic control amplifier circuit breakers	
11. Parachute	Checked as required
12. Life preserver	Checked as required

INTERIOR (POWER ON).

1.	Work and panel lights	Set
2.	Interphone panel	Checked/Set

CAUTION

The IDS mode select switch should not remain in the STBY or OPR position during ground operation for over 45 minutes.

3.	IDS mode select switch	Operate
4.	Gimbal mode select switch	BRAKE
5.	BITE system	Checked

a. BITE switch – SYS

b. Go lamp – Illuminated

Note

There is a built-in time delay of 30 to 60 seconds for the display circuitry when the IDS mode select switch is set to OPERATE.

6.	IDS mode select switch	OFF
7.	Remote control unit	ON/Set

a. PWR switch – ON

b. Video select switches – GRAY SCALE

c. Dot quad/Crosshair controls – ON

8.	8 in monitor	ON/Adjusted (TV)

Note

A TV camera must be on before this check can be completed.

a. Brightness control – ON/Adjusted

b. Contrast (10 shades of gray) – Adjusted

9.	8 in monitor	OFF
10.	Remote control unit	OFF
11.	Control switching unit	LOC
12.	Scanner alarm (hold for 5 seconds)	Depressed

WARNING

After sounding scanner alarm, wait 5 seconds before operating gimbal control. Serious personal injury can result if personnel are in contact with gimbal at time of gimbal movement.

CAUTION

After setting the gimbal select switch from OFF/STOW to BRAKE, wait a minimum of 30 seconds before switching to OPERATE.

13. Gimbal mode select switch (after gimbal STBY lamp goes out)	OPERATE	
14. Gimbal position control	Checked/Set	
a. AZ and ELV movement – Checked		
b. Drift and sensitivity – Checked/set		
15. Gimbal AZ Limit/ELV limit lights	Checked	
16. Sensor interface (as required)	Checked (FCO)	
a. Movement (SAD) — Checked		
b. Consent circuits — Checked		
(1) Normal consent — Checked		
(2) Momentary consent — Checked		
17. Gimbal position control (observe SAD to ensure gimbal stows sphere full forward and up, AZ limit/ELV limit lights illuminate).	OFF/STOW	
18. Video recorder — Checked		
a. Video tape – Installed		
b. Video recorder mode switch — Record		
c. Override switch — Normal (cover down)		

BEFORE STARTING ENGINES.

1. Lights	Set	
2. HOT MIC	*"Set"	P,CP,E,N,TV,IO
a. HOT MIC LISTEN — ON		
3. Oxygen	ON	
4. Before starting engines checks	*"Complete"	E,N,TV,GC,CP

BEFORE TAXI.

1. IDS mode select switch (note time for cool down)	STBY	
2. Gimbal mode select switch – BRAKE		
3. Compass and attitude indicators	*"Checked/Set"	N,P,CP,TV
a. Compass heading – Checked		
b. Vertical reference pitch bar – Checked/Set		

4. Altimeters	*"Set (state setting)"	P,CP,N,TV
5. All warning lights and alarm bells	*"Checked"	E,TV,IO
6. Overhead bookcase	Secured	
7. Before taxi checks	*"Complete"	E,N,FCO,TV,IO,CP

TAXIING.

1. Flight instruments	*"Checked"	P,CP,N,TV

BEFORE TAKE-OFF.

1. All exits (booth door open)	Secure	
2. Safety belt and shoulder harness	Fastened/Locked	
3. Before take-off checks	*"Complete"	E,N,TV,IO,CP

AFTER TAKE-OFF.

1. Booth door	Closed	
2. After take-off checks	*"Complete"	E,N,TV,IO,CP

AIRBORNE SENSOR/WEAPON ALIGNMENT

CAUTION

After approximately 15-20 minutes of cooling time, the cool-down light on the IDS control panel will illuminate, indicating cool-down. This checklist may then be completed. If cool-down lamp does not illuminate within 45 minutes, complete steps 2, 3, and 5 of this checklist. If video on the viewer cannot be achieved, turn IDS mode select switch to OFF and enter the discrepancy in the Form 781.

1. Lignts — Set
2. Interphone Panel — As required
3. IDS control panel — Set
   a. IDS mode select switch — OPR
   b. FOV — Set/As required (TRACK/RMT/SEARCH)
4. Gimbal mode select switch — OPERATE
5. Control switching unit — LOC
6. IR viewer — Adjusted
   a. BRIGHTNESS control - Adjusted
   b. CONTRAST control — Adjusted

c. IDS video gain – Adjusted		
d. IDS IR intensity – Adjusted		
e. IDS focus switch – Adjusted		
f. 0.8/FULL switch – As required		
7. Gimbal control panel	Set	
a. AZ/ELV sensitivity – Set		
b. AZ/ELV drift – Set		
8. Remote control unit	ON, Set	
a. Power switch – ON		
b. Video select switches – As required		
c. Dot quad/crosshair controls – Set		
9. 8 in. monitor	ON, Adjusted	
a. Brightness – On, Adjusted		
b. Contrast (10 shades of gray) – Adjusted		
10. Sensor alignment point/target	Identified (FCO)	

Note

Compare boresight of SEARCH and TRACK FOV of IDS.

11. Consent switches	ON (as required) (FCO)	
12. SAD and slaving	Checked (FCO)	
13. Airborne sensor/weapon alignment checks	*“Complete”	TV,CP

PRE-STRIKE

1. Systems - Set (as required)		
2. Pre-strike checks –	*“Complete”	E,N,FCO,TV,IO,CP

POST-STRIKE.

1. 8 in. monitor	OFF	
2. Remote control unit	OFF	
a. Dot quad/crosshair controls – OFF		
b. Power switch – OFF		
3. IDS mode select switch	OFF	
4. Gimbal mode select switch (check SAD to ensure sphere stows full up and full forward)	OFF/STOW	
5. Video recorder (tape)	Removed/Replaced (as required)	
6. Lights	As required	
7. Post-strike checks	*“Complete”	E,N,TV,IO,CP

BEFORE LANDING PATTERN.

1.	Booth door	Open, Secured	
2.	Altimeters	*"Set (state setting)"	P,CP,N,TV
3.	Before landing patterns checks	*"Complete"	E,N,TV,IO,CP

BEFORE LANDING.

1.	HOT MIC	Set	
	a. HOT MIC LISTEN – ON		
2.	Safety belt and shoulder harness	Fastened, Locked	
3.	Befo. landing checks	*"Complete"	E,N,TV,IO,CP

ENGINE SHUTDOWN.

1.	Oxygen	OFF, 100%	
2.	Lights	Set	
	a. Panel lights – OFF		
	b. Work lights – OFF		
	c. Forward overhead lights – OFF		
3.	Engine shutdown checks	*"Complete"	E,N,TV,IO,CP

BEFORE LEAVING THE AIRPLANE

1.	Interphone cords	Stowed
2.	Receiver group (shroud/sphere)	Checked
3.	Form 781	Completed

ILLUMINATOR OPERATOR.

The illuminator operator is required to have a thorough knowledge of the illuminator and dispenser operations and emergency procedures. He assumes the duties and responsibilities of the observer and airborne gunner as necessary. He also performs such duties of a C-130 loadmaster as are required on the AC-130 airplane. Prior to leaving the airplane, he informs the pilot as to the operational status of the cargo compartment.

ILLUMINATOR OPERATOR'S CHECKLIST.

This checklist covers the illuminator operator's duties on all missions of the airplane.

Items in quotations indicate that a response is required.

PRIOR TO ENTERING.

1.	Chocks	In place
2.	Static ground	Connected

3. Fire extinguisher — Checked

4. External power — As required

5. ALE-20 flare dispenser

   a. Check for security

   b. Flares

6. Flare launcher jettison pin — Inserted (some airplanes)

INITIAL PREFLIGHT.

1. Form 781 — Check for status of airplane and airplane discrepancies.

2. Life support equipment — Checked/Serviceable

3. Weight and balance handbook — Check that the complete weight and balance handbook is on board.

INTERIOR INSPECTION.

1. Galley — Checked/Serviceable

2. Crew entrance area — Checked

Note

Close the door and visually check that the hooks contact the eyebolts and the overcentering linkage contacts the stops.

   a. Crew door latch mechanism (when installed)

   b. Crew door master warning shutoff switch - OFF (door removed)/NORMAL (door installed)

   c. TV/laser platform

   d. Under flight deck electronic equipment racks

   e. Emergency exit light - Checked, ARMED

3. Forward cargo compartment — Checked

   a. Forward cargo compartment light panel — Checked

   b. Interphone panels — Checked, set

   c. Oxygen regulators and portable bottles - OFF, 100%

   d. Oxygen manual shutoff valve - ON, SAFETIED

   e. Cargo compartment circuit breaker panels (F.S. 245, 270)

   f. Fire extinguisher

   g. Life history recorder - Set, OFF

Note

Check that the remaining tape is enough for the flight. Insure recorder is set in accordance with Section IV procedures.

h. Electronic equipment rack

(1) Oxygen regulators — OFF, 100%, checked

i. Overhead electrical equipment rack

j. Floor mounted crash seats

k. Interphone panel — Checked, set

l. ALE-20 ARM/SAFE switch — SAFE

m. Egress panel, scanner's bubble, and pyrotechnic pistol — Checked

n. Oxygen regulator — OFF, 100%

o. Scanners' seat — Checked

p. Emergency exit light — Checked, ARMED

q. NLG emergency extension valve — NORMAL, safetied

r. Booster hydraulic panel — Checked

CAUTION

The MLG emergency engaging handles should not be pulled when the airplane is on the ground.

s. Right MLG emergency engaging handles and handcrank — IN, stowed.

t. Right bleed air manifold isolation valve — Open

u. Front and top of booth — Checked

(1) Aerial refueling valve (IFR airplanes) — Closed

(2) Air-conditioning ducts — Checked

(3) Jacking attachments and emergency gear extension ratchet — Checked

(4) Oxygen manual shutoff valve — ON, safetied

(5) First aid kits, hand axe, and fire extinguisher — Checked

v. Utility hydraulic panel

CAUTION

The MLG emergency engaging handles should not be pulled when the airplane is on the ground.

w. Left MLG and flap emergency engaging handle and handcrank — IN, stowed

x. 20MM and 7.62MM gun batteries — Checked

y. Left bleed air manifold isolation valve - Open

z. Left MLG inspection windows

4. AFT cargo compartment, center and left side Checked

a. Aileron hydraulic boost unit and autopilot servos, flap motor, cables, and hydraulic lines

b. Aft end of booth

(1) First aid kits, fire extinguishers, and hand axe

(2) Oxygen regulators — OFF, 100%

(3) Interphone panels — Checked, set

c. Booth

(1) Door (condition)

(2) Portable oxygen bottles

(3) Oxygen regulators — OFF, 100%

(4) Emergency equipment

(5) Right MLG inspection windows

d. Overhead escape/depressurization hatch and rope — Checked

e. Emergency exit light — Checked, ARMED

f. Manual oxygen shutoff valve — ON, safetied

g. AFT fuselage J-box circuit breakers

h. Aft fuselage light control switches and circuit breakers

i. Fire extinguisher

j. Left paratroop door warning light switches — OFF

k. Emergency exit light — Checked, ARMED

5. Ramp area Checked

a. Retainer reel

b. Oxygen regulators — OFF, 100%

c. Latrine

d. 2 KW illuminator — Pins installed

e. **ALE 20 ARM/SAFE switch — SAFE**

f. Ramp and door locks and telescoping arms (ADS)

g. 40 KW illuminator (if installed) — Checked

h. AFT fuselage flak curtains

i. Overhead escape hatch and rope

j. Emergency exit light — Checked, ARMED

k. Cabin pressure safety valve

l. Rudder and elevator boost units and autopilot servos, cables, and plumbing

m. AFT scanners' couch and bubble

n. Pyrotechnic pistols — Secure (if installed)

o. Oxygen regulator — OFF, 100%

p. Aft cargo door uplock and safety lock

q. LAU-74 flare launcher (if installed) — Checked

r. Floor mounted crash seats

s. Auxiliary hydraulic system

t. Emergency hydraulic system

u. Liferaft release handles — IN, safetied

v. Ramp, AFT cargo door, and right paratroop door warning light shutoff switches — NORMAL

w. Interphone panel — Checked, set (check call button)

x. Oxygen regulator — OFF, 100%

6. AFT cargo compartment right side — Checked

a. Paratroop door and uplatch

b. Air deflector emergency switch — NORMAL

c. Emergency exit light — Checked, ARMED

d. Portable oxygen bottle

e. Fire extinguisher

f. Flare launcher control box and cable (if installed)

g. Dispenser junction box — Checked

(1) Right SUU-42/A — NORMAL

(2) Left SUU-42/A — NORMAL

(3) Right ALE-20 — NORMAL

(4) Left ALE-20 — NORMAL

(5) Two green lights — Checked

h. Tiedown equipment — Available, Checked

7. Ramp controls

Note

Check ramp and door for complete operation.

a. Ramp and door controls — NEUTRAL

b. Auxiliary pump — ON (check with E and NAV)

CAUTION

The emergency release handle will be used in conjunction with the auxiliary pump door open switch to preclude damage to the door and up lock.

c. Door — Open

d. Ram — Down

e. ADS arms — Installed

f. Ram actuators — Checked for leakage and conditions

g. Ramp — Up, checked

h. Door - Closed, checked

i. Door actuator — Checked for leakage and condition

j. Door — Open

k. Ramp — Down

l. Auxiliary pump — OFF

m. Loose equipment — Secured

BEFORE STARTING ENGINES.

1. HOT MIC	"Set"	P,CP,E,N,TV,IO
a. HOT MIC LISTEN — ON		
2. TV lens covers	Removed	

CAUTION

Covers will be removed for flight on which the LLLTV will not be used, as covers can be lost in flight.

3. Fire extinguisher	Available
4. External air conditioner	Removed
5. Head set and extension cord	Ready
6. Clear GTC	"Clear"

7. Ramp and door controls	"Neutral"	
8. Oxygen	Set	
9. Chocks	"Removed"	
10. Before starting engines checks	"Complete"	E,N,TV,GC,CP

STARTING ENGINES.

WARNING

The GC or IO will ensure that all personnel remain clear of the propellers and exhaust area during engine start.

Note

The GC or IO will state "Negative rotation" if the propeller fails to turn within 5 seconds.

1. Clear No. 3 engine	"No. 3 clear"	
2. Clear No. 4 engine	"No. 4 clear"	
3. Remove external equipment		
4. External equipment, ground wires and BC Spoiler	"Removed/Cleared/Secured"	
5. Clear No. 2 engine	"No. 2 clear"	
6. Clear No. 1 engine	"No. 1 clear"	

Note

IO is cleared off ground after engines are on speed.

BEFORE TAXI.

1. Crew aboard, ramp and doors closed	"Aboard/Closed/Checked"	
2. Life history recorder (some airplanes)	ON/Checked	
3. Ground test switch	OFF	
4. Warning lights and alarm bells	"Checked"	E,TV,IO

WARNING

Visually check the locks on the forward crew entrance door to see that they contact the eyebolts anytime airplane will be pressurized.

5. Hydraulic quantities	Quantities checked	
6. Before taxi checks	"Complete"	E,N,FCO,TV,IO,CP

TAXIING.

1. Cargo compartment hydraulic panels	Monitored for leaks and quantities.	
2. Lower side of wings and engines nacelles	Checked for leaks	
3. Cargo compartment temperature	As required (coordinate with EWO)	
4. Taxi checks	"Complete"	E,IO,CP

TWO-ENGINE SHUTDOWN FOR ORDNANCE LOADING.

1. Exit clearance	Open (Upon command of the pilot)	
2. Chocks, ground wire	"In place"	
3. Engine shutdown checks	"Complete"	E,IO,CP

ENGINE START AFTER ORDNANCE LOADING.

1. Chocks, ground wire	"Removed"
2. Clear No. 3 engine	"No. 3 clear"
3. Clear No. 4 engine	"No. 4 clear"

Note

IO is cleared off ground after engines are on speed.

4. Crew aboard, doors closed	"Aboard/Closed/Checked"
5. Ammo	"Secured/Clear to taxi"

ENGINE RUNUP.

1. Cargo compartment hydraulic panels	Monitored for leaks and quantities	
2. Lower side of wings and nacelles	Checked for leaks	
3. Cargo compartment temperature	As required (coordinate with EWO)	
4. Engine runup checks	"Complete"	E,IO,CP

BEFORE TAKE-OFF.

1. All exits	Secured
2. Hydraulic quantities	Quantities checked
3. Loose equipment	Secured
4. Trainable weapon	Stowed
5. Safety belt and shoulder harness	Fastened/Cabin secure

Note

The illuminator operator will occupy one of the crash seats during the take-off and landing.

6. Before take-off checks	"Complete"	E,N,TV,IO,CP

AFTER TAKE-OFF.

1. Wing and nacelles	Scanned	
2. Hydraulic systems	Checked for leaks	
3. Wheel well	Monitor temperature	
4. Gear	Check that the MLG is up and doors closed.	
5. After take-off checks	"Complete"	E,N,TV,IO,CP

CRUISE.

1. Wing and nacelles	Checked
2. Cargo compartment	Checked

PRE-STRIKE.

1. Chute and harness	On and properly fitted	
2. Retainer reel	Connected	
3. Illuminator/Searchlight (some airplanes)	"As required"	P,IO

a. Cargo door — As required

CAUTION

Visually observe lamp as ramp is lowered to insure it clears the airplane. Do not lower ramp if airplane is not in straight and level flight.

b. Ramp – As required

c. Main pump circuit breakers – ON

d. Generator switch – ON

e. Voltage alternators — Checked (with E)

f. Main power switch – ON

g. Pump pressure – Checked

h. Accumulator pressure – Checked

i. Lamp house – Deployed

j. Interlock lights – Checked

k. Mode selector switch – As required

l. AMPS/VOLTS selector switch – As required

m. Lamp start switch – Momentary start

n. Current and voltage – Monitored

o. Pitch, roll, and zoom – As required

p. Control selector switch – As required

4. Dispensers, flare launcher, and flare pistols "ARMED" CP,E,RS,IO

a. (LAU-74/A if installed)

(1) Cargo door – Open

(2) Jettison safety pin – Removed

(3) Reservoir/jettison bottles – Open

(4) Power cable – Connected

(5) Selector valve – ON

(6) Power switch – ON

(7) Ready lights – ON

b. AN/ALE-40(V) – Checked, ARMED

Note

EMI filter switches should automatically switch to OPERATE when the safety pins are removed. Insert pins to SAFE the system. Select RESET at termination of the mission.

(1) Switches – Reset

(2) Pins – Removed

(3) Switches – Operate

5. Lights

6. Pre-strike checks "Complete" E,N,FCO,TV,IO,CP

POST-STRIKE.

1. Illuminator (some airplanes) "As required" P,IO

a. Lamp start switch – OFF

b. Lamp house – Retracted

c. Master switch – OFF

d. Ramp – Raised (pilot notified)

e. Main pump circuit breakers – OFF (after pump stops)

f. Generator switch – OFF

2. Dispensers, flare launcher, and flare pistols "Dearmed" CP,E,RS,IO

a. (LAU-74/A if installed)

(1) Reservoir/jettison bottles – OFF

(2) Selector valve – OFF (pressure depleted)

(3) Power cable – Disconnected

(4) Shorting Plug – Connected

(5) Manual ejector lever lock pins – Locked

(6) Jettison safety pin – Installed

b. AN/ALE-40(V) — Checked/SAFE

Note

EMI filter switches should automatically switch to OPERATE when the safety pins are removed. Insert pins to SAFE the system. Select RESET at termination of the mission.

(1) Safety pins – Installed

(2) Filter switches – Reset

3. Lights
4. Post-strike checks — "Complete" — E,N,TV,IO,CP

BEFORE LANDING PATTERN.

1. Equipment — Secured
2. Trainable weapon — Stowed
3. Before landing pattern checks — "Complete" — E,N,TV,IO,CP

BEFORE LANDING.

1. HOT MIC — Set
   a. HOT MIC LISTEN – ON
2. Main landing gear — Checked/Down

Note

If access is not restricted by cargo compartment configuration, visually confirm the gear is down.

3. Hydraulic quantities — Checked
4. Safety belt and shoulder harness — Fastened, Locked, Cabin secure
5. Before landing checks — "Complete" — E,N,TV,IO,CP

AFTER LANDING.

1. Unnecessary equipment and switches — OFF

Note

During operational stop, turn life history recorder off, dial in new gross weight, fuel weight, and turn system on. BIT test is not required.

ENGINE SHUTDOWN.

1. Life history recorder (some airplanes) — Set/OFF

2. Oxygen regulator	OFF/100%	
3. Drip valves	Checked (as engines are shutdown)	
4. Exit clearance	Open (upon command of pilot)	
5. Chocks	"In place"	
6. Engine shutdown checks	"Complete"	E,N,TV,IO,CP

BEFORE LEAVING THE AIRPLANE.

1. Airplane	Cleaned
2. Equipment	Checked/Secured
3. Galley switches	OFF
4. Illuminator	Lens covers installed
5. TV lens covers	Installed (when TV operator not available)
6. Form 781	Completed

AIRBORNE GUNNER.

The airborne gunners are required to have a thorough knowledge of the aircraft gunnery systems and interphone procedures. Using the checklist as a guide, they must be capable of performing all tasks outlined in this section without supervision. In addition to their normal crew duties, the airborne gunners will be required to make all adjustments on weapons as directed by the fire control officer. Explosive safety, crew coordination, and emergency procedures will be adhered to at all times. Airborne gunners will continuously monitor the gun/ammunition status and report this to the pilot as requested. Familiarization knowledge of general aircraft systems is required. These personnel will engage in scanner/observer duties when missions requirements dictate. The airborne gunner will be thoroughly familiar with the emergency procedures as they pertain to his duties.

AIRBORNE GUNNER'S CHECKLIST.

Items in quotations indicate that a response is required.

The completion of individual airborne gunners checklists will be coordinated through the engineer during tactical operations, the fire control officer during airborne sensor weapon alignment, and the illuminator operator during all other phases.

MISSION PREPARATION.

1. Professional equipment	Checked
a. Flight crew checklist	
b. Tool kit	
c. Flashlight	
2. Airborne gunner's mission briefing	Completed

3. Personal, emergency, and survival equipment — Checked

   a. Helmet with clear visor or safety goggles

   b. Headset (optional)

   c. Oxygen mask

   d. Gloves

PREFLIGHT.

WARNING

All guns will be electrically and mechanically safe and the loading sectors installed in the 7.62MM guns before power is applied to the airplane.

1. Airplane — Checked

   Check that the airplane is chocked, a ground wire is installed and that external power is available.

2. Form 781 — Checked

   Check the Form 781A for any open discrepancies pertaining to the weapon systems. Check the Form 781K for any delayed discrepancies or incomplete equipment inspections.

WARNING

If ammunition is present in any gun, discontinue operation until gun is cleared.

3. 105MM gun — Safe/Clear

   a. Hydraulic valves — OFF

   b. ARM/SAFE switch — SAFE

      SAFE light on — ARM light off/press to test

   c. LWCP MODE CONTROL switch — OFF

   d. Breech area — Checked

      Visually inspect between the breechblock and the breech face of the tube to insure that the breech is clear.

4. 40MM gun — Safe/Clear

   a. ARM/SAFE switch — SAFE

      SAFE light on — ARM light off/Press to test

   b. LWCP MODE CONTROL switch — OFF

   c. Firing selector lever — STOP FIRE

   d. Hydrualic valves — OFF

e. **Breech area — Checked**

Open the top cover and visually inspect between the breechblock and the breech face of the tube to insure that the breech is clear.

f. Loader — Checked

Visually inspect the loader and loader tray to insure that the loader is clear.

5. 7.62MM guns — Safe/Clear

a. ARM/SAFE switch — SAFE

SAFE light on — ARM light off/press to test

b. Rate switch (IFR modified airplanes) — LO RATE

c. Gun switch — SAFE/LOAD

d. Drive motor lead — Disconnected

e. Feeder solenoid lead — Disconnected

f. Safing bar — Removed

g. Loading sector — Removed

h. Gun — Checked

Rotate the gun counterclockwise. Slide each bolt to the rear and visually inspect each chamber to insure that the gun is clear.

i. Loading sector — Installed

j. Safing bar — Installed

k. Repeat stesp 5a through 5j each 7.62MM gun installed.

6. Right scanner's flare pistol — Clear

Open the breech and visually inspect the chamber to insure that it is clear

7. Right scanner's ALE-20 dispenser switch — SAFE

Note

If ammunition is present in the 20MM feed chute or feeder, the feeder must be declutched prior to rotating the gun.

CAUTION

Rotate the 20MM gun counterclockwise only.

8. 20MM guns — Safe/Clear

a. ARM/SAFE switch — SAFE

SAFE light on — ARM light off/press to test

b. Firing lead — Disconnected

c. **Gun — Checked**

(1) Disengage the drive motor brakes.

(2) Rotate the gun and visually check each chamber to insure that the gun is clear.

(3) Engage the drive motor brakes.

d. Repeat steps 8a through 8c for each 20MM gun installed.

9. MASTER ARM switch — SAFE

10. Armament circuit breakers — In

a. **AC circuit breakers**

(1) No. 1 and 2 20MM guns

b. DC circuit breakers

(1) No. 1 and 2 7.62MM guns

(2) Gun trigger

(3) No. 1 and 2 20MM guns

(4) No. 5 and 6 guns

(5) Gun trigger manual mode

(6) Gun trigger auto mode

11. (20MM) Upper gun housing and mount — Checked

a. Check that the gun shroud and shroud tube are securely mounted.

b. Check that the carriage bolt assemblies and yoke pins are properly installed and secure.

c. Check that the recoil adapters are secure.

d. Check that the firing contact assembly is secure, mounting screws are safety wired and that the connector is not damaged.

e. Check that the locking and unlocking cam bolts are secure and that the locking cam bolts are safety wired.

f. Check that the housing cover and pins are not bent or otherwise damaged.

g. Check that the coupling clamp and auxiliary drive unit are secure.

h. Check that the rear mount pin bolts are secure.

12. (20MM) Drive motor brakes — Disengaged

13. **(20MM) Feeder** — **Checked**

a. Check that the feeder lock pin assemblies are not cracked or broken and that they operate properly.

b. Rotate the gun, check that the ammunition feed can booster sprockets and feeder sprockets rotate. (Do not perform this check if ammunition is in the feed system.)

c. Check the operation of the declutching mechanism by actuating it while rotating the gun and insure that the feed sprockets stop rotating. Allow the clutch to engage again while still rotating the gun. (Do not perform this check if ammunition is in the feed system.)

d. Check that the feeder sprockets, guides and T rail are serviceable.

e. Check that the feeder solenoid lead is connected and that the wires are not broken or frayed.

CAUTION

Do not rotate the 20MM gun with the feeder timing pin depressed.

14. (20MM) Feeder timing — Checked

a. Rotate the gun until the feeder gear timing hole is visually aligned with the feeder timing pin.

b. Depress the gun indexing pin and determine if the gun rotor is indexed. If it is not, repeat step a once and check the rotor again.

c. If the gun rotor is indexed, depress the feeder timing pin to insure proper timing.

d. If the feeder is not properly timed to the gun rotor, remove the aft lock pin, align the gears and reinstall the lock pin.

e. Check that the feeder timing pin is out.

15. (20MM) Feed chute and flex drive — Checked

Check that the feed chute and flex drive are serviceable and secured to the feeder.

16. (20MM) Elevation and azimuth scales — Checked

a. Check that the elevation and azimuth scales are legible and secured. Note the settings.

b. Check that the azimuth adjustment screw is secure.

17. (20MM) Lower gun housing and mount — Checked

    a. Check that the guide bar is secure and that it is not bent or distorted.

    b. Check that the spent case chute is secure and not bent or distorted.

    c. Check that the clearing sector retainer and clearing sector are secure.

    d. Check that the elevation screw is secured with the lock plate and that the azimuth lock arm is tight.

18. (20MM) Drive motor brakes — Engaged

    Check that the drive motor is secure and that the receptacle is serviceable.

19. (20MM) Firing and drive motor leads — Checked

    a. Check that the firing lead and connector are not damaged.

    b. Check that the drive motor lead is not damaged and that the connector is properly secured to the drive motor.

20. (20MM) Booster assembly — Checked

    a. Check that the flex drive is secure to the booster assembly.

    b. Check that the booster sprocket roll pins are not sheared.

    c. Check that the rounds counter is serviceable and secured to the booster assembly.

    d. Check that the feed chute is secured to the ammunition feed can.

    e. Check that the feed can cover is serviceable, secured and that the cover springs are in the holders.

21. Repeat steps 11 through 20 for each 20MM installed.

22. (20MM) C-4 lights — Checked

23. (20MM) Ballistic curtains — Checked

    Check that the ballistic curtains are serviceable and can be secured.

24. (20MM) Special equipment — Checked

    a. Shovel

    b. Hand crank

    c. Azimuth and elevation adjustment handle

    d. Brass chute

    e. Brass bags (if applicable)

25.	(20MM) Gun control units	Checked

a. Check that the gun control units are secure and that all leads are connected.

b. Visually inspect the RF filters.

26.	(105MM) Forward ammunition rack	Checked

Check that the door latches and round retainers are serviceable.

27.	(20MM) Ammunition cans	Checked

a. Check that the rails are serviceable.

b. Check that the rear doors are serviceable and secure.

28.	(20MM) Batteries	Checked

a. Check that the vent hoses are connected and are not kinked or damaged.

b. Check that the batteries are secure in the mounts.

29.	(MXU-470/A) RF filters	Checked
30.	(MXU-470/A) Safing bar	Removed
31.	(MXU-470/A) Loading sector	Removed
32.	(MXU-470/A) Gun	Checked

a. Check that the shroud is secure.

b. Check that the barrel clamp is secure.

c. Check that the blast shield, recoil adapters and drive motor are secure.

d. Check that the bolt tracks are properly installed.

e. Check that the bolt assemblies slide freely on the tracks, that the bolt head locking pins are installed and that the extractor lips are serviceable.

33.	(MXU-470/A) Loading sector	Installed
34.	(MXU-470/A) Feeder	Checked

a. Remove the quick release pins from the left recoil adapter and aft gun support and rotate the gun to the right.

b. Remove the rear feeder mounting pin and rotate the feeder out.

c. Check that the feeder solenoid plunger and clearing guides are serviceable and operate freely.

d. Check that the sprockets are not bent or broken.

e. Check that the forward mounting pin is properly installed.

f. Check that all roll pins are installed and are not sheared.

g. Check that the guide bar is secure and serviceable.

35. (MXU-470/A) Gun and feeder — Timed

a. With the timing pin depressed, rotate the gun until the gun rotor indexes. Hold the timing pin in until the feeder has been timed and installed.

b. With the feeder timing spring depressed, rotate the feeder until the gear indexes.

c. Mate the feeder to the gun and install the rear feeder mounting pin.

36. (MXU-470/A) Exit unit and inner drum — Checked

a. Check that the exit unit sprockets are serviceable and that the roll pins are not sheared.

b. Rotate the exit shaft and inspect the inner drum partitions.

c. Check the exit shaft and drum timing.

(1) Align the exit shaft roll pin with the slot in the module upper cover.

(2) Depress the drum timing pin and determine if the drum is properly indexed.

d. Rotate the gun back to its normal position and install the quick release pins in the left recoil adapter and aft gun support.

37. (MXU-470/A) Safing bar — Installed

38. (MXU-470/A) Delinking loader — Checked

a. Check that the delinking loader rotates freely and that the roll pins are not sheared.

b. Check that the delinking loader is properly mounted and that the detent pin has sufficient spring tension to actuate the switches to the loader link switch.

39. (MXU-470/A) Rounds counter — Checked

Check the rounds counter is secure and that the rounds counter and loader link switch leads are connected.

40. (MXU-470/A) Control package and battery — Checked

a. Press to test the lights on the control panel and check that the battery switch is in the AUTO position.

b. Check that all electrical leads are properly connected to the control package and battery and that the drive motor and feeder solenoid leads are serviceable.

c. Check that the control package and battery are securely mounted.

41. (MXU-470/A) Elevation and azimuth scales — Checked

a. Check that the adjustment screw locknuts are tight and that the base support fittings are firmly against the base plate and the locknuts are tight.

b. Check that the elevation and azimuth scales and pointers are secure and legible. Note the settings.

42. (MXU-470/A) Spent brass chute and can — Checked

Check that the spent brass chute and can are serviceable and secure.

43. (MXU-470/A) Safing sector and housing cover — Checked

Check that the dwell segment of the safing sector is serviceable.

44. Repeat steps 30 through 43 for each MXU-470/A installed.

45. (MXU-470/A) Hand crank — Checked

46. (MXU-470/A) Ballistic curtains — Checked

Check that the ballistic curtains are serviceable and can be secured.

47. (40MM) Hydraulic/electronics system — Checked

a. Check that the CEU is secure and that the electrical leads are connected.

b. Check that the azimuth and elevation hydraulic manifolds are not leaking and that all electrical leads are connected.

c. Check the hydraulic lines for leaks.

48. (40MM) Azimuth and elevation actuators — Checked

a. Check that the azimuth actuator is secure to the mount and that the azimuth lock bolts are loose.

b. Check that the elevation actuator is secure to the mount and that the elevation lock plates are loose.

49. (40MM) Recoil cylinder — Checked

a. Check that the recoil cylinder is secure and that it does not leak.

b. Check that the control rod valve lock plate is secure.

50. (40MM) Breech casing — Checked

a. Check that the gun shroud is secure.

b. Check that the gun box screws and tie-rod locknuts are tight.

c. Check that the rear cover and recoil indicator are secure and that the indicator is legible.

d. Check that the cartridge case deflector can be secured down in position for firing.

51. (40MM) Breechblock — Checked

a. Open the breech casing top cover and check that the hinge is secure.

b. Check that the barrel catch is secure.

c. Operate the breechblock and check that the firing pin operates properly.

d. Cock the gun and check that the extractors are not broken and that they operate properly.

e. Close the breech casing top cover and secure the detent in the aft hole.

52. (40MM) Automatic loader — Checked

a. Check that the front guide is secure and serviceable.

b. Check that the stop pawls operate properly.

c. Check that the feed pawls operate properly and are properly positioned.

d. Check that the clip guide is secure.

e. Check that the rammer shoe and rammer levers are properly installed.

f. Release the rammer shoe and check that it moves forward and that the rammer levers spread.

g. Operate the trigger rammer catch lever in the SINGLE, RAPID FIRE and STOP FIRE modes and check for proper operation.

h. Operate the feed control rammer catch lever with both the thumb lever and the feed control lever and check for proper operation.

i. Rotate the thumb lever away from the arrow.

53. (40MM) Hand operating lever — Cocked/SAFE

Check that the rammer levers are spread when the hand operating lever is cocked.

54. (40MM) Firing selector lever — STOP FIRE

55. (40MM) Firing rod — Connected

56. (40MM) Feed rollers — Locked

a. Operate the catch heads and check that they engage and disengage the feed rollers.

b. With the hand operating lever in the SAFE position, rotate the feed rollers and check that the catch head pawls engage the feed rollers.

57. (40MM) Side door — Checked

Check that the side door hinge pin is secure and that the door is latched.

58. (40MM) Breechblock locking bolt — Installed

59. (40MM) Firing solenoid — Checked

Check that the firing solenoid is secure and that the wiring is not broken or frayed.

60. (40MM) Bottom cover — Checked

61. (40MM) Starrett gauges — Checked

Check that the starrett gauges are securely mounted and that the lenses are installed and not cracked.

62. (40MM) Special equipment — Checked

a. Cartridge remover

b. Shell pusher

c. Spent case barrel

Check that the barrel is serviceable and secured to the floor plate.

63. (105MM/40MM) RF filters — Checked

64. (105MM/40MM) LWCP's — Checked

a. Check that the prime power circuit breakers are in the ON position.

b. Check that the panel and Starrett gauge lights operate.

65. (105MM/40MM) C-4 lights — Checked

66. (105MM) Elevation lock housing covers — Checked

67. (105MM) Azimuth actuator lock — Checked

68. (105MM) Hydraulic/electronics system — Checked

a. Check that the CEU is secure and that the leads are connected.

b. Check that the azimuth and elevation hydraulic manifolds are not leaking and that all leads are connected.

c. Check the hydraulic lines for leaks.

69. (105MM) Tube retraction system — Checked

a. Check the hydraulic fluid level in the reservoir.

b. Close the relief valve.

c. Operate the hand pump and move the gun out of battery approximately two inches.

d. Check the assembly for leaks.

e. Open the relief valve and check that the gun returns to the battery position.

CAUTION

The 40MM and 105MM hydraulic valves must be in the OFF position before operating the manual hydraulic systems.

Note

Check that the area near the muzzle end of the 105MM gun is clear before moving the gun.

70. (105MM/40MM) Manual hydraulic systems — Checked

a. Check the fluid level in the reservoir.

b. Position the manual selector valves to the 40MM position.

c. Operate the manual systems and check that the 40 MM gun moves up, down, fore, and aft.

d. Position the manual selector valves to the 105MM position.

e. Operate the manual systems and check that the 105MM gun moves up, down, fore and aft. Leave it in the depressed position.

f. Check the 40MM and 105MM hydraulic lines and actuators for leaks

71. (105MM) Breechblock crank stop — Checked

Check that the breechblock crank stop is centered and secured.

72. (105MM) Buffer striker plate assembly — Checked

a. Check that the gun shroud is secure.

b. Check that the snubbers are not leaking and that the striker plate is secure.

73. (105MM) Tube retraction lock pin — Checked

74. (105MM) Starrett gauges — Checked

Check that the starrett gauges are securely mounted and that the lenses are installed and not cracked.

75. (105MM) Limit and sequence switches — Checked

Check that limit and sequence switches are serviceable and that the wiring is not frayed or broken.

76. (105MM) Recoil indicator — Checked

Check that indicating mark starts at 49 inches.

77. (105MM) Firing mechanism and solenoid — Checked

a. Check that the firing solenoid is secure and that the wiring is not broken or frayed.

b. Check that the firing pawl has no more than 1/4 inch of vertical play and that it is at least 1/8 inch but not more than 1/2 inch from the firing plunger.

78. (105MM) Breech mechanism — Checked

a. Lower the safety cage.

b. Open the breech and check that the breech-block moves freely.

c. Check that the breech ring locking key and breech mechanism assembly key are installed.

d. Check that the extractors are serviceable.

e. Close and lock the breech and check that the operating handle latch operates freely.

f. Fire and recock the percussion mechanism and check that it operates properly.

79. (105MM) Safety cage — Checked/Stowed

80. (105MM) Gun — Stowed

81. (105MM/40MM) Manual selector valves — OFF

82. (105MM) Special equipment — Checked

a. Ramming and extracting tool

b. Spent case barrel

83. (105MM/40MM) Ammunition racks — Checked

a. Check that all 40MM clip trays and retainers are serviceable.

b. Check that all 105MM door latches and round retainers are serviceable.

c. Check that the ballistic curtains are serviceable and can be secured.

WARNING

The 105MM variable recoil regulator must be set for long recoil (approximately the two o'clock position) and secured.

84. (105MM) Variable recoil regulator — Checked

CAUTION

The 105MM gun must not be fired with a low recoil oil reserve. If the indicator rod protrudes more than 5/32 of an inch the oil reserve is insufficient.

85. (105MM) Recoil oil reserve indicator — Checked

86. (105MM) Recoil indicator pin — Checked

Check that the pin is against the sleigh rail.

WARNING

The 105MM recoil piston rod nut must be installed properly for the recoil mechanism to function. If the nut is missing or loose, the gun may recoil out of the cradle assembly.

87. (105MM) Recoil piston rod nut — Checked

88. (105MM) Sleigh and cradle assemblies — Checked

a. Check that the sleigh rails are clean and free of lubrication.

b. Check the forward end of the cradle for cracks, broken welds and hydraulic leaks.

89. (105MM) Blast diffuser — Checked

90. (40MM) Barrel — Checked

Check that the locking collar and the flash hider are secure.

91. (MXU-470/A) Flash suppressors — Checked

92. (20MM) Battery vents — Checked

93. (20MM) Barrels and flash suppressors — Checked

a. Check that the center barrel and muzzle clamps are properly installed.

b. Check that the flash suppressors do not have any cracked or broken ribs and that the bushings are not missing.

c. Check the gun and mount security by exerting vertical and lateral pressure on the barrels.

94. Interphone panel (Individual) — Checked/Set

a. Call button (right scanner) — Checked

BEFORE STARTING ENGINES.

1. Oxygen — Set
2. Interphone panel — Set
   a. HOT MIC LISTEN on

BEFORE TAXI.

Note

The following steps will be accomplished by coordinating with the FCO when called for during Starting Engines checklist.

1. Trainable weapons check — Complete — FCO
   a. (105MM/40MM) Hydraulic valves — ON

      Master, azimuth and elevation handles rotated to the ON position.

WARNING

Ensure all personnel and equipment are well clear of trainable weapons before any slaving operations are performed.

   b. (105M/40MM) LWCP MODE CONTROL switches — SLAVE
   c. (105MM/40MM) Starrett gauges — Checked

      Note settings on gauges and pass them to the FCO.

   d. (105MM) LWCP MODE CONTROL switch — STOW

      Insure weapon drives to the stowed position.

   e. (105MM/40MM) LWCP MODE CONTROL switches — OFF
   f. (105MM/40MM) Hydraulic valves — OFF
2. Safety belt and shoulder harness — Fastened, locked

AIRBORNE SENSOR/WEAPON ALIGNMENT.

1. (105MM/40MM) Hydraulic valves — ON
2. (105MM/40MM) LWCP MODE CONTROL switches — SLAVE

   Inform the fire control officer that the gun is set for slaving operation check. Observe gun movement and determine if operation is normal. Hold checklist until check is completed by FCO.

3. (105MM/40MM) LWCP MODE CONTROL switches — As required/OFF

INFLIGHT 20MM LOADING.

1. ARM/SAFE switch — SAFE
2. E/pilot — Advised

Note

Omit step 3 for loading a partially loaded can.

3. Firing lead — Disconnected
4. Ammunition can service door and cover — Open (As required)
5. Ammunition — Loaded

   With the ammunition projectiles facing the right-hand side of can, slide approximately 15 rounds along top rail. After first rounds are inserted, form loops of approximately 74 rounds (37) on each side), insuring that the loops do not touch the floor. Place two rounds at end of loop on rail. As loops are formed, push forward until first round is visible at the front of can. Grasp first round, pulling forward over booster sprockets and start into chute. Restrain rounds in chute; close top cover, insuring rounds are properly seated in the booster sprockets. Secure fasteners, disengage drive motor brakes, and rotate gun counter-clockwise. Expand the chute fully as it is being filled and insure that the first link of the ammunition belt is properly aligned with the T bar stripper before allowing it to enter the feeder. After the ammunition has entered the feeder, continue rotating the gun until the first link comes out the bottom, insure proper belt/feeder engagement. Engage the drive motor brakes and check that the ammunition chute is properly packed. If an adjustment is necessary, open the top cover and increase or decrease the number of rounds in the chute as required. Load the ammunition can to capacity and insure that the last loop has a minimum of 15 rounds hanging free. If necessary, shorten the previous loop. Close rear door, check that the top cover is secured, and reset the rounds counter.

6. Ammunition can, service door and cover — Closed
7. Repeat steps 1 through 6 for each 20MM can to be loaded

Note

Complete pre-strike and/or gun arming checklists as required.

INFLIGHT 7.62MM LOADING.

1.	ARM/SAFE switch	SAFE
2.	E/Pilot	Advised
3.	GUN switch	SAFE/LOAD
4.	Safing bar	Removed
5.	Drive motor lead	Disconnected
6.	Safing sector	Removed
7.	Gun	Cleared
8.	Loading sector	Installed
9.	Link container	Positioned
10.	Rounds counter	Set (as required)
11.	Loader	Load position (in)
12.	Ammunition	Load first 20 rounds manually
13.	Drive motor lead	Connected
14.	Ammunition	Loaded electrically
15.	Drive motor lead	Disconnected
16.	Loader	Clear/Fire position (out)
17.	Link container	Removed

Prior to removing container, insure loader and surrounding area are clear of all links.

18.	Ammunition	Advanced

Insure 2 rounds drop in spent brass container.

19.	Safing bar	Installed

20. Repeat steps 1 through 19 for each module to be loaded.

Note

Complete prestrike and/or gun arming checklist as required.

20MM PRE-STRIKE.

1.	ARM/SAFE switch	SAFE
2.	Firing lead	Connected
3.	Ballistic curtains	Secured

WARNING

No arming procedures will be accomplished unitl directed by the pilot.

20MM ARMING.

1.	ARM/SAFE switch	ARM
2.	E/Pilot	Advised

20MM POST-STRIKE.

1.	ARM/SAFE switch	SAFE
2.	Firing lead	Disconnected
3.	Gun	Cleared
4.	E/Pilot	Advised - "Guns safe and cleared"

MXU-470/A PRE-STRIKE.

1.	ARM/SAFE switch	SAFE
2.	Safing bar	Removed
3.	Loader	Fire Position (out)
4.	Ammunition	Advanced
5.	Loading sector	Removed
6.	Safing sector/Housing cover	Installed

The safing sector/housing cover will be installed as a unit. Prior to installing, insure all bolts are forward with one bolt in the two o'clock position. Connect the right side of the safing sector to the gun. Grasp the housing cover, pushing down and left while rotating the gun unitl the safing sector seats on the left side. Insert pin through left side of the gun and safing sector. Insert pin through the gun and housing cover.

7.	Feeder solenoid lead	Connected
8.	Drive motor lead	Connected
9.	GUN switch	FIRE
10.	Ballistic curtains	Secured

MXU-470/A ARMING.

1.	ARM/SAFE switch	ARM
2.	Rate switches (IFR modified airplanes)	As required
3.	E/Pilot	Advised

MXU-470/A POST-STRIKE.

1.	ARM/SAFE switch	SAFE
2.	GUN switch	SAFE/LOAD
3.	Drive motor lead	Disconnected
4.	Feeder solenoid lead	Disconnected
5.	Safing sector/Housing cover	Removed
6.	Gun	Cleared

7.	Loading sector	Installed
8.	Safing bar	Installed
9.	E/Pilot	Advised - "Guns safe and cleared"

40MM PRE-STRIKE.

1. Hydraulic valves — ON
2. ARM/SAFE switch — SAFE
3. LWCP MODE CONTROL switch — OFF
4. Breechblock locking bolt — Installed
5. Firing selector lever — STOP FIRE
6. Hand operating lever — Cocked/Safe
7. Feed rollers — Locked
8. Case deflection chute — Down/Secured
9. Spent case barrel — Positioned
10. One round hand positioned on loader tray — Positioned
    a. Remove round from clip.
    b. Position free hand in feed way through top of loader to prevent premature chambering.
    c. Insert round through rear of gun and insure that it locks securely between the rammer levers.
11. Ammunition in loader — Loaded

    Visually check that the bottom round is properly positioned on the feed rollers and insure that no more than one round extends above the top of the loader.
12. Thumb lever — Toward arrow
13. Hand operating lever — Forward
14. Firing selector lever — As requried

40MM ARMING.

Note

For fixed mount operation, the manual operation of 105MM/40MM Gun Mount procedures will be complete prior to accomplishing the following steps.

1. Breechblock locking bolt — Removed

CAUTION

For fixed mount operations, the hydraulic valves for the mount must be OFF before the LWCP mode control switch is rotated from OFF to any other position.

2. LWCP MODE CONTROL switch — SLAVE
    a. Insure power on and hydraulic active lights have illuminated.

3. ARM/SAFE switch — ARM
4. E/Pilot — Advised (include mode of fire)

Note

A spent case placed in the loader should be used to position the last round for firing. After inserting the spent case, position the thumb lever away from the arrow.

40MM POST-STRIKE.

1. ARM/SAFE switch — SAFE
2. LWCP MODE CONTROL switch — OFF
3. Breechblock locking bolt — Installed
4. Firing selector lever — STOP FIRE
5. Thumb lever — Away from arrow
6. Loader/Gun — Cleared
7. Hand operating lever — Cocked, Safe
8. Hydraulic valves — OFF
9. E/Pilot — Advised - "Gun safe and cleared"

105MM ARMING (NORMAL).

WARNING

- PD fuzes may detonate prematurely when fired during extremely heavy rainfall.
- Ammunition identification. Insure projectiles are marked 105H.

1. Hydraulic valves — ON
2. Ammunition — Prepared

   Select ammunition type and set fuze as directed.
3. ARM/SAFE switch — SAFE

WARNING

During trainable operation, the LOAD position must be selected on the LWCP mode control prior to loading the weapon.

4. LWCP MODE CONTROL switch — LOAD
5. Safety cage — Down
6. Ammunition — Loaded
7. LWCP MODE CONTROL switch — SLAVE

   Insure power on and hydraulic active lights have illuminated.
8. ARM/SAFE switch — ARM
9. E/Pilot — Advised
10. Repeat steps 1, 2, 3, 5, 6, 7, and 8 for each subsequent round of ammunition to be fired.

105MM ARMING (FIXED MOUNT).

Note

These procedures will be used whenever electronic control of the mount is not possible and it has to be positioned and secured manually. The manual operation of 105MM/40MM Gun Mount procedures will be completed prior to accomplishing the following steps.

1. Ammunition — Prepared

   Select ammunition type and set fuse as directed.

2. ARM/SAFE switch — SAFE

CAUTION

The hydraulic valves for the mount must be OFF before the LWCF mode control switch is rotated from OFF to any other position.

3. LWCP MODE CONTROL switch — OFF/As required
4. Safety cage — Down
5. Ammunition — Loaded
6. ARM/SAFE switch — ARM
7. E/Pilot — Advised
8. Repeat steps 1, 2, 5, 6, and 7 for each subsequent round of ammunition to be fired.

105MM POST-STRIKE.

1. ARM/SAFE switch — SAFE

Note

Omit step 2 when accomplishing these procedures after fixed mount operations.

2. LWCP MODE CONTROL switch — LOAD
3. Gun — Cleared
4. Safety cage — Stowed
5. Mount — Stowed
   a. After normal operations select STOW on the LWCP mode control switch and insure that the mount moves to the stowed position.
   b. After fixed operations loosen, back off, and secure the elevation and azimuth lock rings and stow the weapon.
6. LWCP MODE CONTROL switch — OFF
7. Hydraulic valves — OFF
8. E/Pilot — Advised — "Gun safe and cleared"

SCANNER'S EQUIPMENT PRE-STRIKE.

1. Dispensers and flare pistols	"ARMED"	CP,E,RS,IO
a. ALE-20 ARM/SAFE switch to ARMED		
b. Flare pistols loaded (if required)		

SCANNER'S EQUIPMENT POST-STRIKE.

1. Dispensers and flare pistols	"DEARMED"	CP,E,RS,IO
a. ALE-20 ARM/SAFE switch – SAFE.		
b. Flare pistols cleared (if required)		

20MM GUN MOUNT ADJUSTMENT PROCEDURES.

1. ARM/SAFE switch (both guns)	SAFE
2. Firing lead	Disconnected
3. Azimuth/Elevation locks	Unlocked
4. Gun mount	Set

Reconfirm gun settings with FCO.

5. Azimuth/Elevation locks	Locked
6. Firing lead	Connected
7. ARM/SAFE switch	ARM

MANUAL OPERATION 105MM/40MM GUN MOUNT.

1. ARM/SAFE switch	SAFE
2. LWCP MODE CONTROL switch	OFF

CAUTION

All hydraulic valves must be OFF before any attempt is made to operate manual hydraulic system.

3. Hydraulic valves (both guns)	Off
4. (105MM) Elevation lock housing covers	Removed
5. LWCP MODE CONTROL switch	SLAVE
6. Gun	Set

Using the manual hydraulic system to move gun, set error monitor to elevation and move gun until monitor indicates "O". Repeat for azimuth. As a cross reference, the FCO may monitor resolver readings.

Note

In the event the error monitor and resolver readings are inaccurate, the starrett gauges may be used to set the guns.

CAUTION

When the gun is manually cranked to the desired settings, the actuator locks must be firmly positioned.

7.	Azimuth/Elevation actuators	Locked
8.	LWCP MODE CONTROL switch	As required
9.	Manual systems selectors	OFF
10.	Gun settings	Confirmed

Verify with the FCO the gun position.

BEFORE LANDING PATTERN.

1. Ammunition and ammunition residue — Secured

BEFORE LANDING.

1. HOT MIC — Set
   a. HOT MIC LISTEN — ON
2. Safety belt and shoulder harness — Fastened,locked

AFTER LANDING AND ENGINE SHUTDOWN.

1. All guns and subassemblies — Checked for serviceability

   Unlock 40MM trainable gun mount locks and install 105MM elevation lock housing covers.
2. Oxygen regulators — OFF, 100%
3. Interphone cords — Stowed
4. Form 781 — Completed as required

FIRE CONTROL OFFICER.

The fire control officer attends pre-mission briefing, assimilates mission data and is thoroughly familiar with the function and performance of the navigation, sensor and fire control systems. His duties are focused on delivering ordinance on the target and assessing the inflicted battle damage. During an air strike, the monitors the fire control display and advises the pilot to cease fire when friendly forces arein danger of coming under fire. He coordinates the crew effort in detecting, validating and destroying targets. He is responsible for computing ballistic wind and gun/sensor alignment errors. He assists the navigator in the preparation of the misssion report and attends post-mission debriefings when required. The following checklists will be assigned to the fire control officer when a fire control officer is included as a crewmember. Items in this checklist that appear in Section II will be accomplished by the fire control officer.

FIRE CONTROL OFFICER'S CHECKLIST.

Items in quotations indicate that a response is required. Tasks that are followed by a letter in parentheses (N) indicate another crewmember with whom that specific task must be coordinated. The navigator will answer all checklist completion responses for the FCO unless F CO response is specifically indicated.

PREPARATION FOR FLIGHT.

1. Maps, charts, and applicable documents
2. Mission planning
3. Weather/Mission briefings
4. Professional, personal, and survival equipment
5. Nominal gun settings

EXTERIOR.

1. Pitot boom — Checked

CAUTION

Do not touch boom if pitot heater is ON.

INTERIOR (POWER OFF).

1. Form 781 — Checked

Note

The purpose of the power off inspection is to insure that power to the individual items of equipment is off. Since many of the power switches are push button type, lights must be on to determine whether a push button is off or on.

2. Lights — Set
   a. Work light - Set
   b. Panel lights - Set
3. Fire control circuit breakers, fuses, and fault indicators — Checked
4. Life preserver — Checked/As required

5.	Parachute	Checked
6.	COMPUTER/GUN indicator switch	FIXED
7.	Monitors	OFF
8.	Remote control units	OFF
9.	Fire control display	OFF

a. Graticule — OFF

b. BRT control — OFF

c. Circle size — OFF

10.	Line printer	OFF

a. Power switch — OFF

b. Tape supply — Checked

11.	IMU ground test switch	Normal (red guard down)

Note

With IMU ground test switch in up position the IMU will not align and ground boresight angles will not be available for TGM check.

12.	Oxygen system	Checked

INTERIOR (POWER ON).

Note

Due to time required for equipment warm-up and operational checks, the navigator may be required to check several systems in close sequence when performing the Interior (Power On) checklist. All applicable Power On checklist items will be completed prior to flight.

1.	Interior lights	Checked/Set
2.	Interphone panel	Checked/Set
3.	Gun mode selector panel	AUTO
4.	Gun status panel	Checked

a. Gun status light control — As required

b. Lights test button — Depressed

5.	Video tape controller	ON

a. STBY-OFF switch — STBY

b. STOP-REC switch — STOP

6. Primary sensor (non-consenting) — Set

7. Fire control display/Head up display — Checked (N)

   a. FCD — Set

      (1) FCD graticule — ON/Adjusted

      (2) FCD BRT control — Set

   b. HUD — Set

      (1) HUD power switch — ON

      (2) HUD settings — Set (for briefed altitude)

      (3) HUD STBY reticle — Checked/OFF

      (4) HUD TEST switch — Checked/OFF (Note HUD/FCO symbology)

      (5) HUD DECLUTTER switch — Checked/OFF (Note HUD/FCD symbology)

   c. Consent coincidence lights — ON

   d. Pilot ADI mode select switch — ASN-91

   e. Copilot ADI mode select switch — Pilot repeat

   f. Computer switch — Test/Checked

      (1) HUD/FCD — Checked

      (2) Off nominal indicator — Checked

      (3) Pilot and copilot AGIS — Checked

   g. GUNFIRE INHIBIT switch — Checked/NORMAL (N)

8. Fire control panels — Checked/Set (N)

   a. Offset range and bearing — Inserted

   b. Alignment SP/TGEL — Inserted

   c. Wind delta — Removed

   d. Sensor/Gun deltas — Inserted

   e. AGL — Set (N)

   f. Guidance — HSIG

WARNING

40MM or 105MM trainable gun mount (TGM) could move when fire control officer is checking fire control data if loader's weapon control panel (LWCP) mode selector switch is placed to SLAVE and hydraulic drive is active.

g. Rates — Set

h. Box limits — Inserted

i. Ground boresight angles — Set

(1) LAG — Insert 010°00.

Note

Computer safeties prevent insertion of LAG prior to 15 degrees or more depression with #6 TGM selected.

(2) Depression — Inserted 020°00'.00

j. Computer commanded gun angle (± 3 min) — Checked

(1) Compare with ground boresight angle

k. Nominal gun angles — Checked

Note

Cross-check each planned nominal/ballistic weapon combination.

l. Moving target mode — Inactive

(1) INS — Primary

(2) SEE light — Activated/Inactivated

m. DIRECT (FCP2) — Selected

n. Coincidence — Set

o. Auto/manual toggle switch (FCP2) — AUTO

9. Line printer — Checked, OFF

a. Power switch — ON

b. Print switch (FCP1) — Depressed

c. Reload — As required

d. Power switch — OFF

10. Remote control units — ON, Set

a. Power switches — ON

b. Video select switches — GRAY SCALE

c. Dot quad and crosshairs controls — ON

11. Monitors — ON, Adjusted (TV)

Note

A TV camera must be on before this check can be completed

a. Brightness — ON/Adjusted

b. Contrast (10 shades of gray) — Adjusted

12. Sensors interface (as required) — Checked (Sensors)

    a. Movement — Checked (SAD/FCD)

    b. CONSENT circuits (NORMAL/MOMENTARY) — Checked

13. Monitors — OFF

14. Remote control units — OFF

15. Video tape controller — Checked, OFF (IR)

    a. Tape threading — Confirmed

    b. STBY-OFF switch — STBY

    c. Tape out lamp — Checked

    d. Elapsed minute indicator — Set

    e. STOP REC switch — REC/Checked/STOP

        (1) Tape movement — Checked

        (2) Elapsed Minute indicator — Checked/Set

    f. STBY-OFF switch — OFF

    g. Local talk switch — Set

16. Fire control display — OFF

    a. Graticule — OFF

    b. Brightness — OFF

17. HUD power switch — OFF

18. Interphone panel — Set

    a. Selector switch — INT

    b. HOT MIC LISTEN on — Set

    c. Monitor sw — As required

BEFORE STARTING ENGINES.

1. HOT MIC — Set

    a. HOT MIC LISTEN — On

2. Lights — Set

3. Oxygen — Set

BEFORE TAXI.

Note

After the engines are started, advise the AG to begin the trainable weapons check. Coordinate all weapon selections with the AG on P1.

1. Trainable weapons check — Completed — FCO (AG)

a. Computer/gun indicator switch — FIXED

b. Computer gun discrete — No. 5

c. SLAVED light — Illuminated

(1) TGM LWCPs slaved (AG)

d. Gun resolver angles (± 20 min) — Checked

(1) Compare with commanded angles

e. Starrett gage readings (± 10 mils) — Obtained/ Checked

(1) Compare with commanded angles

f. Computer gun discrete — No. 6

g. Repeat items c through e for No. 6

2. Before taxi checks	"Complete"	E,N,FCO,TV,IO,CP

BEFORE TAKE-OFF.

1. Lights	Dim (as required)
2. Safety belt and shoulder harness	Fastened. Unlocked
3. Seat	Full left facing forward

AFTER TAKE-OF

1. Interphone panel — As required
2. Hot mike isolate switches — As required (advise crew)

AIRBORNE SENSOR/WEAPON ALIGNMENT.

1. Remote control units — SET

   a. Power switches — ON

   b. Video select switches — As required

   c. Dot-quad and crosshairs — ON

2. Monitors — ON/Adjusted

3. HUD — SET (Pilot states detent)

Note

Advise pilot of new settings if planned altitude has changed.

4. Fire control display — Set

   a. Graticule — ON/Adjusted

   b. BRT — ON/Adjusted

5. Primary sensor — Selected (advise pilot)

d. Primary sensor — Selected

e. Panels checked/Reset (as required)

6. Gun mode selector switch — AUTO

7. Computer gun discrete control panel — Set

Note

Unless otherwise required, select No. 5 TGM.

8. Alignment — Checked

WARNING

Serious eye damage or blindness may result if the energy of the LTDR is beamed directly or indirectly into the eyes from a distance of less than 16,000 feet.

b. Absolute altitude — Checked

(1) Laser AGL/BARO AGL — Checked

Note

Compare fire control computed TGT/SP ELV with actual TGT/SP ELV.

c. Sensors — Aligned.

Note

Boresight box adjustments are only for the 1:1 resolvers. Adjustments will be made to bring the primary aimline (PA) to track on the alignment point (in the HUD). Insure 1:1 resolvers are selected before adjusting.

(1) 1:1 resolvers (TV, RAD, IR, BC) — aligned (P)

Note

- The SSS symbol always represents 1:1 resolver location. If selected to the initial sensor aligned, the remaining sensors may be aligned by observing FCD symbology.
- NCP calibration procedures are for the IR and TV 4:1 resolvers only. If broesight box adjustments are performed for the 1:1 resolvers, the 4:1 resolvers must be calibrated.

(2) 4:1 resolvers (TV, IR) — Calibrated/If required (N)

(a) 4:1 resolvers — Enabled (N)

(b) Primary sensor — TV or IR

(c) Secondary sensor (same as primary sensor) — Set

(d) 4:1 resolvers — Calibrated (N)

Note

By selecting the secondary sensor the same as the primary sensor, when the 4:1 resolvers are calibrated, the PSS symbol should align with the SSS symbol on the FCD. The pilot should check the PA in the HUD to insure that it is tracking the alignment point. The procedure will then be repeated for the other sensor (TV or IR) which remains to be checked.

d. Offset — Checked

(1) OFFSET — Selected

(a) Correct displacement of PA in HUD/FCD— Checked (P)

(2) Slaving — Checked (TV or IR)

(a) FC TGT — Set 999

(b) TV/IR slave to INS — Slaved

(c) Correct slaving of sensor — Checked

Note

- If ASD-5 or APO-150 is operational and a beacon is available, the BC or RAD should be primary for this check.
- Primary sensor must be consenting for accurate offset slaving.

(3) DIRECT — selected

e. Wind — Checked (N)

(1) Wind — Zeroed

(2) Wind — Inserted

(a) Correct displacement of CIP in HUD/FCD — Checked (P)

(3) Current wind — Inserted

f. INS w/v stability (N) — Noted

g. Pitot boom auto cal — Completed/If required (N)

Note

Pitot boom calibration, if required, may be performed concurrent with SADS and slaving checks.

h. SADs and slaving checks — Completed (TV,IR,EWO)

Note

Normal sequence is TV, RAD, IR, BC, as available.

(1) Primary sensor — Selected

(2) TGT 000 (FCP2) — Set

(3) CONSENT — Checked/As required

Note

- All sensors may check INS slaving simultaneously if primary sensor release consent with TGT 000 set in FCP 2. Each sensor then slaves to INS on their respective control switching unit (CSU).
- Boresight box adjustments will affect slaving.

9. Trainable weapons — CHECKED — FCO (AG)

a. No. 5 and No. 6 guns — Slaved (AG)

b. Computer gun discrete switch — As required.

(1) Slaved light — Checked

c. Primary sensor — Selected

d. Gun resolver angles (± 20 min) — Checked

e. Computer/gun indicator switch — Trainable (advise crew)

(1) Fire enable light — Checked (advise sensor)

Note

Primary sensor must consent for fire enable.

f. Trainable box limits — Checked (P)

Note

The CIP will flash if resolver readout is not within limits.

(1) Limit symbology — Checked (P)

(2) Gun movement — Checked (AG)

Note

The computer will not command a TGM to less than 18° depression. Inhibit symbology will be displayed when the limit is reached.

g. Computer/gun indicator switch — Fixed

h. Repeat items (b) thru (g) for remaining gun

10. Alignment and Trainable Weapons — "Checked"

PRE-STRIKE.

1. Video tape controller	addressed, Set (as required)	
a. STBY-OFF switch — STBY		
b. STOP-REC switch — STOP		
c. Local talk switch — I/P		
2. Remote control units	Set	
a. PWR switch — ON		
b. Video select switches — As required		
c. Dot-quad and crosshairs — ON		
3. Monitors	ON, Adjusted	

Note

Crosshairs on the 14 in. monitor should be set white and off maximum intensity to preclude a distorted signal to the video tape recorder.

4. Weapons/Target briefing — Monitored		
5. HUD	Set (P)	
a. Detent — Checked, Set (P)		
b. Mil setting — Checked, Set (P)		

Note

Advise pilot of new settings if planned strike altitude has changed.

6. FCD		
a. Graticle — On, adjusted		
b. BRT — On, Set		
7. Line Printer	On (as required)	
8. Prestrike checks	"Complete"	E,N,FCO,TV,IO,CP

STRIKE.

1. Target/weapon briefing — Updated (as required)

2. HUD

   a. Detent — Updated, as required

3. Orbit thumbwheel — As required

4. AGL/TG EL (use LTD/R if possible)— Checked

WARNING

Serious eye damage or blindness may result if the energy of the LTD/R is beamed directly or indirectly into the eyes from a distance of less than 16,000 feet.

5. Primary sensor — Selected

6. Moving target mode — As required

7. Direct/Offset — As required

8. Coincidence - As required

9. Rate - As required

WARNING

If TRAINABLE is not selected, the computer is programmed to assume the weapon selected is correctly positioned to nominal lag and depression angles. Manual and semiauto gun modes do not incorporate computer program safety limits or temporary stored tolerances as prerequisites to fire.

CAUTION

Do not fire 40MM or 105MM guns at depression angles less than 320 mils or 18 degrees to prevent muzzle blast damage to the left wing trailing edge structure and flaps.

Do not fire 40MM and 105MM simultaneously or the 40MM at a firing rate in excess of 100 rounds per minute to prevent exciting dynamic structural response of the fuselage structure. Airplane structural damage may result.

10. Gun Mode Selector — As required

11. Computer gun discrete switches — As required

12. Ballistics selector — As required

Note

Appropriate ballistic selection must be made with each gun/ammo change or incorrect ballistic data will be used. If a change is made on the ballistic selector panel, reactivate the proper gun discrete control panel switch to insure a valid fire control signal. Selected gun will override incorrectly selected ballistics, but will use only STD for No. 5 and A(HE) for No. 6, otherwise the highest caliber ballistic is used if a double selection is made on the computer gun discrete or gun control panel.

13. Computer gun indicator switch — As required.

14. Weapon positioning — Verified

Note

Weapon positioning will be verified with scales/starrett gauges/resolver readout (FC)/slave light, based the FCO's judgement of the reliability of these indicators.

15. Gunfire inhibit switch — NORMAL

WARNING

If friendly forces are in danger of aircraft fire, the FCO will immediately place the gunfire inhibit switch to INHIBIT and advise the pilot.

POST-STRIKE.

1. Video tape controller — OFF
    a. STOP/REC switch (if necessary) — REC
    b. Tape out lamp — Illuminated
    c. Tape controller — OFF
2. Line printer — OFF
3. Gun control panel — Set
    a. Gun mode selector — AUTO
    b. Computer gun indicator — FIXED
4. Fire control display — OFF
5. Monitors — OFF

6.	Remote control units	OFF
7.	Forms and reports	Completed

BEFORE LANDING PATTERN.

1.	Lights	Dim (as required)
2.	Curtains	Stowed

BEFORE LANDING.

1. HOT MIC — Set
   a. HOT MIC LISTEN — ON
2. Seat — Full left and facing forward
3. Safety belt and shoulder harness — Fastened, Unlocked

ENGINE SHUTDOWN.

1.	Lights	OFF
2.	Oxygen regulators	OFF, 100%

TV OPERATOR.

The TV operator attends pre-mission briefing, assimilates mission data, and is thoroughly familiar with the functions of the TV sensor system and its subsystems. He coordinates with the other sensor operators, navigator and fire control officer in the target area acquiring, tracking targets, and maintaining proper target orientation. He assists in the assessment of target damage and destruction. He is responsible for the coordination of checklists and advises the pilot when required response items have been accomplished by all booth positions. He attends maintenance, operations, and intelligence debriefings as required. Items in this checklist that appear in Section II will be accomplished by the TV operator.

TV OPERATOR'S CHECKLIST.

Tasks that are followed by a letter in parenthesis indicate another crewmember with whom that specific task must be coordinated. Items in quotes indicate that a response is required. The TV operator will answer all checklist responses for the booth. The response will be "TV."

PREPARATION FOR FLIGHT.

1.	Mission planning	Completed
2.	Mission/Weather briefing	Attended
3.	Professional, personal, and survival equipment	Checked

EXTERIOR (POWER OFF).

1.	Form 781	Checked

INTERIOR (POWER OFF).

Note

The purpose of the power off inspection is to insure that power to the individual items of equipment is off. Since many of the power switches are push-button type, lights must be on to determine whether a pushbutton is off or on.

1. 2 KW searchlight — Checked
   - a. Filter — As required

Note

Install clear or IR lens at this time.

   - b. Filter clamps — Secured
   - c. Circuit breakers — Set
   - d. Cables — Connected
   - e. Lockpins — Removed
   - f. Friction locks (if installed) — Lowered
   - g. Freedom of movement — Checked

2. Lights — Set
3. Mount power switch — OFF/STOW
4. Remote control units — OFF
5. RT wing SUU-42A/A control switch — OFF (guard down)
6. 2 KW searchlight control panel — OFF
   - a. Platform power switch — OFF
   - b. Search light power switch — OFF
   - c. Lamp power switch — OFF
   - d. Press-to-test lights — Checked
7. TV console circuit breakers — Set
8. Monitors — OFF

9. Clock — Set, Wound

10. LTD/R control panel — OFF

11. TV/LTD control panel — Set, OFF

    a. Laser FIRE switch — OFF (down)

    b. Laser POWER switch — OFF

    c. TV control knob — OFF

    d. Filter control knob — Set (C position)

    e. Consent switch — OFF

    f. Press-to-test lights — Checked

12. Laser illuminator control panel — Set, OFF

    a. Power switch — OFF

    b. Range switch — MAN

    c. Output switch — RPP

    d. Pulse width knob — CCW

    e. Range control knob — CCW

    f. Camera gate width — Set (C position)

13. TV console monitors — Checked

    a. Circuit breakers — Set

    b. Cables — Connected

    c. OHM switches — 75 OHM (down)

14. TV/laser platform — Checked

Note

The operator should check for proper balance of the platform by manually releasing the elevation locking mechanism with all covers off and wide TV filters on.

    a. TV cameras — Secured

    b. TV lens covers — Removed

    c. WTV filter — As required

    d. Laser illuminator lens cover — Removed

    e. LTD/R lens covers — removed

    f. Platform balance — Checked

    g. Cables and cryogenics lines — Connected

    h. LTD/R pressure gage (300 ± 20 psi) — Checked

15. TV cargo compartment circuit breakers — Checked

    a. Video switching unit — Checked

    b. Cargo compartment dc circuit breaker panel — Checked

16. Laser illuminator dewar — Checked

Note

Dewar should be 90 percent full to fly two missions and at least 50 percent fully to fly one mission.

    a. Pressure gage (6 psi min) — Checked

    b. Nitrogen quantity — Checked

17. Flight deck and flight deck extension circuit breakers — Set

    a. Camera electronics units — Set

    b. TV/laser platform electronics unit — Set

    c. Laser illuminator electronic control amplifier — Set

    d. Flight deck circuit breakers — Set

Note

Flight deck circuit breakers may be checked by the NAV or FCO.

18. Life preserver — Checked/As required

19. Parachute — Checked

20. Oxygen system — Checked

INTERIOR (POWER ON).

1. Work and panel lights — Set

2. Interphone panel — Checked/Set

3. TV control switching unit — LOC

4. Mount power switch — ON

CAUTION

Never point a TV camera at the sun even if the camera is turned OFF. Serious damage to the intensifier and/or the vidicon tube may result from too much light and/or too bright a light.

5. TV/laser and 2 KW searchlight platforms — Checked

   a. Searchlight CSU — TV

   b. Platform power — ON

   c. Platform azimuth and elevation movement (TV and searchlight) — Checked

   d. Drift and sensitivity — Checked/Set

   e. 2 KW platform power — OFF

6. Remote control units — ON/Set

   a. Power switches — ON

   b. Video switches — Gray scale

   c. Crosshair and dot quad controls — On

7. Monitors — ON

CAUTION

During daylight do not turn cameras on unless a neutral density filter is used; do not aim cameras at any bright light source at anytime.

8. TV control knob — Set (as required)

9. Monitors — Adjusted

   a. Brightness — Adjusted

   b. Contrast (10 shades of gray) — Adjusted

10. TV imagery — Checked

   a. WTV video — Checked

   b. NTV video — Checked

   c. Dot quad — Checked

   d. Crosshairs — Checked

   e. NTV focus operation — Checked

11. Sensor interface — Checked (FCO)

   a. Movement (SAD) — Checked

   b. Consent circuits — Checked

      (1) Normal consent — Checked

      (2) Momentary consent — Checked

WARNING

It is not necessary to actually lase while performing this check. Serious eye damage or blindness may result if the energy of the LTD/R is beamed directly or indirectly into the eyes from a distance of less than 16,000 feet.

12. LTD/R lamp and safety limits	Checked, Off	
a. LTD/R — On (do not lase)		
b. Lamp test switch — Depressed (all lamps illuminated)		
c. Safety limits — Checked (-14 to +44 in azimuth; +3.5 to -64 in elevation)		

Note

0 dropout on the range display should occur as the TV/laser platform is moved through limits.

d. LTD/R — Off		
13. TV control/Filter select knobs	OFF, Set (C position)	
14. Monitors	Off	
15. Remote control units	OFF	
16. Mount power switch	OFF/STOW	
17. 2 KW searchlight lock pins	Installed	

BEFORE STARTING ENGINES.

1. Lights	Set	
2. HOT MIC	"Set"	P,CP,E,N,TV,IO
a. HOT MIC LISTEN — ON		
3. Oxygen	Set	
4. Before starting engines checks	"Complete"	E,N,TV,IO,CP

BEFORE TAXI.

1. Laser illuminator power switch (note time for cool down)	Standby	
2. Compass and attitude indicators	"Checked/Set"	N,P,CP,TV
a. Compass heading — Checked		
b. Vertical reference pitch bar — Set		
3. Altimeters	"Set (state setting)"	P,CP,N,TV
4. All warning lights and alarm bells	"Checked"	E,TV,IO
a. Bell — Checked		

b. Light — Checked

5. Before taxi checks	"Complete"	E,N,FCO,TV,IO,CP

TAXIING.

1. Flight instruments	"Checked"	P,CP,N,TV

BEFORE TAKE-OFF.

1. All exits (booth door checked and open)	Secure	
2. Safety belt and shoulder harness	Fastened/Locked	
3. Before take-off checks	"Complete"	E,N,TV,IO,CP

AFTER TAKE-OFF.

1. Lights	Set	
2. After take-off checks	"Complete"	E,N,TV,IO,CP

AIRBORNE SENSOR/WEAPON ALIGNMENT

1. Lights	Set
2. Interphone panel	As required
3. 2KW searchlight lockpins	Removed (as required)

WARNING

Due to moderate turbulence around the TV/laser platform, extreme care must be exercised when the TV lens covers/filter and laser covers are installed or removed during flight. Until T.O. 1C-130(A)E-507 (TV close out panel) is accomplished, the person performing the installation/removal should be secured to the airplane and a safety observer should be present during the entire operation.

4. TV control switching unit	LOC
5. Mount power switch	ON
6. Remote control units	Set

a. Power switches — On

b. Video select switches — As required

c. Dot quad and crosshairs — As required

7. Monitors	ON
8. TV/laser platform	Positioned
9. TV control/Filter select knobs	Set (as required)

10. Montiors — Adjusted

    a. Brightness — Adjusted

    b. Contrast (10 shades of gray) — Adjusted

11. 2 KW searchlight — On (as required)

    a. Platform power switch — ON

    b. Searchlight power — ON

    c. Lamp power — ON

    d. Searchlight CSU — TV

    e. Align unit — (as required)

12. Laser illuminator control panel — Set (as required)

    a. Laser switch (after READY light illuminates) — LASE (as required)

    b. Range switch — MAN

    c. Range control knob — Adjusted

    d. Range switch — AUTO

    e. Camera gate width — As required

    f. Output — RPP (MAX if required)

    g. Pulse width — Adjusted (as required)

Note

The GAAS filter should be installed on WTV camera when laser illuminator is being used.

13. Sensor alignment point/target — Identified

14. Consent switches — On(as required) (FCO)

15. Drift and sensitivity — Adjusted

16. SAD and slaving — Checked

WARNING

Serious eye damage or blindness may result if the energy of the LTD/R is beamed directly or indirectly into the eyes from a distance of less than 16,000 feet. If lasing does not stop when the lasing limits are exceeded with the TV/laser platform, turn the laser off.

17. LTD/R	ON, Checked, Set	

a. LTD/R – ON

b. TV/LTD control panel POWER/FIRE switched – ON

c. Test – Checked

(1) Test/First return switches – Depressed (held simultaneously). Range display should read 19,900 feet. This display will be realized only if the slant range to the selected ground tracking point is more than 19,900 feet.

(2) Test switch – Depressed range display reads 40, 380 feet (Wait at least four seconds after releasing first return switch.)

d. Designator boresight – Checked

e. Guarded laser FIRE switch – OFF (guard down)

18. Airborne sensor/weapon alignment checks	*"Complete"	FCO,TV,CP

PRE-STRIKE

1. Systems	Set (As required)	
2. Pre-Strike	"Complete"	E,N,FCO,TV,IO,CP

POST-STRIKE.

1. LTD/R	OFF
2. TV/LTD control panel	OFF/Set

a. TV control knob – OFF

b. Filter select knob – Set (C position)

c. Laser POWER switch – OFF

d. Laser FIRE switch –OFF (guard down)

e. Consent switch – Off

3. Monitors	OFF
4. Laser illuminator control panel	OFF/Set

a. Power switch – OFF

b. Range switch – MAN

c. Camera gate width – Set (C position)

d. Output – RPP

e. Pulse width knob – CCW

5. Remote control units	OFF	
a. Dot quad and crosshair controls — Off		
b. Power switches — Off		
6. 2 KW searchlight — OFF		
a. Lamp power switch — OFF		

CAUTION

After turning the lamp switch off wait at least 30 seconds before turning the searchlight power switch off.

b. Searchlight power switch — OFF		
c. Lockpins — Installed		
d. Platform power — OFF		
7. Mount power switch	OFF/STOW	
8. Lights	Set	
9. Interphone panel	Set (Main interphone)	
10. Post-strike checks	"Complete"	E,N,TV,IO,CP

BEFORE LANDING PATTERN.

1. Booth door	Open/Secured	
2. Interphone panel	Set (main interphone)	
3. Altimeter	"Set (state setting)"	P,CP,N,TV
4. Before landing pattern checks	"Complete"	E,N,TV,IO,CP

BEFORE LANDING.

1. HOT MIC	Set	
a. HOT MIC LISTEN — ON		
2. Before landing checks	"Complete"	E,N,TV,IO,CP

ENGINE SHUTDOWN.

1. Oxygen	OFF, 100%	
2. Lights	Set	
a. Panel lights — OFF		
b. Work lights — OFF		
c. Overhead rear booth light — OFF		
3. Engine shutdown checks	"Complete"	E,N,TV,IO,CP

BEFORE LEAVING THE AIRPLANE

1. Interphone cords — Stowed
2. TV/Laser platform — Secured
    a. TV lens covers — Installed
    b. Laser lens covers — Installed
    c. Platform — Locked (Stow position)
3. Form 781 — Completed

ELECTRONIC WARFARE OFFICER.

The electronic warfare officer (EWO) attends pre-mission briefings and assimilates required data and intelligence for the mission. He has the responsibilty of being thoroughly familiar with the performance and operation of: the ASD-5 Black Crow (BC), the APQ-150 beacon tracking radar, and all installed ECM equipment. During the mission he is required to search for, acquire, and track both friendly forces and enemy targets. He must coordinate with the pilot, other sensors, navigator, and fire control officer in acquiring and attacking targets. He advises the crew of threats to the aircraft and directs appropriate countermeasures. He assists the navigator and FCO in preparation of the mission report and attends post-mission debriefings as required.

ELECTRONIC WARFARE OFFICER'S CHECKLIST.

Items in quotations indicate that a response is required. Tasks that are followed by a letter in parenthesis indicate another crewmember with whom that specific task must be coordinated. The TV/IR operator will answer all checklist asterisked responses for the booth. The EWO will answer if the TV/IR operator is not aboard.

PREPARATION FOR FLIGHT.

1. Mission planning — Accomplished

Note

The EWO will study the target area, and gather all available intelligence data needed for the mission. He will assist the navigator in updating charts and planning the mission.

2. Mission briefings — Attended

Note

The EWO will attend all required mission briefings and will conduct appropriate portions of those briefings.

3. Professional, personal and survival equipment — Checked

EXTERIOR INSPECTION.

1. Form 781 — Checked

Note

Check for equipment status and expendable loading.

2. Antennas, radomes, and dispensers — Checked

a. Right ALE-20 and ALE-40 ejectors — Checked. Verify expendables are uploaded as required.

b. Right ECM pods (when installed) — Checked. Verify control setting selectors are in override and proper operating mode has been selected where applicable. Check overall general condition.

WARNING

Do not walk directly beneath the SUU-42A/A dispenser or stand directly behind a dispenser loaded with live ammunition.

c. Right SUU-42A/A (when installed) — Checked. Verify tubes are correctly loaded as required. Insure wiring and cannon plug secure.

d. Center TRIM-7A radome — Checked. Visually check right side of radome for cleanliness, condition, and security.

WARNING

When working in the area of nose wheel well, remain clear of the oxygen vent on the right side of the aircraft.

e. Right forward ALR-69 antenna — Checked. Verify cleanliness, condition, and security.

f. Nose TRIM-7A antenna — Checked. Verify cleanliness, condition, and security.

g. Left forward ALR-69 antenna — Checked. Verify cleanliness, condition, and security.

h. ASD-5 radome and deflector — Checked. Check radome for security and damage or deterioration. Check deflector and hinge for security and damage; the deflector will be left secure.

i. ASD-5 servo electronics unit — Checked. Verify four circuit breakers are in and cabling secure.

j. Nose TRIM-7A cabling — Checked

Note

Insure apron pins are secure and nose wheel well light is extinguished.

k. Center TRIM-7A radome — Checked. Visually check left side of radome for cleanliness condition, and security.

l. Left SUU-42A/A (when installed) — Checked. Verify tubes are correctly loaded as required. Insure wiring and cannon plug are secure.

m. Left ECM pods (when installed) — Checked. Verify control setting selectors are in override and proper operating mode has been selected where applicable. Check overall general condition.

n. Left ALE-20 flare ejector — Checked. Verify expendables are uploaded as required.

o. APQ-150 radome — Checked. Check radome for security of mounting, damage or deterioration, and conditon of fairing. Check that the radome locking screw is safety wired.

p. Lower ALR-69 antenna — Checked. Verify cleanliness, condition, and security.

q. Left ALE-40 ejectors — Checked. Verify expendables are uploaded as required.

r. Left TRIM-7A antenna — Checked. Verify cleanliness, condition, and security.

s. Aft radome — Checked. Verify cleanliness, condition, and security.

t. Aft ALE-40 ejectors — Checked. Verify expendables are uploaded as required.

u. Right TRIM-7A antenna — Checked. Verify cleanliness, condition, and security.

INTERIOR INSPECTION.

1. AM-6971 receiver — Checked
   a. Cables and mounting — Checked
2. TRIM-7A cabling (right) — Checked
3. TRIM-7A cabling (left) — Checked
4. TRIM-7A main units (2) — Checked
   a. Cables and mounting — Checked
   b. Test switch — OFF
   c. 115-volt switch — As required (Checked in the ON position unless a particular TRIM-7A is not to be used during the mission in which case it would be checked OFF.)
5. TRIM-7A switching units (2) — Checked
   a. Cables and mounting — Checked
6. ALR-69 equipment — Checked
   a. Cables and mounting — Checked
7. ASD-5 power supply — Checked
   a. Cables, mounting, and CBs — Checked

8. Cargo compartment dc circuit breaker panel — Checked

   a. Black Crow
   b. APQ-150
   c. Comp dc power
   d. Intervalometer
   e. SUU-42A/A
   f. ALE-40
   g. ALR-69

9. ECM wing pod circuit breaker panel — Checked

   a. ECM pods
   b. ALR-69

10. EWO flight deck circuit breakers — Checked

   a. APQ-150
   b. 2-man console
   c. MAU-12
   d. Black crow
   e. RHAW

11. Parachute — Adjusted (As required)

12. Air conditioning T-handle — Set

Note

Setting the T-handle full up is recommended until the booth is adequately cool/warm to assure normal equipment operation.

13. Lights — Checked, Set (as required)

14. Emergency equipment — Checked, Secure

   a. Fire extinguisher (Verify pressure in green)
   b. Crash axe (Secure)
   c. First aid kit (Check condition)

d. Portable oxygen bottle (Fully charged and set on NORMAL)

15.	LPU	Adjusted (as required)
16.	Oxygen	Checked
17.	Two-man console circuit breaker panel	Checked

a. TRIM 7-switching unit

b. ECM control

c. TRIM 7- Nose/Tail

d. TRIM 7 - Left/Right

e. RHAW

18.	ECM pod controls	OFF
19.	TRIM-7A	OFF/Set

a. Power — OFF

b. Mode — CW

c. Frequency selector switch (1, 2, 3, VAR) — 1

Note

The FREQ. VAR. and SWEEP controls consists of two knobs, coaxially mounted. The smaller knobs are fine adjustments and should be set at mid-travel.

d. FREQ. VAR — CCW/Centered

e. Sweep — CCW/Centered

f. INT — CCW

20.	Antenna switching unit	OFF

Note

Turn up antenna switching unit dim control to confirm billboard lights are out, indicating unit is off.

21. ALR-69 — OFF, Set

a. Intensity and audio — CCW

b. Power — OFF

Note

Turn up ALR-69 DIM control to confirm billboard lights are out, indicating the unit is off.

22. ASD-5 — Set (as required)

a. Manual controller — Set

(1) Mount power — OFF

(2) Sensitivity — CW

b. System power — OFF

c. Decoder — OFF

d. Indicator — Set

(1) Scale — CCW

(2) Intensity — CCW

(3) Magnifier — X10

(4) Display — EXT CAL

(5) Ext input — AC

e. Control unit — Set

(1) BITE — OFF

(2) Mode select — MNL track

(3) Track mode display scale — NORMAL

(4) Audio volume — CCW

(5) Blanking disable — OFF

(6) Consent — OFF

(7) Angle gate — OFF

(8) Angle gate pot — Appr. setting 5

(9) Threshold — Set 100

CAUTION

Threshold knob should be set to a minimum of 100 to avoid damage to the zero stop.

(10) Search scan (AFT limit) – CCW

(11) Search scan (FWD limit) – CW

CAUTION

If the ASD-5 is operated in search mode and the forward and aft pots are reversed, the system will drive against itself causing a current overload in the power supply and servo amplifier.

(12) Search scan rate – CW

23. APQ-150 — Set

a. Mode select – OFF

b. RSLVR EXC – OFF

c. 28V CKT BRKR – ON

d. IF GAIN – CCW

e. Display intensity – CCW

24. Chaff control panel — OFF, set

a. Launch switch – OFF (red guard down)

b. Program – 999

c. Manual/Ripple switch – MANUAL

25. Interphone and radios — Set

a. Check CALL position with another crewmember.

26. Clock — Set

27. ALE-40 programmer — Set (as required)

Note

ASD-5 and ALR-69 may be checked prior to starting engines by using applicable parts of the AFTER TAKE-OFF and PRE-STRIKE checklists, and shutting down accomplished by using applicable parts of the POST-STRIKE and BEFORE LANDING checklists.

BEFORE STARTING ENGINES.

CAUTION

Transient voltages may damage the ASD-5 system if both the mount power and the system power are not removed prior to starting engines.

1. HOT MIC	*"Set"	P,CP,E,N,TV,IO
a. Listen — ON		
2. Oxygen system	Set	
3. Before starting engines checks	*"Complete"	E,N,TV,GC,CP

STARTING ENGINES.

1. Air conditioning panel	Set	
a. Cargo compartment temperature control – Set as desired		
b. Cargo compartment air recirculation – OFF		

BEFORE TAXI.

1. Compass and heading indicators	*"Checked/Set"	N,P,CP,TV
2. Altimeter	*"Set"	CP,P,N,TV
3. Alarm system	*"Checked"	E,TV,IO
4. Before taxi checks	* "Complete"	E,N,FCO,TV,IO,CP

TAXIING

1. Flight instruments	*"Checked"	P,CP,N,TV

Note

Check magnetic heading indicator for correct indications on turns. Check attitude indicator adjusted to indicate straight and level flight with no OFF flag showing.

BEFORE TAKE-OFF.

1. Safety belt and shoulder harness (Seat facing forward and locked into position)	Fastened/Locked	
2. Before take-off checks	*"Complete"	E,N,TV,IO,CP

AFTER TAKE-OFF.

1. Power switches — ON/Standby
   a. ECM pods — STBY
   b. TRIM-7A — STBY
   c. Antenna switching unit — ON
   d. ALR-69 — ON
      (1) Intensity — CW
      (2) Rings of fire — Checked
   e. ASD-5 system power — ON
   f. Decoder — As required
   g. APQ-150 — STBY
   h. ASD-5 mount power — ON
2. Interphone panel — Set (as required)
   a. Individual monitoring switches — As required
   b. Master wafer switch — P-2
3. After take-off checks — *"Complete" — E,N,TV,IO,CP

AIRBORNE SENOR/ WEAPON ALIGNMENT

1. Electronic interference — Reduced (as required)

Note

Reduce electronic interference to the ASD-5 and to the APQ-150 as required to complete the sensor alignment. This may include but is not necessarily limited to; propeller governing, TD valves, APN-59, TACAN, and IFF. Coordination with other crewmembers will be required in the elimination of most forms of interference.

2. ASD-5 — Set
   a. Scale — Adjusted
   b. Intensity — Adjusted (increase until antenna reference square becomes visible).

Note

The vertical and horizontal centering controls may be so maladjusted as to place the antenna reference square off the scope. In order to locate it, press the BEAM FIND control located on the intensity control.

   c. Focus — Adjusted
   d. Bite — Boresight
   e. Threshold — Adjusted

Note

- Adjust threshold sensitivity until a steady dot cluster appears. This threshold setting represents only a test calibration setting and not the optimum setting.

- The PRF ALARM light (red) and the AUTO TRACK light (amber) should illuminate.

f. Audio – Adjusted

g. Vertical and horizontal position – Centered

h. Bite – Gain check

i. Track mode display scale switch – Checked

(1) NORMAL – the dot cluster should deflect down 1 cm and to the right 1 cm.

(2) EXPANDED – the dot cluster should deflect down 3 cm and to the right 3 cm.

(3) Return to NORMAL.

j. Angle gate – ON/Checked/OFF

Note

- Turn the angle gate display on. Then, vary the size of the angle gate, noting that while the dot cluster is within the limits of the angle gate, the MANUAL/ AUTO TRACK light is on and steady. Decreasing the size of the angle gate until the dot cluster is no longer within it should cause the light to go out.

- Difficulty in obtaining auto track may result if the angle gate pot is left positioned at or near minimum setting. Therefore, the angle gate pot should be set on an approximate setting of 5 or larger to ensure a rapid transition from manual track to auto track.

k. Bite – OFF

l. Pedestal power lamp – ON

Note

Pedestal power lamp will illuminate following a 60-second delay after the mount power switch is turned ON.

CAUTION

If the AFT limit and forward limit pots are reversed, the system will drive against itself causing a current overload in the power supply and servo amplifier.

m. Mode select — SEARCH

n. Antenna position limits — Checked. (Drive the antenna to each limit and check to see that AFT, UP, FWD and DOWN indicators light amber.)

o. Search scan limits — Checked/Set

(1) AFT LIMIT pot — Adjust CW and note that the sweeping antenna stops short of its original stop. Set pot to desired setting.

(2) FWD LIMIT pot — Adjust CCW and note the sweeping antenna stops short of its original stop. Set pot to desired setting.

p. Scan rate — Checked/Set (Vary the rate pot while the antenna is sweeping and watch for a corresponding change in antenna speed.)

q. Mode select — Manual track

r. Threshold — Set. Increase the threshold setting to achieve optimum sensitivity.

s. Blanking disable switch — ON/Checked/OFF

t. Beacon — Acquired.

u. Drift controls — Adjusted for geometry

Note

When the airplane is at alignment altitude and is in proper geometry, adjust the drift controls to stop movement of the antenna. This must be accomplished in manual mode and prior to boresight check.

v. Mode selector — Auto track

w. Consent — ON

3. APQ-150 Checked

CAUTION

If the amber IND FAULT indicator light illuminates and remains lit after turn-on, turn the mode switch to OFF and do not turn the set back on. Damage to the set may occur.

Note

- If the amber RTR FAULT light illuminates after initial turn-on, recycle the mode switch to OFF and back to STBY to clear the fault. If the fault cannot be cleared turn the set OFF.
- After the set is initially placed in STBY a 60 second time delay is required before the set can be placed in full operational use.

a. Indicator — Tuned

(1) PANEL ILLUM — Set (to desired brightness of panel markings).

(2) SCALE ILLUM — Set (to desired graticle illumination).

(3) IF GAIN — Fully CW

(4) DISPLAY INTEN — Adjusted (to obtain a sharp well defined scope display).

b. Antenna drive — Checked (for aft, forward, up, and down drive).

Note

The servo can be electrically driven past the antenna's physical limits, and may require up to 15 seconds of depression on the control stick in the opposite direction before the antenna will move off the limit.

c. Range slew — Checked. (Using the range slew switch, check to see that the range gate will drive correctly.)

d. Display range — Checked. (Using the DISPLAY RANGE NAUTICAL MI switch, go from the X1 position to the X2 position and check, using an actual signal or the range gate, that the range is acutally changing.)

e. Mode selector — MNL

f. Antenna scan — Checked (Spiral) (that the antenna spiral scans from the reference angle to a maximum of ± 10 degrees in azimuth and elevation and returns to the reference angle.) The green SRCH indicators should be lit.

g. Mode selector — AUTO

h. Antenna scan — Checked (Linear) (that the antenna scan is linear ± 25 degrees either side of the reference angle in elevation.) The amber TRACK light and green SRCH indicator should be lit.

Note

When in AUTO mode and acquisition is lost, the antenna will go into a spiral scan. At times an outside signal may cause the antenna to go into the spiral mode. If this happens, go to STBY and then return to AUTO or push the INHIBIT switch if the sector scan inhibit light is illuminated.

i. Mode selector — BRST

j. Antenna alignment — Checked. (Check that antenna reference angle mark is at zero in both azimuth and elevation.)

k. Code select switch — As required. (Set code of beacon if known.)

l. Mode selector — AUTO/MNL (Acquire and track the beacon.)

4. SAD and slaving — Checked

a. APQ-150 — Checked

(1) Mode control — Slave

(2) Slaving — Checked (That the APQ-150 will slave to within 2 degrees of each of the other sensor that are tracking the alignment point.)

(3) INS storage — Checked (That targets can be stored in the INS from the APQ-150.)

(4) Mode control — As required

CAUTION

If the radar set is to remain in the STBY mode for an indefinate period of time, reduce the CRT DISPLAY INTEN or damage to the CRT may result.

b. ASD-5 — Checked

(1) SAD — Checked (That the relative needles are nulled when each of the other sensors that are tracking are selected.)

(2) Slaving — Checked (That the ASD-5 will slave to within 20 mils of each of the other sensors that are tracking the alignment point.)

(3) INS storage — Checked (That targets can be stored in the INS from the ASD-5.)

5. Airborne sensor/weapon alignment checks — *"Complete" — TV,CP

PRE-STRIKE

Note

The EWO's pre-strike checklist will be accomplished prior to entering any threat area. Items 1, 2, 3, and 4 may be accomplished in conjunction with AIRBORNE SENSOR/WEAPON ALIGNMENT checklist because of the impact that equipment malfunctions could have on continuing the mission.

1. Antenna switching unit — Set
   a. Dimmer — Set
   b. Attended — Selected
   c. Normal — Selected
2. ALR-69 — Checked
   a. INTEN controls - Set
   b. Self-test — Checked
3. TRIM-7A — Checked
   a. Intensity — Set (To a level high enough to display on the CRT on all systems)
   b. Self-test — Performed
      (1) Test button — Depressed
      (2) Intensity — Set (Optimum)
      (3) Focus — Adjusted
      (4) Sweep — Adjusted
      (5) Control switch — READY
      (6) Frequency switch — Checked

(7) Frequency VAR — Checked (The frequency knob will be checked for proper operation through its entire range.)

(8) Mode select switch — Checked

Note

As each mode is selected, check the CRT for correct display patterns. Lights will also be checked for correct indications.

(9) Antenna — Checked (For proper operation. Note any interference on other systems at this time.)

(10) Control switch — STBY

4. ECM pods (when installed) — Checked

a. Selector — Transmit 1 (Check lights, modulation, and interference.)

b. Selector — Transmit 2 (Check lights, modulation, and interference.)

c. Selector — Both (Check lights, modulation, and interference.)

Note

Note interference on other equipment and check modulation by monitoring TRIM-7A as applicable.

d. Reset button — Depressed

e. Selector — STBY

5. Electronic interference (Reduced as necessary to perform the strike portion of the mission.) — Reduced (As required)

6. ASD-5 — Set

a. Threshold — Adjusted (Optimum setting)

b. Audio — Set

c. Angle gate — Set

d. VERT and HORIZONTAL POS — Centered

7. APQ-150 — Set

Note

When trying to acquire a radar transponder the APN-59, search radar, may have to be placed in STANDBY or OFF. Leaving the search radar in a transmitting mode, will cause over interrogation of the transponder and could make acquisition impossible.

a. Code select switch — Set

b. Indicator — Tuned

c. Mode selector — As required

8. Chaff control panel — Set

CAUTION

Do not release cannisters at an interval faster than one second.

a. MANUAL/RIPPLE switch — Set (As required)

b. Intervalometer — Set (As required)

CAUTION

Turn launch switch to the off position before depressing the HOME switch.

c. HOME switch — Depressed

d. Launch safety cover — UP

9. ECM equipment — "Checked, Set" (CP)

a. TRIM-7A — Set (As required)

b. ECM pods (when installed) — Set (As required)

c. Antenna control unit — Set (As required)

d. ALR-69 CP repeater — Checked, Set, Monitored.

e. ALE-40 programmer — Checked

Note

Set controls as required for the mission. Monitor the equipment as long as the airplane remains in the possible threat area.

10. Pre-strike checks — *"Complete" — E,N,FCO,TV,IO,CP

POST-STRIKE.

1. APQ-150 — OFF

a. Display intensity — CCW

b. Mode switch — OFF

2. ASD-5 — OFF

a. Mode selector — MNL TRACK

b. Threshold — CCW (100). (Stop CCW rotation at 100 to prevent damage to control.)

c. Mount power — OFF

d. Decoder — OFF

e. Antenna — Pinned

Note

The antenna should move to the airplane boresight position and remain there after the pedestal power light goes out.

f. Intensity — CCW

g. Scale — CCW

CAUTION

Damage to the system can occur if system power is turned off before mount power light goes out.

h. System power — OFF

3. Post-strike checks	*"Complete"	E,N,TV,IO,CP

BEFORE LANDING PATTERN.

1. TRIM-7As — OFF

a. Intensity — CCW

b. Control switch — OFF

2. Antenna switching unit	OFF	
3. ECM pods	OFF	
4. Chaff control panel	Set	

a. Launch switch — OFF (Safety cover down)

b. Program — 999

c. Manual/Ripple switch — MANUAL

5. ALE-40 programmer — Set

a. Burst count — 1

b. Salvo count — 1

6. Altimeter	*"Set"	P,CP,N,TV
7. Before landing pattern checks	*"Complete"	E,N,TV,IO,CP

BEFORE LANDING.

1. Interphone panel	Set	
a. HOT MIC LISTEN — ON		
b. Master wafer switch — INPH		
2. ALR-69	Set, OFF	
a. Intensity and audio controls — CCW		
b. Power switch — Off		
3. Safety belt and shoulder harness (seat facing forward and locked into position.)	Fastened, Locked	
4. Before landing checks	*"Complete"	E,N,TV,10,CP

AFTER LANDING.

1. Unnecessary equipment and switches	OFF/As required

ENGINE SHUTDOWN.

1. Oxygen regulator	OFF, 100%	
2. Air-conditioning control panel	Set	
a. Cargo compartment temperature control — OFF		
3. Panel and work lights	OFF	
4. Forms	Completed (as required)	
a. Forms 781		
b. RWR reports		
c. Logs		
5. Engine shutdown checks	*"Complete"	E,N,TV,IO,CP

SECTION IX

all-weather operations

TABLE OF CONTENTS

INTRODUCTION.

This section contains only those procedures that differ from or are in addition to the normal operating instructions covered in Section II, except for some repetition necessary for emphasis, clarity, or continuity of thought. References in this section to operation of the airplane component systems or auxiliary equipment mean the operation described in Sections VII and IV, respectively.

INSTRUMENT FLIGHT PROCEDURES.

The airplane is completely equipped for the use of all standard radio navigational and flight aids. It is the responsibility of the pilot to ensure that each crewmember is thoroughly briefed on the exact procedures he is expected to follow during all phases of airplane operation. In planning IFR flights, remember that the airplane has turboprop engines. Fuel requirements at low altitudes are greater than fuel requirements at higher altitudes. Therefore, if required to land under IFR conditions, additional allowance must be made for letdown and holding procedures, and the maximum range and endurance are reduced accordingly.

PRE-FLIGHT AND GROUND CHECKS.

Perform the normal preflight inspections, as outlined in the normal operating procedures in Section II.

INSTRUMENT TAKE -OFF.

1. Tune, identify, and monitor navigational aids to be used during depature. Set course arrows to departure course.

2. Align the horizon bar of the pilot's and copilot's attitude director indicators by aligning the horizon bar with the wings on the miniature airplane.

3. Place the mode selector switch to the primary navigation aid to be used for depature (TAC or VOR/ILS 1), and place the flight director switch to MANUAL.

4. Align the airplane on the take-off runway. Set the heading marker to center the bank steering bar. Set the departure course in the course window on the horizontal situation indicator.

Note

Any erratic movement or oscillation of the bank steering bar on the attitude director indicator indicates a malfunction, and the system should not be relief upon.

5. Apply take-off power consistent with briefed take-off conditions, release brakes, and use nose wheel steering (until rudder control becomes available) as the primary directional control during take-off roll.

6. At minimum control speed or take-off speed, whichever is greater (see T.O. 1C-130(A)H-1-2), raise the nose wheel off the ground, smoothly establish a 7-degree nose-up attitude change on the attitude director indicator, and allow the airplane to fly off the ground.

7. When the airplane is in a definite climb as indicated by the altimeter and vertical velocity indicator, retract the gear.

8. Make an initial climb of at least 300 feet per minute, and retract the flaps when the airplane accelerates to a minimum of 20 knots above take-off speed. Allow the airplane to accelerate to the desired climb speed.

9. Minor trim changes may be required at flap retraction.

10. Establish climb power, and turn on anti-icing as required. Be alert for the loss of engine power that occurs when wing and empennage anti-icing is used.

INSTRUMENT CLIMB.

1. Complete the After Take-Off checklist.

2. Limit the angle of bank to that required for standard rate (3 degrees per second) turns, or 30 degrees, whichever is less.

CRUISE.

Conduct instrument cruise flight according to the normal operating procedures outlined in Section II, except that existing published instructions for utilization of radio aids and instructions from air traffic control must be followed.

HOLDING.

Conduct holding operations at 170 KIAS. If maximum endurance is required, conduct holding operations at maximum endurance airspeed plus 20 KIAS according to instructions from the air traffic controller. This airspeed permits holding to be accomplished at a constant power setting and allows turns to be executed with little, if any, loss of airspeed. Any loss of airspeed may be regained when level flight attitude is resumed.

PENETRATIONS.

Penetrations may be accomplished in this airplane, making certain that the current airspeed limitations in Section V are adhered to. Handling characteristics are very good and pitch attitude is not extreme. A typical penetration is shown in figure 9-1.

The recommended procedure is as follows:

1. Before reaching the initial approach fix, begin the Before Landing Pattern checklist. Checklist will be completed when cleared through the transition level.

2. Begin the penetration at or below penetration airspeed from the initial approach fix, in the clean configuration, by retarding throttles to FLIGHT IDLE and smoothly establish descent at least 4,000 fpm until reaching the penetration airspeed.

3. Follow the published penetration procedure.

4. Start level-off 1,000 feet above the published minimum inbound altitude. Establish an airspeed of 170 KIAS at the published minimum inbound altitude.

5. Complete the Before Landing checklist prior to reaching the final approach fix. Allow the airspeed to decrease to approach speed and execute an approach as depicted in figures 9-2 through 9-9.

INSTRUMENT APPROACHES.

All conventional systems of instrument approach may be used. Flight characteristics during instrument approaches do not differ from those encountered during normal visual flight. Normally, 170 KIAS is used for entry. Airspeed after the Before Landing checklist is initiated will be 150 KIAS or approach speed, whichever is higher (commensurate with gross weight and/or flap setting), when established on final, slow to approach speed.

Automatic ILS Approach.

In automatic approach the ILS receiving equipment is coupled to the autopilot to provide automatic response of the airplane to ILS signals. With the automatic approach controller in the RANGE-LOC position, the airplane may be flown to intercept the localizer beam, from either side of the runway, at an angle of 60 degrees or less from the runway heading. Altitude and distance from the runway should be such that the airplane is beneath the glideslope beam when the localizer beam is intercepted. The Before Landing checklist should be completed prior to intercepting the localizer beam. Refer to figures 9-4 and 9-5 for airplane configuration and airspeeds. When the edge of the localizer beam is reached, the controller may be switched to APPROACH. The airplane will establish a heading such that its ground track is coincident with the center of the localizer beam. The airplane will remain at a constant altitude until the glideslope is intercepted if altitude control is engaged.

Note

The airplane will normally overshoot the glideslope center less than one-half scale deflection and then automatically return to and bracket the glideslope center in approximately 30 seconds. The reason is that, before the autopilot receives a signal to return to glideslope center, it is necessary to develop an initial glideslope error of sufficient amplitude to produce the nose down attitude required to fly the glideslope.

The airplane is brought down the intersection of the glideslope and localizer beam on a correct path for a normal landing. The pilot must monitor the flight instruments, including the course deviation indicator and maintain the desired airspeed with power applications. The landing is executed in the normal manner after visual contact has been established and the autopilot disengaged. See Autopilot and Radio Beam Coupler Equipment in Section IV for descriptive information on the radio beam coupler switch, the radio beam coupler, and RANGE-LOC position of the automatic approach controller.

USE OF FLIGHT DIRECTOR SYSTEM DURING ILS OPERATION.

When using the flight director system during ILS operation, the recommended procedure is as follows:

1. Tune, identify, and monitor ILS station and place mode selector switch to ILS mode.
2. Position HSI course arrow to the published front course localizer heading.
3. Use HSI course deviation indicator to intercept localizer.
4. Prior to or upon intercepting final approach course inbound, position flight director switch to NORMAL.

WARNING

A glideslope warning flag failure indication will appear in the event of an unreliable or a complete loss of signal. However, certain mechanical failures/malfunctions in the glideslope receiver will give an erroneous on glideslope indication without a failure flag indication when in actuality a partial failure has occurred in the ILS glideslope receiver. A cross check of all other available approach aids, i.e., VASI, radar monitor, etc., should be utilized to insure safe aircraft operation.

5. Utilize ADI pitch and bank steering bars to fly ILS.

Note

The pitch and bank steering bars will give accurate command guidance to intercept and maintain the ILS localizer and glidepath. However, certain malfunctions may occur within the flight director system which will not result in visible warning to the pilot. It is essential that the pilot monitor the course deviation indicator and the glideslope indicator throughout the approach.

USE OF THE FLIGHT DIRECTOR SYSTEM DURING BACK COURSE ILS OPERATION.

1. Tune, identify, and monitor station and place mode selector switch to ILS mode.
2. Set the front course in the course selector window on the HSI.
3. Set the heading marker on the tail of the course arrow and place the flight director switch in the MANUAL position.
4. Use HSI course deviation indicator to fly the ILS.

Note

The attitude director indicator will display steering information on the bank steering bar for the selected heading as set by the heading set knob on the HSI. Disregard all indications of the pitch steering bar and the glideslope indicator, and monitor for the ILS warning flag.

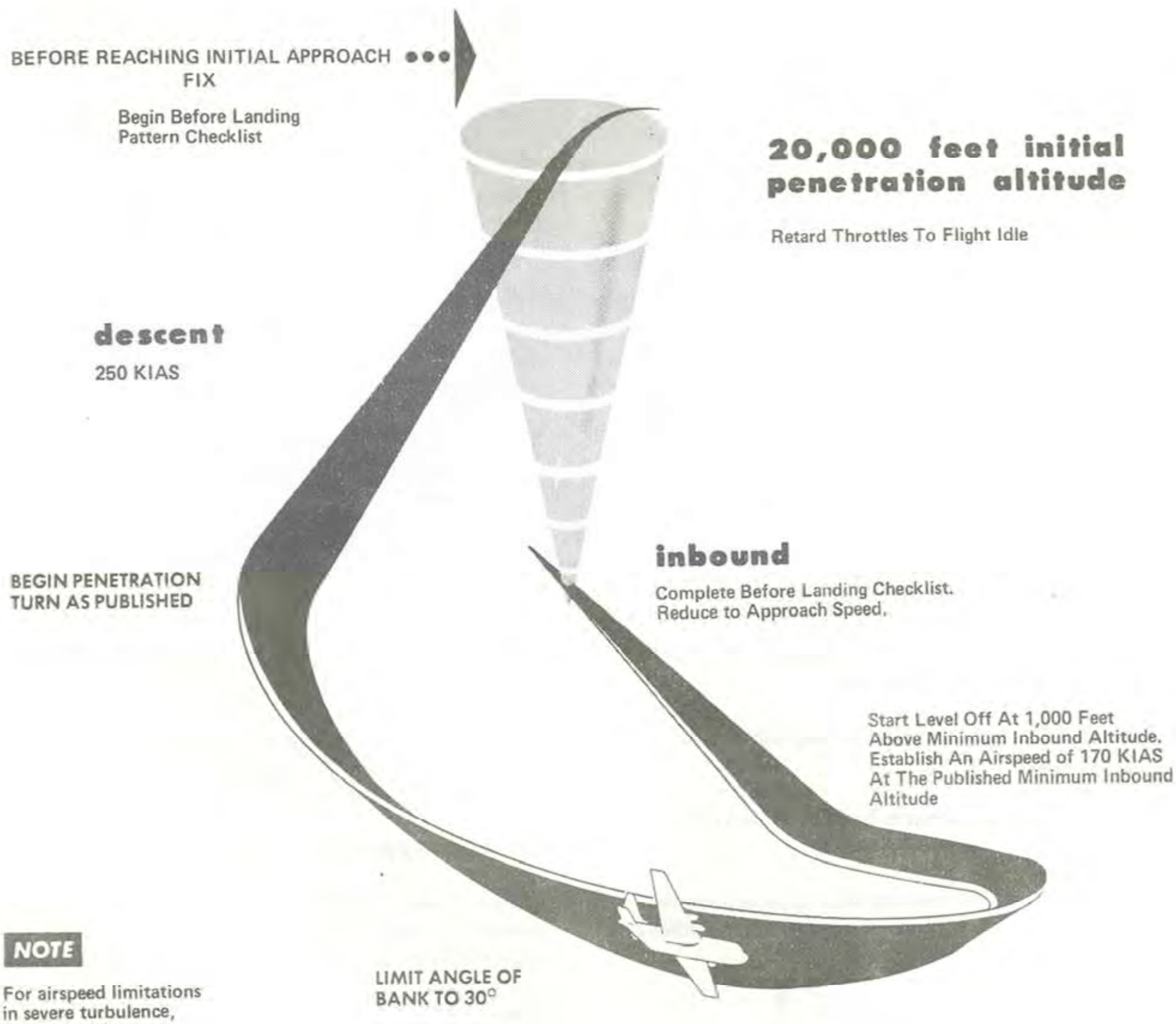
Circling Approach.

The pentration and approach procedures are based on straight in approach speeds. If a circling approach is required, maintain 150 KIAS or approach speed, whichever is higher; when established on final, slow to approach speed.

Missed Approaches.

In the event of a missed approach, immediately apply required power and establish a climb. When a definite climb is shown on the vertical velocity indicator and altimeter, complete the normal go-around procedure described in Section II. For three-engine operation, complete the go-around procedure described in Section III. Accelerate to climb speed and maintain until reaching desired missed-approach altitude. Execute the appropriate missed-approach procedure.

typical penetration



NOTE

For airspeed limitations in severe turbulence, refer to section v.

Figure 9-1.

typical instrument approach - four or three engines - adf, vor, or range procedures

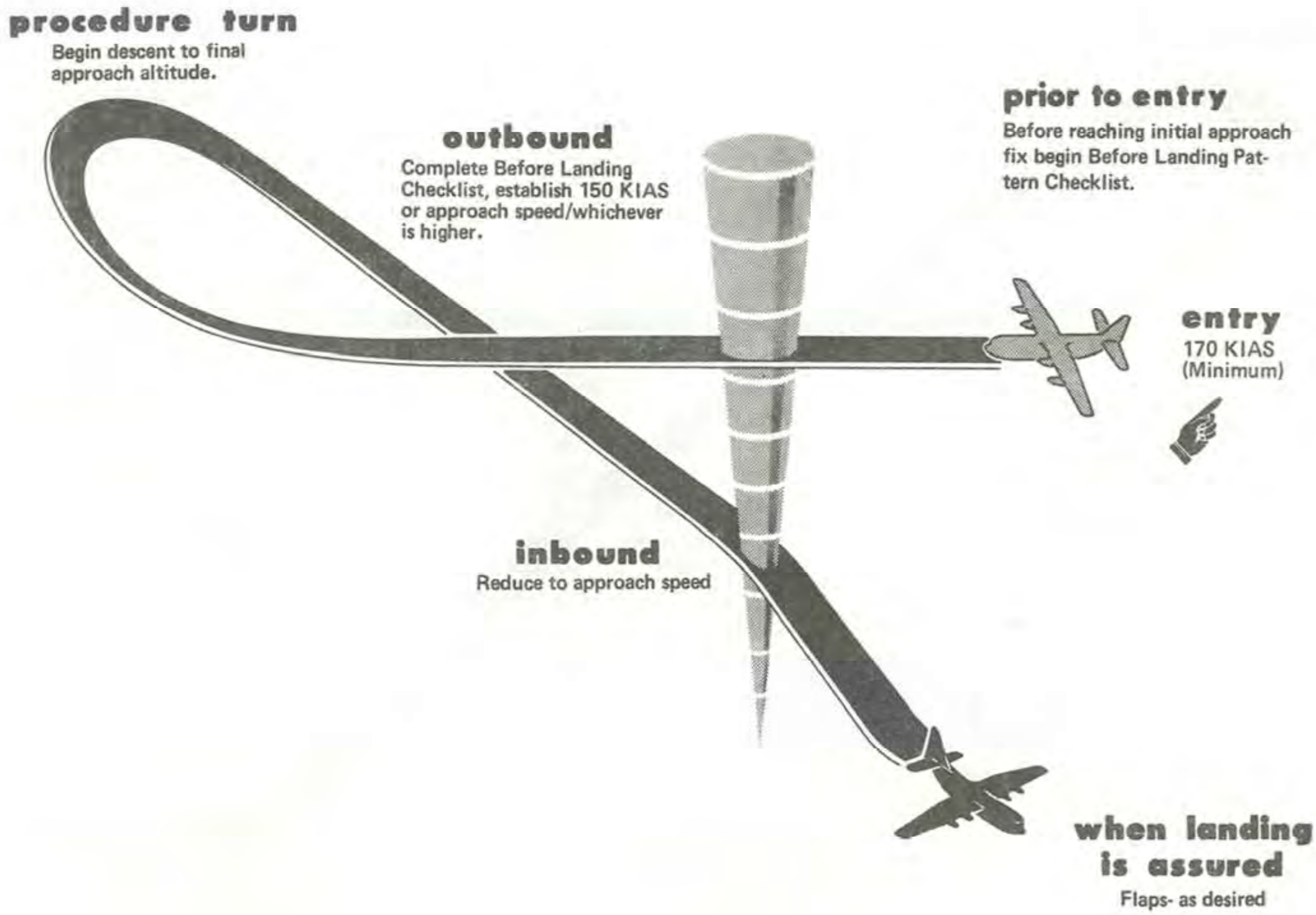


Figure 9-2.

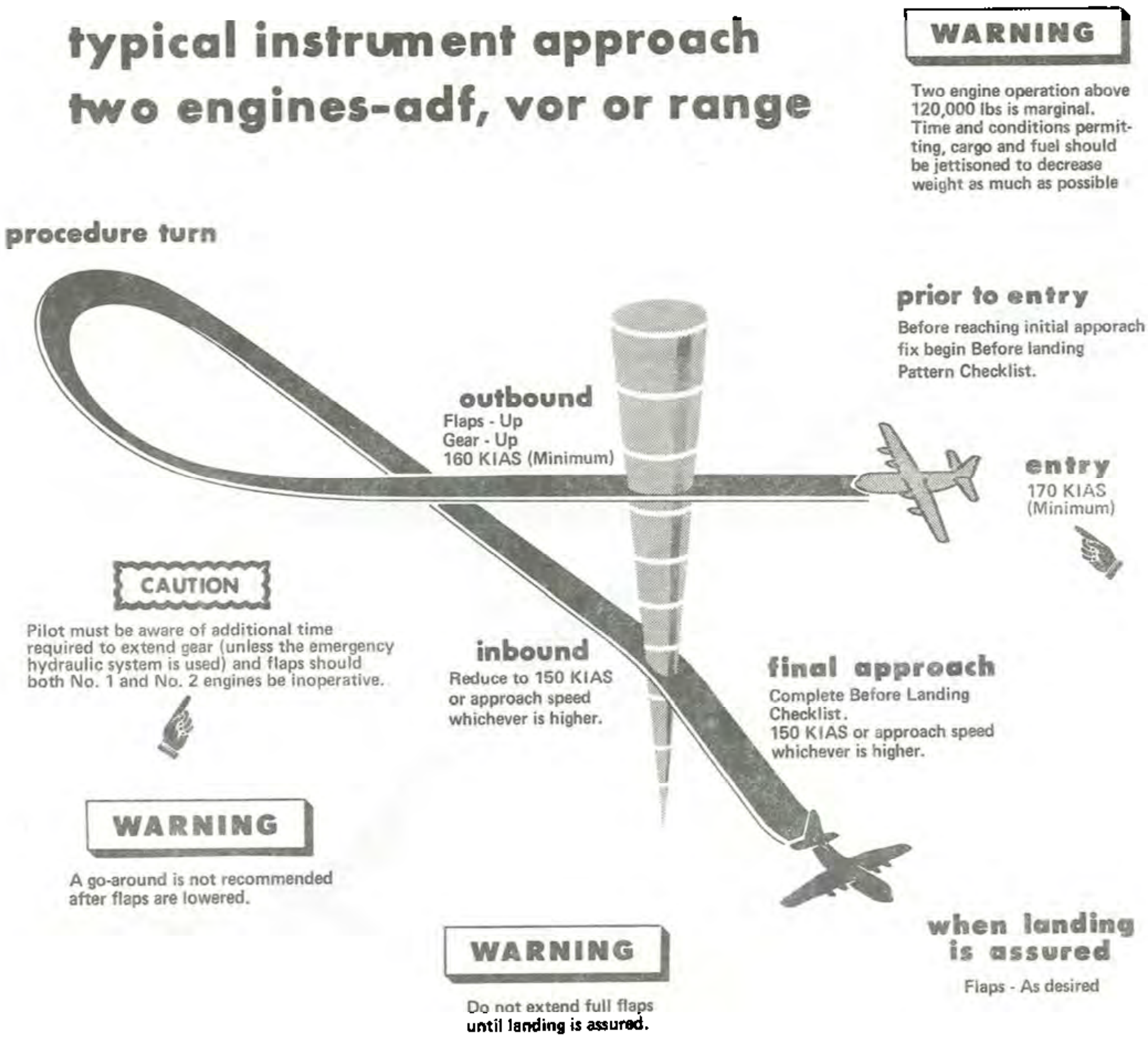

typical instrument approach
two engines-adf, vor or range
WARNING
Two engine operation above 120,000 lbs is marginal. Time and conditions permitting, cargo and fuel should be jettisoned to decrease weight as much as possible
procedure turn
prior to entry
Before reaching initial approach fix begin Before landing Pattern Checklist.
outbound
Flaps - Up
Gear - Up
160 KIAS (Minimum)
entry
170 KIAS (Minimum)
CAUTION
Pilot must be aware of additional time required to extend gear (unless the emergency hydraulic system is used) and flaps should both No. 1 and No. 2 engines be inoperative.
inbound
Reduce to 150 KIAS or approach speed whichever is higher.
final approach
Complete Before Landing Checklist.
150 KIAS or approach speed whichever is higher.
WARNING
A go-around is not recommended after flaps are lowered.
when landing is assured
Flaps - As desired
WARNING
Do not extend full flaps until landing is assured.

Figure 9-3.

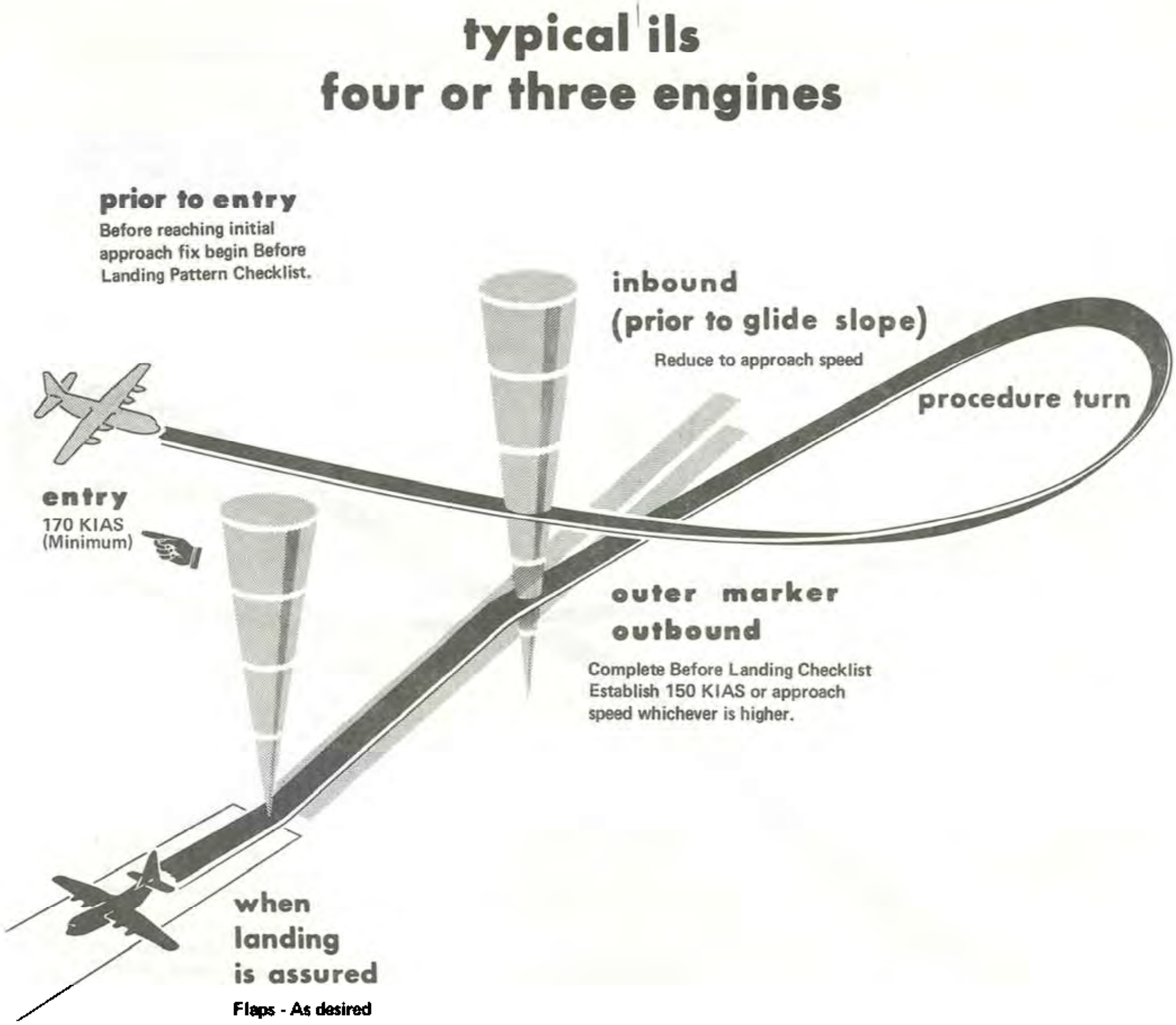

typical ils
four or three engines
prior to entry
Before reaching initial approach fix begin Before Landing Pattern Checklist.
inbound
(prior to glide slope)
Reduce to approach speed
procedure turn
entry
170 KIAS
(Minimum)
outer marker
outbound
Complete Before Landing Checklist
Establish 150 KIAS or approach speed whichever is higher.
when
landing
is assured
Flaps - As desired

Figure 9-4.

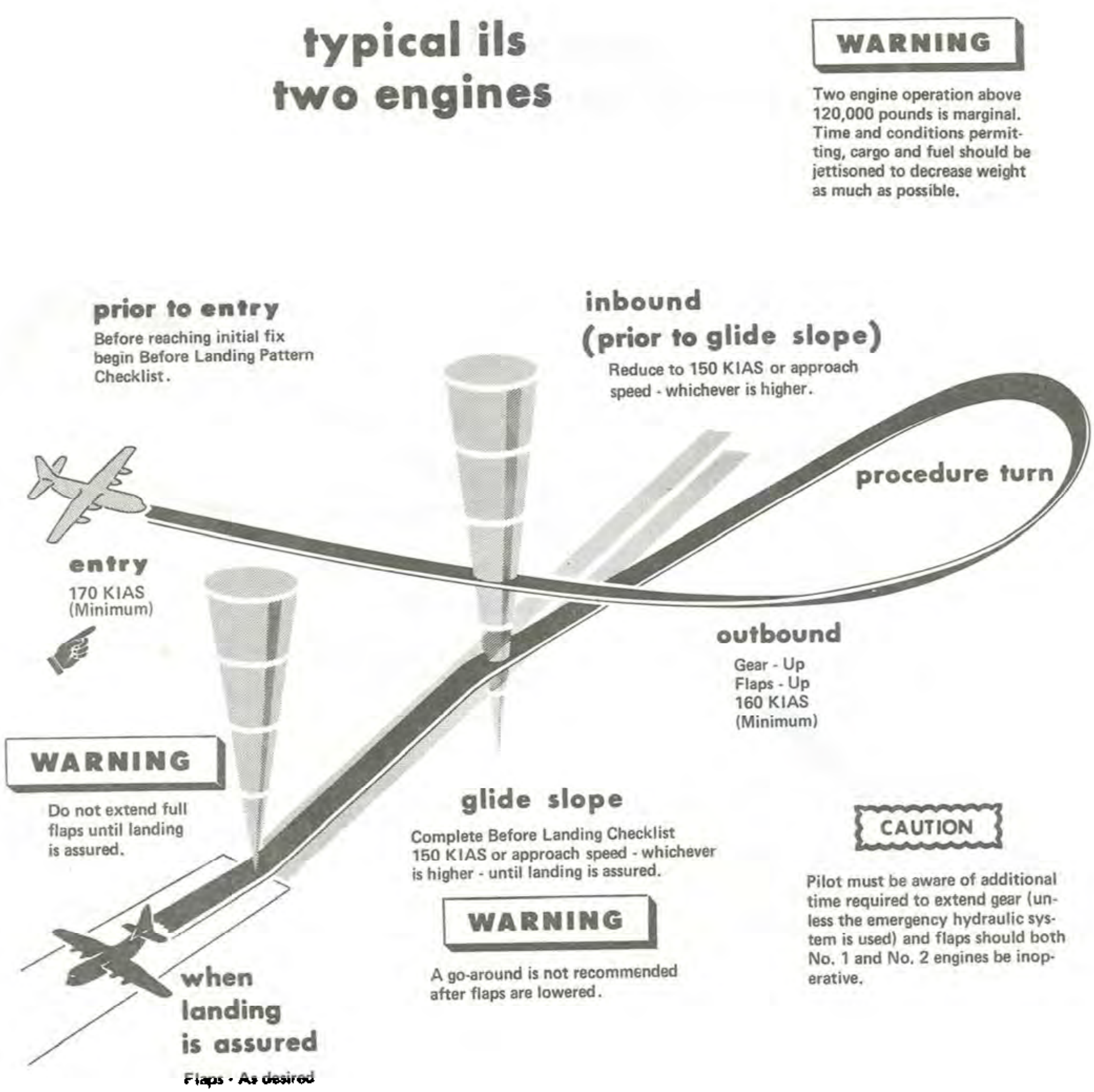

typical ils
two engines
WARNING
Two engine operation above 120,000 pounds is marginal. Time and conditions permitting, cargo and fuel should be jettisoned to decrease weight as much as possible.
prior to entry
Before reaching initial fix begin Before Landing Pattern Checklist.
inbound
(prior to glide slope)
Reduce to 150 KIAS or approach speed - whichever is higher.
procedure turn
entry
170 KIAS
(Minimum)
outbound
Gear - Up
Flaps - Up
160 KIAS
(Minimum)
WARNING
Do not extend full flaps until landing is assured.
glide slope
Complete Before Landing Checklist
150 KIAS or approach speed - whichever is higher - until landing is assured.
WARNING
A go-around is not recommended after flaps are lowered.
CAUTION
Pilot must be aware of additional time required to extend gear (unless the emergency hydraulic system is used) and flaps should both No. 1 and No. 2 engines be inoperative.
when
landing
is assured
Flaps - As desired

Figure 9-5.

typical radar approach pattern - four or three engines

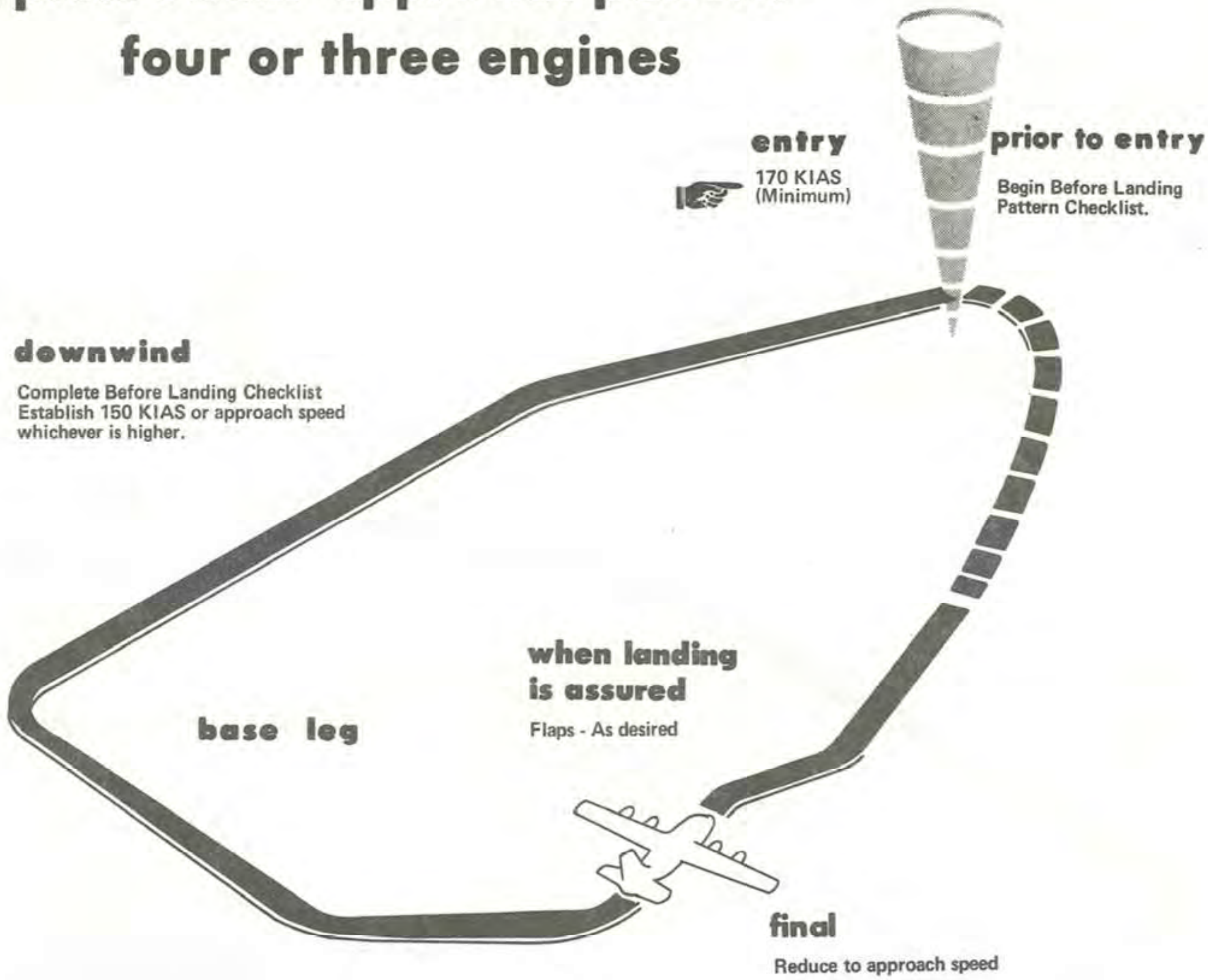


Figure 9-6.

typical radar approach pattern - two engines

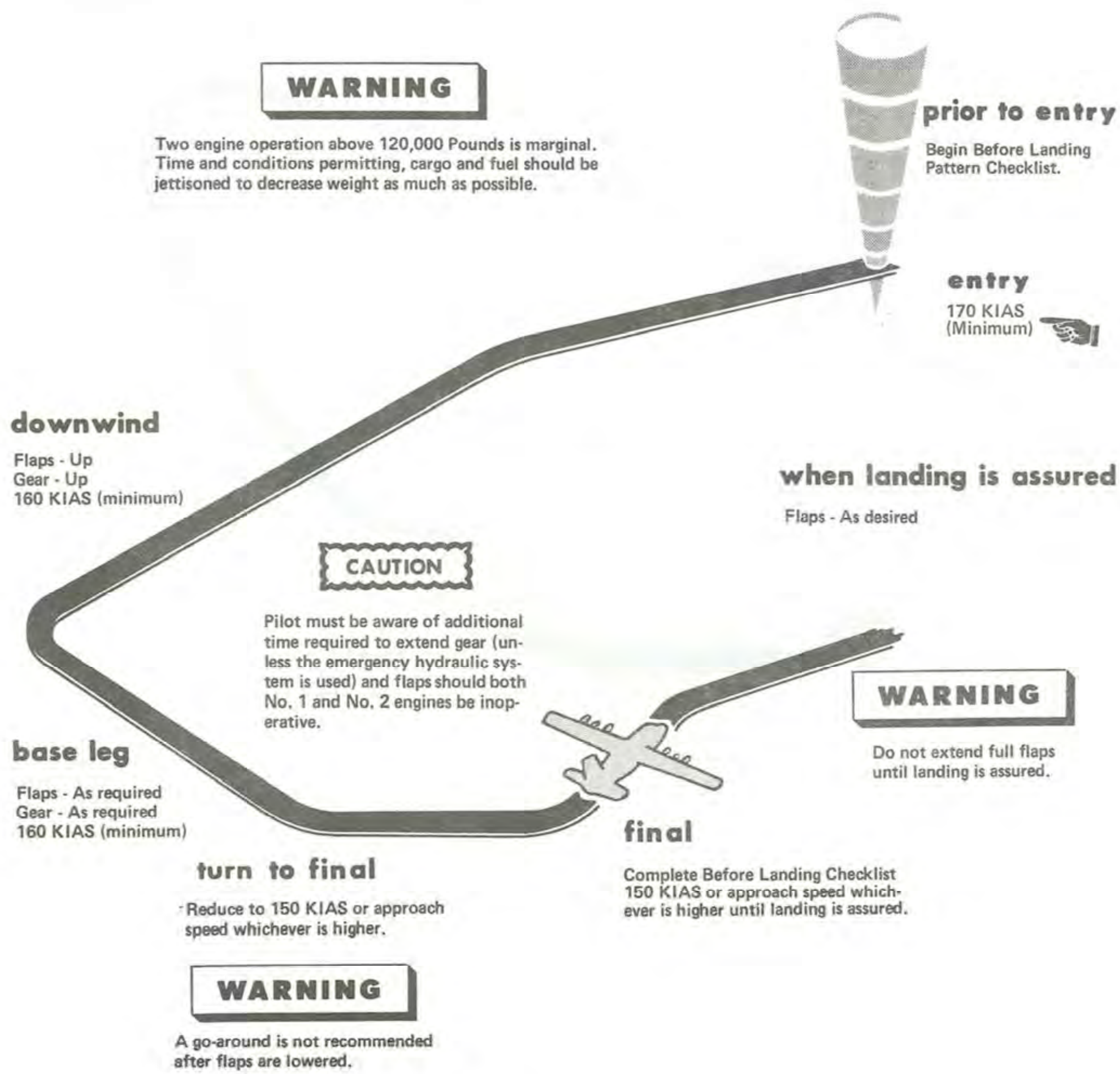


Figure 9-7.

typical tacan pattern - four or three engines

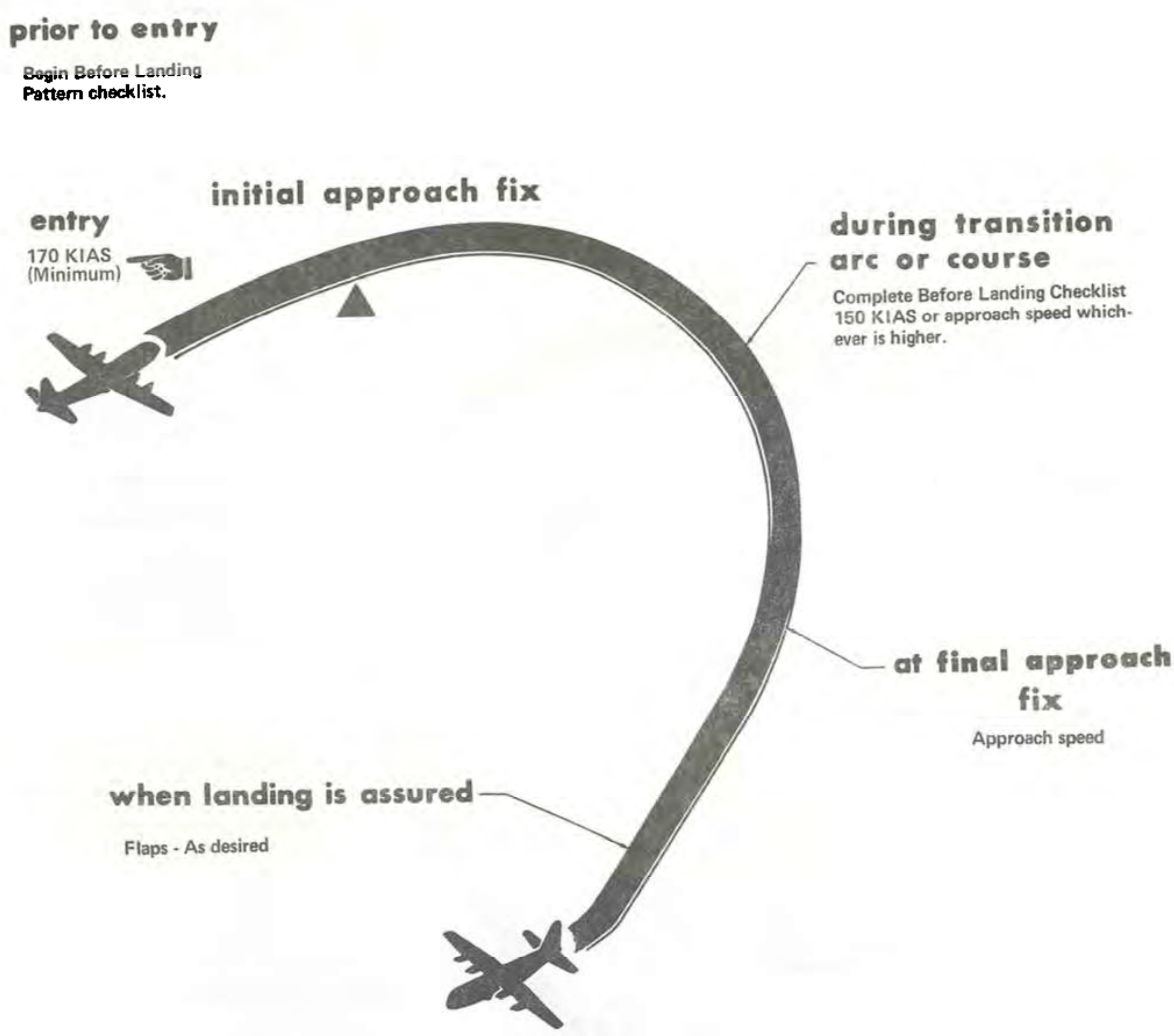


Figure 9-8.

typical tacan pattern - two engines

Figure 9-9.

ICING CONDITIONS.

Avoid icing conditions whenever possible. The biggest danger caused by ice accumulation is the reduced aerodynamic efficiency of the airplane. Specifically, ice accumulation may have the following effects:

Higher take-off, landing, and stall speeds.

Reduces rate-of-climb.

Increases power requirement, thus increasing fuel consumption and decreasing range and endurance.

Impairs control response.

Reduces engine power by obstructing the engine inlet air duct.

If cruise must be made in icing conditions, consideration must be given to the effect of using bleed air from the engines for the anti-icing system. Use of bleed air for anti-icing will reduce speed, and thus range, for any power setting. Additional power or a descent to a lower altitude may be necessary to maintain cruise speed. Refer to T.O. 1C-130(A)H-1-2 for cruise performance with anti-icing systems in operation.

When possible, change altitude to prevent icing. If climbing to a non-icing altitude is not possible, a check of fuel flow versus ground speed should be made to determine if range, or radius of action, will permit completing the mission. The airplane can penetrate icingconditions if the procedure given below is followed.

1. Consider outside air temperature, nature of clouds, type of icing (rime, clear) anticipated or being encountered, and duration of icing, and select the least severe icing altitude consistent with the mission.

WARNING

Operation in the freezing range in visible moisture may cause icing that will prevent air start of shutdown engines.

2. Place the radome anti-icing switch in the AUTO position.

Note

When the warning icing condition ON light illuminates, the propeller and engine anti-icing systems will automatically be turned on by the detection system. If wing and empennage anti-icing is required, the switches must be manually placed in the ON position.

3. When icing conditions no longer exist, turn the propeller and engine anti-icing master switch to the RESET position. When turned to the RESET position, all anti-icing systems, except the wing and empennage are automatically turned off. The wing and empennage anti-icing switches must be manually turned to the OFF position.

4. Delay extension of flaps and landing gear until absolutely necessary. This will help to avoid excessive ice accumulation on the flaps and landing gear. While flying through icing conditions, monitor the leading edge temperature indicators and the de-icing and anti-icing current indicators to make certain that anti-icing equipment is working properly. Make frequent visual checks of wing leading edges, engine inlet air duct leading edges, and propeller spinners. If leading edge anti-icing is seen to be inadequate for preventing ice accumulation, seek a non-icing or less severe icing level.

CAUTION

If possible avoid prolonged flight in freezing rain, particularly at low airspeeds with corresponding higher angles of attack, as there is a possibility of ice accretion on the upper inside surface of the engine inlet air ducts and other areas that are not normally exposed and that are not anti-iced.

CLEAR AIR ICING.

Engine inlet air duct icing in clear air is possible in some combinations of temperature and humidity, depending on the engine power setting and the airspeed. This icing is caused by the sudden drop in temperature resulting from pressure loss in the engine inlet air duct. Such icing is indicated by a falling torquemeter indication. If torquemeter indication falls for no apparent reason, assume that engine inlet air duct icing is occurring. Turn the propeller and engine anti-icing master switch to the MANUAL position, and place the engine inlet air duct anti-icing switch in the ON position and take the following action immediately.

1. Increase airspeed to the maximum consistent with continuous operation, to increase ram pressure in the air duct.

2. Seek an altitude that is less likely to produce air duct icing.

TURBULENCE AND THUNDERSTORMS.

Rain has no appreciable aerodynamic effects on the airplane. At cruise speeds, however, visibility through the windshields will be reduced by streaking as the windshield wipers are ineffective at speeds above approximately 180 KIAS.

Flying under conditions of extreme turbulence, such as though thunderstorms, must be avoided whenever possible. When flying under conditions of low visibility, clear passage around or between thunderstorms can usually be found with the navigation and search radar. The possibility remains, however, that a storm cannot be dodged, or that flight through a storm may be a matter of military necessity.

Recommended airspeed for penetration into thunderstorms is 65 knots above power off stall speed not to exceed 180 KIAS.

The autopilot may be used, and in some cases is desirable. The altitude hold mode should be disengaged and the autopilot should not be either assisted or overpowered in the autopilot mode. If autopilot cannot control attitude, disengage and fly manually.

NIGHT FLYING.

To avoid spatial disorientation, it is recommended that the anti-collision light be turned off during flight in clouds.

COLD WEATHER PROCEDURES.

Extreme cold causes general bad effects on airplane materials. Rubber, plastic, and fabric materials stiffen and may crack, craze, or even shatter when loads are applied. Oils and lubricants congeal. Adjoining metals contract differentially, and could result in adverse variations in tolerances. Moisture, usually from condensation or melted ice, freezes in critical areas. Tire, landing gear strut, fire extinguisher bottle, and accumulator air pressures decrease with a temperature decrease. Extreme diligence on the part of both ground and flight crews is required to ensure successful cold-weather operation. The procedures and precatuions outlined here pertain to operating unhangared airplanes in cold weather and are in addition to be normal procedures given in Section II.

Note

- Cold weather procedures are generally considered to be applicable when the temperature is 0°C (32°F) and below.
- A preheating period will be arranged by the ground crew using portable ground heaters or the gas turbine compressor so that airplane components will be warmed and inspected prior to starting the engines.

BEFORE ENTERING THE AIRPLANE.

Perform a normal preflight inspection of the airplane as outlined in Section II. In particular, check the following:

1. Check for removal of all exterior protective covers not required for heating airplane.

CAUTION

- Ensure that moisture from melted ice is not allowed to remain in critical areas where it may refreeze.
- Do not attempt to scrape or chip ice from flight surfaces or fuselage. Take care to prevent personnel injury from slipping and falling.

WARNING

Do not attempt take off with ice, snow or frost on the wings, empennage, or fuselage. The roughness caused by ice and snow on the surfaces varies the airfoil shape with a resulting loss of efficiency. Take-off run is increased and rate of climb is decreased. Stall speed is increased, and stall characteristics are unpredictable.

Note

If anti-icing compound has not been used on the crew door telescoping rod, frozen condensation may prevent full opening until the rod is heated.

2. Check that fuel tank vents, fuel drains, filters, static ports, and pitot tubes are free of ice and snow.
3. Check for proper inflation of landing gear struts, tires, and hydraulic accumualtors.
4. Check that landing gear strut extensions have been wiped with a hydraulic-fluid soaked cloth to remove ice and dirt.
5. Check that a warm-well-charged battery has been installed.
6. Check that dry bays are free of hydraulic fluid and fuel seepage.
7. Insure that all items to be operationally checked during the preflight, power on, are preheated to prevent damage of components.

BEFORE STARTING ENGINES.

In addition to the normal procedures outlined in Section II, perform the following checks:

1. If isopropyl alcohol has been used to remove frost from the airplane, check the interior of the airplane for

alcohol leaks and fumes. This condition may create a fire hazard.

2. If external ac power is available, energize the Nesa windshields. Bring temperature up gradually to prevent cracking glass. As ice and frost begin to melt, operate the windshield wipers to help clear the windshield. Other windows may be cleared by portable ground heaters.

Note

Either portable ground heaters or the gas turbine compressor may be used to heat the interior of the airplane during the interior inspection. In extreme cold weather it may be necessary to preheat the gas turbine compressor before it can be started. During starting, torching may be observed. After start, allow approximately 4 minutes warm up before applying load.

3. After the GTC is warmed up and the ATM and generator are on and checked, operate the emergency brake system with light pedal pressure several times prior to setting the parking brake. Have an inspection made of each main wheel for evidence of hydraulic leakage after full pressure has been applied to the brake pedals. Seeps and moderate leaks caused by hardened O-rings can often be stopped by direct application of hot air from a ground heater for a few minutes.

CAUTION

Do not attempt to taxi if evidence of hydraulic leakage is found in any main landing gear area. Danger of fire and loss of brakes exists when hydraulic fluid contacts hot brakes.

4. Propellers. Static Feather Checked.

CAUTION

Do not statically change the blade angle of a propeller which has been exposed to prolonged temperatures of 0°C (32°F) or below, warm the propeller hub oil by using warm air or by running the engine at ground idle until engine oil temperature is within 60° to 80°C. Propeller blade seal damage and oil leakage may occur if this is not observed.

Note

- When adequate pre-heating equipment is not available and engine run is not practical, a static feather check will be performed prior to the Before Leaving Aircraft checklist and a propeller feather pump motor check accomplished during ground test this section.
- This static feathering check is a safety of flight requirement and its continuity is required during prolonged cold weather operations. An AFTO Form 781 notation is required when these procedures are implemented.

5. When nacelle preheat is necessary, use if for approximately 5 minutes and turn it off before starting engines.

Note

The nacelle preheat valves must be installed before the preheat system can be operated.

CAUTION

Nacelle preheat should be used only when the ambient temperature is below 0°F and only when necessary to remove frost or ice from equipment in the nacelle to facilitate engine starting. The bleed air for nacelle preheating is at approximately 600°F when supplied by engine or 350°F when supplied by GTC. Air at this temperature can quickly bake electrical cables and damage electronic components in the nacelle. Closely monitor the nacelle overheat warning light. If it illuminates, place the nacelle preheat switch to the OFF position.

6. Before starting engines, remove all ground heater ducts from the airplane.

7. In extremely cold temperatures, the crew door seals may stiffen, thus making it impossible to close the door from inside the airplane. When ground crewmen are not available to assist in closing this door, it may be necessary to have one or more flight crewmembers assist in closing the door from outside, and then enter the airplane through one of the paratroop doors.

STARTING ENGININES.

Start the engines by following the procedures in Section II.

CAUTION

When attempting a start with JP-5 and kerosene type fuels at ambient temperatures below approximately −37°C (−35°F), the TIT and rpm should be closely montiored since stall and over-temperature may be experienced during the start.

BEFORE TAXI.

If not already accomplished with external power, energize the Nesa windshields, bringing temperature up gradually to prevent cracking the glass. As ice and frost begin to melt, operate the windshield wipers to help clear the windshield. Other windows may be cleared by air blast from the defogging ducts.

CAUTION

Do not overheat anti-icing systems on the ground. Do not operate propeller anti-icing and de-icing systems unless engines are running.

TAXIING INSTRUCTIONS.

At the start of taxiing on snow or ice, visually check the landing gear to ensure that the wheels are rotating. The combination of increased engine power at low temperatures and slippery ramp surfaces due to ice and snow require that utmost caution be used during taxiing operations. Ground handling characteristics of the airplane on loose or compacted snow at temperatures below 0°F are good and braking action is fair to good. However, as temperatures rise toward freezing snow-covered surfaces become more slippery and increasing caution must be exercised. Use of anti-skid is recommended during all taxiing in cold weather.

CAUTION

Nose wheel steering becomes ineffective when abrupt turns are attempted on slippery surfaces. Use nose wheel steering, differential braking, and differential power for best directional control. Maintain safe taxi speeds by use of brakes and partial application of reverse thrust. Excessive reverse thrust will cause loss of visibility when taxiing over loose snow.

WARNING

In cold weather, make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing.

When operating on snow or slushy surfaces, use Nesa and pitot heat prior to and during propeller reversing.

GROUND TESTS.

Select the area that has the best available surface for braking and conduct the engine and propeller checks outlined in Section II. Avoid parking airplanes close together or near obstructions when performing ground tests.

Note

- Surfaces covered with loose snow generally provide better braking than surfaces covered with compacted snow.
- The propeller auxiliary feather pump motor will be checked when engine operating temperatures are normal. The engine condition levers will be moved individually to the air start position momentarily. A load indication will be indicated on the appropriate loadmeter.

CAUTION

If auxiliary feathering motor operation is not indicated for a propeller, the malfunction will be corrected prior to flight.

A modification of normal procedures may be required when making run-up on slippery surfaces. Engines and propellers may be checked in symmetrical pairs while using reverse thrust on the other pair to prevent the airplane from sliding forward. When runup must be conducted on snow-covered surfaces, do not attempt to make full power checks until the airplane is lines up on the runway and ready for take-off.

TAKE-OFF.

If the airplane starts to slide before take-off power is reached, release the brakes and begin the take-off run. Continue the power check during the early part of the run.

CAUTION

Under low ambient temperature conditions, never place throttles in TAKE-OFF position without monitoring the torquemeters. At these temperatures, it is possible to exceed maximum allowable torque without exceeding the maximum allowable turbine inlet temperature. In addition, increasing ram effect during the take-off will increase torque for any fixed turbine inlet temperature. This means either that torque must be set below the maximum allowable when setting power for take-off or that power must be reduced as airspeed builds up.

After take-off from slushy runways, leave the landing gear down for 30 seconds if practical to enable the wind to remove some of the slush prior to initial retraction; then cycle the landing gear to reduce the possibility of doors freezing in the closed position.

Note

During operation of the propeller anti-icing system there is a possibility that an indicator jitter may occur in the turbine inlet temperature indicators, the torquemeters, tachometers, and fuel flow gages. This needle jitter may make monitoring the affected instruments difficult. If this condition occurs, momentarily turn the propeller and engine anti-icing master switch to RESET: then read the indicators.

LANDING.

Make a normal pattern and landing as outlined in Section II. Use nose wheel steering gently. Use reverse thrust during the early part of the landing roll. As forward speed decreases, decrease reverse power. If reverse thrust is used at slow speeds on snow or slush-covered surfaces, complete loss of visibility may occur. Use Nesa and pitot heat during landing and be prepared to turn on windshield wipers.

Note

During use of maximum braking on slippery surfaces, cycling of the anti-skid system will be felt on the brake pedals.

LANDING ON ICY RUNWAYS.

Refer to Landing on Slippery Runways as outlined in Section II.

AFTER LANDING.

Note

Allow approximately 4 minutes warm up for GTC before applying load.

STOPPING ENGINES.

Make a normal engine shutdown, as outlined in Section II.

Note

Under sustained daily operations where no adequate preheating equipment is available, the flight crew will perform the static feathering check items listed in Section II while the engines are warm. Upon completion, a 781 notation is required. Maintenance action on propeller systems will require reaccomplishment of the static feather check during this interim operation.

BEFORE LEAVING THE AIRPLANE.

Perform normal Before Leaving the Airplane checklist as outlined in Section II and:

1. Remove ice and dirt from shock struts.
2. Install all exterior protective covers and shields.
3. If the airplane is to remain outside more than 4 hours at temperatures below −29°C (−20°F), remove the battery and store it in a heated area.
4. Close all doors and hatches.

HOT WEATHER PROCEDURES.

Hot weather operation means operation in temperatures above 35°C with or without high humidity. Possible results include malfunctioning of electrical equipment, fogging of instruments, rusting of steel parts, and the growth of fungi in vital areas of the airplane. Further results may be pollution of lubricants and hydraulic fluids, and deterioration of non-metallic materials. The procedures essential to operation and maintenance under such conditions are given in the following paragraphs. They are in addition to normal procedures in Section II.

PRE-FLIGHT CHECK.

Give special attention to the following:

1. Cool the flight station and cargo compartments with portable coolers, if available. If instruments, equipment, and controls are moisture-coated, wipe them dry with a clean, soft cloth.
2. Inspect for freedom of corrosion or fungus at joints, hinge points, and similar locations.
3. Check for hydraulic leaks, as heat and moisture may cause seals and packings to swell.
4. Inspect the shock struts for cleanliness.
5. Inspect tires for proper inflation.
6. Remove all protective covers and shields.

STARTING ENGINES.

1. When practical, position the airplane heading into the wind.
2. Alternate between the four engines for the first engine to be started. On airplanes equipped with a GTC, do not operate the ATM while starting an engine with the GTC.

3. During sustained hot weather operation, record in AFTO Form 781 when an engine does not light-off between 16 and 25 percent rpm, especially during GTC starts.

Note

Attaining light-off between 16 and 25 percent rpm provides better turbine assist for acceleration to on-speed rpm at the earliest possible time in the start cycle.

4. Before turning bleed air on for air-conditioning, turn the air-conditioning master switch to NO PRESS and manually position the temperature control switches to WARM; then operate the system 20 to 30 seconds before selecting AUTO and/or COOL.

CAUTION

If a popping noise (compressor stall) is experienced when changing from normal ground idle to low speed ground idle or from low speed ground idle to normal ground idle, return the airplane for maintenance action.

TAXI.

1. Use brakes as little as possible to avoid overheating.
2. Taxi with all engines in low speed ground idle, except when fire control/IMU is powered.

BEFORE TAKE-OFF.

Turn engine bleed air off to increase power available during take-off and climb-out flight path.

TAKE-OFF.

Take-off run is considerably increased and rate of climb decreased in high temperatures.

CRUISE.

Fuel densities will decrease as the ambient temperature rises resulting in a decrease in operating range. In addition, the boil-off rate will increase and it may be necessary to restrict rate of climb of the airplane at altitude. Refer to Fuel in Section V.

DESCENT.

1. During descent, adjust the throttles to prevent NTS action.
2. During descent (for landing) below 15,000 feet, manually open the oil cooler flaps and place the switches to the FIXED position. Monitor oil temperature and manually control the oil cooler flaps to keep the oil temperature close to 60 C.

LANDING.

CAUTION

Rapid movement of throttles in the reverse range can cause engines to bog down.

AFTER LANDING.

When practical, park the airplane heading into the wind..

STOPPING ENGINES.

As soon as the airplane is parked, chock wheels and release brakes in order to avoid possible damage to brake components from excessive heat generated while taxiing.

BEFORE LEAVING THE AIRPLANE.

1. Have appropriate protective covers installed for protection from the sun.
2. When weather conditions permit, leave flight station windows and cargo compartment doors open to ventilate the airplanes.

DESERT PROCEDURES.

Desert operation generally means operation is a very hot, dry, dusty, often windy atmosphere. Under such conditions, sand and dust will often be found in vital areas of the airplane, such as hinge points, bearings, landing gear shock struts, and engine cowling and intakes. Severe damage to the affected parts may be caused by the dust and sand. Position the airplane so that propwash will not expose other airplanes, personnel, and ground equipment to blown sand or dust. The necessary operations under such conditions are given in the following paragraphs.

BEFORE ENTERING THE AIRPLANE.

Perform a normal preflight inspection as outlined in Section II. Give special attention to the following:

1. Cool the flight station and cargo compartments with portable coolers, if available.

Note

Use of the GTC for ground air conditioning may pull in quantities of sand and dust.

2. Inspect all control surface hinge and actuating linkage for freedom of sand and dust.
3. Inspect tires for proper inflation.
4. Inspect shock structs for cleanliness.
5. Remove all protective covers and shields.
6. Wipe out the inlet ducts to remove any accumulated sand or dust.

BEFORE STARTING ENGINES.

Continue the normal preflight inspection of the airplane, as outlined in Section II. Tive special attention to the following:

1. Inspect instrument panels, switches, and controls for freedom of sand and dust.
2. Operate all controls through at least two full cycles to ensure unrestricted operation.

TAXIING INSTRUCTIONS.

Taxi the airplane as directed in Section II, using care to avoid blowing sand or dust on other airplanes, personnel, or equipment. Use brakes as little as possible, to prevent overheating. The use of reverse thrust may blow sand and dust into the air directly in front of the engine intakes. In deep sand, use differential power, rather than nose wheel steering, for directional control. Minimize ground operation to avoid excessive sand and dust intake by the engines.

1. Use minimum speed when making turns.
2. During taxi-out for take-off, do not lower flaps until lined up with the runway and ready for take-off.
3. When making propeller reverse check before flight, stop the airplane; advance the throttles to at least crossover to blow loose sand away; then make reverse checks. Perform the reverse checks over hard surface areas if possible, two engines at a time, while the other two engines remain at crossover.

REVERSE TAXIING.

1. If it is absolutely necessary to back the airplane using propeller reversing, first advance the throttles to at least crossover to blow loose sand away.
2. After the airplane is positioned, move the throttles to a position slightly above GROUND IDLE until the sand/dust cloud has been blown aft of the airplane.

TAKE-OFF.

Execute normal take-off and climb, as outlined in Section II. Avoid take-off during sand or dust storms, if possible. Sand and dust will cause damage to internal engine parts. Take-off run is considerably increased and rate of climb decreased in high atmospheric temperatures. Refer to the appropriate charts in T.O. 1C-130(A)H-1-2.

CRUISE.

Follow normal procedures for the operation of the airplane, as outlined in Section II. Avoid flying through dust or sand storms, when possible. Excessive dust and grit in the air will cause considerable damage to internal engine parts.

LANDING.

Execute a normal approach and landing, as outlined in Section II. Therefore, on very hot days, follow traffic and landing procedures strictly, and anticipate a longer landing roll. Avoid the use of reverse thrust, since reverse thrust may blow sand and dust into the air directly in front of the engine intakes.

1. Turn the air-conditioning system off prior to landing.
2. Compute landing performance data using maximum anti-skid braking and four engines in ground idle.
3. When propeller reversing is used during landing, start moving the throttles from MAXIMUM REVERSE to GROUND IDLE at approximately 60 KIAS and have the throttles at GROUND IDLE by the time 40 KIAS is reached.

STOPPING ENGINES.

Make normal engine shutdown as outlined in Section II. As soon as the airplane is parked, chock the wheels and release the brakes to avoid damage to brake components due to excessive heat generated while taxiing.

BEFORE LEAVING THE AIRPLANE.

Make a normal Before Leaving the Airplane inspection, as outlined in Section II, giving special attention to the following:

1. Have all protective covers and shields installed.
2. Except in dusty or rainy weather, leave flight station windows and cargo compartment doors open to ventilate the airplane.

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T

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-130(A)H-1.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

13 APRIL 1982

SHORT TITLE: LANDING GEAR SYSTEM

1. PURPOSE.

To advise aircrews of modification of the landing gear system.

2. INSTRUCTIONS.

a. Page 1-89, MAIN LANDING GEAR paragraph is amended to read as follows:

MAIN LANDING GEAR.

The main landing gear system (figure 1-51) consists of four strut-wheel assemblies paired in tandem configuration and connected by a drag strut. Normal landing gear actuation is supplied by utility system pressure with hydraulic flow directed through a landing gear selector valve to each of the two main landing gear reversible hydraulic motors. Each pair of struts is raised and lowered in vertical tracks by means of screwjacks, connected by torque shafts which are driven by their respective hydraulic motor through a gear box. Flow regulators in the up and down lines regulate hydraulic return flow, controlling the extension and

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retraction time of the main gear. Mechanically actuated controllable restrictor valves are located in the up lines reducing hydraulic flow to landing gear motors during the final inches of each forward strut travel, thus slowing the retracting speed of the strut assemblies prior to contracting the upper bumper stop on their respective screwjacks. As system pressure decreases, the main landing gear spring-loaded brake engages and holds the gear in the up position until released by hydraulic pressure or by mechanical means. On airplanes modified by TO 1C-130-1065, after contacting the up-limit switch, the landing gear selector valve will remain energized, allowing landing gear up hydraulic pressure to be continuously applied to the main landing gear motors. The main landing retraction brake will not be applied. In the event of loss of hydraulic pressure, the main landing gear spring-loaded retraction brakes are applied.

b. Page 1-90, figure 1-51 is amended as shown in figure 1 of this supplement.

c. Page 1-91, NOSE LANDING GEAR paragraph is amended to read as follows:

NOSE LANDING GEAR.

The nose landing gear is a swinging-type gear, extending down and aft, actuated by a hydraulic cylinder, and secured in the up and down positions by locks. The gear is normally supplied with hydraulic fluid under pressure by the utility supply system; however, during an emergency, it can be supplied by the auxiliary hydraulic system or manual hand pump (for extension only). Hydraulic fluid from either the up or down side of the landing gear control valve flows to the nose landing gear drag strut actuating cylinder and the uplock cylinder (figure 1-55). When the landing gear is extended, hydraulic fluid for nose landing gear steering is supplied from the landing gear control valve to the steering control valve. A two-way regulator in the line feeding the drag strut actuating cylinder ensures that the flow of hydraulic fluid to and from the cylinder is constant, regardless of the flow rate in the hydraulic system. This slows the movement of the landing gear, and prevents it from slamming into its extended or retracted position. A shuttle valve connects either utility system pressure or auxiliary system pressure to the nose landing gear drag strut actuating cylinder, permitting the auxiliary system pressure to be used to extend the nose landing gear in an emergency. The nose landing gear downlock is an integral part of the nose landing gear drag strut actuating cylinder. When this cylinder is driven by hydraulic pressure to extend the nose landing gear, the downlock is hydraulically actuated when the gear reaches the fully-extended position, locking the cylinder in position. The downlock is released by hydraulic pressure when the gear is retracted. When the nose landing gear is retracted, the uplock is actuated as it reaches the fully-retracted position, mechanically locking the gear in position. On airplanes modified by TO 1C-130-1065, the landing gear selector valve remains energized open in the up position, allowing landing gear up hydraulic pressure to be continuously applied to the nose landing gear actuating cylinder and uplock. In the event of loss of hydraulic pressure, the nose landing gear is held in place by the uplock. The nose gear can be visually checked through a nose landing gear inspection window on the aft bulkhead of the nose wheel well under the flight deck. A removable access panel, which also includes the inspection window, is provided for emergency nose landing gear extension. There are no provisions for emergency retraction of the nose landing gear.

d. Page 3-39, LANDING GEAR SYSTEM FAILURE paragraph is amended to read as follows:

LANDING GEAR SYSTEM FAILURE.

CAUTION

- Do not attempt a take-off with a known or suspected landing gear malfunction.
- If a malfunction is encountered in lowering the landing gear, once the landing gear is down and locked, it will not be moved from this position. If one or more landing gear will not retract, do not attempt to obtain an up and locked condition by recycling the gear. Extend the gear and attempt to obtain a down and locked condition. Visually confirm all the gear is down and locked and land as soon as practicable.

If any landing gear fails to extend after normal operation of the landing gear lever, attempt to identify the malfunction before making further attempts to lower the gear. Do not recycle the gear. Check circuit breakers, utility hydraulic pressure, and hydraulic fluid quantity. Check for evidence of hydraulic leak or mechanical failure.

If a hydraulic leak is the cause of the malfunction, or hydraulic pressure was lost after repositioning the landing gear lever, immediately place/check landing gear lever in the UP position and pull the landing gear control circuit breaker. In all other cases, if the gear fails to extend normally, continue with alternate extension methods.

Pressure-sealed doors in the wheel well bulkheads permit access to inspect the gearbox and hydraulic brake assemblies, and the vertical torque shafts. A window in the nose wheel well aft bulkhead permits visual inspection and access to the nose landing gear. The emergency extension handcranks fit the nuts on the pressure-sealed doors and nose landing gear inspection window. Always depressurize the airplane before removing the pressure-sealed doors or window.

main landing gear system

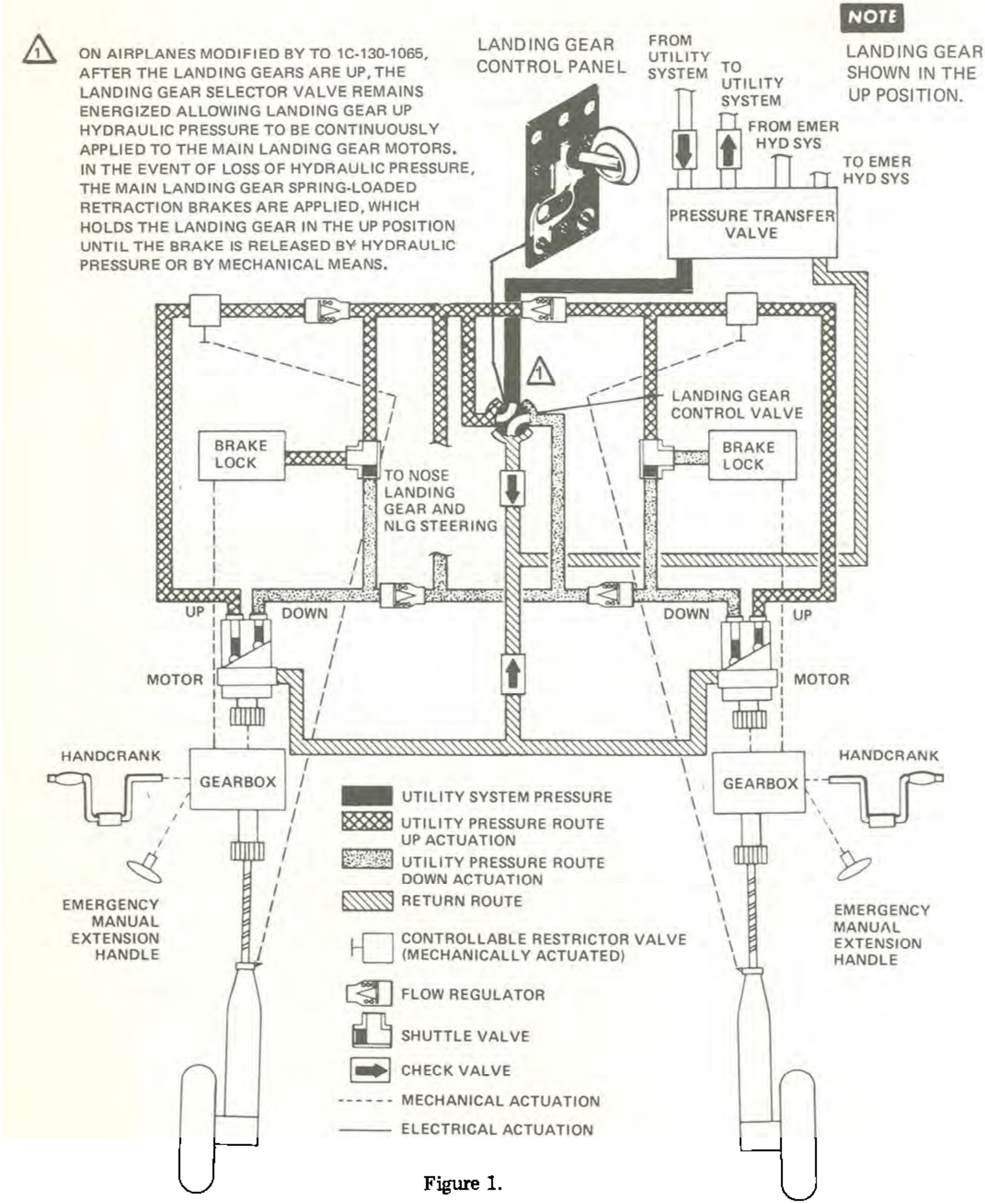

Figure 1.

THE END

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

This page is published with each Safety and Operational Supplement. It provides a comprehensive listing of the current Flight Manuals, Flight Crew Checklist, Safety Supplements, and Operational Supplements. If you are missing any publications listed on this page, see your Publications Distribution Officer and get your copy.

FLIGHT MANUAL	DATE	CHANGE NO.
1C-130(A)H-1	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1-2	1 Feb 80	1 - 28 Jan 81

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-130(A)H-1CL-1	29 Feb 80	2 - 26 Feb 81
1C-130(A)H-1CL-2	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-55	3 Feb 81	Synthetic Hydraulic Fluid	Sec I
S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV
S-57	3 Apr 81	VHF Communication System	Sec I, IV
S-58	10 Jun 81	Emergency Locator Transmitter	Sec I
S-59	28 Sep 81	Satellite Communications System Installation	Sec IV
S-60	30 Dec 81	Altitude Low Caution Lights	Sec IV
S-61	13 Apr 82	Landing Gear System	Sec I, III

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES
AC-130H
AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-130(A)H-1.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

30 DECEMBER 1981

SHORT TITLE: ALTITUDE LOW CAUTION LIGHTS

1. PURPOSE.

To provide aircrews with current information on the installation of two press-to-test ALTITUDE LOW caution lights (airplanes modified by TO 1C-130-991).

2. GENERAL.

Two caution lights, one for the pilot and one for the copilot, are installed on or just below the pilot's and copilot's instrument panel glare shield. These remote press-to-test lights are slaved to the Radar Altimeter Control Indicator's integral warning light.

3. INSTRUCTIONS.

a. Page 4-88 is amended to add the following WARNING to appear immediately preceding Radar Altimeter Controls paragraph:

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WARNING

System capability is inadequate to provide terrain avoidance during low level flight. Geometry of the radar transmission cone is such that the radar set is only approved for information presentation during take-off, landing, and go-around.

b. Page 4-88 is further amended to add the following to the Radar Altimeter Controls paragraph:

On airplanes modified by TO 1C-130-991, two remote "press-to-test" ALTITUDE LOW caution lights, located on or near the pilot's and copilot's instrument panel glare shield, are slaved to the indicator's integral warning light. These caution lights illuminate when the indicator's warning light is illuminated and extinguish when the indicator's warning light extinguishes.

THE END

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

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1C-130(A)H-1-2	1 Feb 80	1 - 28 Jan 81

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
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1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

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S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV
S-57	3 Apr 81	VHF Communication System	Sec I, IV
S-58	10 Jun 81	Emergency Locator Transmitter	Sec I
S-59	28 Sep 81	Satellite Communications System Installation	Sec IV
S-60	30 Dec 81	Altitude Low Caution Lights	Sec IV

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS T.O. 1C-130(A)H-1, DATED 29 FEBRUARY 1980.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

28 SEPTEMBER 1981

SHORT TITLE: SATELLITE COMMUNICATIONS SYSTEM INSTALLATION

1. PURPOSE.

To provide aircrew members with the information applicable to operating the AN/ARC-164(V)12 Satellite Communications System installed by TO 1C-130(A)H-508.

2. INSTRUCTIONS.

Note

A reference to this supplement shall be entered on the title page and opposite each paragraph in the basic manual affected by this supplement.

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a. Pages 4-56 and 4-57, figure 4-31, are amended to insert the following between UHF-2 communication system and direction finder:

Type	Designation	Function	Power Source (Bus)	Range	Location of Controls
UHF-3 SATCOM Communications System	AN/ARC-164(V)12	Clear voice and secure voice capability, transmit and receive in range of 225.000 to 399.975 MHz.	MAIN DC	Line-of-sight and Satellite Communications	EWO Console Extension

b. Page 4-66, figure 4-33, Antenna Locations (Sheet 2 of 2), is amended as shown in Attachment 1.

c. Page 4-67, figure 4-34, Intercommunications System (AN/AIC-18) (Sheet 1 of 5) is amended to read (Sheet 1 of 6).

d. Page 4-68, figure 4-34, Intercommunications System (AN/AIC-18) (Sheet 2 of 6) is amended as shown in Attachment 2 (Sheet 1 of 3).

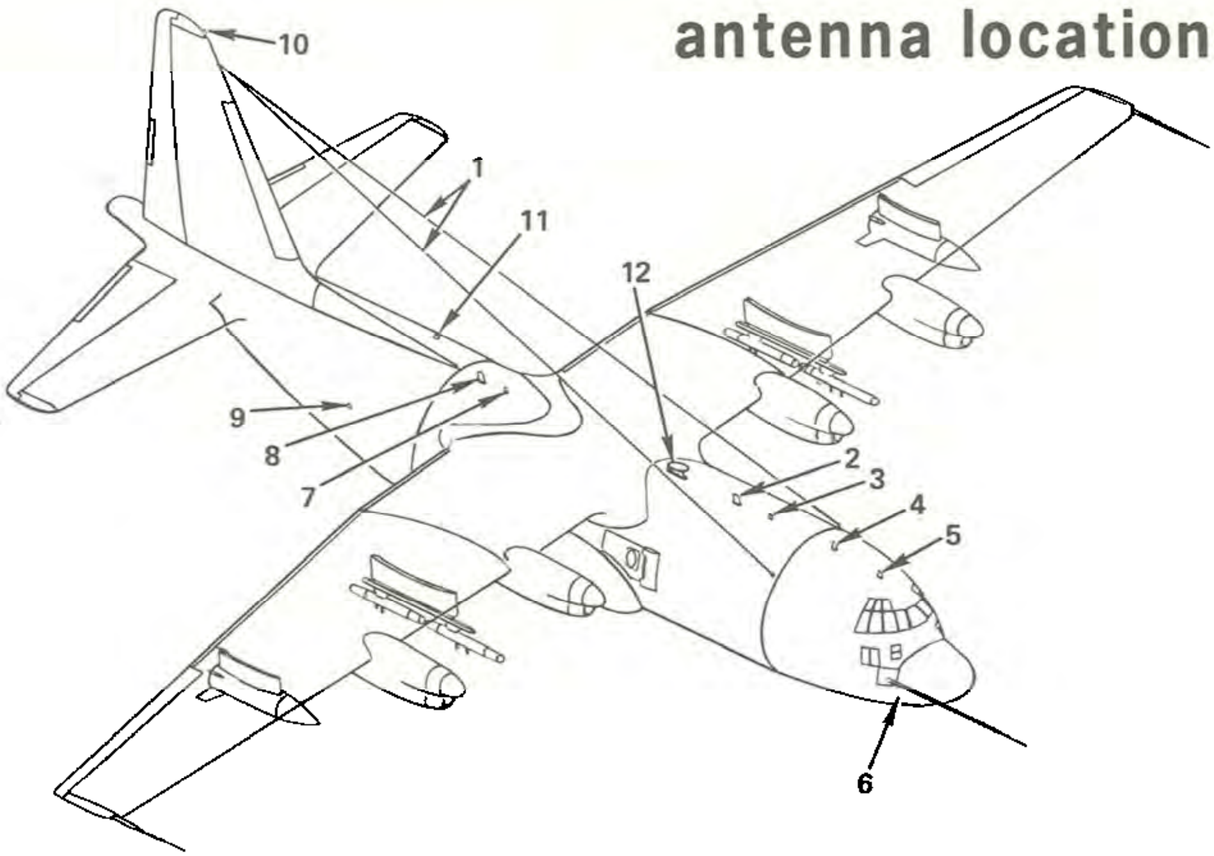
e. The manual is amended to add page 4-70A, figure 4-34, Intercommunications System (AN/AIC-18) (Sheet 5 of 6) as shown in Attachment 2 (Sheet 2 of 3).

f. Page 4-71, figure 4-34, Intercommunications System (AN/AIC-18) (Sheet 6 of 6) is amended as shown in Attachment 2 (Sheet 3 of 3).

g. Page 4-80 is amended to add the text and figure 4-40A, pertaining to AN/ARC-164(V)12 as shown in Attachment 3.

- THE END -

antenna locations



1. NO. 1 AND NO. 2 LIAISON COMM AND LORAN (AN/ARN-92)
2. VHF/FM 1 (COLLINS VHF-FM-AN/ARC-186(V)) F.S. 360
3. IFF (AN/APX-72) F.S. 303.
4. NO. 2 UHF COMM (AN/ARC-133) F.S. 208.
*5. VHF COMM (COLLINS VHF-AM-AN/ARC-186(V)) F.S. 280
6. ECM (AN/ALR-69) F.S. 95
7. NO. 1 UHF COMM (AN/ARC-34C) F.S. 680
8. VHF/FM-2 COMM (COLLINS VHF-FM-AN/ARC-186 (V)) F.S. 710
9. ECM (TRIM-7A) F.S. 867
10. "X" BAND BEACON (SST-181X)
11. ECM (R-1854/AN/ALR-46) (DEACTIVATED) F.S. 702
** 12. NO. 3 UHF (SATCOM) (AN/ARC-164(V)12) F.S. 457

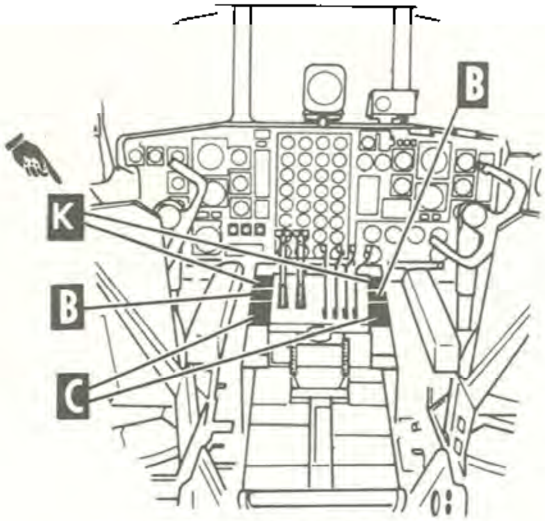
*AIRPLANES MODIFIED BY T.O. 1C-130-949.

**AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508.

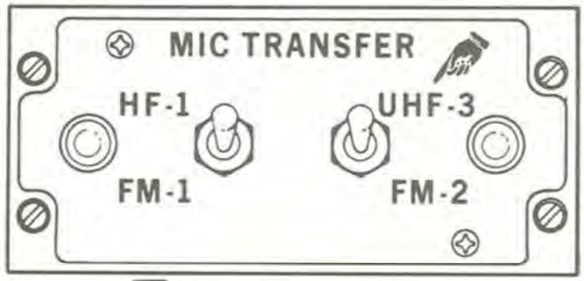
(Reference Figure 4-33 (Sheet 2 of 2))

Attachment 1

intercommunications system (AN/AIC-18)

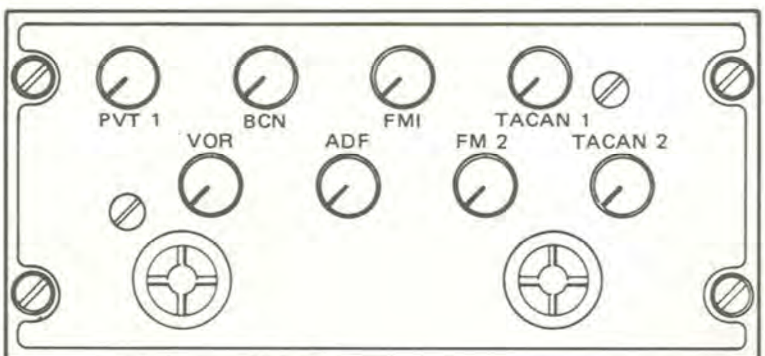


FLIGHT STATION CONTROL PEDESTAL



B MIC TRANSFER PANEL

AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508.

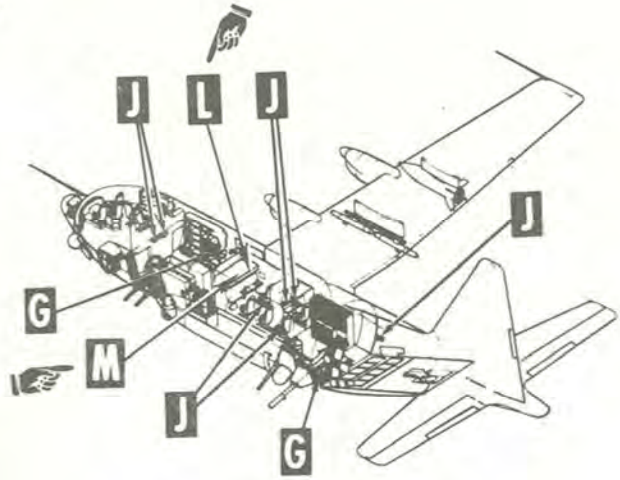


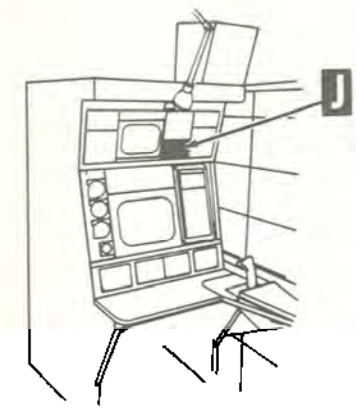
C MONITOR PANEL

(Reference Figure 4-34 (Sheet 2 of 6))

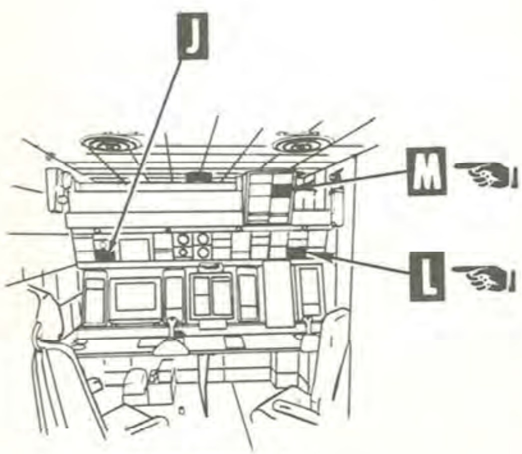
Attachment 2 (Sheet 1 of 3)

intercommunications system (AN/AIC-18)

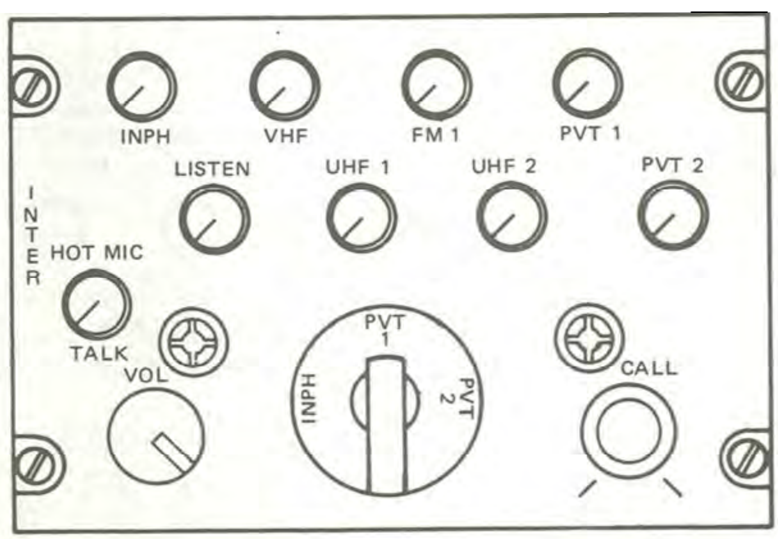




TV CONSOLE



IR/EWO CONSOLE

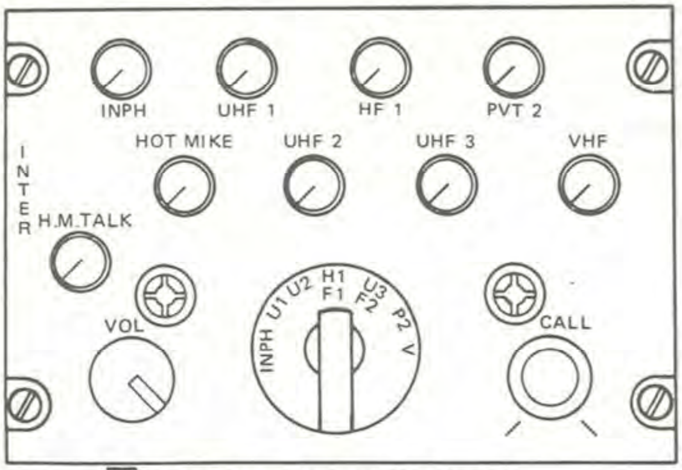


J INTERCOMMUNICATION SET CONTROL

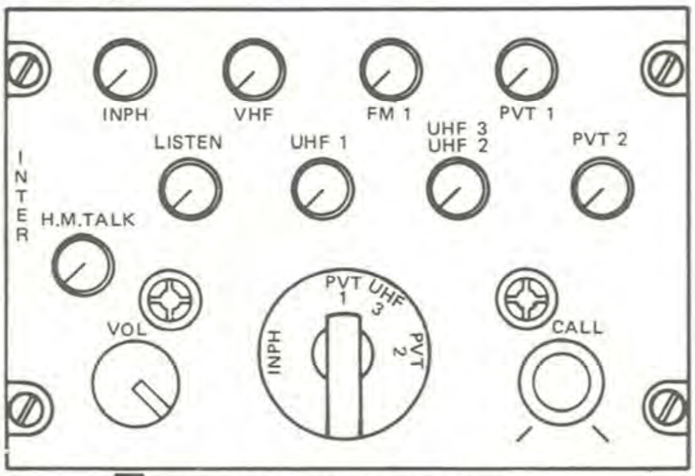
(Reference Figure 4-34 (Sheet 5 of 6))

Attachment 2 (Sheet 2 of 3)

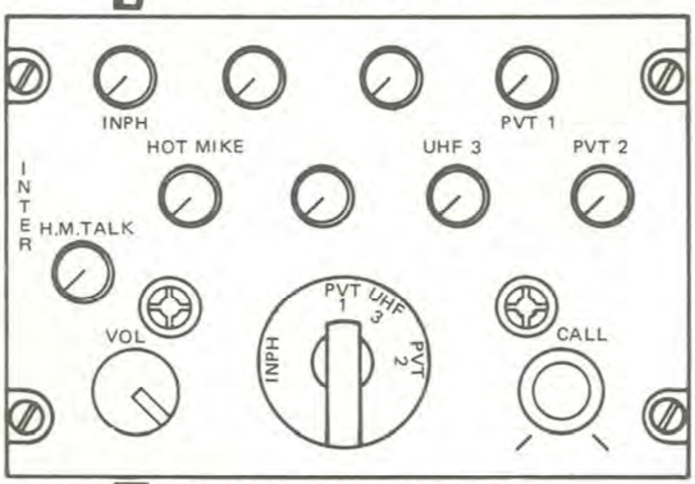
intercommunications system (AN/AIC-18)



K INTERCOMMUNICATION SET CONTROL



L INTERCOMMUNICATION SET CONTROL



M INTERCOMMUNICATION SET CONTROL

Figure 4-34 (Sheet 6 of 6)

Attachment 2 (Sheet 3 of 3)

UHF COMMAND RADIO (AN/ARC-164(V)12) SYSTEM NO. 3 (SATCOM) (AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508)

The AN/ARC-164(V)12 Satellite Communications (SATCOM) Radio System is for communications only (figure 4-40A). The ADF position of the selectors is inoperative and will not provide automatic direction finding through this UHF System No. 3. The SATCOM system receives 28 volts dc power through the ARC-164(V)12 (UHF-3/RT) circuit breaker on the EWO console. In addition to it is another circuit breaker (UHF-3 Bus) located on the cargo compartment dc circuit breaker panel (figure 4-40A). SATCOM can receive or transmit in line-of-sight (HORIZON) or via satellite (ZENITH). The system can receive/transmit in clear voice or secure voice (KY-75) and will operate in either the MAIN, GUARD, or both positions.

The secure voice system (KY-75) operates from a 28 volt dc power source through the KY-75 circuit breaker on the EWO console. The control panel is located in the EWO console extension (figure 4-40A). The control panel contains switches for power and mode selection, a function switch, and various indicator lights. For the operational details of the KY-75, refer to the applicable publications.

Note

Anytime radio transmission from the aircraft is in the secure voice system mode,all other communications systems including aircraft interphone shall not be used. Acoustic coupling will occur through the other systems allowing an inadvertent shift to clear voice transmission.

CONTROLS AND INDICATORS

UHF System No. 3 incorporates two remote radio set controls for one receiver-transmitter unit (figure 4-40A). The left control is used for satellite (SAT) transmission and the right control is used for satellite (SAT) reception. During line-of-sight (LOS) mode of operation, the right control is used for both receive and transmit operations.

System No. 3 has an individual antenna selector panel which consists of three, two-position toggle switches (figure 4-40A). Left on the panel is the AM/FM switch that programs the receiver-transmitter to the desired function. The center switch is the LOS/SAT selector which programs the receiver/transmitter and the remote controls to the desired function. To the right on the panel is the ZENITH/HORIZ selector to provide communications through one of two antenna assemblies. The antennas are combined in a single 'T' shape assembly on top of the fuselage just forward of the wing (figure 4-33).

Note

ZENITH switch position selects an antenna pattern where transmit-receive path to satellite or line-of-sight terminal is 30 degrees or greater above the horizon.

HORIZ switch position selects an antenna pattern where transmit-receive path to satellite or line-of-sight terminal is below 30 degrees.

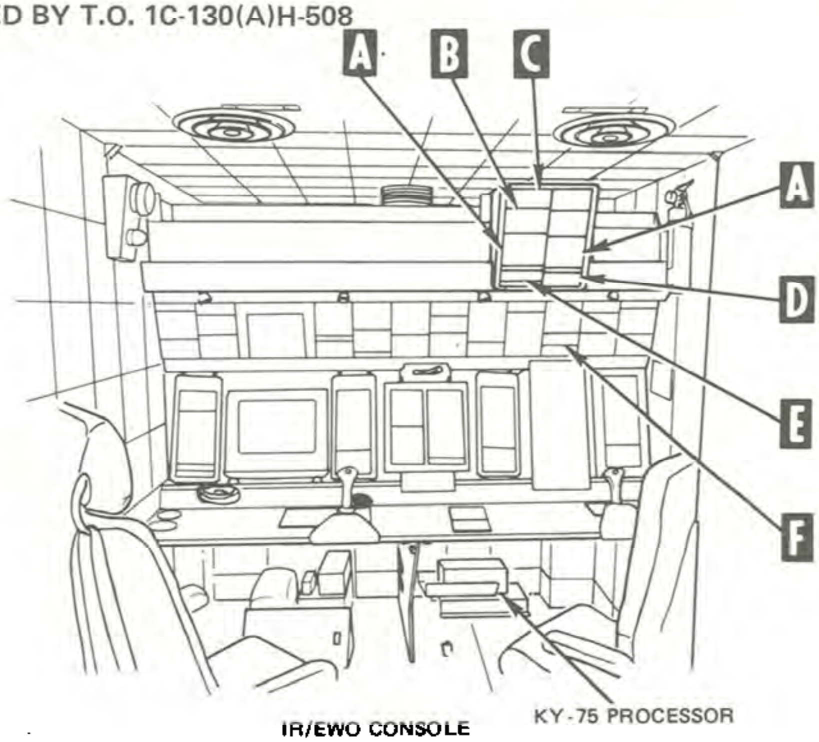
The indicator light panel contains four lights which illuminate to indicate the ongoing function of SATCOM (figure 4-40A).

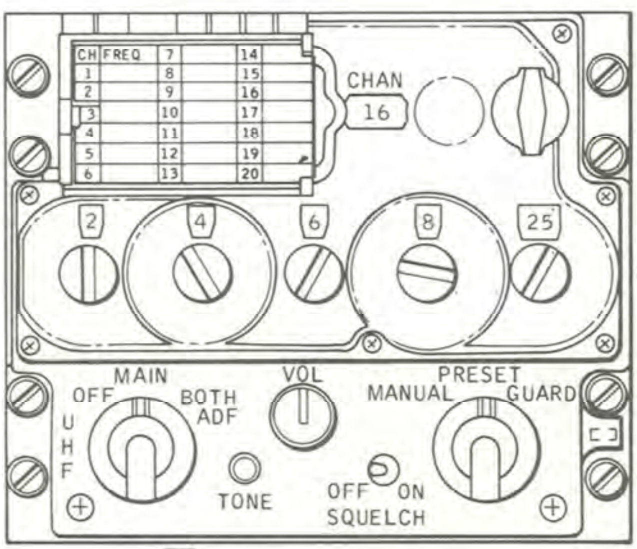
OPERATION

Normal operation of UHF System No. 3 and the emergency operation of the system is the same as UHF Systems No. 1 and No. 2, with the exception of the aforementioned peculiarities.

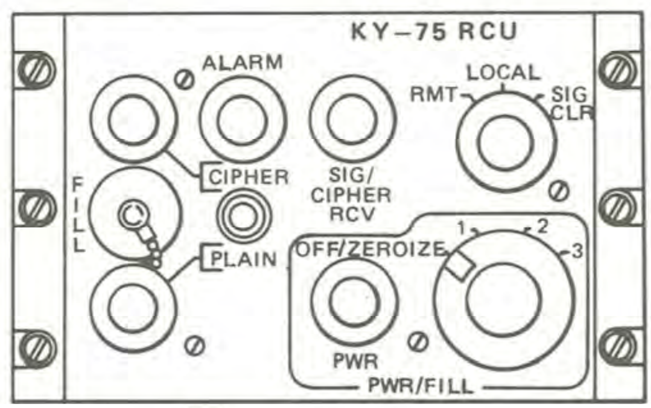
uhf command radio system (AN/ARC-164(V)12) (SATCOM)

AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508





A RADIO SET CONTROL



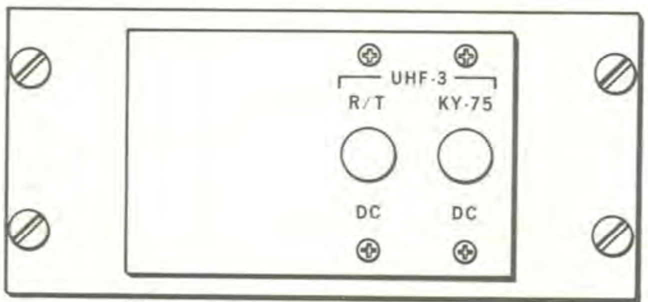
B KY-75 CONTROL

Figure 4-40A (Sheet 1 of 4)

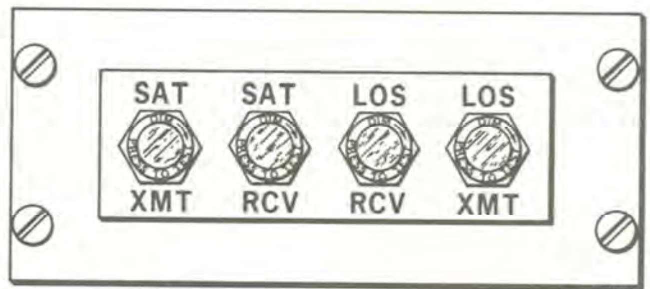
Attachment 3 (Sheet 3 of 6)

uhf command radio system (AN/ARC-164(V)12 (SATCOM)

AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508

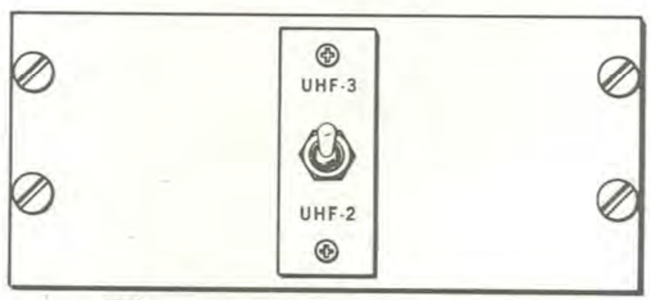


C CIRCUIT BREAKER PANEL



D INDICATOR LIGHT PANEL

E ANTENNA SELECTOR PANEL



F UHF-2/UHF-3 SWITCHING PANEL

Figure 4-40A (Sheet 2 of 4)

Attachment 3 (Sheet 4 of 6)

uhf command radio system (AN/ARC-164(V)12) (SATCOM)

AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508

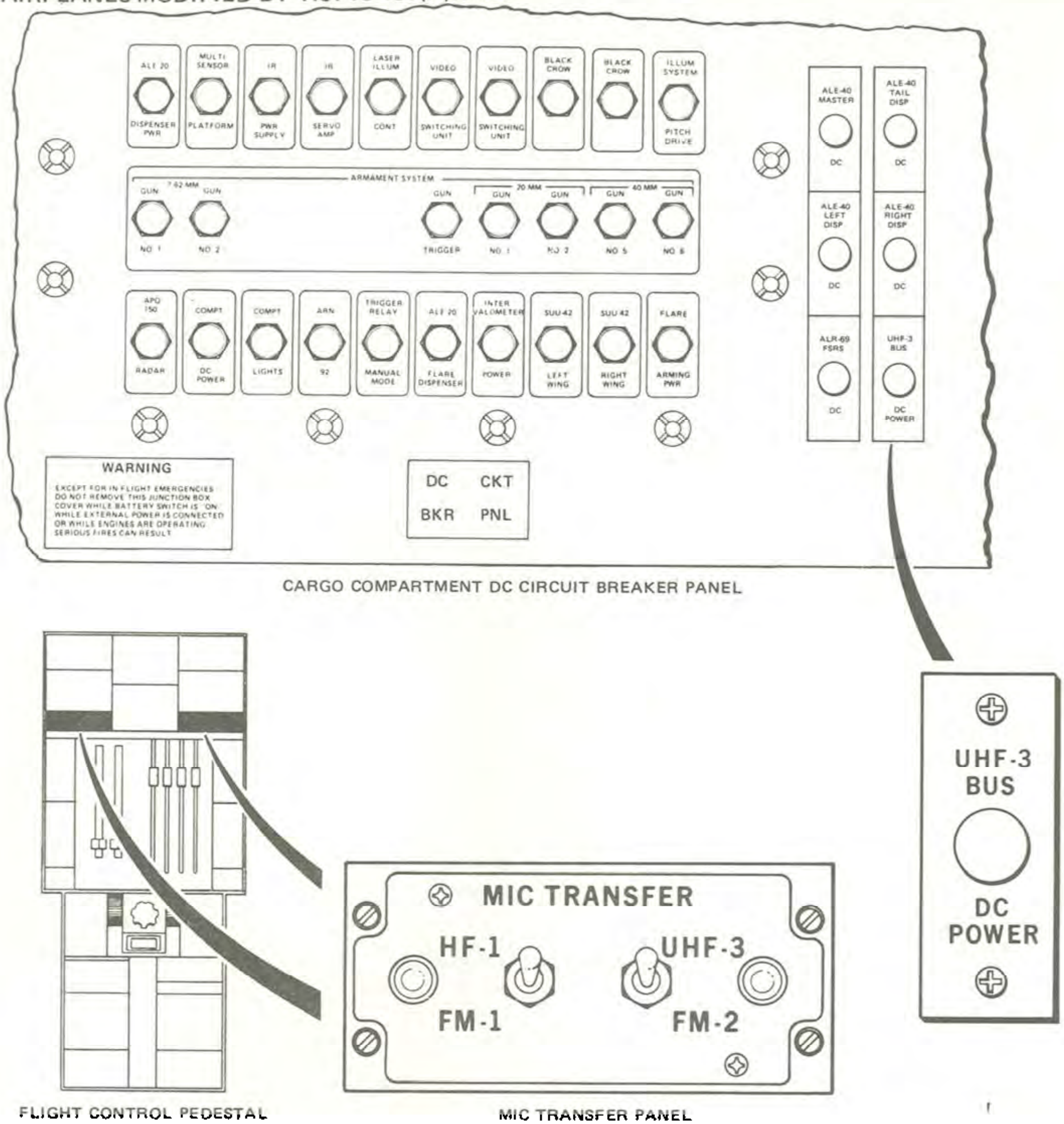


Figure 4-40A (Sheet 3 of 4)

Attachment 3 (Sheet 5 of 6)

uhf command radio system (AN/ARC-164(V)12) (SATCOM)

AIRPLANES MODIFIED BY T.O. 1C-130(A)H-508

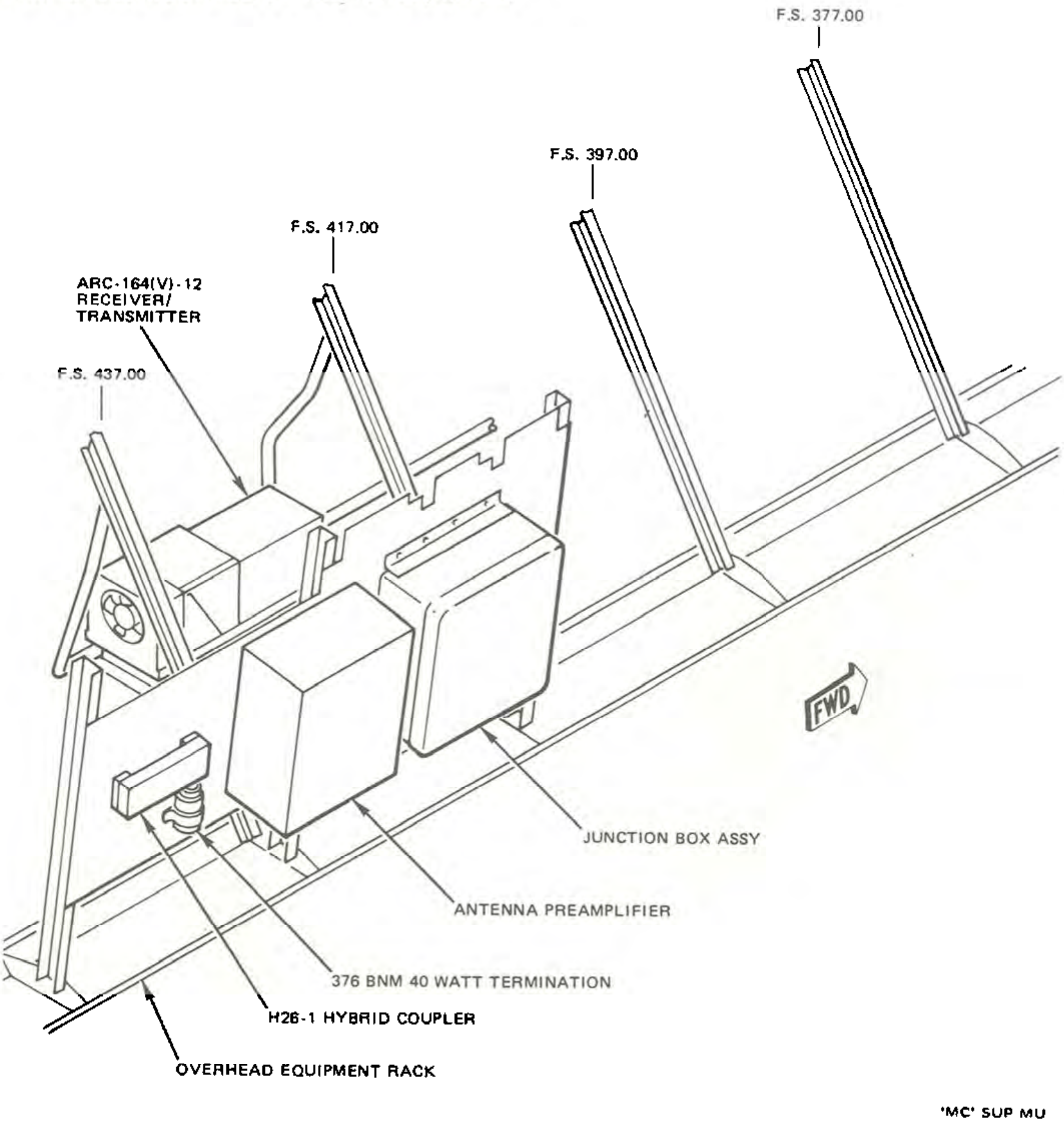


Figure 4-40A (Sheet 4 of 4)

Attachment 3 (Sheet 6 of 6)

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

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FLIGHT MANUAL	DATE	CHANGE NO.
1C-130(A)H-1	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1-2	1 Feb 80	1 - 28 Jan 81

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-130(A)H-1CL-1	29 Feb 80	2 - 26 Feb 81
1C-130(A)H-1CL-2	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-55	3 Feb 81	Synthetic Hydraulic Fluid	Sec I
S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV
S-57	3 Apr 81	VHF Communication System	Sec I, IV
S-58	10 Jun 81	Emergency Locator Transmitter	Sec I
S-59	28 Sep 81	Satellite Communications System Installation	Sec IV

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

PARTIAL FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS T.O. 1C-130(A)H-1.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

10 JUNE 1981

SHORT TITLE: EMERGENCY LOCATOR TRANSMITTER

1. PURPOSE.

To provide aircrew members with information on aircraft modified in accordance with T.O. 1C-130-998, installation of EMERGENCY LOCATOR TRANSMITTER, C-130 AIRCRAFT.

2. GENERAL.

This modification is applicable to aircraft modified by T.O. 1C-130-998. The modification deactivates the Crash Position Indicator (CPI).

3. INSTRUCTIONS.

a. Page 1-61, figure 1-37 (sheet 4 of 12) is amended to delete the circuit breaker designation "CRASH POSITION IND" from the battery bus.

b. Page 1-62, figure 1-37 (sheet 5 of 12) is amended to delete the circuit breaker designation "CRASH POS IND" from the radio circuits.

THE END

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

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1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-55	3 Feb 81	Synthetic Hydraulic Fluid	Sec I
S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV
S-57	3 Apr 81	VHF Communication System	Sec I, IV
S-58	10 Jun 81	Emergency Locator Transmitter	Sec I

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-130(A)H-1 DATED 29 FEBRUARY 1980.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

3 APRIL 1981

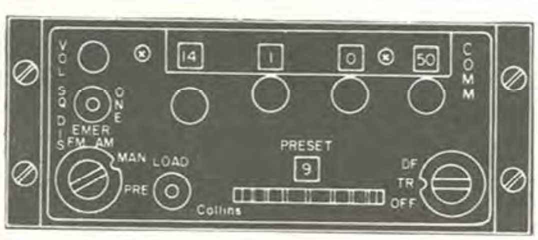
SHORT TITLE: VHF COMMUNICATION SYSTEM

1. PURPOSE.

Provide data for airplanes modified by TO 1C-130-1002, Installation of Collins AN/ARC-186(V) VHF AM/FM Radio.

2. INSTRUCTIONS.

a. Page 1-15, figure 1-13, is amended (on airplanes modified by TCTO 1C-130-1002) to change item 16 VHF Command Control Panel view as follows:



AFLC RAFB, GA

b. Page 4-54, Intercommunication System Control Panel paragraphs are amended (on airplanes modified by TCTO 1C-130-1002) to change all references to VHF Command Radio (Collins VHF-101) and to VHF/FM Radio (FM-622/A) NO. 1 and NO. 2 to read, respectively, as follows:

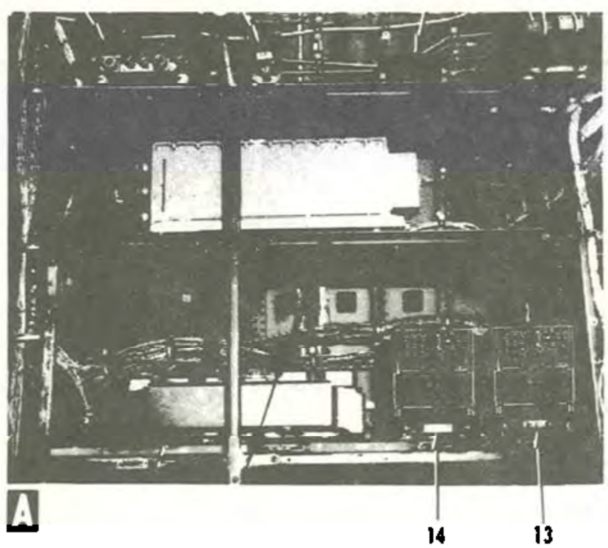
VHF - VHF Command Radio (Collins VHF-AM-AN/ARC-186(V))
FM1 - VHF/FM Radio (Collins VHF-FM-AN/ARC-186(V)) NO. 1
FM - VHF/FM Radio (Collins VHF-FM-AN/ARC-186(V)) NO. 2

c. Page 4-56, figure 4-31, sheet 1 is amended (on airplanes modified by TCTO 1C-130-1002) to change third and fourth entries to read, respectively, as follows:

VHF/FM RADIO(2)	COLLINS VHF-FM-AN/ARC-186(V)	2-WAY VOICE COMMUNICATIONS IN RANGE OF 30.00 to 87.975 MHz (FM1 HAS HOMING PROVISIONS. FM2 HAS SECURE VOICE CAPABILITY)
VHF COMMAND RADIO	COLLINS VHF-AM-AN/ARC-186(V)	2-WAY VOICE COMMUNICATIONS IN THE RANGE OF 116.00 to 151.975 MHZ

d. Page 4-63, figure 4-32, sheet 1 is amended (on airplanes modified by TCTO 1C-130-1002) to change references to VHF-101 in item 1 and to FM-622 in items 13 and 14 to read, respectively, as follows and to change view A as shown in this supplement:

COLLINS VHF-AM-AN/ARC-186(V) RCVR/XMTR
COLLINS VHF-FM-AN/ARC-186(V) RCVR/XMTR FM1
COLLINS VHF-FM-AN/ARC-186(V) RCVR/XMTR FM2



e. Page 4-65, figure 4-33, sheet 1 is amended (on airplanes modified by TCTO 1C-130-1002) to change VHF/FM-1 HOMING ANTENNA (FM-622A) F.S. 249 to read "VHF-FM-1 HOMING ANTENNA (COLLINS VHF-FM-AN/ARC-186(V)) F.S. 249."

f. Page 4-66, figure 4-33, sheet 2 is amended (on airplanes modified by TCTO 1C-130-1002) to change references to FM-622A in items 2 and 8 and to COLLINS VHF-101 in item 5 to read, respectively, as follows:

VHF/FM1 (COLLINS VHF-FM-AN/ARC-186(V)) F.S. 360
VHF/FM2 COMM (COLLINS VHF-FM-AN/ARC-186(V)) F.S. 710
VHF COMM (COLLINS VHF-AM-AN/ARC-186(V)) F.S. 280

g. Page 4-72, VHF/FM TRANSCEIVER SETS (FM-622A) paragraphs are amended (on airplanes modified by TCTO 1C-130-1002) to read as follows:

Two VHF/FM transceiver sets (FM1 and FM2), (figure 4-36), are installed in the aircraft. FM1 is controlled by the navigator; FM2 is controlled by the copilot. The VHF/FM transceivers are used to transmit and receive frequency modulated (FM) signal between the airplane and ground stations, or other airplanes. The AN/ARC-186(V) Radio Sets provide total VHF communication capability. Normal and secure 2-way communication is available in the AM band of 116.000 to 151.975 MHz and the FM band of 30.000 to 87.975 MHz. The AM band of 108.000 to 115.975 MHz is provided as a receive-only band. All channels are spaced 25 kHz apart. Up to 20 channels may be preset. Radio set 1 (FM1) operates in conjunction with the CM-482 Signal Data Comparator and the homing antenna to provide FM homing. The CM-482 switches reception between right and left antennas at a 150 Hz rate. The received signals are demodulated and amplified to provide outputs for homing indicator ID-48 located at the pilot's instrument panel. When homing is not enabled, that is, DF is not selected, FM1 provides normal voice communications. Radio set (FM2) operates in conjunction with the KY-28 secure voice equipment to provide plain or secure voice communications.

Channel spacing in all frequency bands is at 25 kHz increments from the control panel. 20 channels may be preset. Operation may be either narrow band, 6 dB bandwidth at 22 kHz; or wide band, 6 dB bandwidth at 60 kHz.

VHF/FM CONTROLS

The control panels (figure 4-36) contain all the necessary controls to provide remote operation of the transceiver by the navigator (FM1) and copilot (FM2).

The controls consist of a volume control knob, a squelch disable tone switch, preset channel selector, preset channel indicator, mode select switch, four rt frequency select knobs and bandwidth switch.

The volume control knob allows for volume adjustments. The squelch disable/tone select is provided to enable or disable squelch and transmit tones of approximately 1000 Hz.

A frequency control/emergency select switch enables preset (PRE) or manual (MAN) frequency selection providing normal voice functions while EMER AM and EMER FM provide voice reception and transmission on prestored guard channels. The load switch, when depressed, provides provisions to put a manually selected frequency into a selected preset channel.

A preset channel selector rotary switch provides the capability of selecting preset channels from 1 to 20 and displaying the selection in a preset FM homing.

A 3-position rotary mode select switch, depending on its set position, can disable the rt, enable transmit/receive modes, and provide ADF or FM homing.

Four selector knobs provide rt frequencies in 0.025 MHz increments and display the readings in indicator windows. Wide-band/narrow-band capabilities are provided through use of the bandwidth switch.

HOMING INDICATOR (ID-48)

This instrument is located on the pilot's flight panel. The vertical needle indicates left, right, or on-course position. The flags indicate sufficiency of the homing signal. The horizontal needle indicates relative signal strength of the transmitter.

VHF/FM OPERATION

All controls necessary to operate the set are located on the control panel. To operate the set, rotate the mode selector switch to T/R. To operate the FM 1 system in the homing mode, rotate the MODE selector switch to DF and observe indication on the ID-48 indicator. Rotate the frequency selectors to set the desired frequency. Adjust the VOL control to set the audio level.

h. Page 4-73, VHF COMMAND RADIO (Collins VHF-101) paragraphs are amended (on airplanes modified by TCTO 1C-130-1002) to read as follows:

VHF COMMAND RADIO CONTROLS

A panel (figure 4-37) on the flight control pedestal provides operating control for the VHF command radio. The controls consist of a volume control knob, a squelch disable tone switch, preset channel selector, preset channel indicator, mode select switch, four rt frequency select knobs and bandwidth switch.

The volume control knob allows for volume adjustments. The squelch disable/tone select is provided to enable or disable squelch and transmit tones of approximately 1000 Hz.

A frequency control/emergency select switch enables preset (PRE) or manual (MAN) frequency selection providing normal voice functions while EMER AM and EMER FM provide voice reception and transmission on prestored guard channels. The load switch, when depressed, provides provisions to put a manually selected frequency into a selected preset channel.

A preset channel selector rotary switch provides the capability of selecting preset channels from 1 to 20 and displaying the selection in a preset FM homing.

A 3-position rotary mode select switch, depending on its set position, can disable the rt, enable transmit/receive modes, and provide ADF or FM homing.

Four selector knobs provide rt frequencies in 0.025 MHz increments and display the readings in indicator windows. Wide-band/narrow-band capabilities are provided through use of the bandwidth switch.

Normal Operation of the VHF Command Radio

To put the VHF command radio into operation:

1. Place the power switch in the TR or DF position to receive or to transmit.

2. Select the mode of operation desired (AM or FM).

NOTE

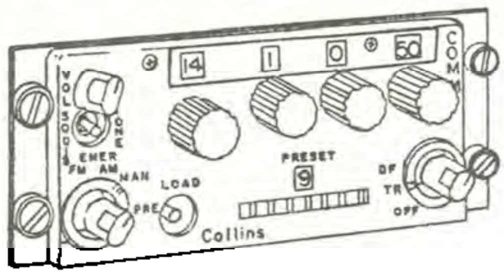
Keying the microphone for voice transmission when in the D/F mode will disable the homing function while the microphone is keyed. Reception while in DF mode may be distorted due to the direction finding equipment operation.

3. Select the desired operating frequency.

4. Adjust the SQ and VOL control as necessary to obtain a comfortable reception level.

5. Place the power switch in the OFF position.

i. Page 4-75, figure 4-37 is amended (on airplanes modified by TCTO 1C-130-1002) to change VHF command radio control panel (COLLINS VHF-101) to read "VHF command radio control panel (COLLINS VHF-AM-AN/ARC-186(V))" and to change control panel view as follows:



j. Page Index-3, Alphabetical Index is amended (on airplanes modified by TCTO 1C-130-1002) to change VHF Command Radio (VHF-101) and VHF/FM Transceiver (FM 622/A) to read, respectively, as follows:

VHF Command Radio (COLLINS VHF-AM-AN/ARC-186(V))
VHF/FM Radio Set (COLLINS VHF-FM-AN/ARC-186(V))

k. Page Index-13/(Index-14 Blank), Alphabetical Index is amended (on airplanes modified by TCTO 1C-130-1002) to change VHF Command Radio (VHF-101) and VHF/FM Transceiver Sets (FM-622/A) to read, respectively, as follows:

VHF Command Radio (COLLINS VHF-AM/AN/ARC-186(V))
VHF/FM Radio Set (COLLINS VHF-FM/AN/ARC-186(V))

THE END

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

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FLIGHT MANUAL	DATE	CHANGE NO.
1C-130(A)H-1	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1-2	1 Feb 80	1 - 28 Jan 81

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-130(A)H-1CL-1	29 Feb 80	2 - 26 Feb 81
1C-130(A)H-1CL-2	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-55	3 Feb 81	Synthetic Hydraulic Fluid	Sec I
S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV
S-57	3 Apr 81	VHF Communication System	Sec I, IV

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

TECHNICAL MANUAL

FLIGHT MANUAL

USAF SERIES

AC-130H

AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-130(A)H-1.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

23 MARCH 1981

SHORT TITLE: MODIFIED AN/ARC-164 RADIOS

1. PURPOSE.

To provide aircrews with procedures for an improved near-term, air-air, and air-ground-air, jam-resistant Ultra-High Frequency (UHF) voice communication capability.

2. INSTRUCTIONS.

a. Page 4-77 is amended to replace figure 4-38 with new figure 4-38 as depicted in this supplement.

b. Page 4-78 is amended to add the following text to appear immediately preceding UHF DIRECTION FINDER (AN/ARA-50) paragraph:

AN/ARC-164 RADIO (MODIFIED BY TO 1C-130-1045)

System Description.

The modified system consists of a modification to selected airborne and ground-based radios, providing them with a frequency hopping capability. Frequency hopping is a technique where the channel or frequency being used for communication on a given link is rapidly changed many times per second.

In the active mode, the radio has the ability to receive and process two simultaneous transmissions on the same net. This conferencing capability is available by selecting 00, 50, or 75 with the hundredths/thousandths manual frequency selector switch, then operating in the active mode. Conferencing is disabled when the net number ends in 25.

In a conference net, the second transmitting radio will automatically shift its transmission frequency by 25 kilohertz (KHZ) when it monitors a transmission on the primary net frequency. The wide band receiver will read both transmissions without the interference normally associated with two radios transmitting on the same frequency simultaneously. Three simultaneous transmissions will result in garbled reception.

Note

When operating in the secure voice mode, conferencing is automatically disabled.

Note

In the active mode, ADF will function, but accuracy will be degraded depending on the frequency hop rate.

System Operation.

The usual operating mode for a modified radio will be its normal mode where it uses any one of the 7000 channels available to the UHF communication band. Use and operation of the radio will be just as they are currently done. The two-position switch on the Control Head is replaced with a four-position switch to provide two new functions. The modified AN/ARC-164 retains the same form/fit as the unmodified radio.

a. All the controls of the modified AN/ARC-164 retain the same functions except as follows:

(1) 200/300 MHz Selector Knob (A-3-2-T Switch).

- "A" position selects active (jam-resistant) mode.

- Selects 100s digit frequency (either 2 or 3) in Normal Mode.

- "T" position selects input of a new Time Of Day (TOD) for up to one minute after being selected. The "T" position is a momentary, spring-return position. "T" position, in conjunction with simultaneously pressing TONE switch, is used for emergency start-up of TOD clock when TOD is not available from external sources. This emergency TOD will not be synchronized to Universal Coordinated Time (UCT).

Note

The radio will automatically accept the first (TOD) signal it receives after power-up. If the operator requires a new TOD after this initial synchronization, he must momentarily depress this switch to the "T" position. The system will then accept the first TOD received within one minute.

b. Preset Channel Selector Switch. Selects one of 14 to 19 preset channels in Normal mode. In active mode, as many as six preset channels (15-20) may be used for loading Word of Day (WOD). In the normal mode, the radio will not use the memory contents used for WOD storage as operating frequencies. Any of the preset channels 19-15 not used for the WOD may be used in the normal mode as preset channels.

c. Tone Switch.

- Prior to TOD reception, there is no change; it operates as a 1020 Hz tone transmission switch.

- After TOD has been received, it will transmit (TOD) followed by the 1020 Hz tone on the selected frequency.

- In conjunction with the A-3-2-T switch, starts the TOD clock within the radio. This is done by simultaneously selecting the "T" position and depressing the TONE button.

d. Preset Switch.

Stores selected frequency in selected preset channels in Normal Mode and WOD in active mode. WOD storage starts in preset 20 and may extend through preset 15. Those presets (19-15) not used for WOD may be used in the normal mode as preset channels.

Operational Procedures.

Existing capabilities of modified radios are preserved to the maximum extent possible when the radios are operated in their normal mode, and no new procedures are required for normal radio operation.

To operate in the active mode, the radios must first be initialized ("primed"). This requires setting into the radio three control entries; i.e., Time of Day, Word of Day, and net number.

a. Time of Day (TOD).

(1) Correct TOD may be transmitted to a modified AN/ARC-164 by feeding the receiver with a radio signal carrying the proper time modulation. The signal may be provided by another modified radio which has the correct time, or it may be provided by the ground-based clock SG-1192/TRC.

(2) TOD entry must be done after the radio is switched on. The clock inside the radio would lose time when the radio is switched off. TOD entry would normally be done on the ground prior to take-off, although it can be easily done while in flight. This also permits time corrections in flight, when necessary.

(3) It is possible to transmit and receive timing information in both normal and active modes, by momentarily depressing the TONE button. In normal mode, a complete TOD message is transmitted; while in the active mode, only an updating time-tick is used. The purpose of the active mode time transmission is to allow a time update to take place in the event that a radio is drifting out of synchronization. An operator will know that his radio requires an update when incoming messages from several different radios do not sound as they should. If incoming messages from only one radio sound poor, then it is that radio which requires an update.

Time of Day (TOD) and TOD Update Reception.

a. Normal Mode. The radio will automatically accept only the first TOD message received after power-up, whenever it occurs. Subsequent messages will be ignored unless the operator first selects the "T" position on the A-3-2-T switch. To receive time in normal mode, rotate the A-3-2-T switch to the "T" position and return to a normal channel (either manual or preset) on which TOD is being transmitted.

b. Active Mode. To receive a time update in active mode, rotate the A-3-2-T switch to the "T" position and then back to the "A" position.

Note

Depressing the TONE button will send out a TOD update if in the active mode or a complete TOD message if in the normal mode.

Note

When the "T" position is selected, the radio will accept the next TOD received in either normal or active mode, provided that it arrives within one minute of the time the "T" position has been selected.

Word of Day (WOD).

a. The WOD defines for the radio the choice of frequency hopping pattern for the day. (The choice is a managerial function and the same WOD may be used for one or many days.)

b. WOD entry is normally done on the ground prior to take-off, although it is possible to enter it while in flight. If the radio is switched off after the entry of WOD, the data will not be lost since it is entered into a non-volatile memory.

c. The entry of WOD is accomplished by using preset channels 20 through 15. To enter a WOD, the radio is set to the preset mode starting at channel 20. At this point, a single or double beep will be heard indicating that the radio is ready to accept WOD entry. The first segment of the WOD is set with the manual frequency selector switch and the preset button is depressed to enter the WOD in non-volatile memory. The next channel is selected, the next WOD segment is set on the manual frequency selector switches, and the WOD segment is entered in non-volatile memory as before. The process is repeated, using successive channels until WOD entry is complete. Once the entire WOD is entered, it must be transferred to volatile memory. This is accomplished by returning to channel 20. A single or double BEEP will be heard. A single BEEP indicates the next lower channel needs to be selected. The operator continues selecting the next lower channel until the double BEEP is heard. This indicates the transfer has been completed.

d. When the radio is switched off, the WOD data is not lost but stored in a non-volatile memory in the switching unit. When the radio is switched on, the WOD must be transfered from the non-volatile memory in the switching unit to the receiver-transmitter. This is done by selecting the preset mode and starting with preset channel 20, rotating the preset channel switch backwards. The operator will hear a single or bouble BEEP. A single BEEP indicates that entry of WOD is not complete but has been transferred and accepted. After the single BEEP is heard, the operator selects preset 19, 18, etc., and continues transferring WOD until a double BEEP is heard. This double BEEP indicates WOD transfer is complete.

e. Net Number. Once TOD and WOD have been entered, any valid active net number may be selected by using the frequency selector knobs.

Operation of AN/ARC-164 in the Active Mode.

a. Rotate function control switch to the MAIN or BOTH position.

b. Select preset position with the mode control switch.

c. Enter word of day in presets 20 through 15 (starting with preset 20 and working back).

d. Select MANUAL or PRESET position with the mode control switch.

e. Enter TOD by selecting frequency on which TOD is being transmitted or by requesting a TOD transmission.

f. Select active net number on frequency selector knobs or any preset designation for active use.

g. Select A on the A-3-2-T switch.

Note

The radio may now be operated in the normal mode by deselecting the "A" position and selecting the desired frequency. A preset channel may also be selected. To return to the active mode, the operator must select the desired active net and then select "A" on the A-3-2-T switch. An audible tone will be heard in the headset when the active mode is improperly selected. The tone will be heard when the active mode is selected and:

- An invalid active net is selected, or;
- TOD has not been initially received, or;
- WOD of day has not been entered.

If the function switch is on BOTH and the active mode is selected, any transmisstion on the GUARD channel will take precedence over the active mode. If GUARD channel is being jammed, operator should then select MAIN on the function switch.

FLIGHT MANUAL, SAFETY SUPPLEMENT, AND OPERATIONAL SUPPLEMENT STATUS

This page is published with each Safety and Operational Supplement. It provides a comprehensive listing of the current Flight Manuals, Flight Crew Checklist, Safety Supplements, and Operational Supplements. If you are missing any publications listed on this page, see your Publications Distribution Officer and get your copy.

FLIGHT MANUAL	DATE	CHANGE NO.
1C-130(A)H-1	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1-2	1 Feb 80	Original

FLIGHT CREW CHECKLIST	DATE	CHANGE NO.
1C-130(A)H-1CL-1	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-2	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-8	24 Oct 80	Original
1C-130(A)H-1CL-9	29 Feb 80	1 - 24 Oct 80

CURRENT SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
S-55	3 Feb 81	Synthetic Hydraulic Fluid	Sec I
S-56	23 Mar 81	Modified AN/ARC-164 Radios	Sec IV

REPLACED/RESCINDED SUPPLEMENTS

NUMBER	DATE	DISPOSITION

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

USAF SERIES
AC-130H
AIRCRAFT

THIS PUBLICATION SUPPLEMENTS TO 1C-130(A)H-1.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AF PERSONNEL
PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

3 FEBRUARY 1981

SHORT TITLE: SYNTHETIC HYDRAULIC FLUID

1. PURPOSE.

To provide aircrews with current information on the type of hydraulic fluid used to service the C-130 aircraft.

2. GENERAL.

In the near future, a synthetic hydrocarbon base hydraulic fluid, MIL-H-83282, will be used in all C-130 aircraft in lieu of MIL-H-5606. The new hydraulic fluid is completely miscible with MIL-H-5606 and has superior fire properties in respect to reducing aircraft vulnerability to ground fire, in crash landings and other hazardous conditions. The synthetic fluid does not support nor propagate combustion. The weight of the fluid is approximately the same as MIL-H-5606. A NATO symbol has not been designated for the synthetic fluid.

3. INSTRUCTIONS.

Page 1-117, figure 1-72 (sheet 2), items 1, 4, 8, 10 and 13 are amended to change "MIL-H-5606" (5 places) to read "MIL-H-83282" and to delete reference to "H-515" (4 places).

THE END

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1C-130(A)H-1-2	1 Feb 80	Original

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1C-130(A)H-1CL-3	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-4	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-5	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-6	29 Feb 80	1 - 24 Oct 80
1C-130(A)H-1CL-7	29 Feb 80	1 - 24 Oct 80
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