T.O. 1C-119(A)G-1

PARTIAL
flight manual

USAF SERIES
AC-119G
AIRCRAFT

THIS PUBLICATION IS INCOMPLETE
WITHOUT T.O. 1C-119G-1

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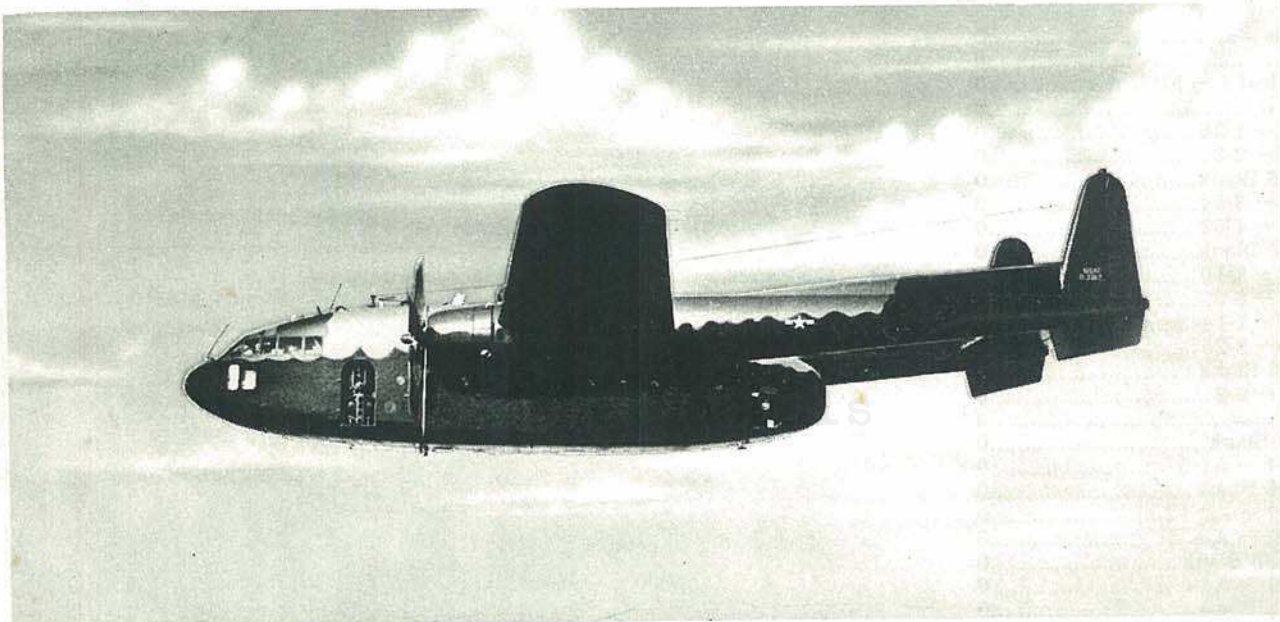

Each transmittal of this document outside the Department of Defense must have approval of the Technical Order Distribution Control Activity. Refer to T.O. 00-5-2.

This manual supersedes T.O. 1C-119(A)G-1, dated 1 October 1969, Operational Supplement T.O. 1C-119(A)G-1S-9 and Safety Supplements T.O. 1C-119(A)G-1SS-3 and -6.

See T.O.0-1-1-3 for current status of Flight Manuals, Safety Supplements, Operational Supplements and Flight Crew Checklist.

Commanders are responsible for bringing this publication to the attention of all Air Force personnel cleared for operation of subject aircraft.

Published under authority of the Secretary of the Air Force.

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1 JANUARY 1971

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line in the outer margin of the page.

Total number of pages in this manual is 374 consisting of the following:

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A	0
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CURRENT FLIGHT CREW CHECKLISTS

T.O. 1C-119(A)G-1CL-1
1 January 1971

T.O. 1C-119(A)G-1CL-2
1 January 1971

T.O. 1C-119(A)G-1CL-3
1 January 1971

T.O. 1C-119(A)G-1CL-5
1 January 1971

T.O. 1C-119(A)G-1CL-6
1 January 1971

Zero in this column indicates an original page.

SAFETY SUPPLEMENT RECORD

Safety Supplements are identified by the letters "SS" immediately following the -1 of the basic publication number. Each supplement is also assigned an individual dash number (eg 1C-119(A)G-1SS-1, 1C-119(A)G-1SS-2, etc). Supplements will not be renumbered after publication and will remain effective until rescinded, replaced, or incorporated in the manual. Refer to T.O. 0-1-1-3 and monthly supplement thereto for listing of current Flight Manuals, Checklists, and Operational and Safety Supplements.

SAFETY SUPPLEMENTS INCORPORATED IN THIS CHANGE OR REVISION

NUMBER	DATE	TITLE	DISPOSITION
T.O. 1C-119(A)G-1SS-3	25 June 1969	Engine Fire on the Ground	Rescinded
T.O. 1C-119(A)G-1SS-6	7 August 1970	Runaway/Overspeeding Propeller.	Incorporated

OUTSTANDING SUPPLEMENTS

This portion is to be filled in by you when you receive your flight manual and added to as you receive additional supplements. Safety Supplements outstanding at the time of preparation of this page are listed below for your convenience.

NUMBER	DATE	TITLE	DISPOSITION

OPERATIONAL SUPPLEMENT RECORD

Operational Supplements are identified by a single letter "S" immediately following the -1 of the basic publication number. Each supplement is assigned an individual dash number (eg 1C-119(A)G-1S-1, 1C-119(A)G-1S-2, etc). Supplements will not be renumbered after publication and will remain effective until rescinded, replaced, or incorporated in the manual. Refer to T.O. 0-1-1-3 and monthly supplement thereto for listing of current Flight Manuals, Checklists, and Operational and Safety Supplements.

OPERATIONAL SUPPLEMENTS INCORPORATED IN THIS CHANGE OR REVISION

NUMBER	DATE	TITLE	DISPOSITION
T.O. 1C-119(A)G-1S-9	10 November 1969	Attitude and Heading Reference System	Incorporated

OUTSTANDING SUPPLEMENTS

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NUMBER	DATE	TITLE	DISPOSITION

RECORD OF TIME COMPLIANCE TECHNICAL ORDERS

Except for the following all information is contained in T.O. 1C-119G-1.

Time Compliance Technical Orders (TCTO's), which are applicable to this manual, are listed below with the corresponding title. For further information concerning effectivity, etc, refer to the appropriate technical order.

TCTO No.	Date	Title	Change/Revision/ Supplement Date
1C-119(A)-501	14 Feb 1969	Installation of LAU-74/A MK-24 Automatic Launcher On, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-502	14 Feb 1969	Installation of Goodyear Hard Faced (HFC) Armor in Cockpit and Cargo Area, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-503	14 Feb 1969	Installation of SUU-11 Pods With GAU-2B/A Guns, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-504	1 Oct 1968	Installation of Wilcox 807A VHF Radio, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-505	14 Feb 1969	Installation of ARC-136 UHF Radio and KY-8 Secure Speech Encryption, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-506	14 Feb 1969	Installation of Ammunition Racks, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-507	1 Oct 1968	Installation of Dual FM 622A VHF Radio and FM Homing Equipment, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-508	14 Feb 1969	Installation of Polyurethane Foam in Fuel Cells, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-509	14 Feb 1969	Installation of Fire Control System, Computer Sight, and Safety Control Unit, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-510	14 Feb 1969	Installation of Night Observation Sight, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-512	1 Oct 1968	Installation of 20 KW (EOS) Illuminator and APU, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-513	1 Oct 1968	Installation of Stretched Acrylic Window Panels in Cockpit Compartment, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-517	1 Oct 1968	Installation of 618T-3 SSB HF Radio, AC-119G/K Aircraft	1 Aug 68
1C-119(A)-519	15 Jun 1969	Replacement of SUU-11 Pods With MXU-470/A Modules, AC-119G/K Aircraft	1 Nov 68
1C-119(A)-520	14 Feb 1969	Weight Reduction Removal of 618T-3 Radio Group "B" Components, AC-119G/K Aircraft	1 Nov 68

TCTO No.	Date	Title	Change/Revision/ Supplement Date
1C-119(A)-522	1 Mar 1970	Installation of Overboard Vent for APU Fire Extinguisher AC-119G/K Aircraft	1 Jan 71
1C-119(A)-523	1 Mar 1970	Installation Emergency Fuel Shutoff Valve for APU Fuel System, AC-119G/K Aircraft	1 Jan 71
1C-119(A)-524C	28 Nov 1969	Installation of Gyroscopic Attitude Reference System, AC-119 Aircraft	1 Jan 71
1C-119(A)G-512	1 Oct 1968	Installation of AN/ARQ-25, AC-119G Aircraft	1 Aug 68
1C-119(A)G-514	12 Feb 1969	Weight Reduction Removal of Aircraft Heaters and Oxygen Bottles AC-119G Aircraft	
1C-119(A)G-515	15 Dec 1968	Weight Reduction, Removal of AN/APN-70 Group "B" Components AC-119G Aircraft	
1C-119(A)G-516	12 Feb 1969	Weight Reduction Removal of Inboard Fuel Tanks, AC-119G Aircraft	

TABLE OF CONTENTS

DON'T HURRY!

READ

SCOPE . . . . When used in conjunction with T.O. 1C-119G-1, this partial manual contains the necessary information for safe and efficient operation of the AC-119G aircraft. This manual provides knowledge of aircraft characteristics which differ from the C-119G aircraft as well as complete normal and emergency operating procedures. Sections II, III, VI, and VIII in this manual are complete.

ARRANGEMENT . . . The supplemental information contained in this manual is arranged similar to the basic flight manual so you may refer easily from one manual to the other. Information contained in the basic manual, and remaining unchanged for the AC-119G configuration, is identified by a note similar to the following: "Information is contained in T.O. 1C-119G-1". Paragraphs of the basic manual which require a change are presented herein in their entirety and should be read in lieu of the corresponding paragraph in the basic manual.

CHECKLISTS . . . . Complete Pilots' and Flight Mechanic's, Illuminator Operator's, Navigator/Safety Officer's, NOS Operator's, and Gunners' checklists have been issued as separate technical orders. Line items of the abbreviated checklist are identical to those of the amplified procedures of Sections II, III, and VIII of the Flight Manual with respect to arrangement and item number.

ILLUSTRATIONS . . . . Illustrations are presented in the partial manual to adequately cover the aircraft changes. Figure numbers and reference numbers appearing throughout the text refer to illustrations contained in this manual and are not intended to coincide with those contained in T.O. 1C-119G-1.

YOUR RESPONSIBILITY - LET US KNOW . . Every effort is made to keep the Flight Manual current. Review conferences 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 Hq. WRAMA, Service Engineering Division, Robins AFB, Georgia 31093, Attn: MMEAH.

SECTION I

DESCRIPTION

table of contents

THE AIRCRAFT.

AC-119G.

The Fairchild Hiller AC-119G aircraft is a twin boom, high-wing, land monoplane, of all metal construction, modified to provide accurate, all-weather, side-firing weapons delivery. This modification incorporates the installation of four MXU-470/A module 7.62 mm guns, LAU-74/A flare launcher, fire control computer, lead computing optical gun sight, fire control display, night observation sight (NOS), illuminator, auxiliary power unit (APU), and additional navigational and communication equipment.

SIZE.

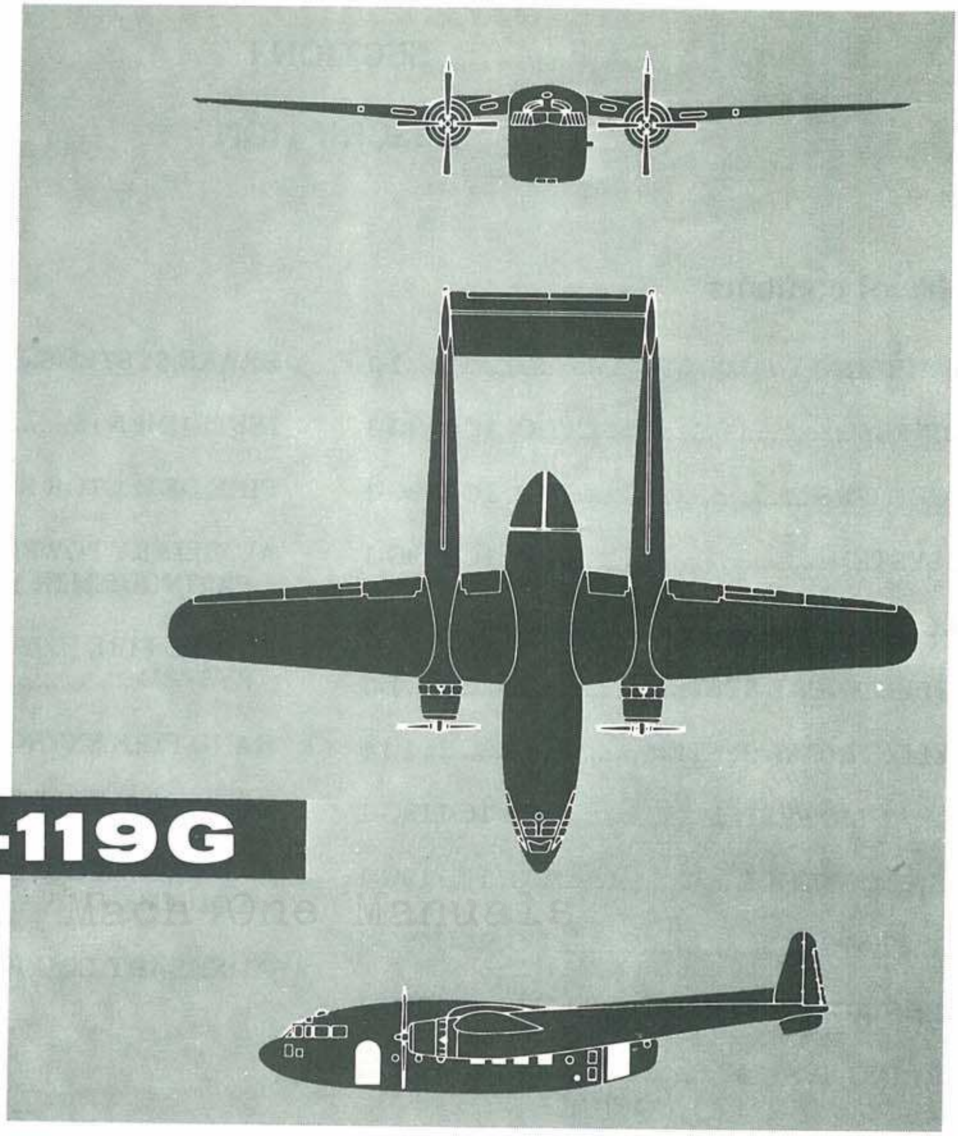
This information is contained in T.O. 1C-119G-1.

GROSS WEIGHT.

The design gross weight of the aircraft is 64,000 pounds. For detailed weight information, refer to OPERATING LIMITATIONS, Section V, this manual.

CREW.

The basic crew of the AC-119G aircraft normally consists of pilot, copilot, navigator/safety officer, flight mechanic, illuminator operator, two gunners, and NOS operator.



AC-119G

Figure 1-1

GENERAL ARRANGEMENT

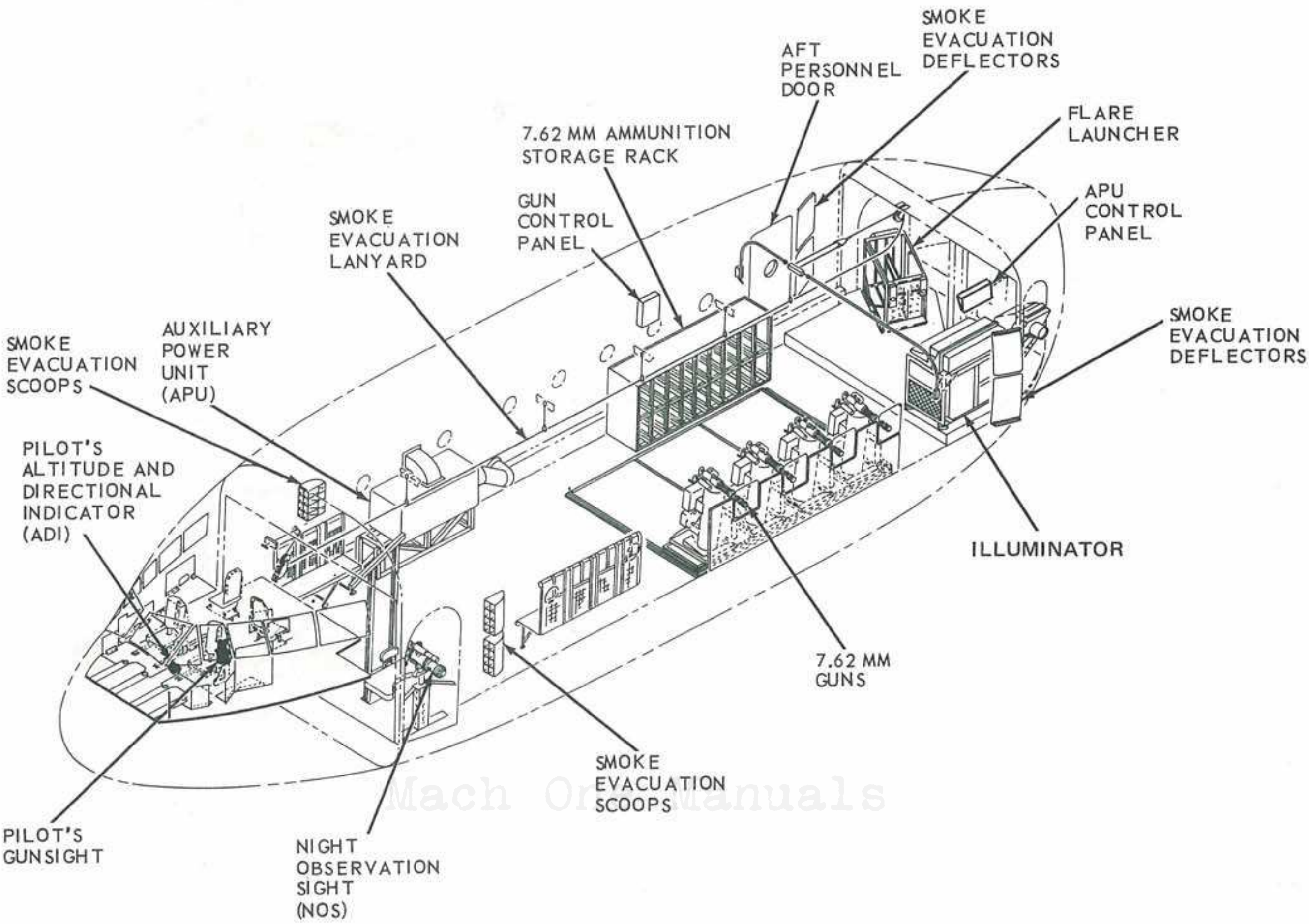


Figure 1-2

FUNCTIONS.

The aircraft function is to provide continuous accurate delivery of ordnance in an approximately circular path around a target. This form of attack requires little recovery time for the aircraft and results in flank and rear exposure of a target not protected by 360-degree shielding.

The following information is contained in T.O. 1C-119G-1.

ENGINES.

PROPELLERS.

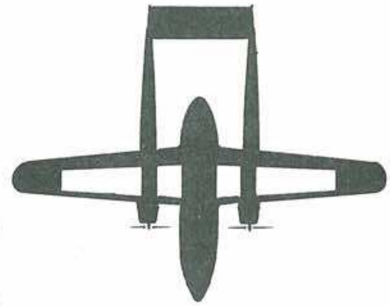
OIL SYSTEM.

FUEL SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

Although each engine is provided with its own separate fuel system and fuel supply tanks, the two systems are interconnected by a crossflow system which makes it possible to operate either engine from any one of the four tanks. Facilities for engine priming, oil dilution, and vapor return from the carburetor are incorporated into each system, as are shutoff valves for preventing fuel flow to the engine should an emergency condition arise. Fuel for the operation of the APU is taken directly from the fuel crossfeed line and is manifolded around the crossflow valve. Heater fuel supply is obtained from the engine-driven fuel pumps when the engines are operating. Boost pumps must be used to supply the fuel under pressure when the engines are shut down. The specification and grade

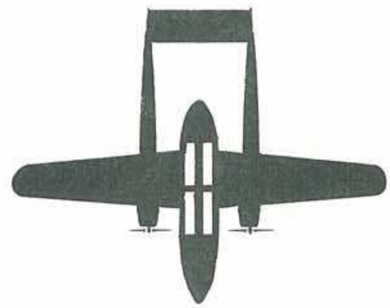
FUEL QUANTITY



WING TANKS
(SELF-SEALING)

	USABLE FUEL		FULLY SERVICED	
	GAL	LB	GAL	LB
RIGHT INBOARD	448	2688	460	2760
RIGHT OUTBOARD	808	4848	826	4956
LEFT INBOARD	448	2688	460	2760
LEFT OUTBOARD	808	4848	826	4956

TOTAL USABLE WING FUEL LOAD (ESTIMATED)
IS 2512 gal — 15,072 lb



AUXILIARY TANKS
(BENSON)

	USABLE FUEL		FULLY SERVICED	
	GAL	LB	GAL	LB
EACH TANK	506	3036	509	3054

TOTAL USABLE AUXILIARY FUEL IS
—TWO TANKS: 1012 gal —6072 lb
—FOUR TANKS: 2024 gal —12,144 lb

USABLE FUEL VS FLIGHT ATTITUDE

	INBOARDS (EACH TANK)		OUTBOARDS (EACH TANK)	
	GAL	LB	GAL	LB
5° UP	446	2676	802	4812
10° UP	439	2634	790	4740
15° UP	426	2556	771	4626
20° UP	413	2478	741	4446

	INBOARDS (EACH TANK)		OUTBOARDS (EACH TANK)	
	GAL	LB	GAL	LB
5° DOWN	455	2730	800	4800
10° DOWN	437	2622	785	4710
15° DOWN	424	2544	762	4572
20° DOWN	412	2472	732	4392

NOTES:

1. WINGS—LEVEL ATTITUDE ASSUMED

2. ALL FUEL WEIGHTS BASED ON A DENSITY OF 6 LB /GAL

Figure 1-3

of fuel used are given in Servicing Diagram, figure 1-16. For a schematic presentation of the system, see figure 1-4.

ANKS.

Four self-sealing fuel tanks contain the normal fuel supply. One tank is located in each side of the center section and one in each wing outer panel. Each inboard tank is composed of three cells (numbered 1 to 3); eight cells (numbered 4 to 11) comprise the outboard tank in each wing outer panel. The tank cells are interconnected. The highest cell of each tank is vented to the atmosphere in such a manner that no spilling or siphoning of the fuel is possible. All tanks are provided with a marked filler neck and drain for overflow fuel. A sump is located at the bottom of each tank with a drain to permit removal of accumulated water and foreign matter. Polyurethane reticulated foam baffle material is installed in all 22 fuel cells as an explosion suppressant. The addition of the foam in the fuel cells reduces the total fuel capacity approximately 3 percent, but reduces the usable fuel capacity by approximately 5 percent (figure 1-3).

DC ELECTRICAL SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

The aircraft's 28-volt direct current electrical system is the single-wire, ground-return type generally employed in modern aircraft. A battery, two engine-driven generators, and a 28-volt dc transformer/rectifier unit comprise the major power source components of the system in flight. To assume the power load during ground operation, an external power receptacle is provided for the utilization of an external generator. The voltage in the system is automatically regulated to provide a constant output throughout the rated load range of the engine-driven generators. Heavy interconnecting wiring between strategically located junction boxes forms the medium of dc power distribution. The distribution system is accomplished through a series of busses: main, battery, and flight emergency. A monitor bus is also incorporated in addition to the three busses stated above.

BATTERY.

A 24-volt, 36 ampere-hour aircraft storage battery is installed under the cargo compartment floor just aft of the rear spar frame. The battery is accessible from the outside of the aircraft through a placarded, hinged door. A forced vent system drives battery fumes through a pint jar battery sump where the fumes are neutralized. The battery is used for ground starting of the APU (auxiliary power unit) when no external power is available, and to provide an emergency source of power at all times if the generators should fail. Emergency provisions are made for operation of the alarm bell and flare launcher jettisoning directly from the battery.

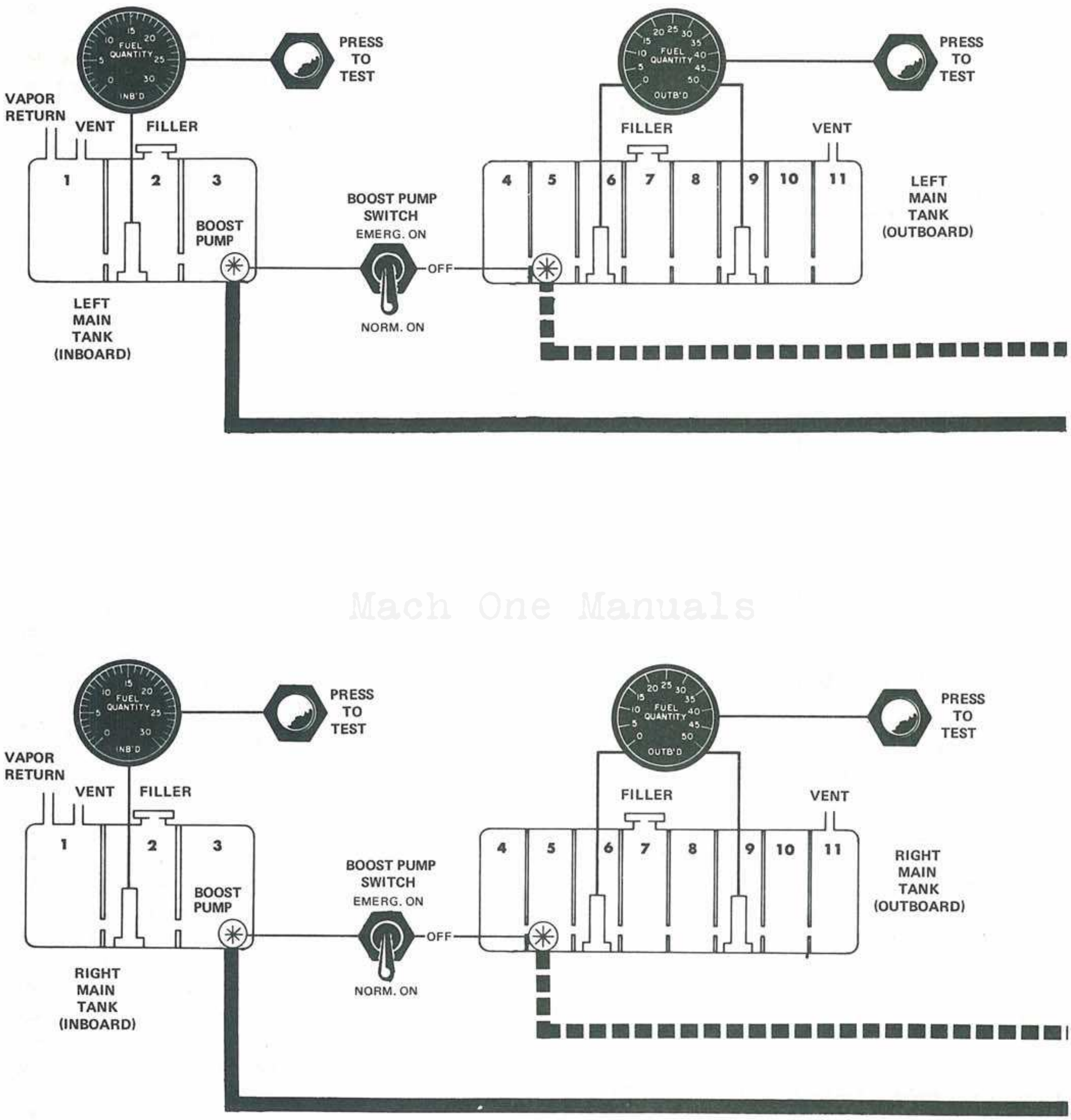
MAIN BUS.

Except for the following all information is contained in T.O. 1C-119G-1.

The main bus, which accomplishes the distribution of 28-volt dc power throughout the aircraft, is energized normally by the engine-driven generators; however, the output of the transformer/rectifier unit or an external generator also may be used to power the bus. The battery is connected to the main bus by the battery relay which is controlled by the BATTERY switch, generator failure relays, and left main gear oleo safety switch. Should a complete failure of generator power occur in flight, the battery relay automatically disconnects the main bus from the battery. The generator failure relays, one in each of the two generator output circuits, provide the means for the automatic operation of the battery relay. Provisions for overriding the automatic disconnect are incorporated to permit energization of the main bus from the battery during an in-flight emergency. On the ground, the left main landing gear oleo safety switch operates the battery relay so that the battery is connected to the main bus whenever the left main gear is extended and the strut compressed and the battery switch is placed in the ON position. Refer to MAIN LANDING GEAR OLEO SAFETY (BARREL) SWITCHES, Section VII, T.O. 1C-119G-1.

Generator and Transformer/Rectifier Failure Relays.

Two 28-volt dc generator failure relays, one for each generator and a failure relay for the transformer/rectifier, are installed to provide the



FUEL SYSTEM

Figure 1-4. (Sheet 1 of 2)

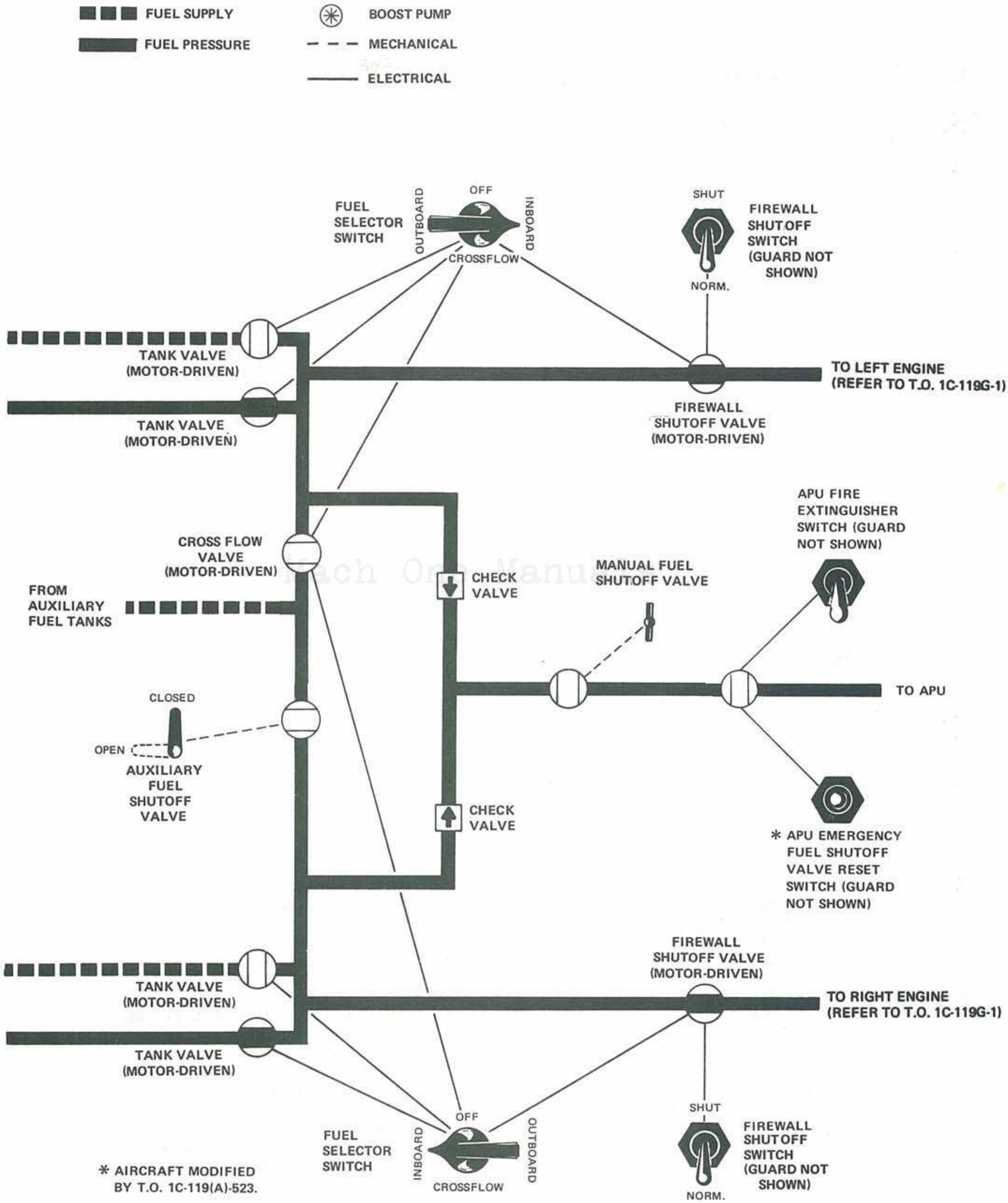
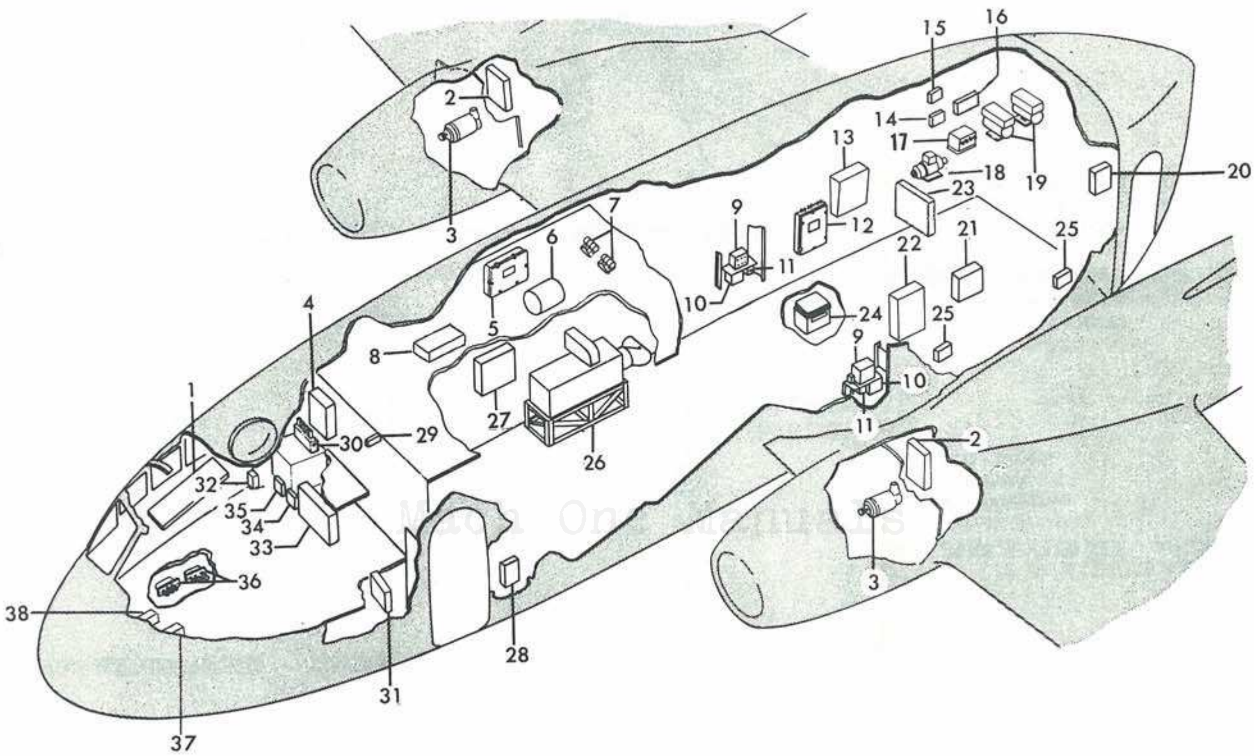


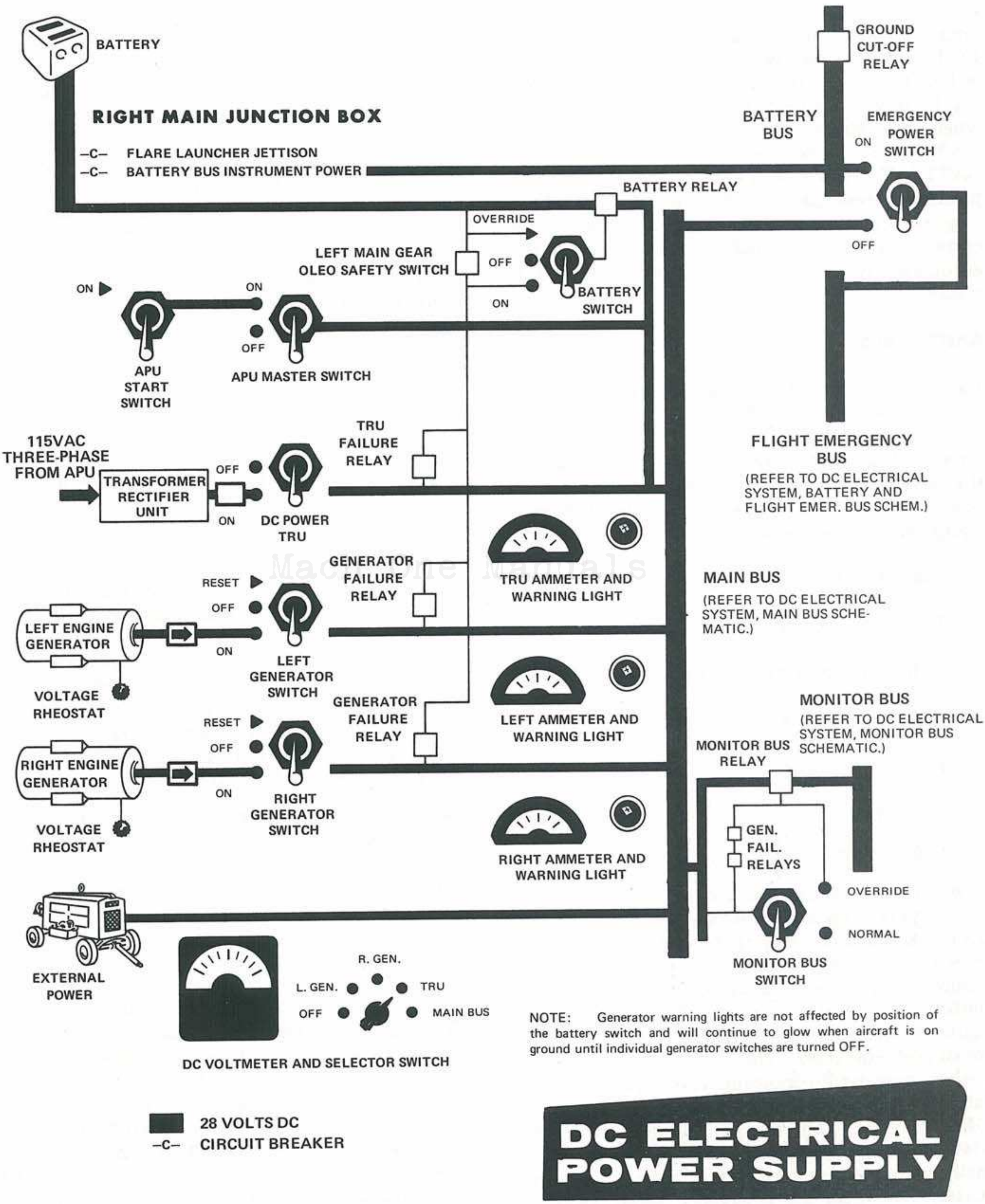
Figure 1-4. (Sheet 2 of 2)

LOCATION OF ELECTRICAL EQUIPMENT (Typical)



1. OVERHEAD PANEL
2. NACELLE JUNCTION BOX
3. ENGINE GENERATOR
4. RADIO JUNCTION BOX NO. 2
5. AUXILIARY FLOOR JUNCTION BOX
6. TRANSFORMER/RECTIFIER UNIT
7. INSTRUMENT INVERTERS
8. GYRO PALLET
9. ENGINE GENERATOR VOLTAGE REGULATORS
10. FIELD CONTROL RELAY
11. OVERVOLTAGE RELAY
12. RIGHT MAIN JUNCTION BOX
13. GUN CONTROL PANEL
14. PILOT'S INSTRUMENT INVERTER RELAY
15. FLARE LAUNCHER JUNCTION BOX
16. PILOT'S INSTRUMENT INVERTER
17. AUTOPILOT POWER JUNCTION BOX
18. AUTOPILOT INVERTER
19. SINGLE PHASE INVERTERS
20. APU CONTROL PANEL
21. AUTOPILOT CONTROLLER JUNCTION BOX
22. LEFT MAIN JUNCTION BOX
23. OVERHEAD JUNCTION BOX
24. BATTERY
25. GUN JUNCTION BOX
26. APU-DRIVEN GENERATOR
27. AC POWER DISTRIBUTION BOX
28. NOS JUNCTION BOX
29. EMERGENCY CIRCUIT BREAKER PANEL
30. ARN-21 JUNCTION BOX
31. NOSE JUNCTION BOX
32. NAVIGATOR'S CIRCUIT BREAKER JUNCTION BOX
33. MAIN RADIO JUNCTION BOX
34. UHF-DF JUNCTION BOX
35. MONITOR BUS BOX
36. EXTERNAL POWER RECEPTACLES
37. PILOT'S ATTITUDE AND DIRECTIONAL INDICATOR
38. ADI CONTROLLER

Figure 1-5



NOTE: Generator warning lights are not affected by position of the battery switch and will continue to glow when aircraft is on ground until individual generator switches are turned OFF.

Figure 1-6

following functions in event of system failure. If any one of the three relays is energized by having its related power supply operating while the aircraft is in flight, the battery may be connected to the main dc bus by positioning the BATTERY switch to ON. If all three relays are deenergized, the battery is connected to the main dc bus only when the aircraft is on the ground and the BATTERY switch is ON, or whenever the BATTERY switch is held in the OVERRIDE position. Deenergization of either or both of the engine generator failure relays causes the corresponding warning light to illuminate, and also automatically deenergizes the monitor dc and ac busses.

BATTERY BUS.

Except for the following all information is contained in T.O. 1C-119G-1.

Should all generators fail in flight, the output of the battery is automatically disconnected from all busses except the battery bus. The following equipment will be operative:

Flare launcher jettisoning

Instrument power failure warning light

Left engine generator failure warning light

Right engine generator failure warning light

Pilot's C-4 spotlight

Alarm bell

Spark control

Power for the battery bus is supplied directly from the battery regardless of the position of the BATTERY switch. During ground operation, the pilot's C-4 spotlight and the instrument power failure warning light are disconnected from the battery bus by the ground cut-off relay. These lights would otherwise deplete the battery by remaining energized when the aircraft is in a parked, power-off condition. The engine generator failure warning lights are deenergized when the GENERATOR switches are turned OFF. The attitude and directional indicator and pilot's instrument inverter are powered directly from the battery bus when the emergency power switch is positioned to ON.

FLIGHT EMERGENCY BUS.

A flight emergency bus is installed to conserve battery power for the energization of essential flight instruments under emergency conditions. Normally, the flight emergency bus receives power from the main bus through the main bus instrument power circuit breaker. Should all generators fail in flight, the main bus, and consequently the flight emergency bus is deenergized. The flight emergency bus may, however, be reenergized from the battery bus through the battery bus instrument power circuit breaker by positioning the emergency power switch to ON. The flight emergency bus supplies the following equipment:

Pilot's turn-and-slip indicator

Spare instrument inverter

Pilot's instrument inverter control circuit

Pitot heaters

Generator reset (power for resetting the engine generator field control relay electrically)

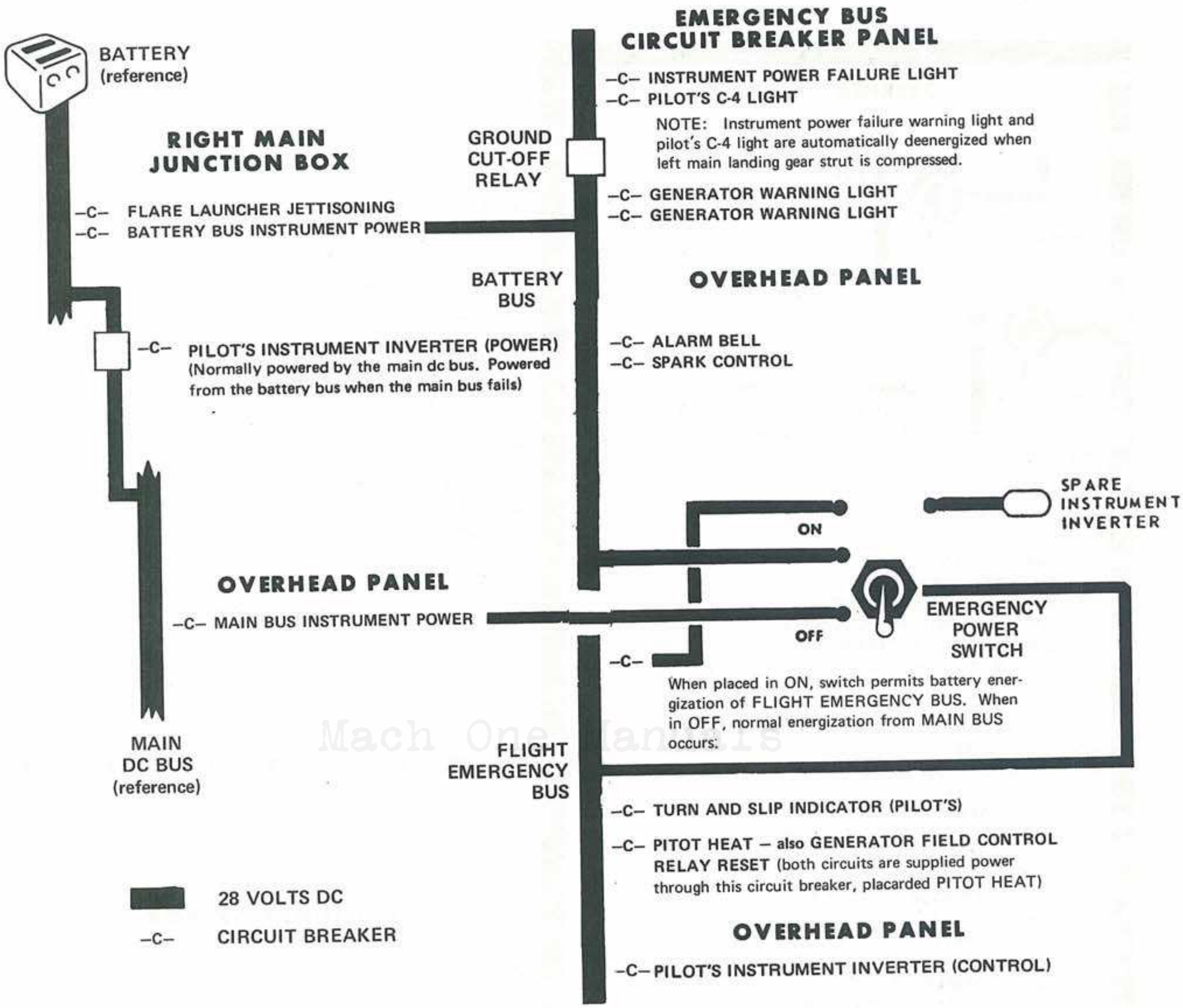
The flight emergency bus is not dependent upon the position of the BATTERY switch or battery relay. Pitot heat and generator reset require manual switch selection. The battery bus and flight emergency bus circuit breakers are located aft of the flight mechanic's station.

DC ELECTRICAL SYSTEM CONTROLS AND INDICATORS.

Except for the following all information is contained in T.O. 1C-119G-1.

Battery Switch.

The three-position battery switch, placarded BATTERY with positions placarded ON, OFF, and OVERRIDE, is located on the engine start panel. The BATTERY switch controls a relay connecting the battery to the main dc bus. In the OFF position, the battery is disconnected from the main dc bus. In the ON position, the battery is connected to the main dc bus if the left gear strut is compressed, or if any of the aircraft's generators is on the bus. In the OVERRIDE position, the



BATTERY and FLIGHT EMERGENCY BUSSES

Figure 1-7

battery is connected to the main dc bus regardless of the operation of generators or compression of the left gear strut. The ON position permits the generators to charge the battery, or, when the transformer/rectifier unit is operating, connects the transformer/rectifier unit to the main bus. OVERRIDE, a momentary-contact position, is an emergency position permitting the battery to supply the main bus directly when no generator power is available. The BATTERY switch should be OFF whenever external power is used.

CAUTION

To prevent rapid depletion of the battery all unnecessary equipment should be individually turned off before the OVERRIDE position is used. The OVERRIDE position should not be used for starting the APU.

OVERHEAD PANEL

–C– PITOT HEAT
–C– PROPELLER DEICING TIMER

PROPELLER DEICING
OFF
ON
–C– PROPELLER DEICING

CARGO HEAT MASTER SWITCH
OFF
ON
–C– CABIN BLOWERS (CONTROL)
–C– HEATER CONTROL (PRIMARY FUEL)
–C– HEATER VALVES (HEATER OPERATION)

–C– ANTICOLLISION LIGHTS
–C– ANTI-ICING (INDICATORS)
–C– AUTOMATIC PILOT (INVERTER)
–C– AUXILIARY INSTRUMENT LIGHTS
–C– CARBURETOR AIR CONTROL
–C– CARBURETOR AIR TEMPERATURE
–C– CARGO HEAT
–C– COCKPIT AIR
–C– CONTROL LAMP (ALDIS)
–C– COWL FLAPS
–C– CYLINDER HEAD TEMPERATURE
–C– DOME LIGHTS
–C– DOOR WARNING LIGHTS
–C– ELEVATOR LOCK–NOSE STEERING
–C– ENGINE ACCESSORY HEAT
–C– FIRE DETECTOR
–C– FIRE/SIGHT MODE CONTROL PANEL
–C– FIRE EXTINGUISHER
–C– FORMATION LIGHTS
–C– FUEL AND OIL SHUT-OFF (VALVES)
–C– FUEL CROSSFLOW (VALVES)
–C– FUEL BOOSTER PUMPS (CONTROL)
–C– FUEL PRIMER–OIL DILUTION
–C– GUN STATUS PANEL
–C– INSTRUMENT INVERTER
–C– INSTRUMENT LIGHTS
–C– LANDING GEAR CONTROL
–C– LANDING GEAR INDICATION (LIGHTS)
–C– LANDING GEAR WARNING (HORN)
–C– LANDING LIGHTS
–C– MAIN BUS INSTRUMENT POWER
–C– MAIN INVERTER

(FOR ORIGIN OF THIS CIRCUIT REFER TO APPLICABLE DC POWER SUPPLY SCHEMATIC.)

–C– NAVIGATION LIGHTS
–C– OIL COOLER CONTROL
–C– OIL DILUTION–FUEL PRIMER
–C– OIL LEVEL
–C– OIL TEMPERATURE
–C– PEDESTAL FRICTION
–C– SIGHT AND ARMAMENT CONTROL
–C– PROPELLER THROTTLE STOP
–C– RADOME ANTI-ICING
–C– STARTER
–C– SUPERCHARGER
–C– TEST POWER INDICATOR LIGHTS
–C– THROTTLE STOPS
–C– TRIM TAB CONTROL
–C– TRIM TAB (INDICATORS)
–C– TURN-AND-SLIP INDICATOR
–C– WATER INJECTION
–C– WINDSHIELD ANTI-ICING
–C– WINDSHIELD WIPERS
–C– WING AND TAIL ANTI-ICING
–C– WING FLAPS

NOS SEAT CONTROL JUNCTION BOX

–C– NOS SEAT CONTROL

LEFT MAIN JUNCTION BOX

–C– CABIN BLOWER (POWER)
–C– FUEL BOOSTER PUMPS (POWER)
–C– GUN AREA WORK LIGHTS
–C– HEATER FUEL VALVE
–C– ILLUMINATOR
–C– WATER INJECTION PUMP

DC ELECTRICAL MAIN BUS Typical

28 VOLTS DC
–C– CIRCUIT BREAKER
–F– FUSE

Figure 1-8. (Sheet 1 of 2)

RIGHT NACELLE JUNCTION BOX

–C– AMMETER (R. GEN)
–C– COWL FLAP MOTOR
–C– DEICING AMMETER (PROPELLER)
–C– GENERATOR (CONTROL)
–C– GENERATOR WARNING LIGHT (R. GEN)
–C– LANDING LIGHT
–C– NACELLE PREHEAT
–C– VOLTMETER (R. GEN)

RIGHT MAIN JUNCTION BOX

–C– APU EMER FUEL SHUTOFF VALVE RESET
–C– APX-6 TEST
–C– CABIN BLOWER (POWER)
–C– FLOOR LIGHTS
–C– FUEL BOOSTER PUMPS (POWER)
–C– HEATER FUEL VALVE
–C– TEST RECEPTACLE APX-25
–C– WATER INJECTION PUMP
–C– WATER QUANTITY GAGE
–C– FLARE LAUNCHER
–C– PILOT'S INSTRUMENT INVERTER
–F–

OVERHEAD JUNCTION BOX

–C– AUTO PILOT INVERTER
–C– AUTO PILOT POWER
–C– INVERTER FAILURE
–C– MAIN INVERTER (POWER)
–C– PROPELLER REVERSING STOP
–C– SPARE INVERTER (POWER)
–C– SPARE INVERTER CONTROL (CHANGEOVER)

NOSE JUNCTION BOX

–C– AC GENERATOR CONTROL (EXTERNAL POWER)
–C– ACCESSORY COMPARTMENT DOME LIGHTS
–C– CARGO DOME LIGHTS
–C– NAVIGATOR'S TABLE LIGHT
–C– RADIO POWER
–C– VOLTMETER

AUXILIARY FLOOR JUNCTION BOX

–C– APU START
–C– AMMETER (TRU)
–C– IGNITION ANALYZER
–C– INSTRUMENT INVERTER LIGHT (BOTH)
–C– MAIN INSTRUMENT INVERTER (POWER)
–C– SPARE INSTRUMENT INVERTER (POWER)
–C– VOLTMETER (TRU)
–C– WARNING LIGHT (TRU)

LEFT NACELLE JUNCTION BOX

–C– AMMETER (L. GEN)
–C– COWL FLAP MOTOR
–C– DEICING AMMETER (PROPELLER)
–C– GENERATOR (CONTROL)
–C– GENERATOR WARNING LIGHT (L. GEN)
–C– LANDING LIGHT
–C– NACELLE PREHEAT
–C– VOLTMETER (L. GEN)

NAVIGATOR'S CIRCUIT BREAKER JUNCTION BOX

–C– LIAISON 618T3
–C– LIAISON 618T3
–C– UHF COMMAND AN/ARC-136
–C– VHF FM622-A SET 1
–C– VHF FM622-A SET 2
–C– SECURE SPEECH KY-8
–C– SLAD
–C– VHF FM622-A SET 1
–C– FIRE CONTROL DISPLAY
–C– COMPUTER
–C– CARGO INTERPHONE
–C– MANUAL GUN CONTROL
–C– AUTOMATIC GUN CONTROL
–C– MASTER ARM CONTROL
–C– UHF RANGING AN/ARQ-25

MONITOR BUS JUNCTION BOX

–C– PROPELLER DEICING TIMER

GUN CONTROL PANEL

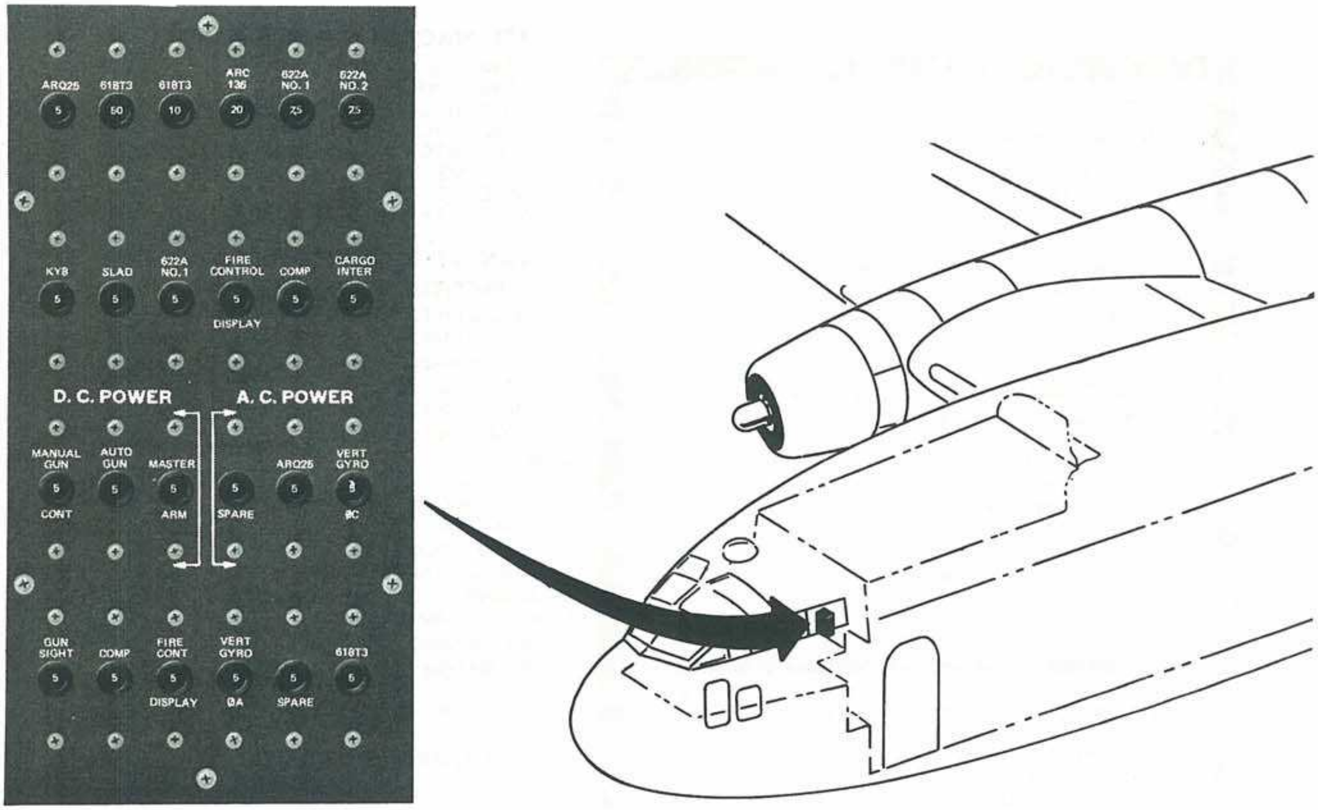
–C– GUN TIMER
–C– PANEL LIGHTS
–C– GUN SAFE
–C– FIRING CIRCUIT
–C– FIRING CIRCUIT
–C– FIRING CIRCUIT
–C– FIRING CIRCUIT
–C– MASTER ARM POWER
–C– CHARGING CIRCUIT
–C– CHARGING CIRCUIT
–C– CHARGING CIRCUIT
–C– CHARGING CIRCUIT
–C– MONITOR BUS CONTROL

RADIO JUNCTION BOX

–C– ANTENNA COUPLER
–C– ARN-21 (TACAN)
–C– AUTO COMPASS NO. 1
–C– AUTO COMPASS NO. 2
–C– GLIDE PATH RECEIVER
–C– HOMING ADAPTER
–C– IFF TRANSMITTER
–C– INTERPHONE
–C– LORAN
–C– MARKER RECEIVER
–C– RADAR NAVIGATION
–C– UHF COMMAND
–C– VHF COMMAND
–C– VHF NAVIGATION
–C– VHF NAVIGATION TEST

NOTE . . . More circuit breakers may be found listed here than occur in a specific panel or junction box. This listing represents a complete composite of all AC-119G aircraft. On any specific aircraft, the circuit breakers are clearly placarded at the junction box or panel in which they are located.

Figure 1-8. (Sheet 2 of 2)



NAVIGATOR'S CIRCUIT BREAKER BOX

Figure 1-9

Voltage Regulator Rheostats.

Two voltage regulators, one for each engine generator, are mounted on the walls of the cargo compartment. Each regulator is equipped with a knurled knob which operates a rheostat to control the voltage output of the related generator. Refer to T.O. 1C-119G-1.

CAUTION

Voltage adjustment by use of voltage regulator rheostats is to be accomplished only by qualified personnel, except as stated in FAILURE OF ONE (or BOTH) ENGINE GENERATORS, Section III.

DC Voltmeter Selector Switch and Voltmeter.

A five-position, rotary-type dc voltmeter selector switch (figure 1-6), placarded D.C. VOLTAGE, and a 30-volt dc voltmeter (figure 1-6) are mounted on the copilot's instrument panel. The placarded switch positions are OFF, L. GEN., R. GEN., TRU, and MAIN BUS. The voltmeter will indicate the voltage output from the component selected by the selector switch.

AC ELECTRICAL SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

NOTE

The three-phase instrument inverters provide no function in the present installation.

Alternating current for the operation of flight instruments, engine instruments, autopilot, radio

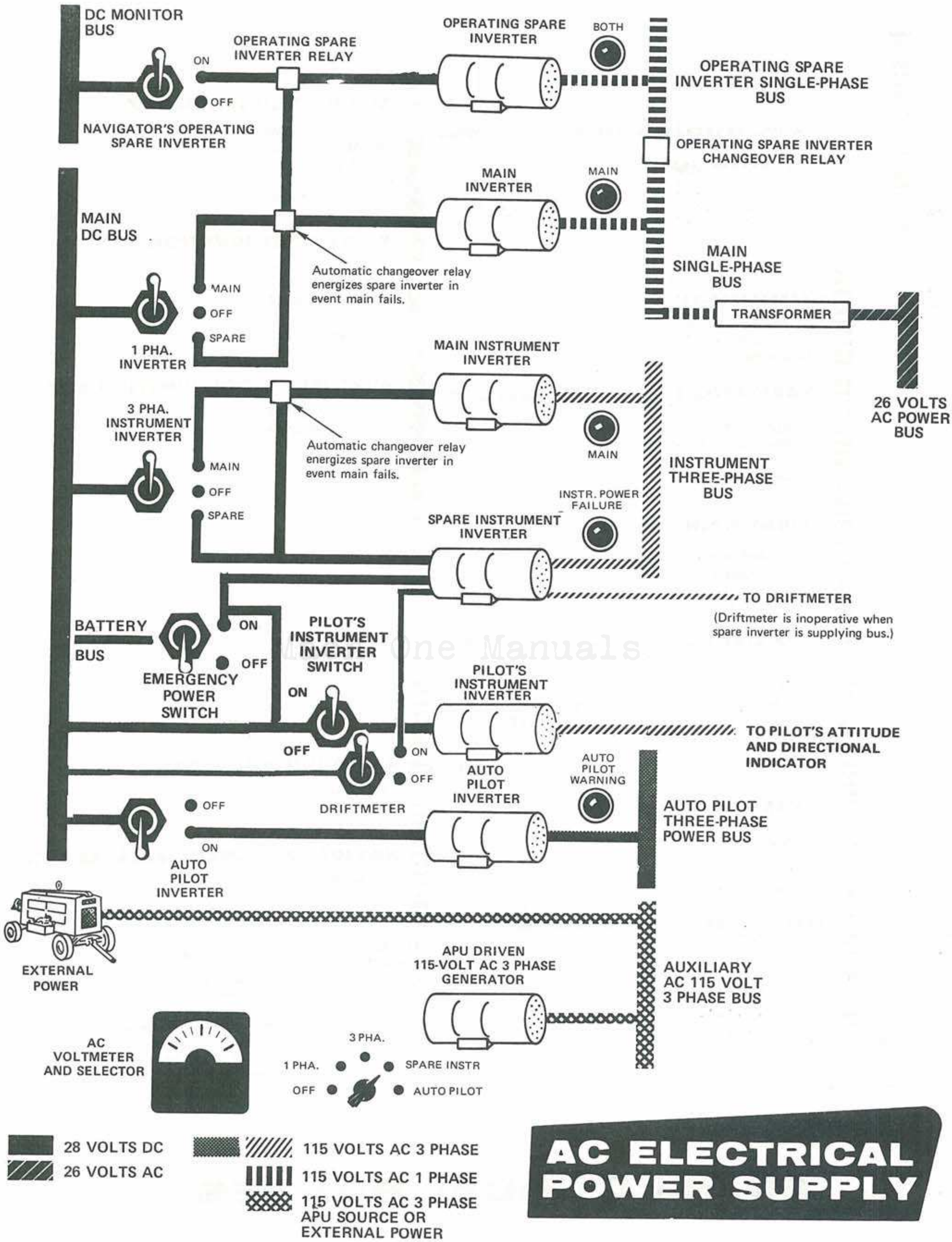
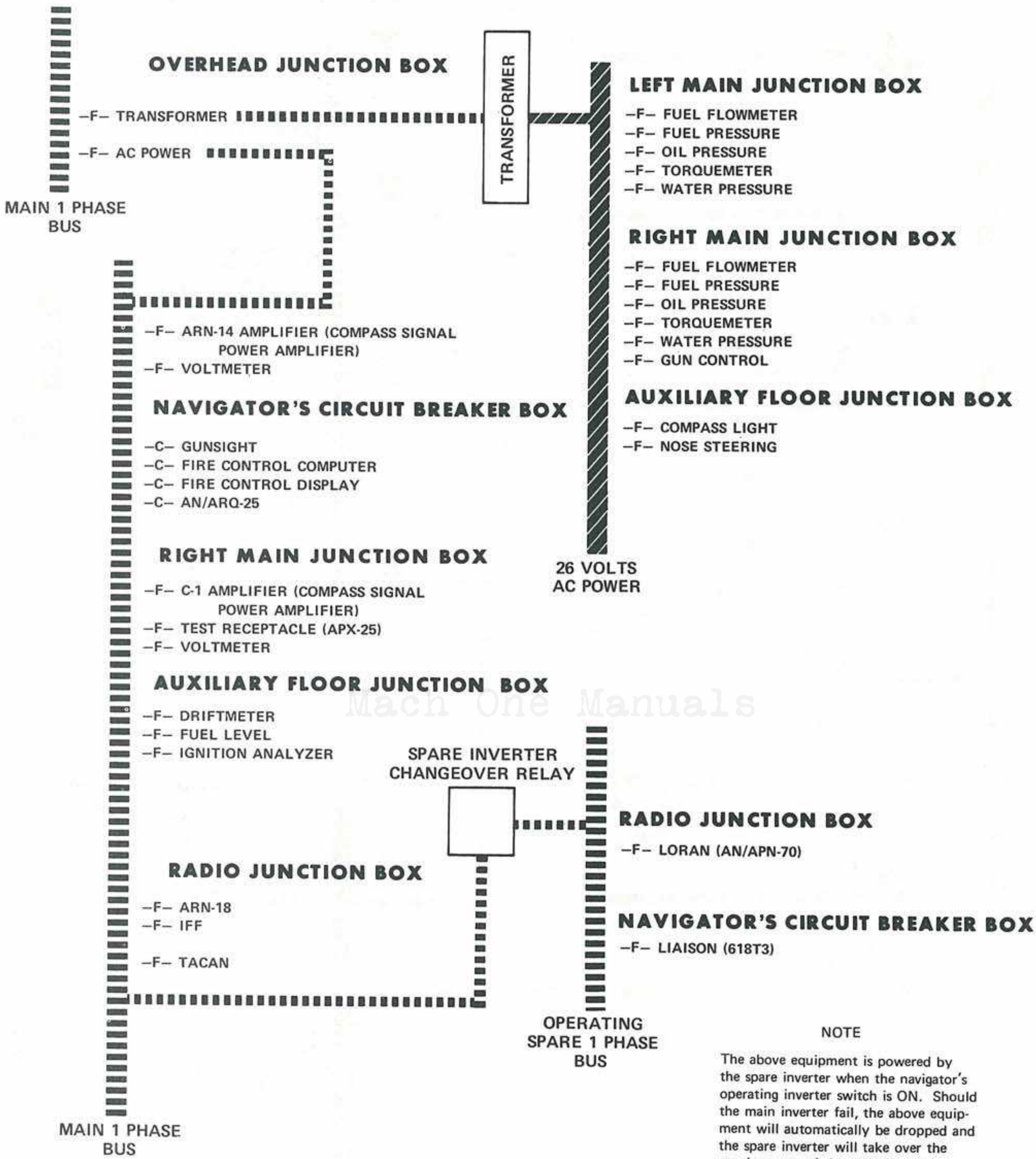

DC MONITOR BUS
ON
OFF
NAVIGATOR'S OPERATING SPARE INVERTER
OPERATING SPARE INVERTER RELAY
OPERATING SPARE INVERTER
BOTH
OPERATING SPARE INVERTER SINGLE-PHASE BUS
OPERATING SPARE INVERTER CHANGEOVER RELAY
MAIN INVERTER
MAIN
MAIN DC BUS
Automatic changeover relay energizes spare inverter in event main fails.
MAIN SINGLE-PHASE BUS
MAIN
OFF
SPARE
1 PHA. INVERTER
TRANSFORMER
26 VOLTS AC POWER BUS
MAIN INSTRUMENT INVERTER
3 PHA. INSTRUMENT INVERTER
Automatic changeover relay energizes spare inverter in event main fails.
MAIN
MAIN
OFF
SPARE
INSTRUMENT THREE-PHASE BUS
INSTR. POWER FAILURE
SPARE INSTRUMENT INVERTER
TO DRIFTMETER
(Driftmeter is inoperative when spare inverter is supplying bus.)
BATTERY BUS
ON
OFF
EMERGENCY POWER SWITCH
PILOT'S INSTRUMENT INVERTER SWITCH
ON
OFF
PILOT'S INSTRUMENT INVERTER
TO PILOT'S ATTITUDE AND DIRECTIONAL INDICATOR
ON
OFF
DRIFTMETER
AUTO PILOT INVERTER
AUTO PILOT WARNING
AUTO PILOT THREE-PHASE POWER BUS
OFF
ON
AUTO PILOT INVERTER
EXTERNAL POWER
APU DRIVEN 115-VOLT AC 3 PHASE GENERATOR
AUXILIARY AC 115 VOLT 3 PHASE BUS
AC VOLTMETER AND SELECTOR
3 PHA.
1 PHA.
SPARE INSTR
OFF
AUTO PILOT
28 VOLTS DC
26 VOLTS AC
115 VOLTS AC 3 PHASE
115 VOLTS AC 1 PHASE
115 VOLTS AC 3 PHASE APU SOURCE OR EXTERNAL POWER
AC ELECTRICAL POWER SUPPLY

Figure 1-10



NOTE

The above equipment is powered by the spare inverter when the navigator's operating inverter switch is ON. Should the main inverter fail, the above equipment will automatically be dropped and the spare inverter will take over the requirements of the main inverter.

AC ELECTRICAL BUSSES

Figure 1-11. (Sheet 1 of 2)

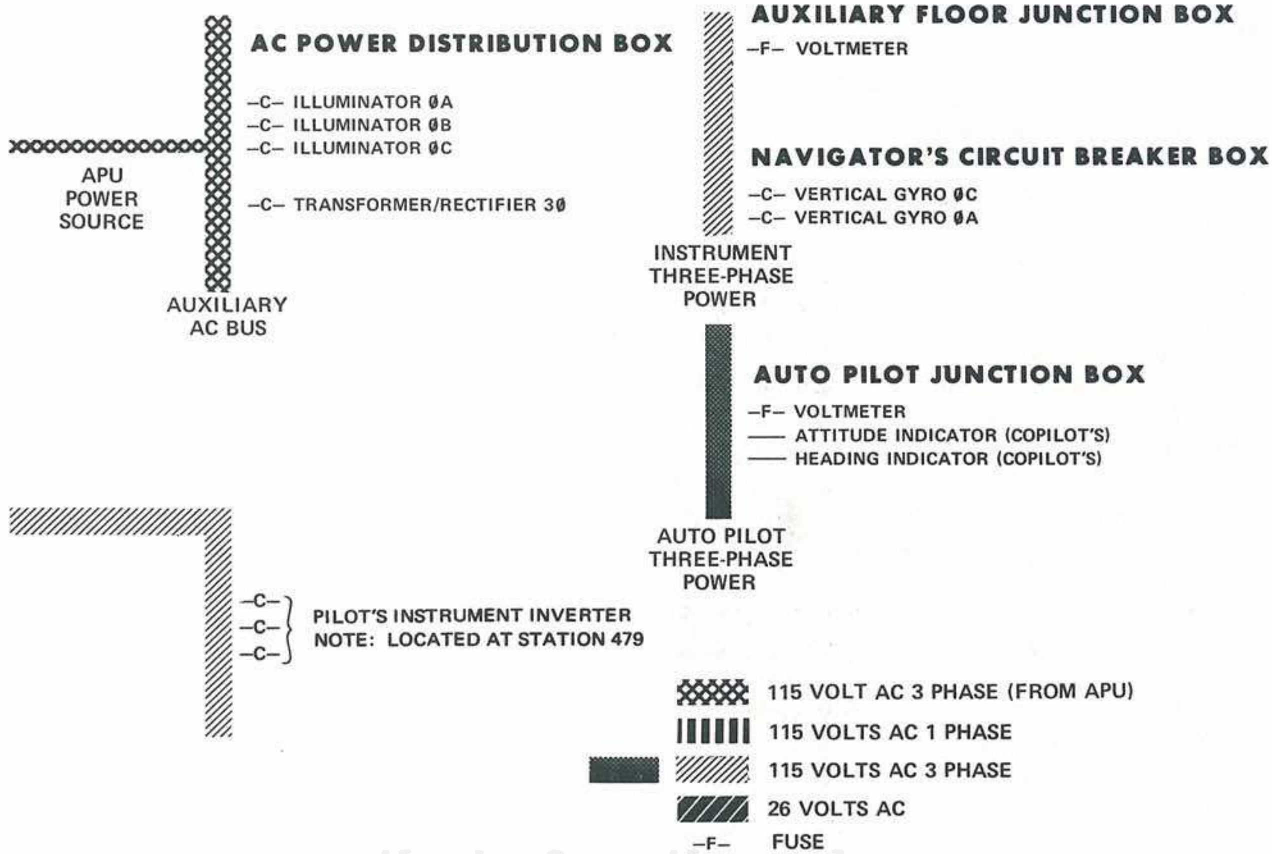


Figure 1-11. (Sheet 2 of 2)

equipment, fire control system, and for other ac electrical requirements on the aircraft is supplied by six inverters. The inverters are 28-volt dc compound-wound motors driving ac generators built on the same shaft. The ac supply is dependent, therefore, upon the dc system. The aircraft is equipped with a main and a spare single-phase inverter, a main and a spare three-phase inverter, an auto-pilot inverter, and a pilot's instrument inverter. The inverters are self-contained units incorporating the necessary controls for governing rpm and voltage. Filters for excluding inverter noises from associated radio equipment are included internally in the inverter assembly.

An auxiliary ac electrical system is installed on AC-119G aircraft to supply power to the illuminator and transformer/rectifier unit. The system is powered by a 60 KVA, 115-volt, 400-cycle, three-phase alternator driven by a gas turbine engine. Electrical power from the APU is supplied to the ac power junction box located on the right side of the fuselage. Refer to Section IV for APU operating instructions.

SINGLE-PHASE INVERTERS.

Two single-phase, 115-volt, 400-cycle inverters, designated as main and spare, are mounted overhead in the aft end of the cargo compartment on a shelf above the soundproofing. In normal operation, the main inverter is used to provide 115-volt, single-phase power for fuel quantity indicators, IFF/SIF, driftmeter, ignition analyzer, course deviation indicator of the ID-249 (TACAN only), AN/ARN-18, gunsight, fire control computer, fire control display, ADF pointers, and the single-phase transformer with its related circuits. The main inverter is powered from the 28-volt dc main bus.

NOTE

The fuel quantity indicators are so constructed that they will continue to indicate the conditions prevailing in their respective systems at the time of electrical failure.

On AC-119G aircraft the spare inverter is used to operate the loran (AN/APN-70) and liaison radio (618T-3). Placing the navigator's operating inverter switch in the ON position connects the spare inverter to the 28-volt dc monitor bus. Should a malfunction occur in the main inverter, an automatic changeover unit switches the power source to operate the inverter from the monitor bus to the main bus and deenergizes the loran and liaison radio. The changeover unit also connects the inverter output to the main ac single-phase bus. This action is accomplished automatically in order to prevent overloading of the remaining operating inverter. The spare inverter now performs the function of the main inverter. Individual operation of either inverter can be selected by using the three-position INVERTER switch on the overhead panel. The output of the main inverter and the spare inverter, when operating as a main inverter, is directed through the ac power fuse in the overhead junction box prior to energizing the main single-phase bus and through the transformer fuse in the overhead junction box prior to energizing the 26-volt ac transformer. Failure of either of these fuses will consequently render inoperative much of the single-phase ac equipment; failure of both fuses will result in apparent failure of all single-phase ac equipment.

NAVIGATOR'S OPERATING SPARE INVERTER SWITCH.

A two-position, ON-OFF switch, located on the navigator's instrument panel adjacent to the smoke evacuation T-handle, is provided to operate the spare inverter as an independent power source for loran, radar altimeter, and liaison radio. When the operating spare inverter switch is placed in the ON position, 28-volt dc power is supplied from the dc monitor bus. Should the main inverter malfunction, the changeover unit will automatically switch the spare inverter output to the main ac single-phase bus. Should a malfunction occur in the inverter, the 1-PHASE INVTR BOTH OUT light will illuminate on the copilot's instrument panel.

AC POWER DISTRIBUTION BOX.

The ac power distribution box (figure 1-12) is installed on the right side of the aircraft cargo compartment between stations 179.0 and 196.5. Its function is to distribute ac power from the APU to the illuminator and transformer/rectifier unit.

AC POWER DISTRIBUTION BOX

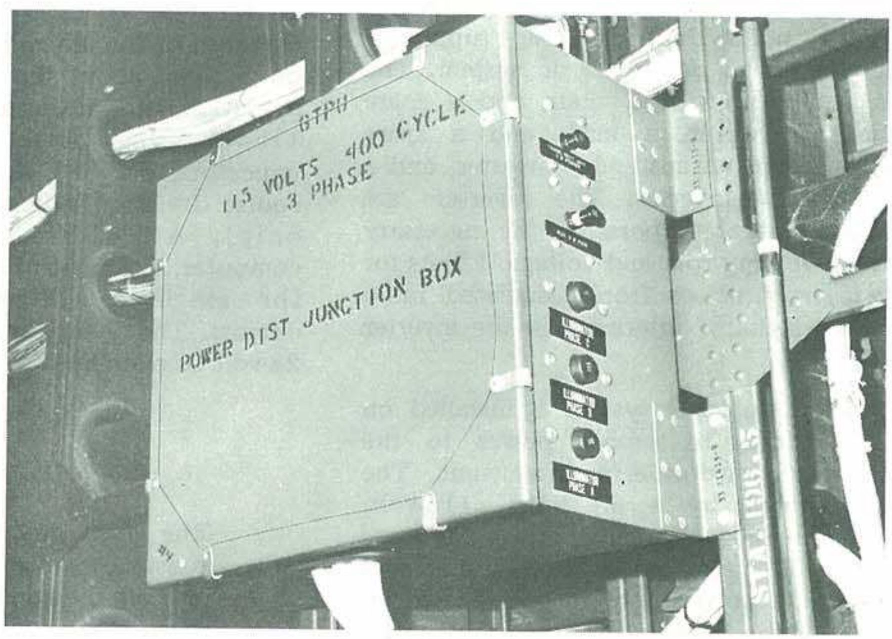


Figure 1-12

The following information is contained in T.O. 1C-119G-1.

HYDRAULIC SYSTEM.

FLIGHT CONTROLS.

WING FLAPS.

LANDING GEAR SYSTEM.

STEERING SYSTEM.

BRAKE SYSTEMS.

INSTRUMENTS.

Except for the following all information is contained in T.O. 1C-119G-1.

FLIGHT AND NAVIGATIONAL INSTRUMENTS.

On the left side of the instrument panel, directly in front of the pilot, are the pilot's instruments which consist of an attitude and directional indicator (ADI), airspeed indicator, turn-and-slip indicator, vertical velocity indicator, and altimeter (see figure 1-13). The attitude and directional indicator operates on a 115-volt, three-phase ac power supplied by the pilot's instrument inverter. The attitude and directional indicator receives information from a displacement gyro assembly, amplifier power supply, compass controller, and a rate switching gyro. A control panel for operation of the attitude and directional indicator is located on the pilot's instrument panel. The turn-and-slip indicator is a 28-volt dc instrument supplied with power from the main bus. The remainder of the pilot's instruments are operated by the pitot-static system and are completely independent of the aircraft's electrical system. The copilot's instruments are located on the right side of the instrument panel and consist of an airspeed indicator, slaved heading indicator, attitude indicator, altimeter, turn-and-slip indicator, and a vertical velocity indicator. Two of these instruments, the attitude indicator (vertical gyro control) and the turn-and-slip indicator (rate gyro control), are components of the automatic pilot system and operate on three-phase ac power supplied by the automatic pilot inverter. The slaved heading indicator, although not actually a functional component of the automatic pilot system, depends upon automatic pilot inverter power for its operation. In addition, a 75-volt source of single-phase ac power, supplied by the compass signal amplifier, is required for this instrument. The copilot's airspeed indicator, altimeter, and vertical velocity indicator are independent of electrical power, being supplied with air pressures from the pitot-static system. The remaining instruments consist of a second slaved heading indicator located in the top center portion of the instrument panel and a standby magnetic compass installed in the windshield vee.

FIRE DETECTOR SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

The fire detector system is incorporated into the aircraft to provide warning of excessive temperature in areas of greatest fire danger in normal operation. Sixty-three fire detector thermocouples are distributed throughout each engine and engine accessory compartment, the heater compartment, and the APU. When heat contacts a detector thermocouple, the thermocouple generates a current which is transmitted to a sensitive relay. On being energized, the sensitive relay closes a contact which allows 28-volt dc from the aircraft's power supply to energize a slave relay. The slave relay closes the circuit to the applicable warning light, located on the fuel selection and emergency panel, and the master fire warning light, located on the engine instrument panel, thus indicating the location of the fire. The fire detector system is unaffected by ambient temperature. A test system is incorporated to provide complete testing of the detection system. Power for operation of the fire detector system and its associated test system is obtained from the 28-volt dc main bus.

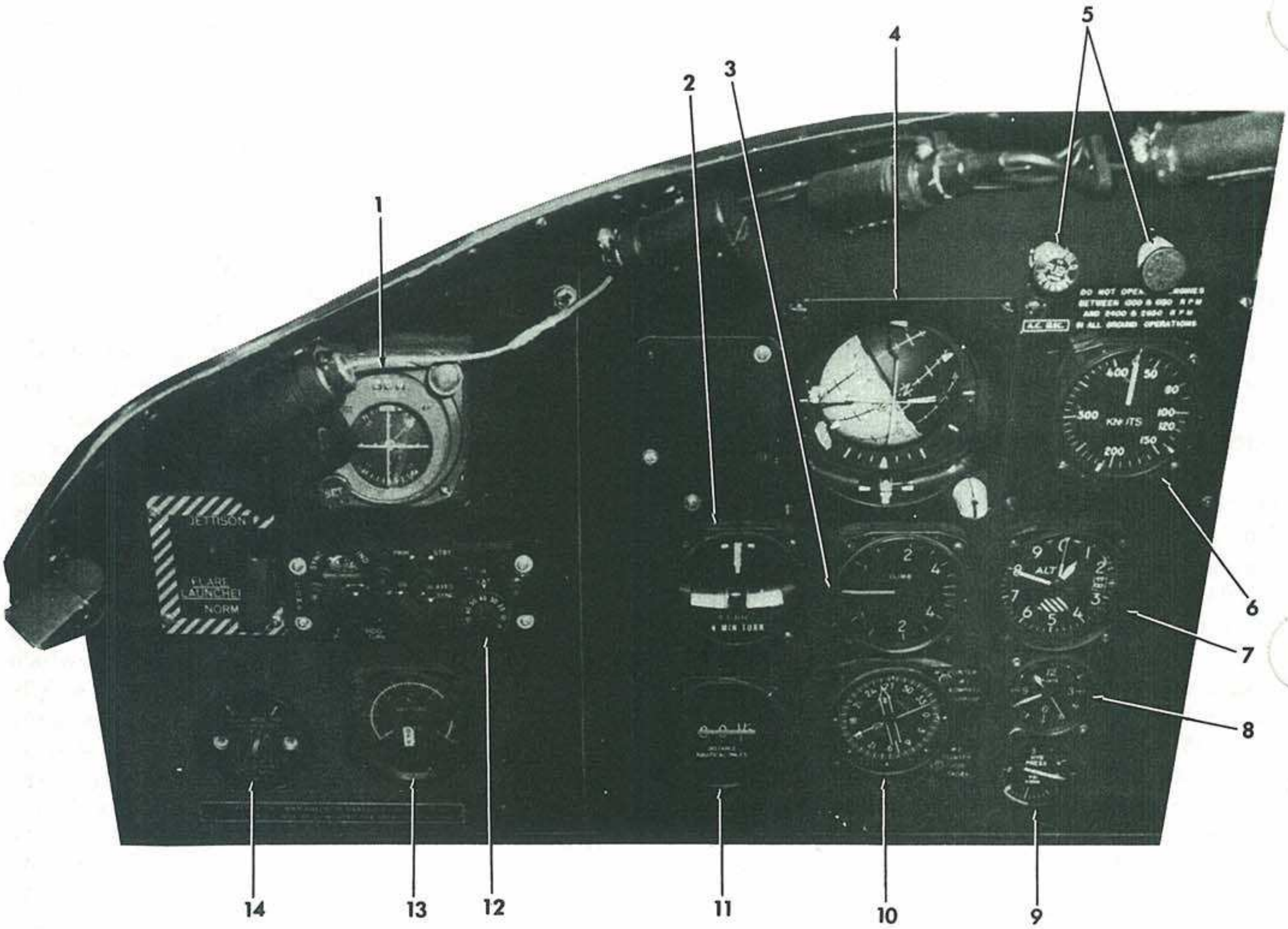
APU DETECTOR THERMOCOUPLES.

Three thermocouples are installed on the APU at the following locations: one 450°F thermocouple at the cover front fairing, one 450°F thermocouple at the top outboard cover, and one 600°F thermocouple at the aft face of the cover.

FIRE DETECTOR MASTER WARNING LIGHT.

The fire detector master warning light, located on the engine instrument panel, will illuminate when

PILOT'S INSTRUMENT PANEL TYPICAL



1. COURSE INDICATOR
2. TURN- AND- SLIP INDICATOR
3. VERTICAL VELOCITY INDICATOR
4. ATTITUDE AND DIRECTIONAL INDICATOR
5. MANIFOLD PRESSURE PURGE VALVE BUTTONS
6. AIRSPEED INDICATOR
7. ALTIMETER
8. CLOCK
9. HYDRAULIC PRESSURE GAGE
10. RADIO MAGNETIC INDICATOR
11. RANGE INDICATOR
12. ATTITUDE AND DIRECTIONAL INDICATOR CONTROL PANEL
13. TARGET RANGE INDICATOR
14. WINDSHIELD WIPER SWITCH

Figure 1-13

the detector thermocouples sense an excessive temperature rise in either engine, the heater compartment, or the APU.

IRE DETECTOR AREA WARNING LIGHTS.

Four indicator lights on the fuel selection and emergency panel indicate the immediate area in which the fire is located. An area warning light is provided for each engine, the heater compartment, and the APU.

FIRE DETECTOR TEST SWITCH.

A three-position fire detector test switch, located on the fuel selection and emergency panel, energizes separate test circuits to provide a complete check of the fire warning lights and fire detector system. The fire detector system is divided into two parts for test purposes. One section of the system includes half of each engine and accessory compartment fire detector system; the other section includes the remaining portions of each engine and accessory compartment and the entire heater and APU detector systems. The center position of the switch is OFF.

AUXILIARY POWER UNIT FIRE EXTINGUISHER SYSTEM.

The APU fire extinguisher system consists of a charged bromochloromethane container located on the A deck, a supply line from the container to the APU enclosure, and a spray bar within the enclosure. Activating the APU fire extinguisher switch releases the extinguishing fluid into the supply line, through the spray bar, and into the APU enclosure to extinguish the fire.

Aircraft modified by T.O. 1C-119(A)-522 are equipped with an overboard discharge line to route extinguishing fluid, expelled from the fire extinguisher bottle due to internal thermal expansion, to the exterior of the aircraft. Discharge is indicated by rupture of the yellow disc installed in the discharge indicator on the outboard end of the discharge line. The indicator is located on the exterior of the aircraft at station 249 above the APU air intake.

APU FIRE EXTINGUISHER SWITCH.

A guarded, two-position switch is located on the fuel selection and emergency panel. The switch is placarded FIRE EXT AUX POWER PLANT. With the guard open and the switch in the aft position, 28 volts dc power is directed to the APU fire extinguisher system discharge cartridge. The system is energized from the main dc bus and protected by the engine fire extinguisher circuit breaker on the overhead panel.

On aircraft modified by T.O. 1C-119(A)-523, the APU fire extinguisher switch also controls 28-volt dc power required for operation of the motor-driven emergency fuel shutoff valve. When the switch is placed in the aft position to operate the fire extinguisher system, power is supplied through the fire extinguisher bottle solenoid valve to the emergency fuel shutoff valve, installed in the APU fuel supply line on the right side of the cargo compartment between stations 266 and 284, to shut off fuel to the APU.

BROMOCHLOROMETHANE CONTAINER PRESSURE VS TEMPERATURE	
PRESSURE PSI	TEMPERATURE
288 (MIN) 348 (MAX) at	-34.4° C (-30° F)
298 (MIN) 358 (MAX) at	-28.90° C (-20° F)
308 (MIN) 368 (MAX) at	-23.30° C (-10° F)
317 (MIN) 378 (MAX) at	-17.8° (0° F)
327 (MIN) 388 (MAX) at	-12.2° (10° F)
337 (MIN) 399 (MAX) at	- 6.71C (20° F)
347 (MIN) 410 (MAX) at	- 1.1° C (30° F)
357 (MIN) 421 (MAX) at	4.4° C (40° F)
367 (MIN) 432 (MAX) at	10.0° C (50° F)
378 (MIN) 443 (MAX) at	15.6° C (60° F)
389 (MIN) 455 (MAX) at	21.1° C (70° F)
401 (MIN) 467 (MAX) at	26.7° C (80° F)
412 (MIN) 479 (MAX) at	32.2° C (90° F)
423 (MIN) 492 (MAX) at	37.8° C (100° F)

Figure 1-14.

APU EMERGENCY FUEL SHUTOFF VALVE RESET SWITCH.

A guarded, two-position switch located forward of the APU emergency fuel shutoff valve on the right side of the cargo compartment between stations

266 and 284 controls opening of the motor-driven shutoff valve. When the valve has been closed by actuating the APU fire extinguisher system, the emergency fuel shutoff valve RESET switch must be momentarily actuated to reopen the shutoff valve before fuel can be resupplied to the APU. Power is supplied to the reset circuit from the 28-volt dc main bus. Circuit protection is provided by a 7.5-ampere circuit breaker on the right main junction box.

The following information is contained in T.O. 1C-119G-1.

ENGINE FIRE EXTINGUISHER SYSTEM.

HAND FIRE EXTINGUISHERS.

Five hand fire extinguishers are provided, one in the forward part of the A-deck, one on the forward cargo compartment bulkhead, one on the right rear side of the cargo compartment, and two on the right rear of the cargo compartment adjacent to the ammunition rack. See figure 3-3 for fire extinguisher locations. The extinguishing agent contained in three hand fire extinguishers is bromochloromethane (CB). The two flare launcher fire extinguishers contain high-pressure H_2O.

A pressure gage is installed on each hand fire extinguisher to indicate the condition of the charge. The pressure as indicated by the gage is subject to a marked variation with temperature change.

EMERGENCY ESCAPE PROVISIONS.

Except for the following all information is contained in T.O. 1C-119G-1.

The following emergency escape provisions are incorporated into the aircraft for exit of crew and passengers: three overhead hatches, a bailout chute, an aft fuselage personnel door equipped with quick-release devices, and right paratroop door if flare launcher has been jettisoned. This equipment is also operable from the exterior of the aircraft to provide ready entrance into the aircraft. (See figure 1-15.)

AFT FUSELAGE PERSONNEL DOOR.

The aft fuselage personnel door, located forward of the flare launcher, is the primary entrance door and provides safe crew egress in event of an in-flight or ground emergency. The door opens inward and is hinged at the trailing edge. Quick-release pins provide fast removal of the door from either inside or outside the aircraft.

WARNING

The aft fuselage personnel door should not be removed in flight except in an emergency. When removing the door, open the door inward into the cargo compartment and stand to the rear of the door when removing the hinge pin. Failure to do so may cause the door to be drawn out of the aircraft where it may strike and damage the empennage. Likewise, because of the above danger, no attempt should be made to replace the aft fuselage personnel door during flight.

MISCELLANEOUS EMERGENCY EQUIPMENT.

All except the following is contained in T.O. 1C-119G-1.

The following miscellaneous equipment is provided for use in the event an emergency condition should arise: Pyrotechnic equipment, alarm bells, emergency axe, flashlights, first aid kits, life rafts, goggles, smoke masks, portable oxygen, fire extinguishers, and asbestos gloves.

ALARM BELL AND BELL SWITCH.

The alarm bell, located on the cargo compartment forward bulkhead, may be controlled by either of two guarded switches in the flight compartment. The identical two-position switches, placarded ALARM BELL with positions placarded ON and OFF, are located one on the jump signal panel at the copilot's station and the other on the GUN STATUS panel at the pilot's station. The bell is so placed that it is audible to crewmembers in the cargo compartment. The alarm bell signal is also provided to the crew through the interphone system. Actuation of the alarm bell may be accomplished with the BATTERY switch in the OFF position.

EMERGENCY DOOR AND HATCH RELEASE HANDLES

TYPICAL

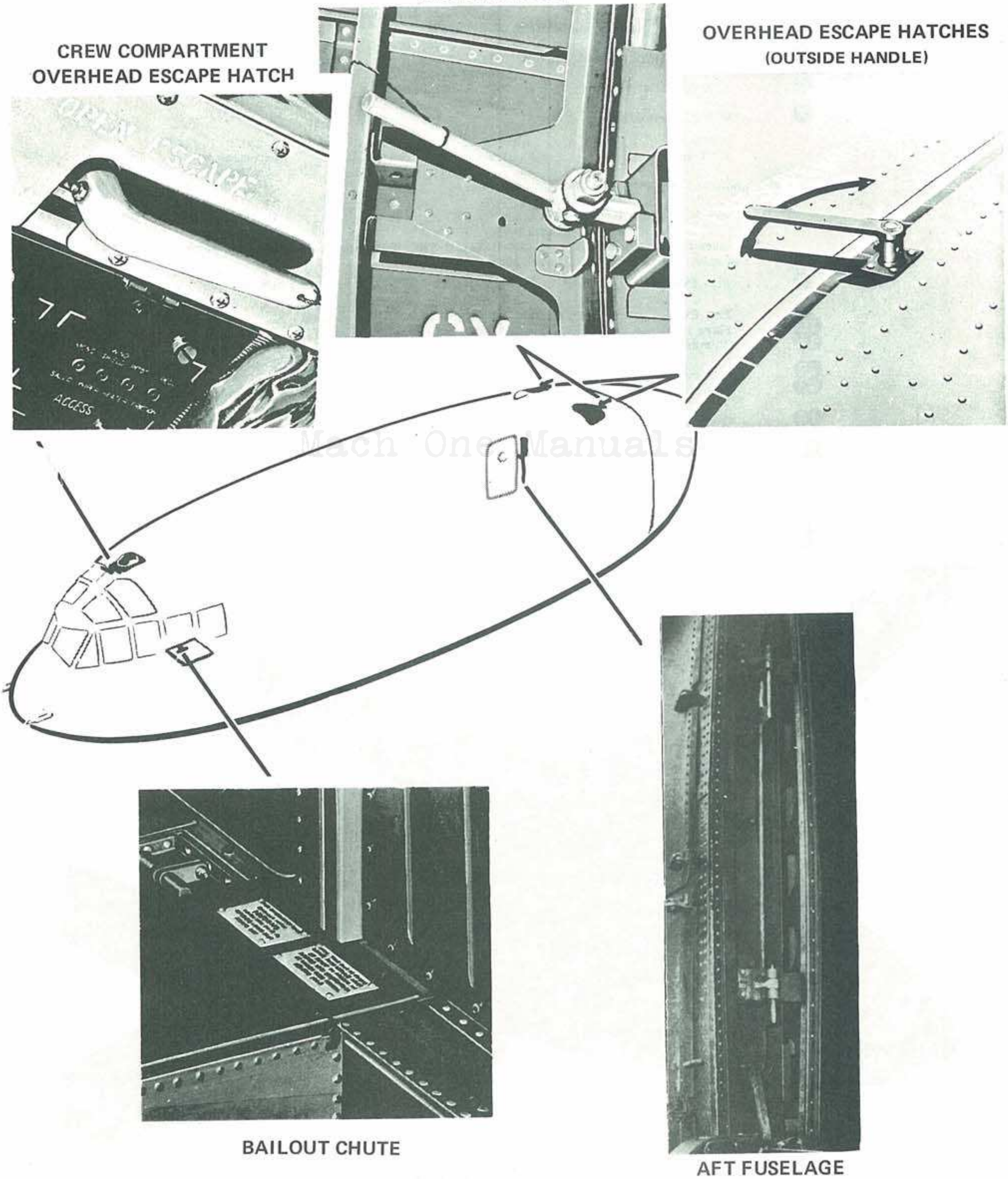


Figure 1-15

SERVICING

1	Smoke Evacuation Bottles		Dry Air or Nitrogen
2	Propeller Oil	Government Designated Numbers 6603X or 1191X, MIL-L-4600Z (NATO None Available)	
3	Fire Extinguisher (Engine)	MIL-B-4394 (NATO None Available)	Bromochloromethane
4	Fuel Tanks (Outboard and Inboard)	MIL-G-5572 (NATO F-22; Alt. F-18)	Grade 115/145 (Alt. 100/130) (6 lb/gal)
5	Oil Tanks (Reciprocating Engine)	MIL-L-22851 (NATO-0-128)	Grade 1100
6	APU Oil Filler	MIL-L-007808F (NATO None Available)	
7	Water Injection Filler		

Ambient Air Temp.	Alcohol Specification	Alcohol Concentration % Volume	Water Concentration % Volume
Above -50°F (-46°C)	O-M-232 (Grade A) (NATO S-747)	60 ± 5	* 40 ± 5
Above -30°F (-35°C)	MIL-A-6091 (ASG) (NATO S-738)	60 ± 5	* 40 ± 5

* Includes oil, specification MIL-C-4339 (NATO C-630), in the amount of 2/3% of the water used. Example: 2/3 gallon of oil for each 100 gallons of water.

8	Fire Extinguisher (Heater)	BB-C-101 (NATO None Available)	Carbon Dioxide
9	Fire Extinguishers (Hand)		Water
10	Flare Launcher		Dry Air or Nitrogen
11	Illuminator		Two parts Water and one part Ethylene Glycol
12	Battery Access		
13	Fire Extinguisher (Hand)	MIL-B-4394 (NATO None Available)	Bromochloromethane
14	Oxygen Cylinder Filler	MIL-O-27210 (NATO None Available)	
15	Hydraulic Power Receptacle		
16	Hydraulic Reservoir	MIL-H-5606 (NATO H-515)	
17	Air Brake Filler		
18	External Power Receptacle DC		
19	External Power Receptacle AC		
20	APU Fire Extinguisher	MIL-B-4394	Bromochloromethane

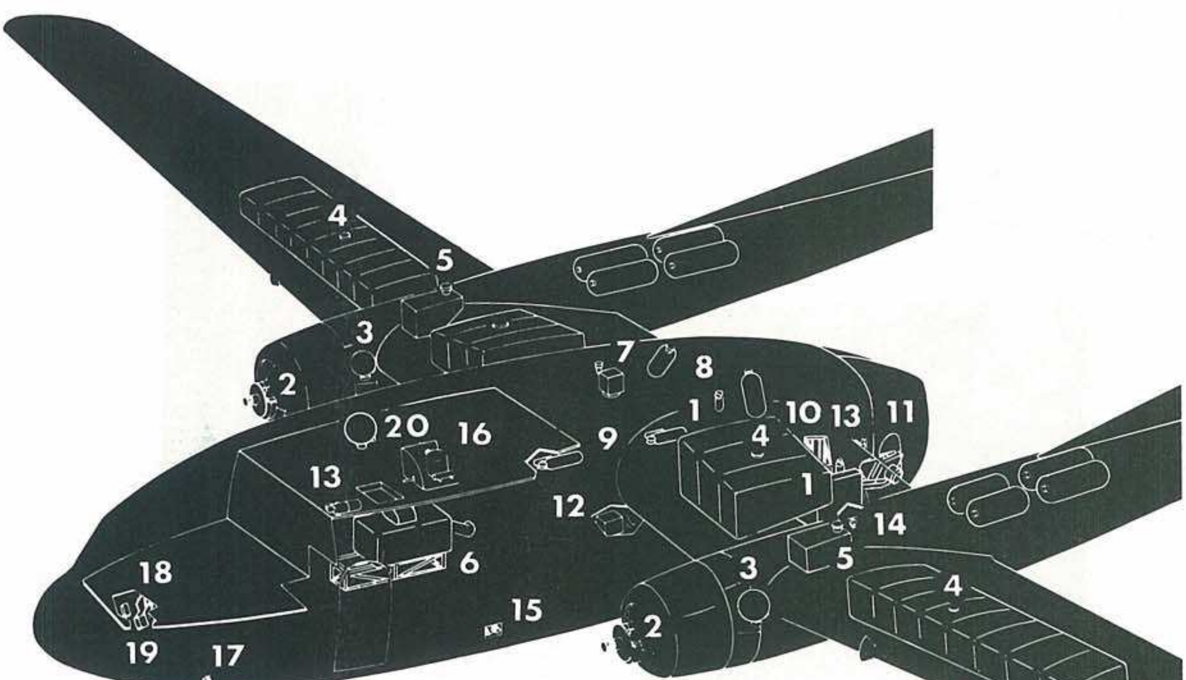


Figure 1-16. (Sheet 1 of 2)

DIAGRAM

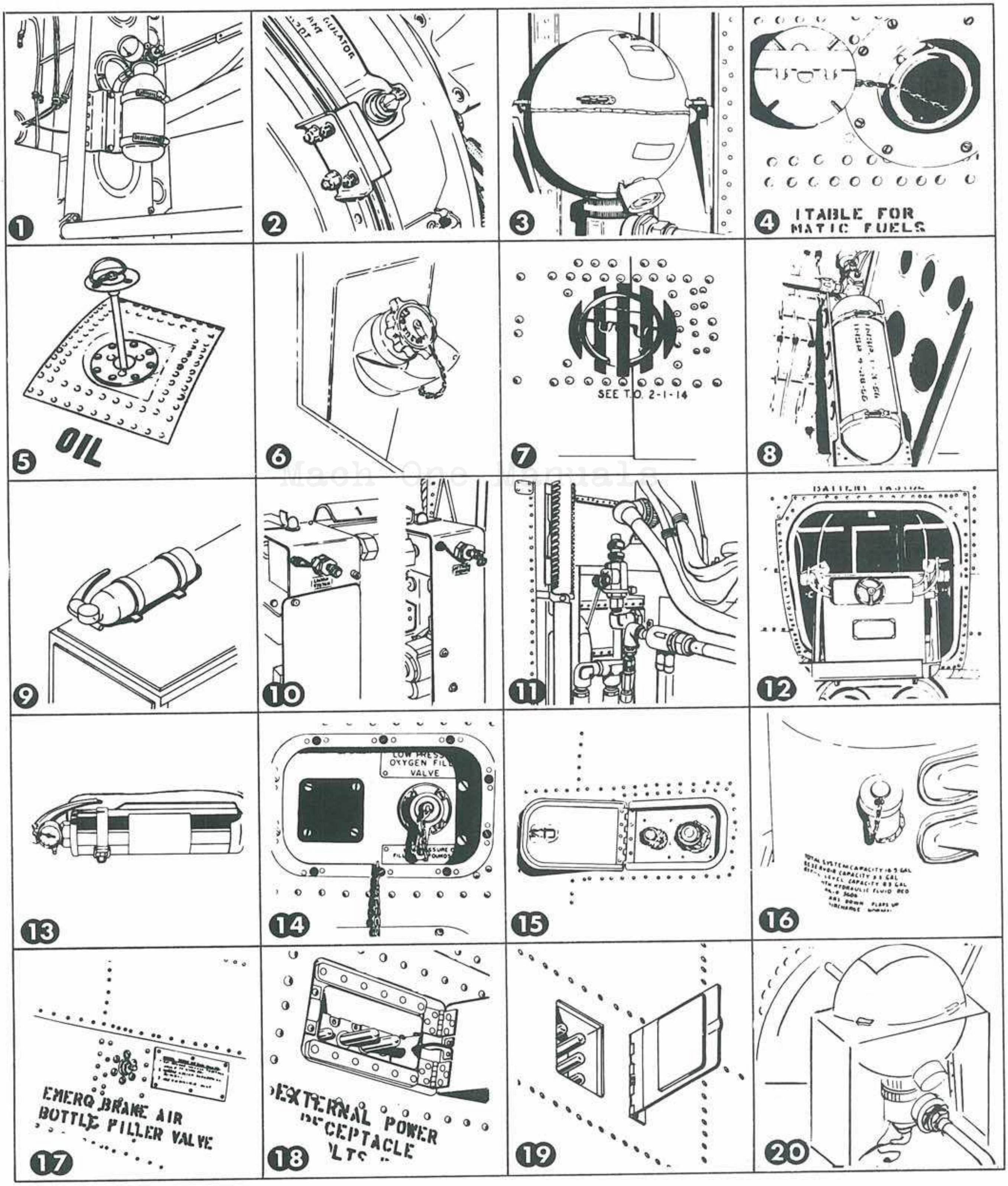


Figure 1-16. (Sheet 2 of 2)

GOGGLES, SMOKE MASKS, PORTABLE OXYGEN, FIRE EXTINGUISHERS, AND ASBESTOS GLOVES.

Space and storage provisions on the right side of the fuselage are allocated for the installation of welding goggles, asbestos gloves, and smoke masks with portable oxygen. Two 2-1/2 gallon high-pressure water fire extinguishers are installed on the aft end of the ammunition rack.

AUXILIARY EQUIPMENT.

The aircraft is equipped with a complete heating, ventilating, and anti-icing system; communications and electronic equipment; lighting system; oxygen system; an automatic pilot; navigation equipment; APU, and other miscellaneous equipment. Refer to Section IV, this manual, and T.O. 1C-119G-1 for detailed descriptions and operating procedures of the auxiliary equipment.

SECTION II

NORMAL PROCEDURES

table of contents

PREPARATION FOR FLIGHT.

OPERATING RESTRICTIONS.

For operating restrictions and limitations imposed on the aircraft, refer to Section V, this manual, and Section V, T.O. 1C-119G-1.

FLIGHT PLANNING.

Determine the fuel quantity, power settings, airspeed, etc, necessary for the successful completion of the proposed mission by using performance data contained in Appendix I.

TAKEOFF AND LANDING DATA CARD.

The Takeoff and Landing Data Card is included with the Pilots' Abbreviated Checklist, T.O. 1C-119(A)G-1CL-1. Prior to each flight the applicable data determined in flight planning will be entered on the Takeoff and Landing Data Card. Use of the card is illustrated in Appendix I, T.O. 1C-119G-1.

CHECKLISTS.

This Flight Manual contains only amplified checklists; the abbreviated checklists have been issued as a separate technical manual, T.O. 1C-119(A)G-1CL-1. For information pertaining to use of the checklist, refer to AFR 60-9.

NOTE

> The term climatic as used in the checklists indicates equipment operation or settings which may be necessary for IFR, night, cold weather, tropic, or desert conditions. In practice, the response to climatic items will be the required switch or control position. The response "checked" denotes that the item or action is to be completed at this time or has previously been completed by a crewmember.

The pilot is responsible for the proper use of the checklist. He will insure that it is used in direct reference during ground and flight operations except during takeoff, climb, landing, or critical emergencies. (In these instances flight crews will refer to the applicable checklist before performing the operation, or afterward to insure completion of all phases of the operation concerned.) The nomenclature P, CP, N, FM, NOS, G, and IO used hereafter will refer to pilot, copilot, navigator/safety officer, flight mechanic, night observation sight operator, gunner, and illuminator operator respectively. The checklist will be read by the copilot when called for by the pilot. Upon completion of each checklist, the pilot will be advised that the checklist called for has been completed. Certain items in the checklist that are accomplished by other crewmembers require coordination with the pilot. These items are indicated by a circle around the number of the item (eg, ②). The crewmember performing checklist duties will not accomplish a circled item without specific approval of the pilot. Some checklist items may be performed simultaneously: (eg, generator voltage may be checked by copilot as pilot checks fuel selector switches).

For those checklist items requiring an ALL response, crewmembers will answer in the following sequence: P, CP, N, FM, NOS, G, IO. ALERT and SCRAMBLE checklists, may be developed and used as approved by the Major Command.

WEIGHT AND BALANCE.

Obtain takeoff gross weight and loading data. From this information, calculate anticipated landing gross weight and balance. Weight limitations are covered in Section V, this manual, and Section V, T.O. 1C-119G-1. For loading information refer to Handbook of Weight and Balance, T.O. 1-1B-40. It is the responsibility of the pilot to ascertain that the aircraft has been properly loaded.

ENTRANCE.

Enter the aircraft through the aft fuselage personnel door in the aft right side of the fuselage by means of the metal hook ladder.

STANDARD TERMINOLOGY.

To assure complete understanding by all crewmembers, the following terminology will be used:

a. Max Power

b. METO Power

c. RPM - Twenty-one hundred

d. Manifold - Three-four

e. Torque - Ninety-five

f. Wing flaps - Takeoff

PREFLIGHT CHECKS.

The visual inspections which must be accomplished prior to flight are the BEFORE EXTERIOR INSPECTION, EXTERIOR INSPECTION, and INTERIOR INSPECTION. The pilot is responsible for assuring that the visual inspections have been accomplished. The actual accomplishment may be delegated as required.

NOTE

> The normal crew for the AC-119G aircraft consists of a pilot, copilot, navigator/safety officer, flight mechanic, two gunners, NOS operator, and illuminator operator.

NOTE

The visual inspections are based upon the assumption that inspection in accordance with T.O. 1C-119C-6 has been accomplished and munitions properly loaded in accordance with T.O. 1C-119(A)G-33-1-2. However, checks of any equipment involving safety of flight are duplicated in the preflight checklist.

THRU-FLIGHT INSPECTION.

When an aircraft is flown by the same crew in the same day, and it is assigned tactical or administrative missions requiring intermediate stops, only those items preceded by an asterisk (*) need be checked. The remaining items may be checked at the discretion of the pilot. All items in the BEFORE TAKEOFF and subsequent checks must be accomplished for all flights. For transition flights when the engines are not shut down, aircrews may proceed from the AFTER LANDING check to the ENGINE RUNUP check and accomplish only the asterisked items on the ENGINE RUNUP checklist.

BEFORE EXTERIOR INSPECTION.

Prior to the exterior inspection, the following pre-exterior inspection safety check should be made.

* 1. Chocks, ground wire, fire bottle, and external power cart (if available) - In place.

* 2. Pitot covers - Removed.

* 3. Forms 781 and 365F and flight information publications - Checked.

Check that G file aeronautical charts, applicable flight information publications, and emergency envelope with Form 15 are aboard.

* 4. Hydraulic pressure - Checked.

If brake accumulator gage does not indicate 600 psi or more, pressure will be pumped up to 600 psi by hand.

5. A-deck - Checked.

6. Circuit breakers - Checked.

Flight emergency bus, monitor and radio junction boxes, overhead panels, and navigator's circuit breaker box.

7. Navigator's operating spare inverter switch - OFF.

8. Monitor bus switch - NORMAL.

* 9. Navigator/safety officer's panel - Checked.

Check for security of equipment.

10. Driftmeter - Caged, OFF.

11. Oxygen bottles pressure - Checked.

Portable oxygen bottles will be serviced. Oxygen system will be serviced as mission dictates.

*12. Brake pressure reservoir - Checked.

Check oil level indicating rod. Maximum extension is 3/4 inch.

13. Alarm bell - Checked.

*14. Landing gear switch - DOWN.

15. Emergency gear switch - OFF, Safetied.

*16. Ignition switches - OFF.

*17. Parking brake - ON.

*18. Master arm switch - SAFE.

*19. External power (dc) - Connected (battery switch ON if external power is not available).

CAUTION

Check that the electrical power from the external power source is of the correct polarity. This may be accomplished by placing the dc voltmeter selector switch in MAIN BUS and observing that the voltmeter correctly indicates the voltage output of the external power unit. A reverse polarity condition will be indicated by a zero reading on the voltmeter. If this precaution is not heeded and a reverse polarity condition exists, extensive damage to the electrical system will result.

20. Trim tabs - Neutral.

CAUTION

To prevent damage to trim tab actuators and rudders, trim tabs will not be exercised on aircraft battery.

21. Cowl flap switches - OPEN.

CAUTION

If cowl flaps are closed and the engine temperature is 0°C, or lower, apply engine preheat for a sufficient length of time to melt any ice that may be formed in the cowl flap system. This will prevent damage to the flex shafts and screw jacks.

*22. Oil, ADI quantity gages - Checked.

23. Push-to-test lights - Checked.

Annunciator, fire/sight mode, overhead instrument panel system lights.

24. Fire detector systems - Checked.

25. Exterior lights - Checked.

Turn the anticollision light switch to BOTH, check for operation of the lights, then turn switch OFF. Visually check all position lights.

26. Top of wing - Checked.

Check general condition of upper surfaces of the aircraft. Check that the aircraft has been serviced with the proper quantities of fuel and oil. Also, check that the water injection system has been serviced and that top of wing is clear, heater covers removed, and fuel and oil caps on. (See figure 1-16.)

CAUTION

The alternate grade fuel permitted is 100/130. Refer to Section V, T.O. 1C-119G-1, for operating limitations when alternate grade fuel is used.

Visually check formation lights.

27. Pitot heater switch - Climatic.

When flight through moisture is anticipated, turn pitot heater switch ON for 15 seconds (warm weather) or 30 seconds (cold weather), then OFF. Check manually for heating during exterior inspection.

28. Battery switch/External power - As required.

WARNING

Aircraft will not be left unattended with power on or APU in operation.

EXTERIOR INSPECTION.

Visually examine exterior of aircraft in accordance with figure 2-1, EXTERIOR INSPECTION.

WARNING

Electrical power will be applied as required to facilitate preflight of the aircraft. All power to weapons systems shall be off until it is ascertained that weapons are electrically and mechanically safe.

INTERIOR INSPECTION.

NOTE

The illuminator operator will perform the aircraft INTERIOR INSPECTION as directed by the pilot.

Accomplish an interior inspection of the aircraft to include gun system and munitions when gunners are not aboard.

Cargo Compartment (Left Side).

* 1. AFTO Form 781 - Checked.

2. NOS - Installed; cover - Removed.

3. Smoke evacuation doors - Secured.

   Check that doors are closed, and relief valve safetied.

4. Life raft release T-handle - Secured.

5. Heater bay area - Checked.

   Check heaters for hot spots, fuel leaks, and electrical wiring for security.

6. MXU-470/A modules - Checked, when no gunners are present.

   a. Check that guns are properly secured.

   b. MXU-470/A module - Drive motor T plug disconnected, safing sector removed, loading sector installed, and safing bar installed.

WARNING

If any of the above items has not been accomplished, interior inspection will cease and appropriate personnel will be immediately notified.

7. Circuit breakers and junction boxes - Checked.

8. Wing flap actuator area - Checked.

9. Illuminator - Checked and secured.

   a. Circuit breakers - Checked in.

   b. Main power switch - OFF.

   c. Lens cover - Removed.

   d. Lens - Cleaned.

   e. Coolant pressure indicator - Checked (30 ± 5 psi).

   f. Coolant plumbing for leaks - Checked.

10. APU control panel - Checked.

11. SLAD panel - Checked.

12. Smoke evacuation air bottle - Checked.

13. Spoiler/deflector control valve - Checked.

14. Overhead escape hatch - Secured and safetied.

15. Flare emergency equipment - Checked.

NOTE

Flare launching should not be attempted without asbestos gloves, welder's goggles, and emergency flare ejector tool aboard.

16. Clam shell doors - Checked.

    Check that latches are properly hooked and safetied.

Cargo Compartment (Right Side).

NOTE

If mission requirement dictates, this step may be omitted until BEFORE TAKEOFF checklist.

1. Flare launcher - Checked.

   a. Circuit breakers - OFF.

   b. Power switch - OFF.

   c. Jettison switch - OFF and safetied.

   d. Launcher - Secured.

NOTE

Check that launcher is secured to the rails by the manual locking pin and cross pin is in place and that the manual jettison handle is safetied and no movement of launcher is noted.

   e. Manual ejection safeties - Safe.

   f. Pneumatic shutoff valve - OFF.

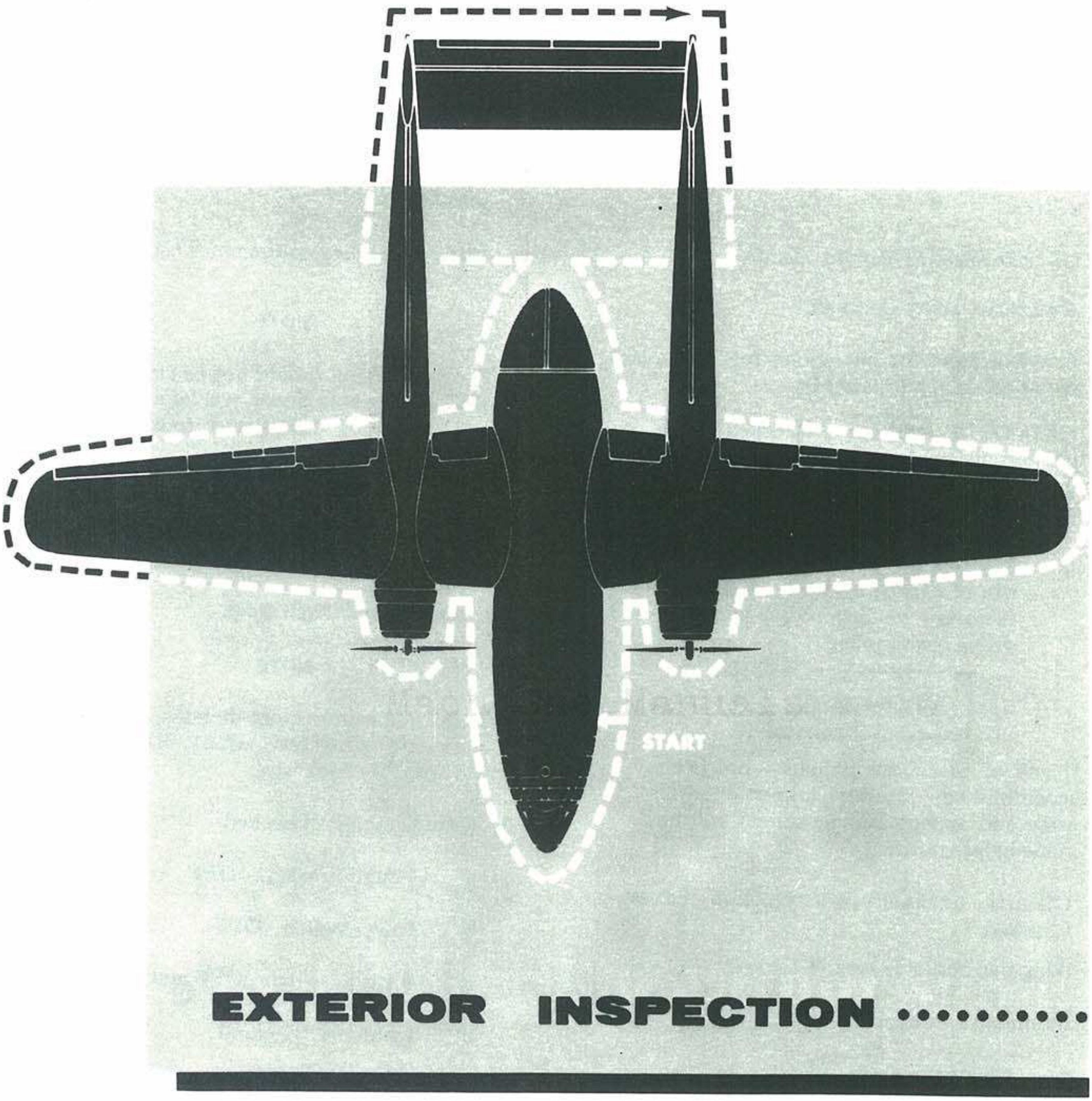


Figure 2-1

1. ENTRANCE DOOR HINGE CAMS AND EMERGENCY RELEASE - CHECKED. (Ferry configuration only).

2. BAILOUT HATCH - CHECKED.

3. EMERGENCY BRAKE PRESSURE - CHECKED. 1600-2000 psi.

4. PITOT TUBES - CHECKED.
   - Manually check heating of tubes if required.

5. NOSE WHEEL SECTION - CHECKED.
   - Hydraulic lines for leaks.
   - Gear door swivels.

* 6. GROUND LOCKING PIN - REMOVED.

7. RIGHT FORWARD FUSELAGE - CHECKED.
   - Smoke evactuation air scoop.
   - Condition of skin for dents or cracks.
   - Condition of APU exhaust and air intake ports.
   - APU fire extinguisher discharge indicator.
   - Static ports clean and undamaged.

* 8. RIGHT PROPELLER - CHECKED.
   - Evidence of static oil leaks (25 drops per minute from rear of regulator is maximum permissible). When static leakage exists, propeller system must be serviced just prior to every flight. No leakage between hub and regulator or hub and accumulator. (Staining, streaking, or seepage is acceptable - refer to T.O. 1C-119G-2-1.)

9. ENGINE COWLING - CHECKED.
   - Security of attachment.

10. COWL FLAPS OPEN - CHECKED.

*11. RIGHT ENGINE - CHECKED.
   - Evidence of fuel, oil, or hydraulic leaks.

12. RIGHT WING - CHECKED.
   - Dust excluder removed.
   - Control surface condition.
   - General wing condition.
   - Trim tab position.
   - Evidence of leaks.

13. RIGHT NACELLE - CHECKED.
   - Circuit breakers.
   - Evidence of fluid leaks.
   - Engine fire extinguisher.

14. RIGHT MAIN WHEEL AND STRUT - CHECKED.
   - Evidence of hydraulic leaks.
   - Brake wear pins.

*15. GROUND LOCKING PIN - REMOVED.

16. RIGHT INBOARD WING - CHECKED.
   - General condition of wing flaps.
   - Evidence of fuel leaks.
   - Dust excluder removed.

17. RIGHT AFT FUSELAGE - CHECKED.
   - Battery door secured.
   - Condition of skin for dents or cracks.
   - Aft fuselage personnel door.
   - Condition of smoke evacuation spoiler deflectors.
   - Condition of launcher.

18. RIGHT BOOM - CHECKED.

19. RIGHT VERTICAL STABILIZER AND RUDDER - CHECKED.
   - General condition and position of trim tab.

20. HORIZONTAL STABILIZER AND ELEVATOR - CHECKED.
   - General condition and position of trim tab.
   - Play stops clearance.

21. LEFT VERTICAL STABILIZER AND RUDDER - CHECKED.
   - General condition and position of trim tab.

22. LEFT BOOM - CHECKED.

23. LEFT AFT FUSELAGE - CHECKED.
   - Condition of skin for dents or cracks.
   - Condition of illuminator.
   - Condition of smoke evacuation spoiler deflectors.
   - Heater fire extinguisher discharge indicators.
   - Condition of gun ports.

24. LEFT INBOARD WING - CHECKED.
   - General condition of wing flaps.
   - Evidence of fuel leaks.
   - Dust excluder removed.

25. LEFT MAIN WHEEL AND STRUT - CHECKED.
   - Evidence of hydraulic leaks.
   - Brake wear pins.

26. LEFT NACELLE - CHECKED.
   - Circuit breakers.
   - Evidence of fuel leaks.
   - Engine fire extinguisher.

*27. GROUND LOCKING PIN - REMOVED.

28. LEFT WING - CHECKED.
   - General condition of wing.
   - Evidence of leaks.
   - Control surface condition.
   - Dust excluder removed.

*29. LEFT ENGINE - CHECKED.
   - Evidence of fuel, oil, or hydraulic leaks.

30. COWL FLAPS OPEN - CHECKED.

31. ENGINE COWLING - CHECKED.
   - Security of attachments.

*32. LEFT PROPELLER - CHECKED.
   - Evidence of static oil leaks (25 drops per minute from rear of regulator is maximum permissible). When static leakage exists, propeller system must be serviced just prior to every flight. No leakage between hub and accumulator. (Staining, streaking, or seepage is acceptable - refer to T.O. 1C-119G-2-1.)

33. LEFT FORWARD FUSELAGE - CHECKED.
   - Condition of skin for dents or cracks.
   - Smoke evacuation air scoop checked.
   - Static ports clean and undamaged.

*34. GROUND LOCKING PINS AND PITOT COVERS - STOWED.

*THRU-FLIGHT INSPECTION ITEM

g. Individual manifold valves - Open.

CAUTION

Manifold valve should remain open, except for a malfunction or air leak on any launch tube.

h. Grounding plug - Removed.

i. Power cable - Connected.

j. Jettison safety pin - Removed.

k. Air bottles - Both open (minimum of 6-1/2 turns).

l. Air pressure - Checked (both bottles).

m. Launch air bottle - Closed.

WARNING

Only launch air bottle will be closed. Jettison air bottle will be left open for emergency jettisoning.

n. Flares/markers properly loaded - Checked.

* 2. Aft fuselage personnel door - Checked.

Check that door is properly installed and emergency release handle is safetied.

3. Overhead escape hatch - Secured and safetied.

4. Pilot's instrument inverter circuit breakers - Checked.

5. Smoke evacuation air bottle - Checked.

6. Spoiler/deflector control valve - Checked.

7. Ammunition storage rack and containers - Checked.

Check that ammunition containers are properly secured.

* 8. Gun control panel switches - OFF.

9. Circuit breakers and main junction boxes - Checked.

10. Gust lock emergency disconnect handle - Checked

Check that handle is normal and safetied.

11. Auxiliary fuel tank selector valve - Checked

Valve is open when tanks are installed; valve is closed and safetied when tanks are not installed.

12. Heater bay area - Checked.

Check heaters for hot spots, fuel leaks, and electrical wiring for security.

*13. Auxiliary power unit - Checked.

a. Oil level - Checked full.

Oil supply is 2 gallons; from tip of dip stick to full mark is 2 quarts.

b. Engine hourmeter circuit breaker - In.

c. Fuel and oil leaks - Checked.

d. Starter and control circuit breakers - In.

e. Broken wiring - Checked.

f. Manual fuel shutoff valve - Open and safetied.

g. APU junction box circuit breakers - In/Reset.

14. AC power distribution box circuit breakers - Checked.

15. Smoke evacuation doors - Secured.

Check that doors are closed and relief valve safetied.

16. Spare bulbs - Checked.

17. Brake system pressure gage - Checked.

System precharge 450 psi, normal pressure 600-1400 psi.

18. Nose junction box circuit breakers - Checked.

19. Nose wheel well inspection door - Checked for security.

20. Oxygen bottles - Checked.

    Pressure checked 400-425 psi; regulators checked; hose for serviceable condition and deterioration; and smoke mask for serviceability, condition, and deterioration.

21. Loose equipment - Stowed.

COCKPIT CHECK.

NOTE

This checklist will be completed prior to beginning BEFORE STARTING ENGINES checklist and after navigator/safety officer's and gunner's POWER-ON checklists are completed. In the event this checklist is completed and the aircraft does not fly, ENGINE SHUTDOWN checklist and the BEFORE LEAVING THE AIRCRAFT checklist will be completed prior to securing the aircraft.

* 1. Navigator/safety officer's station equipment - Checked.

   All power switches off.

2. Electrical power - On.

CAUTION

Check that the electrical power from the external power source is of the correct polarity. This may be accomplished by placing the dc voltmeter selector switch in MAIN BUS and observing that the voltmeter correctly indicates the voltage output of the external power unit. A reverse polarity condition will be indicated by a zero reading on the voltmeter. If this precaution is not heeded and a reverse polarity condition exists, extensive damage to the electrical system will result.

NOTE

If external power is not available, start APU. In the event a successful APU start is not accomplished, external power should be used, since the battery may not provide sufficient power to attempt a restart.

WARNING

Visually clear the APU exhaust area prior to starting APU.

* 3. Master arm switch - SAFE.

4. Auto pilot power switch - OFF.

5. Landing light switches - OFF.

6. Fuel booster pump switches - OFF.

7. Carburetor air switches - COLD.

8. Supercharger switches - LOW.

* 9. Cowl flap switches - OPEN.

   Check visually that cowl flaps are fully open.

10. Wing flap lever - UP.

11. Mixture levers - IDLE CUT-OFF.

12. Water injection switches - OFF.

13. Fire/sight mode panel switches - OFF.

*14. Pilot's C-4 spotlight switch - OFF.

NOTE

If the pilot's C-4 spotlight switch is ON when the left main gear oleo strut extends at takeoff, the C-4 spotlight will illuminate automatically. This could be particularly distracting under night takeoff conditions.

15. Windshield wiper switch - PARK and OFF.

16. Spark control switches - RETARD.

17. Gyro - Uncaged.

    Insure that the copilot's attitude indicator is uncaged.

18. Emergency power switch - OFF.

19. Heater switches - OFF.

    Check that individual heater switches and heater master switch are off.

*20. Engine accessory heat switch - OFF.

21. Anti-icing and deicing switches - OFF.

    Check that all heating system control switches are OFF and PROP DEICE switches off.

*22. Inverter switches - OFF.

*23. Generator switches - ON.

*24. Oil cooler flap switches - AUTO.

25. Firewall shutoff switches - NORMAL.

26. Fire extinguisher switches - Safetied/OFF.

27. External power/APU - As required.

BEFORE STARTING ENGINES.

* 1. External power/APU - As required. CP

* 2. Preflight/thru-flight checks - Complete. ALL

* 3. Gear pins, ground wires, and pitot covers - Removed. FM

* 4. Forms 781 and 365F and flight information publications - Checked. P

* 5. Aircraft commander's briefing - Complete. P

* 6. Command radios - Set. P, CP

    UHF and/or VHF on ground control or tower frequency.

* 7. Flight controls - As required. P

* 8. Seats, rudder pedals, safety belts, shoulder harnesses - Adjusted. P, CP

* 9. Hydraulic pressure - Checked. FM

*10. Parking brake - Set. P

*11. Interior and exterior lights - As required P, CP, FM, IO

*12. Fuel selector switches - Set. P

    Refer to FUEL MANAGEMENT, Section VII, T.O. 1C-119G-1.

*13. Throttle levers - Set. P

    Adjusted to 1-3/4 inches open.

14. Propeller levers - Static feather/full INCREASE RPM. P

NOTE

This check is not required for the first flight after completion of T.O. 1C-119C-6 inspection, if propeller accumulator has not been recharged.

    a. Move the propeller lever to the FEATHER position and visually note that the blades move approximately 10 degrees toward the feather position.

    b. Immediately return the propeller lever to the INCREASE RPM position and note that the propeller blades return to the low pitch (high rpm) position. This check should be accomplished as rapidly as possible since propeller motion is very fast and movement of more than 10 degrees may cause excessive propeller oil leakage. The application of maximum power during the takeoff run will fully recharge the accumulator, no matter what the amount of depletion.

15. Radio call - Completed. CP

    Contact tower to assure that the command radio is operable for alerting fire fighting facilities during engine start. Altimeter and clock may be set at this time.

STARTING ENGINES.

The following procedure should be employed when starting engines.

* 1. Field barometric pressure - Noted. P

NOTE

Field barometric pressure will be used as a reference for power and ignition system checks.

* 2. Right fuel booster pump switch - NORMAL ON. P

CAUTION

Do not turn the fuel booster pump switch to EMERG ON. High boost pump pressure may rupture the carburetor diaphragm.

* 3. Clear right engine - Clear and fire guard posted. CP

NOTE

Make certain ground personnel are provided with fire fighting equipment and all personnel are clear of the propeller. If ground personnel are not available, the illuminator operator will perform this duty.

* 4. Start right engine - Start. P, CP

a. Starter switch - R, P

CAUTION

Energize the starter continuously until the propeller is turned through eight blades. If any indication of hydraulic lock is noted, discontinue starting procedure and investigate. Do not crank engine continuously over any period greater than 1 minute to prevent overheating of starter. Allow starter to cool for at least 1 minute after each period of continuous cranking.

b. Ignition switch - BOTH. CP

c. Normal prime switch - As required. P

Prime continuously and permit engine speed to stabilize at 1000 rpm.

CAUTION

Do not use mixture lever to prime engine except for cold weather operations. Simultaneous use of both the primer and mixture lever often results in exhaust system fires. The engine can be operated up to approximately 1700 rpm on prime alone. (Refer to COLD WEATHER PROCEDURES, Section IX, T.O. 1C-119G-1.)

d. Starter switch - Release when engine is running smoothly. P

e. Inverter switch - SPARE. CP.

NOTE

The single-phase inverter switch will be turned to SPARE immediately after the engine is running.

* 5. Oil pressure - Checked. CP.

CAUTION

If oil pressure does not register within 10 seconds, or reach 40 psi within 20 seconds, shut down engine and investigate.

* 6. Mixture lever - RICH, after engine is running smoothly on prime. CP

NOTE

The mixture lever should be moved smoothly at all times. An engine tending to become overloaded may often be saved by placing the mixture lever back in IDLE CUT-OFF and, without hesitation, returning it to RICH.

a. Normal prime switch - OFF. P

Transition from prime to carburetor operation should be made before disengaging prime to prevent backfire. Discontinue priming when the rpm begins to drop.

b. Throttle lever - 1000 rpm. P

* 7. Fuel booster pump switch - OFF. P

* 8. Fuel pressure - Checked. P

* 9. Hydraulic pump and wing flaps - Checked. CP

Wing flaps are extended to check the operation of the hydraulic pump on the right engine, and check the operation of the wing flaps.

CAUTION

With wing flaps in the DOWN position, single engine runup must not exceed 1000 rpm to prevent possible damage to the wing flap system.

a. Wing flap lever - TAKE-OFF.

Fire guard reports flap position and copilot checks hydraulic pressure and wing flap position indicator.

b. Wing flap lever - DOWN.

Fire guard reports position to copilot and moves to other engine. Copilot checks hydraulic pressure and wing flap position indicator.

*10. Left fuel booster pump switch - NORMAL ON. P

CAUTION

Do not turn the fuel booster pump switch to EMERG ON. High boost pump pressure may rupture the carburetor diaphragm.

*11. Clear left engine - Clear and fire guard posted P.

NOTE

Make certain ground personnel are provided with fire fighting equipment and all personnel are clear of the propeller. If ground personnel are not available, the illuminator operator will perform this duty.

*12. Start left engine - Start. P, CP

a. Starter switch - L. P

CAUTION

Energize the starter continuously until the propeller is turned through eight blades. If any indication of hydraulic lock is noted, discontinue starting procedure and investigate. Do not crank engine continuously over any period greater than 1 minute to prevent overheating of starter. Allow starter to cool for at least 1 minute after each period of continuous cranking.

b. Ignition switch - BOTH. CP

c. Normal prime switch - As required. P

Prime continuously and permit engine speed to stabilize at 1000 rpm.

CAUTION

Do not use mixture lever to prime engine except for cold weather operations. Simultaneous use of both the primer and mixture lever often results in exhaust system fires. The engine can be operated up to approximately 1700 rpm on prime alone. (Refer COLD WEATHER PROCEDURES, Section IX, T.O. 1C-119G-1.

d. Starter switch - Release when engine engine is running smoothly. P

*13. Oil pressure - Checked. CP

CAUTION

If oil pressure does not register within 10 seconds, or reach 40 psi within 20 seconds, shut down engine and investigate.

*14. Mixture lever - RICH, after engine is running smoothly on prime. CP

NOTE

The mixture lever should be moved smoothly at all times. An engine tending to become overloaded may often be saved by placing the mixture lever back in IDLE CUT-OFF and, without hesitation, returning it to RICH.

a. Normal prime switch - OFF. P

Transition from prime to carburetor operation should be made before disengaging prime to prevent backfire. Discontinue priming when the rpm begins to drop.

b. Throttle lever - 1000 rpm. P

*15. Fuel booster pump switch - OFF. P

*16. Fuel pressure - Checked. P

*17. Wing flaps - Checked. CP

When the engine is running smoothly, the wing flaps are raised to the TAKE-OFF position and the wing flap position indicator and hydraulic pressure are rechecked, after which the wing flaps are raised fully. The fire guard will report to the pilot when wing flaps are at takeoff and full up positions.

CAUTION

Wing flaps should be permitted to stop at the selected position prior to reversing the direction of the wing flap mechanism. This precaution must be observed in order to prevent damage to the wing flap linkage.

*18. Carburetor air switches - Climatic. P

ENGINE GROUND OPERATION.

The engine should always be warmed up on the ground at 1000-1400 rpm until proper lubrication for engine operation is assured.

CAUTION

- Do not exceed 1400 rpm until oil temperature reaches 40°C and cylinder head temperatures reach 100° C, as excessive engine wear may result.

- Do not attempt to warm up engines more quickly by closing cowl flaps, as damage to ignition wiring or excessive cylinder head temperature may result.

The ground operation of the engines must be held to a minimum. Engines should be run only when it is necessary to perform the required checks, and should be shut down if running unnecessarily during a prolonged check of another engine. Head the aircraft into the wind when ground operation for an extended period of time is anticipated. Refer to SPARK PLUG ANTI-FOULING PROCEDURE, Section VII, T.O. 1C-119G-1, for prevention of plug fouling during ground operation.

BEFORE TAXI.

* 1. External power - Disconnected. P, CP

NOTE

If external power has been used for starting, disconnect and remove at this time.

* 2. Battery switch - ON. CP

* 3. Throttle levers - Idle. P

Engines should idle at 650-750 rpm.

* 4. Landing gear wheel chocks - Removed. P, CP

Pilot or copilot will signal for removal.

5. Manifold pressure purge valve - Checked. P

a. Depress purge valves noting that manifold pressure increases to approximately field barometric pressure.

b. Release purge valves and note that manifold pressure returns to previous setting.

CAUTION

Do not operate purge valves except when engines are idling. Only when the manifold pressure is less than atmospheric pressure, will the moisture or foreign matter in the lines be drawn into the engine.

6. Ignition switches - Checked. P

a. Throttle levers - IDLE.

Perform this check as rapidly as possible to prevent backfire when the ignition is turned on again.

b. Ignition switches from BOTH, to LEFT to RIGHT, to OFF momentarily, then back to BOTH.

WARNING

If the engine does not cease firing during this check, it is an indication that the magneto ground wire is open at some point and any subsequent ignition check will be unreliable. Warn personnel to keep clear of the propeller after engine has been shut down until the difficulty has been corrected.

* 7. Throttle levers - 1200 rpm. P

* 8. Fuel and water quantity - Checked. P, CP

Fuel quantity indicator test button will be depressed to check operation of fuel indicators.

* 9. APU - As required. IO

The APU should be operated during night or IFR conditions.

Refer to Section IV for starting instructions.

*10. TRU switch - As required. FM

*11. Command and navigation radios - ON. CP, N

a. IFF/SIF - STANDBY. CP

b. Navigation mode selector switch - Set. N

12. Illuminator - Checked/As required. IO

13. Fuel selector switches - Checked (prior to first flight of the day). P

a. Right fuel booster pump switch to EMERG ON, observing increase in right fuel pressure.

b. Right fuel selector switch to CROSSFLOW, observing decrease in right fuel pressure.

c. Right fuel selector switch to OUTBOARD, observing increase in right fuel pressure.

d. Left fuel selector switch to CROSSFLOW, observing increase in left fuel pressure.

e. Left fuel selector switch to OUTBOARD, observing decrease in left fuel pressure.

f. Right fuel booster pump switch - OFF.

g. Left fuel booster pump switch to EMERG ON, observing increase in left fuel pressure.

h. Left fuel selector switch to CROSSFLOW, observing decrease in left fuel pressure.

i. Left fuel selector switch to INBOARD, observing increase in left fuel pressure.

j. Right fuel selector switch to CROSSFLOW, observing increase in right fuel pressure.

k. Right fuel selector switch to INBOARD, observing decrease in right fuel pressure.

l. Left fuel booster pump switch - OFF.

14. TRU - Checked. CP

With the APU running and the TRU switch in the ON position, turn off one generator switch and observe the loadmeter reading on the respective remaining generator. Position the remaining operating generator switch to OFF and observe the TRU loadmeter to assure that the TRU has picked up the dc bus load. Return both generator switches to the ON position.

*15. Generators - Checked. CP

NOTE

To check the output of each generator, place the voltmeter selector switch to the desired generator and turn that generator OFF. Check output at 28 ± 1.5 volts. Turn selected generator switch to ON. Repeat for each generator. Check that loadmeters for each generator are equal.

16. Spare inverter - Checked. CP

*17. Pilot's instrument inverter switch - ON. CP

NOTE

Allow 60-75 seconds for attitude and directional indicator to erect and flag to disappear.

*18. Main and auto pilot inverters - ON and checked. CP

*19. Radio call - Complete. CP

*20. Flight instruments - Checked. P, CP, N

a. Copilot's attitude indicator - Caged and set.

NOTE

Caging the copilot's attitude indicator will quickly align the heading indicators (except pilot's attitude directional indicator).

b. Pilot's attitude and directional indicator - Set.

(1) Compass controller selector switch - DG. P

Set mode selector switch to the DG position.

NOTE

COMP, SLAVED, and SYNC positions are inoperative. The PRIM/STBY switch is inoperative.

(2) Pitch attitude - Set. P

Set pitch attitude to zero with aircraft level for takeoff. Reset on level off as required.

(3) Heading - Set. P

Using known heading information such as copilot's heading indicator, B-16 compass, set heading into ADI using push to turn heading set knob.

(4) Latitude - Set. P

Using latitude set knob, set known latitude under indices and check for N or S in window, as applicable. Reset latitude every 2 degrees of change.

WARNING

Heading information is not valid unless proper latitude is set under indices.

CAUTION

Heading information should be updated at least once each hour to insure against error.

c. Altimeters - Checked.

WARNING

It is possible to set the altimeter 10,000 feet in error and have the correct setting in the Kollsman window. This occurs when the barometric pressure set knob is continuously rotated until the barometric scale is out of view and the scale reappears from the opposite side. If the correct altimeter setting is then placed in the Kollsman window, the altimeter will be in error by approximately 10,000 feet. To avoid this, always check the ten thousand-foot pointer for proper indication when setting the altimeter.

d. Vertical velocity indicators - 0 indication.

e. Airspeed indicator - Checked.

f. Heading indicator - Set and uncaged.

g. Copilot's attitude indicator - Uncaged.

*21. Astrodome - As required. FM

NOTE

Astrodome may be open while taxiing to allow the FM to check taxi clearance at night with the Aldis lamp.

*22. Alarm bell - Checked. P, CP

*23. Cargo compartment - Checked. IO

TAXI.

During taxi the controls should be held firmly to prevent the aileron and elevator from striking the limit stops. When taxiing through areas where loose gravel, ice, etc, exists, taxi at the lowest possible rpm to minimize damage from flying objects. During cold weather, lubrication may be stiff and more than the usual power for taxiing may be necessary initially, but should be reduced after movement has started.

CAUTION

During taxiing, turning, or braking the aircraft at high gross weights, extreme caution shall be exercised to prevent damage to the aircraft. Tight turns and high taxi speeds should be avoided.

* 1. Taxi clearance - Checked. P, CP

Prior to movement of the aircraft, taxi clearances should be checked. For turning radius and vertical clearance dimensions see figure 2-2. Use of the Aldis lamp is recommended during operation at night. If necessary the illuminator operator will direct movement of the aircraft from outside.

CAUTION

Ground maneuvering of the aircraft utilizing reverse thrust will be used only when absolutely required. If backing of the aircraft is required, forward thrust will be used to stop the backward movement of the aircraft. Brakes should not be used while the aircraft is moving backward. A crewmember on interphone will be positioned in the aircraft where he can observe and advise the pilot on the proximity of obstacles. Refer to Section VII, T.O. 1C-119G-1, for undesirable effects of continued reverse operation.

* 2. Hydraulic pressure - Checked. CP

Copilot makes this check constantly during taxiing.

* 3. Brakes - Checked. P, CP

CAUTION

- Do not check airbrakes as this will deplete emergency air pressure and cause uneven wear on brakes.
- Release parking brake. After movement of the aircraft is started, check brake pedals. Apply gently to avoid violent braking action.

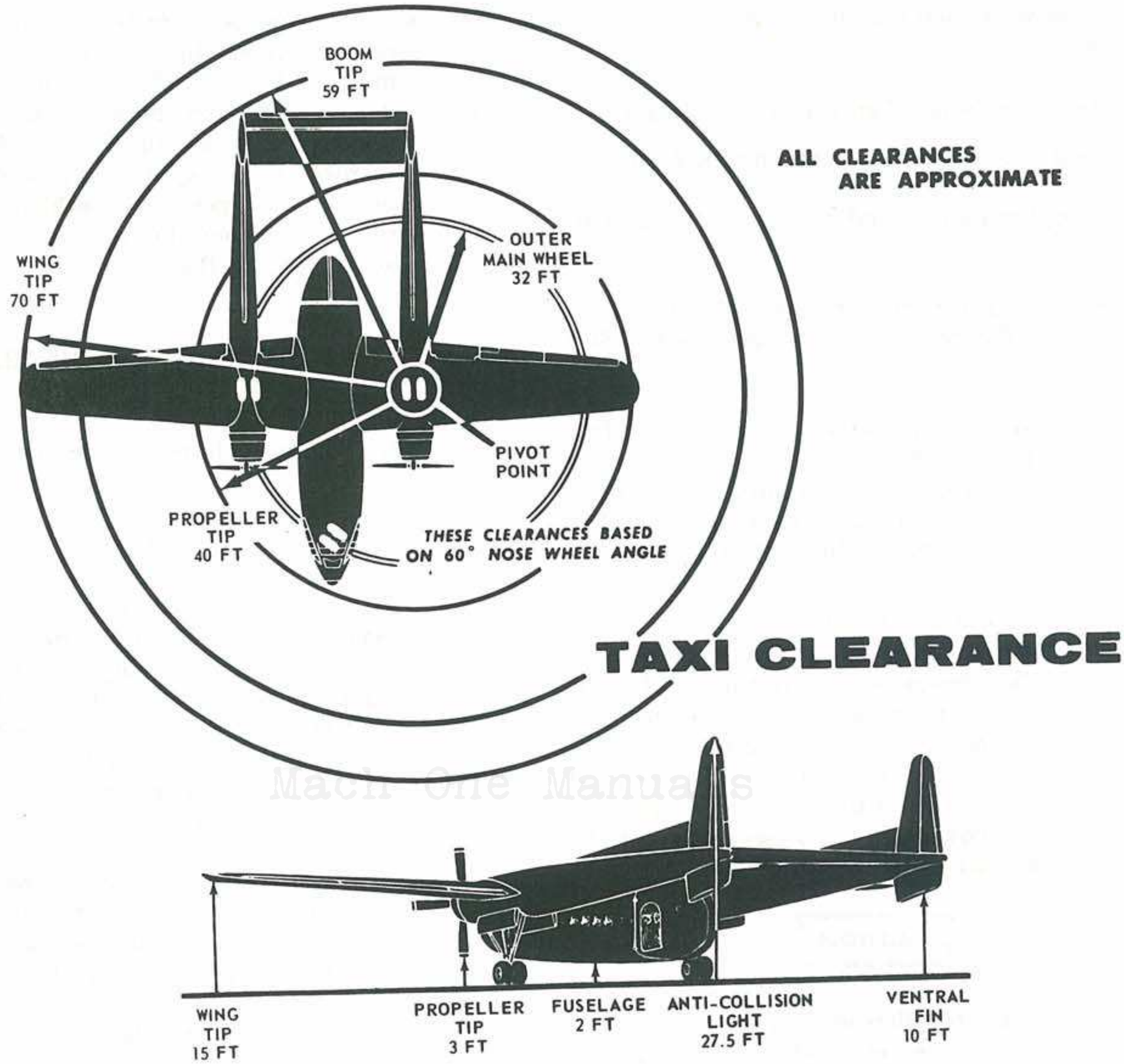


Figure 2-2

CAUTION

On slippery surfaces, ice, or snow, taxi with brakes and engines only since a more positive control is provided by the increased tire contact area of the main wheels; do not use nose wheel steering. However, observe nose gear position before takeoff run is started to make certain it is centered.

* 4. Flight instruments - Checked. P, CP

a. Turn-and-slip indicator - Checked.

Check that the turn needle is indicating a turn in the proper direction and that the ball is free in the race.

b. Heading indicator - Check for turns in proper direction.

5. Navigational radios - Check operation. CP

ENGINE RUNUP.

Whenever possible, head aircraft into the wind for runup.

CAUTION

If possible, select a paved area for runup, as operation at high rpm on unpaved surfaces may cause damage from flying gravel, sand, etc.

* 1. Nose wheel and parking brake - Centered and set. P

* 2. Flight controls - Manual lock unlocked. P

* 3. Engine instruments - Within limits. P, CP, FM

4. Propeller purging and charging - As required. P

    a. With propeller lever in full INCREASE RPM position, adjust throttle to 1800 rpm.

    b. Move propeller lever into full FEATHER position and hold only until rpm drops to approximately 1200 rpm, then immediately return propeller lever to full INCREASE RPM position.

    c. Repeat step b. three times.

    d. Place propeller lever to full INCREASE RPM position. Move throttle into reverse range and apply power with a steady movement to obtain 1700-1800 rpm and hold this power for approximately 15 seconds not to exceed 20 seconds duration.

CAUTION

Do not run propellers in reverse pitch for an extended period, since the engine cylinder head temperature indicators will not give a true indication and extreme temperatures may result.

    e. Return throttles to positive thrust, advance throttles to 2500 rpm and hold this rpm for 3 to 4 seconds. The accumulator will be hydraulically charged.

5. Propeller reversing - Checked. P

CAUTION

- Do not run propellers in reverse pitch for an extended period, since the engine cylinder head temperature indicators will not give a true indication and extreme temperatures may result.
- If either propeller or both should fail to reverse when the pilot's throttles are moved into the REVERSE thrust range, do not make a second attempt to reverse the propeller or propellers which failed to reverse. Damage to the propeller low pitch stop operating mechanism may result. This condition requires corrective action prior to flight.

    a. Propeller levers - Full INCREASE RPM.

    b. Throttle levers - CLOSED.

NOTE

When throttles are moved into the reverse pitch range, the elevator lock will engage and remain engaged until the propellers are unreversed and the left throttle is advanced to approximately 32 to 40 inches Hg manifold pressure. Ailerons and rudders are still free and should be restrained.

    c. Raise throttles over the reversing cams and apply power with a steady movement until the desired reverse thrust power is attained.

    d. Check throttle synchronization in reverse range.

CAUTION

Make certain automatic pilot is disengaged when propellers are reversed, since it imposes unnecessary loads on the flight control system.

    e. To unreverse, advance throttles forward into the normal operating range.

NOTE

If doubt exists that unreversing has been accomplished, move the propeller lever to FEATHER momentarily, then back to full INCREASE RPM. If unreversing has not been accomplished, rpm will increase, then decrease. If unreversing has been accomplished, the rpm will immediately decrease.

* 6. Propeller operation - Checked. P

a. Propeller levers - Full INCREASE RPM.

b. Throttle levers - 1600 rpm.

c. Move propeller lever to full DECREASE RPM and note minimum rpm to be within 1200 - 1400 rpm.

NOTE

Some propellers will oscillate when the lever is placed in the extreme low rpm range. Engine speed variations up to 150 rpm are acceptable below 1600 rpm. Above 1600 rpm, speed variations of 30 rpm or less are acceptable.

d. Return propeller lever to full INCREASE RPM and check for a reading of 1600 rpm.

7. Supercharger operation - As required. P (Checked only when flight requires high blower operation).

a. Propeller levers - Full INCREASE RPM.

b. Throttle levers - 1600 rpm.

c. Supercharger switches - HIGH.

A fluctuation in oil pressure and an increase in manifold pressure indicates that the blowers have shifted to high ratio.

d. Advance throttle levers to obtain 30 inches Hg manifold pressure.

e. Move supercharger switches to LOW.

A decrease in manifold pressure indicates that the blowers have shifted to low ratio.

CAUTION

To prevent overheating of the clutch plates, do not repeat the supercharger clutch operation check at less than 5-minute intervals.

* 8. Ignition system and power - Checked. P

NOTE

During this check the engine should accelerate smoothly with no tendency to backfire with normal throttle movement.

a. Propeller levers - Full INCREASE RPM.

b. Throttle levers - Set.

Obtain field barometric pressure as noted before starting engines.

c. Check that tachometer indicates between 1950-2100 rpm and that all instruments are within desired range.

NOTE

RPM may vary with wind conditions. Add 2 rpm for each mph headwind and subtract 2 rpm for each mph tailwind.

d. Place ignition switch in L position and observe rpm and torque indications.

A drop of 100 rpm or 6 psi TOP or less is considered satisfactory if no engine roughness is encountered.

NOTE

It is essential that all readings be allowed to stabilize between ignition switch changes. This must not be construed to mean that the engines will be allowed to operate on single ignition at this speed for an extended period of time as pre-ignition or detonation may occur. A period of 30 seconds is not considered excessive, but should not be exceeded.

e. Place spark control switch in ADVANCE position.

Observe rpm for an approximate 25 rpm rise and torque for an approximate 2 psi rise.

WARNING

If no torque or rpm rise is noted, the spark control may be locked in either the retard or advance position. This will require corrective action.

f. Return spark control switch to RETARD, noting a decrease in rpm and TOP.

WARNING

If no rpm or torque drop is observed, the distributor may be locked in the advance position. This will require corrective action.

g. Return ignition switch to BOTH to stabilize rpm.

h. Repeat this procedure with ignition switch in R position.

CAUTION

When rpm drop exceeds 150 or excessive roughness is encountered, retard to idle rpm before returning the ignition switch to BOTH.

i. If unacceptable magneto check occurs, attempt to remedy by using the defouling procedure outlined in Section VII, T.O. 1C-119G-1. If an acceptable check is observed, repeat the check on the other engine.

NOTE

The elevator gust lock may be released at this time at the pilot's discretion.

9. Carburetor air system - As required. P

Check at 1600 rpm. Place carburetor air switches in HOT position, check for a rise in temperature, then switch to COLD. If carburetor heat is required, switch to COLD momentarily. Check for a drop in temperature, then toggle switches as necessary to restore the original temperature. If carburetor heat was used during runup and is not required for takeoff, allow 2 minutes operation in COLD position prior to takeoff for stabilization.

10. Propeller deicing - As required. (Required whenever icing conditions are anticipated). CP, FM

a. Propeller levers - Full INCREASE RPM.

b. Throttle levers - 1600 rpm.

c. Turn on the propeller de-icer switch, observing propeller deicing ammeters on the instrument panel to see that the system is functioning correctly as outlined in Section IV, T.O. 1C-119G-1.

NOTE

A 2-minute operation period is required to permit the 15-second on-off cycling of the system. Refer to PROPELLER DEICING, Section IV, T.O. 1C-119G-1, for operational period on the ground.

11. Cowl flap operation — Checked. CP, FM/IO

Place cowl flap switches to TRAIL, CLOSED, TRAIL, and OPEN positions and observe cowl flaps for proper positioning.

NOTE

Lear type cowl flap actuator opening or closing time is approximately 4 seconds. Lundy type cowl flap actuator opening or closing time is approximately 17 seconds.

BEFORE TAKEOFF.

Prior to takeoff, the following checks should be accomplished to ascertain that the systems immediately pertinent to takeoff are functioning normally. Most of the items may be checked immediately after the engine runup has been completed, but if any delay is anticipated, those items listed under the heading LINEUP should be delayed until the aircraft is cleared to take position on the runway.

1. Cargo compartment - Checked. IO

   Illuminator operator will check engines for fuel, oil, and hydraulic leaks; doors and escape hatches closed and secured; brakes for overheat condition; and crew prepared for takeoff.

2. Heater and anti-icing switches - Climatic. FM

3. Carburetor air switches - Climatic. P

   If carburetor heat is used during takeoff, check that CAT has stabilized at the desired temperature setting.

   NOTE

   Refer to Section IX, T.O. 1C-119G-1, for cold weather operation.

4. Wing flap lever - UP or as required. CP

   NOTE

   Use of wing flaps for takeoff is not recommended for normal operation. The use of wing flaps will shorten the takeoff run and improve climb over 50-foot obstacles, but will decrease the margin of safety for single-engine operation, due to the increase in drag.

5. Trim tabs - Neutral. P

6. Propeller levers - Full INCREASE RPM. P

7. Instruments and warning lights - Checked. P, CP

   Check that all instruments are in the desired operating range and that warning lights are extinguished.

8. Crew briefing - Completed. P

   Prior to each takeoff, the pilot will brief the crew as to the specific duties each should accomplish as follows:

   a. Type of takeoff.

   b. Performance data.

      (1) Limit manifold pressure.

      (2) Minimum performance torque.

      (3) Takeoff airspeed.

      (4) Recommended single-engine climb speed.

   c. Cockpit signals and communications procedures.

   d. Abort and emergency procedures.

      Only special procedures (weather, etc) need be covered. If any crewmember is not completely familiar with his duties and procedures outlined in Sections III and VIII, those areas will be included.

      Pilot's intention stated if an emergency should arise on takeoff.

   e. Departure and emergency return procedures.

      Departure instructions, headings, altitudes, and procedures to be used in the event an emergency condition arises necessitating a return to the runway immediately after takeoff.

   NOTE

   The copilot and navigator/safety officer will monitor aircraft progress, radios, and position-fixing devices. The copilot and navigator/safety officer will use FLIP and SID charts to monitor the aircraft departure and will advise the pilot of any deviation.

9. Safety belts and harnesses - Secured. P, CP, N, FM, IO

   The illuminator operator will verify that all crewmembers in the cargo compartment have seat belts secured.

10. Flight controls - Checked (checked for freedom of movement). P

   NOTE

   If not previously accomplished, advance left throttle to approximately 32 to 40 inches Hg to release elevator gust lock.

11. Anti-fouling - As required. P, CP

NOTE

If ground operating time is anticipated to exceed 5 minutes, use anti-fouling procedure as outlined in Section VII, T.O. 1C-119G-1.

12. Anticollision light switch - BOTH/UPPER. CP
Navigation lights - STEADY/BRIGHT.

LINEUP.

If takeoff delay is anticipated, the LINEUP checklist should be delayed until the aircraft is cleared to take position on the runway.

1. Mixture levers - RICH. CP
2. Windows, doors, and hatch - Closed and secured. P, CP, FM, IO
3. Pitot heater switch - ON. FM
4. Fuel booster pump switches - EMERG ON. CP
5. Water injection switches - ON. CP

   Water injection should normally be used on all takeoffs. The resulting horsepower increase provides a greater margin of safety, and power recovery turbine life will be extended. When a series of takeoffs is anticipated and the depletion of ADI fluid will occur before it can be replenished, the pilot may elect to make dry takeoffs to conserve ADI fluid for subsequent takeoffs where its use will be required in the interest of safety.

6. IFF/SIF - NORMAL. CP
7. Cowl flap switches - TRAIL and checked. CP, FM/IO

   If IO checks cowl flaps, he will resecure his seat belt prior to takeoff.

8. Gyro instruments - Set and uncaged. P, CP

TAKEOFF.

Depending upon the conditions encountered, various techniques for takeoff must be employed in order to achieve satisfactory performance. At night the use of landing lights throughout the takeoff run is recommended. Since the basic procedures are common to all takeoffs; eg, "release brakes," "add power," etc, these are described in detail only under STANDARD TAKEOFF, and are repeated briefly where other types of takeoff are described, only as necessary to specify sequence or additional information. Takeoff data presented in Appendix I should be consulted in order to predict the expected performance for the specific conditions involved in each takeoff.

CAUTION

If maximum braking is used during an aborted takeoff, the brakes must be inspected prior to another takeoff attempt.

SHIMMY.

If wheel shimmy should occur during the takeoff run, the decision to abort or continue the takeoff should be made by the pilot, based on such factors as runway distance remaining, refusal airspeed, and the magnitude of the vibration. If the decision is made to continue the takeoff, the nose wheel should be lifted as soon as possible.

STANDARD TAKEOFF.

A standard takeoff is considered to be made from a prepared surface runway of sufficient length that the use of wing flaps is not required. Refer to Standard Takeoff Distances (Flaps 0°), Appendix I, Part 3. Upon completion of the LINEUP checklist, the aircraft is lined up on the designated runway and brought to a complete stop. The pilot should then advance the throttles smoothly to magneto check power, release the brakes and continue advancing the power to approximately 45 inches Hg. The copilot will then advance the throttles until maximum power is attained, at which time a visual check will be made of engine instruments to determine if operating conditions are normal. Concurrently, the copilot will hold the control column slightly forward during the initial takeoff roll to prevent premature liftoff.

CAUTION

Manifold pressure and torque pressure should not be permitted to exceed takeoff limits when using Maximum Wet or Maximum Dry power. Application of power should be halted when either limit is obtained. Full forward throttle may result in power setting above the limits.

NOTE

- Check for a decrease in fuel flow, a slight increase in torque pressure, and the illumination of water lights or the appropriate static (no flow to engine) water pressure indication when the water injection system is activated. Water flow to the engine is indicated by a water pressure decrease as the manifold pressure passes approximately 45 inches Hg.
- In order to achieve the performance plotted on the Standard Takeoff Distances charts, maximum power must be set before brake release and the aircraft must be flown off at V_{to} (takeoff speed).

No visual signal or verbal comments will be given to the pilot if the aircraft performance is normal. Any discrepancy which is noted will be brought to the attention of the pilot in the manner directed by the pilot during the pretakeoff briefing. Maintain directional control by steering with the nose gear until sufficient speed is attained for adequate rudder control.

If critical field length is equal to or greater than the effective runway length, compare the indicated airspeed with the refusal speed determined from Appendix I, Part 3, at the selected runway marker. If the indicated airspeed is less than the refusal speed, the takeoff should be aborted. (Refer to ABORT, Section III). If acceleration is satisfactory, continue the takeoff run allowing the airspeed to build up to takeoff speed (V_{to}) and establish takeoff attitude.

If the critical field length is less than the runway length, and refusal speed is greater than takeoff speed, refusal speed need not be checked. However, an acceleration check should be made to insure normal aircraft performance. If any reject condition exists, the takeoff should be aborted. (Refer to ABORT, Section III.) V_{to} should be $1.1 V_s$ for the condition which yields critical field length equal to runway length. Takeoff ground run predictions should be made from Appendix I, Part 3. If critical field length is less than the runway length, V_{to} should be 1.1 V_s or 108 KIAS (whichever is greater), and takeoff ground run prediction should be made from Appendix I, Part 3.

After gaining sufficient altitude to clear all obstacles, allow the airspeed to increase to normal climb speed (140 KIAS).

MINIMUM RUN TAKEOFF.

When a standard takeoff cannot be made within the available runway length, minimum run technique can be employed to shorten the ground run distance. This is essentially the same technique as standard takeoff, except that wing flaps are lowered to TAKE-OFF and Maximum Power is applied before the brakes are released. Level ground run distance and takeoff speed (V_{to}) are determined from Minimum Run Takeoff Distance (Flaps 15°) chart, Appendix I, Part 3. Notice that the takeoff speed in this case is the same percentage of power-off stall speed (V_s) as in the case of a standard takeoff; ie, 110%. Charts are provided for takeoff distances using minimum control speed, providing conditions warrant.

WARNING

Minimum run takeoff techniques (15° flaps) should be employed only when absolutely essential to urgent combat requirements or in an emergency, since both minimum control speed and safe single-engine speed are disregarded. If an engine fails prior to reaching minimum control speed or attaining sufficient altitude to retract the landing gear and wing flaps and accelerate to safe single-engine speed, ground contact will result.

MAXIMUM PERFORMANCE TAKEOFF.

If runway length is so critical that the takeoff cannot be made using minimum run technique, a further reduction in ground run distance can be realized by taking off at 105% of power-on (3200 BHP) stall speed. This results in maximum performance of aircraft and should only be done when actually required to get out of the field in

TAKEOFF AND CLIMB

NOTE

THIS ILLUSTRATION REPRESENTS A TYPICAL TAKEOFF AND CLIMB. FOR TAKEOFF SPEEDS, ETC, REFER TO APPENDIX 1.

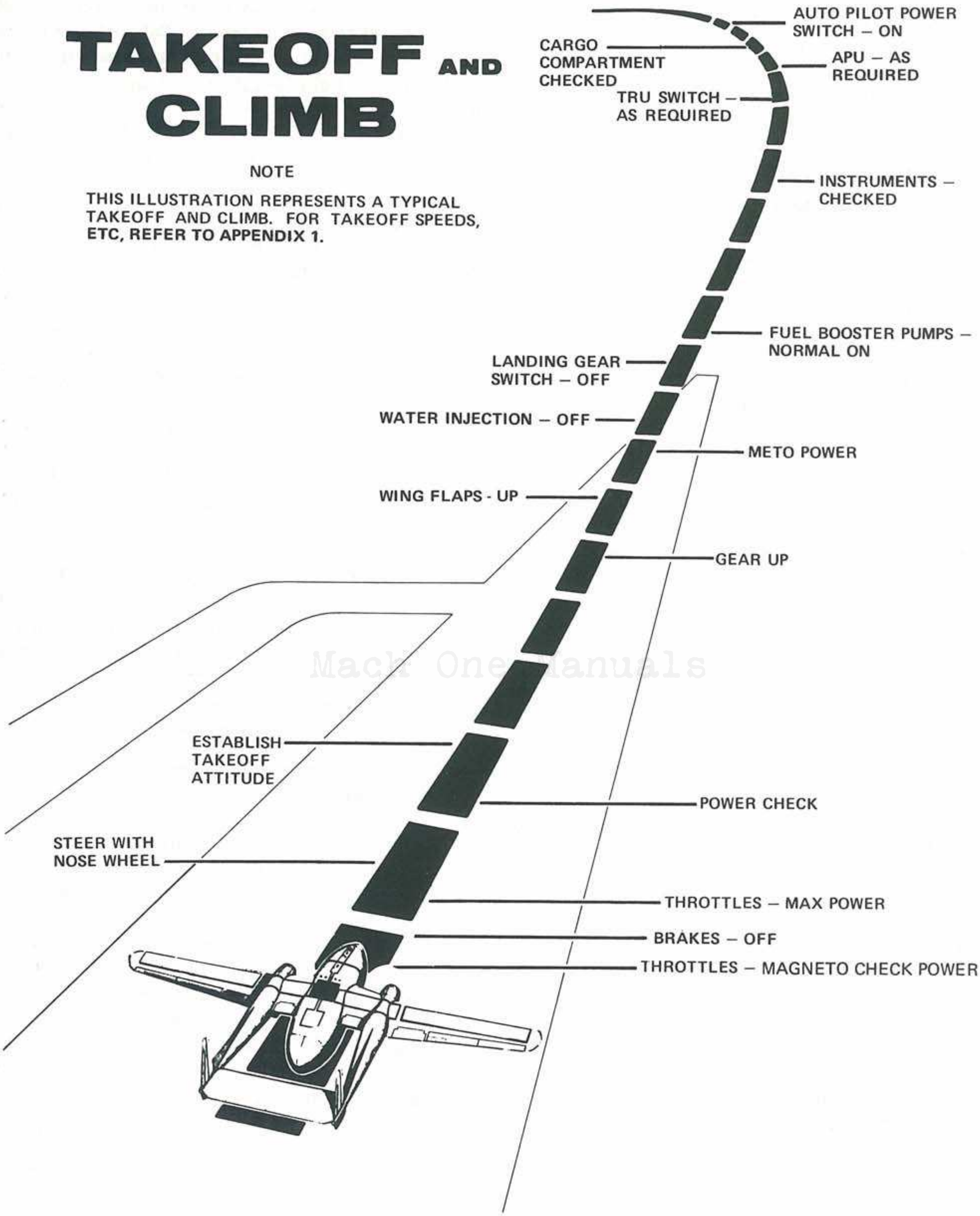


Figure 2-3

question. Maximum performance takeoff speed and ground run distance are charted in Appendix I, Part 3, Maximum Performance Takeoff Distance (Flaps 15°) chart.

WARNING

Maximum performance takeoff techniques (15° flaps) should be employed only when absolutely essential to urgent combat requirements or in an emergency, since both minimum control speed and safe single-engine speed are disregarded. If an engine fails prior to reaching minimum control speed or attaining sufficient altitude to retract the landing gear and wing flaps and accelerate to safe single-engine speed, ground contact will result.

OBSTACLE CLEARANCE TAKEOFF.

When clearance of obstacles at the end of the runway is a critical factor in takeoff planning, the climbout immediately after takeoff should be flown at obstacle clearance speed (V_{50}). This insures the capability of clearing an obstacle 50 feet high at a specified distance from the point where takeoff run commences. The obstacle clearance technique may be used following any of the basic takeoff procedures and does not necessarily imply maximum performance. For standard and minimum run takeoffs, the obstacle clearance speed is 1.2 times the power-off stall speed V_s and is determined from the Standard Takeoff Distance charts in Appendix I, Part 3. The obstacle clearance speed for maximum performance takeoffs is the same as the takeoff speed. Total distance required to clear the obstacle is also determined from the charts in Appendix I, Part 3.

CROSSWIND TAKEOFF.

When taking off in a crosswind, the aircraft has a tendency to turn upwind. During the takeoff run this tendency is overcome by steering with the nose gear. But immediately prior to takeoff when the nose gear is raised off the runway, it is essential that adequate rudder control be available to maintain heading without nose gear steering. Since the turning effect of the crosswind depends on the force and direction, the minimum safe crosswind takeoff speed is variable. (Refer to Crosswind Takeoff chart, Appendix I, Part 3). When the minimum safe crosswind takeoff speed has been determined, a comparison should be made with the takeoff speed (V_{to}) recommended in the appropriate takeoff distance chart. The crosswind takeoff should then be made using the greater of two speeds. If the crosswind takeoff speed is greater than V_{to}, the predicted takeoff distance will not be valid. The correction to the predicted distance can be determined by referring to Takeoff Acceleration chart, Appendix I, Part 3.

UNPREPARED RUNWAY TAKEOFF.

It is recommended that the minimum run technique be employed for takeoff from unprepared runways, thereby reducing the length and rate of travel over rough terrain to the minimum possible for takeoff. To jump the aircraft into the air from a rough or muddy runway, full wing flaps may be extended during the takeoff run. Wing flaps should be retracted from full down to takeoff position as soon as obstacles are cleared. As soon as safe airspeed is obtained, wing flaps may be fully retracted.

AFTER TAKEOFF—CLIMB.

1. Landing gear switch - UP (when definitely airborne). CP

   The pilot will issue a verbal and visual command for retracting the landing gear. The copilot will visually and verbally acknowledge the "gear up" command prior to retracting the landing gear.

   WARNING

   Jamming of the elevator controls can occur if the landing gear is retracted with the nose wheel not centered.

2. Wing flap lever - UP (after reaching recommended single-engine climb speed). CP

3. METO power - Set. CP

   Reduce power after landing gear is fully retracted, indicator lights are out, recommended single-engine climb speed and a minimum of 500 feet AGL has been attained.

NOTE

Climb performance contained in Appendix I, Part 4, is based upon the use of METO power.

4. Water injection switches - OFF. CP

NOTE

Operate the water injection switches one at a time, checking individual water pressures within limits.

5. Landing gear switch - OFF. CP

NOTE

Hydraulic pressure holds the gear slightly above the uplocks until the landing gear switch is placed in the OFF position.

6. Fuel booster pump switches - NORMAL ON. CP

NOTE

Operate the fuel booster pump switches one at a time, checking individual fuel pressures within limits.

7. Instruments - Checked. P, CP, FM

NOTE

Set cowl flap switches to TRAIL position as long as temperatures remain within limits.

8. TRU switch - As required. FM

9. APU - As required. IO

10. Cargo compartment - Checked. IO

Illuminator operator will check engines and propeller regulators for leaks and that landing gear doors are fully closed.

11. Auto pilot power switch - ON. CP

WARNING

The auto pilot power switch shall not be turned on until at least 1000 feet above ground level. Violent flight maneuvers could result from premature or unexpected engagement of the automatic pilot. If this occurs, immediate disengagement of the automatic pilot is required to maintain control of the aircraft.

CRUISE.

1. Cruise power - Set. CP

2. Spark control switches - As required. CP

The spark control switches may be placed in the ADVANCED position at 2300 rpm and below. An increase in TOP should be observed. If no increase is observed, the spark control may be locked in the retard position.

WARNING

- Continued operation with this known discrepancy should only be as an operational necessity.
- At any time the rpm is increased above 2300, the spark control switches will be placed in the RETARD position.

3. Fuel booster pump switches - As required. CP

4. Instruments - Checked. P, CP, FM

5. Mixture levers - As required. CP/FM

6. Cargo compartment - Checked. IO

7. Altimeter - Set. P, CP, N

ENROUTE CLIMB.

1. Fuel booster pump switches - NORMAL ON. CP

2. Mixture levers. - RICH. CP/FM

3. Spark control switches - RETARD. CP

Place switches in RETARD before increasing rpm above 2300.

4. Climb power - Set. CP

5. Cowl flap switches - As required. CP/FM

6. Instruments - Checked. P, CP, FM

AIRBORNE SENSOR ALIGNMENT (AS REQUIRED).

Perform PRE-STRIKE checklist items as required to accomplish this check.

1. Alignment briefing - Completed. P, CP, N

   Navigator will advise airspeed, altitude, and bank angle required for alignment check.

2. Procedure - Checked. P, NOS

   a. Position fixed reticle on alignment point. Alignment point must be detectable by NOS and visible to pilot. A small, defined point is desirable.

   b. Check fixed reticle tracking. Track alignment point within 1° or 18 mils of fixed reticle. (Not required to track alignment point exactly while aligning NOS.)

   c. NOS operator will track target and notify pilot when tracking.

3. NOS alignment - Checked. P, N

   a. Call necessary adjustments to navigator. (One direction at a time - azimuth or elevation.)

4. Final guidance and alignment check - Complete. P

   a. Run an intercept on alignment point using ID-249 to check approach guidance.

   b. Center vertical and horizontal bars.

   c. Roll into a 30° bank.

   d. Fixed and movable reticles must be nearly aligned.

   e. Place fixed reticle on movable reticle. Alignment point should appear in center of both within 10 mils.

   f. ID-249 bars should remain centered if in a 30° ± 2° bank.

5. Navigation mode select switch - As required. CP

PRE-STRIKE.

Before reaching the target area, the following procedures will be followed:

1. Crew stations - Checked. ALL

   The pilot will receive a report from the crew stations by interphone to assure the computer, fire control display, flare launcher, illuminator, and NOS are being prepared for the target run. Gunners will complete PRE-STRIKE checklist only.

2. APU - As required. IO

   Refer to NORMAL OPERATION OF THE APU, Section IV. If the illuminator light will not be used, the APU may be left off.

3. TRU switch - As required. FM

4. Hydraulic bypass valve - As required. FM

5. Fire/sight mode panel - Set. P

   Check that appropriate firing mode is selected, reticles are on, and reticle and cue light brightness is adjusted as desired.

6. Gunsight - Set. P

   Check that gunsight is adjusted for proper attack altitude.

7. Strike briefing - Complete. P, N

   The pilot or navigator will brief the crew on known target information to include type of target, firing altitude, mode of attack, guns required, and gun azimuth and elevation settings.

8. Lights - As required. P, CP, FM,IO

   Cockpit, instruments, cargo compartment, A-deck, and external lights. Check cockpit curtains for light leakage.

9. Mixture levers - As required. CP/FM

10. Fuel booster pump switches - NORMAL ON. CP

11. Fuel selectors - As required. CP/FM
12. Altimeter - Set. P, CP, N

STRIKE.

1. Gunner's STRIKE checklist - Acknowledged. G

NOTE

Pilot checks to see that the appropriate gun lights are illuminated.

2. Navigation mode select switch - As required. CP
3. Target identification - Completed. P, N
4. Master arm switch - ARMED. CP/FM

WARNING

The master arm switch will not be ARMED until the aircraft begins the firing run. It will be SAFE as soon as the aircraft comes out of the firing pass.

AFTER FIRING.

1. Master arm switch - SAFE. CP/FM
2. Navigation mode select switch - As required. CP
3. Gunner's AFTER FIRING checklist - Complete. G

POST STRIKE.

After leaving the target area, the following procedure will be accomplished.

1. Master arm switch - SAFE. CP/FM
2. Navigation mode select switch - As required. CP
3. Power - As required. CP

   The copilot will refer to the ENROUTE CLIMB or CRUISE checklist as directed by the pilot.

4. Hydraulic bypass valve - As required (pressure checked). FM
5. TRU switch - As required. FM
6. APU - As required. IO
7. Lights - As required. P, CP
8. Crew stations - Secure. ALL

   The pilot will receive a report from all crew stations by interphone to assure the computer, fire control display, guns, flare launcher, illuminator, and NOS are shut down and secure. Gunners will report gun and ammunition status.

9. Fire/sight mode panel switches - OFF. P

DESCENT.

The desired rate of descent can be obtained by the combination of airspeed and engine power setting; however, sufficient power to assure proper engine operation during extended descent must be maintained.

The optimum minimum torque pressure to be maintained during extended descent is 75 psi. If necessary, the power may be reduced to not less than a minimum of 1 inch Hg per 100 rpm.

CAUTION

Accumulated operation at high rpm and low manifold pressure can result in failure of the master rod bearing.

An increased rate of descent, if desired, may be obtained by lowering the landing gear and wing flaps to increase drag; however, descent with landing gear and wing flaps extended should not be made at an airspeed in excess of that indicated in Instrument Range Markings, figure 5-1, T.O. 1C-119G-1. Maximum airspeed permitted during descents with landing gear and wing flaps retracted, likewise, is indicated in the Instrument Range Markings by the limiting maximum dive speed. For power-off descents, refer to MAXIMUM GLIDE, Section III.

The DESCENT checklist may be accomplished as required during descent but must be completed prior to entering the downwind leg of the traffic pattern or prior to reaching procedure turn altitude during instrument approaches.

1. Windshield defogging - As required. FM

2. Crew briefing - Complete. P

   The illuminator operator will notify all personnel in the cargo compartment and insure that they are secure for landing. The pilot will brief the copilot and navigator on type of approach anticipated.

3. Radios - Tuned and checked. CP

4. Mixture levers - RICH. CP

5. Spark control switches - RETARD. CP

   Place switches in RETARD before increasing rpm above 2300.

6. Supercharger switches - LOW. CP

7. Instruments and altimeters - Checked. P, CP, N, FM

8. Fuel selectors - As required. CP/FM

9. Takeoff and landing data card - Reviewed. P, CP, FM

10. Auto pilot power switch - OFF. CP

11. APU - As required. IO

12. TRU switch - As required. FM

13. Safety belts and harnesses - Secured. P, CP, N, FM, IO

    The illuminator operator will verify that all crewmembers in the cargo compartment have seat belts secured.

14. Fuel booster pump switches - EMERG ON. CP

15. Hydraulic pressure - Checked. CP

16. Carburetor air switches - As required. CP

BEFORE LANDING.

Upon entering the traffic pattern, the following action should be taken. (See figure 2-4.)

1. Propeller levers - 2600 rpm. CP

2. Wing flap lever - TAKE-OFF, or as required. CP

3. Landing gear switch - DOWN and checked. CP, IO

   NOTE

   The pilot will check that green indicator lights come on. The illuminator operator will make a visual check that all three landing gears are extended and that the steering accumulator pin, where applicable, is properly extended and report gear position to the pilot.

4. Hydraulic pressure - Checked. CP

5. Landing light switches - As required. CP

   NOTE

   Except when detrimental to flying safety, landing lights will be displayed on final approach. Refer to AFM 60-16.

6. Wing flap lever - As required. CP

   Pilot will call out wing flap settings such as "Flaps - Take-Off," or "Flaps - Full Down." Copilot will lower wing flaps and state position of wing flaps when they are set.

7. Propeller levers - Full INCREASE RPM. CP

   When landing is assured, the pilot will call, "Full INCREASE RPM."

LANDING.

Procedures for normal, minimum run, crosswind, and unimproved runway landings are given below. When landing in gusty surface winds or strong crosswinds, a final approach speed slightly higher than that computed in Appendix I is recommended. Performance data based on various procedures are given in Appendix I and landing pattern airspeeds are included in figure 2-4. The data should be consulted to predict aircraft performance for the specific conditions involved in each landing.

NORMAL LANDING.

Plan all normal landings as though reverse thrust were not available.

a. Flare out gradually and ease the power off so as to contact the ground in a slightly nose-high attitude at the recommended touchdown speed (V_{td}). Once nose wheel contact is made, the nose wheel should be held down firmly by the copilot.

CAUTION

If nose wheel shimmy is suspected or has been encountered, plan the landing for a final approach into the wind and proceed as follows: make a gradual flare-out and ease the power off, contacting the ground with the main gear first in a slightly nose-high attitude. Before loss of elevator effectiveness, lower the nose wheel to a point just clear of the runway and hold it there by continued back pressure on the control column until the nose falls through. Do not let the nose wheel fall through from a nose-high attitude; this greatly increases the possibility of a shimmy. In the event a shimmy does occur, stop the aircraft as soon as possible.

b. Reverse thrust - As required.

Before reversing, the copilot should hold the control wheel.

CAUTION

To preclude engine overspeed, avoid "throttle bursting". Apply reverse power evenly and positively.

NOTE

Do not attempt to use reverse thrust until a full touchdown is made. The propellers cannot be reversed until one main gear strut is compressed and the elevator lock will not engage until the nose gear is compressed and the throttles are moved to the reversed position. If necessary, reverse immediately upon nose wheel touchdown, as reverse is most effective during the initial part of the landing roll and stress on the elevator and its control system is minimized.

c. Unreverse - Completed.

d. Brakes - Checked.

TOUCH AND GO LANDING.

Touch and go landings shall be made only when authorized by the major command concerned.

Accomplish a normal approach and landing.

On The Runway.

1. Wing flap lever - UP. CP

2. Trim tabs - Neutral. CP

3. Water injection switches - As required. CP

4. Propeller levers - Full INCREASE RPM. CP

NOTE

The copilot will report to the pilot that the aircraft is configured for takeoff.

5. Throttle levers - Maximum power. P, CP

Standard takeoff procedures will apply afte throttle levers are advanced.

After Takeoff.

Refer to AFTER TAKEOFF - CLIMB checklist.

Only items 1 thru 5 of AFTER TAKEOFF - CLIMB checklist need be accomplished if remaining in closed traffic.

Before Landing.

Refer to BEFORE LANDING checklist.

MINIMUM RUN LANDING.

For minimum run landing the recommended procedure is as follows:

a. Wing flap lever - DOWN.

b. Maintain final approach speed for aircraft gross weight as recommended. (Refer to Appendix I.)

c. Touch down main gear first in a slightly nose-high attitude and immediately lower the nose wheel. Once contact has been made, hold the nose wheel down firmly.

d. After full touchdown, apply reverse thrust and brakes as required.

CAUTION

When maximum braking is used, the brakes must be inspected prior to next takeoff.

NOTE

Reverse thrust is most effective during the initial part of the landing roll. Reverse early and apply power as necessary.

CROSSWIND LANDING.

The wing-down method is recommended when landing in crosswind conditions. A combination of wing-down and crab techniques may be used in crosswinds of high velocities.

Crosswind Landing Speed.

In order to insure that adequate rudder force is available for directional control immediately after touchdown, the aircraft should always be landed above the minumum crosswind landing speed specified in the Crosswind Landing chart, Appendix I, Part 6. Normally, the recommended touchdown speed is well above the minumum crosswind landing speed except when landing in a strong direct crosswind at a low gross weight. In this case, the landing should be made at or above the minimum crosswind landing speed. To improve the directional control of the aircraft, the nose gear should be lowered to the runway at a speed no less than the minimum crosswind landing speed, if practicable.

NOTE

Whenever the landing is made above the recommended touchdown speed (V_{td}) the landing distance specified in Appendix I, part 6, is invalid.

Crosswind Landing Procedure.

a. Plan the approach so as to touch down above the minimum crosswind landing speed.

b. Use aileron and rudder to lower the upwind wing and hold the nose of the aircraft in line with the runway.

c. To hold zero drift, maintain the necessary wing-down attitude throughout the final approach, and carry through touchdown.

d. After touchdown, lower the nose gear at minimum crosswind landing speed.

LANDING ON UNIMPROVED RUNWAYS.

a. Wing flap lever - DOWN.

b. Maintain final approach speed for aircraft gross weight as recommended. Refer to Appendix I, Part 6.

c. Touch down main gear first in a slightly nose-high attitude and immediately lower the nose wheel.

TYPICAL LANDING AND GO-AROUND

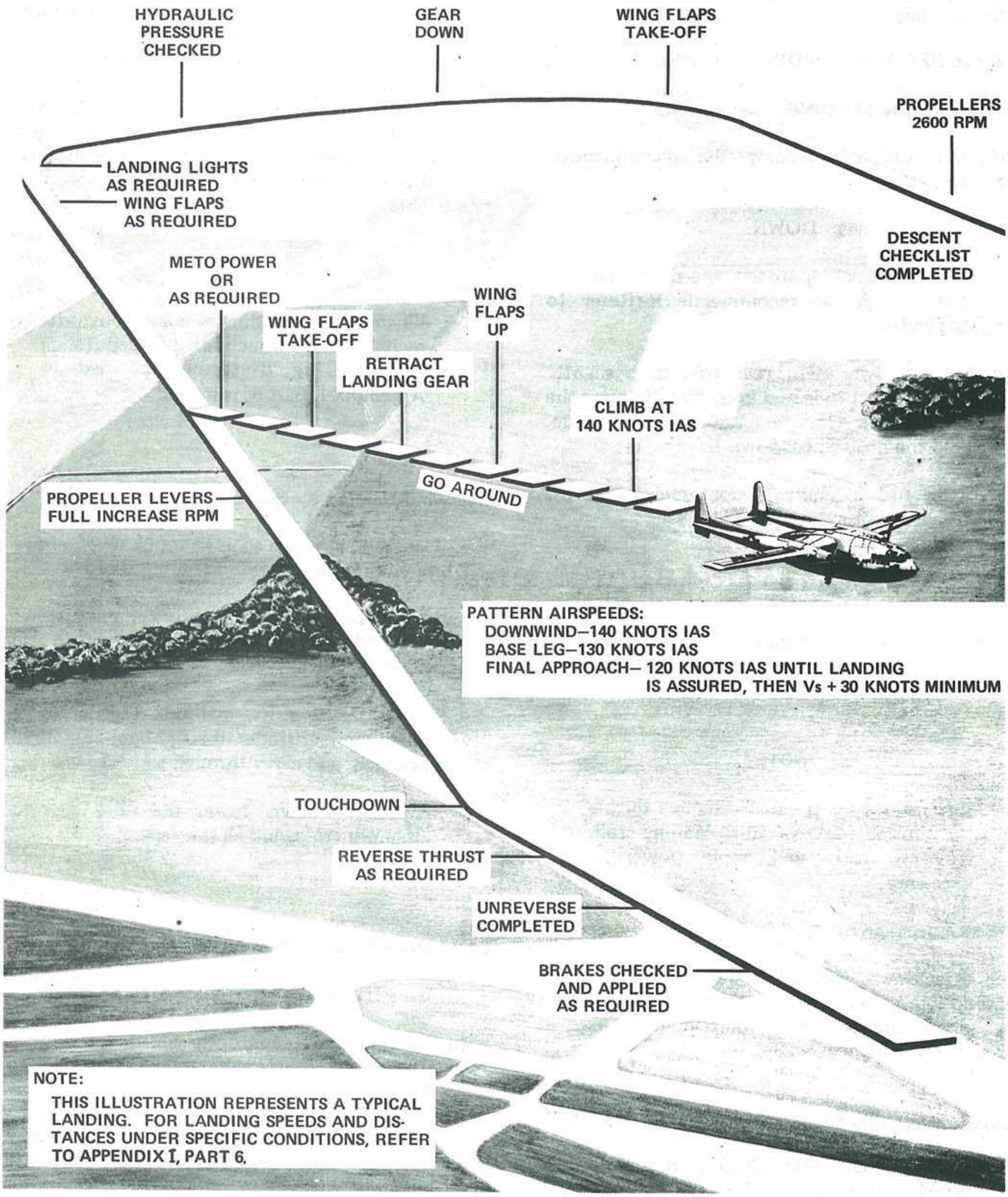


Figure 2-4

d. Brakes - As required.

After full touchdown, apply brakes as required.

CAUTION

Due to the abrasive quality of the sand and gravel which will probably be encountered on unimproved runways, do not lock the brakes. Excessive damage to and possible failures of tire may result.

e. Carburetor air switches - FILTERED.

f. Reverse thrust - If required.

CAUTION

Care must be exercised when reversing on unimproved runways as flying gravel will damage propeller blades and dust will impair the pilot's forward visibility at low aircraft speeds.

GO-AROUND.

The pilot, having elected to go around on a missed approach, should immediately:

a. Advance throttles to obtain maximum manifold pressure for rpm setting. If necessary, move the propeller levers to full INCREASE RPM and throttle levers to the manifold pressure or torque for Maximum Power, whichever comes first.

b. Retract wing flaps to TAKE-OFF, if full wing flaps are extended.

c. Retract landing gear. (Increased power and retracted gear will require nose-down trim.)

d. When recommended single-engine climb speed has been reached, retract wing flaps to full UP position.

e. Accomplish climb check.

AFTER LANDING.

After clearing the runway, the following should be accomplished.

1. Fuel booster pump switches - OFF. CP
2. Carburetor air switches - COLD, or as required. CP
3. Cowl flap switches - OPEN and checked. CP, FM/IO

   Flight mechanic and/or illuminator operator will visually check cowl flaps position for OPEN.
4. Wing flap lever - UP. CP
5. Anti-icing and deicing switches - OFF. FM

   Propellers deicing, pitot heaters, and wing and tail anti-icing.

   NOTE

   The heater master switch should remain ON for 4 minutes for cooling.
6. Lights - Climatic. P, CP, FM
7. IFF/SIF - OFF. CP
8. Unnecessary electrical equipment - Off. P, CP, N

POSTFLIGHT ENGINE CHECKS.

NOTE

Postflight engine checks are to be made upon completion of the last flight of the day, prior to entering the parking area.

1. Nose wheel and parking brake - Centered and set. P
2. Ignition switches - Checked. P

   Follow the same procedure as outlined in BEFORE TAXI checklist.
3. Ignition system and power - Checked. P

   Follow the same procedure as outlined in ENGINE RUNUP checklist.

4. Idle speed and mixture - Checked. P

   a. Propeller levers - Full INCREASE RPM.

   b. Mixture levers - RICH.

   c. Throttle levers - CLOSED.

   d. Idle speed of 650-750 rpm - Checked.

      The desired idle mixture setting is a "best power" mixture with the lever in RICH. To check this setting, accomplish step f on both engines and then step h.

   e. Advance throttle lever to obtain 800-850 rpm.

   f. Slowly move the mixture lever toward the IDLE CUT-OFF position until a change in rpm and manifold pressure is noted. An increase in rpm with a decrease in manifold pressure indicates that the mixture is too rich. If a decrease in rpm and an increase in manifold pressure occurs, the mixture is either at the desired best power setting or is too lean.

   g. Mixture lever - RICH.

   h. To determine if the mixture is too lean or at best power, flick the normal prime switch momentarily and note any change in manifold pressure and rpm. A momentary increase in rpm accompanied by a corresponding decrease in manifold pressure indicates that the mixture is too lean. A momentary decrease in rpm and increase in manifold pressure indicates correct idling mixture.

ENGINE SHUTDOWN.

After parking, employ the following procedures in shutting down the engines.

1. Parking brake - Set. P

2. Pilot's instrument inverter switch and auto pilot inverter switch - OFF. CP

3. Heaters - OFF. FM

NOTE

The heater master switch should remain ON for 4 minutes for cooling.

4. Idle engines - Completed. P

   Idle engines at 650-750 rpm until cylinder head temperature drops to a maximum of 150°C or to a value consistent with existing atmospheric temperatures.

5. Oil scavenging - Completed. P

   Operate engines 30 seconds at 1000-1200 rpm for engine oil scavenging before shutdown.

6. Trim tabs - Neutral. CP

   The copilot will position the trim tabs to the neutral position during the oil scavenging procedure.

7. Oil dilution switches - Climatic. P

   Refer to Section IX, T.O. 1C-119G-1.

8. Right mixture lever - IDLE CUT-OFF. CP

CAUTION

Do not move throttles when stopping engines as backfiring may occur.

9. Left hydraulic pump - Checked. CP

CAUTION

Wing flaps are extended and raised to check operation of the hydraulic pump. Properly functioning pump will immediately restore the pressure to normal operating range. Wing flaps will be permitted to travel through complete cycle prior to reversing direction of the wing flap mechanism in order to prevent damage to the wing flap linkage.

10. Left mixture lever - IDLE CUT-OFF. P

11. Ignition switches - OFF. P

Turn ignition switches OFF only after engines are completely stopped.

BEFORE LEAVING THE AIRCRAFT.

1. Electrical switches - Off or as required. P, CP, FM

NOTE

The generator warning lights will glow at any time the generators are not operating and the generator switches are in the ON position. Placing the generator switches in OFF will turn off the lights and prevent a drain of battery power.

2. Chocks - In place. P, CP
3. Gust lock - Released. P
4. Flight controls - Locked. P
5. Parking brake - Off. P
6. Heater pressure differential drain valves - Climatic. FM
7. Form 781 - Completed. P

CAUTION

In addition to established requirements reporting any system defects, unusual and excessive operations, the flight crew will also make entries in Form 781 to indicate when any limits in the Flight Manual have been exceeded.

8. TRU switch - OFF. FM
9. APU - Shut down. IO
10. Battery switch - OFF. P, CP
11. Gear pins, grounding wire, covers, and dust excluders - Installed. FM, IO, G

ABBREVIATED CHECKLIST.

The checklist of normal operating procedures for the pilot, copilot, and flight mechanic provided in T.O. 1C-119(A)G-1CL-1, is an abbreviated version of Section II. All checklist items established in this section appear in the abbreviated checklist; however, only the initial entry is given. Amplification of a given entry in the checklist may be obtained by referring to the identically numbered step under the appropriate heading in Section II.

SECTION III

EMERGENCY PROCEDURES

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NOTE

The urgency of certain emergencies requires immediate and instinctive action by the air crewmembers. These checklist items are depicted in bold print and will be memorized by the applicable crewmembers. Following completion of the bold print items, the applicable checklist will be completed in its entirety in sequence.

NOTE

Although many in-flight emergencies require immediate corrective action, frequently difficulties are compounded by the tempo of the pilot's commands and hurried execution by the crew. It is essential that the pilot carefully analyze the difficulty prior to taking corrective action.

ENGINE FAILURE.

SINGLE-ENGINE FLIGHT CHARACTERISTICS.

The most significant flight characteristic of the aircraft during single-engine operation is the immediate tendency to yaw toward the dead engine. This can, of course, be offset by timely application of rudder trim and aileron control if necessary. But such corrective control is dependent upon an adequate flow of air across the flight control surfaces and should be applied immediately upon experiencing the engine failure. Of related importance is the immediate loss of thrust which seriously impairs the climb and speed performance of the aircraft. With the paratroop doors open, the additional drag is particularly noticeable when operating on one engine. However, as long as the recommended airspeed is maintained and the aircraft is properly trimmed for single-engine flight, all the normal flight maneuvers may be performed.

Minimum Control Speed.

Minimum control speed (MCS) is that speed required to provide sufficient control to enable the aircraft to fly a straight flight path over the ground when an engine has failed. This speed is based on standard day sea level condition.

Factors Affecting Single-Engine Performance.

Numerous factors influence an aircraft's performance under single-engine conditions. These include poor technique in reducing drag (such as failing to retract the landing gear and wing flaps, feather the propeller, or close the cowl flaps on the dead engine) as well as permitting the airspeed to decrease too far by delaying the application of power on the good engine. Also of major importance are such mechanical items as proper fit of landing gear doors, wing flaps, and all external inspection doors, as well as the general cleanliness of the aircraft's exterior surfaces. Most important, however, is the requirement for reducing the drag of the windmilling propeller by feathering, a move which improves both performance and controllability. The application of Maximum Power on the good engine should not be delayed since adequate rudder power is available to offset this asymmetrical thrust air airspeeds above 113 knots with a windmilling propeller and wings level. By feathering the propeller, this speed can be

POWER RATING	BHP AT SL	ANGLE OF BANK	MINIMUM CONTROL SPEEDS—KNOTS IAS: PROPELLER FEATHERED	MINIMUM CONTROL SPEEDS—KNOTS IAS: PROPELLER WINDMILLING
MAXIMUM WET	3500	0° 5°	102 93	113 103
MAXIMUM DRY	3250	0° 5°	99 90	111 99
METO	2600	0° 5°	92 84	

Figure 3-1

reduced to 102 knots, and by executing a slight bank (5°) toward the good engine, directional control can be maintained at speeds as low as 93 knots. However, if the airspeed is allowed to fall below these critical speeds, the only alternative is to reduce power on the good engine momentarily in order to retain control of the aircraft. See figure 3-1. Depending upon the gross weight of the aircraft, this may or may not necessitate losing altitude to regain the minimum control speed.

Recommended Single-Engine Climb Speeds.

Recommended single-engine climb speed is the speed at which maximum rate of climb occurs, providing this speed is above the minimum control speed of the aircraft. When the speed at maximum rate of climb is less than minimum control speed, then the minimum control speed becomes the recommended single-engine climb speed. Recommended climb speeds for single-engine operation at sea level conditions are plotted as a function of gross weight on figure 3-2; however, for flight planning purposes at any particular altitude, refer to Appendix I.

Recommended Single-Engine Cruise Speeds.

Recommended single-engine cruise speeds may be selected by referring to the Air Nautical Miles Per Pound of Fuel (Single-Engine) charts found in Appendix I, Part 5. The power settings for long range (99% Best Economy) specified thereon should be used in establishing the recommended cruise speeds.

Safe Single-Engine Speed.

Safe single-engine speed is that speed which will permit the aircraft to maintain a 100 feet per minute rate-of-climb after a clean configuration (gear and wing flaps UP) has been established and the propeller on the inoperative engine is feathered. At higher temperatures and altitudes above sea level a deterioration of performance occurs. Refer to the Emergency Climb curves, Appendix I, Part 4.

WARNING

The aircraft will not maintain altitude with one propeller windmilling regardless of gross weight or configuration.

DETECTION OF INOPERATIVE ENGINE.

If engine failure should occur, the inoperative engine can be determined by:

a. Noting the change in directional trim. When an engine fails, the effect of asymmetric power is such that it causes the aircraft to yaw in the direction of the engine which has failed.

b. Noting the torquemeter readings. The torquemeter, which is a ready index of the power an engine is producing, will drop off rapidly at the time of engine failure.

c. Observation of the engine in question. Engine roughness, spewing of oil, or evidence of fire indicate engine malfunction.

d. Noting cylinder head temperature. A drop in cylinder head temperature is an accurate indication of engine failure; however, it is not as immediately discernible as the drop in torque pressure.

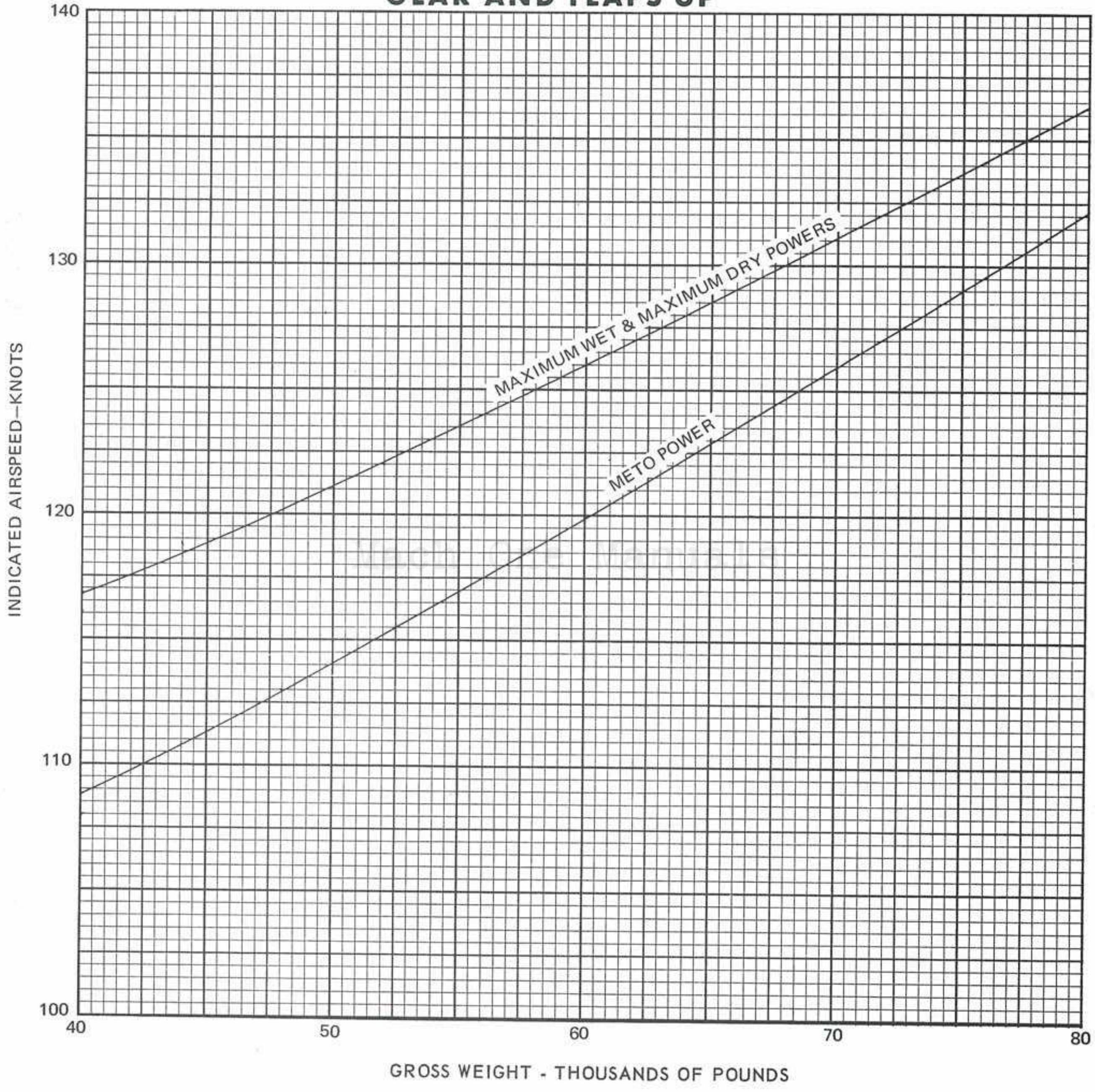
ENGINE FAILURE/FIRE DURING TAKEOFF.

During Takeoff Run.

If complete engine failure should occur during the takeoff run before the aircraft becomes airborne, the pilot should immediately reduce power and follow the procedure outlined in ABORT, this section. This may involve running off the end of the runway if the failure occurs after passing refusal speed, but is considered less hazardous than attempting to take off with marginal directional control (Refer to REFUSAL SPEED, Appendix I, Part 3). A partial loss of power can be tolerated in some cases, depending upon the speed at which the power loss occurs, and how much power is lost. The critical situation develops when the power loss occurs between refusal speed and takeoff speed. In this case, it is possible to continue the takeoff (provided critical field length does not exceed runway length), but directional control may be marginal if the power loss is severe.

RECOMMENDED SINGLE-ENGINE CLIMB SPEEDS

GEAR AND FLAPS UP



DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

Figure 3-2

Before Obtaining Minimum Control Speed.

If, during takeoff, engine failure is encountered when airborne and before minimum control speed has been obtained:

1. Maintain directional control. P

   If directional control cannot be maintained, reduce power on good engine proportionally.

2. Propeller lever - FEATHER (malfunctioning engine). CP

3. Prepare for crash landing. ALL

NOTE

Alert crew and passengers by turning alarm bell on.

4. Land straight ahead with landing gear and wing flaps down, if possible. P

After Obtaining Minimum Control Speed and Prior to Obtaining Recommended Single-Engine Climb Speed.

Depending upon aircraft gross weight, the minimum control speed may be considerably less than the recommended single-engine climb speed. However, by sacrificing altitude, recommended single-engine climb speed may be obtained and flight continued by following the procedure in ENGINE FAILURE DURING TAKEOFF AND CLIMB AFTER OBTAINING RECOMMENDED SINGLE-ENGINE CLIMB SPEED, this section. Therefore, the pilot will have to determine the course of action to be taken should engine failure occur during the transition period from minimum control speed to recommended single-engine climb speed. Factors to be considered are altitude, airspeed, gross weight, and runway remaining.

ENGINE FAILURE DURING TAKEOFF AND CLIMB AFTER OBTAINING RECOMMENDED SINGLE-ENGINE CLIMB SPEED.

WARNING

- With an inoperative engine, the aircraft will not attain the predicted climb performance from the Takeoff Gross Weight Limits chart until the landing gear is fully retracted and the propeller on the inoperative engine is feathered and the cowl flaps are closed. This could place the aircraft in a position where a crash landing is inevitable until a positive rate of climb is attained.

- Landing gear retraction time will be increased with only one hydraulic pump operating. Landing gear retraction or extension may require as much as 40 seconds.

If engine failure occurs during takeoff after recommended single-engine climb speed is obtained and prior to initiating the AFTER TAKEOFF - CLIMB checklist, maintain airspeed and control and accomplish the following procedure. Refer to the Emergency Climb curves, Appendix I, Part 4.

Shut Down Dead Engine.

1. **GEAR AND FLAPS—UP. CP**
2. **THROTTLE—CLOSED (dead engine). P**
3. **PROP—FEATHER (dead engine). CP**
4. Mixture lever (dead engine) - IDLE CUT-OFF. CP
5. Firewall shutoff switch (dead engine) - SHUT. CP
6. Fuel selector switch (dead engine) - OFF. CP
7. Engine fire extinguisher switch - ON (if fire exists). CP
8. Cowl flaps.

   a. Cowl flap switch (dead engine) - CLOSED (TRAIL, if fire exists). CP, FM

   b. Cowl flap switch (good engine) - As required. CP, FM

Cleanup.

1. Fuel booster pump switch of dead engine - OFF. CP

2. Ignition switch of dead engine - OFF. CP

3. Generator switch of dead engine - OFF. CP

4. Oil cooler flap switch of dead engine - CLOSED. FM

5. Unnecessary electrical equipment - Off. CP, FM

6. Cowl flap switch of dead engine - CLOSED (after all danger of fire is past). CP, FM

   Close the cowl flaps of the dead engine to reduce drag.

WARNING

- If engine has been shut down due to fire, do not attempt to restart engine. If the cause of engine failure has been other than fire and it is deemed reasonably safe to do so, the engine may be restarted in flight.

- It is necessary to maintain both straight flight and the recommended airspeed for several minutes in order to gain altitude before attempting to circle back for a landing. Any maneuvering of the aircraft during this critical period will further reduce the rate-of-climb (possibly from a positive rate to negative), and continued flight may become impossible. Keep in mind that the rate-of-climb may be as low as 100 fpm if the takeoff was accomplished at a maximum gross weight adjusted for existing atmospheric conditions.

- At least several hundred feet of altitude should be gained by straight flight before any turning is attempted, and the recommended speed should be held throughout the turning, even at a sacrifice in altitude.

ENGINE FAILURE DURING FLIGHT.

Conditions permitting, attempt to return the affected engine to normal operation by reducing power on the engine and placing the mixture lever to RICH, fuel booster pump switch to EMERG ON, switching fuel tanks, and/or applying carburetor heat. Do not compromise directional control or allow airspeed to dissipate below recommended single-engine climb speed during this period. If normal or partial power output (above 75 psi torque oil pressure) cannot be realized, shut down the inoperative engine immediately by accomplishing the procedure outlined below. Following this, equipment should be jettisoned, if necessary, to maintain altitude. If this is not possible and difficulty is encountered in maintaining directional control, altitude, and airspeed, the crew should be alerted for bailout. Normally, flight on one engine is possible, in which case the aircraft should be landed at the nearest suitable landing field.

Maintain Airspeed and Control.

WARNING

Landing gear retraction time will be increased with only one hydraulic pump operating. Landing gear retraction or extension may require as much as 40 seconds.

1. **GEAR AND FLAPS—AS REQUIRED. CP**

   If landing gear is down and landing is imminent, leave the landing gear down.

2. **BOOST PUMPS—EMERG ON. CP**

3. **MIXTURES—RICH. CP**

4. **SPARK CONTROLS—RETARD. CP**

5. **PROP—FULL INCREASE RPM (good engine), or as required. CP**

6. **THROTTLE—MAXIMUM POWER (good engine), or as required to maintain safe-airspeed. P**

   Water injection switch - ON, if required.

7. **THROTTLE—CLOSED (dead engine). P**

8. **PROP—FEATHER (dead engine). CP**

   While the propeller is feathering, advance power on the good engine, as desired.

Cleanup.

1. Mixture lever of dead engine - IDLE CUT-OFF. CP
2. Firewall shutoff switch of dead engine - SHUT. CP
3. Fuel selector switches - As required. CP

WARNING

The fuel selector switch of the dead engine should not be turned OFF if the fuel selector switch for the good engine is on CROSSFLOW, as the fuel supply to the good engine will be shut off at all tanks. However, if some fuel remains in either tank on the side of the good engine, it is recommended that the fuel selector switch for the good engine be positioned to use that fuel. The fuel selector switch of the dead engine then should be turned OFF. This will preclude the development of a fire hazard aft of the firewall, which could conceivably result from firewall and fuel line damage caused by specific types of engine failure. When the emergency has passed and it is deemed safe to use fuel from the tanks of the dead engine, crossflow operation may be resumed.

4. Engine fire extinguisher switch - ON (if fire exists). CP
5. Cowl flaps.
   a. Cowl flap switch of dead engine - CLOSED (TRAIL, if fire exists). CP, FM
   b. Cowl flap switch of good engine - As required. CP, FM
6. Fuel booster pump switch of dead engine - OFF. CP
7. Ignition switch of dead engine - OFF. CP
8. Generator switch of dead engine - OFF. CP
9. Oil cooler flap switch of dead engine - CLOSED. FM
10. Cowl flap switch of dead engine - CLOSED (after all danger of fire is past). CP, FM

    Close the cowl flaps of the dead engine to reduce drag.

11. Monitor bus switch - OVERRIDE, if required. N/FM
12. Unnecessary electrical equipment - Off. ALL
13. APU - Start. IO
14. TRU switch - ON. FM

RESTARTING ENGINE IN FLIGHT.

WARNING

If engine has been shut down due to fire, do not attempt to restart engine. If the cause of engine failure has been other than fire and it is deemed reasonably safe to do so, the engine may be restarted in flight.

1. Airspeed - 150 knots maximum during unfeathering. P
2. Throttle lever of dead engine - CLOSED. CP
3. Firewall shutoff switch - NORM. CP
4. Fuel selector switch - As required. CP
5. Generator switch - ON. CP

6. Oil cooler flap switch - AUTO. FM

7. Starter switch - 8 blades. P, CP

   Energize the starter continuously to turn the propeller through eight blades. If any indication of hydraulic lock is noted, discontinue starting procedure.

8. Ignition switch - BOTH. CP

9. Propeller lever - Full INCREASE RPM. CP

   As soon as engine speed reaches 800-1000 rpm, move propeller lever to permit governing at 1200-1400 rpm.

10. Oil pressure - Checked. CP

11. Mixture lever - RICH. CP

12. Cowl flap switch - As required. CP, FM

NOTE

Allow engine to warm up at low power settings until cylinder head temperature reaches 100°C and oil temperature reaches 40°C. During this time engine power setting should not exceed 1800 rpm and 75 psi torque pressure.

13. Propeller - Recharged. P

    Operate propeller at 2600 rpm for 20 seconds to recharge propeller feathering system.

14. TRU switch - As required. FM

15. APU - As required. IO

ENGINE BACKFIRING.

Backfiring, which is premature ignition of the fuel/air charge in the engine cylinders and/or ignition of intake passage gases, may occur at all power schedules.

DURING GROUND OPERATION.

Whenever engine backfiring is encountered during ground operation, the engine should be immediately shut down. The cause of backfiring should be determined and the condition corrected before resuming operation of the engine.

DURING TAKEOFF.

Should backfiring occur during the takeoff run, the takeoff should be aborted, if possible. If backfiring occurs after reaching refusal speed and insufficient runway remains for a safe abort, power should be reduced as soon as possible after minimum safe altitude and airspeed is reached. In the best interest of flying safety the aircraft should be landed as soon as possible.

DURING FLIGHT.

Backfiring during flight requires immediate corrective action. If the situation permits, power should be reduced until backfiring ceases. Cylinder head, carburetor air, and oil temperatures should be closely monitored and maintained within desirable limits if possible. Should these steps fa" to stop the backfiring and if the aircraft w maintain safe flight without the affected engine, shut down the engine and land as soon as possible at the nearest suitable airfield.

FUEL PRESSURE DROP—ENGINE OPERATING NORMALLY.

DURING GROUND OPERATION.

If the fuel pressure drops below the operating limits during ground operation, but the engine continues to operate normally, employ the following procedure:

1. Mixture lever - IDLE CUT-OFF (affected engine). P

2. Firewall shutoff switch - SHUT (affect engine). P

3. Both engines - Shut down. P, CP

DURING FLIGHT.

If the fuel pressure drops below the operating limits during flight, but the engine continues to operate normally, the cause may be one or more of the following: primer leakage, oil dilution solenoid leakage, engine-driven fuel pump bypass valve leakage, clogged pressure line, instrument failure, or line leakage. Possible courses of action, depending on the cause of the pressure drop, are listed below.

WARNING

Whenever fuel pressure drops and the engine continues operating normally, the first concern of the crew must be to guard against the outbreak of an engine fire. The greatest danger lies in the fact that the crew develops a false sense of security because no fire exists at the time that the fuel pressure drop is noticed nor after several hours of flight. However, when the throttle is retarded (as in preparation for a landing), an engine fire develops and the results are usually disastrous. What has happened is that a fuel leak existed, but the cooling and dispersing effect of the airflow through the engine nacelle at cruising speed has prevented the start of a fire. When the throttle was retarded, the airspeed dropped and the airflow was reduced sufficiently to permit ignition of the leaking fuel. Any change in the airflow pattern, such as feathering the propeller or entering a climb, can start a fire if a fuel leak exists. Increasing the power is less likely to start a fire since airspeed will be increased, but even then, there is a possibility of fire since the exhaust heat and flame pattern may change sufficiently to outweigh the increase in cooling airflow. Accordingly, it must be the objective of the crew to eliminate the fuel before any change is made to the airflow or exhaust pattern. The most effective means of accomplishing this is by moving the mixture lever to IDLE CUT-OFF before any throttle reduction, propeller feathering, or any other engine shutdown procedure is initiated. An additional advantage of moving the mixture lever to IDLE CUT-OFF is that it provides the most rapid means of eliminating exhaust stack flames and reducing exhaust heat.

a. Cut the engine immediately by means of the mixture lever. Do this if the power is not necessary to sustain flight or to reach a safe destination.

b. Keep the affected engine in operation at or above cruising speed while maintaining watch for fire. This can be done if it cannot be determined whether or not an actual leak exists, and the engine is required to either sustain flight or maintain the required altitude for arrival at a safe destination. However, prior to power reduction for entrance to the landing pattern, cut the affected engine completely (by means of the mixture lever - not by retarding the throttle) and accomplish a single-engine power landing. Unless the added power is absolutely essential to effect a safe landing, do not reduce airspeed until the affected engine is shut down.

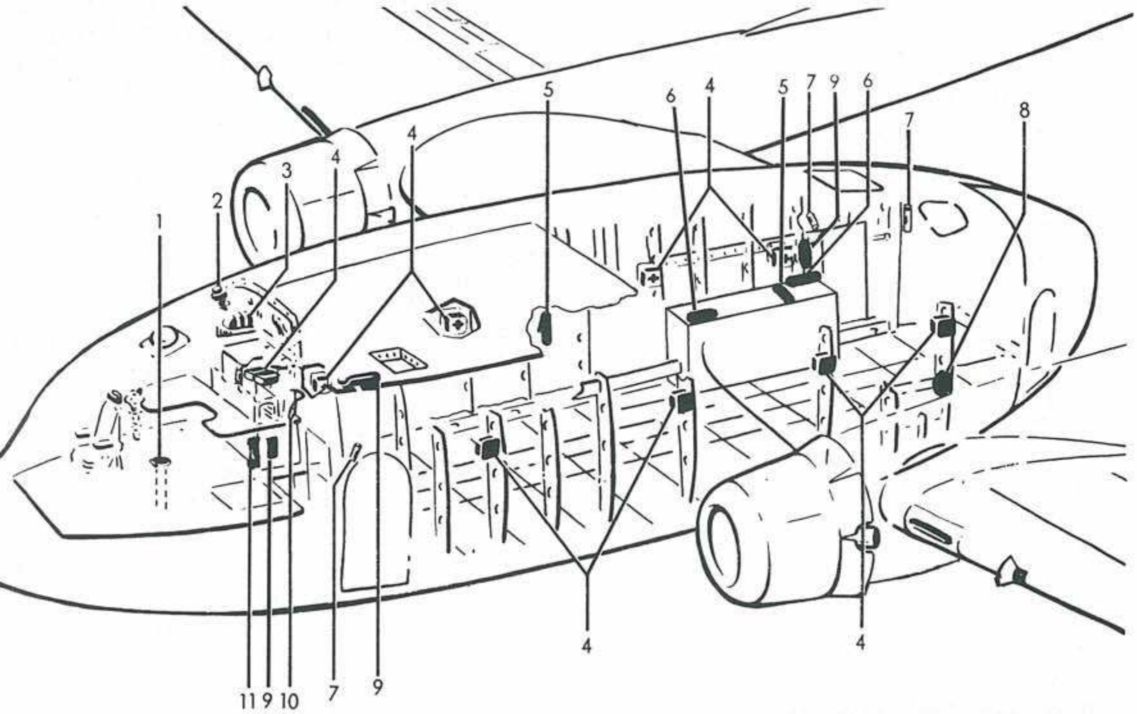
c. Continue operating the engine normally. This may be done if it can be reasonably ascertained that the indicated fuel pressure drop has not resulted from a fuel leak.

NOTE

All other factors being equal, course a is generally the best. However, action to be taken depends entirely upon the circumstances existing at the time. Such factors as the known condition of the aircraft and the remaining engine, stage and requirements of the mission, and power requirements of the aircraft should be considered.

MAXIMUM GLIDE.

The glide performance of the aircraft is illustrated graphically in figures 3-4 and 3-5, Maximum Glide. One chart illustrates the best glide speed, rate of sink, and glide range (no wind) with both propellers feathered. The other chart contains



1. FLARE CHUTE
2. PYROTECHNIC PISTOL MOUNT
3. PYROTECHNIC STOWAGE
4. FIRST AID KITS
5. FIRE FIGHTING OXYGEN BOTTLE
6. HAND FIRE EXTINGUISHER H_2O
7. FLASHLIGHTS
8. SMOKE MASK
9. HAND FIRE EXTINGUISHER (CB)
10. EMERGENCY AXE
11. BAILOUT CHUTE STATIC LINE

MISCELLANEOUS EMERGENCY EQUIPMENT

TYPICAL

Figure 3-3

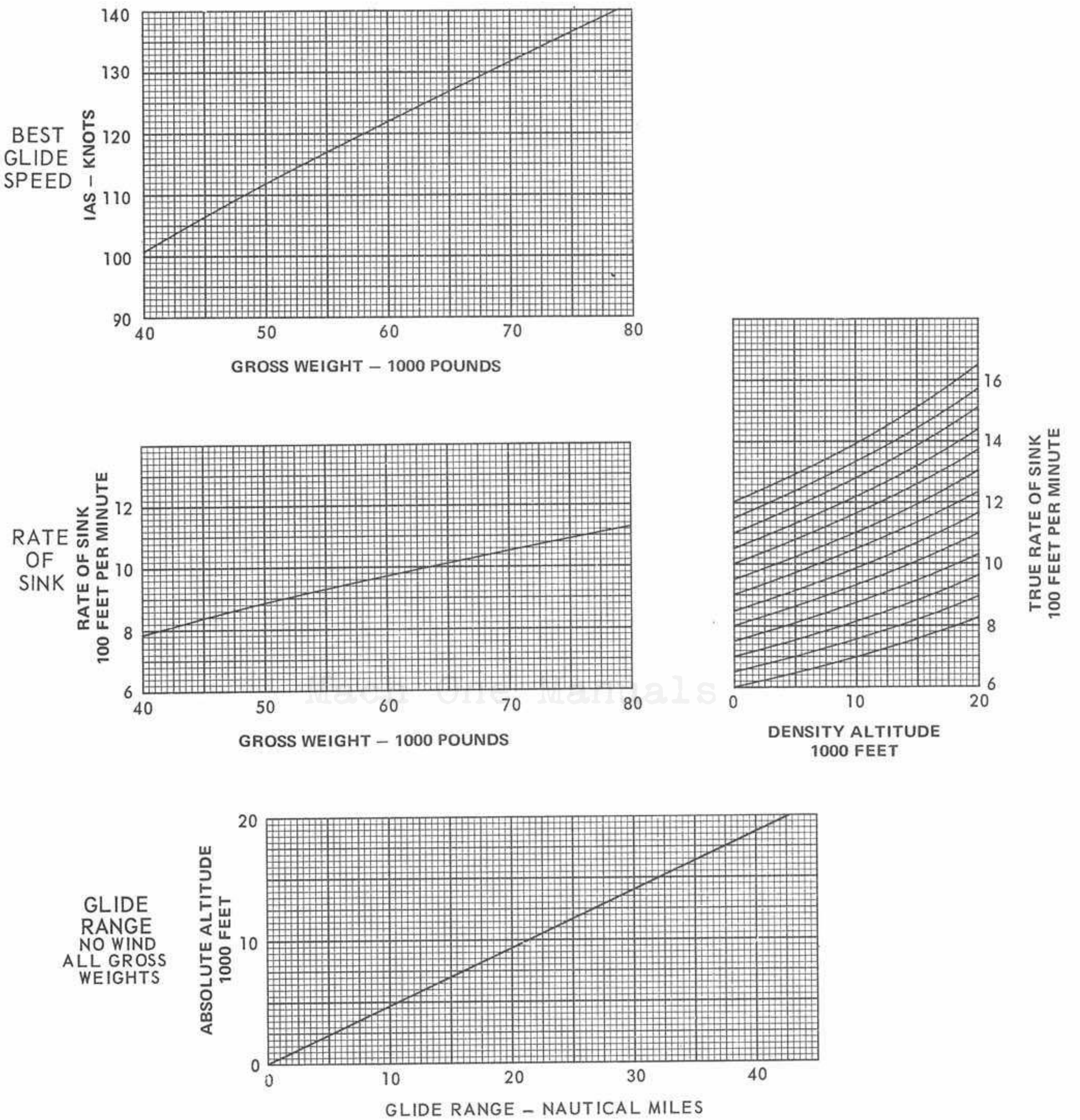
similar glide performance information for the propellers windmilling condition. Notice that when both propellers are feathered, gross weight has no effect on the maximum glide range of the aircraft, but that when the propellers are allowed to windmill, slightly more range is obtained at the higher gross weights than at the lower gross weights.

BEST GLIDE SPEED.

The best glide speed is that which results in the minimum glide angle. With both propellers feathered, the minimum glide angle for the aircraft is 4.4°. But when both propellers are windmilling, the best angle of glide is dependent upon the gross weight and is tabulated in the upper right-hand corner of figure 3-5. Descent at the minimum glide angle will result in the maximum glide range with no engine power available. This is accomplished by maintaining the glide speed recommended in the Best Glide Speed portion of the Maximum Glide charts.

RATE OF SINK.

Inasmuch as the airspeeds required to hold the minimum glide angle increase as the gross weights increase, the rates of sink (vertical velocities of descent) likewise increase. The rates of sink also vary with atmospheric conditions and altitudes because of the variations in air density. By entering the center portion of the Maximum Glide charts, the rate of sink at any known density altitude may be found. In figure 3-4 this is done by first finding the rate of sink at sea level and then correcting for density altitude (pressure altitude corrected for

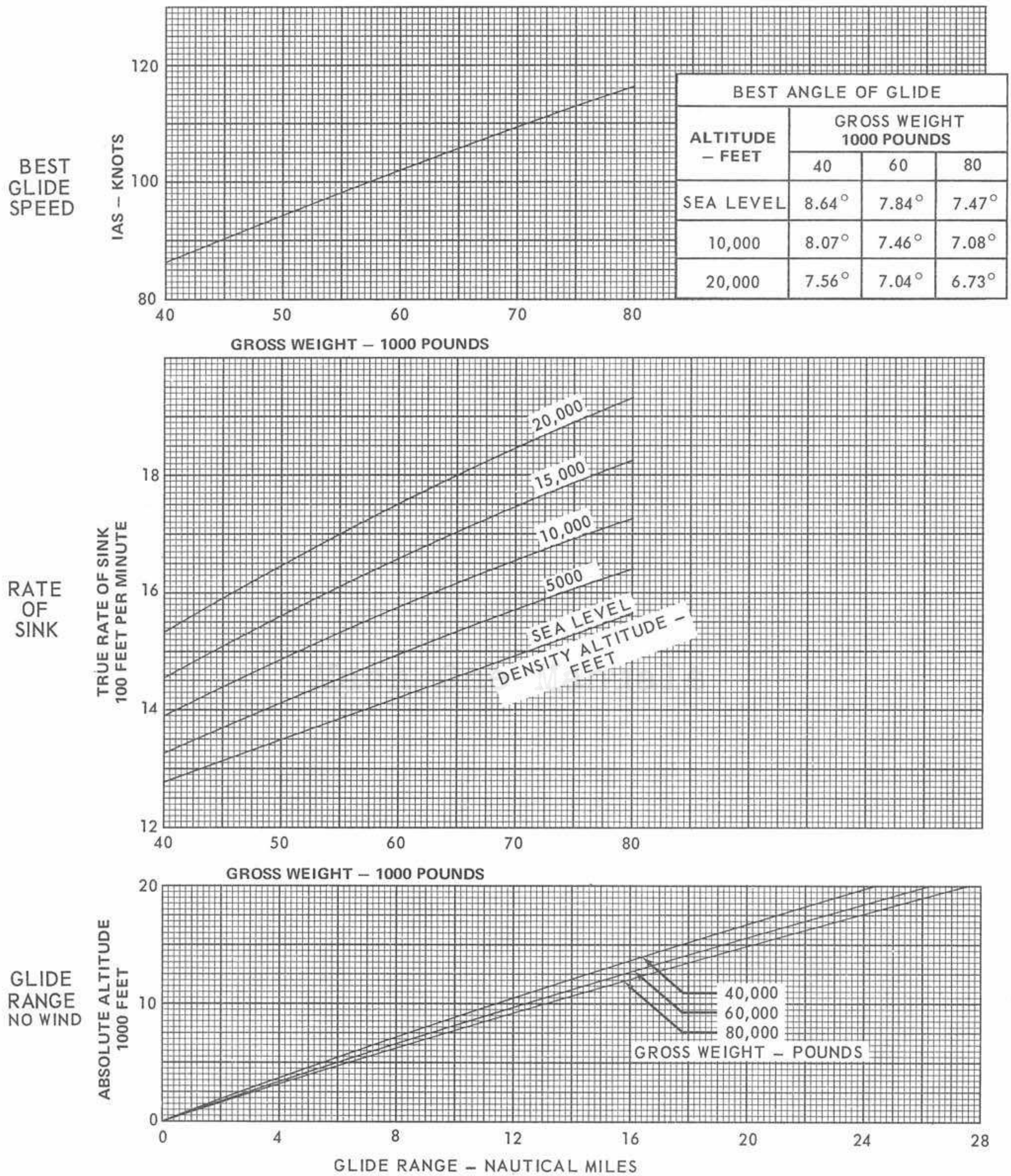


MAXIMUM GLIDE

PROPELLERS FEATHERED
GEAR AND FLAPS UP

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

Figure 3-4



BEST ANGLE OF GLIDE			
ALTITUDE – FEET	GROSS WEIGHT 1000 POUNDS		
	40	60	80
SEA LEVEL	8.64°	7.84°	7.47°
10,000	8.07°	7.46°	7.08°
20,000	7.56°	7.04°	6.73°

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

MAXIMUM GLIDE

PROPELLERS WINDMILLING
GEAR AND FLAPS UP

Figure 3-5

free air temperature). Refer to the Density Altitude Curve, Appendix I, Part 1. True rate of sink is found directly on figure 3-5 by reading vertically upward from the gross weight scale to the appropriate density altitude line, then across to the scale at the left.

GLIDE RANGE.

With both propellers feathered, the glide range of the aircraft is independent of the gross weight, provided the recommended glide speed is maintained. However, when both propellers are allowed to windmill, glide range is no longer independent of gross weight. Notice that slightly more range is available at a gross weight of 80,000 pounds than at 40,000 pounds. This is due to the fact that the drag of a windmilling propeller is a nonlinear relationship with respect to airspeed. To determine the glide range from a known true altitude, enter the Glide Range portion of the appropriate chart and read across horizontally to the line, then read glide range (no wind) in nautical miles on the scale at the bottom.

SINGLE-ENGINE LANDING.

There are several significant factors which should be considered in executing a single-engine landing. One of these is the drag produced by extending the landing gear. At high gross weights, it is very difficult to maintain altitude under single-engine conditions with the landing gear down. Plan the approach in the usual manner, but do not lower landing gear or wing flaps until the final stages of the approach. Selection of the exact point at which to extend the landing gear is left to the discretion of the pilot and should be based on a consideration of the increased time for gear extension (due to one hydraulic pump operating) and the possible necessity for emergency extension of the gear, as well as the additional drag associated with the geardown configuration. After turning onto the final approach leg, maintain altitude no lower than normal final approach altitude until the runway can be made with reduced power to point of touchdown. At this point, lower the wing flaps, adjust power as required, and let down at or above recommended single-engine climb speed for the applicable gross weight. If necessary, cowl flaps may be opened to increase drag and rate of descent if the approach is too high.

SINGLE-ENGINE LANDING PROCEDURE.

Should it be necessary to execute a single-engine landing, refer to the charts in Appendix I and determine the landing distance (brakes only) and recommended single-engine climb speed.

a. Fly pattern as required to establish normal final approach.

b. Extend landing gear at pilot's discretion.

c. Maintain recommended single-engine climb speed for the applicable gross weight.

d. Water injection switch - ON, if desired.

e. Trim tabs - As required.

f. When landing is assured, use wing flaps as desired and proceed with normal landing procedure.

WARNING

For single-engine landings, do not lower wing flaps until landing is assured, as altitude cannot be maintained on one engine with landing gear and wing flaps extended.

SINGLE-ENGINE REVERSING.

The use of single-engine reverse thrust is a positive aid in landing an aircraft with one engine inoperative, provided the necessary techniques are employed and their limitations thoroughly understood. Under any of the conditions listed below, it should be noted that reverse thrust is most effective during the initial phase of the landing roll and that rudder control is sufficient to maintain heading at this time. Likewise, it should be understood that a minimum run approach on the longest available runway, with consideration of wind velocity and direction, gross weight, and width and surface of runway, is recommended. If landing in a crosswind is unavoidable, land so that the crosswind is from the direction of the dead engine. In addition, when the use of single-engine reversing is anticipated, land well to the dead-engine side of the runway as the reverse thrust of one propeller will tend to cause the aircraft to turn into the direction of the propeller reversed.

Single-Engine Reversing with Brakes and Steering Available.

With both brakes and nose wheel steering available, the use of reverse thrust on one propeller is definitely controllable and may be used to shorten the landing roll. Employ the following procedure:

a. Reverse immediately upon initial contact of all three gear.

b. Maintain directional control by use of the brakes and nose wheel steering.

c. When a full stop can be safely accomplished with brakes only, return throttle to forward thrust range.

Single-Engine Reversing with Steering but Without Brakes.

If nose wheel steering is available but brakes are not, there is a reduction in controllability, so that the amount of reverse thrust applied should be governed by the ability to control the aircraft directionally. The following procedure is recommended:

a. Reverse immediately upon contact of all three gear.

b. Maintain directional control by use of rudder and nose wheel steering. With the loss of rudder control, the amount of reverse thrust which may be applied is governed by the ability to maintain directional control with nose wheel steering.

c. If a full stop cannot be safely accomplished within the remaining runway length, the aircraft may be partially ground looped.

Single-Engine Reversing with Neither Brakes nor Steering Available.

If neither brakes nor nose wheel steering is available, extreme caution should be exercised when using reverse thrust on one propeller. The following procedure is recommended:

a. Reverse immediately upon initial contact of all three gear.

b. Use maximum reverse thrust during that portion of the landing roll that rudder control is available. As airspeed is reduced and rudder control becomes ineffective, reverse thrust, likewise, will have to be reduced.

c. If a full stop cannot be made safely within the remaining runway length, reverse thrust may be used to ground loop the aircraft.

CAUTION

If it is anticipated that a ground loop may be necessary, select that section of the runway which affords the widest paved area and maximum clearance of obstacles. Attention should also be given to the suitability of the field immediately off the sides of the runway as the ground loop may cause the aircraft to veer off the paved area.

d. Should a collision with buildings, personnel, or parked aircraft be unavoidable, retract the landing gear by use of the landing gear emergency switch to restrict further travel of the aircraft.

SINGLE-ENGINE GO-AROUND.

The decision to go around should be made before descending to 500 feet if possible, as the altitude lost may cause the aircraft to settle in. When weighing the possibilities for go-around in terms of altitude, airspeed, gross weight, aircraft configuration, wind conditions, runway facilities, and visibility, the pilot should always consider the advantages of a controlled crash landing versus an unsuccessful go-around, especially if aircraft performance is critical or altitude is marginal (about 500 feet or less above the ground).

SINGLE-ENGINE GO-AROUND PROCEDURE.

If a go-around is necessary during single-engine operation, use the following procedure:

1. **PROP—FULL INCREASE RPM. P**

2. **THROTTLE—MAX POWER. P**

   Water injection switch - ON, if required.

3. **FLAPS—TAKE-OFF (if full wing flaps have been used). CP**

4. **GEAR—UP. CP**

5. **AIRSPEED—MAINTAIN RECOMMENDED SINGLE-ENGINE CLIMB SPEED. P**

6. **FLAPS—UP. CP**

If the aircraft will not remain airborne, maintain straight flight and land with landing gear and wing flaps down.

SINGLE-ENGINE PRACTICE MANEUVERS.

To familiarize yourself completely with the single-engine characteristics of the aircraft, practice the following single-engine procedures:

CAUTION

> To avoid excessive loads on engine master rod bearings, maintain at least 1 inch Hg for each 100 rpm during all practice maneuvers.

SINGLE-ENGINE TURNS.

After you become proficient in single-engine procedure, practice single-engine turns. You can turn safely in either direction if you maintain safe single-engine airspeed.

a. Roll into the turn smoothly and slowly.

b. Maintain a constant airspeed throughout the turn, holding the speed for which you were trimmed when you rolled into the turn.

c. Practice turns in both directions at shallow and medium angles of bank.

SINGLE ENGINE DURING TAKEOFF.

Before Obtaining Single-Engine Minimum Control Speed.

Simulate takeoff conditions at altitude using METO Power, wing flaps UP (or TAKE-OFF), and landing gear DOWN, at an airspeed of 90 knots. Cut one throttle lever back completely and note that to maintain directional control it is necessary to reduce power on the good engine with a consequent loss of altitude which would necessitate making a crash landing straight ahead. Accomplish as much of the single-engine procedure as possible before simulated ground-level altitude is reached.

After Obtaining Recommended Single-Engine Climb Speed.

Simulate takeoff conditions at altitude using METO Power, wing flaps and landing gear UP, at the recommended single-engine climb speed corresponding to gross weight. Refer to Recommended Single-Engine Climb Speed, Appendix I, Part 4. Cut one throttle lever, perform normal single-engine procedures, and continue the simulated takeoff. With practice you can accomplish this procedure with little or no loss of altitude. This clearly demonstrates the advisability of gaining recommended single-engine climb speed immediately after takeoff and illustrates that the takeoff can be subsequently continued.

SINGLE-ENGINE FLYING.

NOTE

> In the following practice maneuvers a single-engine condition with feathered propeller may be simulated by setting dead engine propeller lever at full DECREASE RPM and good engine propeller lever at 2600 rpm. Retard dead engine throttle lever to 18 inches Hg. This simulates a feathered condition and allows use of the dead engine if necessary.

Effect of Airspeed on Trim.

The importance of airspeed in a single-engine flight may be demonstrated as follows: Simulate single-engine flight and trim the aircraft at a constant airspeed and power setting. With feet off the rudder pedals, ease back on the control column. As the airspeed decreases, the trim becomes less effective because of decreased flow of air over control surfaces, and the aircraft will turn into the dead engine. Push the control column forward until the original airspeed is exceeded, and as the trim becomes more effective with the increased airflow over the control surfaces, the aircraft will turn into the good engine.

Effect of Power Reduction on Trim.

Practice directional control on single engine by using the throttle only. Simulate single-engine flight and trim the aircraft. With feet off the rudder pedals, pull control column back slowly. As speed decreases, gradually reduce power on the good engine to prevent aircraft from turning into the dead engine. It is possible to maintain directional control in this manner up to the point of stall. This demonstrates the importance of reducing power to maintain directional control in case of engine failure during takeoff or slow flying when the airspeed is below single-engine minimum control speed.

SINGLE-ENGINE RECOVERY FROM SLOW FLYING.

An engine failure while flying at a very low airspeed can be disastrous, especially at low altitude, unless you take immediate corrective action. To demonstrate this, put the aircraft in a slow-flying attitude, landing gear and wing flaps down, at a safe altitude, and then retard one throttle completely. The first step of your single-engine procedure, obtaining airspeed and directional control, is vital when the engine fails at this time. Reduce power, lower the nose, and raise the landing gear and wing flaps. As the airspeed increases and you regain directional control, start adding power to the good engine and then complete the normal single-engine procedure.

SINGLE-ENGINE STALLS.

You can safely stall the aircraft when only one engine is operating, provided you observe the principle of reducing power to maintain directional control. The following practice stall will teach you the limits of operating on one engine, and will also show the difficulties encountered in counteracting the thrust of the good engine when below single-engine minimum control speed.

a. At safe altitude set the engine at 2000 rpm and a torque pressure of 95 psi. Feather the other engine or simulate feathering.

b. Pull the nose up slowly and smoothly, using coordinated control movements.

c. Your first indication of the stall is an even downward trend of the vertical velocity indicator.

d. Continue the slow even back pressure on the control column until the aircraft stalls completely.

e. At this point, close the throttle and lower the nose.

f. As you pick up speed, gradually add power and resume level flight. Remember, a power-off nose down recovery is the only safe recovery from a full stall on single engine; failure to decrease power the necessary amount to hold straight path may cause the aircraft to roll into a dangerous attitude. If you approach the stall too fast and too steeply, the first indication of stall on the vertical velocity indicator will be missed, and the resulting stall may be abrupt. Abrupt and uncoordinated control movements in entry and recovery will increase the stalling speed and exaggerate the rolling tendency.

SIMULATED SINGLE-ENGINE GO-AROUND AT SAFE ALTITUDE.

See figure 3-6.

PROPELLER FAILURE.

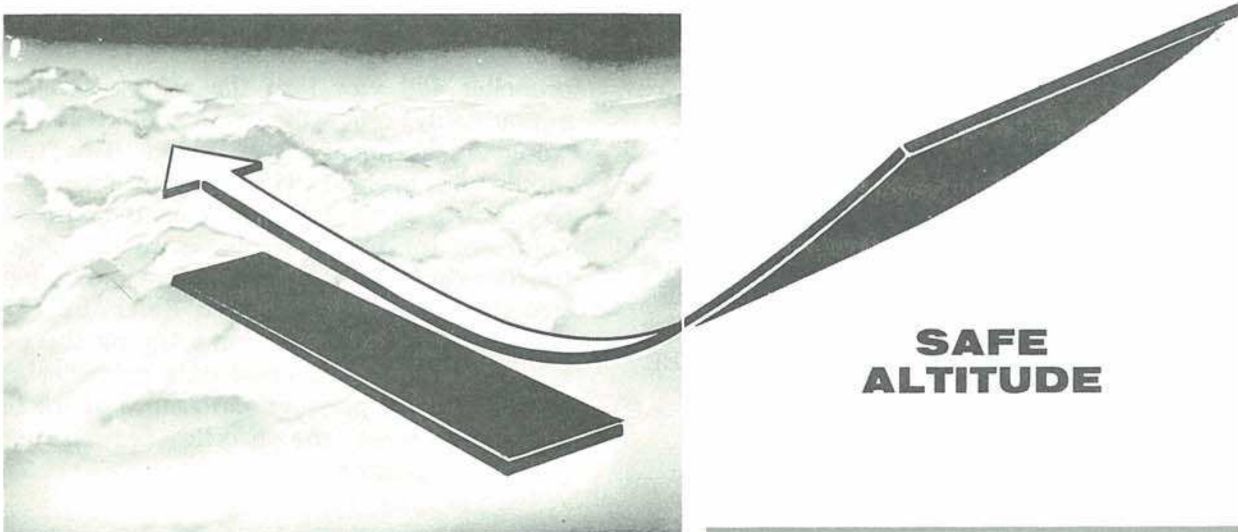
If propeller failure is encountered in flight, the corrective action which the pilot may take is necessarily limited. However, below is a listing of propeller failures and procedures to be followed in minimizing the adverse effects of each on continued operation.

EXTERNAL PROPELLER OIL LEAKAGE.

Starvation of the propeller pump due to low oil or an external loss of oil will be evident initially by a relatively slow increase in rpm. If setting the propeller lever one knob-length (approximately 1 inch) toward the DECREASE RPM position does not control the increase in rpm, the propeller lever should immediately be moved to the FEATHER position.

SIMULATED SINGLE-ENGINE GO-AROUND

TO PREPARE YOURSELF FOR A SAFE APPROACH TO A SINGLE-ENGINE LANDING, PRACTICE SIMULATED APPROACHES AND GO-AROUND AT SAFE ALTITUDE. DURING THESE MANEUVERS, NOTICE CAREFULLY THE ALTITUDE LOST, AND THE AMOUNT OF POWER YOU CAN USE ON THE GOOD ENGINE AND STILL MAINTAIN DIRECTIONAL CONTROL.



1. SET UP STANDARD SINGLE-ENGINE LANDING APPROACH.
2. AT 500 FEET ABOVE SIMULATED FIELD ELEVATION, START GO-AROUND BY APPLYING POWER SMOOTHLY TO THE GOOD ENGINE.
3. RAISE THE FLAPS AND GEAR AND RETRIM THE AIRCRAFT.
4. NEVER ALLOW AIRSPEED TO DROP BELOW SAFE SINGLE-ENGINE SPEED.
5. NOTE THAT WHEN PROPER TECHNIQUE IS USED, ONLY 200 TO 300 FEET OF ALTITUDE IS LOST.

TO SHOW WHAT HAPPENS IF YOU ATTEMPT TO GO AROUND BELOW 300 FEET AND 100 KNOTS . . .

1. SET UP STANDARD SINGLE-ENGINE LANDING APPROACH.
2. AT 300 FEET ABOVE SIMULATED FIELD ELEVATION, REDUCE POWER AND SLOW AIRCRAFT TO 100 KNOTS IN PREPARATION FOR LANDING.
3. START GO-AROUND BY APPLYING POWER ON GOOD ENGINE NOT SO MUCH THAT YOU LOSE DIRECTIONAL CONTROL—MAINTAIN YOUR HEADING.
4. RAISE THE FLAPS AND GEAR AND GAIN RECOMMENDED SINGLE-ENGINE CLIMB SPEED AS SOON AS POSSIBLE.
5. NOTE LOSS OF ALTITUDE—500 TO 600 FEET WILL PROBABLY BE LOST IN THE GO-AROUND ATTEMPT, WHICH SHOULD EMPHASIZE THE IMPORTANCE OF MAINTAINING SAFE SINGLE-ENGINE SPEED.

Figure 3-6

NOTE

> The charge of oil contained in the accumulator will be sufficient to feather the propeller but will not be sufficient to maintain an operating rpm by intermittent movement of the propeller lever to the FEATHER position. Once the accumulator is depleted, it is impossible to feather the propeller.

INTERNAL OIL LEAKAGE IN THE CONTROL SYSTEM.

An internal leak in the propeller control system will be evident by erratic governing, poor response to change in rpm, and a tendency to go toward high rpm. If this condition becomes uncontrollable, move propeller lever to FEATHER position.

NOTE

> Do not attempt to maintain an operating rpm by "milking" the propeller lever in and out of the FEATHER position. Doing so will deplete propeller accumulator hydraulic fluid pressure. Feathering will then be impossible and a runaway propeller will result.

SELF-FEATHERING OF PROPELLER.

If the propeller should inadvertently move toward the feathered position, the decrease in engine rpm can sometimes be corrected by placing the propeller lever in the INCREASE RPM position. If the rpm continues to decrease to the point where no power is obtained from the engine, place the propeller lever in FEATHER and continue the flight on single-engine operation.

RUNAWAY/OVERSPEEDING PROPELLER.

A runaway/overspeeding propeller is an extremely dangerous emergency which requires the pilot to make a rapid appraisal of the situation and determine whether the aircraft can be controlled and recovered or whether the aircraft should be abandoned. The sequence listed in these procedures provides the aircrew numerous options to reduce and/or eliminate the problems associated with runaway/overspeeding propellers. Based on flight test performance data, power curves substantiate the fact that power is available to the affected engine even though 2900 rpm is exceeded. Additionally, when a runaway/overspeed situation occurs, some apparent drag will be noted by the flight crew. This apparent drag, accompanied by the high noise level of the runaway/overspeeding propeller and yaw into the affected engine, will undoubtedly cause the aircrew to react as they would if an engine had failed. This tendency should be avoided. However, prompt action is required to prevent serious engine damage and/or failure of the propeller blades. In the latter case, the damage is apt to be progressive and may lead to structure failures and fire. Refer to ENGINE SEPARATION, this section. Among the possible causes of runaway/overspeeding propeller are loss of propeller oil pressure and failure of the teleflex linkage between the nacelle firewall and the propeller regulator.

NOTE

> Do not confuse the momentary surge in rpm which occurs when the throttles are advanced to takeoff position with propeller runaway. As propeller governor assumes control, this rpm will decrease to the desired range.

Although performance and controllability are improved under single-engine conditions when the propeller of the dead engine is feathered rather than allowed to windmill, the propeller should not necessarily be feathered when a runaway propeller condition exists. In general, much better climb performance can be obtained by maintaining some power on the affected engine, thereby taking advantage of the thrust developed by the overspeeding propeller.

LANDING WITH AN OVERSPEEDING PROPELLER.

If the runaway/overspeeding propeller has been successfully feathered, land as soon as practicable using engine-out procedures. runaway/overspeeding propeller is being powered to 3100 rpm, land the aircraft as soon as practicable. It is desirable to maintain approximately 120 KIAS on final approach as rpm will vary directly proportional to the airspeed. Therefore, increasing airspeed will increase the rpm which will increase drag and result in an increased rate of descent. Lower the landing gear when landing is assured.

WARNING

- Once the landing gear has been lowered, a go-around may not be successful as at least 500 feet of altitude is required before a positive rate of climb can be obtained.
- If an attempt was made to feather the propeller and the rpm remains in excess of 3100, a landing may be attempted at the discretion of the pilot. The pilot's decision should be based on such variables as the availability of a suitable runway, aircraft controllability, rate of descent, engine power available, jettisonable munitions and the possibility of having nonessential aircrew members bail out to further reduce the rate of descent. Variables are of such magnitude and the results so undeterminable that firm guidance to bail out or land the aircraft cannot be provided.

Runaway Propeller at Takeoff.

If an overspeed or runaway propeller condition (above 3100 rpm accompanied by a substantial decrease in engine torque pressure) occurs during takeoff or initial climb and abort is impossible, proceed with the following course of action:

NOTE

The aircraft will be considered in initial climb until the landing gear is fully retracted METO power set, and recommended single-engine climb speed and 500 feet AGL has been attained.

1. **THROTTLE—REDUCE TO 3100 RPM (affected engine). P**
2. **AIRSPEED—APPROXIMATELY 120 KNOTS. P**

WARNING

Do not attempt to feather.

At the above airspeed and power setting some propeller thrust is available and the aircraft performance is better than the single-engine performance with the inoperative engine propeller feathered. Land as soon as possible.

Runaway Propeller During Climb, Cruise, or Descent.

1. Throttle lever - Closed. P
2. Airspeed - Adjusted. Reduce to 120 KIAS. P

   If rpm decreases to less than 3100 as the throttle lever is retarded and airspeed adjusted, the propeller has oversped and is controllable. Power is available if required. While maintaining 120 KIAS, adjust throttle lever to obtain 3100 rpm. The propeller is operating as if it were at a fixed blade angle. If the rpm remains in excess of 3100, the propeller is considered to be a runaway and may not be controllable. In either case it is essential to adjust airspeed to 120 KIAS.

NOTE

The two most important factors to consider on an overspeed or runaway propeller are true airspeed and power to the engine. Varying altitude and/or airspeed will necessitate throttle adjustments to maintain 3100 rpm.

3. Propeller lever - FEATHER (as required). CP

The pilot may elect to either feather the propeller or to attempt to use the thrust available from the affected engine.

WARNING

- If the decision is made to feather the propeller, do not cut mixture lever until assured that the propeller has completely feathered. If the propeller does not feather, but rpm is reduced below 3100 rpm, some power may be obtained from the engine by advancing the throttle lever, not to exceed 3100 rpm and 120 KIAS.
- If an attempt is made to feather the propeller and the rpm remains at some rpm above 3100 with the throttle lever closed and 120 KIAS and level flight cannot be maintained, as a last resort, a lesser rate of descent may be realized by placing the mixture lever to IDLE CUT-OFF. If this is done, advance the throttle lever to the full forward position. This will force the engine to operate against the maximum air charge, further reducing the rpm. If after the mixture is cut and the rate of descent increases, consideration should be given to returning the mixture lever to RICH and restarting the engine. The crew should be prepared for possible bailout or crash landing.

(4.) Engine shutdown - As required. CP, FM

Perform engine shutdown as outlined in ENGINE FAILURE DURING FLIGHT, this section.

NOTE

If there is no evidence of fire, the firewall shutoff switch should be left in NORM.

FAILURE TO FEATHER.

If propeller has been operating erratically and fails to feather, refer to the procedure for RUNAWAY/OVERSPEEDING PROPELLER, this section. If propeller has been functioning properly and fails to feather with normal movement of the propeller lever to the FEATHER position, the propeller will feather, in most cases, if the lever is momentarily returned to cruise and immediately placed back in FEATHER with severe action (hard against the feather stops with one fast motion).

NOTE

If this last action is unsuccessful, leave the propeller lever in the FEATHER position. The propeller will crank itself to within 1° to 1.5° of full feather in 4 to 5 minutes. The drag will be negligible.

Complete shutdown of the engine as outlined in ENGINE FAILURE DURING FLIGHT, this section, and continue single-engine operation.

NOTE

If there is no evidence of fire, the firewall shutoff switch should be left in NORM.

FAILURE TO UNFEATHER.

Should a propeller, having been intentionally or unintentionally feathered, fail to unfeather when the propeller lever is placed in the full INCREASE RPM position, repeat the procedure several times. If this fails, place the propeller lever in full DECREASE RPM and rotate with the starter until windmilling begins. If unfeathering is then impossible, place propeller lever in FEATHER, complete engine shutdown as outlined in ENGINE FAILURE DURING FLIGHT, this section, and continue single-engine operation.

FAILURE TO REVERSE.

CAUTION

If one or both propellers fail to reverse when the pilot's throttle levers are moved into the REVERSE THRUST range, do not make a second attempt to reverse the propeller or propellers which failed to reverse. Damage to the propeller low pitch stop operating mechanism may result. Make certain ground maintenance personnel are informed of this condition.

If one or both propellers fail to reverse during landing, advance both throttle levers to forward thrust range and use brakes to stop forward landing roll. If only one propeller fails to reverse and brakes are not adequate to stop forward roll of the aircraft:

a. Attempt to hold the aircraft straight with nose wheel steering and use procedure in SINGLE-ENGINE REVERSING, this section.

b. As last resort retract landing gear, by use of the landing gear emergency switch.

FAILURE TO UNREVERSE.

If either or both propellers should fail to unreverse after being used to brake the landing roll and it is necessary to obtain forward thrust for continued operation, leave the throttle levers in the forward thrust range and move the propeller levers to the FEATHER position for a sufficient length of time to bring the propellers into the forward thrust range. If continued operation of the engines is not required, shut down with the propellers in reverse; this will aid the ground crews in determining the cause of the failure.

FAILURE OF PROPELLER DEICING.

In the event deicing failure on one propeller should occur, continue until excessive roughness is detected. Attempt to locate altitude where icing conditions are less prevalent. If excessive roughness does develop, feather and shut down engine. Should the propeller deicing system on both propellers fail or should a complete failure of the electrical system occur, avoid icing conditions if possible. If icing conditions cannot be avoided and if propeller roughness has not become excessive, increase engine rpm periodically for a period of 10 to 20 seconds to dislodge the ice from the blades.

PROPELLER BLADE FAILURE.

Propeller Vibration and Its Detection.

The in-flight warning of the start of a propeller blade failure may be a high-frequency, low-amplitude vibration of the entire aircraft structure which can be detected by a blurring of the instruments and an awareness of vibration. The time intervals between the initial vibratory condition and the separation of an engine from the nacelle may vary from a few seconds to as much as 40 minutes. In view of the limited warning interval and the difficulty of isolating the defective propeller assembly by instrumentation or observation, it is recommended that the following procedure be employed.

a. Automatic pilot - Disengaged.

b. Immediately reduce power and rpm on both engines to the minimum possible. If altitude permits, close the throttle levers and reduce rpm to a minimum.

c. If vibration ceases, increase rpm and then power, individually on each engine, to the original settings.

d. Immediately feather the propeller of the engine that causes a recurrence of the sensed vibration.

e. If vibration does not cease during the power and rpm reduction outlined above, individually feather and unfeather each propeller to determine the source of vibration.

f. If feathering either propeller eliminates the vibration, leave that propeller feathered, shut down the engine as outlined under ENGINE FAILURE DURING FLIGHT, this section, and continue with single-engine operation.

Engine Separation.

A propeller blade failure can cause separation of the engine from the aircraft. In the event a separation occurs, the pilot must immediately determine whether the aircraft is safe to land or must be abandoned. Because separation of an engine from the aircraft results in varying extents of damage to the affected wing, it is impossible to predict the effect of such an eventuality on the flight characteristics of the aircraft. Drag effects may be particularly critical during landing when speeds may be so low as to make directional control impossible even with full rudder deflection. Also contributing to the complication of a landing under these conditions is the fact that stalling speeds may be adversely affected, especially if the aircraft is in a yawing attitude or if extensive damage is done to the wing. Therefore, the pilot must carefully weigh the advantages of landing versus abandoning, depending on individual circumstances. When any doubt exists regarding the possibility of accomplishing a safe landing, the aircraft should be abandoned. If, in the event of an engine separation, it is determined that flight may be safely continued and a successful landing accomplished, employ the following procedure:

a. Automatic pilot - Disengaged.

b. Use aileron and rudder as needed to maintain control.

c. Increase rpm and power on remaining engine.

NOTE

Do not hesitate to exceed METO Power as needed for either control or performance.

d. If additional drag on the clean side is required for directional control, slowly open the cowl flaps on that side.

e. Depending on the extent of the damage, accomplish those steps of ENGINE FAILURE DURING FLIGHT, this section, as are applicable.

f. Refer to SINGLE-ENGINE LANDING, this section.

FIRE.

ENGINE FIRE DURING GROUND OPERATION.

If fire is located in the air induction or exhaust system, open the throttle lever of the affected engine. Fire is often sucked through the engine and extinguished or blown out. If fire continues, stop the aircraft, call the control tower, and employ the following procedure:

1. **MIXTURES—IDLE CUT-OFF. P**

2. **FIREWALL SHUTOFFS—SHUT. P**

3. **FUEL SELECTORS—OFF. P**

4. **ENGINE FIRE EXTINGUISHER—ON, as soon as engine stops. P**

5. Ignition switches - OFF. P

6. Electrical power - Off. P, IO

   a. Battery switch - OFF. P

   b. APU - Shut down. IO

   c. External power - Disconnected. IO

7. Fight the fire. IO

Use hand fire extinguisher to fight fire. As soon as engine stops, ground personnel should place hand fire extinguisher nozzle through the access door in the bottom of the nacelle, and release the extinguishing agent.

ENGINE SMOKE AND FLAME IDENTIFICATION.

For the identification of various types of engine fires and the remedial action to be undertaken, see figure 3-7.

ENGINE FIRE DURING FLIGHT.

Accomplish the following procedure on the affected engine:

(1.) **PROP—FEATHER. CP**

Do not wait until propeller feathers before proceeding with the next three steps.

(2.) **MIXTURE—IDLE CUT-OFF. CP**

3. **FIREWALL SHUTOFF—SHUT. CP**

(4.) **FUEL SELECTOR—OFF. CP**

WARNING

The fuel selector switch of the dead engine should not be turned OFF if the fuel selector switch for the good engine is on CROSSFLOW, as the fuel supply to the good engine will be shut off at all tanks. However, if some fuel remains in either tank on the side of the good engine, it is recommended that the fuel selector switch for the good engine be positioned to use that fuel. The fuel selector switch of the dead engine should then be turned OFF. This will preclude the development of a fire hazard aft of the firewall, which could conceivably result from firewall and fuel line damage caused by specific types of engine failure. When the emergency has passed and it is deemed safe to use fuel from the tanks of the dead engine, crossflow operation may be resumed.

5. **ENGINE FIRE EXTINGUISHER—ON, as soon as engine stops. CP**

6. **COWL FLAPS—TRAIL. CP**

Cleanup.

1. Advance power on good engine as necessary. P, CP

   a. Fuel booster pump switch of good engine - EMERG ON. CP

   b. Mixture lever of good engine - RICH. CP

   c. Spark control switches - RETARD. CP

      Place the switches in the RETARD position before exceeding 2300 rpm.

   d. Propeller lever of good engine - As required. CP

   e. Throttle lever of good engine - As required. P

2. Unnecessary electrical equipment - Off. ALL
3. APU - Start. IO
4. TRU switch - ON. FM
5. Fuel booster pump switch of dead engine - OFF. CP
6. Ignition switch of dead engine - OFF. CP
7. Generator switch of dead engine - OFF. CP
8. Oil cooler flap switch of dead engine - CLOSED. FM
9. Cowl flap switch of dead engine - CLOSED (after all danger of fire is past). CP, FM

   Close the cowl flaps of the dead engine to reduce drag.

10. Fuel selector switches - As required. CP
11. Monitor bus switch - OVERRIDE, if required. N/FM

HEATER COMPARTMENT FIRE.

1. **RADOME ANTI-ICING SWITCH—OFF (if installed). FM**
2. **MASTER HEATER SWITCH—OFF. FM**

WARNING

Allow 5 seconds delay after turning the radome anti-icing switch OFF prior to turning the heater master switch to OFF, to prevent fumes from entering the crew compartment.

3. **HEATING SYSTEM CONTROLS—OFF. FM**

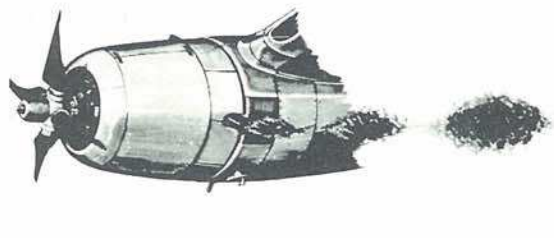
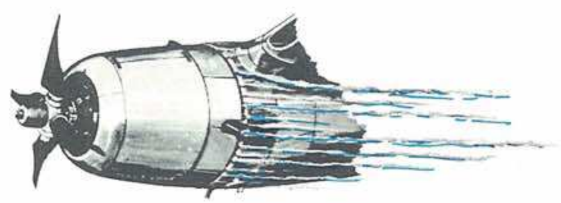
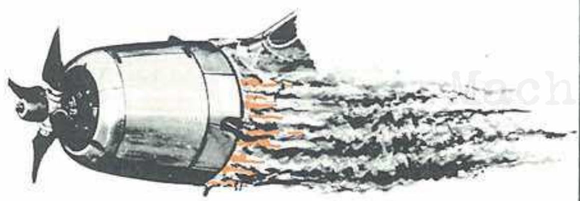
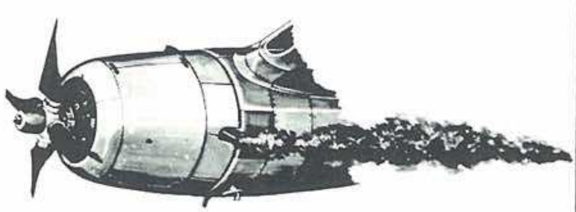
WARNING

When operating the heater fire extinguisher system, the cockpit air, windshield anti-icing, and cargo heat master switches should be turned OFF to prevent fumes from entering the crew and cargo compartments.

4. **HEATER FIRE EXTINGUISHER SWITCH— ON. CP**

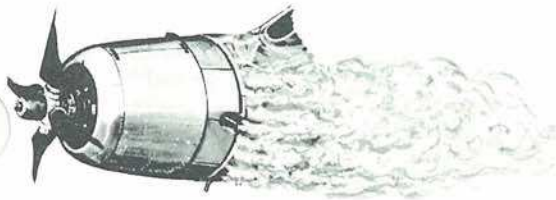
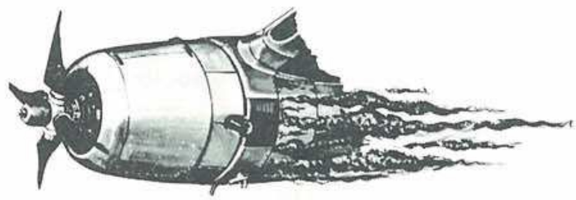
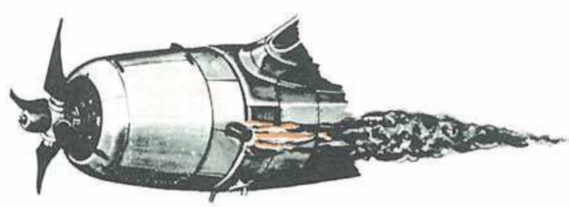
WARNING

Do not restart the heaters.

	CAUSE	ACTION
 ROUGH ENGINE AND PUFFS OF BLACK SMOKE FROM EXHAUST	Detonation, afterfire or backfire from lean mixture and/or carburetor failure which may be indicated by high CHT and CAT, fluctuating MP, RPM and fuel flow. If this condition is allowed to continue, loss of power and engine failure are imminent.	Enrich mixture, reduce power and temperature, monitor engine instruments.
 THIN WISPS OF BLUISH-GRAY SMOKE FROM COWL FLAPS AND EXHAUST AREA	Slight oil leak which may possibly be indicated by a drop in oil quantity. Slight possibility of fire exists but no action necessary unless fire develops.	Watch closely and feather if volume of smoke indicates the necessity.
 ROUGH ENGINE AND VARIABLE QUANTITY OF GRAY SMOKE AND POSSIBLY LIGHT FLAME FROM COWL FLAPS AND EXHAUST AREA	Cylinder head or exhaust stack failure indicated by high CHT, fluctuating MP and RPM, low oil pressure. If this condition is allowed to continue, engine failure and fire may result.	Fire and feather procedure and alert crew.
 HEAVY BLACK SMOKE FROM EXHAUST	Initial induction fire from burning fuel possibly indicated by high CHT and a sudden drop in MP and RPM. An uncontrolled fire may develop.	Fire and feather procedure and alert crew.

ENGINE SMOKE AND FLAME

Figure 3-7. (Sheet 1 of 2)

	CAUSE	ACTION
 DENSE WHITE SMOKE FROM EXHAUST AND/OR COWL FLAPS AREA	Induction casting burning and/or burned through possibly indicated by very high CHT and CAT and fluctuating engine instruments. An uncontrolled fire may develop.	Fire and feather procedure and alert crew.
 BLACK SMOKE FROM ACCESSORY SECTION	Oil leak and oil fire possibly indicated by variable oil pressure, high CHT and illumination of fire detector lights. An uncontrolled fire may develop.	Fire and feather procedure and alert crew.
 BLACK SMOKE AND ORANGE FLAME FROM ACCESSORY SECTION	Gasoline leak and fire possibly indicated by variable fuel pressure, high CHT, and illumination of fire detector lights. An uncontrolled fire may develop.	Fire and feather procedure and alert crew.
 UNUSUAL DISCHARGE OF BLACK SMOKE AROUND EXHAUST FLIGHT HOOD, HEAVY ORANGE FLAME AND SPARKS.	Malfunction or fire in power recovery turbine.	Fire and feather procedure and alert crew.

IDENTIFICATION

Various engine malfunctions are often indicated by characteristic smoke and flame patterns. This chart is provided so that the flight crew may more accurately identify different engine smoke and flame conditions and know at once the cause and the remedial action to be undertaken.

Figure 3-7. (Sheet 2 of 2)

FUSELAGE FIRE.

a. The pilot will designate those crewmembers who will use available oxygen equipment. All crewmembers not required to control the aircraft will immediately begin to fight the fire.

WARNING

Some portable oxygen units presently installed may not provide 100% oxygen unless the regulator port is covered by hand.

b. If the auxiliary fuel system is being used, switch to main fuel system and close auxiliary fuel manual shutoff valves.

c. If electrical fire, turn battery switch OFF, generator switches OFF, and APU master switch OFF. Turn the emergency power switch ON.

d. After fire is extinguished, ventilate the aircraft in accordance with SMOKE EVACUATION, this section.

WING AND/OR WHEEL WELL FIRE.

1. Wing lights - OFF. CP
2. (2.) Landing gear switch - DOWN. CP

If fire is suspected in the wheel well due to overheated brakes, the landing gear should be extended.

NOTE

Follow progress of fire closely and land aircraft as quickly as possible, or bail out, whichever the situation demands.

ELECTRICAL FIRE.

When a short circuit in the electrical system is detected by fire, smoke, or overheating of the electrical wiring or equipment, the following course of action should be followed:

1. (1.) **ELECTRICAL POWER—OFF (all sources). P, CP, N, FM, IO, G**

The engine generator switches, TRU switch, and battery switch will be turned OFF. The gun batteries shall be disconnected.

2. (2.) **EMERGENCY POWER SWITCH - ON, if required. CP**
3. **OXYGEN - 100%. ALL**

The pilot will designate those crewmembers who will use available oxygen equipment. All crewmembers not required to control the aircraft will immediately begin to fight the fire.

WARNING

Some portable oxygen units presently installed may not provide 100% oxygen unless the regulator port is covered by hand.

4. Fight the fire. FM/IO

Should the malfunctioning wiring or equipment be located, turn off switches and pull out circuit breakers for the affected system.

5. Supercharger switches - LOW. CP
6. Electrical equipment switches - Off. ALL

   a. If the short circuit cannot be located by inspection, turn off all electrical switches.

   b. When smoke or odor has cleared, turn on power switches individually, allowing sufficient time to observe results before turning on the next switch.

   c. Turn on equipment switches individually, beginning with essential flight equipment switches and allowing sufficient time to observe results before energizing the next piece of equipment.

d. Continue to turn on equipment as before, until the defective circuit is detected. When located, the malfunctioning circuit should be deenergized by turning off the switches controlling its source of power and releasing the associated circuit breakers.

e. If cause of fire or overheating cannot be isolated, land as soon as possible.

AUXILIARY POWER UNIT (APU) FIRE.

If a fire should occur in or around the APU, follow the procedures outlined below.

1. **APU MASTER SWITCH - OFF. IO**
2. **APU FIRE EXTINGUISHER - ON. CP**
3. Manual APU fuel valve - Closed. IO/G

NOTE

The flight mechanic/illuminator operator will employ hand fire extinguishers to combat fire as necessary.

WARNING

Prolonged exposure (5 minutes or more) to high concentrations (indicated by prolonged irritation of eyes and nose) of bromochloromethane (CB) or its decomposition products should be avoided. It is safer to use than previous fire extinguishing agents such as carbon tetrachloride or methylbromide. However, especially in confined areas, 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.

NOTE

Before fuel can be resupplied to the APU, the emergency fuel shutoff valve must be reopened by momentarily actuating the reset switch.

SMOKE EVACUATION.

If smoke or fumes are detected, employ the following procedures:

NOTE

Use oxygen masks if the concentration of smoke and fumes require it.

CAUTION

Do not attempt to ventilate, except in case of a flare launcher fire, until it is certain that the fire has been extinguished as a draft may tend to spread the fire.

WARNING

- Personnel should be forward of the air intake scoops or at least 6 feet aft of the air scoops whenever the system is actuated in order to prevent injury from air blast.
- Activating the smoke evacuation system will result in transient erratic indications of the altimeter, airspeed indicator, and vertical velocity indicator, followed by large negative position corrections to the airspeed and altitude readings. Extended flight with the system activated should be avoided due to the large negative position corrections caused by the open air scoop doors.
- Use caution when using the smoke evacuation system during single-engine operation due to the additional drag on the aircraft. Continued flight may not be possible with the doors deployed.

1. Lanyard - Pulled. IO, N, FM
2. Reset spoiler system-deflectors and air scoop doors - Closed. IO, FM

SMOKE ELMINATION (Ferry Configuration).

The most rapid means of dissipating smoke and toxic fumes may be obtained by:

NOTE

Use oxygen masks if the concentration of smoke and fumes require it.

a. Extending the landing gear and removing the cover plate from the nose wheel well.

b. Opening side windows of crew compartment.

CAUTION

Do not attempt to ventilate until it is certain that the fire has been extinguished, as the draft may tend to spread the fire.

c. Opening the air ducts on the pedestal immediately below the instrument panel.

d. Opening the aft fuselage personnel door.

WARNING

Personnel opening the aft fuselage personnel door will wear a parachute or be secured by a restraining harness.

FLARE LAUNCHER EMERGENCIES.

NOTE

Asbestos gloves are required and should be worn for any flare malfunction.

FLARE FAILS TO EJECT (HUNG FLARE).

1. Pilot - Advised. IO
2. Manifold valve (affected tube) - Closed. IO

WARNING

In the event of a hung flare the malfunctioning tube will not be used to eject additional flares. The manifold valve for the malfunctioning tube will be closed. No less than two people should be used to eject the hung flare.

3. Flare lanyard - Cut. IO
4. Flare - Ejected, using emergency ejection device. IO

WARNING

The pilot will decide if the flare launcher must be jettisoned. If he decides not to jettison the launcher, an emergency will be declared prior to landing.

FLARE FIRE.

In the event of a fire in the flare launcher, the following procedures will be accomplished.

WARNING

Personnel should be forward of the air intake scoops or at least 6 feet aft of the air scoops whenever the system is actuated in order to prevent injury from air blast.

1. **PILOT ADVISED. IO**
2. **SMOKE EVAC LANYARD - PULLED. IO, N, FM**
3. **LAUNCHER - JETTISONED. P, IO**

   If launcher fails to jettison electrically, li^ the manual jettison handle and push launcl out the door.

4. Reset spoiler system-deflectors and air scoop doors - Closed. IO, FM

FLARE FAILS TO EJECT ELECTRICALLY (ELECTRICAL FAILURE).

In the event of an electrical failure, and launcher air pressure is above 750 pounds, flares can be manually launched by performing the following steps:

WARNING

Visually verify correct placement of the flare in the launch tube breech before pressing the manual ejector lever for which no ready light indication is present.

1. Pilot - Advised. IO
2. Manual ejector lever lock pin - Unlocked. IO
3. Manual ejector lever - Depressed. IO

WARNING

Do not attempt to launch flares when air pressure is below 750 psi for single launch or 1000 psi for salvo.

ILLUMINATOR EMERGENCIES.

Should any malfunction of the illuminator be indicated by illumination of the interlock lights or apparent smoke or fire, and the unit not shut down automatically, employ the following procedure:

1. Main power switch - OFF. IO
2. Main pump circuit breakers - OFF. IO
3. Illuminator 28-volt dc circuit breaker - Pulled. IO
4. Pilot - Advised. IO

GUN EMERGENCIES.

GUN MALFUNCTIONS.

The following procedures will be performed prior to attempting corrective action on any malfunctioning weapon.

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. Do not attempt to clear or repair a malfunctioned gun before allowing sufficient time for the gun to cool.

- Anytime ammunition is present in the gun, while in flight, no attempt will be made to remove the gun.

MXU-470/A Module.

1. FIRING POWER SWITCH—OFF. G
2. DRIVE MOTOR - DISCONNECTED. G
3. PILOT - ADVISED. G
4. GUN SWITCH – SAFE AND LOAD. G
5. SAFING SECTOR - REMOVED. G
6. GUN - CLEAR. G

Advise pilot of gun status.

WARNING

Insure that no ammunition is present in gun. Visually check bolt and chamber at firing position. Manually rotate barrel cluster counterclockwise one revolution and observe each bolt and chamber approaching the firing position.

ELECTRICAL FIRE—MXU-470/A MODULE.

Should the malfunctioning of wiring or batteries occur on MXU-470/A module control package, CHARGING and FIRING circuit breakers will be pulled and batteries disconnected.

DEMOLITION OF GUNS.

Normally, the MXU-470/A module and GAU-2B/A machine gun will be destroyed in conjunction with destruction of the aircraft when such action becomes necessary to prevent capture by hostile forces. Destroy the weapons by any appropriate means: ie, mechanical smashing, bending, breaking parts, or burning with thermite grenades.

JETTISONING EQUIPMENT.

In the event that it is necessary to jettison the aircraft equipment, armament, or ammunition in order to maintain altitude during emergency single-engine operation, the right paratroop door will be used, providing the flare launcher has been jettisoned. If the flare launcher cannot be jettisoned, the aft fuselage personnel door can be used for jettisoning. Communications shall be maintained between the pilot and crew in the cargo compartment.

WARNING

The pilot shall direct the items to be jettisoned in order that the cg limits are not exceeded. Personnel accomplishing the jettisoning should be properly secured to the aircraft by restraining harnesses.

TAKEOFF AND LANDING EMERGENCIES.

Takeoff and landing emergencies develop basically from equipment failure or flight conditions which were not foreseen and taken into account at the onset of the mission. By accurately checking the aircraft before takeoff and by anticipating emergency conditions which may develop, the hazards involved, which suddenly become very real as the takeoff progresses or the landing pattern is approached, may be effectively reduced. Techniques and procedures are of primary importance in successfully accomplishing an emergency landing. Any ground aid which may be available should be alerted. Use of foam covering on a hard-surface runway has been found effective in reducing the hazards of gear-up landings. The foam covering should, if possible, be approximately 3000 feet in length and 50 feet wide. Aircraft, vehicles, and other movable obstructions should be removed from the anticipated landing area. Employ minimum sinking speed in all landing emergencies. For landing on unprepared sites, personnel in the cargo compartment should bail out and the landing be made with as many landing gear extended as possible. Following are the recommended procedures to be employed should a takeoff abort be necessary. In addition, procedures are given to cover the following landing emergencies: forced landing, landing without brakes, landing with a flat tire, and landing with various landing gear emergencies. Refer to SINGLE-ENGINE LANDING, this section, for the recommended landing procedure should engine failure occur during flight.

WARNING

The jump seat will not be used as a crash station during any emergency landing or ditching.

ABORT.

Should abort become necessary during the takeoff run, the procedure used to stop the aircraft is basically the same regardless of the type of failure or emergency encountered.

a. Retard throttle levers.

b. Apply reverse thrust, if required. When reversing, the copilot should hold the control wheel.

c. Apply brakes as necessary to bring the aircraft to a stop within the available runway length.

NOTE

Nose wheel steering should be utilized during propeller reversing and wheel braking. This is especially important if the abort decision was made because of an engine failure, since maximum wheel braking during single-engine reversing can only be applied if steering is used to maintain a straight path.

d. Should braking and propeller reversing be insufficient to prevent crashing into buildings, aircraft, or other obstacles, the landing gear emergency switch may be used to retract the gear and restrict further travel of the aircraft.

CAUTION

If maximum braking is used during an aborted takeoff, the brakes must be inspected prior to another takeoff attempt.

FORCED LANDING PROCEDURES.

See figure 3-8.

LANDING WITHOUT HYDRAULIC OR AIR BRAKES.

If the source of hydraulic pressure is inoperative but the brake system accumulator is charged, the pilot will have at least one application of brakes upon landing. If the hydraulic brake system is completely discharged, reverse thrust and the emergency air brakes are available to brake the forward speed of the aircraft. Should the loss of both hydraulic and emergency air brake systems occur, employ the following procedure:

Procedure.

Plan the landing so that the most effective use of aerodynamic braking can be achieved. Select the runway with the best combination of length and headwind; it may be advantageous to land crosswind if a longer runway is available and the surface wind is not too strong. Approach the runway with full wing flaps (wing flap lever DOWN) at the minimum safe airspeed consistent with the gross weight, and attempt to touch down as close to the end of the runway as possible. After making contact with the main gear first, ease the nose gear down and immediately apply maximum reverse thrust. Stop the aircraft as soon as possible and do not attempt to taxi. If it becomes evident that reverse thrust will not stop the aircraft in time to avoid hitting obstacles at the end of the runway, retract the landing gear with the landing gear emergency switch.

WARNING

Turn off all nonessential electrical switches (including heaters), tighten safety belts and shoulder harnesses, and lock inertia reel lock control prior to commencing the approach.

LANDING WITH FLAT TIRE.

If landing with a flat tire, make a normal approach, planned so the touchdown will be as short on the runway as possible. It should be expected that the drag caused by the flat tire may cause the aircraft to swerve to the same side as the flat tire, so that careful application of reverse thrust, brakes, and nose wheel steering is necessary to maintain directional control. Land on the side of the runway opposite to the direction the aircraft is expected to swerve so that a maximum use of paved runway area can be made. If the flat exists in the dual nose gear, the effect will be less severe than that caused by a main gear flat, although some tendency to swerve will be noticed. In all instances of flat tires, the affected gear should be held off the runway as long as possible to minimize damage to the aircraft.

LANDING WITH PARTIAL EXTENSION OF THE LANDING GEAR.

A consideration of the various possibilities and procedures which may be involved in accomplishing a landing with a partial extension of the landing gear is outlined below.

WARNING

When a landing with partial extension of the landing gear is required, as many personnel as possible should bail out.

Impact Loads on Landing.

In any normal landing, the impact load is assumed primarily by the landing gear structure. The kinetic

PILOT	COPILOT	NAVIGATOR/ SAFETY OFFICER
WARNING If at all possible (altitude, time, etc, permitting), order all personnel in the cargo compartment to bail out. a. Give six short rings on the alarm bell. If immediately after takeoff, give one long ring.	a. Assist pilot. Turn IFF to emergency.	a. Transmit position, course, speed, altitude, nature of distress, and intentions.
b. Order crew to jettison all possible equipment and loose gear if time permits. Destroy equipment as deemed necessary.	b. Alert ground facilities.	b. Alert crew as to location and terrain.
c. Check that the landing gear is extended and locked.		c. Shut off unnecessary equipment.
d. All nonessential electrical switches - OFF.		d. Stow loose equipment.
e. Shoulder harness and safety belt tightened and inertia reel lock control locked. **CAUTION** The pilot is prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.	c. Shoulder harness and safety belt tightened and inertia reel lock control locked. **CAUTION** The copilot is prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.	e. Destroy equipment as directed. Assume seat on flight deck, fasten safety belt, and turn seat to face forward. Fold arms and lean forward, using any available padding to protect head and shoulders.
f. Land with as slow a forward speed as possible, wing flap lever DOWN; make normal approach.		
g. One long sustained ring of the alarm bell.		f. Brace for impact.
h. Immediately prior to impact, close throttles, place firewall shutoff switch SHUT, fuel selector switches OFF, and ignition switches OFF.		
		g. Check pilot and copilot. Follow FM.

FORCED LANDING
(ON OTHER THAN

Figure 3-8. (Sheet 1 of 2)

FLIGHT MECHANIC	ILLUMINATOR OPERATOR	NOS OPERATOR AND GUNNERS
a. Assist pilot as briefed.		a. Bail out if at all possible. If bailout is impossible, proceed as follows.
	a. Take charge of jettisoning equipment.	b. Assist in jettisoning.
	b. Shut down APU (as applicable).	
b. Destroy equipment as directed. Assume flight mechanic's seat on flight deck, fasten safety belt, and turn seat to face forward. Fold arms and lean forward, using any available padding to protect head and shoulders.	c. Destroy equipment as directed. Assume forced landing position in troop seat. Tighten safety belt and lean toward nose of aircraft as far as possible.	c. Shut down all equipment. Destroy equipment as directed. Assume forced landing position in troop seat. Tighten safety belt and lean toward nose of aircraft as far as possible.
c. Brace for impact.	d. Brace for impact.	d. Brace for impact.
d. As soon as movement of the aircraft is halted, open crew compartment escape hatch.	e. As soon as movement of the aircraft is halted, open appropriate escape exits.	e. As soon as movement of the aircraft is halted, open appropriate escape exits.

PROCEDURES
PREPARED RUNWAY)

Figure 3-8. (Sheet 2 of 2)

energy resulting from the deceleration of the aircraft's mass is initially dissipated through the oleo shock struts and, subsequently, through friction over the landing roll distance. The fuselage of the aircraft must absorb the load developed by the acceleration of the equipment carried in the cargo compartment; however, it is not designed to sustain the impact load as is the landing gear structure. The factors which will affect the impact load are the gross weight, forward speed, rate of sink, and the center of gravity of the aircraft and the density of the landing surface. If a touchdown is made on the fuselage alone, the extent of damage to the aircraft and injury to personnel is dependent upon not only the above conditions, but the attitude of the aircraft, which determines the point at which the impact load occurs. If the fuselage does not contact the landing surface in a comparatively level attitude (this may be a difficult judgment for the pilot to make, since the aircraft is normally landed in a nose-high attitude), the impact load is distributed over fewer fuselage cross frames and more extensive damage results. In view of the above reasons, it is considered desirable to touch down on as many landing gears as it is possible to extend, since landing with one or two landing gears extended will lessen the impact load that eventually must be dissipated throughout the fuselage.

Retraction of the Landing Gear After Touchdown.

After touching down with a partial extension of the landing gear, it may be considered desirable to retract the extended landing gear before control of the aircraft is lost. This procedure, in effect, would permit the extended landing gear to absorb a portion of the impact load, as well as increase the chances of the fuselage contacting the landing surface in a comparatively level attitude. However, since a landing with a partial extension of the landing gear will only be accomplished because a malfunction has occurred in the landing gear system, retraction of the landing gear after touchdown must depend upon the nature of the landing gear system failure. If, for example, the touchdown is accomplished with the two main landing gear extended and the decision is made to retract the landing gear, the situation is far from improved should only one of the landing gear retract. Accordingly, the landing gear should be retracted only if it can be determined that the basic malfunction will not prevent all extended landing gear from retracting.

WARNING

When accomplishing a landing with a partial landing gear extension on other than hard-surface runways, do not retract the landing gear. Retracting the landing gear will increase the likelihood of injury to personnel and damage to the aircraft.

Also, it should be considered that retraction of the gear by use of the landing gear emergency switch may require the shoulder harness of one pilot to be unlocked — a condition which is not recommended on crash landing.

LANDING—MAIN LANDING GEAR ONLY.

Should the nose landing gear fail to extend when both the normal and emergency extension procedures are employed, it is usually possible to enter the nose wheel compartment, disconnect the nose landing gear actuator, and push the landing gear down. If this last action is unsuccessful, the following procedure is recommended for landing on prepared runways:

a. Brief personnel.

b. Turn off all nonessential equipment (including heaters).

c. Tighten safety belts and shoulder harnesses; lock inertia reel lock control.

CAUTION

When the inertia reel lock control is locked, it is impossible to bend forward; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

d. Keep the main landing gear extended and plan a normal approach for a nose-high landing at minimum speed consistent with the gross weight of the aircraft.

e. Wing flap lever - DOWN.

f. Close throttle levers upon contact with the ground.

g. Hold nose off the ground as long as possible to reduce fuselage damage.

NOTE

It may be advisable to retract the main landing gear as the aircraft slows to approximately 70 knots. This procedure may be used at the pilot's discretion on hard-surface runways, but should not be used when personnel are carried in the cargo compartment.

h. Use brakes, if necessary, only after nose contacts runway.

i. Mixture levers - IDLE CUT-OFF.

j. Firewall shutoff switches - SHUT.

k. Fuel selector switches - OFF.

l. Ignition switches - OFF.

m. Battery switch - OFF, when it is certain that the fire extinguisher system will not be needed.

n. Immediately after aircraft stops, open crew compartment overhead escape hatch.

LANDING—ONE MAIN LANDING GEAR ONLY.

If only one main landing gear can be extended, accomplish the applicable procedures as outlined in LANDING - MAIN LANDING GEAR ONLY, this section. Touch down on the extended landing gear to absorb a portion of the impact load and hold the wings level as long as possible with aileron control.

NOTE

It may be advisable to retract the main landing gear as the aircraft slows to approximately 70 knots (or before aileron control is lost). This procedure may be used at the discretion of the pilot when landing on hard-surface runways, but should not be used when personnel are carried in the cargo compartment.

LANDING—NOSE LANDING GEAR AND ONE MAIN LANDING GEAR.

If the nose landing gear and only one main landing gear can be extended, remove the nose wheel access panel and insert the nose landing gear ground lock pin. Following this, accomplish the applicable procedures outlined in LANDING - MAIN LANDING GEAR ONLY, this section. Touch down on the extended main landing gear to absorb a portion of the impact load and hold the wings level as long as possible with aileron control.

NOTE

It may be advisable to retract the main landing gear as the aircraft slows to approximately 70 knots (or before aileron control is lost). This procedure may be used at the pilot's discretion when landing on hard-surface runways, but should not be used when personnel are carried in the cargo compartment.

LANDING—NOSE LANDING GEAR ONLY.

If the nose landing gear only can be extended, the landing should be accomplished with the landing gear extended when no personnel are carried in the cargo compartment. In this case, remove the nose wheel well access panel and insert the nose landing gear ground lock pin. Accomplish the applicable procedures outlined in LANDING - MAIN LANDING GEAR ONLY, this section, and attempt to touch down in a slightly nose-high attitude so that the nose landing gear and fuselage will contact the ground simultaneously. Maintain directional control by steering with the nose wheel. Should it be necessary to land with personnel in the cargo compartment, retract the nose landing gear and land in a comparatively level attitude so that the initial contact will be made on as many fuselage frames as possible.

NOTE

A noticeable decrease in the rate of descent results from the decreased drag with all gear fully retracted.

LANDING—LANDING GEAR UP.

When it is impossible to extend any of the landing gear, accomplish the applicable procedures outlined in LANDING - MAIN LANDING GEAR ONLY, this section, and attempt to touch down in a comparatively level attitude so that the initial contact will be made on as many fuselage frames as possible.

NOTE

A noticeable decrease in the rate of descent results from the decreased drag with all landing gear fully retracted.

EMERGENCY ENTRANCE.

In the event of a crash landing which damages all doors so that entrance into the aircraft is impossible, the emergency entrance areas marked in yellow on the aircraft should be used. (See figures 3-9 and 3-10.) These areas are located on all the hatches on the top of the fuselage. If it is impossible to open the hatches by means of the external release handles, cutting through the fuselage skin at these areas will afford the least resistance. An additional emergency rescue area is provided on the right side of the fuselage just below the navigator's side window. By cutting through this area, entry into the lavatory compartment is possible.

DITCHING.

No experience in ditching a C-119 aircraft is available. On the basis of expected performance, the following ditching procedure is recommended. The success of aircraft ditchings is primarily dependent upon three factors.

a. Wind and sea conditions.

b. Type of aircraft.

c. Skill and technique of pilot.

Under ideal conditions of wind and sea, and by skillful execution of the recommended techniques, the ditching of transport-type aircraft can usually be accomplished with a high degree of success. However, due to the high-wing configuration of this aircraft, the fuselage may be expected to settle rapidly after touchdown with consequent flooding of the cargo compartment. For this reason, it is recommended that all personnel bail out rather than ditch whenever possible. 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.

PREPARATION FOR DITCHING.

The fundamental procedures and techniques essential to successful ditching operations should be emphasized in periodic drills and training exercises. In this way the flight crew can become proficient in the performance of ditching duties to the extent that a successful ditching can be made when little time is available to prepare.

Preflight.

Before all flights over water, sufficient life rafts will be carried for the number of personnel on board. A visual inspection should be made of emergency equipment with particular attention to location and quantity of life rafts and life jackets. A preflight briefing should be conducted, including instructions on the use of seat belts, life jackets, parachutes, and ditching procedures. Preflight planning should include a review of the emergency communications frequencies, rescue facilities, and surface vessels that may be available to render assistance in the event of an emergency.

Communications.

The pilot, as commander of the aircraft, has the responsibility of deciding when an emergency exists, or when a forced landing or bailout is necessary. He should, therefore, start the appropriate emergency communications procedures as soon as any doubt exists concerning the safety of the aircraft. It is far better to start the distress procedure, and then not to need assistance, than to delay until it is too late. Turn IFF/SIF to EMERGENCY and immediately transmit SOS (CW) or MAYDAY (voice) three times on the normal air/ground frequency, followed by the aircraft identification repeated three times. If this channel fails, use 121.5 mc (VHF), 243 mc (UHF), or 8364 kc (LIAISON), depending upon distance and time of day. Following the initial distress signal a more complete distress message should be sent, including as much of the following information as time permits.

a. Navigational position.

b. Course, speed, and altitude.

Figure 3-9

c. Nature of distress.

d. Intentions; bailout or ditch.

e. Kind of assistance required (escort, information concerning sea conditions, ditching heading, etc).

At the end of the message, transmit two 10-second dashes followed by the aircraft identification. This will aid receiving stations in taking direction-finding bearings. In the event it is impossible to establish two-way communications, continue transmitting distress messages "in the blind".

Final Preparations.

Once the decision to ditch has been made, the pilot should warn the crew by sounding six short rings on the alarm bell. The aircraft should be lightened to increase flotation and reduce the possibility of structural failure on impact. All equipment that can be jettisoned should be disposed of, as well as any equipment that is likely to break loose and cause injury to personnel. Fuel should be burned down to the minimum required for several approaches. In the meantime, personnel should dispose of any sharp objects such as keys, glasses, pens, pencils, etc, and attempt to arrange padding from whatever material is at hand; extra clothing, blankets, parachutes, etc, in order to minimize the danger of injury. At the same time, consideration should be given to the need for extra clothing as protection from exposure. Last minute preparations should be made at the discretion of the pilot. Among these are jettisoning of the overhead escape hatches, transmission of latest navigational position, and assumption of ditching stations by all personnel. Interior lights, flashlights, and life jacket lights should be turned on at this time if the ditching is conducted at night. Upon the pilot's order, "Stations for ditching," the NOS

EMERGENCY ENTRANCES

External Release Handles

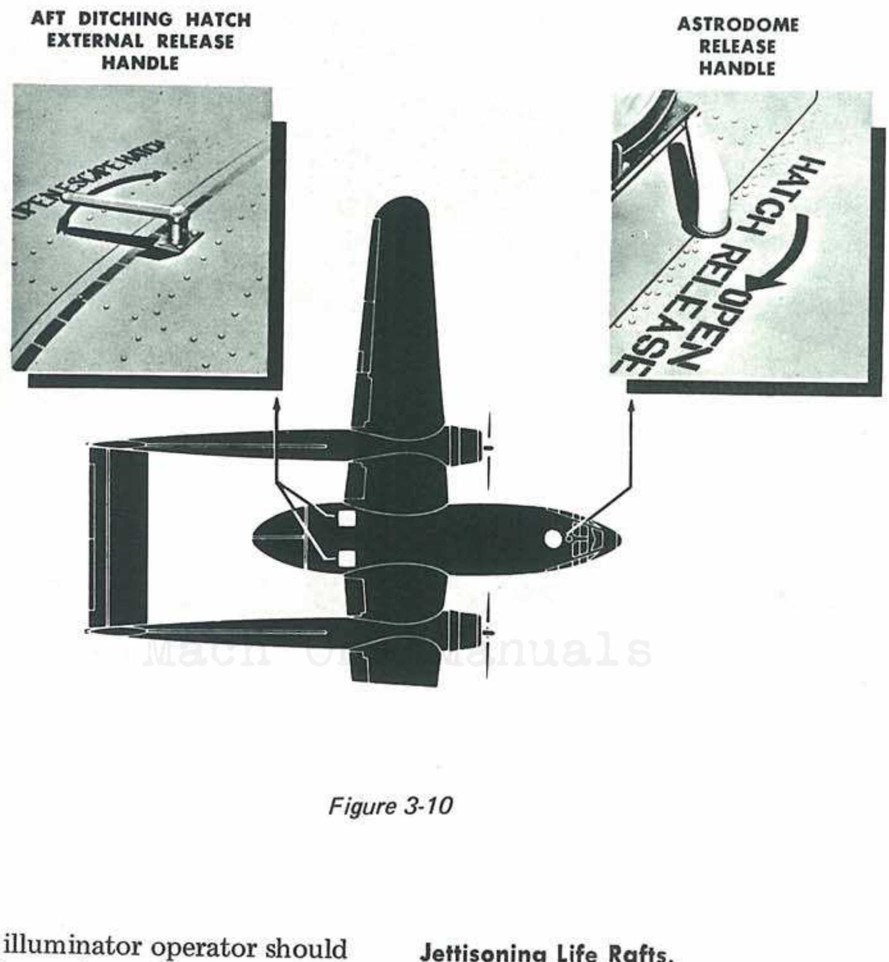


Figure 3-10

operator, gunners, and illuminator operator should take a position in the forward section of the cargo compartment, draw seat belt tight around the hips (not the stomach) and lean forward as far as possible, covering the head with arms. The flight mechanic should then occupy his seat, facing forward with the arms folded and braced on the knees. The navigator assumes a similar position. The pilot and copilot should at this time tighten shoulder harness and safety belt and lock the inertia reel lock control. Approximately 5 seconds before striking the water, the pilot should warn all personnel to brace by sounding one long sustained ring on the alarm bell. Occupants should not relax until the aircraft has definitely stopped, since more than one shock may be felt.

Jettisoning Life Rafts.

In the normal ditching situation in which the navigator/safety officer and crewmembers bail out, the life rafts carried in the cargo compartment are dropped before the aircraft is ditched. This should be accomplished at an altitude of 500 feet, if a parachute is used, or lower if a parachute is not used. Life rafts are dropped at an airspeed of approximately 120 knots. The drop must be planned so that the life rafts will land upwind of the survivors. No provisions are made to inflate the raft during descent; therefore, the possibility of loss of the raft by being blown away from the survivors faster than they can maneuver to it is minimized. A quick release is provided for the parachute harness.

Sea Evaluation.

In order to select the proper ditching heading upon which to establish the ditching pattern, the pilot should begin analyzing the surface from as high an altitude as the surface can be seen; 2000 feet or more, if possible. The primary basic swell can readily be distinguished from high altitude and will be seen first. It may be hidden beneath another system or a surface chop but, from high altitude, the largest and most dangerous system will be the first one recognized. If a secondary swell system is present, it may not be visible until the altitude is decreased, so continued scanning is required. Some minor systems may not be seen until an altitude of 500 to 800 feet is reached. The wind-driven sea, if any, will be easily recognized by the appearance of white caps. Ironically, once a low altitude has been reached (approximately 1500 feet), the basic swell system may disappear from view, hidden by the secondary system and the local chop. It is important, therefore, to plot the direction of the various systems as they are recognized. Once the primary and secondary systems are recognized, the analysis may be checked by flying on various headings around the compass just above the water. When flying into any system, the sea appears steep, fast, and rough. When flying down or parallel to systems, the surface appears much more calm. From these observations, the ditching heading should be selected in accordance with the following general rules:

a. The best ditching heading is usually parallel to the primary swell system and down or parallel to the secondary swells. When landing down a swell system, attempt to touch down on the falling or back side, rather than the face of the swell.

b. Never land into the face of a primary swell system unless the winds are extremely high.

c. In moderately strong winds, it may be desirable to combine the above rules by landing more into the wind and slightly across the swell system.

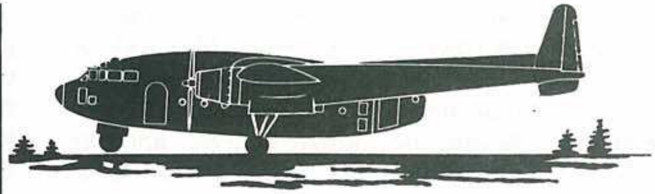
DITCHING PATTERNS.

The circumstances of the particular ditching situation largely determine the flight pattern that should be flown prior to commencing the final-approach leg. Regardless of the circumstances, however, the primary purpose of the ditching pattern is to enable the pilot to approach the touchdown point on the selected ditching heading. In addition, when personnel are carried, the basic pattern should include two crosswind bailout runs upwind of the intended touchdown point. On the first run, the navigator and all personnel should leave the aircraft in rapid succession, using the aft fuselage personnel door or the right paratroop door, providing the flare launcher has been jettisoned. On the second run (500 feet altitude) the large life rafts carried in the cargo compartment should be dropped upwind of personnel at an airspeed of approximately 120 knots IAS. The pilot may then plan to ditch the aircraft, downwind of personnel, on the third approach to the ditching area. This represents the ditching pattern in a fundamental form, and will normally suffice for ditchings conducted under day VFR conditions. Should an Ocean Station Vessel be standing by to rescue survivors, it is very likely that a marked sea lane will be provided to improve the pilot's depth perception and assist him in touching down near the rescue vessel on the selected ditching heading. When this is the case, the pattern should be flown so as to intercept the final-approach leg far enough out to avoid overshooting the ditch point near the vessel.

Night Ditching.

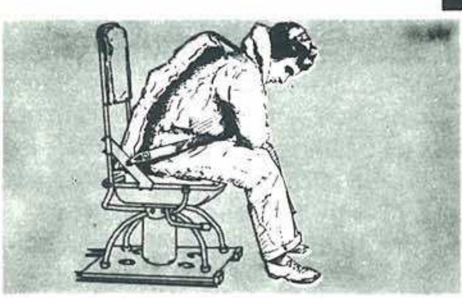
When a ditching is attempted at night, the immediate purpose of the ditching pattern is to place the aircraft in a position to fully utilize flare or starshell illumination provided by escort aircraft or surface vessels. Various patterns are in common usage, and it is only necessary for the average pilot to know the general background of illumination procedures. The SAR pilot or Ocean Station Vessel may modify the standard procedure when required by a particular situation. Detailed instructions will be given at the time. When illumination is provided by an escort aircraft, parachute flares of approximately 3 minutes duration are commonly used with the escort in position 3 miles ahead and 500-1000 feet higher than the distressed aircraft. Generally one flare is dropped to afford an opportunity for sea evaluation by the distressed aircraft. When the ditching heading has been selected, a second flare is dropped to mark the point at which the turn to ditching heading should be made, and the escort immediately turns to that

DITCHING AND CRASH LANDING STATIONS



PILOT–COPILOT

Shoulder harness and safety belt tightened . . . inertia reel lock control–locked.



NAVIGATOR/SAFETY OFFICER

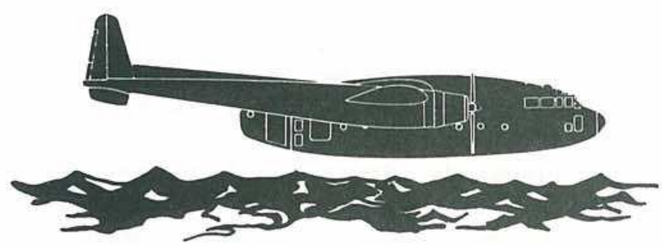
Face seat forward . . . fasten safety belt . . . lean forward . . . brace for impact.

FLIGHT MECHANIC

Assume seat on flight deck in flight mechanic's seat . . . face seat forward . . . fasten safety belt . . . lean forward . . . brace for impact.

OTHER CREWMEMBERS

Assume a forward seat in the cargo compartment, if available, safety belts tight . . . otherwise, against the forward bulkhead . . . lean towards nose of aircraft as far as possible.



CAUTION

IF CARGO IS CARRIED AND IT CANNOT BE JETTISONED DURING EMERGENCIES, THE CREW SHOULD RETAIN THEIR NORMAL POSITIONS.

Figure 3-11

heading. By the time the distressed aircraft reaches the second flare and turns onto the final leg, the escort is in position ahead and is ready to illuminate. When passing 400-600 feet of altitude, the ditching pilot calls for illumination, and the escort commences to drop a line of five flares at 1000-yard intervals. The first flare will ignite approximately 2-1/2 miles ahead of the distressed aircraft, and all five will be burning when the aircraft is 1 mile from the first flare. No special pattern is required to take advantage of illumination provided by Ocean Station Vessels. Normally, these ships will station themselves on the left side near the end of the lighted sea lane, and fire flares and star shells as necessary to illuminate the entire ditching area. Remember that it is important to fly the pattern so as to touch down short of the flares. It is far better to err by landing too short than by overshooting from a brightly lighted area into darkness.

IFR Conditions.

Ocean Station Vessels are equipped to provide three types of radar-assisted approach to the sea lane; full pattern, straight-in, and radar-assisted ADF. The full-pattern, radar-assisted approach is a rectangular pattern similar to a normal GCA-PPI approach and uses the Ocean Station Vessel as a fix point. Normally, this pattern calls for left turns, but may be flown to the right at the request of the pilot. The final approach is commenced at 800 feet, 10 miles out, with descent at the pilot's discretion. When the distressed aircraft is unable to maintain altitude or fuel is low, a straight-in radar approach is used in which the distressed aircraft is vectored directly to the final-approach leg at a distance of 10 miles from the vessel. When the radar-assisted ADF approach is used, the distressed aircraft tracks outbound on the reciprocal of the ditching heading, makes a procedure turn to the right or left, and descends inbound using radar-range information from the Ocean Station Vessel to judge his descent.

DITCHING TECHNIQUE.

Upon commencing the final-approach leg of the ditching pattern, the pilot should recheck landing gear up and locked, wing flaps full down, and let down at the lowest speed and rate of descent consistent with adequate control and optimum nose-high attitude. Over glassy smooth water or at night with insufficient light, it is important to establish the proper speed and power combination early in the approach. Under these conditions it is very easy for even the most experienced pilots to misjudge altitude as much as 50 feet or more. The proper use of power on the approach is of great importance. If power is available on one engine only, a little power should be used to flatten the approach, but the good engine should not be used to such an extent that directional control is sacrificed. If the ditching is made with both engines out, a slightly higher approach speed is recommended down to the flare-out. This additional speed will allow the glide to be broken early and more gradually, thereby giving the pilot more time to feel for the surface, decreasing the possibility of stalling high or flying into the water. The aircraft should not be fully stalled at impact, but rather dragged in tail first by gradually cutting power. When landing parallel to a swell system, little difference is noted between landing on top of a crest or "in the trough". If the wings are trimmed to the surface of the sea rather than the horizon, there is little danger of a wing hitting a crest. However, if contact is made on the face of a swell, the aircraft may be swamped or thrown violently into the air, dropping heavily into the next swell. This may prove disastrous, particularly if the control surfaces are damaged or carried away on the first impact. If the control surfaces remain intact, the pilot should attempt to maintain the proper nose attitude by rapid and positive use of the yoke. In most cases, drift caused by crosswind can be ignored unless the wind is extremely strong; the forces acting on the aircraft after touchdown are of such magnitude that drift will be only a secondary consideration. If the aircraft is under good control, the crab should be "kicked out" with rudder just prior to touchdown in order to minimize any tendency of the fuselage to roll to one side.

BAILOUT.

Should it become necessary to bail out over either water or land, the following procedures are recommended:

WARNING

When using the bailout chute, the bailout should be accomplished in a head-first manner, thus placing the head in the slipstream prior to the remainder of the body and reducing the likelihood of head injury.

DITCHING CHART

PERSONNEL	DUTY	PROVIDE	POSITION	EXIT
PILOT	Sound three short rings on the alarm bell to warn crew to standby for bailout. Order bailout with one long ring. Alert crew for ditching with six short rings. Jettison equipment if time permits; destroy as deemed necessary. Evaluate wind and sea conditions to determine ditching heading. Check life jacket, tighten safety belt and shoulder harness, and lock inertia reel lock control. Locate all crewmembers, after leaving aircraft.	Parachute, flashlight, first aid kit.	Pilot's station.	Crew compartment escape hatch.
COPILOT	Take over control of aircraft while pilot adjusts his equipment. Turn all nonessential electrical equipment OFF. Turn IFF/SIF to EMERGENCY. Check life jacket, tighten safety belt and harness, lock inertia reel lock control. Destroy equipment as directed. Ring alarm bell as signal to brace for impact.	Drinking water container, flashlight.	Copilot's station.	Crew compartment escape hatch.
NAVIGATOR/ SAFETY OFFICER	Transmit position, course, speed, altitude, nature of distress, and intention to ditch. Check life jacket and parachute. Destroy equipment as directed. (Bail out when directed.)	Navigation kit, confidential folder, briefcase.	Navigator's station. Seat facing forward.	Crew compartr escape hatch.
FLIGHT MECHANIC	Remove crew compartment escape hatch. Destroy equipment as directed. Prepare for ditching. Bail out when directed.	Flashlight, pyrotechnic pistol and flares, drinking water container.	Flight mechanic's seat.	Crew compartment escape hatch.
ILLUMINATOR OPERATOR	Oversee jettisoning of flare launcher and all other removable equipment. Open cargo compartment escape hatches when directed. Destroy equipment as directed. (Bail out when directed.) Check life jacket and parachute. Tighten safety belt.	First aid kit.	Forward cargo compartment.	Cargo compartment escape hatches.
GUNNERS AND NOS OPERATOR	Assist illuminator operator as directed. Check life jacket and parachute. Bail out when directed, or prepare for ditching. Destroy equipment as directed. Tight safety belts. Lean toward nose of aircraft as far as possible.	Emergency radio, first aid kit, crash axe, flashlight.	Cargo compartment seats.	Cargo compartment escape hatches.

Figure 3-12

BAILOUT OVER LAND.

a. Give bailout warning by three short rings of alarm bell.

b. Turn IFF/SIF to EMERGENCY.

c. Reduce airspeed as much as possible.

d. Check parachutes and parachute harnesses.

e. Trim aircraft for level flight.

f. Jettison flare launcher and bail out right paratroop door or bailout chute.

NOTE

On aircraft in the ferry configuration, use the aft fuselage personnel door and bailout chute.

g. Give bailout order by one long ring of alarm bell.

h. Set automatic pilot to fly aircraft away from inhabited area.

BAILOUT OVER WATER.

Consideration of various unfavorable factors involved in an overwater bailout limits the decision recommending overwater bailout 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; and when fire or loss of control makes ditching impossible.

a. Give bailout warning by three short rings of alarm bell.

b. Turn IFF/SIF to EMERGENCY.

c. If time permits (approximately 1 extra minute is required), put on exposure suits over flying clothing. (Exposure suits are only carried on special missions.)

d. Don life jackets and parachutes, making certain the individual life raft pack is secured to parachute harness. Crewmembers should check the equipment of each other for completeness and proper adjustment.

e. Reduce airspeed as much as possible, yet maintain control.

f. Trim aircraft for level flight.

g. Jettison flare launcher and bail out right paratroop door or bailout chute.

NOTE

On aircraft in the ferry configuration, use the aft fuselage personnel door and bailout chute.

h. If ship is in the vicinity, make a run so that the crew, on bailing out, will drift onto the course and just ahead of the ship.

i. Give bailout order by one long ring of alarm bell.

j. Set automatic pilot to fly aircraft away from immediate area.

ELECTRICAL SYSTEM EMERGENCY OPERATION.

PARTIAL DC POWER FAILURES.

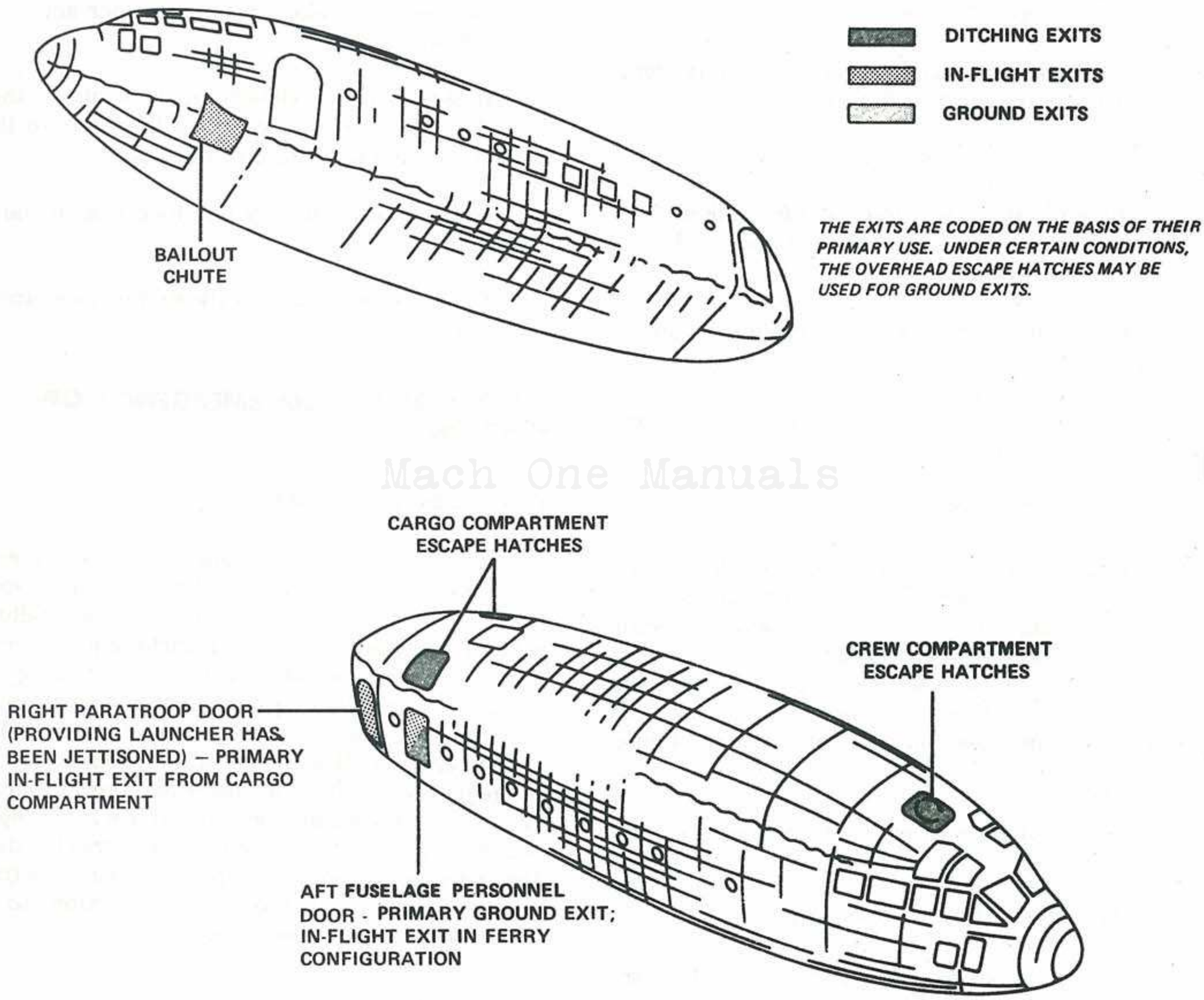
Partial electrical power failures are emergency conditions in that they restrict the aircraft in some specific phases of its operation. Such failures seldom jeopardize safety of flight and, in most cases, prompt corrective action in utilizing the equipment provided to cope with a partial power failure will offset the power loss. The dc and ac voltmeters, as well as the generator loadmeters, will immediately confirm a suspected power failure. Likewise, the generator and inverter warning lights will indicate a malfunction in the electrical system. Discussed below are some specific partial electrical power failures and the remedial action to be undertaken should they occur.

Failure of One Engine Generator.

When an engine generator power failure warning light glows, indicating a malfunction in its respective generator system, employ the following procedure.

1. All unnecessary electrical equipment - Off. P,CP,N,FM,IO,G

EMERGENCY EXITS



ONLY THOSE EXITS MARKED IN ▒▒▒ SHOULD BE USED FOR IN-FLIGHT EXIT FROM THE AIRCRAFT. USE OF ANY OTHER EXIT COULD RESULT IN DEATH OR SERIOUS INJURY TO PERSONNEL.

Figure 3-13

2. APU - Start. IO

3. TRU switch - ON. FM

4. Generator switch - RESET, then OFF. FM

   The RESET position of the generator switch will reset the field control relay. When the generator switch is moved to RESET position, the generator warning light will go out. This does not indicate that the field control relay has reset.

5. DC voltmeter - Select malfunction generator and check voltage. CP

   Also select TRU and remaining generator and check for approximately 28 volts.

6. If voltmeter reading is approximately 28 volts: A voltmeter reading of 28 volts indicates that the field control relay has been reset.

   a. Generator switch - ON. CP

      Closing the switch guard will not necessarily position the switch from OFF to ON. Check that the warning light remains off.

   b. Loadmeter - Check for output. CP

   NOTE

   If the voltage output is normal, but the reading of the loadmeter is zero, turn the corresponding generator switch OFF and note if the reading on the other loadmeter increases. An increase on the other generator loadmeter indicates that the generator voltage was reaching the bus, and that the loadmeter has failed.

7. If voltmeter reading is more than 28 volts: A voltmeter reading of 28 volts or more indicates that the field control relay has been reset.

   a. Voltage regulator rheostat - Adjust for 28 volts. FM

      A knurled knob on its corresponding voltage regulator in the cargo compartment permits adjustment of voltage.

   b. Accomplish step 6, if applicable. CP

8. If the voltmeter reading is 0-5 volts: A voltmeter reading of 3-5 volts indicates that the field control relay has not reset. A voltmeter reading of zero probably indicates a mechanical failure of the generator; however, to preclude the possibility of field control malfunction, it is advisable to attempt field relay resetting.

   a. Manual reset button - Depress. FM

      The manual reset button is located on its corresponding field control relay.

   b. DC voltmeter - Check for 28 volts. CP

   c. Accomplish step 6, if applicable. CP

9. If it is impossible to recover generator output:

   a. Generator switch-OFF. CP

      The generator is turned OFF to avoid the danger of fire resulting from generator failure and to prevent excessive voltage of one generator from tripping the overvoltage relays of the other generators.

   b. TRU switch - As required. FM

   c. APU - As required. IO

10. Fuel selector switches - Select fullest tanks. CP

    Fullest fuel tanks are selected in order to obviate a fuel emergency in event of complete electrical failure.

11. Monitor bus switch - OVERRIDE, if required. N/FM

    The monitor bus is automatically deenergized by failure of one or both of the engine generators. The monitor bus may be reenergized from the main bus by placing the monitor bus switch in OVERRIDE. The loadmeters should be checked frequently to ascertain that the remaining generators are not being overloaded.

12. Maintain fire watch. IO, FM

Periodically check the engine to ascertain that the failed generator does not result in an engine fire.

Failure of the Monitor Bus Relay.

The dc monitor bus is energized through the dc monitor bus relay. Failure of the dc monitor bus relay will result in loss of propeller deicing, loran (AN/APN-70), and liaison (618T-3) equipment. Should the dc monitor bus fail, no corrective action is possible except temporary electrical maintenance to bypass the faulty relay.

Failure of Both Engine Generators.

Failure of both engine generators will be indicated by illumination of both generator failure warning lights. The battery is automatically disconnected from the main dc bus (assuming the APU is not operating). Failure is immediately apparent by loss of all electrical equipment except certain emergency equipment. The flare launcher jettisoning, alarm bell, and manual spark control circuits are energized by battery power. In flight, the pilot's C-4 spotlight also remains energized. When the battery is used solely to energize the emergency equipment, it supplies the necessary power for approximately 3 to 4 hours, depending on the condition of the battery at time of failure. Operation of additional equipment (eg, navigation or communications equipment, etc) should be held to a minimum.

The following procedure is recommended should both engine generators fail:

NOTE

Make certain that location of flashlights is known to all crewmembers. Should both generators fail during a night mission, several flashlights will be required in accomplishing the emergency procedures.

1. Battery switch—OFF. CP

NOTE

Attempt to stay clear of IFR conditions and land at the first suitable landing field.

2. Emergency power switch—ON, check voltage. CP

The emergency power switch provides battery power for the pilot's turn-and-slip indicator, pitot heat, engine generator field control relay resetting, and pilot's instrument inverter.

3. Superchargers—LOW. CP

WARNING

If the engines were being operated in high blower at the time of the power loss, the superchargers will shift to low blower. If high blower operation is desired after generator power is restored to the main dc bus, shift to high blower in accordance with the limitations outlined in SUPERCHARGER LIMITS, Section V, T.O. 1C-119G-1.

4. Pilot's instrument inverter switch - OFF/As required. CP

CAUTION

Due to the large current drain of the pilot's instrument inverter, it should be turned OFF and any further flight continued under VFR conditions. If impossible to maintain VFR, instrument flight should be conducted on partial panel; ie, turn - and - slip indicator, magnetic compass, and pitot static instruments. Only as a last resort should the pilot's instrument inverter be left on with no generators on the bus, as it will completely drain a fully charged battery in approximately 10 minutes.

5. Unnecessary electrical equipment - OFF. ALL

The autopilot and single-phase inverters, propeller deicing, and other unnecessary equipment should be turned OFF so that the load which the APU must assume is reduced to minimum.

CAUTION

If emergency use of any equipment on the main dc bus becomes imperative, the battery switch may be held in the OVERRIDE position and the specific equipment turned on. Use of the OVERRIDE position must be restricted to limited operation of communications equipment essential to safety of flight; otherwise, an excessive drain on the battery will result.

6. Fuel management - As required. CP

Fullest tanks are selected in order to obviate a fuel emergency in event of complete electrical failure. If necessary to select the fullest tank, proceed as follows:

a. Fuel booster pump switches - NORMAL ON. CP

b. Battery switch - OVERRIDE. CP

c. Fuel selector switches - Fullest tanks. CP

d. Battery switch - OFF. CP

e. Fuel booster pump switches - OFF. CP

7. Generator switch (select one) - RESET, then OFF. CP

The reset position of the generator switch will reset the field control relay.

NOTE

The engine generator reset circuit is protected by the pitot heaters circuit breaker. The pitot heaters circuit breaker must be closed in order to accomplish electrical resetting of the field control relay.

8. DC voltmeter - Select corresponding generator and check voltage. CP

9. If voltmeter reading is approximately 28 volts: A voltmeter reading of 28 volts indicates that the field control relay has been reset.

a. Generator switch - ON. CP

Closing the switch guard will not necessarily position the switch from OFF to ON. Check that the warning light remains off.

b. Loadmeter - Check for output. CP

10. If a voltmeter reading is more than 28 volts: A voltmeter reading of 28 volts or more indicates that the field control relay has been reset.

a. Voltage regulator rheostat - Adjust for 28 volts. FM

A knurled knob on its corresponding voltage regulator in the cargo compartment permits adjustment of voltage.

b. Accomplish step 9, if applicable. CP

11. If voltmeter reading is 0-5 volts: A voltmeter reading of 3-5 volts indicates that the field control relay has not reset. A voltmeter reading of zero probably indicates a mechanical failure of the generator; however, to preclude the possibility of field control malfunction, it is advisable to attempt field control relay resetting.

a. Manual reset button - Depress. FM

The manual reset button is located on its corresponding field control relay in the cargo compartment.

b. DC voltmeter - Check for 28 volts. CP

c. Accomplish step 9, if applicable. CP

12. If the output of the generator has been recovered:

    a. Battery switch - ON. CP

    b. APU - Start. IO

    c. TRU switch - ON. FM

13. If the output of the generator cannot be recovered:

    a. Generator switch - OFF. CP

    The generator is turned OFF in order to avoid the danger of electrical fire resulting from a generator failure and to prevent excessive voltage of one generator from tripping the field control relays of other generators.

14. Attempt to recover the output of the other engine generator by repeating steps 7 through 12 for the other generator. CP, FM

15. If the output of only one engine generator is recovered.

    a. TRU switch - As required. FM

    b. APU - As required. IO

16. If neither engine generator output can be recovered:

    a. Engine generator switches - OFF. CP

    b. Battery switch - ON, or as required. CP

CAUTION

Battery energy may be depleted by an unsuccessful APU start.

    c. APU - As required. IO

    d. TRU switch - As required. FM

CAUTION

When operating solely on the APU, propeller deicing may be used in an extreme emergency provided all electrical systems except the instrument inverter and the heaters (if required) are turned OFF.

17. Monitor bus switch - OVERRIDE, if required. N/FM

    The monitor bus is automatically deenergized by failure of one or both of the engine generators. The monitor bus may be reenergized from the main bus by placing the monitor bus switch to OVERRIDE. The loadmeters should be checked frequently to ascertain that the remaining generators are not being overloaded.

18. Maintain fire watch. IO, FM

    Periodically check the engines to ascertain that the failed generators do not result in an engine fire.

INVERTER FAILURE.

FAILURE OF BOTH SINGLE-PHASE INVERTERS.

Should failure of both single-phase inverters occur, the following equipment is inoperative: fuel quantity, fuel flowmeters, fuel pressure, oil pressure, torque pressure, water pressure, driftmeter, IFF/SIF, loran, card and both pointers of the radio magnetic indicators, heading pointer and glide slope indicator, course deviation indicator (TACAN only), slaved heading indicators, range indicator, azimuth indicator, ignition analyzer, compass light, nose wheel position indicator, bearing converter, and the transmitting function (but not indication) of the master heading indicator. See figure 3-14.

a. AC voltmeter - SINGLE-PHASE.

b. Single-phase inverter switch - MAIN, then SPARE.

   Check the warning lights and ac voltmeter to confirm that there is no output from either single-phase inverter.

c. Check ac power fuse, transformer fuse, and voltmeter fuse in the overhead junction box.

WHEN SINGLE PHASE INVERTER BOTH LIGHT GLOWS, THE FOLLOWING EQUIPMENT IS INOPERATIVE . . .

- * FUEL QUANTITY INDICATORS
- * DRIFTMETER
- * IFF
- * LORAN
- * RADIO MAGNETIC INDICATORS (CARD AND BOTH POINTERS)
- * HEADING POINTER OF ID-249
- * SLAVED HEADING INDICATORS
- * GLIDE SLOPE INDICATOR OF ID-249
- * RANGE INDICATOR
- * AZIMUTH INDICATOR
- * IGNITION ANALYZER
- * BEARING CONVERTER
- * MASTER HEADING INDICATOR (TRANSMITTING FUNCTION)
- * COURSE DEVIATION INDICATOR (TACAN ONLY)
- * GUN SIGHT
- * FIRE CONTROL COMPUTER
- * FIRE CONTROL DISPLAY
- * AN/ARQ-25
- † FUEL FLOWMETER INDICATORS (RECIPROCATING)
- † FUEL PRESSURE INDICATORS
- † OIL PRESSURE INDICATORS
- † TORQUE PRESSURE INDICATORS
- † WATER PRESSURE INDICATORS
- † COMPASS LIGHT
- † NOSE WHEEL POSITION INDICATOR

* THIS EQUIPMENT BECOMES INOPERATIVE IF THE AC POWER FUSE BURNS OUT.
† THIS EQUIPMENT BECOMES INOPERATIVE IF THE TRANSFORMER FUSE BURNS OUT.

WHEN AUTO PILOT INVERTER LIGHT GLOWS, THE FOLLOWING EQUIPMENT IS INOPERATIVE . . .

- AUTO PILOT
- RADIO MAGNETIC INDICATOR CARDS
- MASTER HEADING INDICATOR
- COPILOT'S ATTITUDE INDICATOR
- COPILOT'S TURN-AND-SLIP INDICATOR
- SLAVED HEADING INDICATORS
- HEADING POINTER OF ID-249

INVERTER WARNING

NOTE

With the operating spare inverter switch set to ON, the operating spare inverter supplies power to AN/APN-70 loran and 618T-3 liaison sets. In the event the single-phase inverter fails, the operating spare inverter assumes the single-phase inverter load. The AN/APN-70 loran and 618T-3 liaison sets will then be inoperative.

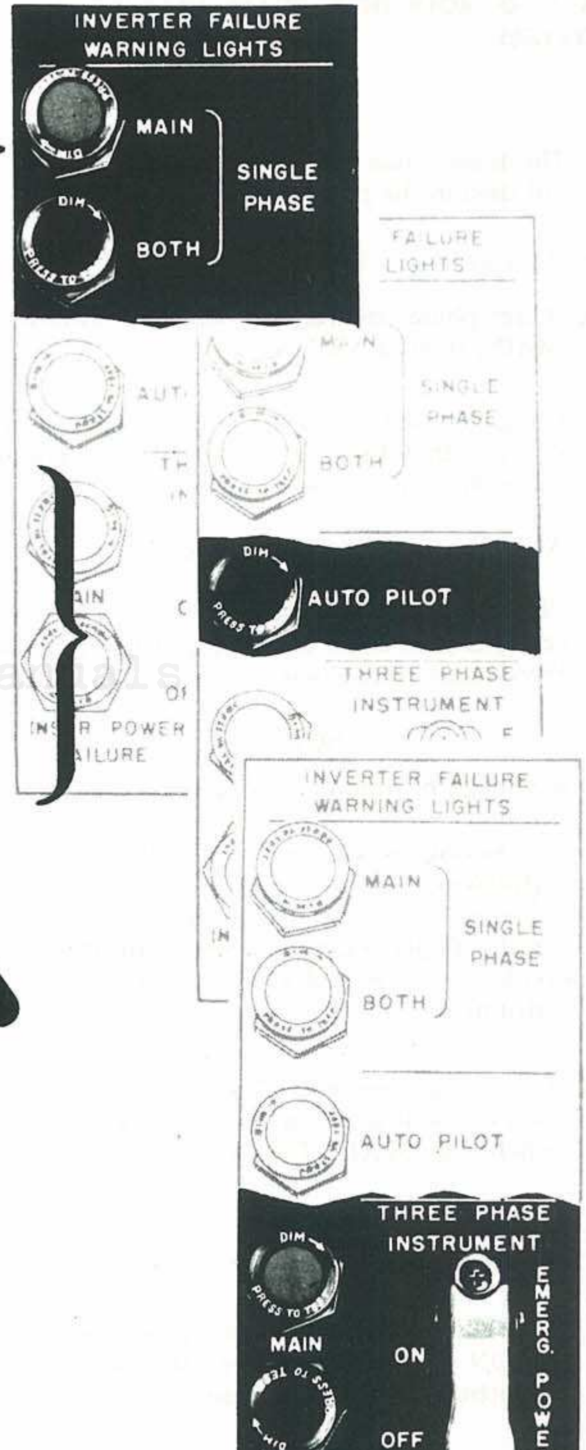


Figure 3-14

d. Single-phase inverter switch - OFF.

Turn the single-phase inverter switch OFF to avoid the danger of electrical fire resulting from inverter failure.

FAILURE OF BOTH THREE-PHASE INSTRUMENT INVERTERS.

NOTE

The three-phase instrument inverters are not used in the present installation.

a. AC voltmeter - THREE-PHASE.

b. Three-phase instrument inverter switch MAIN, then SPARE.

Check the warning lights and ac voltmeter to confirm that there is no output from either three-phase instrument inverter.

c. AC voltmeter - SPARE INSTR.

Check the warning lights and ac voltmeter to confirm that there is no output from either three-phase instrument inverter.

NOTE

A voltage reading of 115 volts on the ac voltmeter when on SPARE INSTR, but no reading when on THREE-PHASE, indicates that the spare three-phase instrument inverter is operating but certain faulty circuitry exists. In this event, power is still available for flight instruments.

d. If a voltage reading of approximately 115 volts is obtained when the voltmeter selector switch is on SPARE INSTR:

(1) Emergency power switch - ON.

Placing the emergency power switch ON will supply power to the pilot's attitude and heading indicators.

e. If no three-phase instrument power is available:

(1) Three-phase instrument inverter switch - OFF.

Turn the three-phase instrument inverter switch OFF to avoid the danger of electrical fire resulting from inverter failure.

FAILURE OF AUTOMATIC PILOT INVERTER.

Failure of the automatic pilot inverter will result in the loss of the automatic pilot system, as well as the radio magnetic indicators (cards), master heading indicator, copilot's attitude indicator, copilot's turn-and-slip indicator, slaved heading compasses, and the heading pointer of the course indicator (ID-249). See figure 3-14.

a. AC voltmeter - AUTOPILOT.

Check the warning light and ac voltmeter to confirm that there is no output from the autopilot inverter.

b. If no autopilot inverter power is available:

(1) Autopilot inverter switch - OFF.

Turn the autopilot inverter switch off to avoid the danger of electrical fire resulting from inverter failure.

FAILURE OF PILOT'S INSTRUMENT INVERTER.

Failure of the pilot's instrument inverter will result in loss of the pilot's attitude and directional indicator (ADI), and the fire control system will be unreliable. Any firing will be done in manual mode. If the pilot's instrument inverter fails, turn off the pilot's instrument inverter switch. Further flight will be at the discretion of the aircraft commander; however, IFR should be avoided.

LOSS OF ALL ELECTRICAL POWER.

In the event a loss of all electrical power should occur, the major factor influencing the pilot's course of action is the atmospheric conditions prevailing at the time. If the failure should occur during VFR conditions, continued operation is practical; however, every effort should be made to stay clear of instrument flight conditions and to land at the first suitable airport. If such a failure should occur during IFR conditions, continued operation would be made at the discretion of the aircraft commander. Under the above conditions control of the aircraft is limited to the following:

a. Flight controls less aileron and rudder trim tabs.

b. Control of engines with throttle levers, propeller levers, and mixture levers only. Supercharger operation is restricted to low blower.

c. Engine instruments - MAP and rpm.

d. Flight instruments - Standby magnetic compass, altimeter and vertical velocity, also airspeed, depending upon atmospheric conditions.

e. Landing gear and wing flaps emergency procedures only.

f. Brake systems operate normally.

HYDRAULIC SYSTEM EMERGENCY OPERATION.

In the event of complete hydraulic system failure, the elevator lock and nose wheel steering are inoperative. The brake system accumulator will provide at least one application of brakes; thereafter, the air brakes must be used. The wing flaps and landing gear may be operated through the hydraulic emergency system.

EXCESSIVE HYDRAULIC PRESSURE.

Relief valves in the main hydraulic system are set to relieve at 3500 psi. Should excessive cycling of the pressure regulator occur, or should failure of the relief valves result in the buildup of excessive pressures, the hydraulic pressure bypass valve on the emergency hydraulic control panel should be placed in the EMERGENCY PRESSURE RELEASE position to prevent damage to seals, lines, and actuators. Placing this valve in the EMERGENCY PRESSURE RELEASE position diverts main system pressure back to the reservoir. Pressure of the circulating fluid will be approximately 250 psi. More than eight operations per hour of the pressure regulator is considered excessive cycling.

LANDING GEAR EMERGENCY OPERATION.

ELECTRICAL SYSTEM FAILURE.

In the event there is a complete electrical failure the landing gear switches will be inoperative and the landing gear retraction and extension should be accomplished as follows:

1. Landing gear switch - OFF. CP

2. Landing gear selector valve manual control button - Depressed. FM

   Hold in proper (UP or DOWN) selector valve manual control button until all landing gear are either full up and locked or full down and locked.

3. Gear position - Visually Checked. IO

   The landing gear indicating system will be inoperative; therefore, a visual check should be made to assure that the gear are locked.

HYDRAULIC SYSTEM FAILURE.

Should a failure of the hydraulic system occur, the emergency operation of the landing gear should be accomplished in accordance with the following procedure. See figure 3-15.

1. Landing gear switch - DOWN. CP

2. Nose landing gear uplock release handle - Pulled. FM

3. Pins removed and main landing gear uplock release handles - Pushed. FM

4. Hydraulic emergency selector valve - EMERGENCY PRESSURE RELEASE. FM

5. Operate the hydraulic emergency hand pump. FM

6. Landing gear indicator lights - Checked. P, FM

7. Gear position - Visually Checked. IO

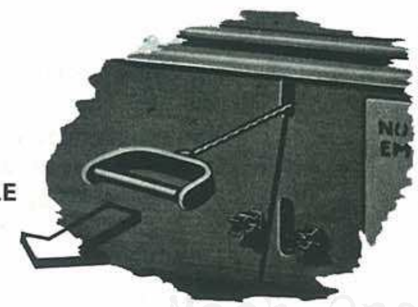
In the event the hydraulic normal power system should fail, the landing gear may be extended through the use of the following procedure.

1

LANDING GEAR SWITCH . . . . DOWN.

2

NOSE LANDING GEAR UPLOCK RELEASE HANDLE . . . . PULLED.



3

PINS . . . . REMOVED AND MAIN LANDING GEAR UPLOCK RELEASE HANDLES . . . . PUSHED.

4

HYDRAULIC EMERGENCY SELECTOR VALVE . . . . EMERGENCY PRESSURE RELEASE.

5

OPERATE THE HYDRAULIC EMERGENCY HAND PUMP.

6

INDICATOR LIGHTS . . . . CHECKED.

LANDING GEAR EMERGENCY EXTENSION . . HYDRAULIC FAILURE

Figure 3-15

ELEVATOR GUST LOCK EMERGENCY RELEASE OPERATION.

Emergency release of all hydraulic gust lock pressure may be accomplished by pulling the automatic pilot emergency disconnect or manually operating the selector valve in the cargo compartment should there by any indication of pressure restricting control column movement of the elevator surface except during intentional locking. By positioning the elevator gust lock emergency release valve to EMERGENCY, this pressure release is assured.

CAUTION

When the elevator gust lock release valve is turned to EMERGENCY, the hydraulic elevator gust lock is inoperative until the valve is repositioned to NORMAL. If landing with the valve in EMERGENCY position, the pilot should exercise caution when reverse thrust is used, and the pilot should attempt to restrain the movement of the control column.

HYDRAULIC BRAKE SYSTEM EMERGENCIES.

BRAKE PEDAL SYSTEM FAILURE.

A failure of the brake pedal system is indicated by no fluctuation of the hydraulic system low pressure indicator when the brake pedals are depressed. Should the brake pedal system fail, brakes may still be applied by use of the parking brake or the emergency air brakes.

HYDRAULIC SYSTEM FAILURE.

The hydraulic brakes operate from the hydraulic low pressure system. If a complete hydraulic system failure or low pressure system failure should occur, the brakes may be inoperative for any continuous use. However, the brake system is so arranged, with a special brake accumulator, that there will be at least one brake application left after a hydraulic system pressure supply failure.

NOTE

If the hydraulic pressure indicators on the instrument panel should indicate low pressure, a check should be made of the brake system accumulator air gage, located in the lavatory compartment to determine the amount of pressure available in the brake system.

NOSE WHEEL STEERING SYSTEM EMERGENCIES.

Should all hydraulic pressure in the steering system be lost, the nose wheel will trail in the centered position, but shimmy dampening will be lost. An electrical system failure will render control of the steering system inoperative; however, the nose wheels will trail in the centered position and shimmy dampening will remain effective. Steering of the aircraft will be accomplished by use of throttles and brakes.

WING FLAP EMERGENCY OPERATION.

Should a failure of the electrical or hydraulic system occur, employ the following procedures for emergency operation of the wing flaps:

NOTE

Landing may be accomplished without the use of wing flaps. Consideration must be given to the fact that wing flaps should be retracted in the event of go-around; consequently, emergency operation of the wing flaps should be governed accordingly.

ELECTRICAL SYSTEM FAILURE.

In the event there is a complete electrical failure, the wing flap lever will be inoperative and the wing flaps operation should be accomplished as follows:

a. Pull the wing flap circuit breaker on the overhead panel. (This is a safety precaution in case electrical power should become available.)

b. Hold in the proper (UP or DOWN) wing flap selector valve manual control button, located on the hydraulic emergency control panel, until the wing flaps are in desired position.

HYDRAULIC SYSTEM FAILURE.

In the event the hydraulic normal power system should fail, the wing flaps may be operated by placing the hydraulic emergency selector valve to the EMERGENCY PRESSURE RELEASE position and wing flaps lever to desired setting.

a. Operate the hydraulic emergency hand pump until wing flaps are in position desired.

b. In the event of a hydraulic system failure and an electrical system failure, the wing flaps selector valve manual control button must be held in during the hand pumping operation.

SECTION IV

AUXILIARY EQUIPMENT

table of contents

HEATING, VENTILATING, AND ANTI-ICING.

Except for the following all information is contained in T.O. 1C-119G-1.

SMOKE EVACUATION SYSTEM.

A smoke evacuation system provides an emergency ram air system to quickly and effectively remove smoke accumulation, resulting from inadvertent flare ignition or malfunction, from the aircraft interior. The system consists of three air scoop doors, two located on the left side of the fuselage and one on the right side, and four spoilers, two on each side of the fuselage. The right air scoop door may be opened approximately 1 inch for constant ventilation of the cargo compartment. The three air scoops are located in the forward cargo compartment area at station 179; the spoilers are installed just forward of the paratroop doors. The scoops and spoilers are pneumatically operated through compressed air bottles, containing sufficient air pressure to operate the system two times while in flight. The pneumatic system is actuated through a lanyard cable arrangement by pulling a T-handle at the navigator/safety officer's station or by pulling the lanyard at any point in the cargo compartment.

Normal Operation of Smoke Evacuation System.

OPERATING PROCEDURES - TO OPEN.

WARNING

Activating the smoke evacuation system will result in transient erratic indications of the altimeter, airspeed indicator, and vertical velocity indicator, followed by large negative position corrections to the airspeed and altitude readings. Extended flight with the system activated should be avoided due to the large negative position corrections caused by the open air scoop doors.

SMOKE EVACUATION SYSTEM CONTROL AND RELIEF VALVES

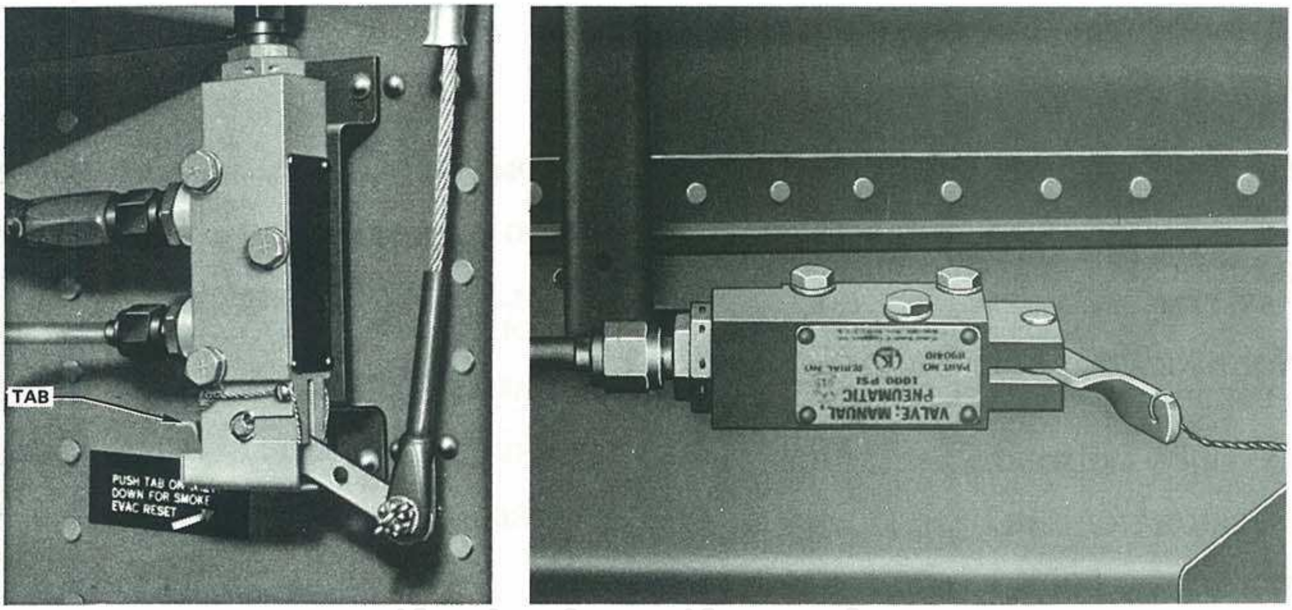


Figure 4-1

In event of an inadvertent flare ignition or malfunction; to activate smoke evacuation system, simply pull lanyard cable or pull T-handle at navigator/safety officer's station.

OPERATING PROCEDURES - TO CLOSE.

1. Push tabs down on valves (figure 4-1), one located on each side of the cargo compartment at station 479, to reset smoke evacuation system; spoilers will automatically close.

NOTE

If the pneumatic manual valve (figure 4-1), located at approximately station 179, is actuated with the system control valve open, the smoke evacuation system air will be depleted on the respective side and the system will be inoperative.

2. Close scoop doors and secure.

3. To reopen right air scoop door for ventilating:

a. While holding air scoop door securely, pull T-handle on door actuator to disengage locking pin.

b. Open air scoop door approximately 1 inch until locking pin is aligned with inboard slot in door.

c. Release T-handle to engage locking pin in slot.

The following information is contained in T.O. 1C-119G-1.

ELECTRICALLY HEATED SYSTEMS.

COMMUNICATION AND ELECTRONIC EQUIPMENT.

Except for the following all information is contained in T.O. 1C-119G-1.

WARNING

Due to high voltages within electronic equipment, no attempt at in-flight maintenance beyond checking circuit breakers should be made.

NOTE

Discussion of classified matter within the flight compartment when an unsecured transmitter is keyed is prohibited. No transmission of classified information will be made when unsecured transmitters are in operation.

INTERPHONE SYSTEM AN/AIC-10A.

The AN/AIC-10A interphone system provides intercommunication between the various crewmembers whenever the 28-volt dc main bus is energized. Each interphone station in the aircraft is equipped with a C-824 or C-824A control panel. These panels provide all the necessary switches for use of the equipment either as an interphone or radio communications system. In addition to interphone voice communications, the audible emergency alarm bell signal is supplied to the crewmembers through the interphone headsets. Monitoring switches on the C-824 or C-824A control panels and the companion C-826 or C-826A mixer panels at each crew station in the flight compartment provide for monitoring of all communication and navigation equipment and are marked accordingly. Selection of a communications set for transmitting purposes is accomplished by placing the rotary selector switch to the desired function. Electrical power is supplied to the interphone system from the 28-volt dc main bus through a 10-ampere circuit breaker in the radio junction box and a 5-ampere circuit breaker in the navigator's circuit breaker box.

Interphone Controls.

The interphone system controls (figure 4-2) are located in the flight compartment at the pilot's, copilot's, navigator/safety officer's, flight mechanic's, and observer's stations, and in the cargo compartment at the NOS operator's, No. 1 and No. 2 gunners', and illuminator operator's stations.

The pilot's, copilot's, navigator/safety officer's, and flight mechanic's C-824 or C-824A control panel rotary selector switch is placarded CALL, INTER, ARQ, LIA, VHF, and AUX. The five monitoring toggle switches are placarded INTER, LIA, ARQ, ADF-1, and VHF COMM. The pilot's, copilot's, navigator/safety officer's, and flight mechanic's C-826 or C-926A mixer panel monitoring toggle switches are placarded GUN INT, MARKER, ADF-2, and VHF NAV. An auxiliary selector panel is installed at the pilot's, copilot's, navigator/safety officer's, and flight mechanic's interphone stations when the associated C-824 or C-824A control panel rotary selector switch is positioned to AUX.

The NOS operator's rotary selector switch is placarded CALL and INTER and the toggle switches are placarded INTER, UHF/2, and FM/1. The illuminator operator's rotary selector switch is placarded CALL and INTER and the toggle switches are placarded INTER, UHF, GUN INT, and FM. The observer's rotary selector switch is placarded CALL, INTER, UHF, and FM, and the toggle switches are placarded INTER, UHF, GUN INT, and FM. The gunner No. 1 and No. 2 rotary selector switches are placarded CALL, INTER, and HOT MIC, and the toggle switches are placarded INTER, UHF, GUN INT, and FM.

Microphone and Headsets.

The pilot and copilot are provided with plug-in jacks just forward of the side windows, while the navigator/safety officer and flight mechanic are provided with plug-in jacks located on the radio rack. The pilot's and copilot's microphones are controlled by pushbutton on their respective control wheels.

The navigator/safety officer's and flight mechanic's microphones are controlled by a foot switch located under their respective work tables. A microphone button is located on each interphone plug-in jack in the cargo compartment. The No. 1 and No. 2 gunners are provided with hot mic capability. By positioning their respective C-824 or C-824A interphone control panel rotary selector switches to HOT MIC, the gunners may transmit

INTERPHONE CONTROL PANELS AND LOCATIONS

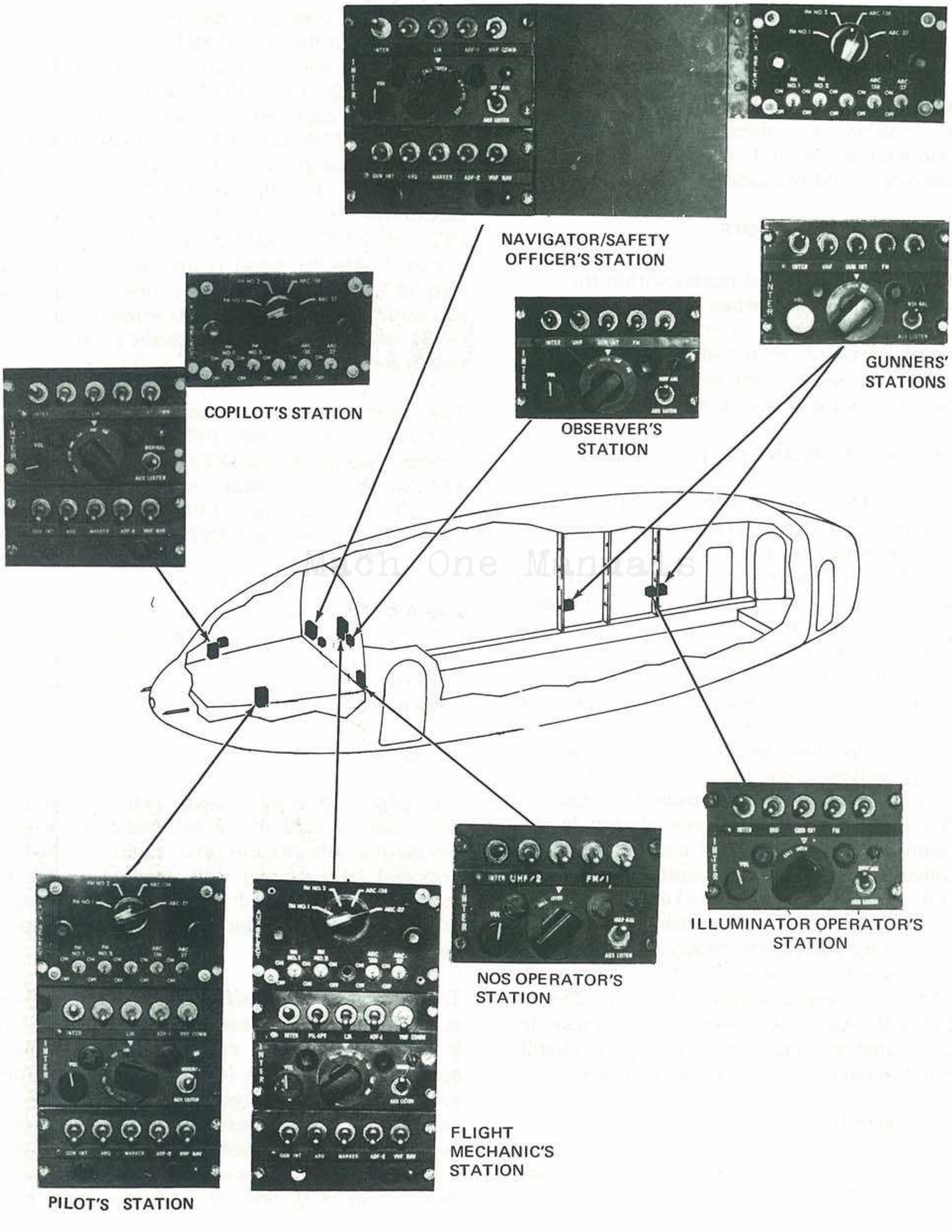


Figure 4-2

voice communications through the gunner's interphone system without depressing their microphone buttons.

Auxiliary Select Panel.

An AUX SELECT panel is installed at each crew compartment interphone station (figure 4-2). The panel contains ON-OFF toggle switches, placarded FMI, FM2, ARC-136, and ARC-27. Individual or multiple systems may be monitored by placing the switch or switches to the ON position. The panel also contains a rotary selector switch placarded FM1, FM2, ARC-136, and ARC-27. This switch operates in conjunction with the C-824 or C-824A control panel. By placing the selector switch of the C-824 or C-824A control panel to the AUX position, and by positioning the rotary selector switch of the AUX SELECT panel to one of the four placarded positions, the operator is able to transmit and receive through the selected system.

VHF COMMAND SET WILCOX 807A.

The Wilcox 807A VHF command set provides line-of-sight, air-to-air, or air-to-ground communications. The set consists of an antenna, a lightweight receiver-transmitter, and a remote control panel located on the center radio control panel (figure 4-6). An OFF-PWR switch, volume control, two frequency selector knobs, COMM TEST pushbutton switch, and frequency indicator comprise the control panel. Voice communication is possible on any one of 1360 different frequencies in the band from 116.000 to 149.975 megacycles. Transmission and reception are accomplished on the same frequency and with the same antenna. The COMM TEST switch, when depressed, disables the squelch circuit in the receiver to permit reception of signals below threshold level. The range of the equipment ranges from approximately 30 miles at 1000 feet altitude to 135 miles at an altitude of 10,000 feet. Power for the operation of the set is supplied through a 10-ampere circuit breaker located on the main radio junction box panel.

Normal Operation of Wilcox 807A.

1. To start equipment, rotate power switch to PWR position and select desired frequency with frequency selector knobs.

NOTE

The receiver will continuously monitor the frequency indicated, except during periods of transmission, at which time the receiver is isolated from the antenna.

2. To stop equipment, rotate power switch to OFF.

VHF/FM COMMAND RADIO SET FM-622A.

Two FM-622A command radio sets provide air-to-air and air-to-ground frequency modulated voice communications and retransmitting capabilities. FM No. 1 also provides homing capabilities. The radio sets operate over a line-of-sight distance from approximately 60 miles at 1000 feet altitude to 140 miles at 10,000 feet altitude. A total of 920 crystal-controlled channels, 50 kilocycles apart, are provided over the 30- to 76-megacycle range within the VHF band. The FM control panels (figure 4-7) provide remote control operation of the set. The No. 1 control panel is located on the center radio control panel; the No. 2 control panel is located at the navigator/safety officer's station. The ID-249 indicator, located on the pilot's instrument panel, provides homing data when using the HOME mode of the No. 1 FM set. Transmission and reception are accomplished on the same frequency and with the same antenna. During homing operation, however, the homing signals are received on a separate antenna system. Power to operate the set is provided by the 28-volt dc main bus and protected by a 7.5-ampere circuit breaker located on the navigator's circuit breaker box.

Normal Operation of FM–622A.

1. To operate set, place function switch on control panel in T/R position for normal voice communications, RETRAN position for retransmission (additional set required), or HOME position for homing.

2. Select desired frequency with switches on control panel.

NOTE

A tone should be heard in the headset while the radio set is tuning.

EQUIPMENT	DESIGNATION	LOCATION
Interphone System	AN/AIC-10A	Control panels at crew stations.
VHF Command Set	Wilcox 807A	Remote control on radio control panel.
VHF/FM Command Radio Set (2)	FM-622A	No. 1 control on radio control panel. No. 2 control at navigator/safety officer's station.
UHF Command Set	AN/ARC-27	Control panel on radio control panel.
UHF Command Set	AN/ARC-136	Control on copilot's side panel.
Speech Encryption System (Used with AN/ARC-136 and VHF/FM No. 2 Radio Sets)	TSEC/KY-8	Control on radio control panel.
UHF Direction Finding Equipment	AN/ARA-25	Control switch on UHF control panel on radio control panel.
Liaison Radio Set	Collins 618T-3	Control panel on radio control panel.
Radio Compass	AN/ARN-6	Control panel on radio control panel.
Marker Beacon	AN/ARN-12	Indicator lights on pilot's and copilot's panel.
TACAN	AN/ARN-21	Control on radio control panel.
VOR Receiver and Glide Slope Approach Radio	AN/ARN-14 AN/ARN-18	Control on radio control panel.
IFF Set	AN/APX-6, AN/APX-6A, AN/APX-25	Controls at copilot's side panel.
UHF Ranging System	AN/ARQ-25	Control on radio control panel.
LORAN	AN/APN-70	Navigator/safety officer's station.

COMMUNICATIONS AND

Figure 4-3. (Sheet 1 of 2)

OPERATOR	FUNCTION	RANGE
Crewmembers	Internal communications between crew.	Crew stations within aircraft.
Pilot and copilot	Short range voice and code communication.	Line-of-sight.
No. 1 pilot or copilot No. 2 navigator/safety officer	No. 1 used with normal communications and homing. No. 2 used with TSEC/KY-8 and normal communications.	Line-of-sight.
Pilot and copilot	Short range voice and code communication.	Line-of-sight. Range varies with altitude in respect to receiving station.
Copilot	Secure speech when used with TSEC/KY-8 and normal UHF communication.	Line-of-sight. Range varies with altitude in respect to receiving station.
Pilot and copilot	Provides encoding and decoding an AN/ARC-136 and No. 2 FM-622A.	Line-of-sight.
Pilot and copilot	Directional reception of UHF signals for homing or bearing.	Line-of-sight. Range depends on power of transmitting stations and conditions.
Pilot and copilot	Long range voice and code communication.	200-2500 miles depending on frequency, conditions, and time of day.
Pilot and copilot	Reception of low frequency range signals for beam navigation; directional reception for homing or bearings.	20-200 miles depending on frequency, conditions, and time of day.
Pilot and copilot	Indicates passage over ground marker beacon.	
Pilot and copilot	Provides bearing and range from ground beacon stations.	Line-of-sight. 0-195 miles.
Pilot and copilot	Reception of VHF navigational aids and lateral guidance in ILS approach. Vertical guidance in ILS approach.	Line-of-sight. Short range, line-of-sight. 15 miles.
Copilot	Identifies aircraft as friend or foe.	Line-of-sight.
Pilot and copilot	Slant range homing, lateral direction finding with AN/ARA-25, and tone and voice communication.	Line-of-sight.
Navigator/safety officer	Provides navigational fix.	Varies with conditions and time of day. Day: 700-900 miles; Night: 450-1400 miles.

ELECTRONIC EQUIPMENT

Figure 4-3. (Sheet 2 of 2)

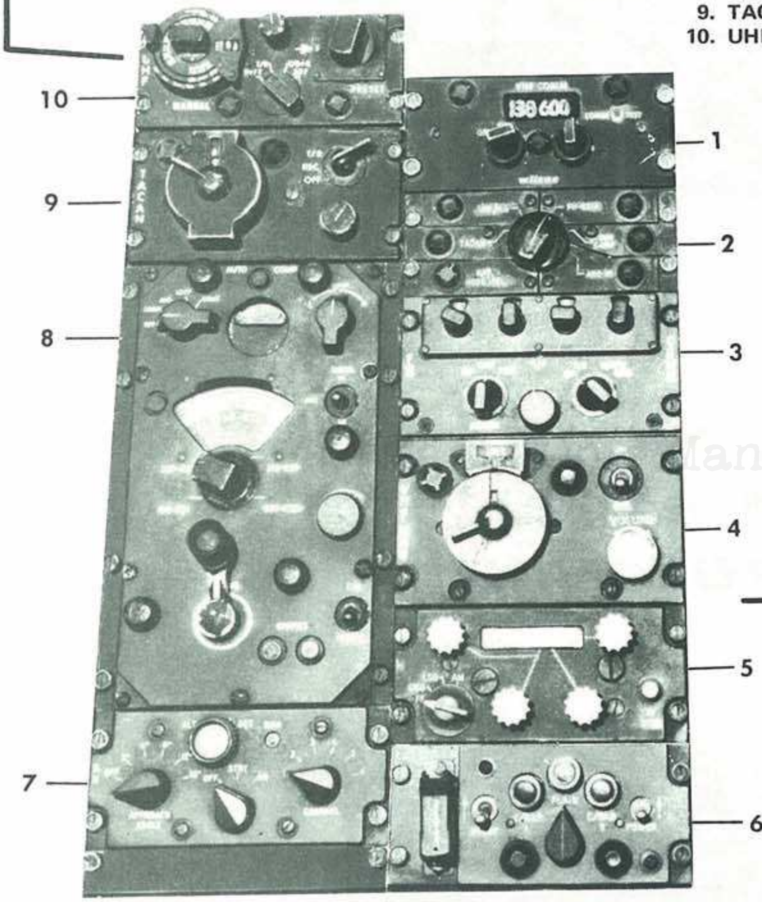
EQUIPMENT	ELECTRICAL SYSTEM	PROTECTION		
		AMP	TYPE	LOCATION
AN/AIC-10A	28-volt dc	10 (Crew Comp) 5 (Cargo Comp)	CB CB	Radio junction box Nav circuit breaker box
Wilcox 807A	28-volt dc	10	CB	Radio junction box
VHF/FM-622A No. 1	28-volt dc	5 7.5	CB	Nav circuit breaker box
VHF/FM-622A No. 2	28-volt dc	7.5	CB	Nav circuit breaker box
AN/ARC-27	28-volt dc	25	CB	Radio junction box
AN/ARC-136	28-volt dc	20	CB	Nav circuit breaker box
TSEC/KY-8	28-volt dc	5	CB	Nav circuit breaker box
AN/ARA-25	28-volt dc	5	CB	Radio junction box
Collins 618T-3	28-volt dc 115-volt ac 1 phase	10 50 5 15	CB CB FUSE	Nav circuit breaker box Nav circuit breaker box Radio junction box
AN/ARN-6	28-volt dc	5	CB	Radio junction box
AN/ARN-12	28-volt dc	5	CB	Radio junction box
AN/APN-21	28-volt dc 115-volt ac 1 phase	10	CB FUSE	Radio junction box Radio junction box
AN/ARN-14 and AN/ARN-18	28-volt dc 28-volt dc 28-volt dc	5 3 5	CB CB CB	Radio junction box Radio junction box
AN/APX-6, AN/APX-6A, AN/APX-25	28-volt dc 115-volt ac 1 phase	5 5	CB FUSE	Radio junction box Radio junction box
AN/ARQ-25	28-volt dc 115-volt ac 1 phase	5 5	CB CB	Nav circuit breaker box Nav circuit breaker box
AN/APN-70	28-volt dc 115-volt ac 1 phase	5 5 15	CB CB FUSE	Monitor bus Radio junction box

COMMUNICATIONS AND ELECTRONIC EQUIPMENT CIRCUIT BREAKERS AND FUSES

Figure 4-4

RADIO CONTROL PANEL-TYPICAL

1. VHF COMMAND CONTROL PANEL, WILCOX 807A
2. NAV MODE SELECT PANEL
3. VHF/FM CONTROL PANEL, FM-622A
4. VOR CONTROL PANEL, AN/ARN-14
5. LIASON RADIO CONTROL PANEL, 618T-3
6. SPEECH ENCRYPTION CONTROL PANEL, TSEC/KY-8
7. UHF RANGING CONTROL PANEL, AN/ARQ-25
8. RADIO COMPASS, AN/ARN-6
9. TACAN CONTROL PANEL, AN/ARN-21
10. UHF COMMAND CONTROL PANEL AN/ARC-27



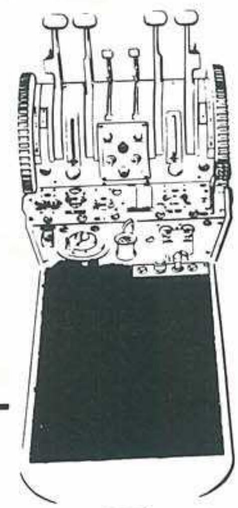


Figure 4-5

VHF COMMAND SET (WILCOX 807A) CONTROL PANEL

Figure 4-6

VHF/FM RADIO SET (FM-622A) CONTROL PANEL

Figure 4-7

3. Set SQUELCH control on control panel to DIS for disabling squelch, CARR for normal squelch operation, or TONE for tone squelch (selective calling). Allow at least 20 seconds for warmup.

4. Place interphone selector switch in AUX position. Place rotary selector switch and monitor switch on AUX SELECT panel to desired FM set.

5. Press mike switch, note sidetone in headset(s), and adjust VOL control for proper volume.

6. If operating in HOME mode, vertical needle should deflect to right when aircraft is to left of being on course, to left when aircraft is to right, and centered when on course. The horizontal needle will rise when approaching the homing station and should dip after station passage.

NOTE

Any known FM station within range can be utilized for homing. If signal is not strong enough, flags on indicator will appear. HOME position automatically selects CARR squelch operation.

7. To stop equipment turn function switch on control panel OFF.

UHF RANGING SYSTEM AN/ARQ-25.

The AN/ARQ-25 UHF ranging system consists of complex airborne equipment operated in conjunction with associated ground equipment. The system operates at predetermined frequencies in the UHF communications band. Operation at these frequencies requires that the aircraft be in a line-of-sight with the antenna on the ground equipment transponder. The airborne equipment includes an interrogator, range indicator, directional coupler, and control panel. The interrogator contains the range processing elements, voice transmitting and receiving equipment, glide slope computer, station passage computer, and a separate ADF receiver. Provisions are also included for a static pressure line connection which feeds an integral barometric sensor. The sensor then provides the airborne equipment with a measure of the aircraft's height above the ground transponder, as well as the aircraft's vertical approach path. The operational limit of the barometric sensor is 10,000 feet barometric altitude; however, the sensor may be subjected to sustained altitude pressures of 30,000 feet without damage. Lateral direction finding is provided utilizing the aircraft's UHF automatic direction finder equipment in conjunction with the interrogator's self-contained ADF receiver. The interrogator is also capable of transmitting a CW carrier, frequency modulated for range tone transmission, as well as AM for voice communication. Selection of the ranging and glide slope display mode is afforded by positioning the NAV MODE SEL switch, located on the radio control panel, to the UHF RNG position. Power for system operation is 115-volt, single-phase ac and 28-volt dc provided through the navigator's circuit breaker box. Each power source is protected by a 5-ampere circuit breaker.

UHF Ranging System Controls.

The AN/ARQ-25 control panel (figure 4-8), installed on the radio control panel, provides APPROACH ANGLE and CHANNEL setting selections, as well as OFF, STBY (standby), and ON control of the system. With the switch positioned ON, continuous transmission interrogation is initiated from the airborne unit. Selecting STBY permits momentary transmission/interrogation, provided the MOM (momentary) switch is depressed for at least 10 seconds. The OFF position is selected when continuous transmission/interrogation is not desirable. The CHANNEL switch provides selection of six sets of transmit and receive frequencies. The ALT SET dial provides a setting of the ground equipment barometric pressure at field altitude. This setting is required for proper operation of the approach angle function. The APPROACH ANGLE switch provides a reference angle setting for the approach angle computer. Approach angles of 3°, 6°, 9°, 12°, and 15° can be selected and the approach can be made from any direction.

UHF Ranging System Indicator.

The range display for the UHF ranging system is provided by the ID-1512/ARQ-25 range indicator installed on the left side of the pilot's instrument panel. The indicator incorporates two scales (0-6NM and 0-60NM) which provide the pilot with a direct readout of slant range to the ground

UHF RANGING (AN/ARQ-25) CONTROL PANEL

Figure 4-8

transponder. A drop-zone light in the center of the indicator illuminates whenever the aircraft passes the point closest to the ground transponder. A red flag appears on the face of the indicator when the transponder is beyond the range of the (airborne) interrogator or is not being received.

Normal Operation of UHF Ranging System.

The UHF ranging system may be operated continuously in the ranging mode, without the approach angle function, for the purpose of determining distance to the ground equipment. Two-way duplex voice communication is provided simultaneously with continuous ranging. Continuous ranging operation, with the approach angle, permits the pilot to make a controlled, direct approach on a desired approach angle. Two-way duplex voice communication is provided simultaneously with continuous ranging and approach angle computation. The system may also be operated on a momentary basis (long or short intervals), independent of the approach angle function, for the purpose of determining distance to the ground transmitter with a minimum of ground and airborne equipment radiation time. Two-way duplex voice communication is provided only during the interrogation period. Momentary ranging operation, with approach angle, permits the pilot to make a semicontrolled, direct approach on a desired approach angle with minimum ground and airborne radiation time. As long as the pilot initiates the momentary interrogation, range and approach angle deviation data will be provided. Two-way duplex voice transmissions are possible while simultaneously ranging during the interrogation interval.

For operation of the UHF ranging system in the continuous interrogation mode perform the following:

1. Position APPROACH ANGLE switch to OFF.

2. Position OFF-STBY-ON switch to OFF.

3. Position CHANNEL switch to correspond with the ground equipment channel selected.

4. Rotate the OFF-STBY-ON switch to STBY for 10-15 minutes warmup, then ON.

NOTE

If the aircraft is within 60 nautical miles, the radio is in line-of-sight of the ground equipment, and the ground equipment is turned on, the range indicator OFF flag should retract. If the OFF flag does not retract, continue flying in the general direction of the ground equipment until the OFF flag does retract.

5. Turn NAV MODE SEL switch to ARQ-25 position.

NOTE

The ID-1512/ARQ-25 range indicator operates independently of the NAV MODE SEL switch and will give accurate and reliable range and drop-zone passage information whenever the OFF-STBY-ON switch is ON and the red flag on the indicator is not in view.

6. Position ARQ monitoring toggle switch on rotary selector switch to ARQ position on desired interphone control box. Standard communication procedures can now be employed to converse with the ground operator. Voice communication on this channel can be conducted only while interrogation is taking place.

7. If approach angle operation is to be used, contact ground equipment operator and obtain ground equipment altitude reading read from a barometric device on transponder. Set ALT SET on control panel to setting given by ground equipment operator.

8. To fly a fixed approach path to ground equipment on a known heading, set APPROACH ANGLE switch to any of five available approach angle settings as desired. Operation of the horizontal bar is the same as that portrayed during an ILS approach. If the aircraft is above the selected approach path, the ILS indicator horizontal bar will be deflected down, indicating that the aircraft must descend to attain the selected approach path. If the horizontal bar is deflected up, the aircraft is approaching the path. For proper operation of the approach angle computing function, the aircraft pressure altitude must not be greater than 10,000 feet.

9. Continue flying inbound toward ground equipment while keeping horizontal bar of ID-249 indicator centered. The aircraft will be approaching the ground equipment on the selected approach angle. When it is desired to fly over ground equipment at a prescribed altitude, merely level off at desired altitude and continue to fly toward ground equipment at this altitude. The range indicator will continue to reduce in range indication to a point where it reaches a minimum value; and when the drop-zone indicator illuminates, the aircraft is at the closest point to the ground equipment. The drop-zone lamp will remain on for approximately 4 seconds. If the ground equipment is overflown, the range indicator will indicate an increasing range.

WARNING

Inbound flights should not be continued below 150 to 200 feet absolute altitude unless visual flight references are available.

10. Position OFF-STBY-ON switch to OFF. The range indicator flag will come into view, signaling the UHF ranging system is off, and a red flag will appear on the horizontal bar of the ID-249 indicator, providing the NAV MODE SEL switch is in the ARQ-25 position.

SPEECH ENCRYPTION SYSTEM TSEC/KY-8.

The TSEC/KY-8 speech encryption equipment is installed and may be used with either the AN/ARC-136 UHF command or FM-622A No. 2 communication systems. The equipment is designed to provide encoding of voice transmissions through the UHF command or VHF-FM radio sets as well as decoding of the incoming signals. A control panel (figure 4-9) is provided on the center radio control panel for remote control operation of the equipment. The system is powered by 28-volt main dc bus power and protected by a 5-ampere circuit breaker located on the navigator's circuit breaker box.

Controls and Indicators (TSEC/KY-8).

a. Zeroize - Inoperative.

b. Delay - Inoperative.

c. C/RAD 1 - Selects AN/ARC-136.

d. Plain - Bypasses TSEC/KY-8 for standard voice transmission.

e. C/RAD 2 - Selects FM-622A No. 2.

f. Power Switch - Turns set on or off.

Normal Operation of TSEC/KY–8.

WARNING

If operation does not proceed as outlined, switch to PLAIN voice. Do not pass classified traffic.

a. To start equipment, place POWER switch to ON.

b. Place DELAY switch to OFF (inoperative).

c. Place mode selector switch to PLAIN.

NOTE

Accomplish test transmissions in both VHF/FM and UHF modes of operation.

d. Set mode switch to C/RAD-2 (VHF/FM). Push mike switch, listen for beep (should be heard in approximately 3 seconds). After beep, system is ready for secure transmission with equivalent secure speech equipment.

e. To stop equipment, turn POWER switch to OFF.

UHF COMMAND SET AN/ARC-136.

The AN/ARC-136 UHF command set is used in conjunction with the TSEC/KY-8 speech encryption system. Specifications and capabilities remain basically the same as the AN/ARC-27, but has no ADF capability. The AN/ARC-136 system consists of a receiver-transmitter, a control panel (figure 4-10) located on the copilot's side panel, and an antenna. Power to operate the equipment is 28 volts dc, supplied through a 20-ampere ARC-136 circuit breaker on the navigator's circuit breaker box.

Normal Operation of AN/ARC–136.

1. To start equipment, turn master function switch to T/R.

2. Turn channel selector switch to channel desired and allow set to warm up.

CAUTION

Allow at least 2 minutes warmup time before attempting to transmit on UHF.

3. If manual channel selection is desired, turn channel selector to M and use manual frequency selector controls.

4. Adjust volume.

5. If guard channel monitoring is desired, turn master function switch to T/R + G.

6. Should transmission be necessary on guard channel frequency, turn master function switch to T/R and channel selector switch to G. This actually turns the separate guard receiver off, but tunes the main transmitting and receiving equipment to the guard channel frequency.

7. To stop unit, turn master function switch to OFF.

NAVIGATIONAL MODE SELECTOR PANEL.

The navigational mode selector panel, located on the radio control panel (figure 4-12), employs a five-position rotary selector switch, placarded NAV MODE SEL, to allow operation of the selected input to be visually displayed on the ID-249 indicator. Placarded switch positions, and thus accessible navigational inputs, are TACAN, VOR/ILS, FM-622A, GUN CMPTR (fire control computer), and ARQ-25. The navigational mode selector panel is powered from the 28-volt dc main bus.

LIAISON RADIO SET 618T-3.

The 618T-3 high frequency liaison radio set provides air-to-air and air-to-ground communications. The set transmits and receives voice communications in the high frequency band on any one of 28,000 frequencies between 2.0 and 29.999 mc. Modes of transmission are upper side band (USB), lower side band (LSB), and AM. The remote control panel (figure 4-13), located on the radio control panel, provides the operator remote selection of any one of the 28,000 frequencies. Power for operation is 28-volt dc through two circuit breakers and 115-volt single-phase ac through a circuit breaker on the navigator's circuit breaker box.

SPEECH ENCRYPTION (TSEC/KY-8) CONTROL PANEL

Figure 4-9

UHF COMMAND RADIO (AN/ARC-136) CONTROL PANEL

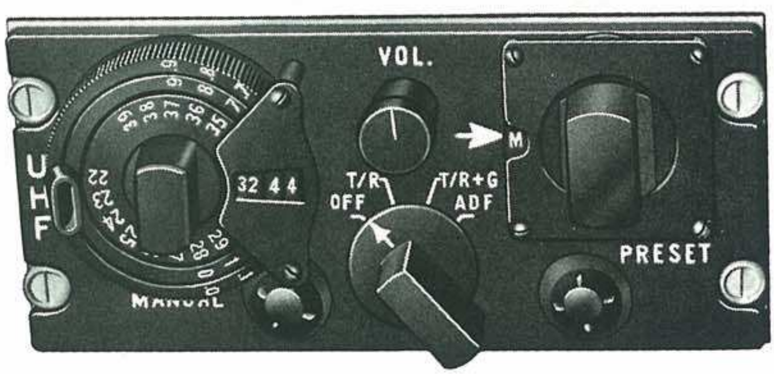
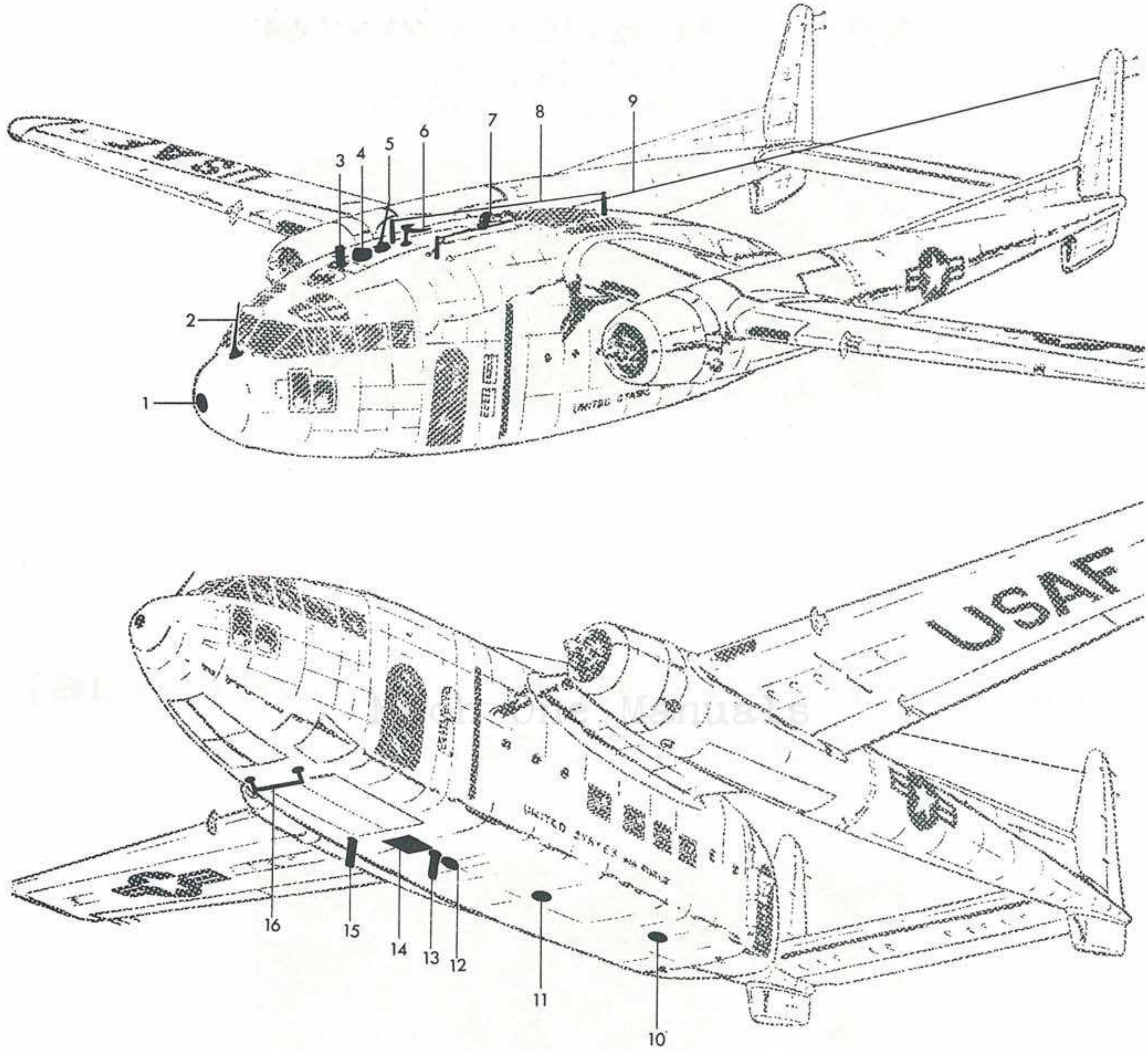


Figure 4-10



ANTENNAS

1. GLIDE SLOPE APPROACH, AN/ARN-18
2. NO. 1 FM COMMAND, FM-622A
3. AN/ARQ-25
4. NO. 1 RADIO COMPASS LOOP, AN/ARN-6
5. NO. 2 FM COMMAND, FM-622A
6. VOR, AN/ARN-14
7. VHF COMMAND, WILCOX 807A
8. RADIO COMPASS SENSE, AN/ARN-6
9. LIAISON 618T-3 AND LORAN
10. IFF RADAR, AN/APX-6
11. UHF DIRECTION FINDER, AN/ARA-25
12. TACAN, AN/ARN-21
13. UHF COMMAND, AN/ARC-136
14. MARKER BEACON, AN/ARN-21
15. UHF COMMAND, AN/ARC-27
16. FM HOMING, FM-622A

Figure 4-11

NAVIGATIONAL MODE SELECTOR PANEL

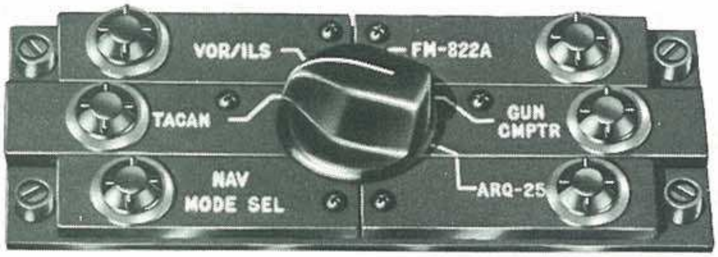


Figure 4-12

LIAISON RADIO (618T-3) CONTROL PANEL

Figure 4-13

Normal Operation of 618T–3.

1. Navigator's spare inverter switch - ON.

2. Place rotary selector switch on liaison radio control panel to desired mode of operation.

3. Allow approximately 1 minute for warmup.

4. Select desired channel frequency.

5. Place interphone selector switch in LIA position.

6. Trigger microphone to tune transmitter.

7. To receive, place interphone mixer switch in ON (up) position.

8. Key microphone, note sidetone in headset(s), and adjust volume to comfortable level.

9. To turn liaison set off, turn function selector switch to OFF.

NOTE

When engines are not operating or one generator is not operating, the monitor bus switch must be placed in the OVERRIDE position if the liaison radio is to be used.

ATTITUDE AND DIRECTIONAL INDICATOR.

The attitude and directional indicator (ADI) system consists of a displacement gyro assembly, amplifier power supply, compass adapter, compass controller, rate switching gyro, attitude director indicator, and a control panel (figure 4-14). Power to operate the system is 115 volts, three-phase ac supplied by the pilot's instrument inverter through three circuit breakers labeled PILOT INSTRUMENT INVERTER located at station 479. Power to operate the pilot's instrument inverter is supplied through a 50-ampere circuit breaker from the main bus located on right main junction box at station 373. Control power to operate the inverter is supplied through a 5-ampere circuit breaker on the overhead circuit breaker panel from the flight emergency bus. A PILOTS INSTR. INVERT switch located on the overhead control panel turns the inverter ON and OFF.

The attitude and directional indicator (ADI) provides the pilot with heading and attitude information.

CAUTION

The attitude warning flag will not appear with a slight electrical power reduction or failure of other components within the system. Failure of other components can result in erroneous or complete loss of pitch and bank presentation without a visible flag.

The control panel for operation of the attitude and directional indicator (ADI) is located on the pilot's instrument panel. It consists of a mode selector switch, latitude controls, sync indicator, primary/standby switch, and a push to turn control for setting the heading information into the indicator.

NOTE

The sync indicator and primary/standby switches are inoperative. The DG position of the mode selector switch is the only operable mode.

The attitude and directional indicator (figure 4-14) consists of the following parts:

ATTITUDE SPHERE. Provides an artificial horizon which, relative to the miniature airplane, shows roll and pitch and heading attitudes of the aircraft.

BANK POINTER. Rotates with the roll gimbal to indicate bank angle against the bank index scale.

PITCH TRIM KNOB. Used to adjust the position of the attitude sphere in the pitch axis.

BANK STEERING BAR. Inoperative.

SLIP INDICATOR. Indicates aircraft slip or skid information.

TURN NEEDLE. Inoperative.

PITCH STEERING BAR. Inoperative.

WARNING FLAGS. The course warning flag is inoperative. The attitude warning flag indicates loss of power to the indicator.

The following information is contained in T.O. 1C-119G-1.

EXTERIOR LIGHTING.

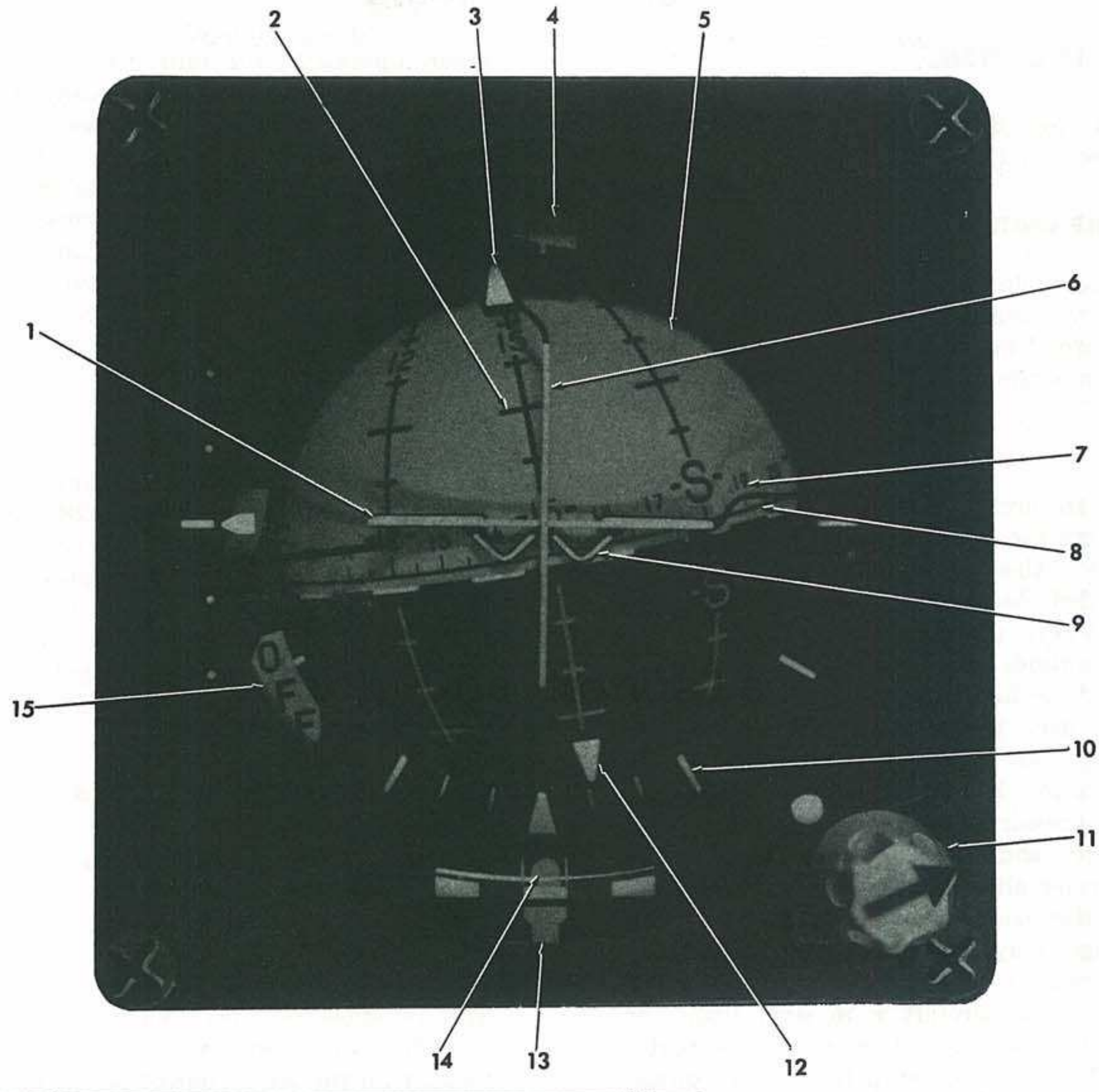
INTERIOR LIGHTING.

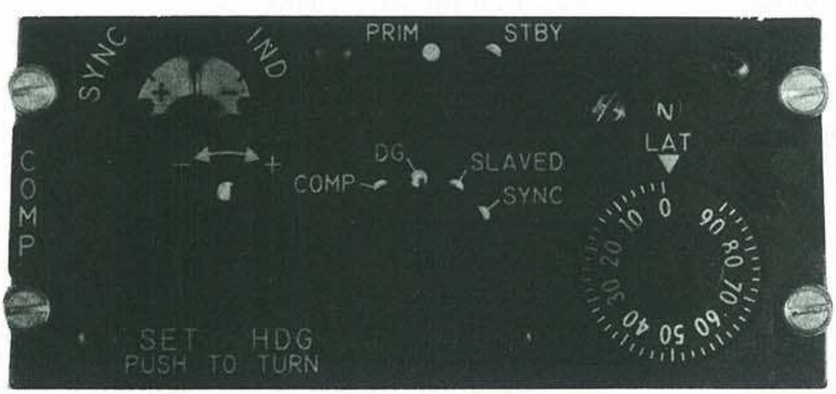
Except for the following all information is contained in T.O. 1C-119G-1.

GUN AREA WORK LIGHTS.

An adjustable lighting fixture is installed at each of the gun stations in the fuselage. The lights provide illumination for operation, maintenance, etc, at the

ATTITUDE AND DIRECTIONAL INDICATOR AND CONTROL PANEL





1. PITCH STEERING BAR
2. PITCH REFERENCE SCALE
3. BANK POINTER (HEAD)
4. COURSE WARNING FLAG
5. ATTITUDE SPHERE
6. BANK STEERING BAR
7. HEADING SCALE
8. HORIZON BAR
9. MINIATURE AIRPLANE
10. BANK SCALE
11. PITCH TRIM KNOB
12. BANK POINTER (TAIL)
13. TURN NEEDLE
14. SLIP INDICATOR
15. ATTITUDE WARNING FLAG

Figure 4-14

gun installations during flight. A rheostat installed at each gun station provides intensity control for each work light. Power for circuit operation is provided by 28-volt dc from the left main junction box.

OXYGEN SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

PORTABLE UNITS.

Three portable oxygen units, consisting of an oxygen cylinder and regulator, are provided in the crew compartment and one unit is provided in the cargo compartment at the flare launcher station.

NOTE

As an aircraft ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. As the cylinders grow colder, the oxygen gage pressure is reduced, sometimes rather rapidly. With a 100°F decrease in temperature in the cylinders, the gage pressure can be expected to drop 20 percent. This rapid fall in pressure is occasionally a cause for unnecessary alarm. All the oxygen is still there, and as the aircraft descends to warmer altitudes, the pressure will tend to rise again so that the rate of oxygen usage may appear to be slower than normal. A rapid fall in oxygen pressure while the aircraft is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.

The following information is contained in T.O. 1C-119G-1.

AUTOMATIC PILOT.

NAVIGATION EQUIPMENT.

AUXILIARY POWER UNIT (MODEL GTGE85-127).

A model GTGE85-127 auxiliary power unit (APU) (figure 4-15), located on the right side of the cargo compartment, provides an ac power source for operation of the airborne illuminator and transformer/rectifier unit. The unit is subdivided into a turbine section, compressor section, fuel and fuel control section, and accessory section, and includes integral lubrication and electrical systems When operating, the unit drives a 115/200-volt, three-phase, 400-cycle ac generator. Starting of the unit is afforded by a control panel (figure 4-16), located above the illuminator and adjacent to the illuminator SLAD panel. Fuel for operation of the APU is supplied from the fuel crossflow line. The approximate standard day fuel consumption is 122 pounds per hour at 100% load and 76.6 pounds per hour under no-load condition. See figure 1-16 for oil specification and grade.

APU OPERATION.

The APU is electrically started utilizing either the aircraft's 28-volt dc output or a 28-volt dc external power source connected to the aircraft. Operationally, the APU ac generator output is used primarily as a power source for the airborne illuminator; however, the ac generator's 115/200-volt, three-phase, 400-cycle ac output also supplies power for operation of the transformer/rectifier unit.

APU CONTROLS AND INDICATORS.

The controls and indicators are shown in figure 4-16.

APU Master Switch.

The two-position APU master switch, placarded MASTER with positions placarded ON and OFF, is located on the APU control panel. Positioning the MASTER switch to ON supplies 28-volt dc power to the APU START switch enabling the turbine to be started.

APU Start Switch.

The two-position APU start switch, placarded START with a placarded ON position and spring-loaded to an unplacarded off position, is located on the APU control panel. Momentarily positioning the START switch to ON energizes the start sequence holding relays, start relay, starter motor, and initiates turbine acceleration. Completion of the starting sequence is automatically controlled within the unit to bring the turbine up to operating speed.

APU INSTALLATION

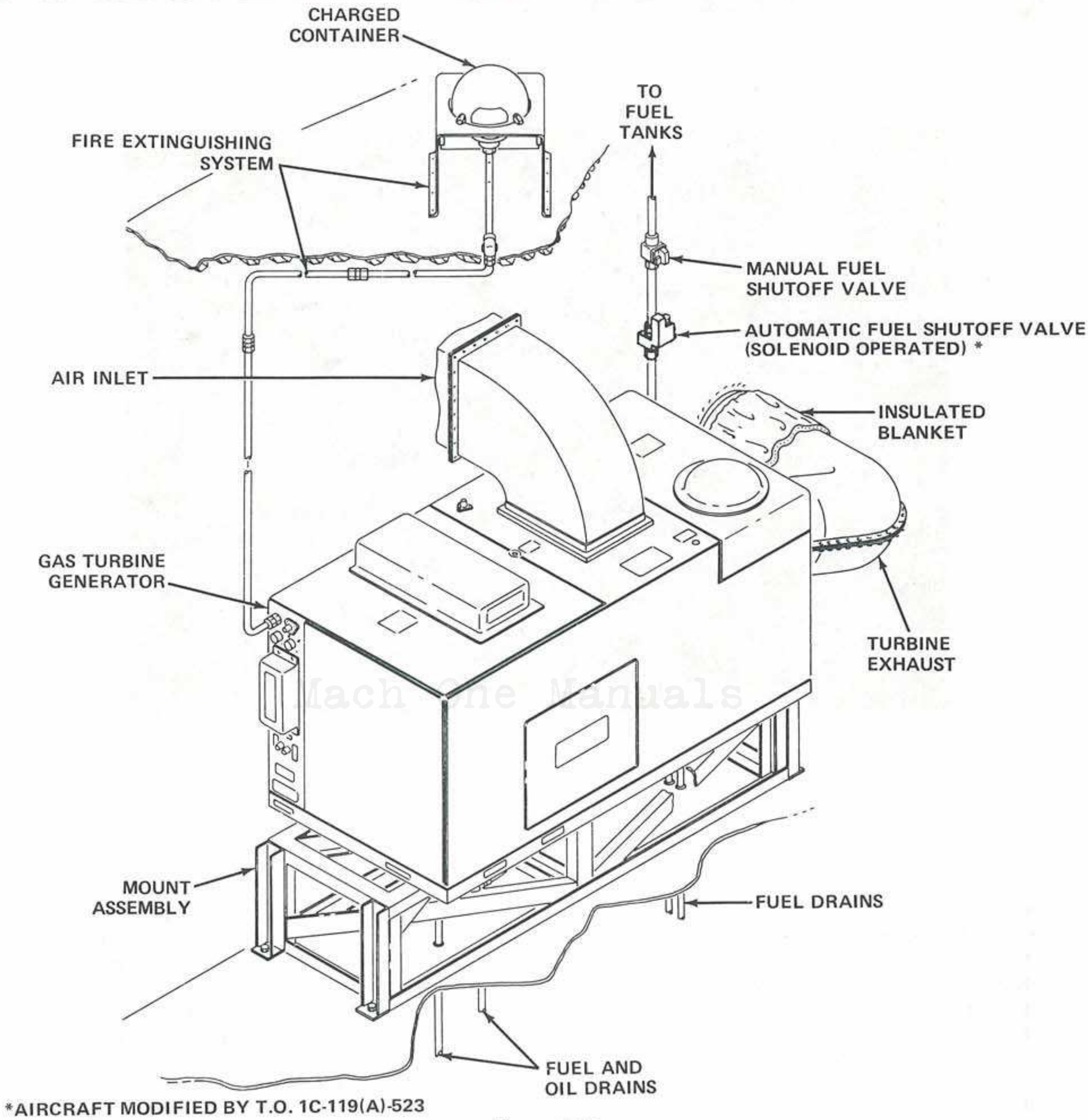


Figure 4-15

APU Contactor Switch.

The three-position APU contactor switch, placarded CONTACTOR with placarded OPEN and CLOSE positions and spring-loaded to an unplacarded off position, is located on the APU control panel.

NOTE

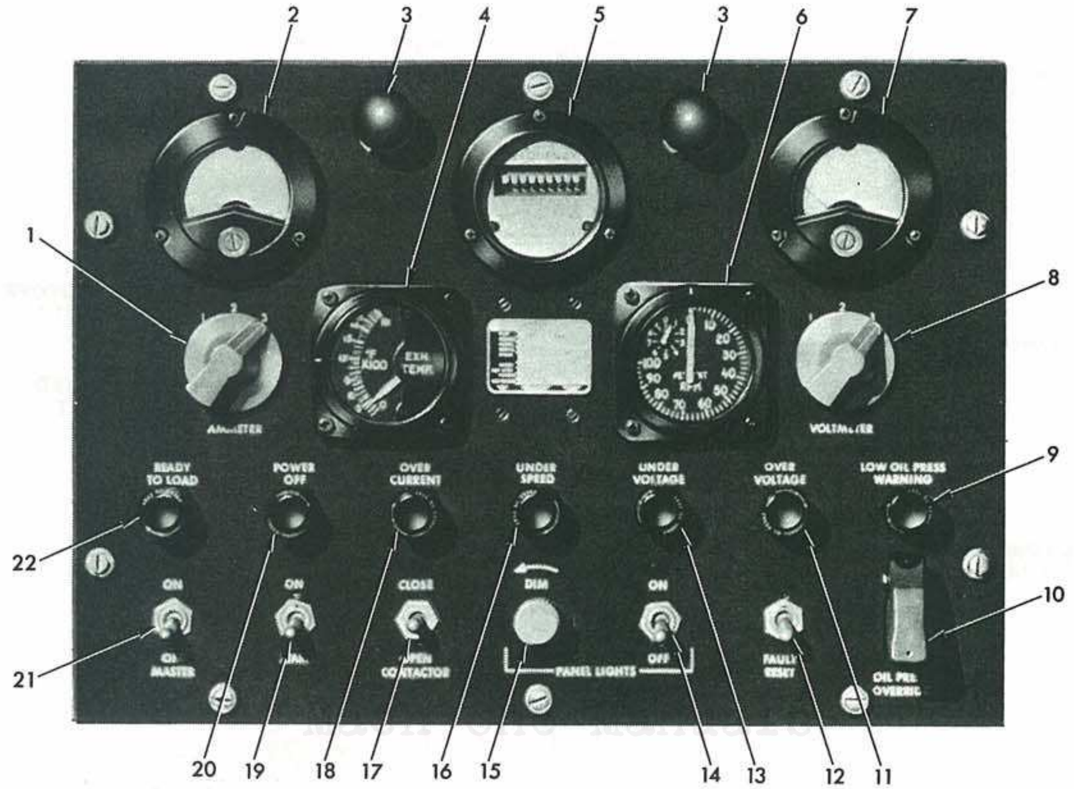
Do not position the CONTACTOR switch to CLOSE until the READY TO LOAD light has illuminated.

Positioning the CONTACTOR switch to CLOSE connects the 115/200-volt, three-phase, 400-cycle ac generator output to the ac power distribution box buses. When the switch is in the OPEN position, the generator's output is removed from the buses.

APU Fault Reset Switch.

The APU fault reset switch, placarded FAULT RESET, is located on the APU control panel. The two-position switch is spring-loaded to the off

APU CONTROL PANEL



1. AMMETER SWITCH
2. AMMETER (0 TO 300 AMPERES)
3. PANEL LIGHT ASSY
4. EXHAUST GAS TEMPERATURE INDICATOR (0 TO 1800°F)
5. FREQUENCY METER
6. TACHOMETER INDICATOR (PERCENT RPM)
7. VOLTMETER (0 TO 150 VOLTS)
8. VOLTMETER SWITCH
9. LOW OIL PRESSURE WARNING LIGHT (RED)
10. OIL PRESSURE OVERRIDE SWITCH
11. OVERVOLTAGE LIGHT (RED)
12. FAULT RESET SWITCH
13. UNDERVOLTAGE LIGHT (RED)
14. PANEL LIGHTS SWITCH
15. PANEL LIGHTS DIM CONTROL
16. UNDERSPEED LIGHT (RED)
17. CONTACTOR SWITCH
18. OVERCURRENT LIGHT (RED)
19. START SWITCH
20. POWER OFF LIGHT (RED)
21. MASTER SWITCH
22. READY TO LOAD LIGHT (GREEN)

Figure 4-16

position. If a fault indication exists before starting the APU, momentarily actuating the FAULT RESET switch will extinguish the fault indicator light(s).

APU Oil Pressure Override Switch.

The APU oil pressure override switch, placarded OIL PRESS OVERRIDE, is located on the APU control panel. The two-position, guarded switch is safetied in the off position. The low oil pressure protection circuit may be bypassed by actuating the OIL PRESS OVERRIDE switch.

CAUTION

> The OIL PRESS OVERRIDE switch should be actuated only in extreme emergency.

APU Ready to Load Light.

The green APU ready to load light, placarded READY TO LOAD, is located on the APU control panel. The light will illuminate when the APU has reached operating speed and a load may be applied.

APU Fault Indicator Lights.

Six red press-to-test fault indicator lights, located on the control panel, provide visual indication of faults in their respective circuits. Indicator lights are provided for POWER OFF, OVERCURRENT, UNDERSPEED, UNDER VOLTAGE, OVER VOLTAGE, and LOW OIL PRESS WARNING.

NOTE

> The fault indicator lights will illuminate automatically to indicate circuit conditions. The press-to-test feature does not indicate circuit conditions, but merely shows if bulb is operative.

APU Panel Lights Control Switch and Dimmer.

The two-position panel lights control switch, placarded PANEL LIGHTS with positions placarded ON and OFF, controls power supplied to the control panel illumination lights. The switch is located on the APU control panel. The adjacent dimmer control knob may be adjusted to provide illumination at any desired level.

APU Ammeter Switch.

A control knob, placarded AMMETER, located on the APU control panel, may be used to monitor the amperage of any phase of the ac generator's three-phase output. The amperage of the selected phase will be displayed on the ammeter located above the ammeter switch.

APU Ammeter.

A 0-300 ampere ammeter, located on the APU control panel, displays the amperage of any phase of the ac generator's three-phase output as selected by the ammeter switch.

APU Voltmeter Switch.

A control knob, placarded VOLTMETER, located on the APU control panel may be used to monitor the voltage of any phase of the ac generator's three-phase output. The voltage of the selected phase will be displayed on the voltmeter located above the voltmeter switch.

APU Voltmeter.

A 0-150 volt voltmeter, located on the APU control panel, displays the voltage of any phase of the ac generator's three-phase output as selected by the voltmeter switch. Normal output voltage of each phase is 115 ± 3 volts.

APU Exhaust Gas Temperature Indicator.

A 0°-1800°F exhaust gas temperature indicator, located on the APU control panel, displays a constant indication of exhaust gas temperature during APU operation. Normal exhaust gas temperature is 590°-600°F (no load) and 600°-750°F (full load).

NOTE

> Exhaust gas temperature must not exceed 1310°F during start cycle. Maximum allowable operating exhaust gas temperature is 1275°F. For steady state operation at full load, exhaust gas temperature must not exceed 1225°F.

APU Tachometer Indicator.

A tachometer indicator, located on the APU control panel, displays APU engine speed in percent of rpm. At an engine speed of approximately 35 percent, the starting circuit is opened; at approximately 95 percent engine speed the ignition system circuit is opened and the time totalizing meter circuit is closed. In the event of an engine overspeed to 105-110 percent, the fuel solenoid valve circuit is opened, shutting off fuel to stop the engine. Normal APU engine speed is 100 ± 2%.

APU Frequency Meter.

A frequency meter, located on the APU control panel, displays frequency of the ac generator output in cycles per second. Normal output frequency is 399-408 cps.

NORMAL OPERATION OF THE APU.

To Start the Auxiliary Power Unit.

The following procedure should be employed when electrical power is available for starting the APU.

WARNING

Monitor LOW OIL PRESS WARNING light when operating APU. The light will normally extinguish at 30-40% rpm; the light should not remain illuminated at speeds above 50% rpm unless operating APU with low oil pressure protection circuit bypassed.

1. MASTER switch - ON.

2. PANEL LIGHTS switch - ON, as necessary. Adjust dim control knob for proper illumination.

3. If fault indication exists, momentarily actuate FAULT RESET switch.

CAUTION

Do not exceed starter motor duty cycle of 1 minute on, 4 minutes off; 1 minute on, 4 minutes off; and 1 minute on, 10 minutes off.

4. Momentarily position START switch to ON. Observe exhaust gas temperature during acceleration. Exhaust gas temperature must not exceed 1310°F during start cycle.

NOTE

Completion of the starting sequence is automatically controlled within the unit. The APU will start and accelerate to governed speed within 25 seconds.

5. When READY TO LOAD light illuminates, momentarily position CONTACTOR switch to CLOSE.

NOTE

Monitor exhaust gas temperature indicator. Maximum allowable operating exhaust gas temperature is 1275°F. For steady state operation at full load, exhaust gas temperature must not exceed 1225°F.

6. When dc power is desired, position the transformer/rectifier unit (TRU) switch to ON.

To Shut Down the Auxiliary Power Unit.

1. Position TRU switch to OFF.

2. Momentarily position CONTACTOR switch to OPEN to remove electrical load.

3. Position MASTER switch to OFF.

TRANSFORMER/RECTIFIER UNIT (TRU).

A 115-volt, 200-ampere transformer/rectifier unit provides an auxiliary dc output to supplement the aircraft dc power supply. The unit is installed on the A-deck, and power for operation is supplied by the APU. The transformer/rectifier unit is used primarily as an emergency source of electrical power for starting the aircraft engines. As an emergency precaution, it is operated during takeoffs and landings under night or IFR conditions to augment the output of the engine generators. The transformer/rectifier unit may also be operated to perform battery charging and to energize electrical equipment during ground checking procedures when the engines are not running. However, an external power source should be used when ground checks are being made to avoid unnecessary operation of the APU and transformer/rectifier unit. To operate transformer/rectifier unit, start APU and turn TRU switch, located on the radio rack, to ON.

ARMAMENT SYSTEM.

GLOSSARY OF ABBREVIATIONS AND TERMS.

Abbreviations and terms used throughout the armament system are defined as they apply to the system; definitions may not be consistent with common usage.

Abbreviations.

Az- Azimuth
CRT - Cathode Ray Tube (FCD)
El - Elevation
FCC - Fire Control Computer
FCD - Fire Control Display
IR - Infrared
Mil - Milliradian
NOS - Night Observation Sight
SLAD - Sensor/Light Angle Display

Terms.

Boresight harmonization - Accurate and effective delivery of gunfire on a desired target is dependent upon coordinated pointing angles of the optical gunsight, the NOS, and the guns. Boresight harmonization is the physical positioning of these units to coincide the gun projectiles, gunsight fixed reticle, and NOS reticle at a common point.

Coincidence - As set on the fire control computer, coincidence is the allowable firing angle error in milliradians. For example, a coincidence setting of 0 would require the gunsight fixed and movable reticles to be superimposed, while a setting of 25 would require the center of the fixed reticle and the center of the movable reticle to be within 12.5 milliradians to achieve coincidence.

Consent switch - Either of the two trigger-type consent switches, one located on the right grip and one on the left grip of the night observation sight (NOS), is depressed when the NOS operator has made positive identification of the target and is accurately tracking it. Depressing the consent switch illuminates the OD TRACKING light on the FCC (supplying data to the FCD) and the ID-249 marker beacon light, informing the pilot that a valid target is being accurately tracked.

Gun azimuth correction - The precalculated azimuth angle of the sensor when the aircraft has attained the proper firing geometry. Gun azimuth as set on the FCC is corrected in units of 0 to 500 to 999, representing a correction of -6 to 0 to +6 degrees. For example, a gun azimuth correction of +3 degrees would require a setting of 750; a correction of -3 degrees would require a setting of 250.

Gun elevation correction - The precalculated elevation angle of the sensor when the aircraft has attained the proper firing geometry. Gun elevation as set on the FCC is corrected in units of 0 to 999, representing a correction of 0 to -40 degrees. For example, a gun elevation correction of -10 degrees would require a setting of 250.

Infrared - Infrared light energy, produced by the illuminator in IR mode consists of light rays which are not visible without the aid of an infrared filter. Thus, the infrared light reflected by an object is visible only through the NOS.

Milliradian - Milliradians, or "mils", are the units of plane angular measurement of the gunsight fixed and movable reticles and the associated FCC coincidence setting (see Coincidence).

Offset - Target offset is a method used to direct gunfire on a target that is not visible from the aircraft. The NOS is held on a fixed point on the ground, and distance (in meters) and direction (in degrees) from this point to the target are set into the FCC. In short, offset provides the capability of looking at one point (with the NOS) and firing at another point.

Visual - Visual (white) light energy, produced by the illuminator in VISUAL mode, consists of light rays visible to the unaided eye.

FIRE CONTROL SYSTEM.

A fully computerized fire control system (figure 4-17) is incorporated in the aircraft and is capable of automatic, semiautomatic, and manual modes of operation. The fire control system consists of many subsystems that provide data to direct the pilot to the target and permit the pilot to direct his armament while orbiting the target. The main component of the system is an analog computer which utilizes the data from the night observation sight (NOS), three-axis gyro system, and manual inputs. The three-axis gyro system provides aircraft attitude and heading information. Angular data to provide target location is provided by a NOS. Manual inputs consist of wind data, target distance, and direction if different from the NOS aiming point, and precalculated elevation and azimuth data, coincidence, and altitude. During normal operation, azimuth and elevation angular signals are fed to the computer from the NOS, and pitch, roll, and heading from the three-axis gyro system. The computer then computes the fire control problem and feeds error signals to the pilot's optical gunsight, ID-249 indicator, and the fire control display. The pilot has three modes of firing at his disposal: automatic, semiautomatic, and manual. The pilot alone, at his discretion, selects the firing mode of the system. Of these modes, automatic and semiautomatic utilize full system operation, while the manual mode involves only the pilot's gunsight. The gun firing circuit is wired through the left main landing gear down lock switch, preventing inadvertent firing of the guns when the landing gear is in transient or down and locked. A ground override switch located on the fire/sight mode selector panel allows the guns to be checked when the aircraft is on the ground. The sensor/light angle display panel provides a fast means of aligning the NOS with the airborne illuminator, while the illuminator enhances the operation of the NOS and aids during visual target sighting at night. The ID-249 indicator, under the direction of the fire control computer, guides the pilot to his attack circle. The marker beacon light is used to inform him that a NOS consent switch is depressed and the NOS is on target. With the exception of the airborne illuminator, which receives power from the APU ac generator, all units depend upon the aircraft's 28-volt dc and 115-volt ac systems for operating power.

Firing Modes.

Manual mode of system operation (figure 4-19) is selected by positioning the FIRING MODE selector switch to MAN. In manual mode the pilot may fire the guns at his discretion by depressing the GUN trigger switch; provided the MASTER ARM SWITCH is set to ARMED, the navigator/safety officer's GUN FIRING OVERRIDE switch is set to NORMAL, the landing gear is up and locked, a minimum of one MXU-470/A module gun switch is set to FIRE, and the associated FIRING POWER switch is set to ON.

Semiautomatic mode of system operation (figure 4-19) is selected by positioning the FIRING MODE selector switch to SEMI AUTO. In semiautomatic mode the pilot may fire the guns at his discretion, without achieving coincidence of the gunsight reticles, by depressing the GUN trigger switch; provided the MASTER ARM SWITCH is set to ARMED, the navigator/safety officer's GUN FIRING OVERRIDE switch is set to NORMAL, the landing gear is up and locked, a minimum of one MXU-470/A module gun switch is set to FIRE, the associated FIRING POWER switch is set to ON, and one NOS consent switch is depressed.

FIRE CONTROL SYSTEM DIAGRAM

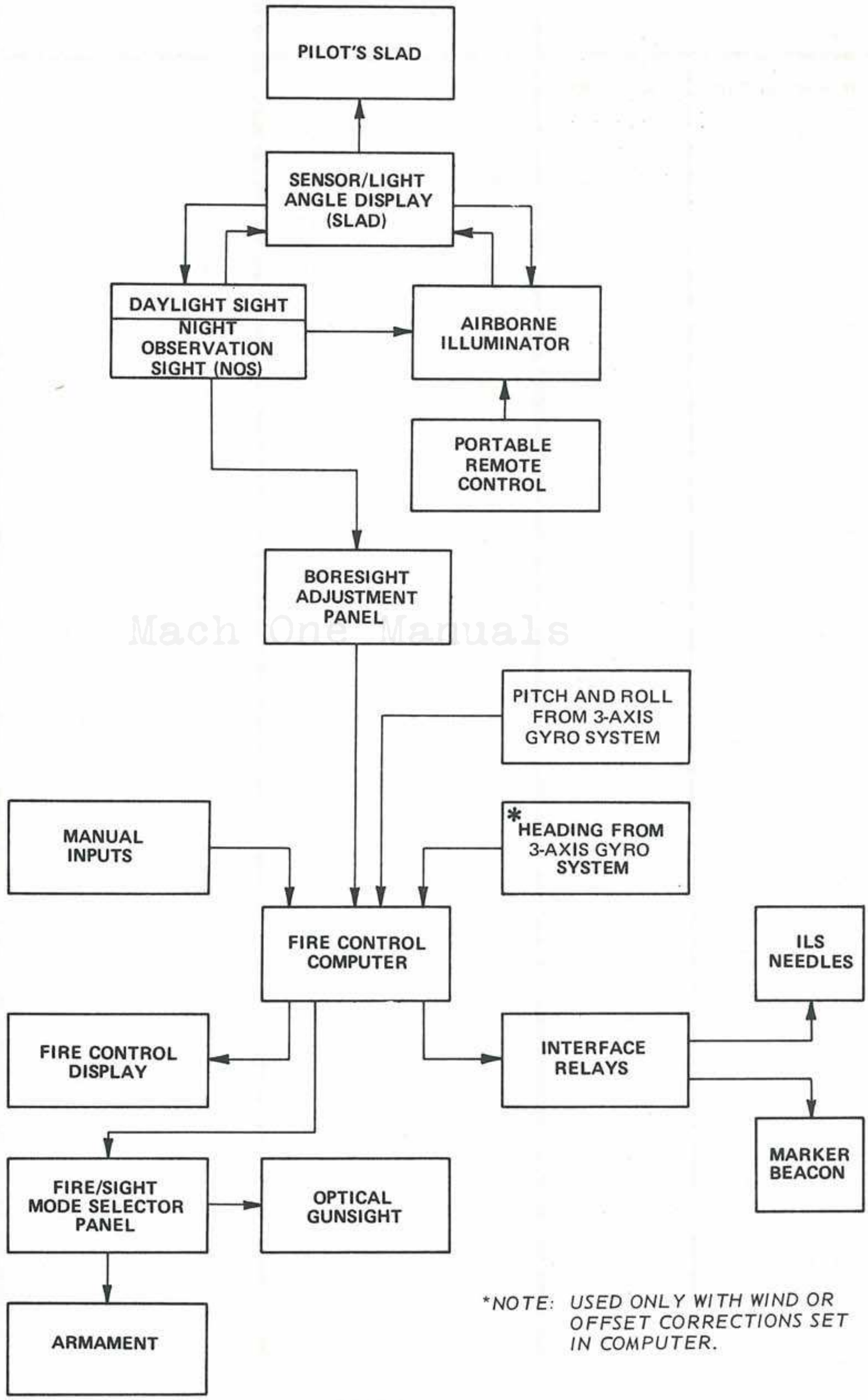


Figure 4-17

FIRE CONTROL SYSTEM ALIGNMENT CHART

		7.62 MM GUNS		GUNSIGHT		COMPUTER SETTING	
TRUE AIRSPEED (KT)	ALTITUDE	AZ	EL	AZ	EL	AZ	EL
150	A	5-1/2°	4-1/8°	15/16°	5-7/8°	565	147
	B	6-7/16°	13-3/8°	1-7/8°	15-5/16°	646	382
	C	7-3/16°	20-5/16°	2-3/4°	22-3/8°	719	559
	D	7-13/16°	25-7/16°	3-9/16°	27-11/16°	786	692
	E	8-3/8°	29-3/8°	4-5/16°	31-3/4°	850	794
155	A	5-1/2°	2-1/4°	11/16°	4-1/8°	547	103
	B	6-5/16°	11-7/16°	1-1/2°	13-7/16°	617	336
	C	7°	18-3/8°	2-5/16°	20-9/16°	681	514
	D	7-9/16°	25-5/8°	3°	26-1/16°	741	650
	E	8-1/16°	27-11/16°	3-11/16°	30-1/4°	799	756
160	A	5-1/2°	7/16°	1/2°	2-7/16°	532	61
	B	6-1/4°	9-1/2°	1-1/4°	11-5/8°	593	291
	C	6-7/8°	16-7/16°	1-7/8°	18-13/16°	650	470
	D	7-3/8°	21-13/16°	2-9/16°	24-15/16°	703	609
	E	7-13/16°	25-15/16°	3-1/8°	28-11/16°	754	717
165	A	——	——	——	——	——	——
	B	6-3/16°	7-5/8°	1°	9-15/16°	574	248
	C	6-3/4°	14-9/16°	1-9/16°	17-1/16°	623	426
	D	7-1/4°	19-15/16°	2-1/8°	22-11/16°	670	567
	E	7-5/8°	24-1/4°	2-11/16°	27-1/8°	716	679
170	A	——	——	——	——	——	——
	B	6-3/16°	5-3/4°	3/16°	8-1/4°	558	206
	C	6-11/16°	12-11/16°	1-5/16°	15-3/8°	601	384
	D	7-1/8°	18-3/16°	1-13/16°	21-1/16°	642	526
	E	7-1/2°	22-3/8°	2-5/16°	25-5/8°	683	640
175	A	——	——	——	——	——	——
	B	6-1/4°	4°	5/8°	6-5/8°	545	166
	C	6-11/16°	10-7/8°	1-1/16°	13-11/16°	581	343
	D	7-1/16°	16-3/8°	1-1/2°	19-7/16°	618	486
	E	7-3/8°	20-3/4°	1-15/16°	24-1/6°	654	601

Figure 4-18

FIRE CONTROL SYSTEM FIRING MODES

COMPONENT	MANUAL	SEMIAUTOMATIC	AUTOMATIC
FIRING MODE selector switch	MAN	SEMI AUTO	AUTO
MASTER ARM SWITCH	ARMED	ARMED	ARMED
GUN FIRING OVERRIDE switch	NORMAL	NORMAL	NORMAL
Landing gear	Up and locked or GROUND OVERRIDE switch set to OVERRIDE	Up and locked or GROUND OVERRIDE switch set to OVERRIDE	Up and locked or GROUND OVERRIDE switch set to OVERRIDE
MXU-470/A module gun switch	FIRE	FIRE	FIRE
FIRING POWER switch	ON	ON	ON
NOS consent switch(es)	Not required	Depressed	Depressed
Optical gunsight reticles	Automatically aligned in azimuth; controlled in elevation by EL thumbwheel	Coincidence not required	Within coincidence
GUN trigger switch	Depressed	Depressed	Depressed

Figure 4-19

Automatic mode of system operation (figure 4-19) is selected by positioning the FIRING MODE selector switch to AUTO. The pilot maneuvers the aircraft in such a manner that the movable and fixed reticles are within coincidence and then depresses the gun trigger switch. The guns will fire, provided the MASTER ARM SWITCH is set to ARMED, the navigator/safety officer's GUN FIRING OVERRIDE switch is set to NORMAL, the landing gear is up and locked, a minimum of one MXU-470/A module gun switch is set to FIRE, the associated FIRING POWER switch is set to ON, and one NOS consent switch is depressed. The FCC will stop the guns from firing if the reticles become seperated by a distance equal to or greater than one half the coincidence setting.

Boresight Adjustment Panel.

The boresight adjustment panel (figure 4-20), located at the navigator's station, is a box containing differential resolvers, one for each NOS revolver transmitter, whose function is to provide a means of adjusting the resolver signals to the computer. One resolver is provided for azimuth signals; the other for elevation signals.

NOTE

Boresight adjustment is made on boresight harmonization and will be readjusted only by maintenance personnel. No adjustment will be made in flight.

FIRE CONTROL COMPUTER.

The fire control computer (figure 4-22) receives information from the NOS, three-axis gyro, and manual inputs and computes the fire control problem and feeds error signals to other equipmment for the purpose of accurately controlling armament fire on a designated target. The fire control computer controls gun firing in two of the three modes of the fire control system. In the automatic mode, the computer will allow firing the guns only when the movable reticle and the fixed reticle in the gunsight indicate the computed aiming point and the actual aiming point are within a set coincidence window and consent is given. The size of the coincidence window is manually set. In the semiautomatic mode, the computer will provide the same information to the gunsight that it does in the automatic mode. However, reticle coincidence is not required to fire the guns.

BORESIGHT ADJUSTMENT PANEL

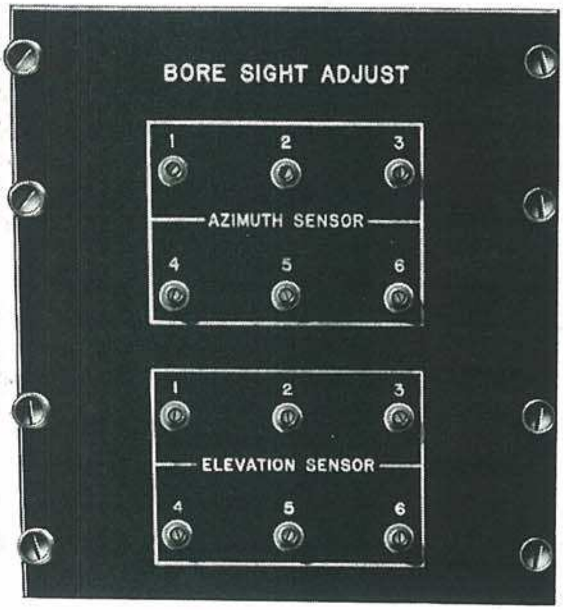


Figure 4-20

The manual mode of operation overrides all computer control, thus providing no computed correction factors to the gunsight and allowing the pilot to fire at his discretion. Controls on the computer provide inputs for wind velocity and direction, target offset distance and direction, and gun elevation and azimuth corrections. Since wind velocity and direction are variable, this information must be hand set into the computer. Compass heading inputs are not necessary for proper operation if wind or offset functions are not utilized (figure 4-17).

NOTE

> Although wind velocity and direction between the aircraft's altitude and the ground may vary, the computer's correction to the system assumes that these values are constant.

Wind velocity compensation, up to 50 knots, and wind direction, from 0 to 360 degrees in azimuth, may be set into the computer by rotating the respective selector knob until the desired figure appears in the window above the knob. Target offset consists of both distance and direction from the NOS aiming point. These two inputs are hand set into the computer. Distance input is variable from zero to 999 meters; however, accurate results in the offset mode cannot be obtained for offset distances greater than 200 meters. Magnetic direction input may be any figure from zero to 360 degrees.

To minimize the variable parameters, certain requirements must be met by the pilot. He must fly at a predetermined airspeed and absolute altitude. Altitude must be that selected on the fire control computer. Since every mission is not flown at the same altitude and airspeed, gun azimuth and elevation correction must be hand set into the computer. These corrections are displayed as units, adjustable from 0 to 999. Each altitude and airspeed combination has its corresponding correction units, which when properly set, will bring the armament to bear on the target from that particular altitude and airspeed. These figures correspond with the NOS azimuth and elevation angles when the aircraft is in the proper geometry for firing.

The coincidence window is calibrated in milliradians from 0 to 70. Its function is to determine the accuracy required before the guns will fire in the automatic mode or coincidence lights extinguish in the automatic or semiautomatic mode. The lower the setting, the smaller the zone of fire. The firing zone area is increased by increasing the setting of the coincidence window, allowing the guns to fire even though they are not aimed at the exact center of the target. The primary sensor select switch, located on the fire control computer, should remain in the OD position. The light located adjacent to the OD position illuminates only when one of the NOS consent switches is depressed, indicating that the NOS is accurately tracking a valid target.

Fire Control Computer Controls and Indicators.

The controls and indicators are shown in figure 4-22.

WIND VELOCITY DIAL AND CONTROL KNOB. The wind velocity dial, placarded WIND-VELOCITY KT, indicates wind velocity (0 to 50 knots) set into the computer. The dial is manually set by the adjacent PUSH TO TURN knob.

WIND DIRECTION DIAL AND CONTROL KNOB. The wind direction dial, placarded WIND-DIRECTION, indicates wind direction (0 to 360°) set into the computer. The dial is manually set by the adjacent PUSH TO TURN knob.

TARGET OFFSET DISTANCE COUNTER AND CONTROL KNOB. The target offset distance counter, placarded TARGET OFFSET - DISTANCE METERS, indicates offset distance (0 to 999 meters) from the NOS aiming point to the target. The counter is manually set by the adjacent PUSH TO TURN knob.

TARGET OFFSET DIRECTION COUNTER AND CONTROL KNOB. The target offset direction counter, placarded TARGET OFFSET-DIRECTION indicates offset direction (0 to 360°) from the NOS aiming point to the target. The counter is manually set by the adjacent PUSH TO TURN knob.

ALTITUDE SELECTOR SWITCH. The four-position altitude selector switch, placarded ALTITUDE with positions placarded A, B, C, and D, selects the aircraft firing altitude.

GUN ELEVATION CORRECTION COUNTER AND CONTROL KNOB. The gun elevation correction counter, placarded GUN ELEVATION CORR, indicates from 0 to 999 units which represents a correction of 0 to -40 degrees. Elevation correction is set to a nominal value for each altitude and airspeed. The counter is manually set by the adjacent PUSH TO TURN knob.

GUN AZIMUTH CORRECTION COUNTER AND CONTROL KNOB. The gun azimuth correction counter, placarded GUN AZIMUTH CORR, indicates gun azimuth correction from 0 to 500 to 999 units, representing a correction of -6 to 0 to +6 degrees. The counter is manually set by the adjacent PUSH TO TURN knob.

COINCIDENCE WINDOW DIAL AND CONTROL KNOB. The coincidence window dial, placarded COINCIDENCE WINDOW MILLIRADIANS, indicates allowable firing angle error (0 to 70 milliradians) in both azimuth and elevation. The dial is manually set by the adjacent PUSH TO TURN knob.

TRACKING LIGHTS AND PRESS-TO-TEST SWITCH. The associated tracking light, placarded TRACKING-OD, illuminates to indicate that one of the NOS consent switches is depressed. The lights placarded IR and RAD and the three blank lights have no function on AC-119G aircraft. However, all tracking lights will illuminate when the PRESS TO TEST switch is depressed.

PRIMARY SENSOR SELECTOR SWITCH. The six-position primary sensor selector switch, placarded SENSOR with placarded positions OD, RAD, and IR (plus three blank positions), selects the sensor input supplied to the FCC.

POWER SWITCH. The two-position power switch, placarded ON and OFF, controls power supplied to the computer.

AC AND DC RESET CIRCUIT BREAKERS. The 3-ampere ac and 5-ampere dc reset circuit breakers, placarded AC and DC RESET, provide circuit protection for the FCC. The circuit breakers must be depressed to reset. A tripped condition is indicated by the exposed white sleeve.

DIMMER CONTROL KNOBS. Two dimmer control knobs, placarded LAMPS and PANEL, manually control intensity of the tracking lights and panel illumination lights, respectively.

Normal Operation of the Fire Control Computer.

TURN-ON AND OPERATING PROCEDURE. (See figure 4-22.)

1. Set power switch OFF.
2. Check that circuit breakers are in.
3. Set coincidence to zero.
4. Set WIND-VELOCITY KT and DIRECTION to zero.
5. Set TARGET OFFSET-DISTANCE METERS and DIRECTION to zero.

EQUIPMENT	DESIGNATION	LOCATION	OPERATOR
Fire Control Computer	FCC	Navigator/safety officer's station	Navigator/safety officer
Boresight Adjustment Panel		Navigator/safety officer's station	(Maintenance only)
Fire Control Display	FCD	Navigator/safety officer's station	Navigator/safety officer
Sensor/Light Angle Display	SLAD	Pilot's instrument panel, NOS station, and illuminator station	NOS operator, illuminator operator, and pilot
Night Observation Sight	NOS	Front entrance door	NOS operator
Illuminator		Left paratroop door. Remote control at navigator/safety officer's station	Illuminator operator
Optical Gunsight		Left side of crew compartment at pilot's side window	Pilot
Gunsight Amplifier		Left side of crew compartment	
Three-Axis Gyro System		A-Deck	Pilot (by controlling ADI)

Figure 4-21

MAJOR FIRE CONTROL

FUNCTION	ELECTRICAL SYSTEM	PROTECTION		
		AMP	TYPE	LOCATION
Provides for manual and sensor inputs and computes problem to guide aircraft during air-to-ground attack.	28-volt dc 115-volt, single-phase ac	5 5	CB CB	Nav circuit breaker box Nav circuit breaker box
Provides for zeroing bore-sight elevation and azimuth signals from the NOS at boresight condition.	Supplied through NOS			
Provides navigator/safety officer with a display of firing zone, target, and safety zone.	28-volt dc 115-volt, single-phase ac	5 5	CB CB	Nav circuit breaker box Nav circuit breaker box
Provides NOS operator, illuminator operator, and pilot with relative azimuth and elevation of NOS and illuminator.	28-volt dc	5	CB	Nav circuit breaker box
Provides capability for night target acquisition. Elevation and azimuth resolvers provide input to computer.	6.75-volt, self-contained battery			
Provides white or infrared beam for ground illumination of the target area.	28-volt dc 115-volt three-phase ac	70 135	CB CB(3)	Left main junction box AC power distribution box
Provides pilot data by which he can steer the aircraft on a desired course to keep target in center field of fire.	115-volt, single-phase ac	5	CB	Nav circuit breaker box
Provides gunsight with computer signals.	28-volt dc			From the fire/sight mode selector panel
Provides computer with aircraft pitch, roll, and heading information.	115-volt, three-phase ac	5	CB	Station 479

SYSTEM COMPONENTS

FIRE CONTROL COMPUTER

1. ON/OFF POWER SWITCH
2. PRIMARY SENSOR SELECT SWITCH
3. PRIMARY SENSOR TRACKING LIGHTS
4. GUN AZIMUTH CORRECTION KNOB
5. ALTITUDE SELECTOR SWITCH
6. TARGET OFFSET (DISTANCE IN METERS) CORRECTION KNOB
7. WIND (VELOCITY IN KNOTS) CORRECTION KNOB
8. WIND (DIRECTION) CORRECTION KNOB
9. TARGET OFFSET (DIRECTION) CORRECTION KNOB
10. GUN ELEVATION CORRECTION KNOB
11. COINCIDENCE WINDOW MILLIRADIANS KNOB
12. FCC CIRCUIT BREAKERS
13. LAMPS AND PANEL LIGHTS RHEOSTAT

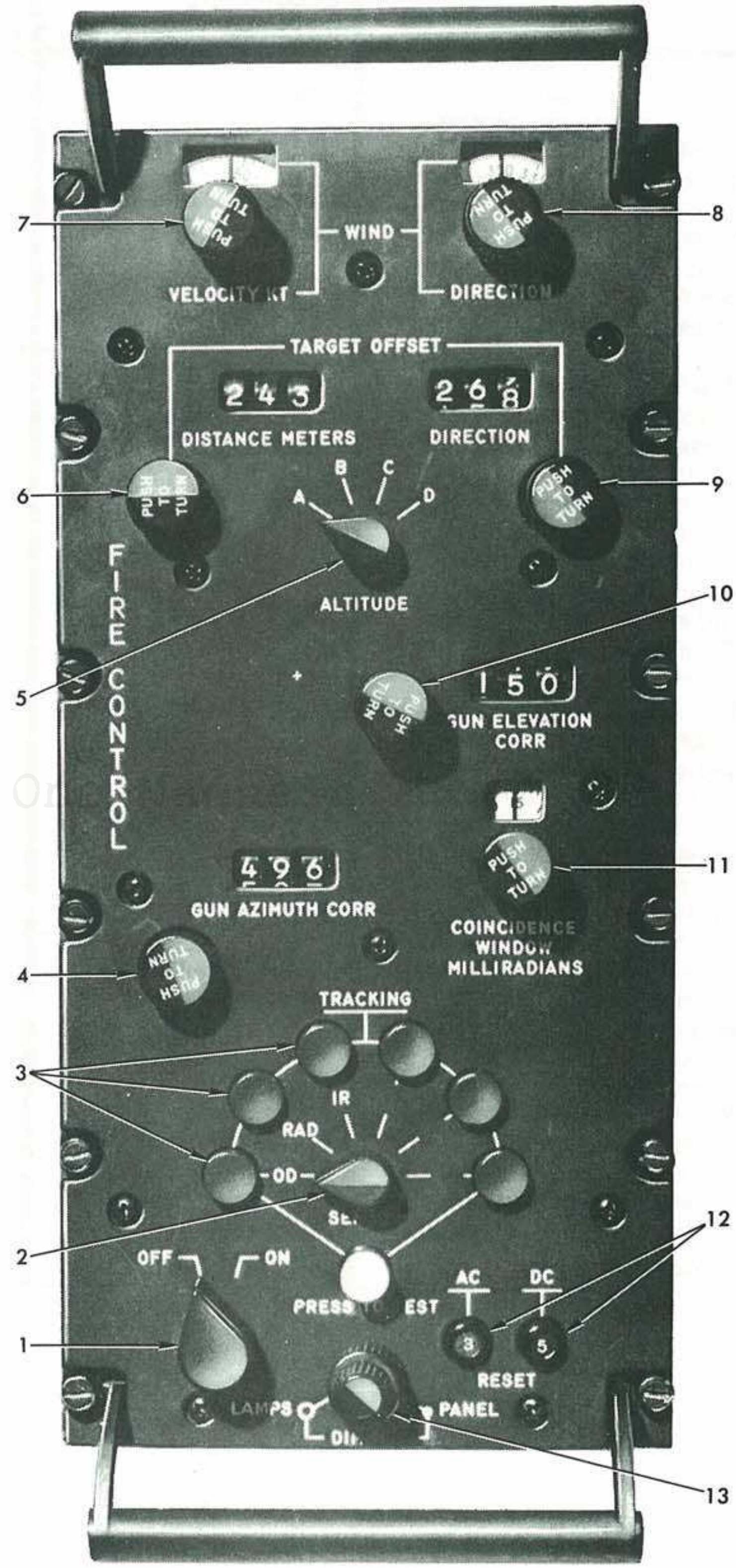


Figure 4-22

6. Set primary SENSOR switch to other than OD.

7. Turn DIMMER knobs CCW.

8. Set power switch ON.

9. Set DIMMER knobs to obtain optimum panel and tracking lights illumination.

10. Depress TRACKING lights PRESS TO TEST switch and check that lights illuminate.

NOTE

Accomplishment of this procedure completes initial FCC turn-on. Operating procedures are integrated into NORMAL OPERATION OF THE FIRE CONTROL DISPLAY, this section.

TURN-OFF PROCEDURE.

1. Set TARGET OFFSET-DISTANCE METER and DIRECTION to zero.

2. Set WIND VELOCITY KT and DIRECTION to zero.

3. Set coincidence to zero.

4. Set primary SENSOR switch to blank position.

5. Turn DIMMER knobs CCW.

6. Set power switch OFF.

FIRE CONTROL DISPLAY.

The fire control display (figure 4-23) displays various sensor inputs, firing zone, safety zone, and a target symbol to allow control of weapons fire on a designated target. These displays are presented on a cathode ray tube and give the relationship of the pointing angle of the NOS, direction to the munitions impact pattern on the ground, and location of the target. The displays will be identified by different symbols. A safety zone circle may be centered around the primary sensor symbol, the NOS trained on a ground point where firing is not desired, and the resulting display used to determine when firing approaches too close to the area encircled by the safety zone symbol. The display may also be used as a guide to direct the NOS to look in a specified direction. Primary controls and indicators for the FCD are located on the front panel.

Fire Control Display Controls and Indicators.

The controls and indicators are shown on figure 4-23.

PRIMARY POWER SWITCH. The primary power switch, placarded PRIMARY POWER with positions placarded ON and OFF, controls power supplied to the FCD.

NOTE

A dc fuse, an ac fuse, and a spare fuse for each are located on the lower left side of the unit.

ELAPSED TIME INDICATOR. The elapsed time indicator, placarded ETI, indicates operating time of the FCD.

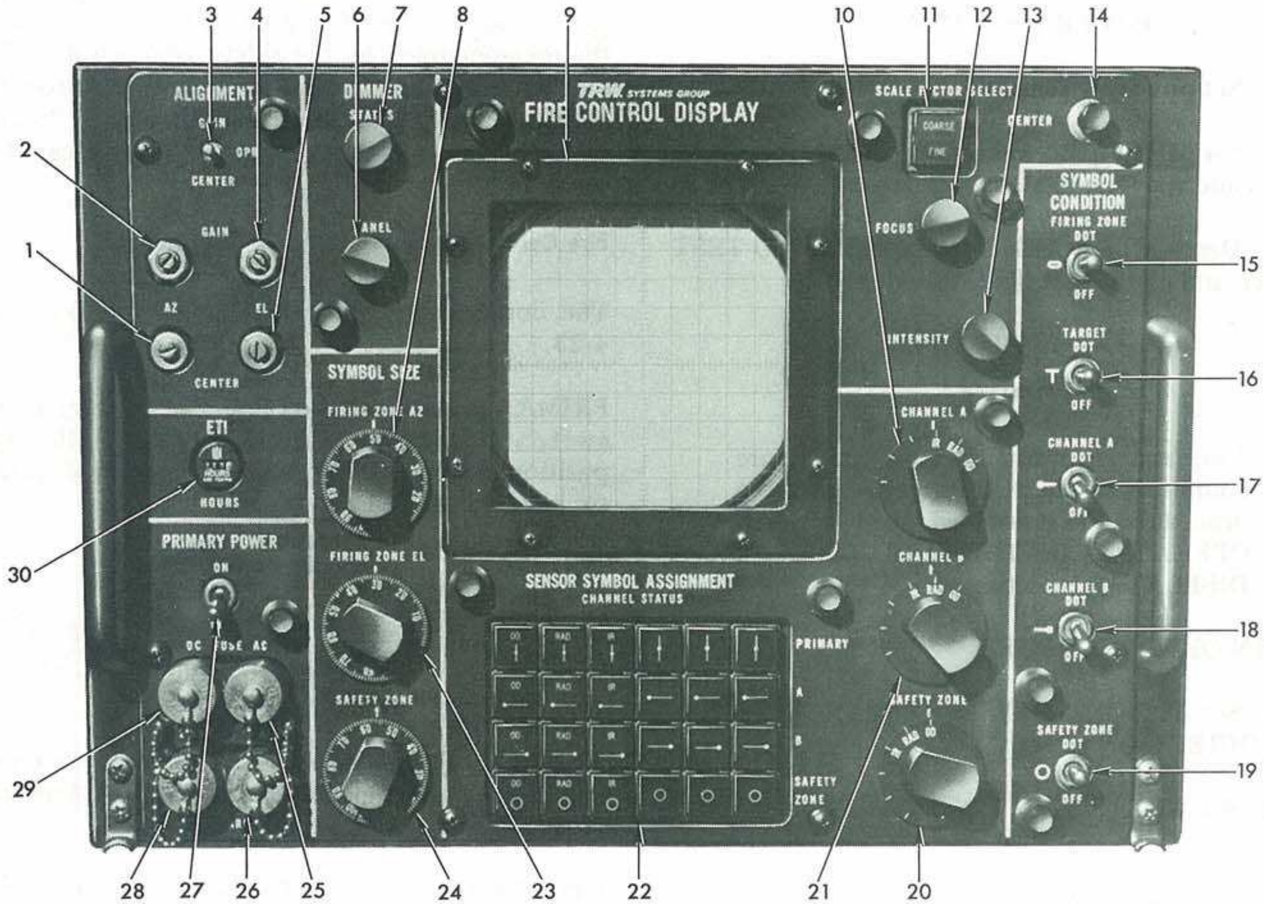
DIMMER CONTROLS. The status and panel lights dimmer controls, placarded DIMMER-STATUS and PANEL, control brightness of the channel status lights, panel light, and display grid.

SYMBOL SIZE-FIRING ZONE AZIMUTH CONTROL. The firing zone azimuth control, placarded FIRING ZONE AZ, adjusts the firing pattern size in azimuth.

SYMBOL SIZE-FIRING ZONE ELEVATION CONTROL. The firing zone elevation control, placarded FIRING ZONE EL, adjusts the firing pattern size in elevation.

SYMBOL SIZE - SAFETY ZONE CONTROL. The safety zone control, placarded SAFETY ZONE, adjusts the size of the safety zone.

CATHODE RAY TUBE (CRT). The CRT provides visual display of FCD symbols. The center of the CRT represents the "no wind" center of fire of the guns.



FIRE CONTROL DISPLAY

1. ALIGNMENT AZ CENTER ADJUSTMENT SCREW
2. ALIGNMENT AZ GAIN-ADJUSTMENT SCREW
3. ALIGNMENT SWITCH
4. ALIGNMENT EL GAIN ADJUSTMENT SCREW
5. ALIGNMENT EL CENTER ADJUSTMENT SCREW
6. DIMMER PANEL CONTROL
7. DIMMER STATUS CONTROL
8. SYMBOL SIZE FIRING ZONE AZ CONTROL
9. CATHODE RAY TUBE
10. CHANNEL A SWITCH
11. SCALE FACTOR SELECTOR SWITCH
12. FOCUS CONTROL
13. INTENSITY CONTROL
14. CENTER BUTTON CONTROL
15. SYMBOL CONDITION FIRING ZONE SWITCH
16. SYMBOL CONDITION TARGET SWITCH
17. SYMBOL CONDITION CHANNEL A SWITCH
18. SYMBOL CONDITION CHANNEL B SWITCH
19. SYMBOL CONDITION SAFETY ZONE SWITCH
20. SAFETY ZONE SWITCH
21. CHANNEL B SWITCH
22. SENSOR SYMBOL ASSIGNMENT CHANNEL STATUS LIGHTS
23. SYMBOL SIZE FIRING ZONE EL CONTROL
24. SYMBOL SIZE SAFETY ZONE CONTROL
25. PRIMARY POWER FUSE
26. SPARE POWER FUSE
27. PRIMARY POWER SWITCH
28. SPARE POWER FUSE
29. PRIMARY POWER FUSE
30. ELAPSED TIME INDICATOR

Figure 4-23

NOTE

Sensor azimuth angular change is displayed by horizontal deflection of the symbol. Deflection to the right on the CRT represents sensor azimuth deflection in the forward direction with respect to the aircraft. Sensor elevation angular change is displayed by vertical deflection of the symbol. Downward deflection of the symbol represents downward movement of the sensor.

SCALE FACTOR SELECTOR SWITCH. The scale factor selector switch, placarded SCALE FACTOR SELECT with positions placarded COARSE and FINE, adjusts the visual display scale to 9 degrees per centimeter (coarse) or 3 degrees per centimeter (fine).

FOCUS CONTROL. The focus control knob, placarded FOCUS, adjusts the sharpness of the visual display.

INTENSITY CONTROL. The intensity control knob, placarded INTENSITY, adjusts the brightness of the visual display.

CHANNEL A AND CHANNEL B SWITCHES. The channel A and channel B switches, placarded CHANNEL A and CHANNEL B with placarded positions OD, RAD, and IR (plus three blank positions), select the sensor signal source for these input channels, illuminating the associated channel status light.

NOTE

Since the AC-119G has only one sensor, the channel A and channel B controls are set one to IR and the other to RAD during FCD operation. The primary sensor switch on the FCC is set to OD, supplying the FCC and FCD information from the NOS.

SAFETY ZONE CONTROL. The safety zone control, placarded SAFETY ZONE, selects the sensor signal source for this input to the FCC and FCD, illuminating the associated channel status light.

CENTER CONTROL. The center control, placarded CENTER, controls manual centering of the visual display on the CRT.

SYMBOL CONDITION SWITCHES. The five symbol condition switches, placarded SYMBOL CONDITION FIRING ZONE, TARGET, CHANNEL A, CHANNEL B, and SAFETY ZONE, control visual display of sensor symbols on the CRT. In the center (symbol on) position, the various symbols are pictorially displayed as follows:

Primary sensor (⍿) symbol displayed with origin at the harmonized azimuth and elevation pointing angles of the primary sensor.

Channel A (•—) symbol displayed with origin at the harmonized azimuth and elevation pointing angles of the selected channel A sensor.

Channel B (—•) symbol displayed with origin at the harmonized azimuth and elevation pointing angles of the selected channel B sensor.

Target (T) symbol displayed with origin at the intersection of the vertical horizontal segments. The target symbol is generated at the aiming point of the NOS. Increasing offset distance on the FCC will displace the target symbol from the primary sensor symbol in the direction set on the computer.

Firing zone (⬭) symbol displayed with origin (center of ellipse) at azimuth and elevation wind correction angles. The firing zone is the gun fire impact area. The firing zone symbol is displayed downwind at wind correction angle or at center when wind is not a factor.

Safety zone (O) symbol displayed with origin coincident with origin of the selected sensor symbol.

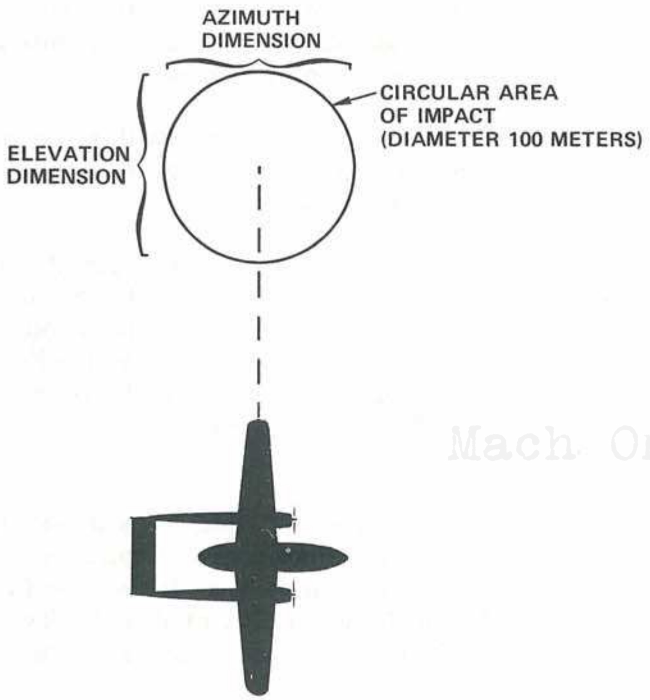
The displayed symbols will be replaced by a dot, located at the origin of the symbol, when the associated symbol condition switch is positioned to DOT.

FIRING ZONE SYMBOL SIZE CONTROL SETTINGS. The size of the elliptical firing zone symbol, representing the area of munitions impact on the ground, is adjusted by the FIRING ZONE AZ and EL controls on the FCD.

Control settings are determined as shown in figures 4-24 and 4-25. Figure 4-24 presents the relationship between the firing zone azimuth setting and the ground impact area. Figure 4-25 presents the relationship between the firing zone elevation setting and the ground impact area. Refer to the following examples:

Example A:

Assume the munitions impact area for the number of guns selected for firing is a circular ground area with a diameter of 100 meters as shown below.

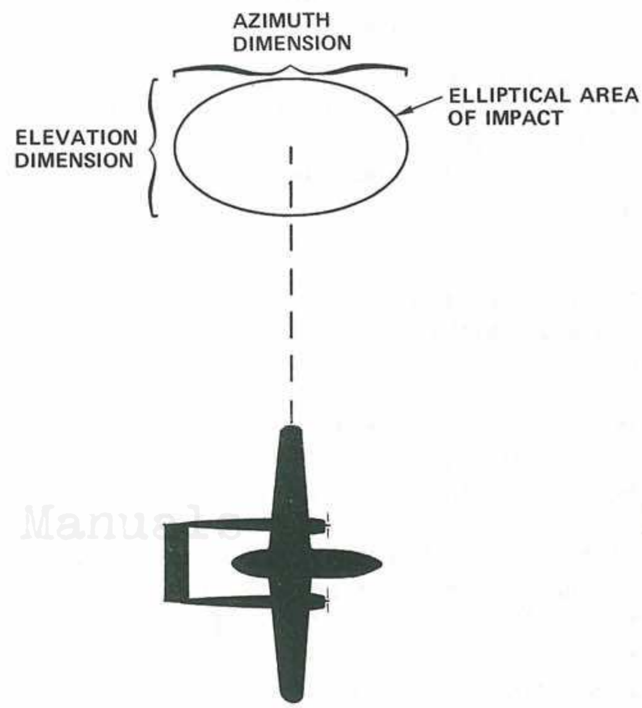


Enter figures 4-24 and 4-25 at 100 meters; proceed to the right to the intersection of the desired altitude curve. Project vertically downward to the azimuth setting (figure 4-24) and elevation setting (figure 4-25) and read the following settings for the four firing altitudes:

ALTITUDE	AZ SETTING	EL SETTING
A	52	33
B	46	31
C	42	31
D	38	29

Example B:

Assume the munitions impact area for the number of guns selected for firing is an elliptical ground area with an elevation dimension of 50 meters and an azimuth dimension of 100 meters as shown below.



Enter figure 4-24 at 100 meters and figure 4-25 at 50 meters; proceed to the right to the intersection of the desired altitude curve. Project vertically downward to the azimuth setting (figure 4-24) and elevation setting (figure 4-25) and read the following settings for the four firing altitudes:

ALTITUDE	AZ SETTING	EL SETTING
A	52	17
B	46	16
C	42	16
D	38	14

APPROXIMATE DISPLAY SCALE FACTOR. An estimation of ground distances (in meters) can be obtained in either the FINE (3 degrees per centimeter) or COARSE (9 degrees per centimeter) modes of the FCD by observing the centimeter displacement of a display symbol from the center of the CRT (gun aimline) as follows:

	FINE MODE		COARSE MODE	
ALTITUDE	EL (m/cm)	AZ (m/cm)	EL (m/cm)	AZ (m/cm)
A	108	67	307	203
B	112	76	314	226
C	113	84	324	251
D	121	92	348	275

SAFETY ZONE SYMBOL SIZE CONTROL SETTINGS. The size of the circular safety zone symbol, representing an area on the ground where no munitions impact is desired, is adjusted by the safety zone control.

The control is calibrated from 0 to 100, representing a 0- to 25-degree angular region about the line of sight to the center of the safety zone ground area.

Control settings are determined as shown in figures 4-26, 4-27, 4-28, and 4-29 for aircraft firing altitudes A, B, C, and D respectively. Each figure presents the relationship between the target offset distance, the desired safety zone ground radius, and the FCD safety zone setting for its particular altitude. Refer to the following example:

To determine the correct control setting for altitude A, a target offset distance of 200 meters, and a desired safety zone ground radius of 100 meters, enter figure 4-26 at 200 meters target offset distance and proceed to the right to the intersection of the 100 meters safety radius curve. Project vertically downward to the FCD safety zone setting and read the required setting of 41.

The required safety zone setting for any desired safety zone ground radius may be determined by using this same procedure and interpolating between the lines of constant radius noted on the curves. Thus, to determine the required setting for a safety zone ground radius of 75 meters, interpolate between the 50 and 100 meter lines.

The safety radius limit dashed line shown on the curves illustrates the safety zone restriction corresponding to the target offset distance. The safety zone size should not exceed the target offset distance or the target will be within the safety zone.

Normal Operation of the Fire Control Display.

TURN-ON AND OPERATING PROCEDURE. (See figure 4-23.)

1. Set PRIMARY POWER switch OFF.

2. Set all SYMBOL CONDITION switches OFF (down).

3. Set CHANNEL A and CHANNEL B controls to other than OD.

4. Turn DIMMER and INTENSITY controls ccw.

5. Check dc and ac fuses.

6. Set ALIGNMENT switch to OPR.

7. Set PRIMARY POWER switch ON.

NOTE

A 1-minute warmup period is required before operating the FCD.

CAUTION

Do not permit a sharply focused spot of high intensity to remain stationary on the screen for any appreciable length of time. Under such conditions the entire beam energy is concentrated upon a small area, subjecting the screen material to discoloration and burning. This condition is most likely to occur when any of the SYMBOL CONDITION switches are in the DOT position.

8. Set all SYMBOL CONDITION switches to center position (symbol on).

9. Set DIMMER (STATUS and PANEL), INTENSITY, and FOCUS controls to obtain optimum panel and CHANNEL STATUS lights illumination.

10. Set ALIGNMENT switch from OPR to CENTER (down) and verify that alignment dot is centered on FCD. If not, adjust dot to center position with AZ and EL CENTER adjustment screws. Switch to GAIN (up) and dot should be displaced 3 centimeters up and 3 centimeters to

FCD FIRING ZONE AZIMUTH SETTING

TRUE AIRSPEED – 150 KT

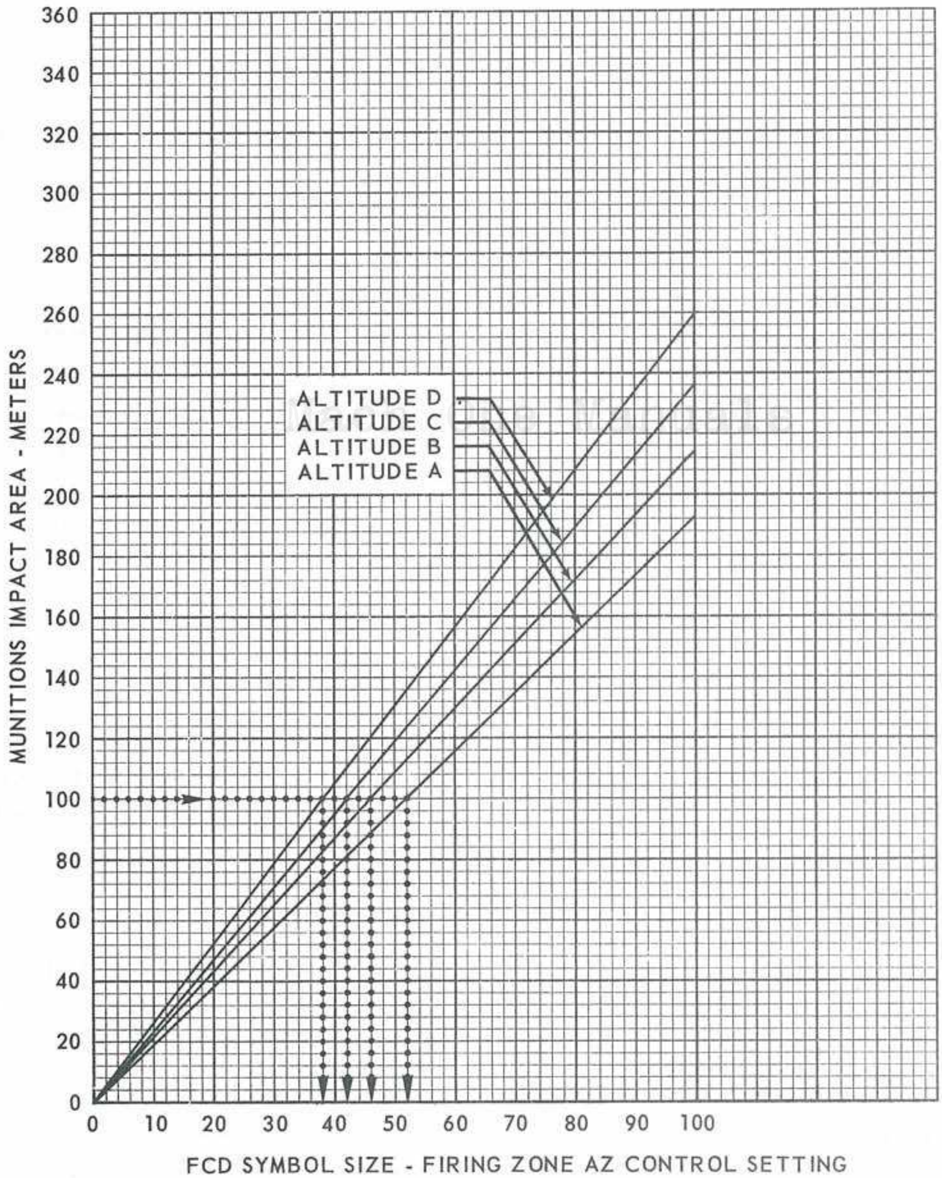


Figure 4-24

FCD FIRING ZONE ELEVATION SETTING

TRUE AIRSPEED — 150 KT

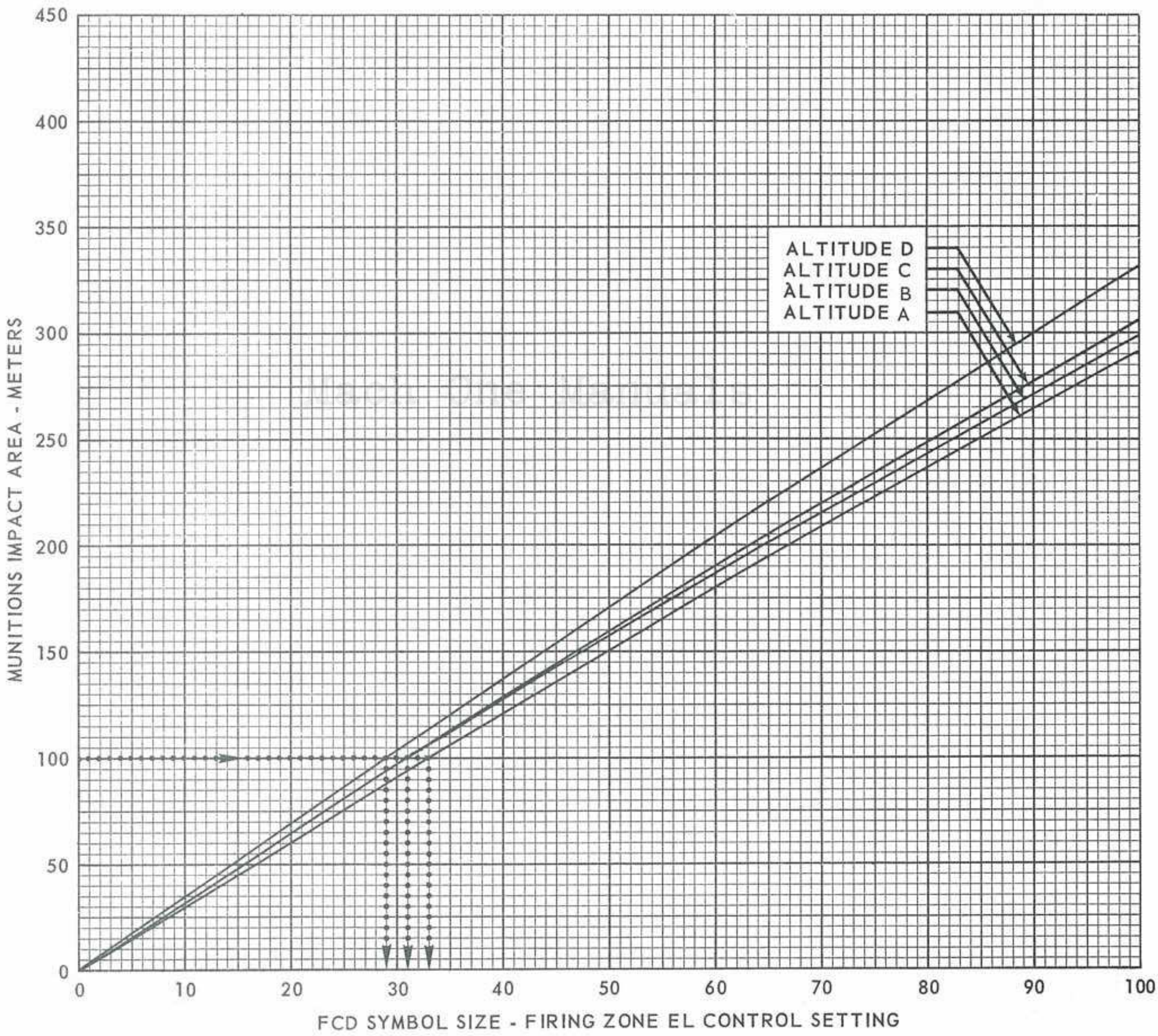


Figure 4-25

FCD SAFETY ZONE SETTING
ALTITUDE A

TRUE AIRSPEED — 150 KT

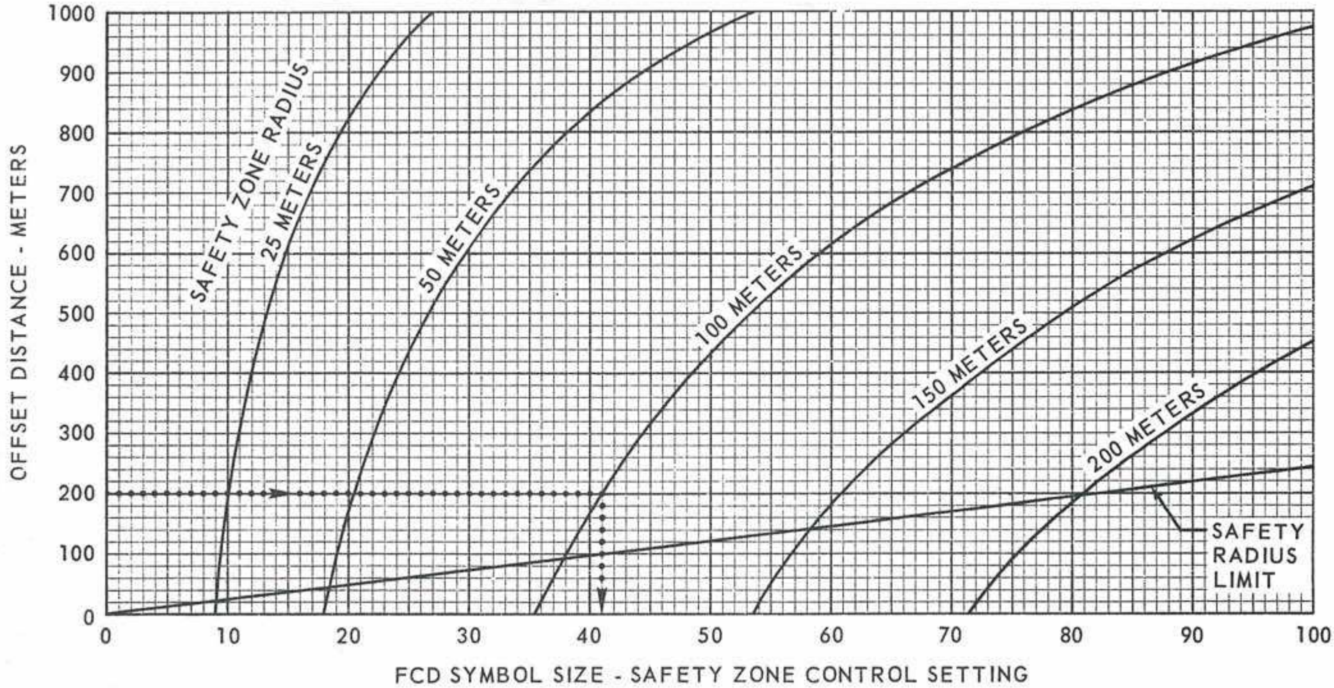
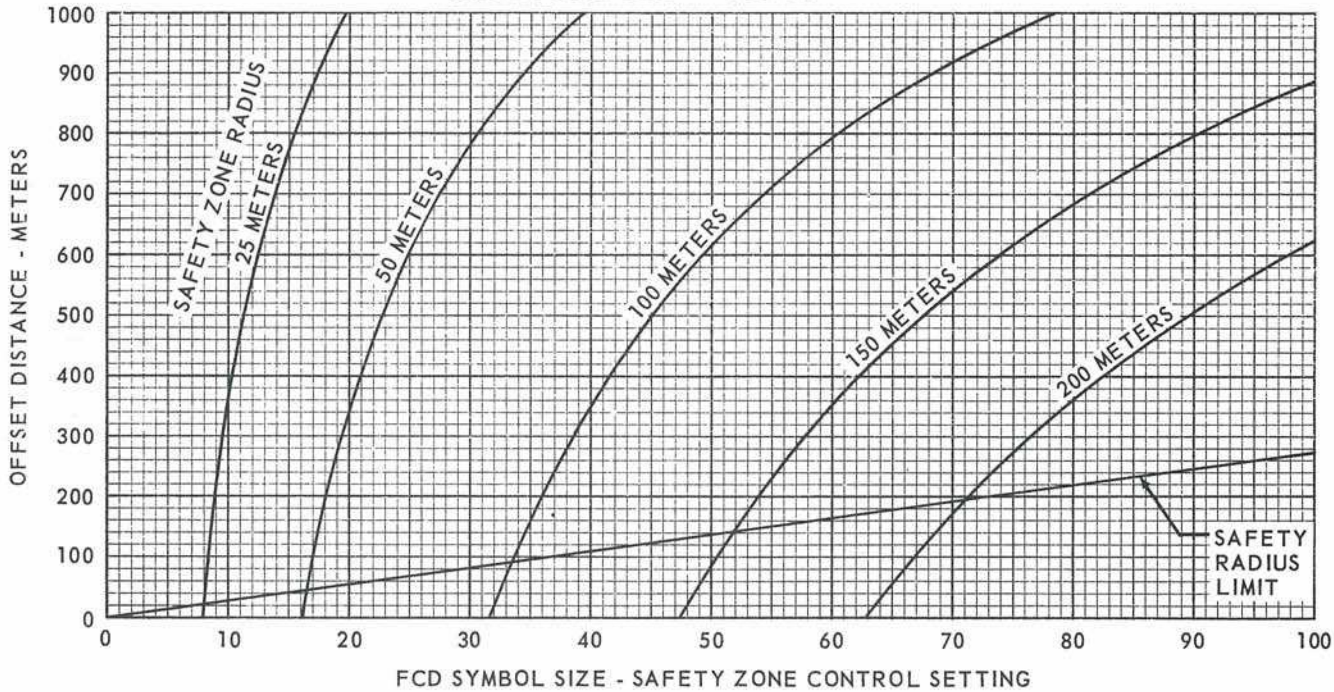


Figure 4-26

ALTITUDE B

TRUE AIRSPEED — 150 KT



Firure 4-27

FCD SAFETY ZONE SETTING

ALTITUDE C

TRUE AIRSPEED – 150 KT

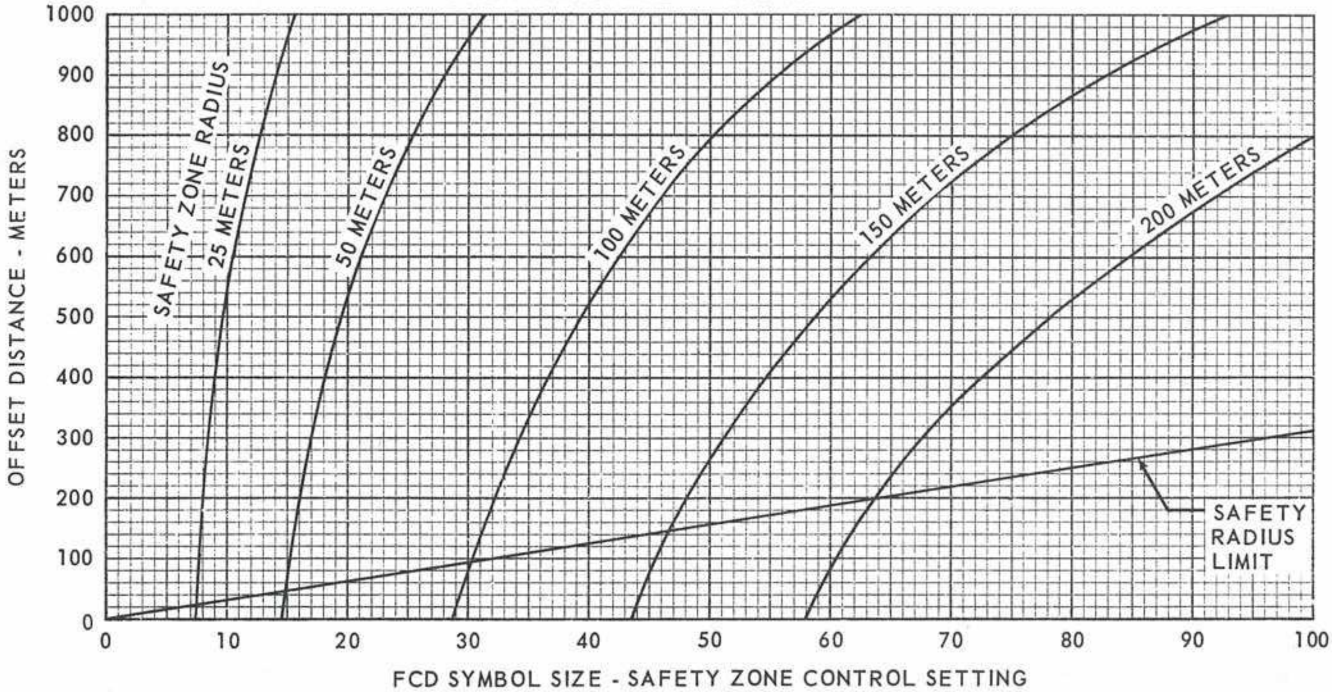


Figure 4-28

ALTITUDE D

TRUE AIRSPEED – 150 KT

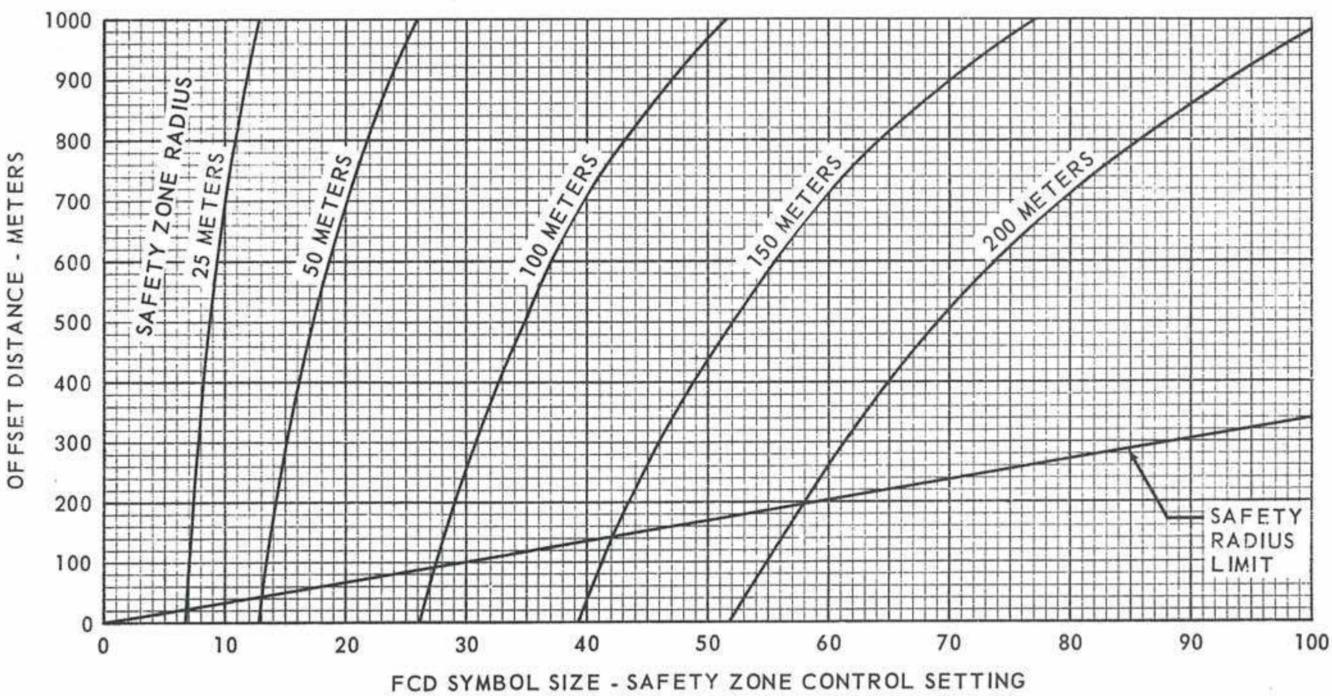


Figure 4-29

T.O. 1C-119(A)G-1

the right of center. If not, adjust dot to this position with AZ and EL GAIN adjustment screws. Set switch to OPR.

11. Depress CENTER control and note that all symbols move to center of FCD within ± 0.2 centimeter. Check FIRING ZONE and SAFETY ZONE controls. Set SCALE FACTOR SELECT switch to FINE and note that symbols increase in size 3:1. Release CENTER control.

12. Operate CHANNEL A switch throughout its range and note that CHANNEL A STATUS lights illuminate. Set to other than OD.

13. Operate CHANNEL B switch throughout its range and note that CHANNEL B STATUS lights illuminate. Set to other than OD.

14. Operate SAFETY ZONE switch throughout its range and note that SAFETY ZONE STATUS lights illuminate. Set to OD.

15. Have NOS placed in approximate on-target position. Turn FCC on. Select OD on FCC primary SENSOR select switch. Have the NOS swiveled and check for proper movement of the primary sensor symbol on the FCD.

TURN-OFF PROCEDURE.

1. Turn INTENSITY control ccw.

2. Set all SYMBOL CONDITION switches OFF (down).

3. Turn DIMMER control ccw.

4. Set PRIMARY POWER switch OFF.

MARKER BEACON LIGHT.

The marker beacon light on the ID-249 indicator is illuminated by depressing one of the NOS consent switches when the desired aiming point has been positively identified. When the light is illuminated, the pilot is assured that valid information is being supplied to the fire control computer and that the computer outputs may be used to guide the aircraft into attack position.

NOTE

> Before the marker beacon light can be used for signaling that a valid target is being accurately tracked, the NAV MODE SEL switch must be positioned to GUN COMPTR.

ID-249 INDICATOR.

The ID-249 indicator needles, under the direction of the fire control computer, display steering information for the pilot. This information will guide the pilot to a tangent point on the attack circle (a precomputed circle, about the target, from which the attack will be effected). When the pilot has guided the aircraft to the attack circle radius distance from the target, the ID-249 bars will give a center (null) indication. This is the signal for the pilot to place the aircraft into a 30-degree bank and to turn his attention to the optical gunsight for precise attitude correction information.

NOTE

> Before the ID-249 indicator can be used for target acquisition, the NAV MODE SEL switch must be positioned to GUN CMPTR.

OPTICAL GUNSIGHT.

The optical gunsight (figures 4-30 and 4-32) provides target aiming data under daylight or night conditions through a fixed and a movable image reticle. The pilot, using the reticles for reference, guides the aircraft in a coordinated orbit to keep the target centered in the field of fire. At the various firing altitudes and airspeeds, the gunsight elevation must be adjusted accordingly. Adjustment is made by loosening the locking knob on each side of the gunsight mount, turning the adjustment knobs to position the gunsight to the proper index point, and retightening the locking knobs. Indicator lights located around the collimating lens periphery display three significant events to the pilot.

1. White cue lights, when illuminated, indicate the movable reticle has hit or passed the outer limits of the gunsight in automatic or semiautomatic mode.

OPTICAL GUNSIGHT

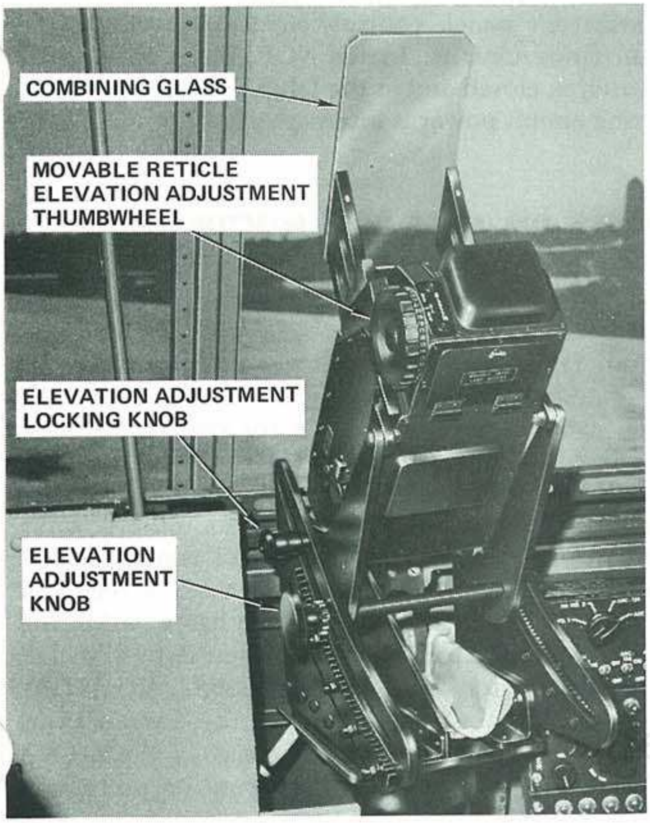


Figure 4-30

2. Amber cue lights, when illuminated, indicate the pilot has not yet achieved the coincidence of the movable and fixed reticles as set on the FCC in semiautomatic or automatic mode.

3. Red cue lights, when illuminated, indicate that neither of the NOS consent switches is depressed to allow firing of the guns in semiautomatic or automatic mode.

NOTE

- In automatic mode the guns will fire when no cue lights show on the sight.
- In semiautomatic mode the guns may be fired even though the amber lights are illuminated.
- In manual mode the cue lights signify nothing and should be turned off.

The optical gunsight system consists of the sight head, sight amplifier, and fire/sight mode selector panel. The optical sight consists of a fixed reticle, representing the projectile impact point and a movable reticle, representing the target. The lead computing optical gunsight automatically displays pertient gun-aiming information on the combining glass in the pilot's side field of view. The fixed reticle is used in all modes of operation.

The movable reticle is displayed in all modes; however, the FCC controls reticle position in automatic and semiautomatic modes only. In manual mode, the movable reticle is automatically aligned in azimuth with the fixed reticle; elevation is controlled by the EL thumbwheel. In semiautomatic and automatic mode, by maintaining an aircraft attitude that keeps the two reticles superimposed, the pilot knows he is on target. In the manual mode the pilot must fly the aircraft in such a manner as to keep the fixed reticle superimposed or displaced according to wind on the target on the ground. For wind corrections see figure 7-5. A fire/sight mode selector panel, installed above the pilot's side window, contains ON and OFF switches for the reticles, and a FIRING MODE selector switch.

Normal Operation of the Optical Gunsight.

TURN-ON PROCEDURE.

1. Place FIRING MODE selector switch to desired mode.

2. Set FIXED and MOVABLE reticle switches to either NO. 1 FIL or NO. 2 FIL.

3. Allow 5-minute warmup period.

TURN-OFF PROCEDURE.

1. Place FIXED and MOVABLE reticle switches OFF.

2. Position FIRING MODE selector switch OFF.

PILOT'S GUN STATUS PANEL.

The pilot's gun status panel (figure 4-31) is located to the left of the pilot's station forward of the optical gunsight. Indicator lights on the panel

PILOT'S GUN STATUS PANEL

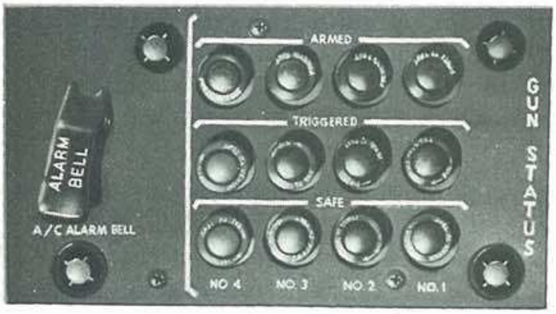


Figure 4-31

provide the pilot with a visual indication of gun status: ARMED (amber) TRIGGERED (red) or SAFE (green). The guarded A/C ALARM BELL switch is also located on the panel.

MASTER ARM SWITCH.

A master arm switch (figure 4-33), located on the forward right side of the radio control panel, controls electrical power to the gun firing circuit, providing the gun firing override switch is in the NORMAL position. The switch, placarded SAFE and ARMED, connects 28 volts dc to the gun fire control circuit when placed in the ARMED position. When in the SAFE position, electrical power is interrupted.

PILOT'S GUN TRIGGER SWITCH.

The gun trigger switch, placarded GUN and located on the right grip of the pilot's control yoke (figure 4-34), affords the pilot gun firing control in all firing modes. The switch is powered by 28 volts dc through the gun firing override switch from the main junction box.

NOTE

> If the copilot occupies the pilot's seat during a mission, extreme caution should be used to avoid depressing the GUN trigger switch when desiring microphone operation.

GUN FIRING OVERRIDE SWITCH.

The gun firing override switch, located on the navigator's panel, controls electrical power to the gun firing circuits. In the NORMAL position, the switch is closed and in the DISABLED position, all firing circuit power is interrupted.

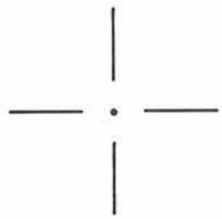
PILOT'S FIRE/SIGHT MODE SELECTOR PANEL.

The fire/sight mode selector panel (figure 4-35), located above the pilot's side window, contains illumination and brightness control switches for the gunsight reticles, a brightness control for the cue lights, a firing mode selector switch, a ground override switch, and four rheostats. The MOVABLE and FIXED reticle switches control on-off illumination of the gunsight reticles, while the RETICLES brightness control regulates their intensity. The CUES brightness control regulates the illumination level of the cue lights within the limit set by the four rheostats. The FIRING MODE selector switch may be positioned to AUTO, SEMIAUTO, or MAN to select the desired firing mode, or OFF. The guarded GROUND-OVERRIDE switch may be positioned to OVERRIDE in order to power the gun circuits while the aircraft is on the ground.

NIGHT OBSERVATION SIGHT (NOS).

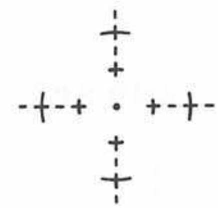
The primary function of the NOS is to provide angular data of the line of sight of the NOS aiming point to the fire control computer and SLAD system. The night observation sight (NOS) (figure 4-36) is a precision electro-optical instrument for observation of distant objects during night missions. The integrally mounted daylight sight performs the same function during high ambient lighting conditions. The four-power (4X) magnification NOS amplifies reflected ambient night illumination (moonlight, starlight, or skyglow) or infrared light energy supplied by the illuminator to produce a visible image of the object when viewed through the eyepiece. An iris control is installed to vary light intensity. The three-power (3X) magnification daylight sight is used for day viewing or in high ambient lighting conditions at night (illuminator on visual mode or area illuminated by flares). Handgrips on the NOS yoke assembly assist the operator in moving the unit in

OPTICAL GUNSIGHT -



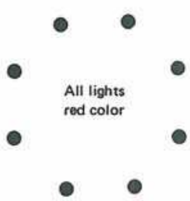
FIXED RETICLE IMAGE DISPLAY

Fixed alignment of reticle is provided as reference to armament line so that the pilot must maneuver aircraft in order to move fixed reticle image to coincide with movable reticle image.



MOVABLE RETICLE IMAGE DISPLAY

Positioning of movable reticle image is accomplished through fire control computer. Movable reticle image position indicates general location of target. Pilot must put both reticle images in coincidence for accurate weapons firing.

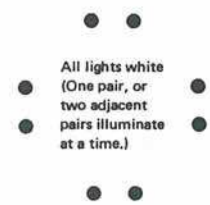


INVALID DATA CUE LIGHTS

Eight red cue lights illuminate to indicate when invalid target data has been received by computer. Reticles may or may not be in coincidence. Weapons should not be fired.

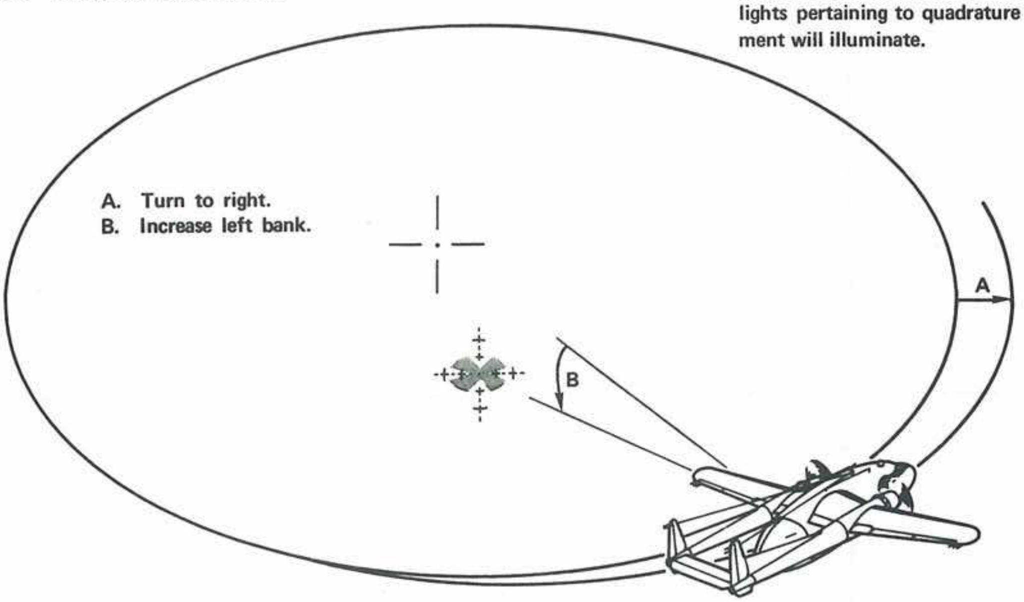
TARGET COINCIDENCE CUE LIGHTS

Eight amber cue lights are extinguished to indicate that the reticles are within coincidence.



RETICLE LIMITS CUE LIGHTS

Pairs of white reticle limit cue lights will illuminate to indicate when movable mirror assembly has been displaced near angular limits of azimuth and elevation. Only those lights pertaining to quadrature of displacement will illuminate.



EXAMPLE

Position aircraft in attack circle around the target. Change aircraft attitude in turn and bank so that the fixed reticle is superimposed on the movable reticle image. In the above example the aircraft is turned slightly to the right and then the left bank is increased until the fixed reticle has superimposed on the movable reticle image.

Figure 4-32 (Sheet 1 of 2)

RETICLE IMAGES AND CUE LIGHT DISPLAYS

AUTOMATIC AND SEMIAUTOMATIC

RETICLES

1. Fixed
2. Movable

CUE LIGHTS

A. Amber
R. Red
W. White

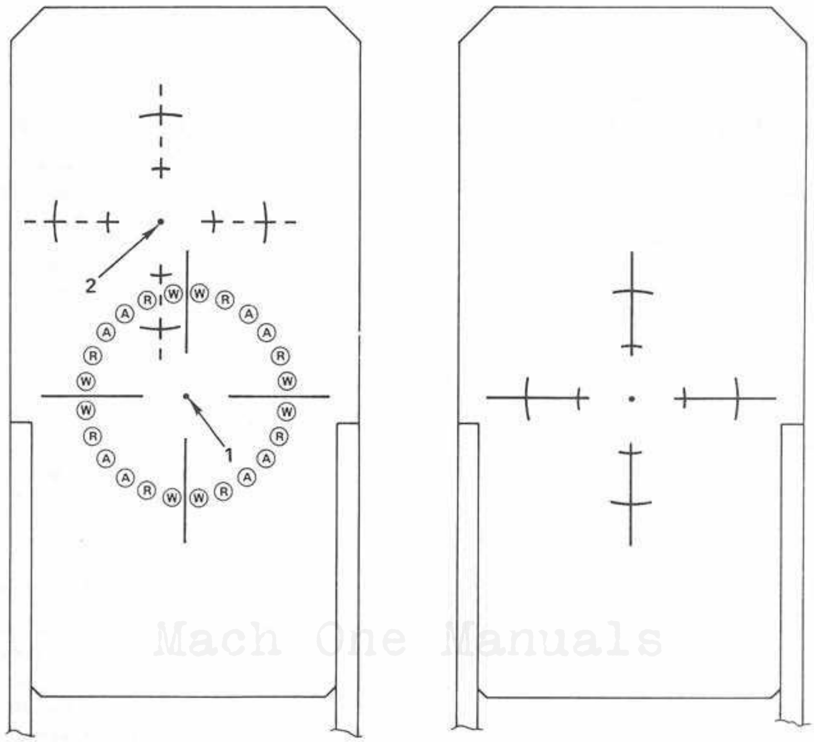
MANUAL

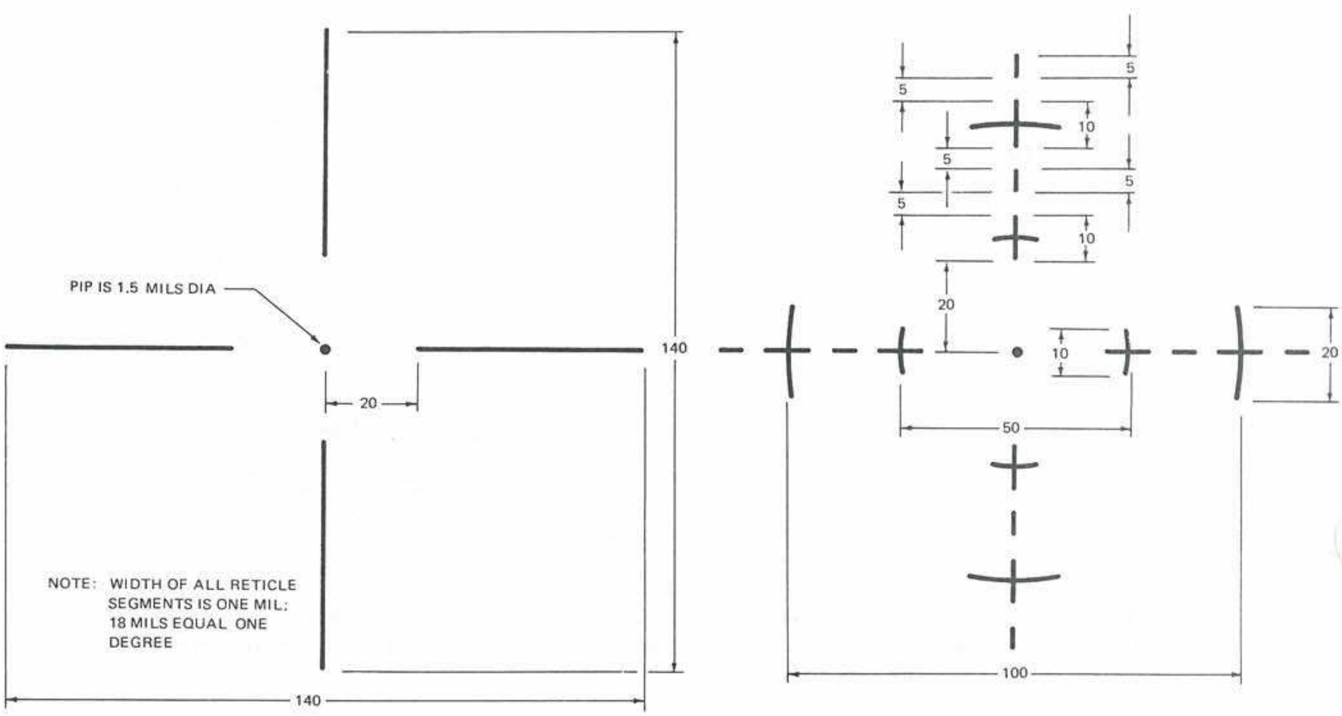
RETICLES

Automatically aligned in azimuth; controlled in elevation by elevation thumbwheel

CUE LIGHTS

Off





VALUES IN MILLIRADIANS

Figure 4-32 (Sheet 2 of 2)

MASTER ARM SWITCH

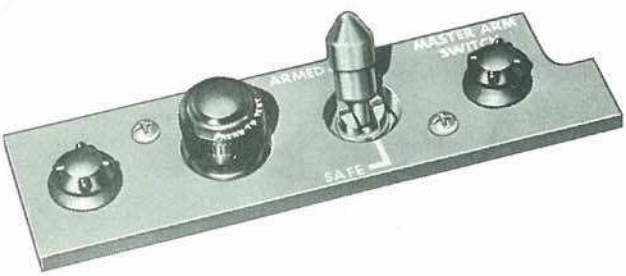


Figure 4-33

azimuth and elevation when seeking and/or tracking ground targets. Either trigger-type (consent) switch, located one on the right and one on the left grip, illuminates the ID-249 marker beacon light and the FCC OD TRACKING light to indicate that the NOS operator is accurately tracking the target.

WARNING

> The consent switch(es) will not be depressed until positive target identification has been made.

A four-position switch, also located on the right grip, controls vertical and horizontal positioning of the illuminator. The thumb switches located on the right and left grips are the interphone switches. In operation, the target is acquired by the NOS and angular data is then fed to the computer and SLAD system using the NOS resolvers. Power for system operation is provided by a self-contained 6.75-volt battery installed in the power supply housing on the upper side of the NOS. Power is controlled by a guarded, two-position switch on the power supply housing. The supporting frame assembly is located in the front entrance door opening. A movable operator's seat is provided as an integral part of the installation. Vertical movement of the seat is controlled by a two-position switch located on the left grip. Power to operate the seat is from the aircraft power supply system.

Normal Operation of the NOS.

CAUTION

> Do not turn on NOS in high ambient lighting conditions (daylight, illuminator on visual mode, or ignited flares). This will cause a burn on the image tube. The image tube will shut itself off; however, repeated attempts will ruin the tube. Perform the procedure only at night or daytime with polaroid cover installed.

1. Set iris for minimum aperature (ccw).

2. Place NOS power switch to on position.

3. Open iris and adjust eyepiece focusing for sharp reticle image.

4. Adjust range focus for sharpest image.

NOS RETICLE OPERATION. (See figure 4-37.)

1. Rotate eyepiece focus control for sharp reticle image.

2. Open iris fully to reduce depth of field, then rotate range focus control for sharp image of object being viewed.

3. Rotate iris control for sharpest image. To turn viewing device off, place NOS power switch in off position.

NOTE

> A change in altitude will require a change in focus.

NOS Battery Replacement. (See figure 4-38.)

Should it become necessary to replace the NOS battery in flight, employ the following procedure:

1. Position NOS power switch toward guard on power supply housing (off).

PILOTS' CONTROL YOKE SWITCHES

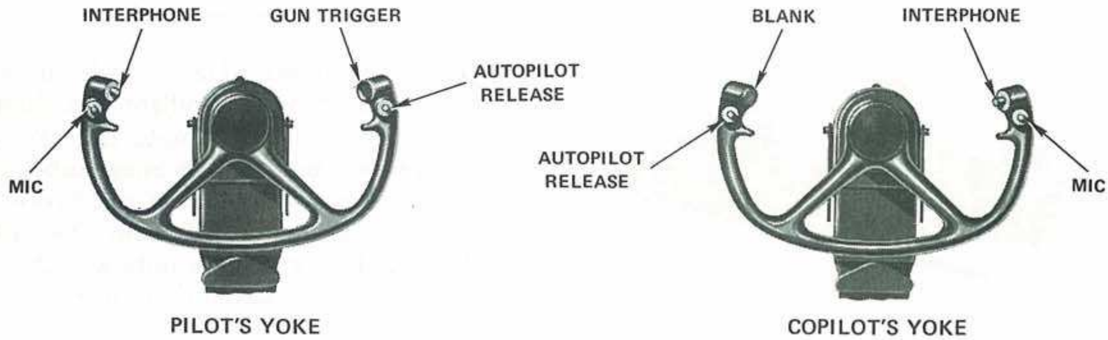


Figure 4-34

FIRE/SIGHT MODE SELECTOR PANEL

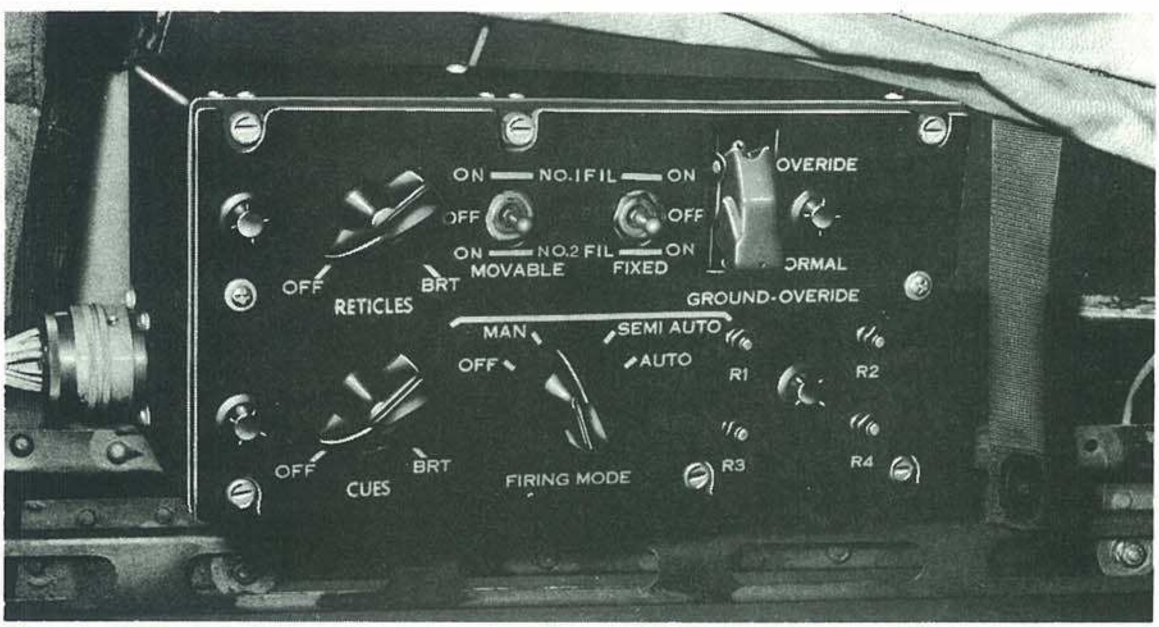
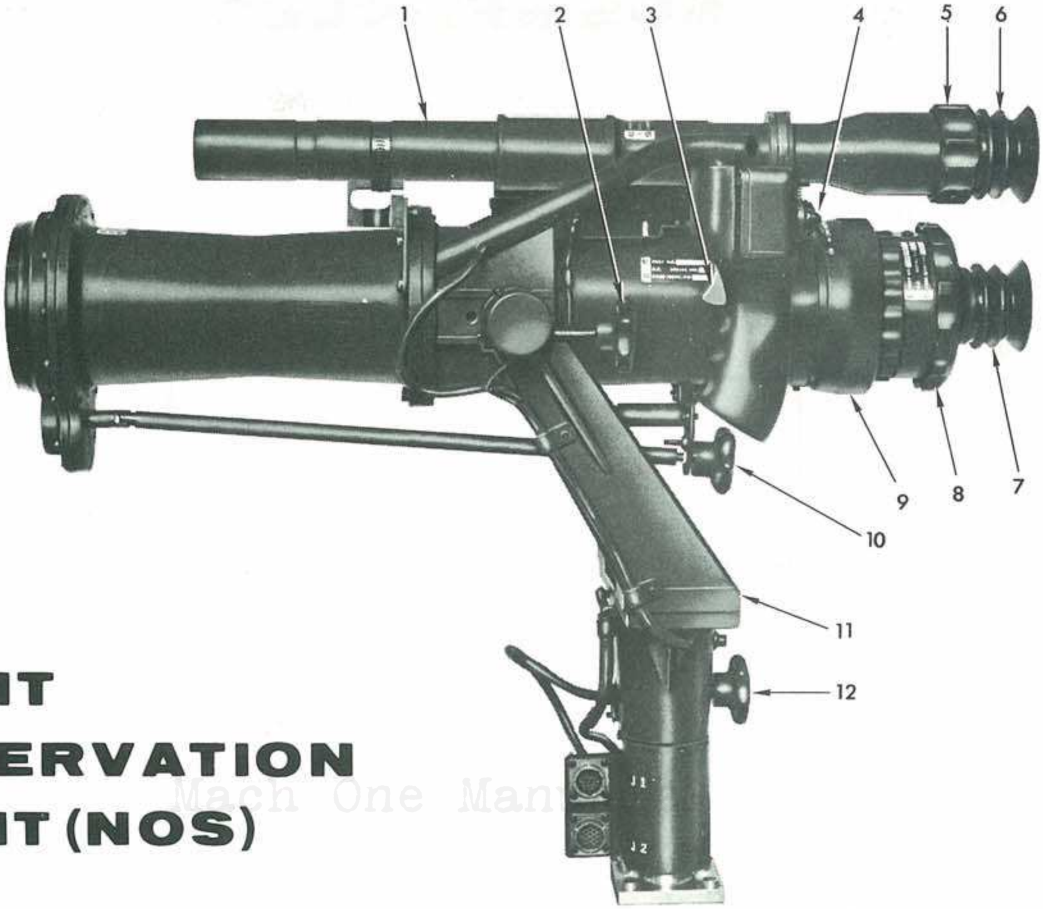
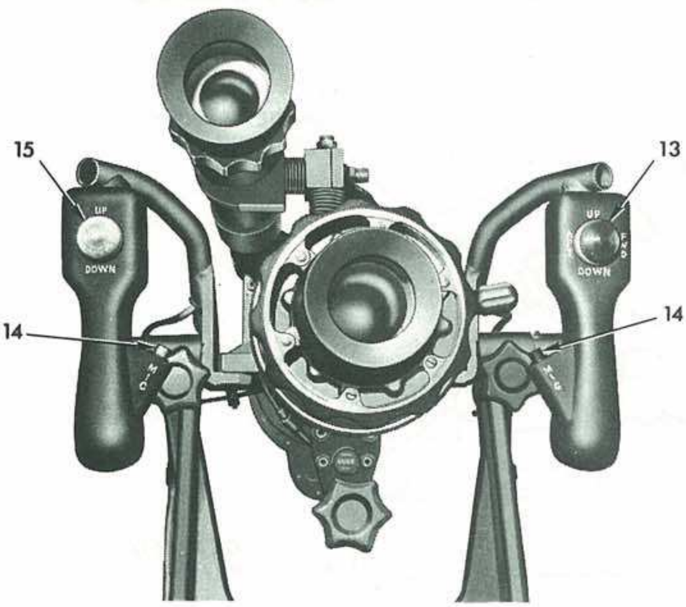


Figure 4-35



NIGHT OBSERVATION SIGHT (NOS)



1. DAYLIGHT SIGHT
2. ELEVATION LOCKING KNOB
3. CONSENT SWITCH (RIGHT AND LEFT GRIP)
4. NOS SEAT CONTROL SWITCH
5. EYEPIECE FOCUS CONTROL (DAYLIGHT SIGHT)
6. EYE SHIELD (DAYLIGHT SIGHT)
7. EYE SHIELD (NOS)
8. EYEPIECE FOCUS CONTROL (NOS)
9. RANGE FOCUS CONTROL
10. IRIS ADJUSTMENT CONTROL KNOB
11. MOUNTING YOKE
12. AZIMUTH LOCKING KNOB
13. ILLUMINATOR POSITION CONTROL SWITCH
14. INTERPHONE SWITCH
15. NOS SEAT CONTROL SWITCH

Figure 4-36

NOS RETICLES

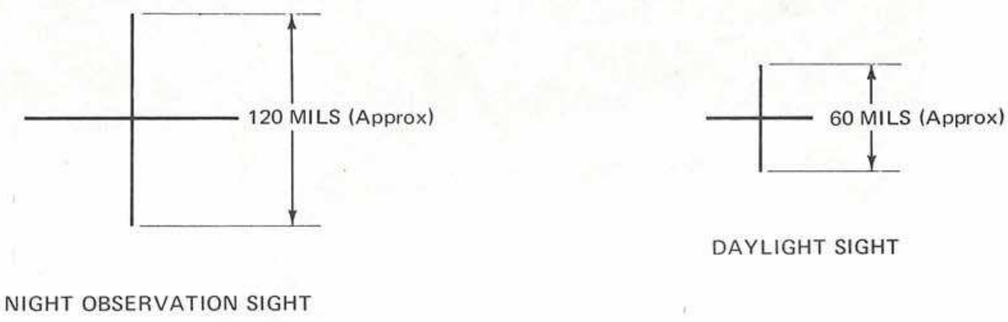


Figure 4-37

NOS BATTERY INSTALLATION

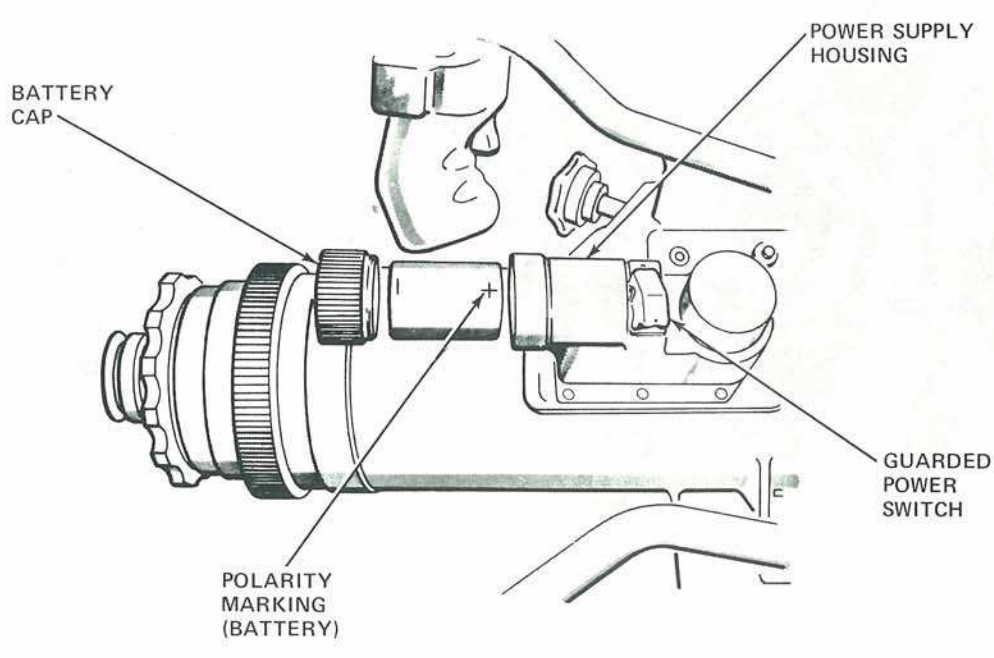


Figure 4-38

2. Unscrew and remove battery cap.

3. Remove battery.

WARNING

Battery must be handled with care. A mild shock may result in a buildup of internal pressure and explosive rupture, creating a hazard to personnel and equipment. If such a shock is sustained, the battery should be placed in a suitable explosive-proof container for a minimum of 24 hours.

4. Install new battery with positive (+) end facing into power supply housing.

5. Install battery cap.

SENSOR/LIGHT ANGLE DISPLAY (SLAD).

The SLAD system displays the azimuth and elevation of the station sensor and the relative position of either the illuminator or night observation sight to the other unit operator. a SLAD panel (figure 4-39) is located at the NOS and illuminator stations. Also, a partial SLAD panel is located at the pilot's station. These panels receive azimuth and elevation signals directly from the NOS or illuminator and display this information on two SENSOR POSITION indicators calibrated in degrees. Except for the pilot's partial SLAD panel, two STATION COMPARISON indicators are contained on the other panels. Their purpose is to display the relative position of the NOS to the illuminator, or vice versa, and to indicate in which direction the NOS or the illuminator should be positioned to be in alignment with the other unit. Power for system operation is 28-volt dc, derived through a 5-ampere circuit breaker in the navigator's circuit breaker box.

NOTE

The SLAD system has a tolerance of ± 10 degrees and should be used for reference purpose only.

Normal Operation of the SLAD.

To determine the azimuth and elevation of the NOS or illuminator from their respective stations:

1. Read azimuth and elevation in degrees directly from AZ and EL indicators on SENSOR POSITION section of associated SLAD panel.

To determine the azimuth and elevation of the NOS or illuminator from the pilot's station:

1. Set SLAD panel rotary selector switch to NOS or AIR LT, as desired. Read azimuth and elevation in degrees directly from AZ and EL indicators on SLAD panel.

To align the NOS with the illuminator:

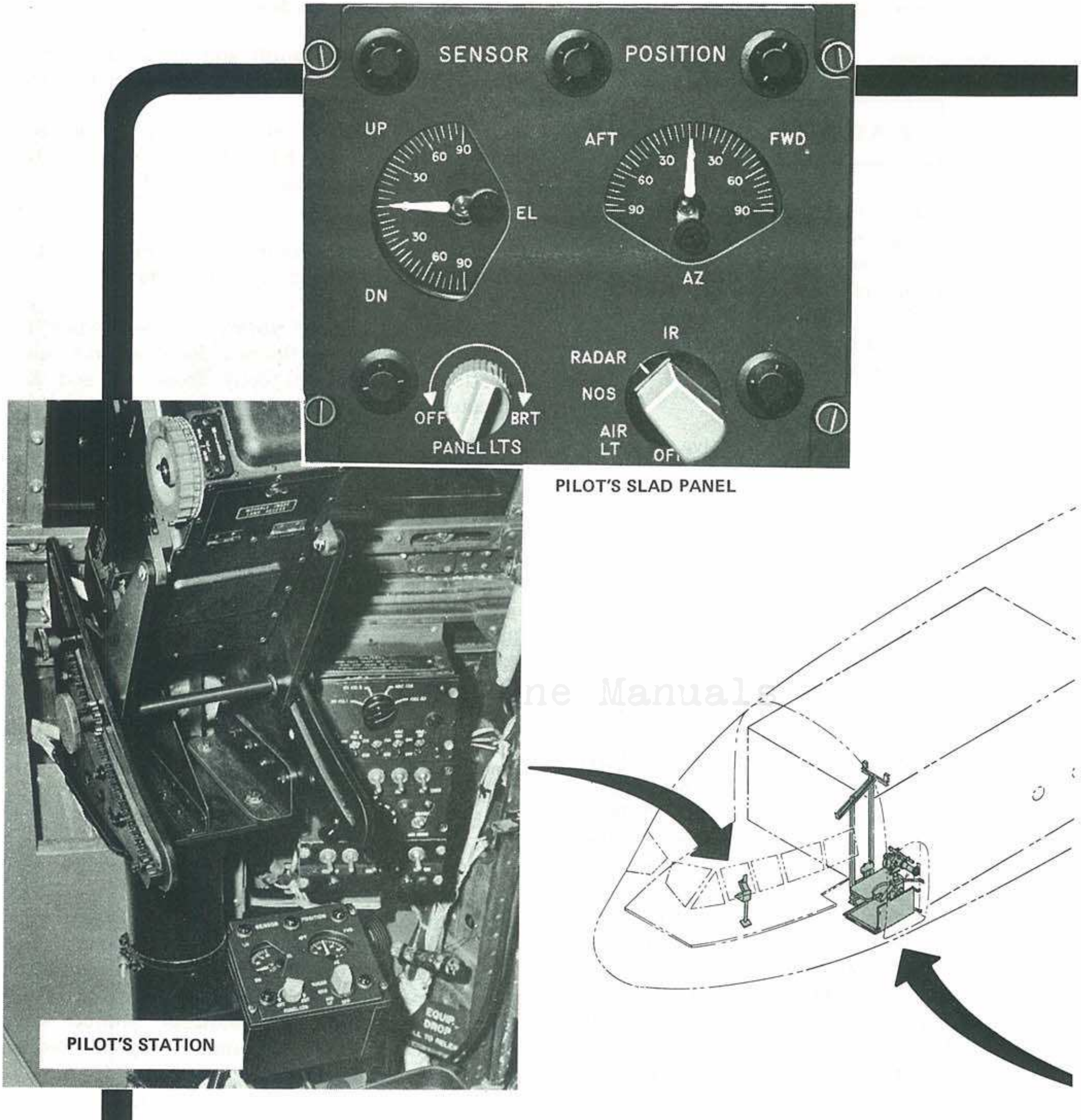
1. Set selector switch on STATION COMPARISON section of NOS SLAD panel to AIR LT.

2. Note relative azimuth and elevation of illuminator on REL AZ and REL EL indicators on STATION COMPARISON section of NOS SLAD panel. These indications show the direction the NOS must be moved to be in alignment with illuminator. For example, if the REL AZ indicator needle is between ON TGT and FWD and the REL EL indicator needle is between ON TGT and UP, the NOS must be moved forward and up until the REL AZ indicator and REL EL indicator needles are ON TGT, indicating that the NOS and illuminator are in alignment. The EL and AZ indicators on the SENSOR POSITION section of the NOS and illuminator SLAD panels will continue to indicate the azimuth and elevation of their respective unit. The pilot's SLAD panel AZ and EL indicators will indicate azimuth and elevation of the NOS or illuminator as selected by the rotary selector switch.

To align the illuminator with the NOS:

1. Set selector switch on STATION COMPARISON section of illuminator SLAD panel to NOS.

2. Note relative azimuth and elevation of NOS on REL AZ and REL EL indicators on STATION



SENSOR/LIGHT ANGLE DISPLAY

Figure 4-39 (Sheet 1 of 2)

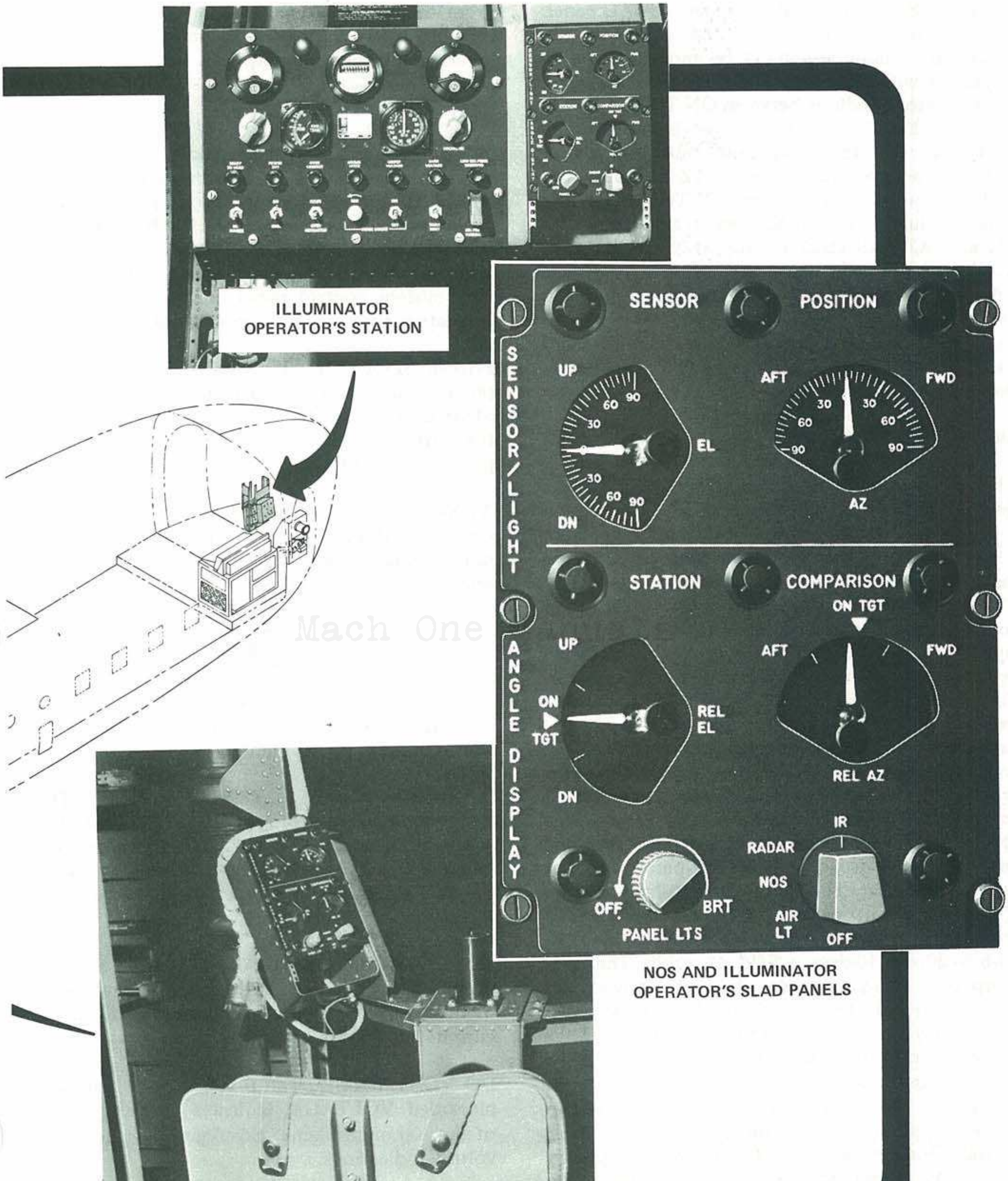


Figure 4-39 (Sheet 2 of 2)

COMPARISON section of illuminator SLAD panel. These indications show the direction the illuminator lamphouse must be moved to be in alignment with the NOS. For example, if the REL AZ indicator needle is between ON TGT and FWD and the REL EL indicator needle is between ON TGT and UP, the lamphouse must be moved forward and up until the REL AZ indicator and REL EL indicator needles are ON TGT, indicating that the illuminator and NOS are in alignment. The EL and AZ indicators on the SENSOR position section of the illuminator and NOS SLAD panels will continue to indicate the azimuth and elevation of their respective unit. The pilot's SLAD panel AZ and EL indicators will indicate azimuth and elevation of the illuminator or NOS as selected by the rotary selector switch.

AIRBORNE ILLUMINATOR.

The airborne illuminator is a completely self-contained Xenon arc lamp, shock mounted on a platform located on the auxiliary cargo compartment floor. The platform is a fixed installation utilizing standard tiedown equipment. The airborne illuminator incorporates a closed-loop cooling system, containing a mixture of water and glycol, capable of dissipating the heat produced during 20 KW ground operation of the illuminator. The system includes a lightweight liquid-to-air heat exchanger, coolant pump, flowmeter, pressure gages, and associated controls. Integral interlocks and safety devices assure proper coolant flow rate and temperature for safe operation of all subsystems and components of the airborne illuminator. The light is positioned so that the lamphouse will project out the left paratroop door during operation. The illuminator utilizes one 20 KW Xenon light capable of visual and infrared modes of operation. A zoom lens provides the light with a 20- to 40-degree field of vision. The APU supplies 115-volt, three-phase ac power for operation of the illuminator's self-contained transformer/rectifier unit. The transformer/rectifier unit provides an output of 39 to 47 volts dc at 260 to 460 amperes for lamp operation. The lamp is rotated inboard in the stowed position and is rotated into the door opening during operation. The lamp is controlled from the illuminator control panel, the NOS station, or from a lap-held remote control unit in the flight compartment. Controls allow lamp movement 60 degrees down and 10 degrees up from the horizontal position with a ± 15-degree azimuth control. The illuminator is completely weather and environmentproof.

Illuminator Control Panels.

A power distribution panel and a system control panel are located on the illuminator. (See figure 4-40.) The power distribution panel contains system circuit breakers, fuses, a phase sequential indicator light, and an auxiliary pump switch and adjustment potentiometers for maintenance use. The system control panel contains controls and indicators necessary for operation of the unit.

PHASE SEQUENTIAL INDICATOR LIGHT. The phase sequential indicator light, placarded PHASE SEQUENTIAL INDICATOR, will illuminate when the three phases of the 115-volt, 400-cycle ac power supplied by the APU are in proper sequence.

AUXILIARY PUMP SWITCH. The auxiliary pump switch, placarded AUX PUMP, is used by maintenance personnel during cooling system operation and maintenance.

CAUTION

The AUX PUMP switch must remain in the OFF position during normal operation of the illuminator.

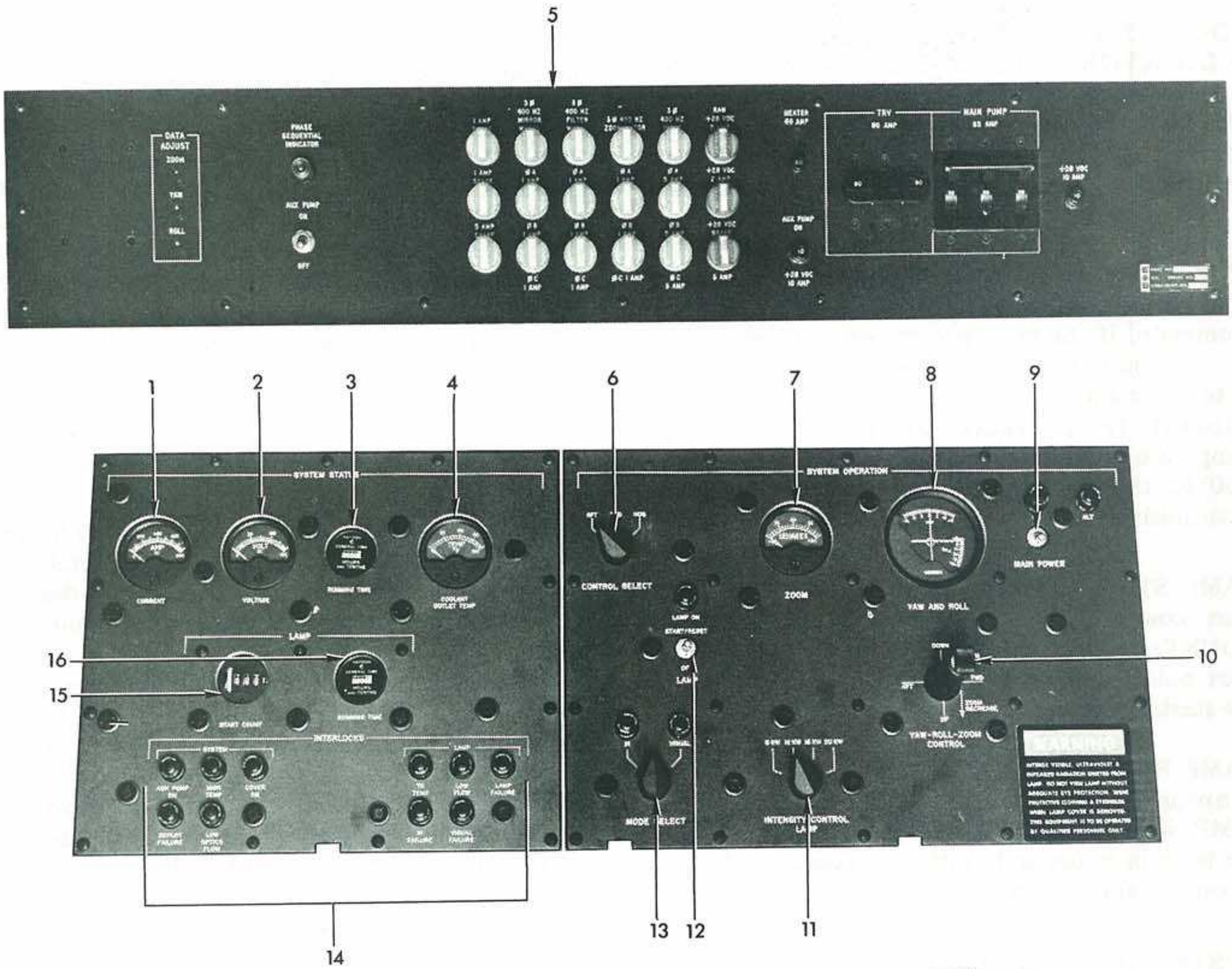
DATA ADJUST POTENTIOMETERS. Three potentiometers, placarded DATA ADJUST, accessible from the front of the power distribution panel are used by maintenance personnel to adjust the ZOOM meter and YAW and ROLL meter settings.

DC AMMETER. The 0-800 ampere dc ammeter, placarded CURRENT, indicates operating current of the Xenon arc lamp. See figure 4-41 for normal current indications.

DC VOLTMETER. The 0-150 volt dc voltmeter, placarded VOLTAGE, indicates operating voltage of the Xenon arc lamp. See figure 4-41 for normal voltage indications.

SYSTEM RUNNING TIME INDICATOR. The system running time indicator, placarded RUNNING TIME, indicates total operating time of

ILLUMINATOR CONTROL PANELS



1. AMMETER
2. VOLTMETER
3. RUNNING TIME INDICATOR
4. COOLANT OUTLET TEMPERATURE INDICATOR
5. CIRCUIT BREAKER AND POWER DISTRIBUTION PANEL
6. CONTROL SELECT SWITCH
7. ZOOM INDICATOR
8. YAW-ROLL INDICATOR
9. MAIN POWER SWITCH AND INDICATOR LIGHTS
10. YAW-ROLL-ZOOM CONTROL
11. LAMP INTENSITY CONTROL
12. LAMP START RESET SWITCH
13. MODE SELECT SWITCH
14. INTERLOCK LIGHTS
15. START COUNT INDICATOR
16. RUNNING TIME INDICATOR

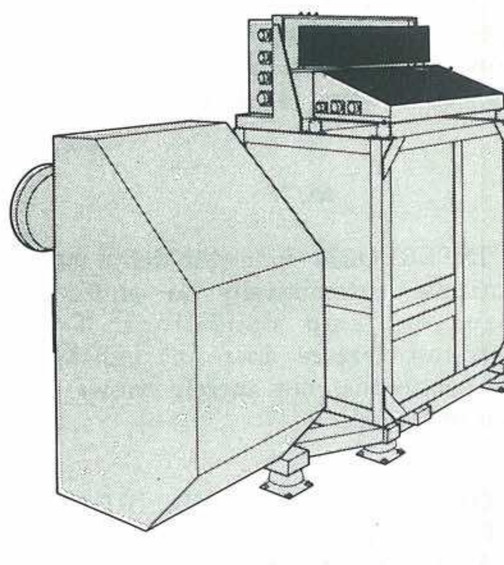


Figure 4-40

the illuminator system in hours and tenths. A separate indicator records operating time of the lamp.

COOLANT OUTLET TEMPERATURE INDICATOR. The 0°-200°F coolant outlet temperature indicator, placarded COOLANT OUTLET TEMP, indicates temperature of the cooling system water/glycol mixture. Normal coolant temperature during illuminator operation is 45°-150°F. If the main power switch is positioned off and coolant temperature is below 45°F, the auxiliary pump and heater will operate and the auxiliary pump indicator light will illuminate. If the main power switch is positioned on, the auxiliary pump and heater will not operate until the coolant temperature drops to 40°F. At a coolant temperature of 135°F, the high temperature indicator light will illuminate; at 150°F, the illuminator lamp will automatically extinguish.

LAMP START COUNT INDICATOR. The lamp start count indicator, placarded LAMP START COUNT, records the total number of 115- volt start pulses applied to the lamp igniter circuit by the starter circuit.

LAMP RUNNING TIME INDICATOR. The lamp running time indicator, placarded RUNNING TIME, indicates total operating time of the Xenon arc lamp in hours and tenths. A separate indicator records operating time of the system.

SYSTEM AND LAMP INTERLOCK. Ten red, press-to-test indicator lights provide visual indication of system and lamp operating conditions. See figure 4-42 for specific light functions.

NOTE

> The INTERLOCK indicator lights will illuminate automatically to indicate system or lamp conditions. The press-to-test feature does not indicate these conditions, but merely shows if bulb is operative.

MAIN POWER SWITCH AND INDICATOR LIGHT. The two-position main power switch, placarded MAIN POWER with placarded ON and unplacarded off positions, controls power supplied to the illuminator system. The green indicator light located immediately above the switch indicates that 28-volt dc power is available; the green indicator light above and to the right of the switch indicates that 115-volt, three-phase ac power is available.

YAW AND ROLL INDICATOR. The yaw and roll indicator, placarded YAW AND ROLL, is a dc voltmeter calibrated in 5-degree increments from +10 to -90 degrees (roll) and 1-degree increments from +15 to -15 degrees (yaw), indicating the angular position of the lamphouse in the yaw and roll positions. The maximum down (roll) position of the lamphouse is -60 degrees. Positioning rate in either roll or yaw is approximately 10 degrees per second.

ZOOM INDICATOR. The zoom indicator, placarded ZOOM, is a dc voltmeter calibrated in 1-degree increments from +20 to +40 degrees, indicating the beam spread angle of the zoom lens.

YAW-ROLL-ZOOM CONTROL. Angular position of the deployed lamphouse is controlled by the yaw-roll-zoom control, placarded YAW-ROLL-ZOOM CONTROL. The control handle actuates a four-way switch to move the lamphouse in the desired yaw or roll direction indicated on the yaw and roll indicator. A thumbswitch located on top of the control handle varies the beam spread angle (in degrees) of light through the zoom lens. Beam spread angle is variable from 20 to 40 degrees as indicated on the zoom indicator.

LAMP INTENSITY CONTROL SWITCH. The four-position lamp intensity control switch, placarded INTENSITY CONTROL LAMP, controls the output of light energy from the Xenon arc lamp. Placarded intensity settings are 8 KW, 12 KW, 16 KW, and 20 KW.

MODE SELECT SWITCH AND INDICATOR LIGHTS. Operating mode, either visual or infrared, is selected by the two-position mode select switch, placarded MODE SELECT, with positions placarded IR and VISUAL. Operating mode is indicated by the adjacent indicator lights. Switching time between modes is 8 to 10 seconds.

ILLUMINATOR INTENSITY VS CURRENT & VOLTAGE

SELECTED INTENSITY (KW)	CURRENT (AMPERES)	VOLTAGE (VOLTS)
8	260-280	39-41
12	325-350	41-43
16	370-380	43-44
20	420-460	44-47

NOTE: On initial start, voltmeter will indicate approximately 150 volts until lamp illuminates, then stabilize to values shown above. Ammeter will indicate 540-580 amperes, then stabilize to values shown above.

Figure 4-41

NOTE

When the CONTROL SELECT switch is set to FWD, the MODE SELECT switch on the control panel is inoperative. Visual or infrared mode of operation is then controlled by the MODE SELECT switch on the remote control unit.

LAMP SWITCH AND INDICATOR LIGHT. The spring-loaded, two-position lamp switch is placarded LAMP with positions placarded START/RESET and OFF. A series of three high-energy start pulses is applied to the lamp igniter circuit by momentarily positioning the lamp switch to START/RESET. If the lamp fails to ignite, the start failure indicator light will illuminate. To reset, momentarily position lamp switch to START/RESET to initiate another series of start pulses. When the lamp is ignited, the LAMP ON indicator light will illuminate.

ILLUMINATOR INTERLOCKS

INDICATOR LIGHT	INDICATION
SYSTEM AUX PUMP ON	Coolant temperature below 45°F; auxiliary heater and pump operating.
HIGH TEMP	Coolant temperature above 135°F; illuminator lamp will automatically extinguish above 150°F.
COVER ON	Lens cover installed; remove cover before deploying lamphouse.
DEPLOY FAILURE	System deploy malfunction - lamphouse cannot be deployed, lamp cannot be ignited; or, lamphouse is fully deployed.
LOW OPTICS FLOW	Coolant quantity through IR filter and lamphouse mirrors below safe level; do not ignite lamp.
LAMP TR-V TEMP	Temperature of illuminator transformer/rectifier unit above safe limit; do not ignite lamp.
LOW FLOW	Coolant quantity through transformer/rectifier unit below safe level; do not ignite lamp.
LAMP FAILURE	Lamp has not ignited ; momentarily position lamp switch to START/RESET.
IR FAILURE	Malfunction in change mode from IR to visual.
VISUAL FAILURE	Malfunction in change mode from visual to IR.

Figure 4-42

CONTROL SELECT SWITCH. The three-position control select switch, placarded CONTROL SELECT with positions placarded AFT, FWD, and NOS, selects the position controlling the illuminator lamphouse: aft (illuminator control panel), forward (remote control unit at navigator/safety officer's station), or NOS (four-position switch on right grip).

Illuminator Remote Control Unit.

A remote control unit (figure 4-43), located at the navigator's station, provides control of lamphouse position, mode selection, and lamp operation. These functions are controlled by the unit only when the CONTROL SELECT switch on the illuminator control panel is positioned to FWD.

FORWARD CONTROL INDICATOR LIGHT. The green forward control indicator light, placarded FWD CONTROL, will illuminate when the CONTROL SELECT switch on the illuminator control panel is set to FWD, indicating that the illuminator may be controlled from the remote control unit.

LAMP ON INDICATOR LIGHT. The green lamp on indicator light, placarded LAMP ON, is illuminated when the Xenon arc lamp has been ignited from the illuminator control panel.

INTERLOCK OPEN INDICATOR LIGHT. The red interlock open indicator light, placarded INTERLOCK OPEN, will illuminate to indicate a malfunction in system interlock circuits.

KILL SWITCH. The Xenon arc lamp may be extinguished from the remote control unit by depressing the kill switch, placarded KILL SWITCH. The lamp must be restarted from the illuminator control panel before resuming operation.

ZOOM INDICATOR, YAW AND ROLL INDICATOR, YAW-ROLL-ZOOM CONTROL, AND MODE SELECT SWITCH. Refer to applicable description under ILLUMINATOR CONTROL PANELS, this section.

Normal Operation of the Airborne Illuminator.

Illuminator operation requires coordination from three crew positions: the illuminator, the NOS, and the navigator's station. Initial turn-on and deployment are accomplished from the illuminator operator's station. The yaw and roll position of the lamphouse may then be controlled from the NOS, navigator's, or illuminator operator's station.

WARNING

- The illuminator Xenon arc lamp produces infrared and ultraviolet light energy at levels dangerous to personnel. In the visual mode of operation, the high light intensity can result in severe skin burns and eye damage. In the infrared mode, the lamp emits a high degree of infrared radiation. In either mode, observe all safety precautions to avoid exposing personnel to the light beam at short distances.

- The illuminator cooling system operates at a high noise level which may result in hearing damage. The illuminator operator must wear suitable ear protection when the system is operating.

PRE-OPERATING PROCEDURE.

1. Check:

   a. Circuit breakers on power distribution panel - In.

   b. ILLUMINATOR circuit breaker on left main junction box - In.

   c. MAIN POWER switch - Off.

   d. Lens cover - Removed.

   e. Lens - Cleaned.

   f. Coolant pressure indicator - Checked for 30 ± 5 psi.

   g. Coolant plumbing for leaks - Checked.

TURN-ON AND OPERATING PROCEDURE.

1. Insure that 28-volt dc power is available to system.

ILLUMINATOR REMOTE CONTROL UNIT

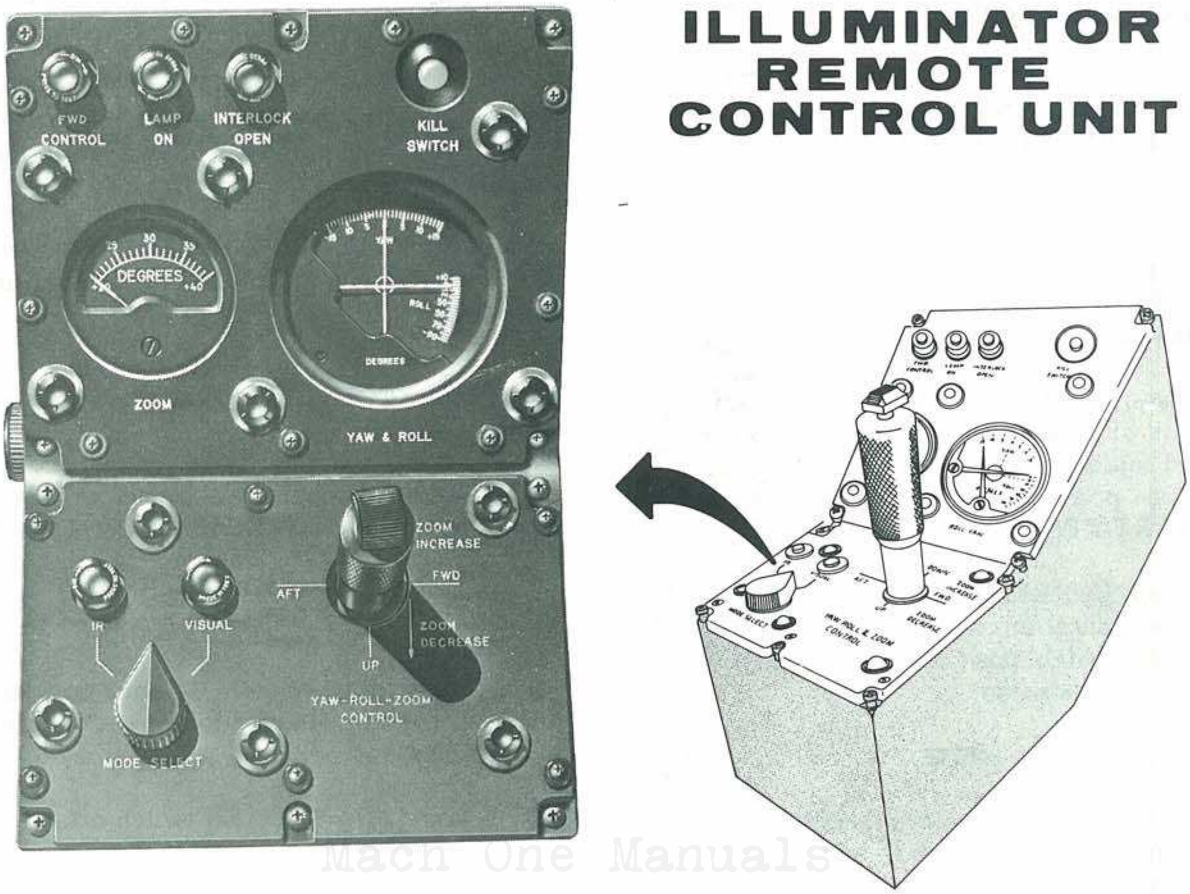


Figure 4-43

2. Start APU to supply power to illuminator's self-contained transformer/rectifier unit.

3. Manually deploy lamphouse to full extent of travel.

NOTE

Turn drive shaft ratchet on deploy drive assembly counterclockwise for deployment, clockwise for retraction. Tighten knurled knob to lock drive shaft in place.

4. Check APU voltmeter for 115 ± 3 volts.

5. Position MAIN POWER switch ON.

6. Connect remote control unit at navigator's station.

7. Press-to-test all indicator lights on control panel and remote control unit.

8. Check that all INTERLOCK indicator lights on control panel and all indicator lights on remote control unit are extinguished.

CAUTION

Do not attempt to start lamp if a malfunction is indicated.

9. Position MODE SELECT switch to VISUAL.

10. Position CONTROL SELECT switch to AFT.

11. Set LAMP INTENSITY CONTROL switch to 8KW.

12. Rotate lamphouse to full down position (60 degrees) with YAW-ROLL-ZOOM CONTROL handle.

13. To start lamp operation, momentarily position LAMP switch to START/RESET.

NOTE

Positioning the switch to START/RESET initiates a series of three high-energy pulses for lamp starting. If the lamp fails to start on any of these pulses, the LAMP FAILURE indicator light will illuminate. To reset the system and initiate another series of start pulses, again position the LAMP switch to START/RESET.

14. Check CURRENT and VOLTAGE indicators for proper indications at each LAMP INTENSITY CONTROL switch position (figure 4-41). Return switch to 8KW position.

NOTE

To insure an accurate indication, main pump should be operating approximately 15 minutes to warm up the system.

15. Position MODE SELECT switch on control panel and remote control unit to IR.

16. Check that coolant pressure is 175-250 psi.

17. Check that coolant temperature is 45°-135°F.

18. Position CONTROL SELECT switch to FWD and check operation from remote control unit as follows:

a. Check zoom operation on ZOOM indicator by operating thumbswitch on YAW-ROLL-ZOOM CONTROL forward and aft.

b. Position MODE SELECT switch to VISUAL and verify lamp changes to visual operation. Return switch to IR.

c. Depress KILL SWITCH and check that illuminator lamp and LAMP ON indicator lights on control panel and remote control unit are extinguished.

d. Check that YAW & ROLL indicator indicates -60 degrees roll.

e. Check yaw and roll movement of lamphouse with YAW-ROLL-ZOOM CONTROL. Return lamphouse to full down (-60 degrees) position.

19. Position CONTROL SELECT switch to NOS and check yaw and roll control of illuminator from NOS station.

20. Return CONTROL SELECT switch to AFT position.

21. Position lamphouse to 0 degrees yaw and 0 degrees roll with YAW-ROLL-ZOOM CONTROL.

CAUTION

Lamphouse must be in 0-degree position before being retracted to prevent damage from mount.

22. Position MAIN POWER switch off.

NOTE

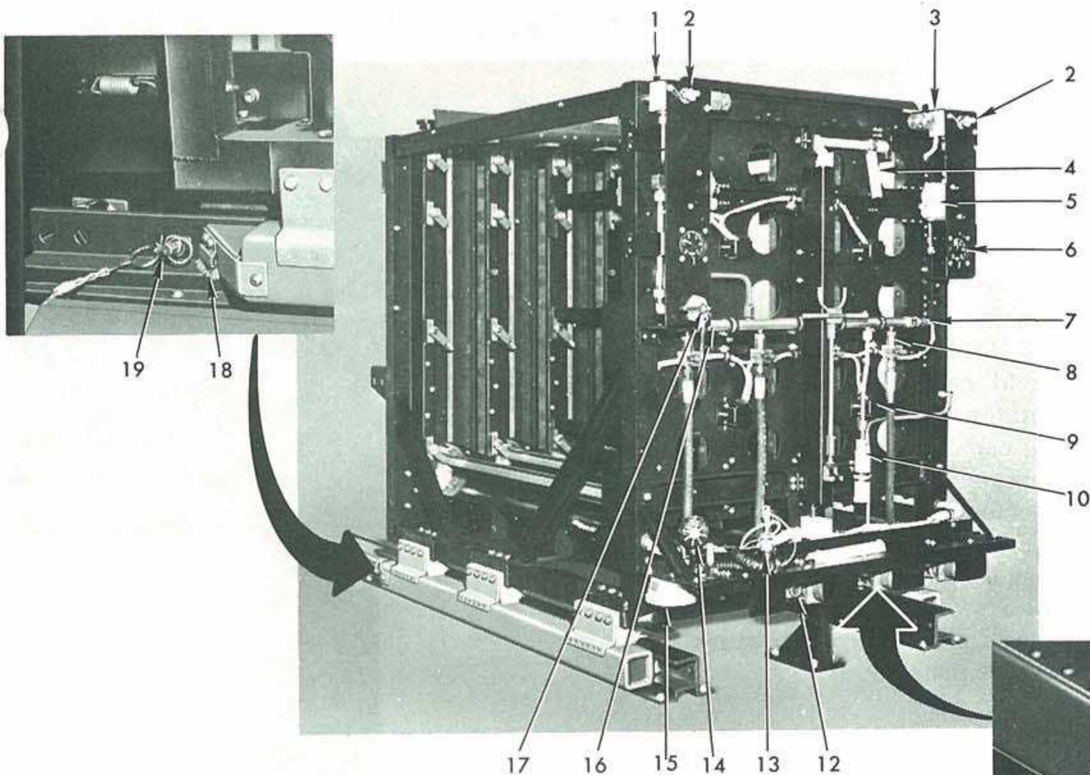
Power to the cooling system is interlocked by a time delay relay to cool down the illuminator. The cooling system pump will continue to run for approximately 2 minutes after main power is turned off.

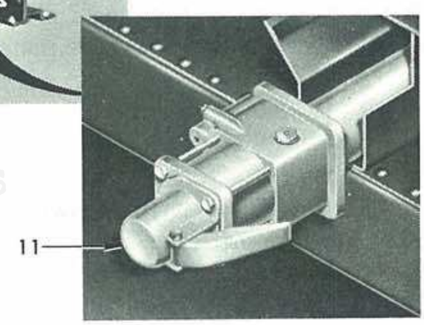
23. Manually retract lamphouse.

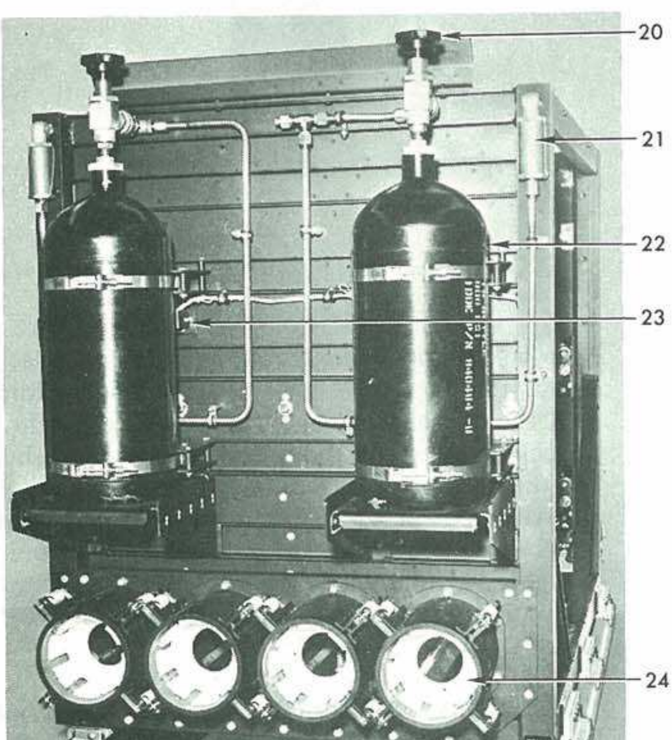
FLARE LAUNCHER.

A four tube, semiautomatic, LAU-74/A flare launcher (figure 4-44) is installed in the aft right side of the cargo compartment at the paratroop door opening. Major components of the launcher are the launcher assembly, a hand-held control panel, associated electrical harnesses, and mounting equipment. The launcher assembly includes two compressed air reservoirs; one supplies pressurized air for ejecting flares, the other supplies pressurized air for jettisoning the launcher. The launcher has a capacity for storing and launching 24 MK24, Mod. 4 and LUU-1/B flares/markers. Flare ejectors, located on the rear of the launcher behind each launch tube, are electrically controlled by the launcher control panel. In the event of electrical

FLARE LAUNCHER INSTALLATION







1. LAUNCH SYSTEM INDICATOR LIGHT
2. FILLER VALVE (2 PLACES)
3. JETTISON SYSTEM INDICATOR LIGHT
4. MANUAL JETTISON LEVER
5. PRESSURE REGULATOR (2 PLACES)
6. PRESSURE GAGE (2 PLACES)
7. PRESSURE SWITCH
8. EJECTOR SHUTOFF VALVE (4 PLACES)
9. FIRE DETECTOR (2 PLACES)
10. RELIEF VALVE
11. MANUAL EJECTOR VALVE (4 PLACES)
12. ELECTRICAL RECEPTACLE
13. GROUNDING PLUG
14. UTILITY LIGHT
15. WARNING HORN
16. PRESSURE MANIFOLD
17. SHUTOFF VALVE
18. BRUSH
19. PIN WITH STREAMER (REMOVE BEFORE FLIGHT)
20. SHUTOFF VALVE (2 PLACES)
21. FILTER (2 PLACES)
22. COMPRESSED AIR RESERVOIR (2 PLACES)
23. FIRE DETECTOR (4 PLACES)
24. EJECTOR (4 PLACES)

Figure 4-44

failure, the ejectors can be operated manually by a lever on the ejector valve assembly. Provisions are made to jettison the launcher manually, electrically, or automatically in the event of an emergency. Power for launcher operation is 28 volts dc supplied by the main dc bus and protected by a 5-ampere circuit breaker located on the right main junction box. The launcher jettisoning system is powered from the aircraft battery through a 5-ampere circuit breaker located on the right main junction box.

Flare Launcher Control Panel.

A walk-around, hand-held control panel (figure 4-45) provides the operator with flare launching and launcher jettisoning capabilities from various locations in the fuselage. The control panel remotely monitors the launcher assembly firing circuit status through READY LIGHTS located on the panel. Flare launching is controlled by pressing PUSH TO FIRE FLARES switches on the panel. Jettisoning of the launcher is initiated by activating the JETTISON switch on the panel.

Pilot's Jettison Switch.

A flare launcher jettison switch, guarded in the NORMAL position, is located on the pilot's overhead panel. The switch enables the pilot to jettison the flare launcher, should an emergency occur, by placing the switch to the JETTISON position.

Normal Operation of the Flare Launcher.

Flares are electrically launched (figure 4-46) by depressing the No. 1, 2, 3, and 4 PUSH TO FIRE FLARES switches on the control panel. As the flares in the tubes are ejected, another set automatically drops into position for launch when the firing mechanism returns to a ready-fire condition. The flares can be manually fired in the event of an electrical power failure by manually tripping the firing mechanism.

Emergency Launcher Jettisoning.

AUTOMATIC JETTISONING. (See figure 4-47.) The flare launcher will be automatically jettisoned when one or more of the six fire detectors located on the launcher assembly closes in response to a temperature above 450°F. The audible warning

FLARE LAUNCHER CONTROL PANEL

Figure 4-45

horn will sound immediately and, after a 2-second delay, the explosive bolt in the jettison actuator will be detonated and the launcher will be propelled along its mounting rails and overboard by the jettison actuator. During jettisoning, the electrical power source connector on the control panel cable is automatically disconnected from the launcher by a lanyard. The control panel, attached cable, and jettison actuator piston remain with the aircraft.

ELECTRICAL JETTISONING. (See figure 4-47.) The flare launcher may be jettisoned electrically by positioning the pilot's jettison switch to JETTISON or by positioning the JETTISON

FLARE LAUNCHER LAUNCH SYSTEM

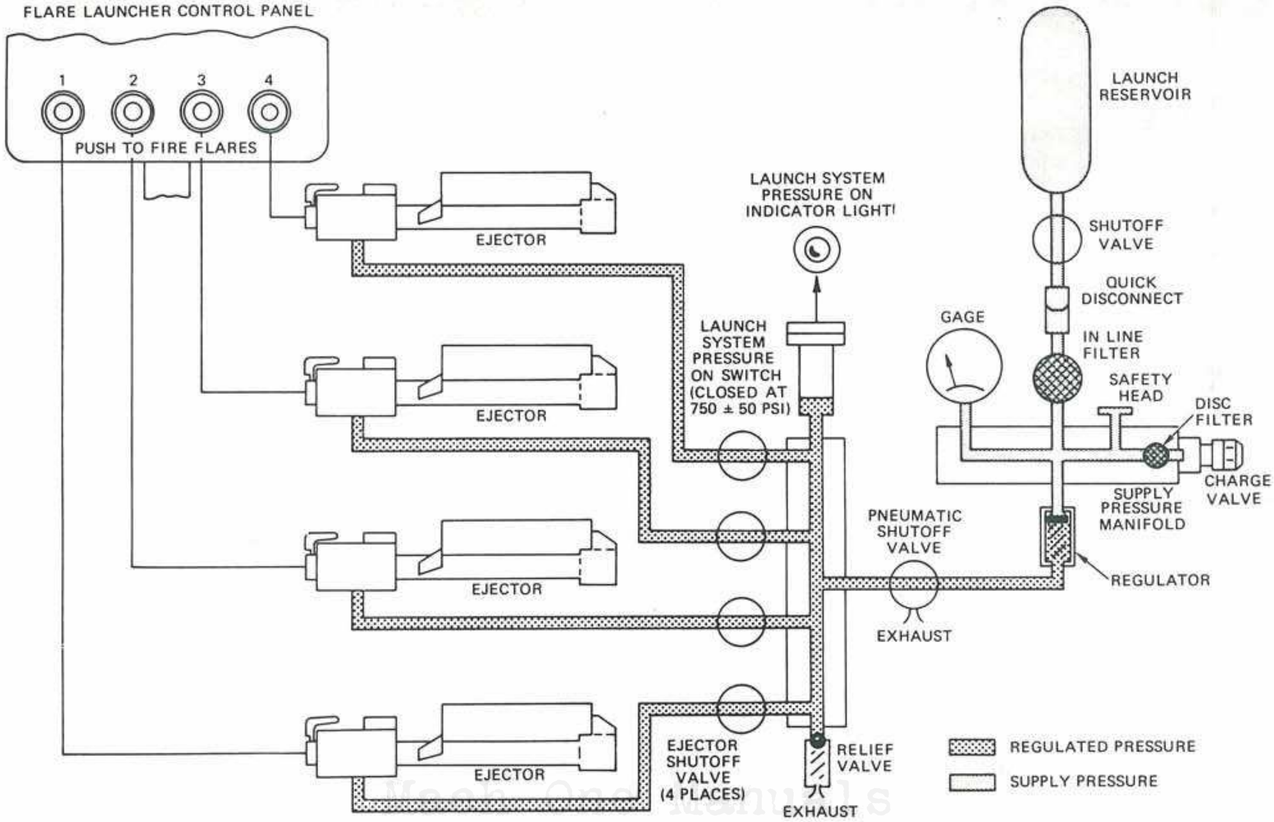


Figure 4-46

switch on the flare launcher control panel to ON. The jettisoning sequence will be identical to that described in AUTOMATIC JETTISONING.

MANUAL JETTISONING. In the event the flare launcher fails to jettison automatically or electrically, it may be manually jettisoned by raising the manual jettison lever (figure 4-44) and hand-pushing the launcher overboard. As in automatic and electrical jettisoning, the control panel, attached cable, and jettison actuator piston remain with the aircraft.

GUNNERY EQUIPMENT.

Four GAU-2B/A aircraft machine guns are mounted on the left side of the cargo compartment between stations 337 and 461. The guns are installed on the MXU-470/A module (figure 4-48). Each gun consists of a rotor assembly, six bolt assemblies, six removable tracks, gun housing, safing sector, housing cover, guide bar, rear gun support, six barrels, and barrel clamp. An ammunition storage rack is installed on the right side of the cargo compartment between stations 319 and 479. A ram air cooling system provides a continuous flow of outside air to the four gun stations. The system consists of four ram air scoops which direct ram air through cooling tubes to the gun stations.

GUN SYSTEM.

The MXU-470/A module is designed for fixed installation in an aircraft for air-to-ground firing missions. The module consists of a GAU-2B/A aircraft machine gun, linkless ammunition storage and feed system (containing a maximum of 2000 rounds of ammunition when loaded), battery power supply, and an electrical control package and stand. The module is capable of firing either 3000 or 6000 rounds per minute and may be power or manually loaded.

FLARE LAUNCHER JETTISON SYSTEM

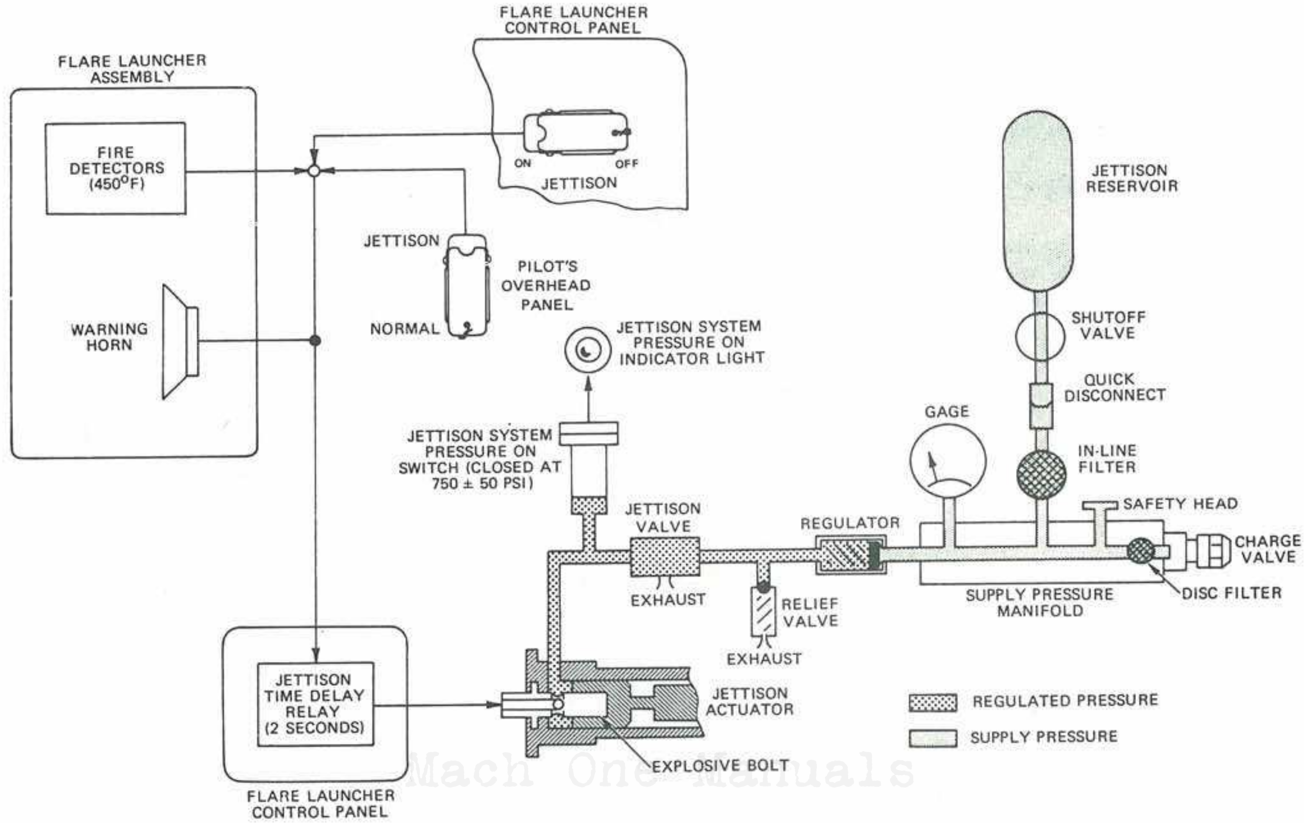


Figure 4-47

Gun Installation.

Two metal frame structures are installed along the left side of the cargo compartment floor; one between stations 319 and 391 (approximate) and one between stations 391 and 479 (approximate). Each platform provides support and mounting points for two module assemblies. One screwjack on the rear of the MXU-470/A module provides elevation adjustment. (See figure 4-49.)

Control Panel.

The gun control panel (figure 4-50), located on the aft right side of the fuselage above the ammunition rack, provides fire control for each of the guns. FIRING RATE selector switches, located on the panel, afford a selection of HI or LO rate of fire. FIRING POWER switches, also located on the panel, connect 28-volt dc to the FIRING RATE selector switches. The FIRING POWER switches must be on before the FIRING RATE selector switches will function. A BURST LENGTH timer can be set to limit the length of each gun burst, by selecting the TIMED mode on the BURST MODE selector switch. With the BURST MODE selector switch in MANUAL, the guns will fire as long as the trigger is depressed.

Ammunition Storage Rack.

The ammunition storage rack is installed along the right side of the cargo floor between fuselage stations 319 and 479 (approximate). The rack is capable of storing 18 1500-round containers of belted ammunition. Each container is supported and restrained during the course of the mission, yet they are readily removed from the rack durin periods of reloading.

MISCELLANEOUS EQUIPMENT.

Except for the following all information is contained in T.O. 1C-119G-1.

7.62MM GUNS

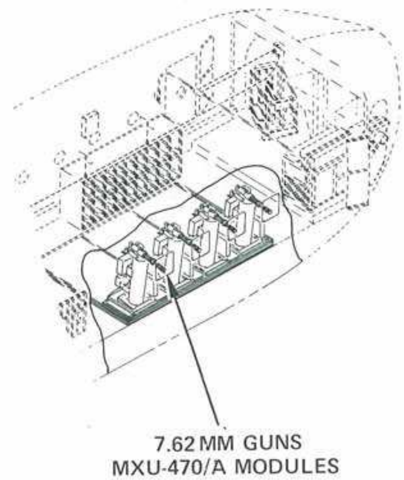


Figure 4-48

ARMOR PROTECTION.

The aircraft is equipped with an armor system (figure 4-51) which protects crewmembers from hostile enemy fire. The armor system provides protection for each crewmember in the flight compartment. Protective armor is installed on the cargo compartment floor to provide protection for the gunners. The armor material consists of a hard ceramic-fiberglass composite. The ceramic material is applied to the fiberglass laminate in a tile grid network. The armor is installed so that the ceramic face is exposed to impacting projectiles. A post flight examination of armor components shall be made after every mission. Although the armor is capable of withstanding multiple impacts, damaged components should be replaced as soon as possible.

CREW COMPARTMENT ACRYLIC WINDSHIELD AND SIDE WINDOW INSTALLATION.

The aircraft is equipped with transparent stretched acrylic plastic panels for protection of the crew from flying glass resulting from projectile impacts. The stretched acrylic panels are used behind the existing windshield and are substituted in place of the existing side windows. Ordinary glass and unstretched acrylic plexiglass will shatter if impacted by projectiles. The stretched plexiglass does not shatter after impact but remains intact except for a hole the size of the projectile core.

GUN AZIMUTH AND ELEVATION SCALES

MXU-470/A MODULE

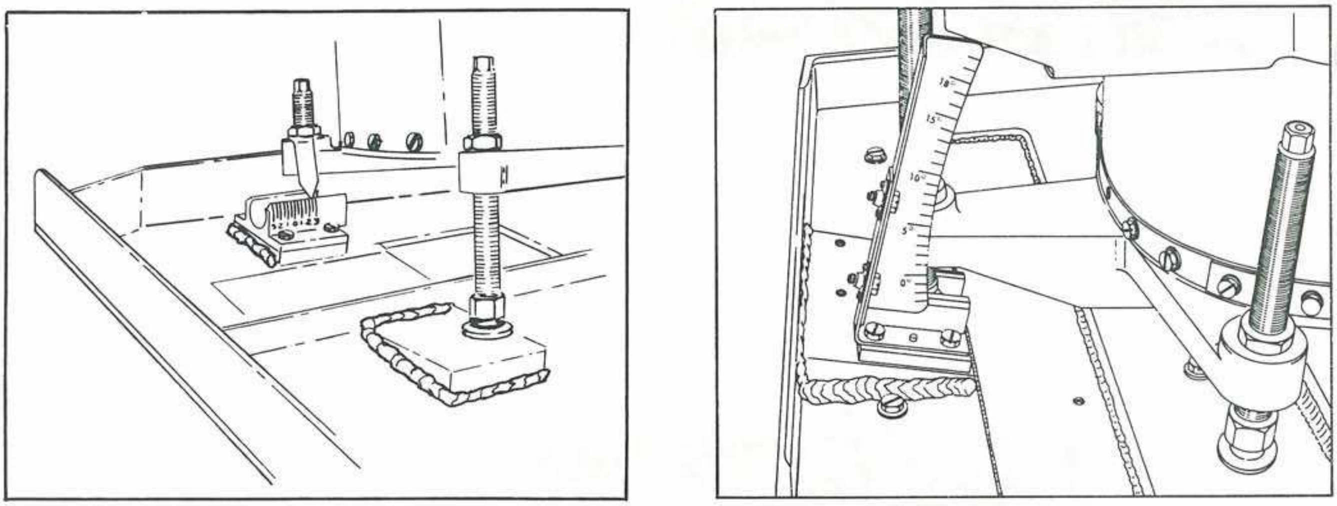
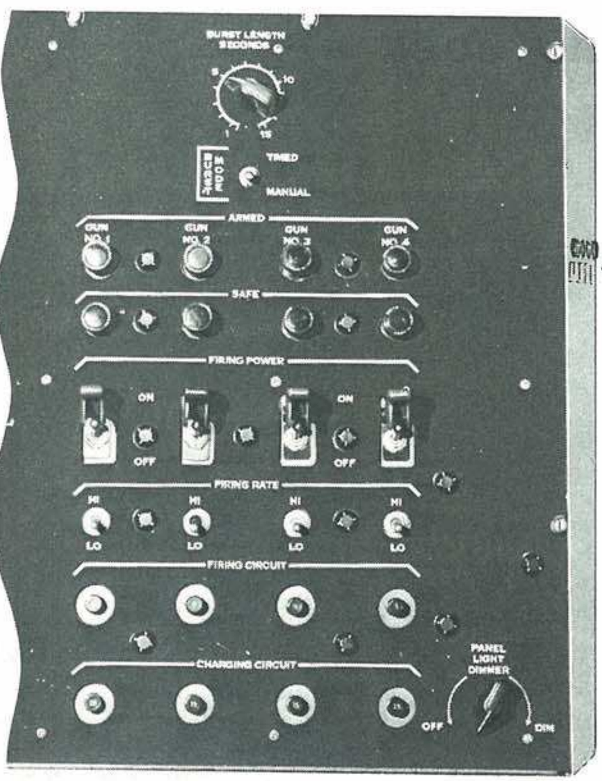
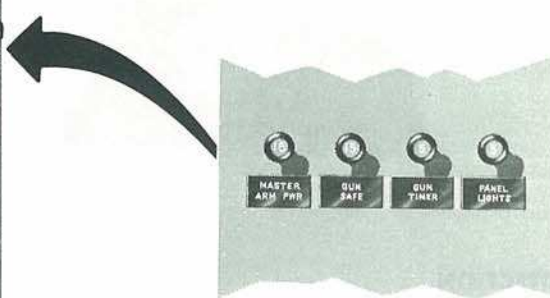


Figure 4-49

GUN CONTROL PANEL





CIRCUIT BREAKERS

Figure 4-50

ARMOR PROTECTION TYPICAL

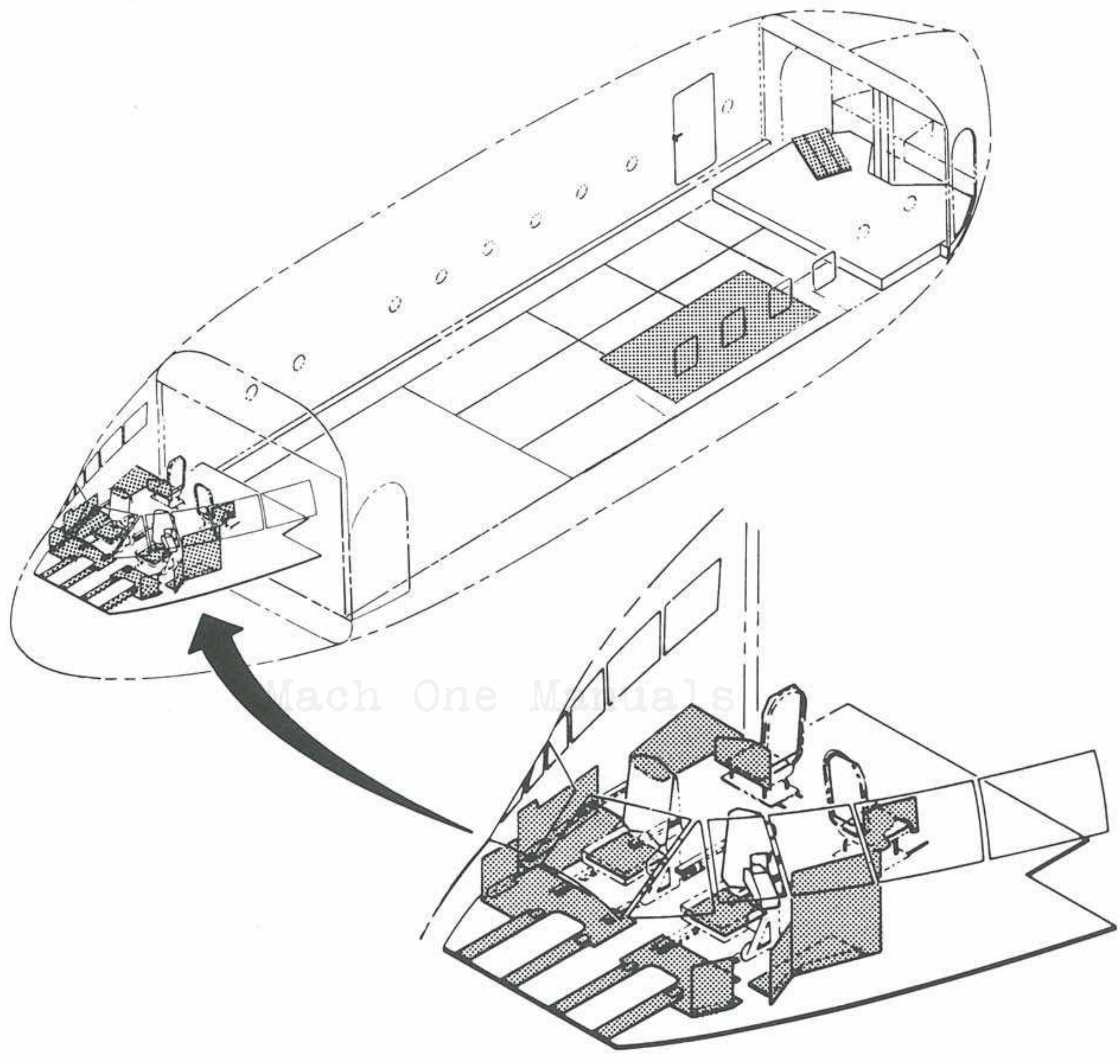


Figure 4-51.

SECTION V

OPERATING LIMITATIONS

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INSTRUMENT RANGE MARKINGS.

Except for the following all information is contained in T.O. 1C-119G-1.

Instrument range markings applicable to the AC-119G aircraft are shown pictorially in figure 5-1 as they appear on the aircraft.

MINIMUM CREW REQUIREMENTS.

The minimum crew required for the AC-119G aircraft consists of pilot, copilot, flight mechanic, and illuminator operator. Additional crewmembers, as required, will be added at the discretion of the Commander.

The following information is contained in T.O. 1C-119G-1.

ENGINE LIMITATIONS.

AUXILIARY POWER UNIT LIMITATIONS.

APU EXHAUST GAS TEMPERATURE LIMITATIONS.

During start cycle	1310°F
Operating:	
Normal:	
No Load	590°—600°F
Full Load	600°—750°F
Full Load (steady state)	1225°F
Maximum Allowable	1275°F

APU GENERATOR LIMITATIONS.

VOLTAGE:	
Undervoltage	97.5 Volts
Normal	115 ± 3 Volts
Overvoltage	130 Volts
FREQUENCY:	
Underfrequency	380 cps
Normal	399—408 cps

APU ENGINE RPM LIMITATIONS.

Normal	100 ± 2% RPM
Overspeed	105—110% RPM

INSTRUMENT RANGE MARKINGS

FLARE LAUNCHER LAUNCH PRESSURE

- ● 3150 PSI MAXIMUM
- ● 1000 PSI MINIMUM FOR SALVO LAUNCH
- ● 750 PSI MINIMUM FOR SINGLE LAUNCH

FLARE LAUNCHER JETTISON PRESSURE

- ● 3150 PSI MAXIMUM
- ● 2000 PSI MINIMUM

SMOKE EVACUATION AIR PRESSURE

- ● 3000 – 3500 PSI NORMAL OPERATION
- ● 500 – 3000 PSI LIMITED OPERATION
- ● 500 PSI MINIMUM FOR OPERATION

Figure 5-1

APU AUTOMATIC SHUTDOWN SYSTEM LIMITATIONS.

The APU will be shut down automatically when any of the following limits are exceeded:

VISUAL INDICATION	LIMIT	TOLERANCE
OVERCURRENT light illuminated	250 amp	10-30 seconds
UNDERSPEED light illuminated	95% rpm	Immediate shutdown
UNDERVOLTAGE light illuminated	97.5 volts	10 seconds
OVERVOLTAGE light illuminated	130 volts	Immediate shutdown
LOW OIL PRESS. WARNING light illuminated	37 ± 3 psi	Immediate shutdown
FREQUENCY meter indicates underfrequency	380 cps	Immediate shutdown
Tachometer indicator indicates overspeed	105-110% rpm	Immediate shutdown

The following information is contained in T.O. 1C-119G-1.

ALTERNATE FUEL GRADE LIMITATIONS.

PROPELLER LIMITATIONS.

TURNING LIMITATIONS.

AIRSPEED LIMITATIONS.

PROHIBITED MANEUVERS.

CENTER-OF-GRAVITY LIMITATIONS.

WEIGHT LIMITATIONS.

Except for the following all information is contained in T.O. 1C-119G-1.

Weight, more than any other single factor, will determine the capability and performance of the aircraft. In the designing of an aircraft, weight has always been a primary restrictive factor, as it has a direct effect on an aircraft's configuration, power, and range. An aircraft is designed with sufficient strength to accomplish a certain basic mission without undue allowance for overloading or improper weight distribution. Every effort is made to eliminate unnecessary weight; on the other hand, the weight penalty for making an aircraft foolproof is prohibitive. Weight limitations, therefore, are necessarily involved in the operation of the aircraft. If these limitations are exceeded, a loss in the performance of the aircraft is inevitable and structural failure is quite probable. When an aircraft is loaded beyond the established limits, ceiling and range are decreased, control forces and stalling speed become higher, and the rate of climb falls off rapidly as the maximum gross weight is exceeded. The takeoff and landing rolls increase appreciably with an increase in gross weight. Likewise, the brakes are insufficient to brake the forward momentum of the aircraft, and the wings are more vulnerable to air loads during maneuvers or flight through turbulent air. These resultant effects can reach serious proportions when the weight limitations of a specific aircraft are disregarded. A consideration of the weight factors involved, particularly as they apply to this aircraft, appears in the succeeding paragraphs.

WEIGHT AND LOADS.

Gravity Effects.

Due to the effect of gravity on the mass of the aircraft, the aircraft possesses weight. More exactly, this weight is a force which gravity exerts on the material used in the fabrication of the aircraft and which pulls the aircraft toward the earth. In any condition of static equilibrium during straight and level flight or at rest on the ground, the aircraft is subjected to this pull of gravity, the strength of which is spoken of as 1g. As fuel, armament, crewmembers, and additional equipment are added in order that the aircraft may accomplish a specific mission, the weight of the aircraft correspondingly increases, and the additional weight constitutes a force acting on the aircraft structure. The weight of the aircraft, or the force which gravity imposes on the aircraft, may also be considered as a load. On the ground this load must be sustained by the landing gear; in flight, by the wings. There is a limit to the load which the landing gear is capable of supporting during taxi, takeoff, and landing operations; there is, likewise, a limit to the load which the wings can sustain in flight.

Maneuvering.

During maneuvering and flight through turbulent air, additional loads are imposed on the aircraft. These loads, caused by the acceleration of the aircraft, are the result of forces which, in addition to that of gravity, act upon the total mass of the loaded aircraft. Both these forces tend to produce undesirable and potentially dangerous loads on the aircraft structure and its members. This is particularly true of the wings which must sustain the aircraft in flight. When the weight of the aircraft is increased, the wings become more and more vulnerable to the loads imposed by sudden changes in air currents or manipulation of the controls. The ultimate strength of the aircraft structure is eventually exceeded by the combined forces of weight and air loads. When this condition occurs, structural failure results. As the maximum weight which the aircraft can safely carry is dependent upon distribution of the weight throughout the aircraft and its capacity to sustain air loads in accelerated flight, an understanding of weight limitations is required to accomplish a mission successfully.

LOAD FACTORS.

Symmetrical Loading.

A load factor is the ratio of the load imposed on the aircraft when accelerated in any direction as compared with the load imposed on the aircraft by gravity in any condition of static equilibrium. The load factor denotes the strength of the forces acting on the aircraft due to sudden changes in air currents and manipulation of the controls, and is expressed by the term g, which is the gravitational force. By definition, then, all aircraft at rest on the ground or in straight and level flight possess a load factor of 1g because the force acting upon the aircraft under either of these conditions is merely that of gravity. When the aircraft enters a region of turbulent air or the pilot elects to maneuver the aircraft, additional forces are imposed on the structure. The additional load on the wings resulting from these forces is expressed in relation to the gravitational force and referred to as 0.5g, 2.0g, 3.0g, etc, which means that the forces exerted on the wing structure and its members are 0.5, 2, or 3 times the force exerted by gravity. For example, if the normal weight of the aircraft is 60,000 pounds and the load factor at some given moment of accelerated flight is 3.0g, the total force which the wings must sustain is 180,000 pounds or three times the normal weight of the aircraft in straight and level flight.

Asymmetrical Loading.

Additional forces imposed on the wings are not always symmetrically disturbed, as in a rolling pull-out maneuver. When the overall wing load becomes too unequally disturbed, excessive shear stresses are applied to one side of the wing mounting structure. Thus, it becomes necessary to establish design criteria for specifying the extent of asymmetrical wing loading which the aircraft must support. In the case of this aircraft, it is required that the aircraft structure be capable of sustaining 100% of design stress on one wing while simultaneously sustaining not less than 85% on the other. For example, at the design gross weight of 64,000 with a full fuel load, the design wing load factor is 3.0g. In level flight, the load on each wing would amount to 32,000 pounds. But if due to heavy turbulence or maneuvering flight, a 3.0g load factor is imposed on one wing, the total load on that wing becomes 96,000 pounds, or three times the normal amount. Then in order to avoid a dangerously unequal load distribution, the other wing must carry at least 85% of that amount or 81,600 pounds.

MARGIN OF SAFETY.

The margin of safety is the range of forces which exist between two points, one of which is the load factor the aircraft is sustaining at any given moment and the other is the load factor at which structural damage will occur. If, for example, the aircraft is incapable of sustaining a load factor greater than 3.0g and during flight through turbulent air is subjected to a force of 1.5g, the margin of safety at this particular moment is 1.5g. When fuel and cargo loads are increased, the margin of safety decreases. This increase in weight actually becomes a component of the forces acting on the aircraft, and, as such, lessens the capacity of the aircraft to sustain further loads due to accelerated flight. For this reason, it is advisable in loading an aircraft to maintain a margin of safety which will never be exceeded during any period of flight. Experience has shown that an aircraft should never be overloaded to the point where it cannot make good a load factor of 2.0g because almost any mission, even with ideal conditions, will subject the aircraft at one time or another to load factors of at least 2.0g.

WARNING

If the combined weight of armament and fuel is such that the aircraft is incapable of sustaining a force of 3.0g, turns and pullouts should be made with caution to minimize the resulting air loads.

EXPLANATION OF THE CHART.

Except for the following all information is contained in T.O. 1C-119G-1.

The Structural Weight Limitations chart (figure 5-2), is intended to present graphically the weight-carrying capabilities of the aircraft as defined by the various structural limitations to permit safe and efficient operation. Through the use of the chart, the flight planner is aided in recognizing the structural weight limitations which may restrict operation in a specific mission and in determining what margin of safety may be established.

NOTE

Although the chart indicates the structural limitations involved in the loading of the aircraft, the authority for operation of the aircraft at a given gross weight remains the responsibility of the local authority.

The Takeoff Gross Weight Limit curves, Appendix I, Part 3, complement the criteria presented on the Structural Weight Limitations chart by providing limiting gross weights throughout the whole range of altitudes and atmospheric conditions which might conceivably be encountered.

Gross Weights.

The data in the Structural Weight Limitations chart are based on the basic operating weight of the aircraft exclusive of the munitions and the fuel required for the mission but including the following items: crew; fuel, oil, and water; trapped fuel, oil, and water; unusable fuel; and armament equipment. Any special equipment such as jacks, troop seats, wheel chocks, tool boxes, etc, are considered to be special load items and, when carried, should be computed as part of the load to use the Structural Weight Limitations chart. The zero point of the chart at the junction of the fuel- and load-carrying capacity axis represents a basic operating weight of 51,226 pounds. As individual basic operating weights may vary, it will be necessary to adjust the chart for the specific aircraft involved. The basic operating weight plus the fuel and munitions as required in a mission can be shown by gross weight lines which slope at a 45-degree angle to the axis of the chart. One diagonal, the 80,400-pound gross weight line, is the landing gear and nacelle structural strength limitation for taxi and ground handling. Any gross weight line may be plotted, by interpolation, to obtain a graphic representation of the limitations involved in the fuel-weight combination which a mission may require.

NOTE

The gross weight of the aircraft should never exceed that required for the mission, since unnecessary risk and wear of the equipment will otherwise result. Takeoff gross weights must also be considered in light of available runways, surrounding terrain, altitude, atmospheric conditions, mission requirements, and the urgency of the mission.

CAUTION

During taxiing, turning, or braking the aircraft at high gross weights, extreme caution shall be exercised to prevent damage to the aircraft. Tight turns and high taxi speeds should be avoided.

Wing Fuel Load.

At the base of the chart along the horizontal axis, the weight of the fuel normally carried in the wing tanks is indicated in thousands of pounds. Although specific wing fuel markers are provided, any amount of fuel may be carried within the range indicated by the markers. However, as the load-carrying capability of the wing is greatest when the outboard tanks are full, it is desirable to retain fuel in the outboard tanks as long as possible. The fuel management sequence is designed to meet this condition, thus retaining the greatest possible wing load factor as long as possible.

NOTE

The wing load factor lines on the chart are valid only when the fuel sequence (outboard tanks used last) in FUEL MANAGEMENT, Section VII, T.O. 1C-119G-1, is followed.

Munitions-Carrying Capability.

In any mission, range and fuel consumption directly determine the fuel which must be carried and, indirectly, the munitions which can be transported. With all wing fuel tanks filled, munitions loading is variable within the limits established by the strength and performance of the aircraft. The munitions load, as carried in the cargo compartment, appears in thousands of pounds along the vertical axis of the chart.

WING LOAD FACTORS.

The loads which the wing will sustain under different weight conditions are represented by the wing load factors on the Allowable Load Factor chart (figure 5-3). Under loading conditions which are limited by single-engine performance, the margin of safety provided by the wing load factors is adequate. However, when flight through turbulent air is anticipated, the highest practical wing factor is desirable. Note in the chart that a reduction in the munitions load is necessary to maintain a constant wing load factor as the fuel load is increased beyond that normally carried in the outboard fuel tanks. The addition of fuel in the inboard tanks will not permit an increase in munitions weight without a reduction in the wing load factor resulting. If the munitions weight is increased, the bending moment of the wings increases rapidly and the capacity of the wings to sustain air loads decreases.

NOTE

The wing load factor lines on the chart are valid only when the fuel sequence (outboard fuel tanks used last) in FUEL MANAGEMENT, Section VII, T.O. 1C-119G-1, is followed.

LANDING GEAR AND NACELLE STRENGTH.

The landing gear structure is designed for normal landings at a gross weight of 64,000 pounds. However, tests have proven the gear will withstand a landing gross weight of 72,300 pounds at a contact sinking speed of 12 feet per second ultimate. Extrapolation of this data indicates the landing gear will withstand a landing gross weight of 93,700 pounds at a contact sinking speed of 8 feet per second ultimate. The landing gear load limitation is not critical except in the case of an aborted mission. Even then, the reserve strength of the aircraft at a contact sinking speed of 8 feet per second will allow the landing to be accomplished without danger of structural failure if extra precaution is taken to assure simultaneous and even contact of both main gears. Landing gear and nacelle structural strength limitation for taxi and ground handling conditions is 80,400 pounds.

PERFORMANCE LIMITATIONS.

Except for the following all information is contained in T.O. 1C-119G-1.

In the case of two-engine aircraft, it is generally inherent that performance rather than structural limitations restricts the weight which the aircraft can carry. Obviously, the gross weight must necessarily be limited by the ability of the aircraft to take off within available runway length and clear any obstacles. But, if the runway length is sufficient, the aircraft may be loaded, as required, using the Structural Weight Limitations chart.

Power Loss and Performance.

In two-engine aircraft, the effect of an engine failure on aircraft performance is immediate. The loss of half the total thrust normally developed by both reciprocating engines and the asymmetric power condition which results produce a marked decrease in the rate of climb. The significance of gross weight and configuration immediately becomes apparent, for the aircraft with partial power is unable to maintain an adequate rate of climb at high gross weights or in a configuration with the landing gear and wing flaps extended. Power losses due to temperature, humidity, and engine variation exert a considerable influence on the rate of climb even when both engines are operating. It is not difficult to visualize the effect which engine failure will produce on the rate of climb, but it is interesting to note the remarkable difference in aircraft performance resulting from a rise in temperature and a corresponding fall in air density. The difference between a standard day (15°C at sea level) and a hot day (38°C at sea level) requires a considerable reduction in the cargo load to maintain a 100-fpm rate of climb. This reduction reflects the loss in power output of the engine at full throttle (due to the increase in carburetor air temperature) and the reduction in lift resulting from the decrease in air density. Naturally, variations of temperature and altitude within this range will give similarly graduated values in brake horsepower and rate of climb. The effect of altitude and nonstandard conditions is thoroughly examined in the Brake Horsepower Available curves and the Takeoff Gross Weight Limit curves, Appendix I.

Configuration and Performance.

The configuration of the aircraft also imposes a penalty on performance. In other than clean configurations, the increase in drag produces a decrease in the rate of climb and requires a readjustment of the gross weight at which the aircraft may be operated. As with power losses, this condition is most critical at takeoff when, of necessity, the landing gear is extended, the cowl flaps are open, and the wing flaps are at 15° deflection.

LOADING AREAS.

Some idea of the direct relationship between gross weight limitations and structural limitations may be obtained from the discussion of the loading areas in the paragraphs which follow. (See figure 5-2.)

Recommended Loading Area.

The green area on the chart represents the loading conditions that present no particular problem in regard to strength of the aircraft. Operation of the aircraft at weights outside this recommended loading area should be avoided unless the dictates of the mission require it.

Cautionary Loading Area.

The yellow area on the chart represents loading of progressively increasing risk as the red area is approached.

Not Recommended Loading Area.

The red area represents loadings which are not recommended because the margin of safety, from the standpoint of landing gear and nacelle structural limitations, is something less than the most desirable or the best practical. Under conditions of extreme emergency when safety of flight is of secondary importance, the Commander will determine if the degree of risk warrants operation of the aircraft at gross weights appearing in the red zone.

NOTE

Whenever flights are conducted at weights shown in the red area of the chart, entry of this fact in Form 781 is required.

USING THE CHART.

Except for the following all information is contained in T.O. 1C-119G-1.

A sample problem for the AC-119G aircraft, the solution of which is obtained through the use of the Structural Weight Limitations chart (figure 5-2), appears below.

Problem.

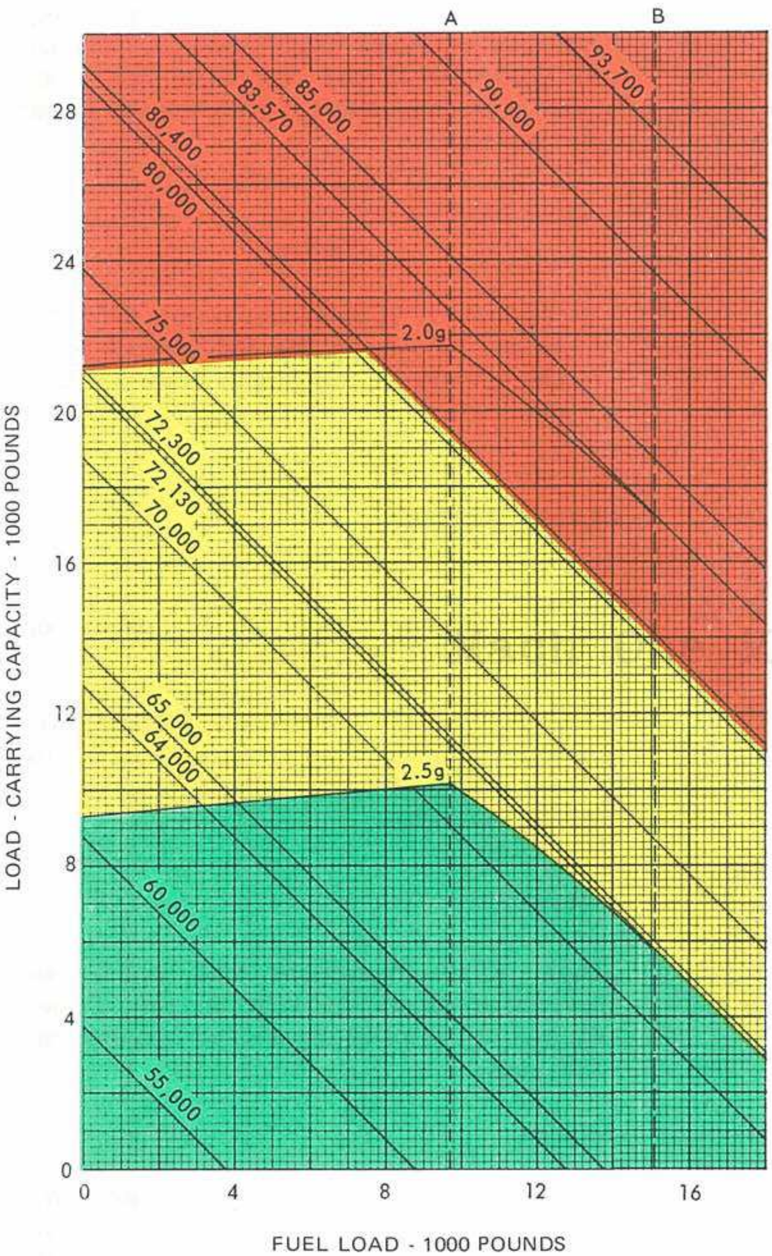
What is the munitions load which can be transported by an AC-119G aircraft if the fuel required to complete the mission is approximately 2000 gallons?

Solution.

With the range of the target established, the amount of fuel required to complete the mission can be computed and converted to weight in pounds. Using 6 pounds per gallon as the fuel conversion factor, the weight of the fuel is calculated to be 12,000 pounds. Locate this fuel load along the horizontal axis of the Structural Weight Limitations chart and proceed vertically from that point until the 2.5g wing load factor line is reached. From this point at which the fuel

STRUCTURAL WEIGHT LIMITATIONS

BASIC OPERATING WEIGHT 51,226 POUNDS



AC-119G

STRUCTURAL WEIGHT LIMITS

NOTE

64,000 LB	DESIGN GROSS WEIGHT LIMITED BY A 3.0 DESIGN WING LOAD FACTOR WITH WING FUEL.
72,130 LB	DESIGN GROSS WEIGHT LIMITED BY A 2.5 MARGINAL WING LOAD FACTOR WITH TOTAL WING FUEL.
72,300 LB	MAXIMUM LANDING GROSS WEIGHT AT A CONTACT SINKING SPEED OF 12 FT /SEC ULTIMATE.
80,400 LB	LANDING GEAR AND NACELLE STRUCTURAL STRENGTH LIMITATION FOR TAXI AND GROUND HANDLING CONDITIONS ON AIRCRAFT.
83,570 LB	DESIGN GROSS WEIGHT LIMITED BY 2.0 MINIMUM WING LOAD FACTOR WITH TOTAL WING FUEL.
93,700 LB	MAXIMUM LANDING GROSS WEIGHT AT A CONTACT SINKING SPEED OF 8 FT /SEC ULTIMATE.

USEABLE FUEL WEIGHTS: A. OUTBOARD SELF - SEALING TANKS - 9696 LB
B. TOTAL SELF - SEALING TANKS - 15,072 LB

RECOMMENDED LOADING — CAUTIONARY LOADING — NOT RECOMMENDED

Figure 5-2

weight line and the wing load factor line intersect move directly across to the load-carrying capability on the vertical axis of the chart. Note that a munitions weight of 8400 pounds may be carried in the cargo compartment under these conditions. If, however, the temperature is near standard day conditions and the urgency of the situation demands that the limitations imposed by the 2.5g wing load factor be ignored, the line from the fuel weight of 12,000 pounds may be extended to the point at which it intersects the 80,400 pound line. Proceeding left from this point, note that a munitions load of 17,200 pounds may be carried in the cargo compartment under these conditions.

ALLOWABLE G LOADS.

Since the maximum allowable load factor g is variable throughout a mission, figure 5-3 provides a means of computing this factor at any point from the beginning of the mission to return to base after a mission.

USE OF THE CHART.

A sample problem for the AC-119G aircraft, the solution of which is obtained through the use of the Allowable Load Factor chart (figure 5-3) appears below.

Problem.

What are the maximum allowable g's for the beginning of a mission, midway of the mission, and during return to base after a mission?

GIVEN:

Ramp weight	68,000 pounds
Ramp fuel	10,000 pounds
Beginning of mission fuel	9,000 pounds
Beginning ammunition and flares used	1,000 pounds
Mid-mission fuel	5,000 pounds
Mid-mission ammunition and flares used	2,000 pounds
Returning fuel	1,000 pounds
Returning ammunition and flares used	4,000 pounds

Solution.

Enter chart with ramp weight (68,000 pounds) and proceed horizontally to the right to intersect the RAMP FUEL condition. Project vertically downward from this point to the AMMUNITION AND FLARES USED grid and follow the guide lines to the applicable value (1000, 2000, or 4000 pounds). Project vertically downward from this point to intersect the GUIDE LINE. Proceed horizontally to the right from this point to the vertical grid line representing present fuel on board. Interpolation may be necessary to determine allowable load factor if the intersection of these lines is between the plotted g lines.

Maximum allowable g's are:

Beginning of mission	2.85g
Mid-mission	2.90g
Return to base	2.95g

ALLOWABLE LOAD FACTOR

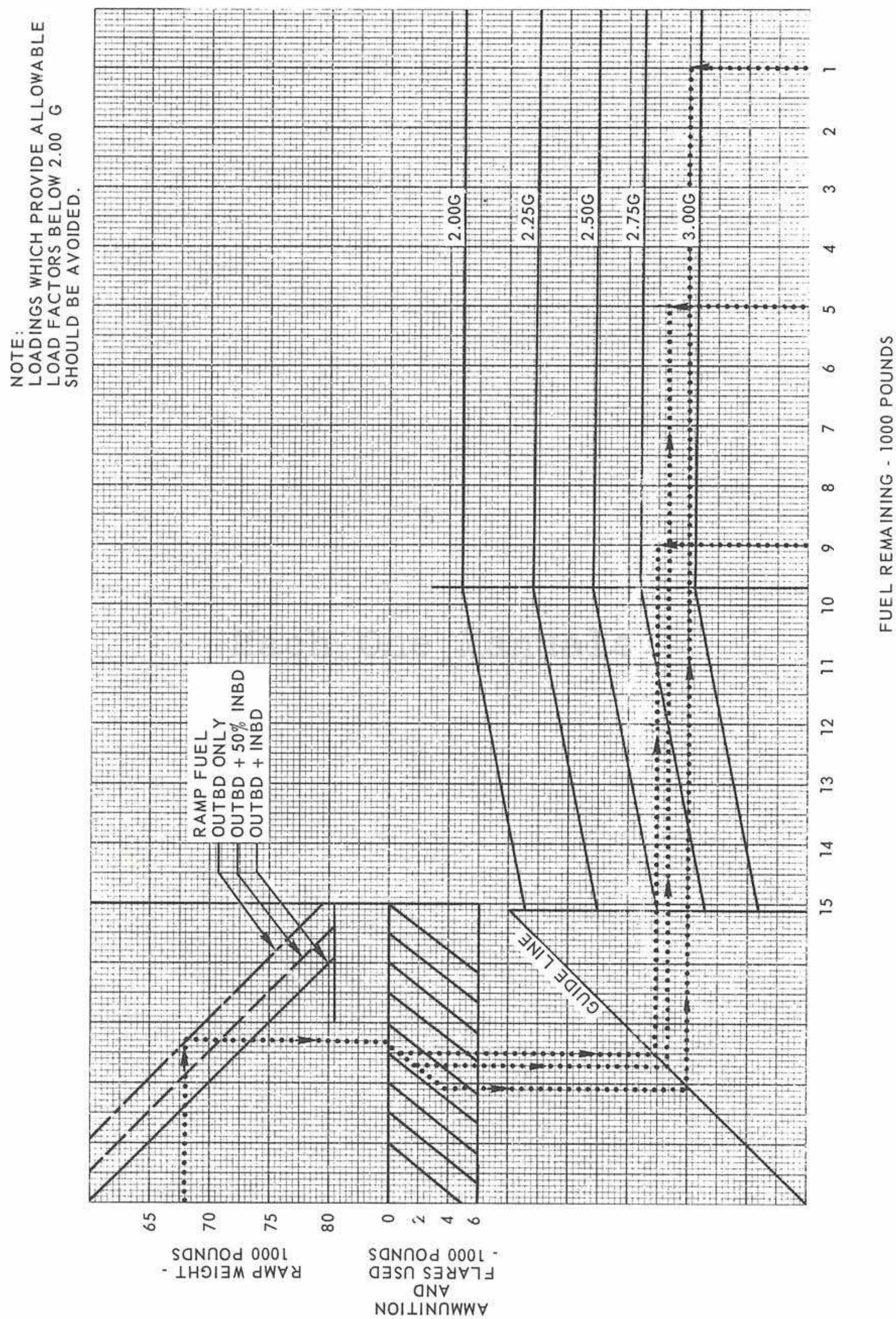


Figure 5-3

SECTION VI

FLIGHT CHARACTERISTICS

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NORMAL FLIGHT.

With normal and fully military loads, the aircraft is stable at all normal speeds. In two-engine flying there is no noticeable torque effect, and the aircraft is easily controlled in single-engine flight. Very little change in elevator and rudder trim is necessary for changes in power and speed. At low airspeeds the efficiency of the ailerons decreases, and rudder correction should be used to assist in keeping the wings level.

SPINS.

Spinning in this aircraft is prohibited. However, if an unintentional spin should occur, use the conventional procedure for recovery from the spin.

MANEUVERING FLIGHT.

The stick forces per g are comparatively low for this class aircraft. It is impossible to encounter stick reversal. Although stick force gradient in accelerated flight is within allowable specification limits, the effectiveness of the elevator for one pilot effort is such that the allowable load factor limit of the aircraft can be exceeded. Extreme maneuvering flight is prohibited.

DIVING.

Refer to the Instrument Range Markings, Section V (T.O. 1C-119G-1) for maximum speeds permitted during flight. Do not allow the airspeed to exceed the limit marking on the airspeed indicator. Use conventional methods for recovery from a dive, avoiding abrupt pullouts to prevent structural damage.

CAUTION

Elevator forces are so designed for maneuvering and formation flight that, with one arm, it is possible for the pilot to exceed the maximum allowable acceleration limits.

STALLS.

The aircraft stall warning appears 5-10 knots above power-off stall speed in the clean configuration. It appears as aileron snatch and a general buffeting throughout the aircraft which increases in intensity as a complete stall is approached.

WARNING

In the takeoff and approach configurations (wing flaps set at TAKE-OFF or LANDING) with the throttles closed (idle power condition) the aircraft will not provide adequate stall warning. In all other configurations and power settings, stall warning is adequate.

To prevent a complete stall or enable a safe recovery from one, the normal procedure of regaining airspeed and neutralizing controls should be employed as this aircraft has no abnormal characteristics during stall recovery. Refer to Stall Speeds charts, this section, for airspeeds at which stalls are calculated to occur both in and out of ground effect.

NOTE

The power-on stall speeds listed in figures 6-3 and 6-4 are the stall speeds of the aircraft with approach power. Approach power is defined as that power which is required to maintain a level-flight speed of 1.2 times the power-off stall speed. Approach power is based on the landing configuration of the aircraft with landing gear and wing flaps extended.

ACCELERATED STALLS.

Stalls while the aircraft is banked in the firing circle are characterized by aileron snatch, loss of aileron effectiveness, and increasing airframe buffet as the stall progresses. A successful recovery can be accomplished, even after the ailerons become ineffective, by rolling out of the bank with rudder alone.

POWER-OFF STALL SPEEDS

OUT OF GROUND EFFECT

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

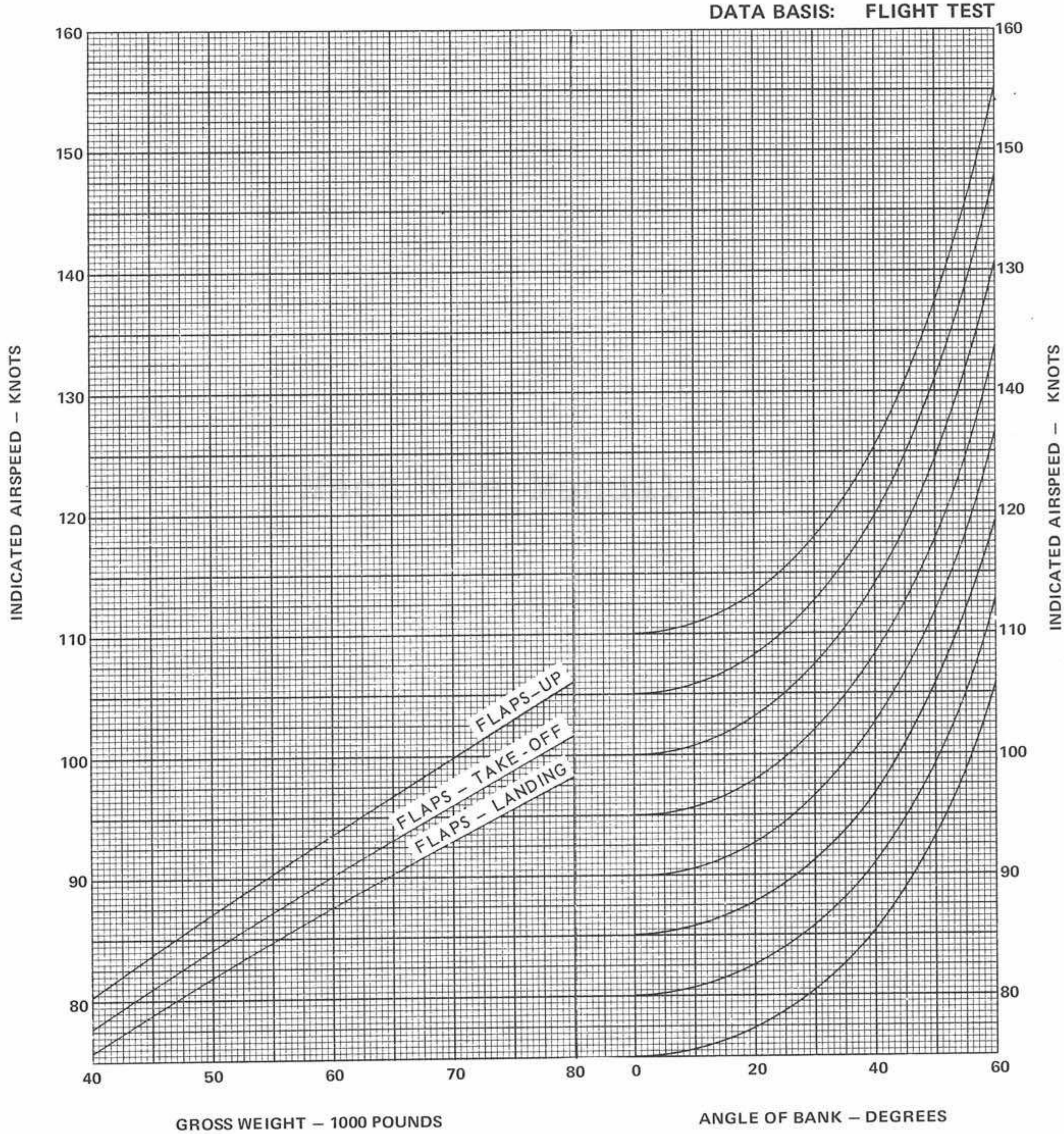

Figure 6-1

POWER-OFF STALL SPEEDS

IN GROUND EFFECT

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

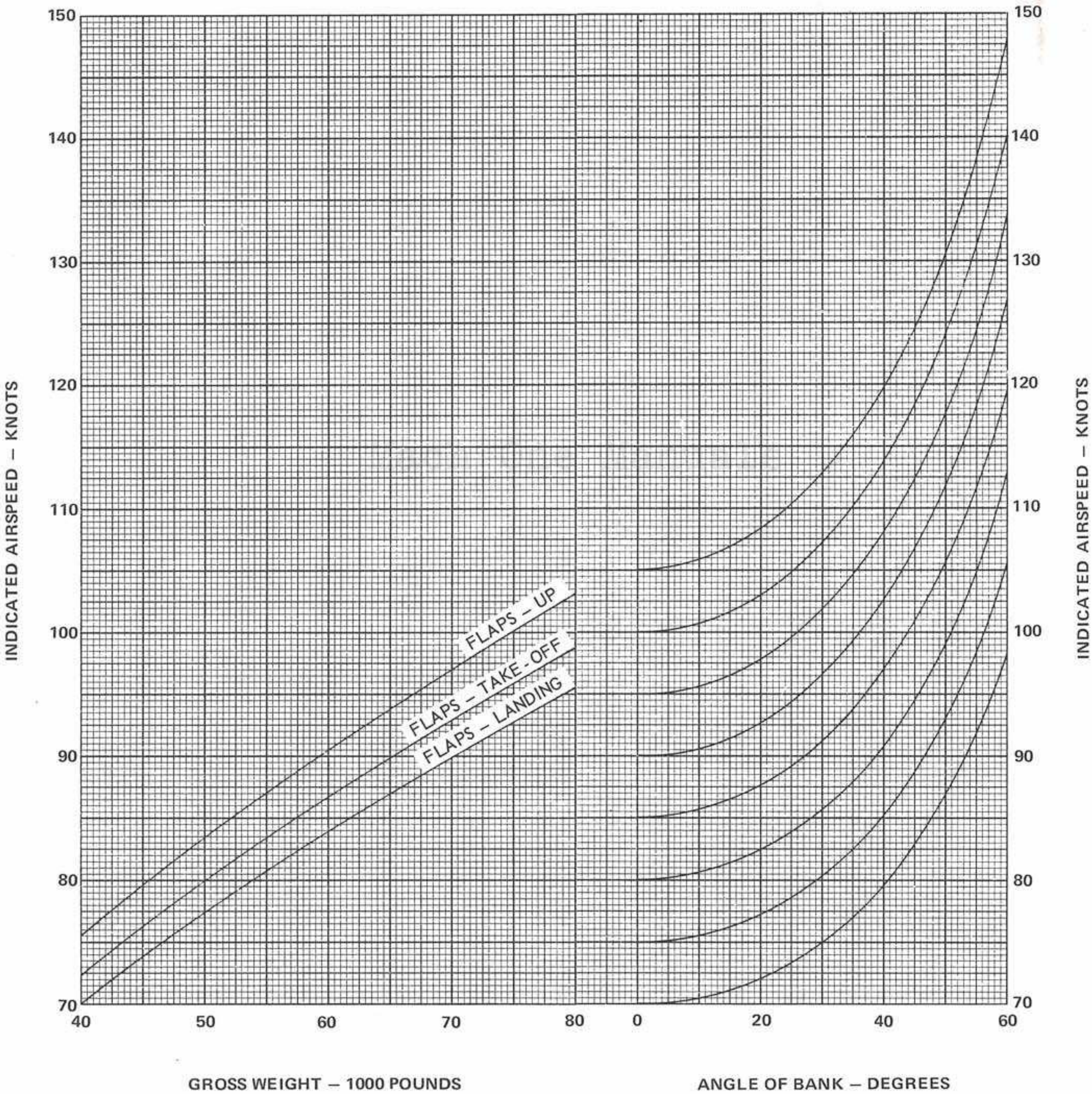

Figure 6-2

POWER-ON STALL SPEEDS

OUT OF GROUND EFFECT

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

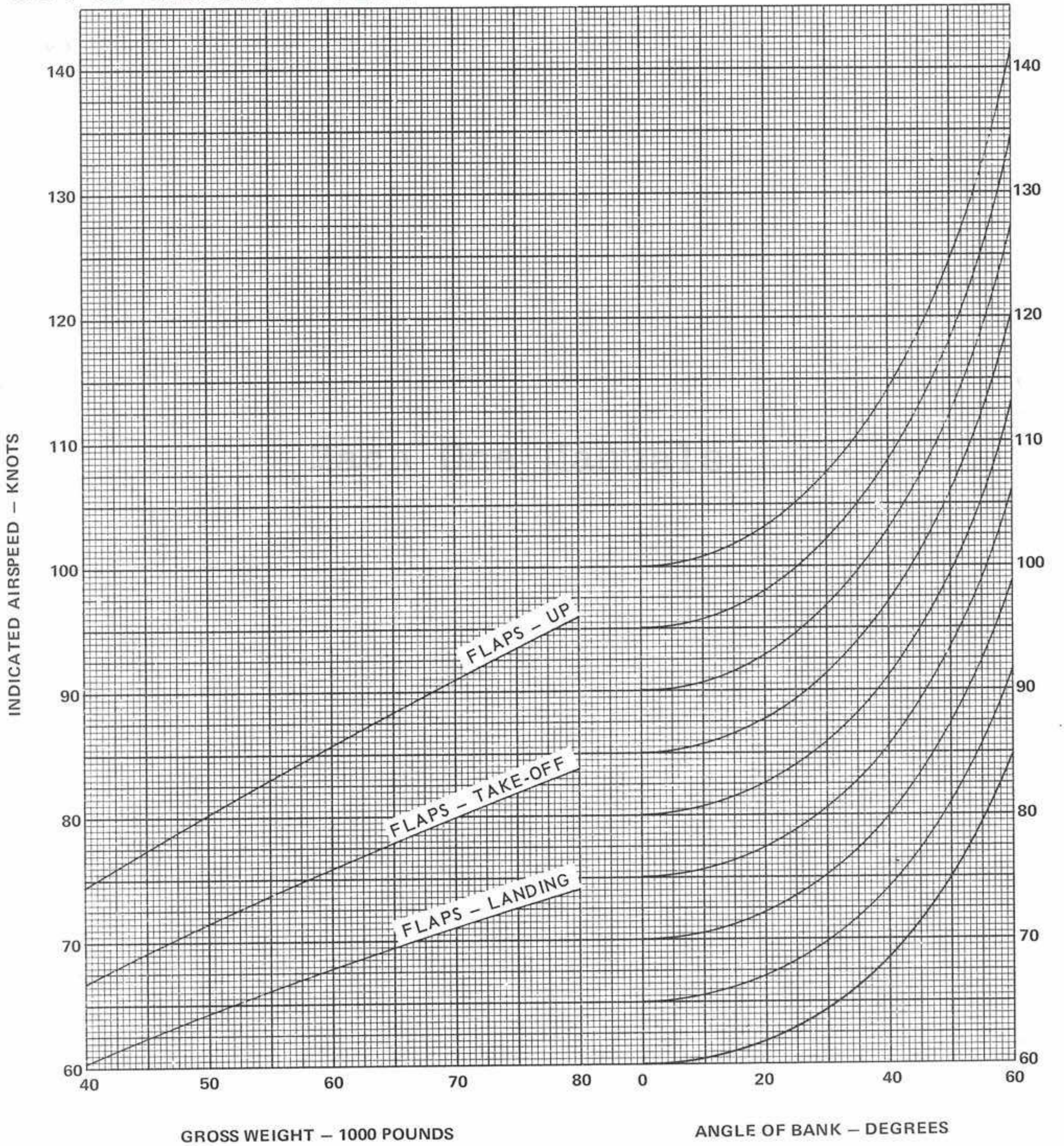

Figure 6-3

POWER-ON STALL SPEEDS

IN GROUND EFFECT

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

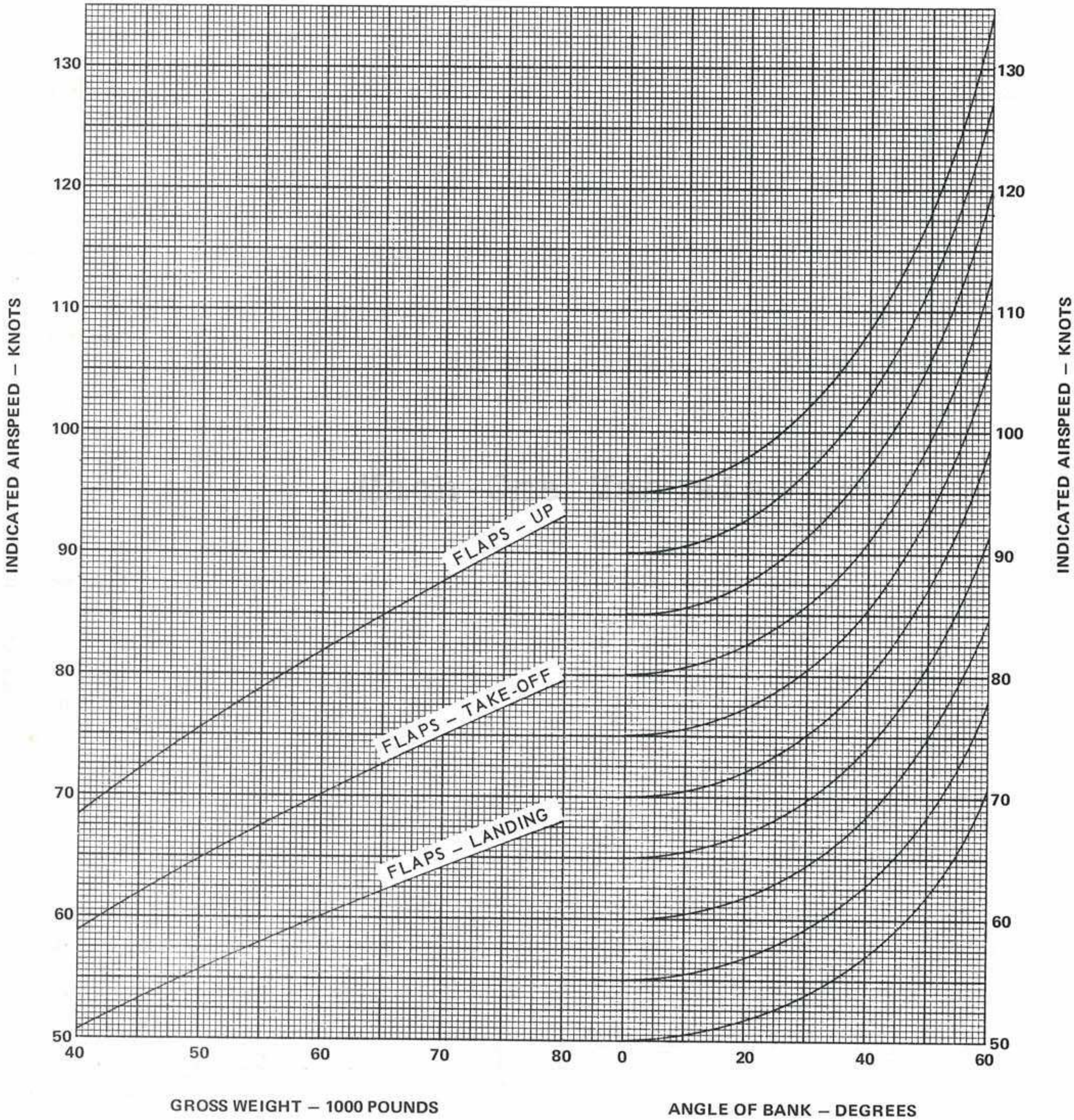

Figure 6-4

SECTION VII

SYSTEMS OPERATION

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The following information is contained in T.O. 1C-119G-1.

ENGINES.

PROPELLERS.

FUEL MANAGEMENT.

Except for the following all information is contained in T.O. 1C-119G-1.

The sequence of normal tank usage is based on the requirement for using fuel first from the tanks to which the vapor return lines are connected, in order to provide space for fuel return from the carburetors. Once this requirement has been met, the effect on wing load factors should be considered. Refer to Structural Weight Limitations chart, Section V. The wing load factor lines (2.0g and 2.5g), plotted on the chart represent the maximum g loads the wings will safely sustain under any particular fuel and cargo loading. However, since the distribution of fuel load throughout the wings directly affects the bending moment of the wings, the load factor lines in the chart are valid only when fuel is used first from the inboard tanks, and then from the outboard tanks. When this sequence is used, the bending moment is minimum and a greater margin or safety is available for flight through turbulent air.

MAIN FUEL SYSTEM.

Except for the following all information is contained in T.O. 1C-119G-1.

Running Inboard Tanks Dry.

When it is necessary to use all of the fuel in the tanks, the following procedure should be used to avoid losing suction simultaneously on both engines:

a. When there is 600 pounds of fuel remaining in inboard tanks, turn boost pump switches to NORMAL, change one engine fuel selector to OUTBOARD, and turn fuel boost pump switch to EMERG ON.

WARNING

When fuel quantity indicators register less than 600 pounds in the inboard tanks, close observation shall be maintained to prevent fuel starvation to the engines.

b. Turn OFF fuel boost pump switch of other engine and drain associated inboard tank using engine-driven pump pressure only.

c. When fuel pressure or fuel flow fluctuates on engine being served by inboard tank, shift that engine to CROSSFLOW. When fuel pressure stabilizes, turn fuel boost pump to EMERG ON and shift that engine to OUTBOARD.

d. Shift opposite tank to INBOARD and turn boost pump switch OFF.

e. When this inboard tank is empty, repeat procedure as outlined in step c.

The following information is contained in T.O. 1C-119G-1.

ELECTRICAL SYSTEM.

BRAKE SYSTEM.

INSTRUMENTS.

NAVIGATIONAL INSTRUMENTS.

Attitude and Directional Indicator.

The pilot's attitude and directional indicator (ADI) provides the pilot with heading and attitude information on one instrument. The ADI presents the forward display of the airplane and is the primary attitude instrument for combining roll and pitch and turn and slip. Heading information is presented on the sphere of the ADI. This portion of the ADI replaces the directional gyro. Proper heading is selected by depressing the HDG knob on the control panel and setting in reference to the standby magnetic compass. The miniature airplane is aligned with the horizon by adjusting the pitch trim knob at the lower right corner of the ADI.

The following information is contained in T.O. 1C-119G-1.

SURFACE CONTROL BOOST TABS.

FIRE CONTROL SYSTEM.

The fire control system performs several distinct but related functions. It directs a pilot to the target area and indicates the position to commence orbiting. During orbit about the target, the fire control system provides information to permit the pilot to maintain correct orbit, align the guns with the target, and fire the guns automatically, semiautomatically, or manually as desired. During operation, signals from the NOS are fed to the fire control computer. The computer solves the firing problem and displays the results on the fire control display, the optical gunsight, and the ID-249. Operation of the fire control system is dependent upon the mode of firing selected. The pilot selects the firing mode by positioning the mode selector switch to MAN (manual), SEMIAUTO (semiautomatic), or AUTO (automatic).

MANUAL MODE.

In the manual mode, only the optical gunsight is used. The pilot places the aircraft in a firing orbit without computer guidance, places the gunsight reticle on the visible target or upwind if a correction is being used, and fires the guns. (See figure 7-5.)

SEMIAUTOMATIC AND AUTOMATIC MODES.

NOS.

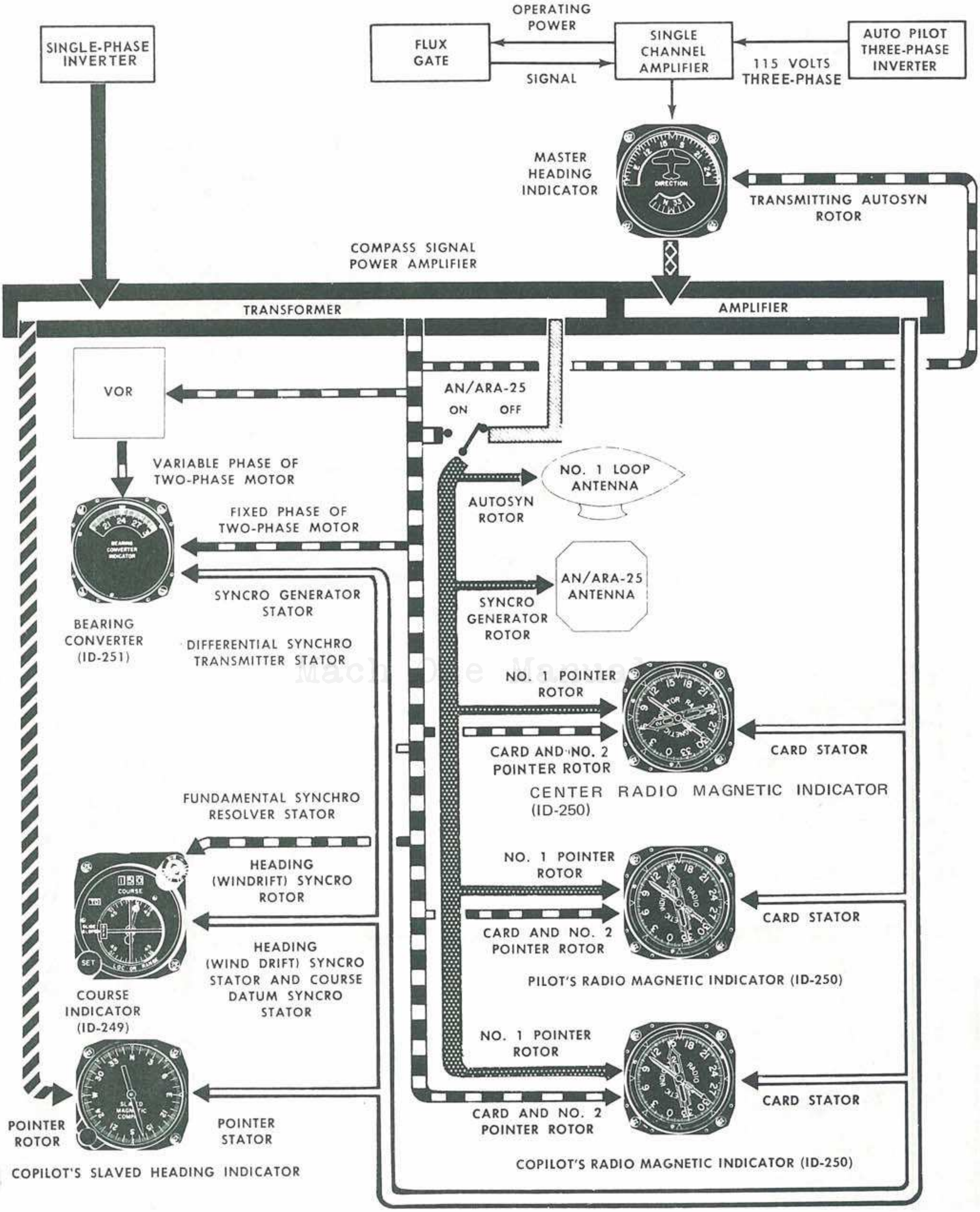
The NOS operator identifies and tracks the target, or reference point if offset is being used. While accurately tracking a confirmed target, the operator activates his consent switch. Separate NOS resolvers feed NOS azimuth and elevation signals to the SLAD system. The NOS operator uses his SLAD to aid in pointing the NOS or the illuminator. The illuminator may be used to enhance the NOS presentation.

Fire Control Computer.

The FCC utilizes the NOS azimuth and elevation signals, pitch and roll from the three-axis gyro system, and manual inputs of gun azimuth correction, gun elevation correction, and altitude to solve the basic firing problem.

a. Wind correction. — A wind will move the bullet impact point downwind from the no-wind impact point. The FCC can compensate for this effect by using the basic inputs, heading from the three-axis gyro system and manual wind velocity and direction inputs to correct the movable reticle.

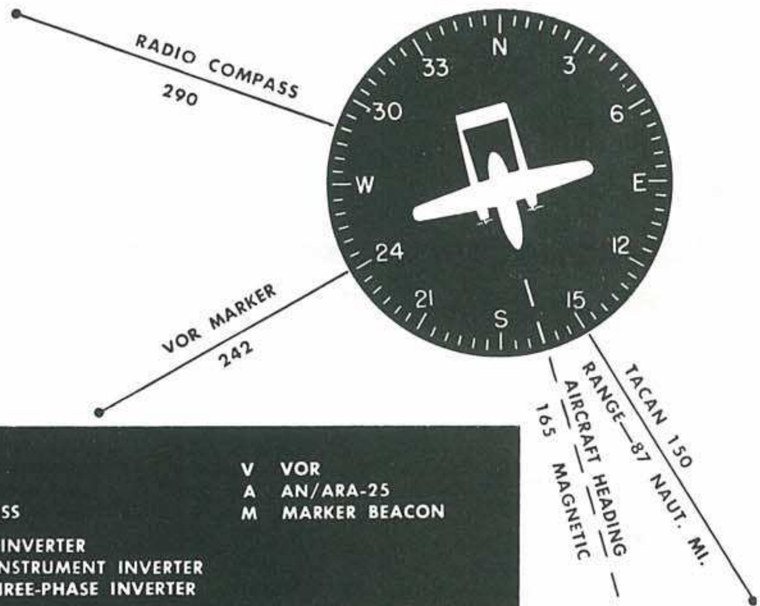
b. Offset. — If the target cannot be identified, but a reference point close to it can, the offset capability may be used to strike the target. The FCC will use manual inputs of distance and direction (magnetic) from the reference point to



COMPASS SIGNAL POWER AMPLIFIER FUNCTIONS

Figure 7-1

NAVIGATIONAL INSTRUMENTS



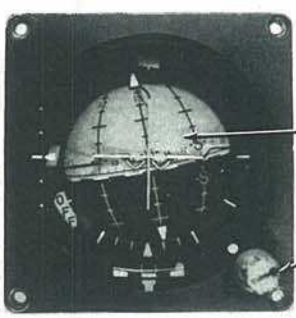
SIGNAL
- T TACAN
- G GLIDE SLOPE
- F FLUX GATE
- 1 RADIO COMPASS
- V VOR
- A AN/ARA-25
- M MARKER BEACON

AC POWER
- ● SINGLE-PHASE INVERTER
- ✪ THREE-PHASE INSTRUMENT INVERTER
- ⊙ AUTO-PILOT THREE-PHASE INVERTER

RELATED DC BUS
- ◍ MAIN DC BUS
- ★ EMERG. DC BUS

	SIGNAL	POWER AC 3Ø	POWER AC 1Ø	DC
ATTITUDE AND DIRECTIONAL INDICATOR		✪		★
COPILOT'S SLAVED HEADING INDICATOR	F	⊙	● ●	◍ ● ●

ATTITUDE AND DIRECTIONAL INDICATOR



HEADING...
Set by adjusting HDG knob on ADI control panel. Heading information from compass controller.

KNOB...
Zeros miniature aircraft.

COPILOT'S SLAVED HEADING INDICATOR

POINTER . . .
STATOR: Flux gate signal from compass signal power amplifier.
ROTOR: 75 volts ac from compass signal power amplifier.

KNOB . . .
Manually rotates card and pointer simultaneously to any desired position.

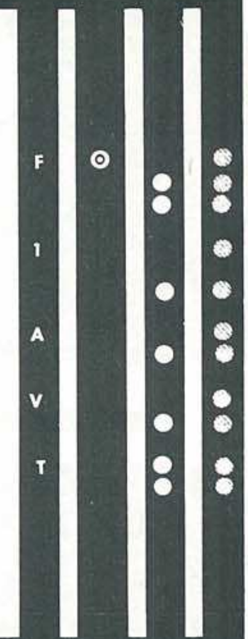
Figure 7-2 (Sheet 1 of 3)

PILOT'S AND COPILOT'S RADIO MAGNETIC INDICATORS, ID-250

CARD . . .
STATOR: Flux gate signal from compass signal power amplifier.
ROTOR: 26.5 volts ac from compass signal power amplifier.
NO. 1 POINTER (AN/ARA-25 OFF)÷ . . .
STATOR: No. 1 radio compass loop antenna (position) autosyn signal.
ROTOR: 36.0 volts ac from compass signal power amplifier.
NO. 1 POINTER (AN/ARA-25 ON) . . .
STATOR: AN/ARA-25 antenna (position) autosyn signal.
ROTOR: 26.5 volts ac from compass signal power amplifier.
NO. 2 POINTER (selector switch in VOR/ILS position)*. . .
STATOR: VOR signal (through ID-251).
ROTOR: 26.5 volts ac from compass signal power amplifier.
(Selector switch in TACAN position.)*
STATOR: Tacan signal (through ID-307).
ROTOR: 26.5 volts ac from compass signal power amplifier.

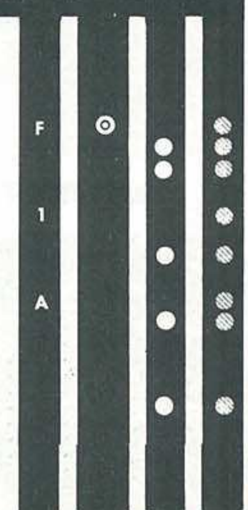
÷ AN/ARA-25 OFF is the selected condition for the illustration.

* TACAN selected is the condition illustrated.

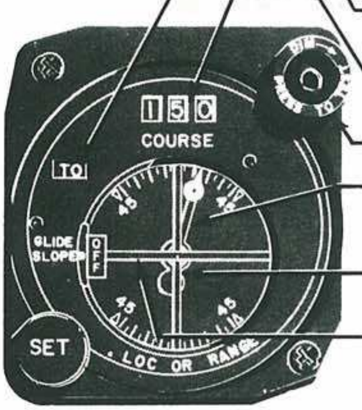


CENTER RADIO MAGNETIC INDICATOR, ID-250

CARD . . .
STATOR: Flux gate signal from compass signal power amplifier.
ROTOR: 26.5 volts ac from compass signal power amplifier.
NO. 1 POINTER (AN/ARA-25 OFF)÷ . . .
STATOR: Radio compass loop antenna (position) autosyn signal.
ROTOR: 36.0 volts ac from compass signal power amplifier.
NO. 1 POINTER (AN/ARA-25 ON) . . .
STATOR: AN/ARA-25 antenna (position) autosyn signal.
ROTOR: 26.5 volts ac from compass signal power amplifier.
NO. 2 POINTER (selector switch in VOR/ILS position)* . . .
STATOR: VOR signal (through ID-251).
ROTOR: 26.5 volts ac from compass signal power amplifier.
(Selector switch in TACAN position.)*
STATOR: Tacan signal (through ID-307).
ROTOR: 26.5 volts ac from compass signal power amplifier.
ROTOR: 36.0 volts ac from compass signal power amplifier.
÷ AN/ARA-25 OFF is the selected condition for the illustration.



COURSE INDICATOR, ID-249



TO-FROM INDICATOR . . .
Responds to VOR or TACAN* signal as selected.
COURSE . . .
Manually set by course set knob.
MARKER BEACON LIGHT . . .
Illuminates over marker in response to beacon signal/consent signal.
HEADING POINTER . . .
STATOR: Flux gate signal from compass signal power and amplifier.
ROTOR: 26.5 volts ac from compass signal power amplifier.
COURSE DEVIATION INDICATOR . . .
Operated by VOR, ILS, FM homing, gun computer or TACAN* as selected.
GLIDE SLOPE INDICATOR . . .
Operated by signal from glide slope receiver, or gun computer as selected. Inoperative if NAV MODE SEL switch is positioned to TACAN.

* TACAN selected is the condition illustrated.

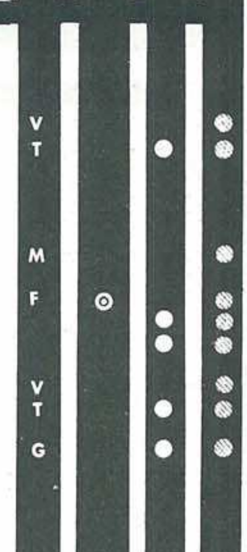


Figure 7-2 (Sheet 2 of 3)

PILOT'S RANGE INDICATOR, ID-310

NUMERAL DRUMS . . .
Distance measuring potentiometer and resolver:
Supply power to operate motor-rate generator which causes numerals to rotate (search) or indicate range (lock-on).
RANGE WARNING FLAG . . .
Prevents reading of distance when the instrument is searching as when the beacon is not being received or is beyond 195 nautical miles.

MASTER HEADING INDICATOR

CARD (TWO-PHASE MOTOR) . . .
FIXED PHASE: 26 volts ac, 975 cycles, from single-channel amplifier.
VARIABLE PHASE: Flux gate signal from single-channel applifier.
COUPLING AUTOSYN . . .
STATOR: Flux gate signal.
ROTOR: Flux gate signal induced from the stator.
TRANSMITTING AUTOSYN . . .
STATOR: Transmits flux gate signal to C-1 amplifier.
ROTOR: 26 volts ac from compass signal power amplifier.

BEARING CONVERTER, ID-251

CARD . . .
Indicates magnetic bearing to VOR station.
DIFFERENTIAL AUTOSYN GENERATOR . . .
STATOR: Flux gate signal from compass signal power amplifier.
ROTOR: Sends magnetic bearing of VOR station to No. 2 pointer of pilot's and copilot's radio magnetic indicators (when VOR/ILS is selected).
REVERSIBLE TWO-PHASE MOTOR . . .
FIXED FIELD: 26.5 volts ac from compass signal power amplifier.
VARIABLE FIELD: Comparison signal from VOR.
PHASE SHIFTER . . .
INPUT: From VOR phase-splitter.
OUTPUT: To VOR comparitor.

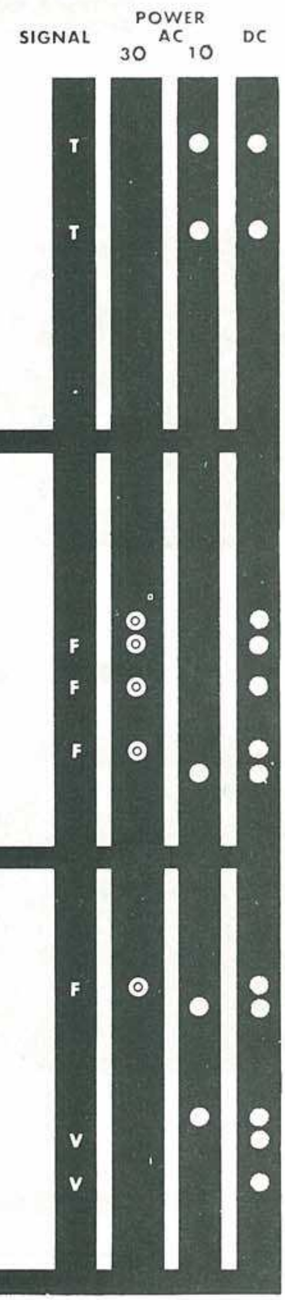


Figure 7-2 (Sheet 3 of 3)

the target and heading from the three-axis gyro system to displace the movable reticle to the target.

NOTE

Accurate results in the offset mode cannot be obtained for offset distances greater than 200 meters.

Fire Control Display.

The navigator/safety officer monitors the FCD during firing to determine if the NOS is tracking or to monitor the firing situation and place the gun firing override switch to the DISABLED position when firing zone and the safety zone come together.

ID–249 Indicator.

The ID-249 displays information to direct the pilot to the target orbit pattern in semiautomatic and automatic modes. In the gun computer mode, the course deviation indicator (CDI) indicates the position of the target orbit entering point (tangent) in relation to the nose of the aircraft (X-axis) only (See figure 7-3). The CDI displacement is relative to the error in degrees of the X-axis. Therefore, anytime the nose of the aircraft is not directed at the tangent, the CDI is displaced, directing the pilot to turn toward the CDI displacement. This results in correcting for any crosswind condition. In the target steering mode, the glide slope indicator (GSI) indicates the target's position in relation to the lateral axis (Y-axis) of the aircraft. As the aircraft nears the target orbit tangent, the GSI will begin moving from the full up deflection to the center (null) position. When GSI is centered, the lateral axis is aligned with the target. The speed that the GSI moves is proportional to the ground speed of the aircraft; ie, headwind, slow moving; tailwind, fast moving. The pilot keeps the CDI centered, maintains altitude and airspeed, and continues flying toward the tangent. The pilot positions the aircraft in a 30-degree bank just as the GSI centers (null) and transfers his attention to the optical gunsight.

Optical Gunsight.

The copilot maintains constant altitude and airspeed and the pilot maintains alignment of the gunsight reticles by turning and banking the aircraft. The guns will not fire unless the red cue lights are extinguished. Additionally, in the automatic mode, the guns will not fire unless the fixed reticle (guns) and the movable reticle (target) are within coincidence (amber cue lights extinguished).

AIMING ERROR CHARTS.

The aiming error charts, figures 7-4 through 7-8, show the impact error due to deviations in airspeed and altitude in all firing modes, information for aiming correction for wind in the manual mode, and miss distance if the proper target orbit is not maintained.

AIRSPEED ERROR CHART.

The Airspeed Error Chart, figure 7-4, is used to determine the miss distance caused by a deviation from the desired airspeed as a function of drop time.

Use of the Chart.

The drop time is determined from figure 7-8. Enter the chart at the bottom with the drop time and proceed upwards to the airspeed error line. From this point move left horizontally and read the miss distance.

NOTE

Airspeed fast-impact forward.
Airspeed slow-impact aft.

WIND CORRECTION CHART.

The Wind Correction Chart, figure 7-5, depicts the distance correction required to lead or lag the target in the manual mode or whenever the wind correction is not used in the FCC.

Use of the Chart.

The drop time is determined from figure 7-8. Enter the chart at the bottom with the drop time and proceed upwards to the wind speed line. From this point move left horizontally and read the distance correction in meters.

Example.

GIVEN: Drop time 8.5 seconds, wind speed 7 knots.

FIND: distance correction.

a. Enter figure 7-5 at the bottom with the drop time, 8.5 seconds, and proceed vertically upward to the wind correction line 7 knots, interpolate visually.

b. From this point move horizontally to the left and read the distance correction, 30.5 meters.

c. Displace the reticles 30.5 meters upwind from the target.

NOTE

The correction is always applied upwind from the target.

ALTITUDE ERROR CHART.

The Altitude Error Chart, figure 7-6, shows the effect a deviation from the selected altitude has on the impact point. Only some altitudes are shown to indicate the small miss distances due to altitude.

Use of the Chart.

Enter the Altitude Error Chart with the deviation from the selected altitude and move horizontally to intercept the selected altitude line. From this point move vertically to read impact error.

Example.

GIVEN: 250 feet below selected altitude C.

FIND: impact error.

a. Enter the Altitude Error Chart (figure 7-6) with 250 feet, the distance below the selected altitude.

b. Proceed horizontally to the right to the selected altitude line C, then upward vertically to the distance correction scale and read 2 meters long.

RADIUS ERROR CHART.

The Radius Error Chart, figure 7-7, illustrates the effect a change from the desired radius has on the impact area.

Use of the Chart.

Enter the Radius Error Chart with the percent of course deviation indicator deflection from the center (null) position and move vertically to the selected altitude line. From this point move horizontally to read the miss distance.

Example.

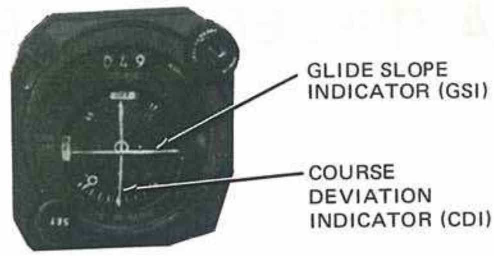
GIVEN: altitude B, inside the desired radius -30 percent course deviation indicator deflection.

FIND: impact error.

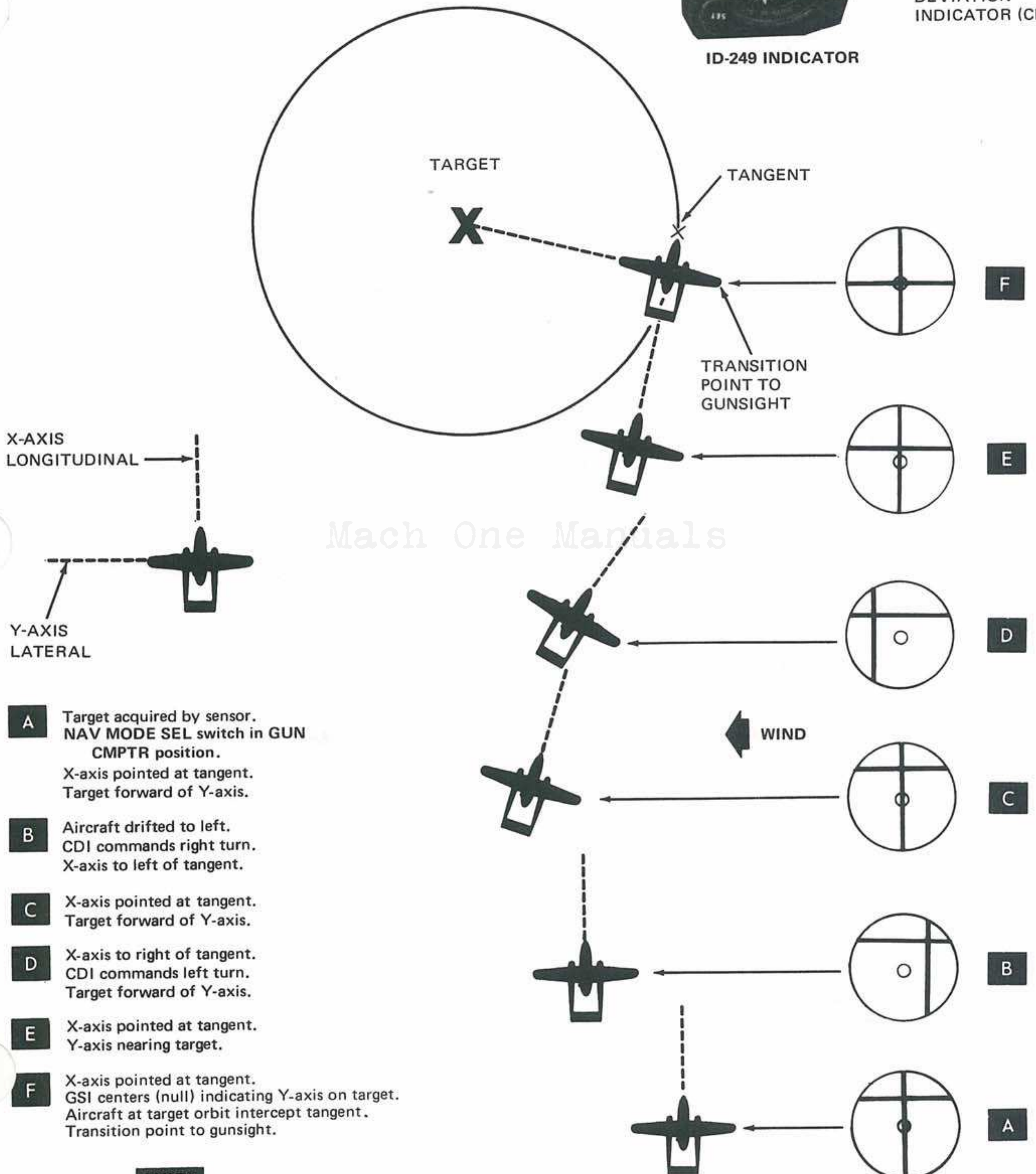
a. Enter the Radius Error Chart (figure 7-7) on the left side with -30 percent course deviation indicator deflection, then proceed upward vertically to the selected altitude line B.

b. From this point move horizontally to the right and read the distance; 11 meters long.

TARGET ORBIT INTERCEPT



ID-249 INDICATOR



NOTE

NOT TO SCALE

Figure 7-3

AIRSPEED ERROR CHART

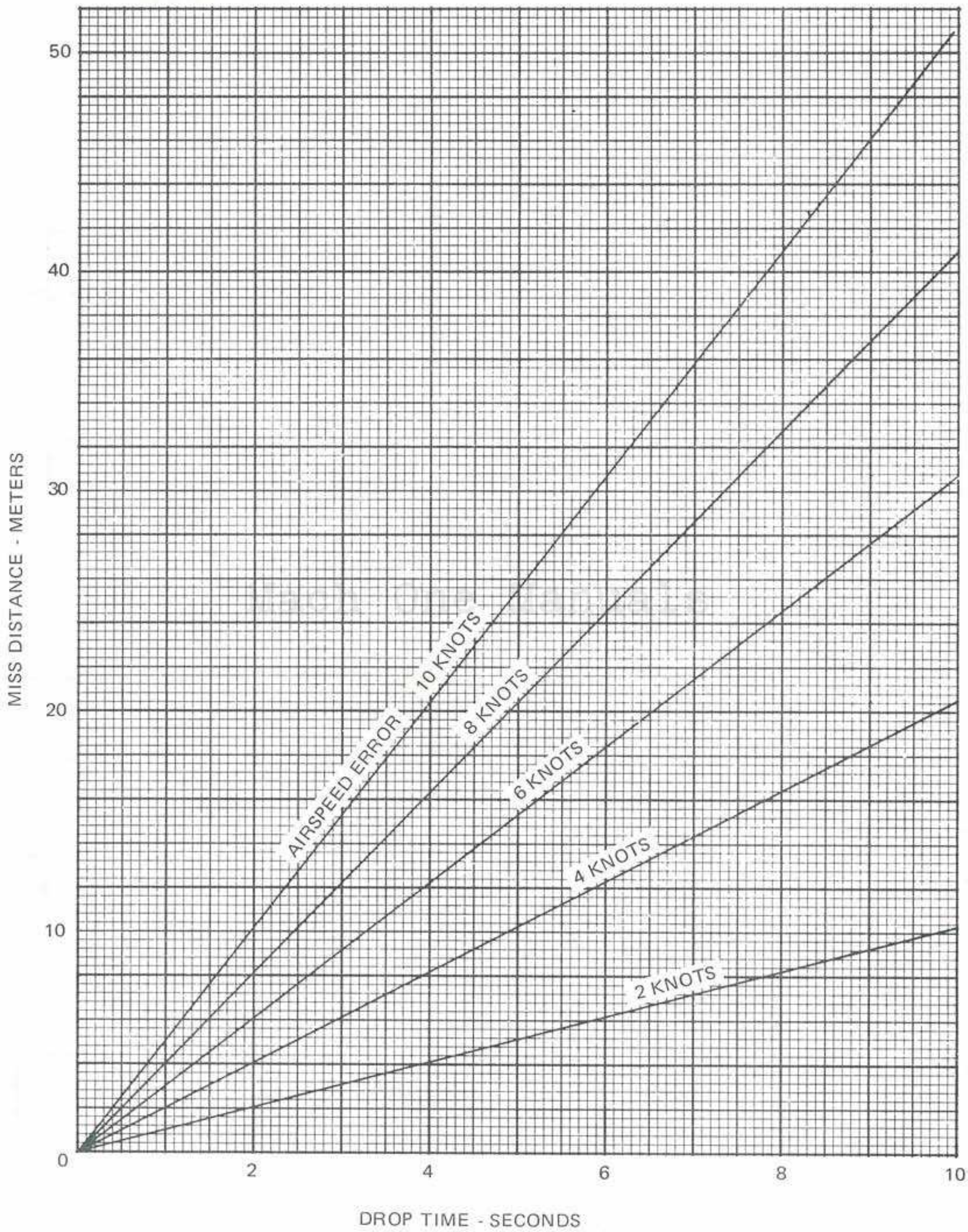


Figure 7-4

WIND CORRECTION CHART

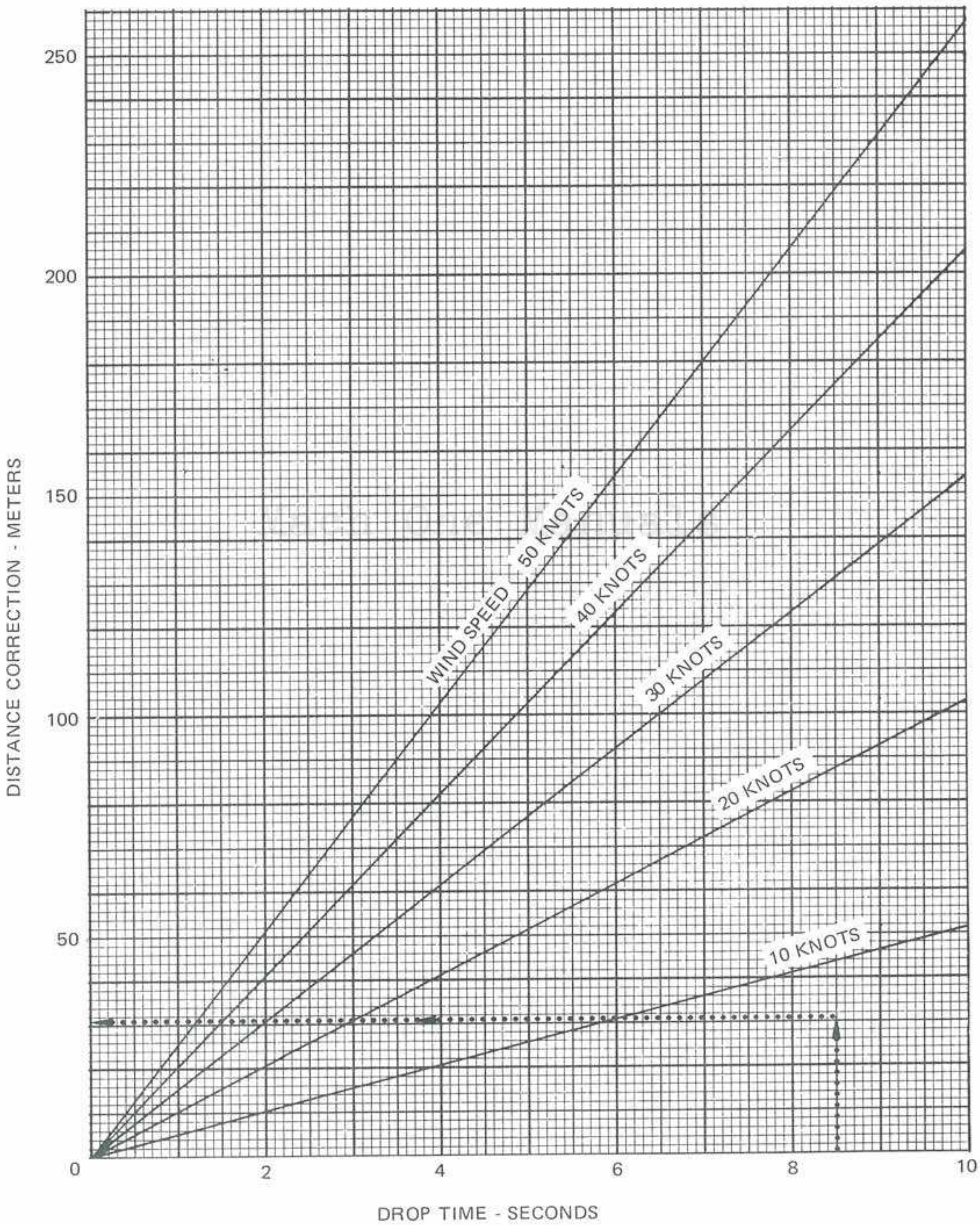


Figure 7-5

ALTITUDE ERROR CHART 7.62 MM

DATA OF OF: NOVEMBER 1970
DATA BASIS: CALCULATED

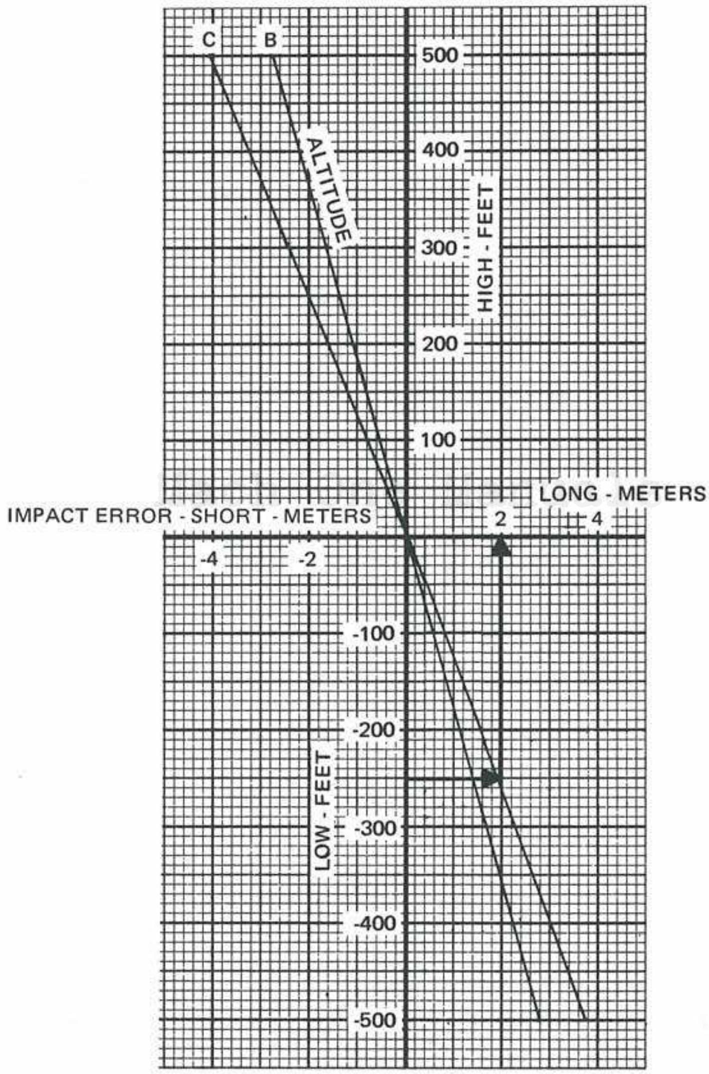


Figure 7-6

RADIUS ERROR CHART 7.62 MM

DATA AS OF: NOVEMBER 1970
DATA BASIS: CALCULATED

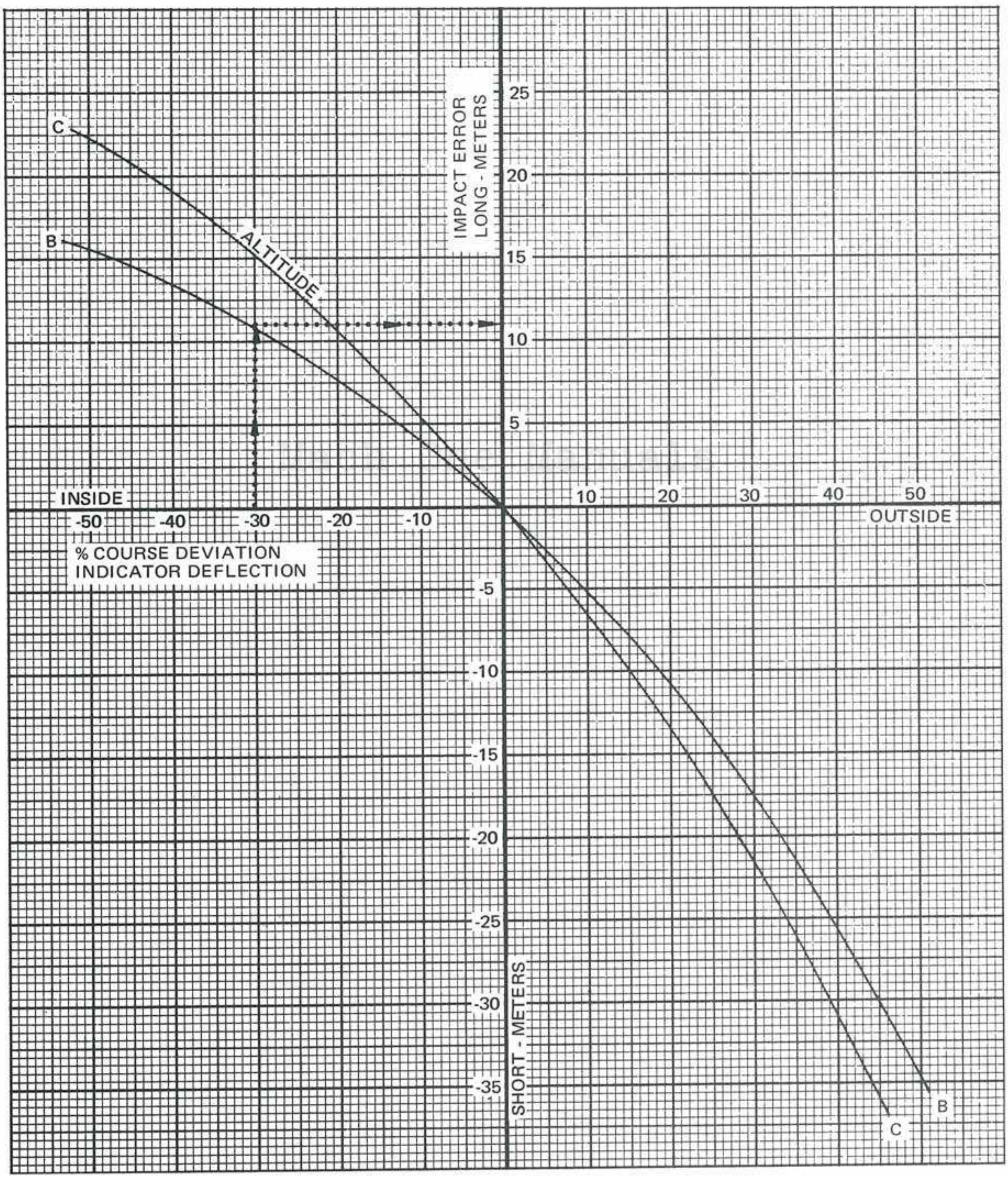


Figure 7-7

DROP TIME (SECONDS) CHART 7.62 MM

TRUE AIRSPEED (KNOTS)	ALTITUDE				
	A	B	C	D	E
150	3.17	3.86	4.69	5.64	6.68
155	3.38	4.05	4.87	5.80	6.83
160	3.62	4.27	5.07	5.98	7.00
165	3.87	4.50	5.28	6.18	7.18
170	4.13	4.74	5.50	6.39	7.38
175	4.42	5.01	5.75	6.62	7.59
180	4.72	5.29	6.01	6.87	7.82
185	5.04	5.59	6.29	7.14	8.07

Figure 7-8

SECTION VIII

CREW DUTIES

table of contents

INTRODUCTION.

This aircraft is one that requires teamwork from its crew; the pilot is the commander of the team. The success of the mission and safety of the crew and aircraft depend upon how well the team is organized and the manner in which it is led. The crew is made up of specialists, each one vitally important to the safety and effectiveness of the entire crew. The purpose of this section is to provide a compact collection of material wherein each crewmember can readily determine his duties relating to his specialty as a crewmember. Any discrepancy noted during preflight which would affect the accomplishment of the mission will be brought immediately to the attention of the pilot and maintenance personnel.

NOTE

For explanation of circled items and those items preceded by an asterisk(*), refer to Section II.

CREW COORDINATION.

NOTE

When more than one crewmember has the same response to the same item, the crewmembers subsequent to the initial crewmember responding need respond only with his crew position.

Coordination of actions within a crew is of prime importance and will insure the optimum degree of mission success and safety during all phases of operation. This coordination is not necessarily limited to actions alone. Complete familiarity with one's crew position, the responsibilities thereof, and a working knowledge of the other crewmembers' duties will contribute immeasurably toward crew coordination. Each crewmember must be constantly on the alert and should notify the responsible crewmember of any deviation or discrepancy which will affect successful accomplishment of the mission. Coordination between individuals concerned must be established prior to initiating any action or procedure which will alter aircraft configuration or require correlation of activities between crewmembers. Prior to flight, the pilot must insure that all crewmembers are thoroughly familiar with all aspects of the assigned mission as pertaining to their crew specialty to include:

a. Applicable instructions in the flight information publications.

b. Departure routes, altitudes, obstructions, and traffic procedures.

c. Route of flight.

d. Normal and emergency communications procedures.

e. Any special instructions or procedures pertaining to the mission.

It is imperative that the pilot, copilot, and navigator be thoroughly familiar with the letdown, approach, missed approach, landing patterns, altitudes, and obstructions at both destination and alternate airfields. Available aids such as current FLIP terminal and approach charts must be studied. A complete set of current approach charts must be available for in-flight use by both the pilot and the navigator. The navigator, as well as the pilot not at the controls of the aircraft, will closely monitor all letdowns and approaches. The pilot at the controls will be notified immediately of any deviation from published procedures.

Positive measures must be taken to insure that safety of personnel and aircraft is not jeopardized. Flight attitude of the aircraft must be carefully monitored by both the pilot and copilot at all times. During any critical phase of flight, especially under night and/or weather conditions, the pilot not at the controls of the aircraft will maintain visual contact with the ground as far as possible, closely monitor his flight instruments, and cross-check them against those of the other pilot. Any apparent error in flight attitude or airspeed will be immediately brought to the attention of the pilot at the controls. This pilot will initiate immediate and appropriate corrective action, if required.

Prior to accomplishing any of the following, verbal coordination between applicable crewmembers will be required when:

a. Control of the aircraft is transferred between pilot and copilot.

b. Changing fuel control settings.

c. A crewmember leaves his position or leaves interphone.

d. Any electrical power source is changed.

e. It is necessary for the pilot at the controls of the aircraft to transfer control to the other pilot when he is required to do something which will divert his attention from flying, such as check oxygen, tune radios, change fuel control settings, etc.

f. The pilot intends to perform any critical maneuver, at which time all crewmembers will be secured in their respective positions.

All applicable crewmembers will acknowledge that an intended course of action is understood prior to the initiation of the action and will conduct themselves accordingly. All applicable crew positions, when practical, should monitor all communications outside the aircraft by use of mixer switches during flare drops, firing passes, takeoffs, landings, and instrument approaches. Extreme care must be exercised by the pilots, when leaving seats, to avoid inadvertent operation of switches or controls on the control pedestal or overhead panel. When a safety belt is unfastened in flight or on the ground, place the belt carefully so as not to inadvertently operate any switches or damage equipment.

IDENTIFICATION.

The crewmember who is being called will be identified first, followed by the identification of the transmitter; eg, "Gunner from pilot." All crewmembers will advise the pilot when leaving or returning to their respective crew positions. Interphone conversation will be held to the absolute minimum during the following: flight under adverse weather conditions, instrument approaches, firing passes, flare drops, takeoffs, and landings.

ACKNOWLEDGEMENT.

Every command will be acknowledged by the receiving crewmember prior to execution to assure proper understanding of the transmission. If not certain what the command was, the crewmember will momentarily press his mike button and state, "Say again." The crewmember will then repeat his original transmission.

NOTE

On a radar approach, the pilot may direct the crewmembers not to acknowledge his command to prevent interphone transmission from interfering with the ground controller's instructions. Under emergency conditions, brevity on the interphone is essential to avoid interruption of procedures.

PILOT.

In addition to the normal operational duties and functions required of the pilot as outlined in

Section II, the pilot will be responsible for assuring:

a. That he has received adequate briefing for the assigned mission.

b. That crewmembers are assigned individual preflight duties.

NOTE

Each member of the crew has received a thorough course of technical training pertinent to his particular specialty. Therefore, certain duties concerning the preflight inspection may be delegated to each crewmember. These duties, when so assigned, are performed under the pilot's supervision.

c. That flight planning is accomplished to include a check of the weather, terrain, danger areas, route, NOTAMS, fuel requirements, and aids to navigation (when applicable), as well as the filing of clearance with attached Form 365F, crew list, and departure messages.

d. Completion of individual preflight duties.

e. Accomplishment of crew briefing.

f. That individual crewmembers are assigned postflight duties.

g. That Form 781, mission reports, and records are completed.

COPILOT.

The copilot will aid the pilot in any way, when directed, to accomplish the assigned mission. He should be able to assume full command if the occasion arises. He and the pilot must be virtually interchangeable. The pilot must remember that the copilot is a potential aircraft commander and should assign him responsibilities appropriate to eventual assumption of command of a crew.

NAVIGATOR/SAFETY OFFICER.

NOTE

Underlined items indicate a response is required.

The navigator/safety officer will perform the duties of a navigator and aid the pilot in all matters pertaining to flight planning and navigation, as well as the duties of fire control and safety officer. This additional duty requires that he have a complete knowledge of operational procedures for the fire control system. The navigator/safety officer will maintain the highest possible level of proficiency in all types of navigation and fire control system operation employed in accomplishing the mission of the aircraft. The navigator/safety officer will:

a. Assemble all materials and data necessary for complete mission planning.

b. Perform a thorough preflight inspection of all navigation equipment and fire control system.

c. Know the position of the aircraft at all times, utilizing all available aids to navigation.

d. Set the fire control computer and monitor the fire control display.

e. Maintain a current and accurate record of the flight and keep the crew informed of flight progress.

f. Prepare necessary position reports.

PREPARATION FOR FLIGHT.

1. Flight plan - Completed.
2. Range control chart - Completed, as required.
3. Necessary maps and charts - Obtained and completed.
4. Gunsight, computer, and gun settings - Obtained.
5. Professional and personal equipment - Checked.
6. Time hack - Obtained.
7. Weather and mission briefing - Attended.
8. Emergency survival equipment - Checked.

INTERIOR CHECK (POWER OFF).

1. Form 781 - Checked.

   Check Form 781 for any discrepancies that may affect operation of any navigational or fire control system components. Note any inoperative equipment.

2. Emergency survival equipment - Checked.

3. Illuminator remote control - Stowed.

   Insure that the remote control box power plug will connect, and that the box is stowed in a position with a tiedown strap.

4. Astrodome - Checked.

   Insure that the astrodome is clean and unmarked; also, that the dome refraction card is complete and current.

   a. Astrocompass - Checked as required.

      Insure that the astrocompass is in working condition by performing an internal alignment check. Refer to AF Manual 51-40, Volume III, Chapter 3.

   b. Mount alignment - Checked as required.

      Align the astrocompass in all four positions. Values for the aft mounts are right side, 011-1/2°; left side, 348-1/2°. Refer to AF Manual 51-40, Volume III.

5. Flight station - Checked.

   Check physical condition of navigator's table and seat.

6. Navigation publications - Checked.

   Check that all required FLIP documents, approach plates, maps, and charts are on board and current.

7. Oxygen - Checked as required.

8. Circuit breakers - Checked.

   Check all circuit breakers on the navigator's circuit breaker box and radio junction box.

9. Pyrotechnic equipment - Checked and stowed as required.

   Check that required flares and flare gun are on board, serviceable, and secured in their proper location.

10. Loran set - OFF.

    Master X-Y gain control full ccw. All knobs ccw.

11. Fire control computer - Set.

    a. Power switch - OFF.

    b. Dimmer knobs - CCW.

    c. Circuit breakers - Checked.

    d. Coincidence - Zero.

    e. Primary sensor selector switch - Set to blank sensor position.

    f. Target offset distance - Zero.

    g. Wind velocity - Zero.

12. Fire control display - Set.

    a. Primary power switch - OFF.

    b. Dimmer status and panel controls - CCW.

    c. Intensity control - CCW.

    d. Symbol condition switches - OFF.

       There are five symbol condition switches located on right side of fire control display with the OFF position being down.

    e. Channel A and B switches - Set to blank sensor position.

f. Fuses - Checked.

Insure covers are in place and secure.

g. Alignment switch - OPR.

13. Gun firing override switch - NORMAL.

14. Radios - OFF.

Check both FM, both UHF, VHF, HF, and ADF.

15. Operating spare inverter - OFF.

16. Monitor bus override switch - NORMAL.

INTERIOR CHECK (POWER ON).

1. External power/APU - As required.

If both dc and ac power is available from power carts, no inverters need be turned on to preflight. If only dc power is available or the APU is furnishing power, the main inverter must be placed on to preflight the equipment.

2. Main and pilot's instrument inverters - ON.

Switches located on the overhead panel.

3. Voltages - Checked.

Voltmeters and selector switches are located on the copilot's panel. Check the main dc bus for a reading of 28 volts and the main single-phase inverter for a reading of 110 to 120 volts.

4. Interior lights - Checked.

Insure the navigator's swivel light is operational by turning the rheostat located beside the base of lamp; check navigator instrument light.

5. Interphone and mixer panel - Set.

a. Transmit select wafer switch - Set to desired position.

b. Receive switches - As desired.

c. Volume control - Adjusted.

6. Fire control computer - Set.

a. Power switch - ON.

b. Dimmer knobs - CW.

The outer rheostat knob adjusts the lamps, and the inner rheostat knob adjusts the panel lights.

c. Tracking lights - Checked.

Insure that all lights located around the primary sensor selector switch illuminate when the press to test button is depressed.

d. Gun azimuth correction - 500.

e. Gun elevation correction - 387.

f. Altitude selector switch - B.

7. Fire control display - Set.

a. Primary power switch - ON.

NOTE

Allow 1 minute warmup period before operating.

b. Dimmer status and panel controls - CW.

This adjusts the brightness of the fire control display panel lights and channel status lights. Do not adjust to maximum intensity because of the danger of being burned.

c. Symbol condition switches - On.

There are five symbol condition switches located on the right side of the fire control display with the center position being on.

d. Intensity knob - CW.

Adjust the brightness of symbols on the cathode ray tube.

e. Focus - Adjusted.

Insure for a sharp presentation on the visual display of the cathode ray tube.

f. Alignment switch - Checked.

Switch to CENTER (down). Dot should be in center of cathode ray tube. If not, adjust dot to center with azimuth and elevation center adjustment screws.

Switch to GAIN (up) and dot should be displayed 3 centimeters up and 3 centimeters to the right of center. If not, adjust dot to this position with azimuth and elevation gain adjustment screws.

NOTE

If azimuth or elevation gain is adjusted, the azimuth and elevation center should be rechecked. Adjusting one may require resetting the other. Tighten all lock nuts.

Set alignment switch to OPR.

g. Symbols - Checked.

Set all symbol condition switches to DOT position. Depress center control. All symbols should appear in the center of the cathode ray tube ± 0.2 centimeter. Place all symbol switches to the on position. Keeping the center control depressed, operate between COARSE and FINE, noting symbols increase in size 3:1.

h. Safety zone switch - Set to OD.

8. Navigation mode select switch - GUN CMPTR.

The navigation mode select switch is located on the radio control panel with five preset modes. This switch must be in GUN CMPTR during semiautomatic and automatic modes of firing in order to use the fire control computer.

9. Fire/sight mode selector panel - Set.

a. Firing mode selector switch - AUTO.

b. Fixed and movable reticles switches - FIL NO. 1 ON.

c. Reticles brightness control - CW.

Controls the intensity of the movable and fixed reticles in the optical gunsight.

d. Fixed and movable reticles switches - FIL NO. 2 ON.

Check that both reticles are present.

e. Cue lights control - CW.

Controls the intensity of the amber, red, and white cue lights around the optical gunsight.

10. ADI - Checked.

Confirm that the warning flag has disappeared and that the ADI sphere is properly erected.

a. Selector switch - DG.

b. Latitude - Set to local latitude.

11. NOS guidance - Checked.

Select NOS as primary sensor. Have the NOS moved forward, aft, up, and down, and check for proper movement of the primary sensor symbol on the fire control display. Insure for proper movement of the movable reticle in the pilot's sight. Check that the steering information being sent to the ID-249 indicator and to all the SLAD panels are portrayed correctly. Set NOS at 0 azimuth and 15 degrees depression by the SLAD panel. Check the position of the NOS symbol on the fire control display.

12. NOS consent switch - Checked.

Have the NOS consent switch depressed and insure that the green OD light on the fire control computer and the yellow marker beacon light are illuminated. Check that the red cue lights in pilot's gunsight are extinguished.

13. Coincidence - Checked.

a. Reticles - Superimposed.

Position the NOS to superimpose the reticles on the pilot's gunsight. With FINE set in the fire control display, center the primary symbol. Final small adjustments may be made with the gun azimuth and gun elevation correction setting on the fire control computer.

b. Zero tolerance - Checked.

The amber cue lights in the pilot's gunsight should be extinguished. If not, increase coincidence until the amber cue lights extinguish. The value on the coincidence scale should not exceed 8.75 mils.

c. 25-mil tolerance - Checked.

Increase gun azimuth correction by approximately 125 units such that the movable reticle is displaced 25 mils to the right.

Increase coincidence value until the amber cue lights on the pilot's gunsight extinguish. The coincidence scale should be 50 ± 8.75 mils.

d. Gunsight reticles - Superimposed.

Reset gun azimuth correction on the fire control computer to original value.

14. Wind - Checked.

a. Firing zone switch - DOT.

b. Wind direction - Set to heading on ADI.

Take the heading reading of the attitude and directional indicator (ADI) located on pilot's instrument panel and set it into the computer's wind direction.

c. Wind velocity - Set 47.5 knots.

d. Fire control display - Checked.

Insure that the firing zone dot is displaced 1 centimeter to the left of center.

e. Pilot's gunsight - Checked.

The movable reticle is displaced 52 mils right. 52 mils on the movable reticle is 2 mils past the outer reticle circle.

f. Wind velocity - Zero.

g. Firing zone switch - On.

15. Offset - Checked.

a. Target offset direction - Set to heading on ADI.

Take the heading reading of the attitude and directional indicator (ADI) located on the pilot's instrument panel and set it into the computer.

b. Target offset distance - Set to 78 meters.

c. Fire control display - Checked.

The target T symbol should be displaced 1 centimeter to the right.

d. Pilot gunsight - Checked.

The movable reticle should be displaced 52 mils right.

e. Target offset distance - Zero.

16. Fire control computer - Set.

a. Dimmer knobs - As required.

b. Power switch - OFF.

c. Primary sensor switch - Blank sensor.

17. Fire control display - Set.

a. Symbol condition switches - OFF.

There are five symbol condition switches located on the right side of the fire control display with the down position being the OFF position.

b. Intensity control - CCW.

c. Dimmer status and panel controls - As required.

d. Primary power switch - OFF.

18. Fire/sight mode selector panel - Set.

a. Movable and fixed reticles switches - OFF.

b. Reticles control - CCW.

c. Cue control - CCW.

d. Firing mode selector switch - OFF.

19. Navigation mode select switch - TACAN.

20. ARC-136 UHF radio - Checked.

a. Function switch - T/R.

b. Channel/frequency selector - Set.

Select frequency of known station. Do not use GUARD.

c. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

d. Function switch - OFF.

21. ARC-27 UHF radio - Checked.

a. Function switch - T/R.

b. Channel/frequency selector - Set.

Select frequency of known station. Do not use GUARD.

c. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

d. Function switch - OFF.

22. FM-622A (FM-1) - Checked.

a. Function switch - T/R.

b. Squelch switch - CARR.

c. Frequency selector knobs - Set.

Tune set to frequency of a known station.

d. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

e. Function switch - OFF.

23. FM-622A (FM-2) - Checked.

a. Function switch - T/R.

b. Squelch switch - CARR.

c. Frequency selector knobs - Set.

Tune set to frequency of a known station.

d. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

24. HF liaison radio, Collins 618T-3 - Checked.

a. Function selector switch - USB (allow 3-minute warmup).

b. RF sensitivity knob - CW, as required.

c. Frequency selector - Set.

Select frequency of a known station. Key microphone switch to tune transmitter to selected receiver frequency.

NOTE

Tuning time should not exceed 45 seconds. If it does, turn set off for a 3-minute period and repeat cycle.

d. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

25. VHF command radio, Wilcox 807A - Checked.

a. Power switch - PWR.

b. Frequency selector knobs - Set.

Select a frequency of a known station.

c. Operation - Checked.

Communicate with other station to verify correct operation of receiver and transmitter.

d. Power switch - OFF.

26. ADF - Checked.

Tune in local station and check identifier and bearing.

27. Sextant - Checked and stowed as required.

28. APN-70 loran - Checked as required.

a. Monitor bus switch - OVERRIDE.

b. Navigator operating inverter switch - ON.

c. APN-70 loran - ON/Checked/OFF. (Refer to AF Manual 51-40, Volume III.)

d. Navigator operating inverter switch - OFF.

e. Monitor bus switch - NORMAL.

29. Main and pilot's instrument inverters - OFF.

30. Navigator's instrument and table light - OFF.

BEFORE STARTING ENGINES.

1. Interphone and radio monitor switches - Set.

2. Preflight/thru-flight checks - Complete.

3. Instrument, panel, and interior lights - As required.

BEFORE TAXI.

1. Command and navigation radios - On.

Turn on FM-2 (FM-622A) as required.

2. Illuminator remote control - Checked, as required.

WARNING

The illuminator must be in the full down position any time it is illuminated on the ground.

a. Lights - Checked.

b. Mode select switch - Checked.

Switch from IR to VISUAL positon. It requires 7 seconds to complete the cycle.

c. Kill switch - Checked.

Press kill switch; light should go out.

d. Zoom control - Checked.

Increase and decrease zoom and check zoom indicator. Leave zoom in the decreased position.

e. Elevation movement - Checked (up, down).

f. Azimuth movement - Checked (forward, aft).

3. Flight instruments - Checked.

a. Heading - Checked.

Master indicator, ADI, and repeaters agree with B16 compass.

b. Altimeter - Set.

Set current altimeter setting in Kollsman window.

WARNING

It is possible to set the altimeter 10,000 feet in error and have the correct setting in the Kollsman window. This occurs when the barometric pressure set knob is continuously rotated until the barometric scale is out of view and the scale reappears from the opposite side. If the correct altimeter setting is then placed in the Kollsman window, the altimeter will be in error by approximately 10,000 feet. To avoid this, always check the ten thousand-foot pointer for proper indication when setting the altimeter.

BEFORE TAKEOFF.

1. Clearance - Copied/As required.
2. Departure/navigation briefing - Complete.

   Advise pilot of desired departure route and first navigation check point, and any additional pertinent information.

3. Safety belts and harnesses - Secured.

   Seats will be locked in tracks and facing forward for takeoff.

4. Takeoff time - Recorded.

CRUISE.

1. Altimeter - Set.

   Set altimeter as required. If above transition altitude, set 29.92 inches.

2. Heading - Checked as required.
3. Illuminator remote control - Connected as required.

AIRBORNE SENSOR ALIGNMENT.

NOTE

Complete steps 1 and 2 of the PRE-STRIKE checklist prior to attempting AIRBORNE SENSOR ALIGNMENT.

1. Alignment briefing - Completed.

   The pilot, sensor operator, and navigator determine a suitable alignment point. The navigator will brief altitude and indicated airspeeds to fly.

2. Wind velocity - Zero.
3. Target offset distance - Zero.
4. NOS alignment - Checked.

   a. Gun azimuth correction - Adjusted required.

   b. Gun elevation correction - Adjusted as required.

   Pilots will call necessary azimuth and elevation adjustments to be set on the fire control computer. Complete each one independently.

NOTE

Azimuth and elevation correction values should be recorded and used as required.

5. Wind velocity - As required.
6. Target offset - As required.

PRE-STRIKE.

1. Fire control computer - Set.

   a. Power switch - ON.

   b. Dimmer knobs - Set.

   c. Primary sensor selector switch - OD.

d. Gun azimuth correction - Set.

Set the gun azimuth correction for the firing attitude to be flown, or value obtained in airborne sensor alignment.

e. Gun elevation correction - Set.

Set the gun elevation correction for the firing altitude to be flown, or value obtained in airborne sensor alignment.

f. Coincidence - Set.

Set the coincidence to the value requested by the pilot.

g. Altitude switch - Set.

Set the altitude switch for the firing altitude to be flown.

h. Target offset - Set as required.

i. Wind - Set as required.

2. Fire control display - Set.

a. Primary power switch - ON.

b. Dimmer status and panel controls - Set.

c. Symbol condition switches - ON.

d. Intensity and focus controls - Set.

e. Coarse/fine switch - As required.

f. Firing zone - Set.

Set the azimuth and elevation knobs to place a firing zone on the fire control display to represent strike impact point.

g. Safety zone - As required.

3. Gun firing override switch - NORMAL.

Switch must be in NORMAL position for the guns to fire.

4. Compass system - Checked.

Navigator will check the ADI, flux gate, and standby compasses to determine which is accurate if there is a discrepancy.

5. Crew stations - Checked.

6. Strike briefing - Complete.

a. Target altitude.

b. Firing altitude.

c. Orbit airspeed (IAS).

d. Type and description of target.

e. Highest terrain within 5 and 10 nm and location.

f. Tacan fix for target.

If target is an area, give limiting tacan fixes for edges.

g. Location of friendlies.

Specify nearest friendlies, as well as any friendlies within 5 kilometers of the target.

h. Heading and time to best bailout area.

i. Heading and time to nearest emergency airfield.

Include location and elevation of high terrain enroute.

NOTE

Items j through p are read from the fire control computer.

j. Wind.

k. Offset.

l. Gun elevation correction setting.

m. Gun azimuth correction setting.

n. Coincidence setting.

o. Primary sensor.

p. Altitude selected on computer.

7. Altimeter - Set.

Place latest known altimeter setting of the strike area, if known.

STRIKE.

1. Target identification - Completed.

NOTE

Target and friendly position positively identified by pilot, navigator, or sensor operator as practicable.

2. Clearance to expend - Obtained.

Insure that clearance to expend ordnance and/or illumination is received and recorded from an authorized source.

3. Fire control computer - Checked.

Insure that all values computed for that specific target are properly set.

4. Fire control display - Monitored.

WARNING

In the event the firing zone symbol and safety zone symbol show danger of touching, or there is other indication of a possibility of friendly forces coming under fire, activate the gun firing override switch and notify pilot.

POST STRIKE.

1. Fire control computer - Set.

a. Primary sensor switch - Blank sensor position.

b. Dimmer knobs - CCW.

c. Power switch - OFF.

2. Fire control display - Set.

a. Symbol condition switches - OFF.

b. Intensity control - CCW.

c. Dimmer status and panel controls - CCW.

d. Primary power switch - OFF.

3. Illuminator remote control - Stowed.

4. Crew stations - Secure.

5. Mission report - Completed.

NOTE

The following items should be recorded for all targets: target coordinates, time on and off, expenditures, and B.D.A.

DESCENT.

1. Instruments and altimeter - Checked.

Set latest altimeter setting in the Kollsman window.

2. Letdown plates - Checked.

Have the appropriate letdown book open to the approach being made or field diagram if VFR landing is being made.

3. Sextant, astrocompass, and mount - Stowed, as required.

4. Safety belts and harnesses - Secured.

BEFORE LANDING.

1. Seat - Positioned.

Seat will be facing forward and locked in a detent in the track.

AFTER LANDING.

1. Unnecessary electrical equipment - Off.

a. FM-622A (FM-2) - OFF.

b. Loran - OFF.

c. Operating spare inverter switch - OFF.

d. Monitor bus switch - NORMAL.

2. Landing time - Recorded.

3. Inoperative equipment - Reported.

   Write up all discrepancies encountered during mission in Form 781.

4. Interior lights - OFF.

FLIGHT MECHANIC.

The flight mechanic must be proficient in servicing, inspection, minor repair, and preflight of the aircraft and incorporated systems. He must also have thorough knowledge of normal, emergency, and all-weather procedures for operation of aircraft engines and systems. He must also be capable of the following: Proper applicable entries in Forms 781 and 365F, computing takeoff gross weight limitations and engine power requirements for takeoff and cruise by using Brake Horsepower Available chart, Takeoff Gross Weight Limit chart, Power Schedule Curve, and portions of the Air Nautical Miles Per Pound Of Fuel charts. His primary duties are:

a. Accomplish preflight checks to determine aircraft status.

b. Perform required in-flight servicing and repairs.

c. Use applicable checklists, and accomplish those items for which he is responsible (refer to AFR 60-9) and other duties as directed by the pilot; eg, wing-walk, etc.

ILLUMINATOR OPERATOR.

NOTE

Underlined items indicate a response is required.

The illuminator operator must be proficient in servicing, inspection, minor repair, preflighting, and operation of the illuminator, flare launcher system, and APU. His primary duties are:

a. Be thoroughly familiar with and accomplish preflight checks of the cargo compartment.

b. Accomplish preflight checks of illuminator, flare launcher, and APU.

c. Use the applicable checklist and accomplish those items for which he is responsible and other duties as directed by the aircraft commander.

d. Be responsible to the pilot for security of the cargo compartment and crewmembers during all phases of the mission.

AIRCRAFT INTERIOR INSPECTION.

NOTE

The illuminator operator will perform the AIRCRAFT INTERIOR INSPECTION as directed by the pilot.

Accomplish an interior inspection of the aircraft to include gun system and munitions when gunners are not aboard.

Cargo Compartment (Left Side).

* 1. AFTO Form 781 - Checked.

2. NOS - Installed, cover removed.

3. Smoke evacuation doors - Secured.

   Check that doors are closed, and relief valve safetied.

4. Life raft release T-handle - Secured.

5. Heater bay area - Checked.

   Check heaters for hot spots, fuel leaks, and electrical wiring for security.

6. MXU-470/A modules - Checked, when no gunners are present.

   a. Check that guns are properly secured.

   b. MXU-470/A module - Drive motor T-plug disconnected, safing sector removed, loading sector installed, and safing bar installed.

WARNING

If any of the above items has not been accomplished, interior inspection will cease and appropriate personnel will be immediately notified.

7. Circuit breakers and junction boxes - Checked.
8. Wing flap actuator area - Checked.
9. Illuminator - Checked and secured.
   a. Circuit breakers - Checked in.
   b. Main power switch - Off.
   c. Lens cover - Removed.
   d. Lens - Cleaned.
   e. Coolant pressure indicator - Checked (30 ± 5 psi).
   f. Coolant plumbing for leaks - Checked.
10. APU control panel - Checked.
11. SLAD panel - Checked.
12. Smoke evacuation air bottle - Checked.
13. Spoiler/deflector control valve - Checked.
14. Overhead escape hatch - Secured and safetied.
15. Flare emergency equipment - Checked.

NOTE

Flare launching should not be attempted without asbestos gloves, welder's goggles, and emergency flare ejector tools aboard.

16. Clam shell doors - Checked.

Check that latches are properly hooked and safetied.

Cargo Compartment (Right Side).

1. Flare launcher - Checked.

NOTE

If mission requirements dictate, this step may be omitted until the BEFORE TAKEOFF checklist.

   a. Circuit breakers - OFF.
   b. Power switch - OFF.
   c. Jettison switch - OFF and safetied.
   d. Launcher - Secured.

NOTE

Check that launcher is secured to the rails by the manual locking pin and cross pin is in place. The manual jettison handle is safetied and no movement of launcher is noted.

   e. Manual ejection safeties - Safe.
   f. Pneumatic shutoff valve - OFF.
   g. Individual manifold valves - Open.

CAUTION

Manifold valve should remain open, except for a malfunction or air leak on any launch tube.

   h. Grounding plug - Removed.
   i. Power cable - Connected.
   j. Jettison safety pin - Removed.
   k. Air bottles - Both open (minimum of 6-1/2 turns).
   l. Air pressure - Checked (both bottles).
   m. Launch air bottle - Closed.

WARNING

Only launch air bottle will be closed. Jettison air bottle will be left open for emergency jettisoning.

   n. Flares/markers properly loaded - Checked.

* 2. Aft fuselage personnel door - Checked.

Check that door is properly installed and emergency release handle is safetied.

3. Overhead escape hatch - Secured and safetied.

4. Pilot's instrument inverter circuit breaker - Checked.

5. Smoke evacuation air bottle - Checked.

6. Spoiler/deflector control valve - Checked.

7. Ammunition rack and containers - Checked.

   Check that ammunition containers are properly secured.

* 8. Gun control panel switches - OFF.

9. Circuit breakers and main junction boxes - Checked.

10. Gust lock emergency release handle - Checked.

    Check that handle is normal and safetied.

11. Auxiliary fuel tank selector valve - Checked.

    Valves are open when tanks are installed; valve is closed and safetied when tanks are not installed.

12. Heater bay area - Checked.

    Check heaters for hot spots, fuel leaks, and electrical wiring for security.

*13. Auxiliary power unit - Checked.

    a. Oil level - Checked full.

       Oil supply is 2 gallons; from tip of dip stick to full mark is 2 quarts.

    b. Engine hourmeter circuit breaker - In.

    c. Fuel and oil leaks - Checked.

    d. Starter and control circuit breakers - In.

    e. Check for broken wiring - Checked.

    f. Manual fuel shutoff valve - Open and safetied.

    g. APU junction box circuit breakers - In/Reset.

14. AC power distribution box circuit breakers - Checked.

15. Smoke evacuation doors - Secured.

    Check that doors are closed and relief valve safetied.

16. Spare bulbs - Checked.

17. Brake system pressure gage - Checked.

    System precharge 450 psi, normal pressure 600-1400 psi.

18. Nose junction box circuit breakers - Checked.

19. Nose wheel well inspection door - Checked for security.

20. Oxygen bottles - Checked.

    Pressure checked 400-425 psi; regulators checked; hose for serviceable condition and deterioration; and smoke mask for serviceability, condition, and deterioration.

21. Loose equipment - Stowed.

BEFORE STARTING ENGINES.

* 1. APU - As required.

   Refer to NORMAL OPERATION OF THE APU, Section IV.

* 2. Preflight/thru - flight checks - Complete.

* 3. Interior lights - As required.

BEFORE TAXI.

1. APU - As required.

2. Illuminator - Checked (if required).

   a. Lamphouse - Deployed.

   b. APU voltage - Checked.

   c. Main power switch - ON.

   d. Press-to-test indicator lights - Checked.

e. Interlock lights - Checked out.

f. Mode select switch - VISUAL.

g. Control select switch - AFT position.

h. Lamp intensity control switch - Set

i. Yaw-roll-zoom control stick - Rotate lamphouse to full down position (60 degrees).

j. Lamp switch - START/RESET.

k. Voltmeter and ammeter - Checked.

Intensity	Current/amperage	Voltage
8 to 20 KW	260 to 460 amp	39 to 47 volts

NOTE

For an accurate indication, illuminator main pump should be operating for about 15 minutes to warm up the system.

l. Mode select switches - IR.

NOTE

To avoid operating the lamp in visual mode when the control select switch is set to FWD, the mode select switch on both the control panel and remote control unit must be set to IR.

m. Coolant pressure - Checked (175 to 250 psi).

n. Coolant temperature - Checked (45° to 135°F).

o. Control select switch - FWD.

p. All stations - Checked for lamphouse operation.

q. Lamphouse - Set at 0 degrees.

CAUTION

Lamphouse must be in 0-degree position before being retracted to prevent damage from lamphouse mount.

r. Main power switch - OFF.

NOTE

Main pump runs for 2 minutes to cool system and then shuts down automatically.

s. Lamphouse - Retracted and stowed.

3. APU - As required.

4. Flare launcher jettison circuit breaker - RESET.

5. Cargo compartment - Checked.

Alarm bell checked; gear pins aboard and stowed, doors closed.

ENGINE RUNUP.

1. Cowl flap operation - Checked.

BEFORE TAKEOFF.

1. Flare launcher - Checked (if not previously accomplished).

2. Circuit breakers - Checked.

3. Cargo compartment - Checked.

The illuminator operator will check engines for fuel, oil, and hydraulic leaks; doors and escape hatches closed and secured; brakes for overheat condition; and crew prepared for takeoff.

4. Safety belts - Secured.

Report that all personnel in the cargo compartment are seated and secured with a safety belt.

LINEUP.

1. Windows, doors, and hatches - Closed and secured.

2. Cowl flaps - Trail.

NOTE

Resecure safety belt prior to responding.

AFTER TAKEOFF—CLIMB.

1. APU - As required.
2. Cargo compartment - Checked.

   Observe engines, propeller regulators for leaks, gear up, and doors closed. Check for cargo compartment security.

3. Heater selector switches - As required.
4. Interior lights - As required.

CRUISE.

1. Cargo compartment - Checked.

   Observe engines, propellers and hydraulic systems for leaks, and APU for proper operation; repeat at least hourly.

PRE-STRIKE.

1. Crew stations - Checked.
2. APU - As required.
3. APU voltage - Checked.
4. Illuminator - As required.

   If the illuminator is to be used, accomplish the following steps:

   a. Lamphouse - Deployed.
   b. Main power switch - ON.
   c. Interlock lights - Checked out.
   d. Mode select switch - As required.
   e. Control select switch - AFT position.
   f. Lamp intensity control switch - As required.
   g. SLAD panel control switch - As required.

5. Flare launcher - As required.

   a. Launch air bottle - Open.
   b. Flare launcher launch circuit breaker - RESET.
   c. Power switch - ON.
   d. Control panel ready lights - Illuminated.

   NOTE

   Ready lights will illuminate when their respective flare/marker is ready for launching.

6. Lights - As required.
7. PRE-STRIKE checklist - Completed.

   Notify pilot that illuminator and flare launcher checklists are completed.

STRIKE.

1. Launching flares - As required.

   a. Pneumatic shutoff valve - ON.
   b. Push to fire flares switches - Depressed (as directed).

   NOTE

   - In the event of an electrical failure, flares/markers can be launched manually. Refer to FLARE FAILS TO EJECT ELECTRICALLY (ELECTRICAL FAILURE), Section III.
   - Check for proper position of flare ejector after each flare is launched to prevent flare malfunction and loss of air.

   WARNING

   Visually verify correct placement of flare/marker in the launch tube breech before launching. Do not attempt to launch flares/markers when air pressure is below 750 psi for single launch, or 1000 psi for salvo launch.

(2.) Illuminator - As required.

a. Lamp switch - START/RESET.

b. Interlock lights - Checked out.

c. Control select switch - As required.

POST STRIKE.

1. Illuminator - Shut down.

a. Lamp switch - OFF.

b. Lamphouse - Positioned to 0 degrees.

CAUTION

Lamphouse must be in 0-degree position before being retracted to prevent damage from lamphouse mount.

c. Main power switch - OFF.

NOTE

Main pump runs for 2 minutes to cool system and then shuts down automatically.

d. SLAD panel switch - OFF.

e. Lamphouse - Retracted.

(2.) APU - As required.

3. Flare launcher - Secured.

a. Power switch - OFF.

b. Pneumatic shutoff valve - OFF.

c. Launch air bottle - Closed.

d. Flare launcher launch circuit breaker - OFF.

4. Crew stations - Secure.

DESCENT.

1. Crew - Briefed.

The illuminator operator will notify all personnel in the cargo compartment and insure that they are secure for landing.

(2.) APU - As required.

3. Safety belts - Secured.

The illuminator operator will verify that all crewmembers in the cargo compartment have seat belts secured.

BEFORE LANDING.

1. Landing gear - Down and checked.

The illuminator operator will make a visual check to assure that all three landing gears are extended and that the steering accumulator pin, where applicable, is properly extended, and report to pilot.

AFTER LANDING.

1. Cowl flaps - Open and Checked.

BEFORE LEAVING THE AIRCRAFT.

1. Entrance ladder - Installed.

2. Flare launcher - Secured.

a. Jettison air bottle - Closed.

b. Flare launcher jettison circuit breaker - OFF.

c. Jettison safety pin - Installed.

d. Power cable - Disconnected.

e. Grounding plug - Installed.

f. Covers - Installed.

3. Illuminator - Secured.

a. Lens cover - Installed.

b. Lamphouse and illuminator covers - Installed.

4. AFTO Form 781 - Completed.

5. APU - Shut down.

6. Covers and dust excluders - Installed.

GUNNERS.

NOTE

Underlined items indicate a response is required.

The gunners will load, unload, arm and dearm the guns selectively as required. They must also be capable of repairing gun malfunctions in flight, adjusting the boresight settings of the weapons as required, and perform other duties assigned by the pilot. The first gunner will be responsible to insure completion of the checklist in the proper sequence, at the appropriate time, to insure maximum explosive safety. Those items requiring coordination between crew positions will be completed over the interphone employing the basic challenge-response method. Standard interphone procedures will be used.

MXU-470/A MODULE, GAU-2B/A GUN.

PREPARATION FOR FLIGHT.

1. Gun azimuth and elevation settings - Obtained.
2. Professional equipment - Checked.
3. Mission briefing - Completed.

WEAPONS SYSTEM PREFLIGHT–POWER OFF.

1. Aircraft chocks, ground wire, fire bottle, and external power cart - In place.
2. Form 781 - Checked.
3. Electrical power - As required.

WARNING

Electrical power will be applied as required to facilitate preflight of the aircraft. All power to weapons systems shall be off until it is ascertained that weapons are electrically and mechanically safe.

4. Gunner's equipment and ammunition - Stowed and secured.

   Check that all gunnery equipment is properly stowed and secure. Insure ammunition is proper type and quantity and is properly stowed.

5. Emergency and survival equipment Checked.

   Check condition and stowage of aircraft emergency and survival equipment required for the mission.

6. Master arm switch - SAFE.
7. Firing power switches - OFF.
8. Module gun switch - SAFE AND LOAD.
9. Drive motor connector - Disconnected.
10. Clearing solenoids - Disconnected.
11. Loading sector - Removed.
12. Safing bar - Removed.
13. All guns - Clear.

WARNING

If ammunition is present in gun, discontinue operation until gun is cleared. If barrel cluster is rotated with safing sector installed, the gun may fire.

Rotate barrel cluster one complete revolution to assure no ammunition is present in gun.

14. Gun and module - Checked.

    Check overall condition of the gun. Check bolt assembly for nicks, burrs, and freedom of movement; bent or burred guide bar; drive motor for security; exit unit for freedom of movement and condition of shear pin. Check serviceability of electrical connector and security of module.

15. Loading sector - Installed.
16. Loader - FIRE position.
17. Safing bar - Installed.

18. Clearing solenoid - Connected.

19. Rounds counter - Set.

    Set rounds counter above 6.

20. Battery charger switch - AUTO.

21. Battery heater switch - As required.

22. Repeat steps 8 through 21 for each module - Checked.

23. Circuit breakers - In.

    Check that all circuit breakers located on the gun control panel and the circuit breakers located on the navigator's circuit breaker junction box beneath the navigator's table are in.

WEAPONS SYSTEM PREFLIGHT—POWER ON.

1. Electrical power - On.

   External power should be used if available.

2. Safe lights - On.

   Check that the four SAFE lights located on both the pilot's gun status panel and the gun control panel illuminate.

3. Gun work lights - Checked.

   Rotate rheostat through full range of travel and note that the light brightens and dims.

4. Battery charger switch - AUTO.

   Check battery charging light (red or green) located on the module control box illuminator.

5. Firing mode select switch - MAN.

6. Ground override switch - OVERRIDE.

   The ground override switch is located on the right side of the fire/sight mode selector panel.

7. Gun firing override switch - NORMAL.

   The gun firing override switch is located to the right of the fire control display above the navigator's table.

8. Master arm switch - ARMED.

9. Firing power switch - ON.

10. Armed lights - On.

    Check that the amber (ARMED) light illuminates and the green (SAFE) light extinguishes when the firing power switch is placed in the ON position.

11. Module gun switch - FIRE.

12. Gun trigger switch - Depressed.

13. Triggered light - On.

14. Clearing solenoid - Energized.

15. Gun trigger switch - Released.

16. Clearing solenoid - Deenergized.

17. Triggered light - Off.

18. Module gun switch - SAFE AND LOAD.

19. Firing power switch - OFF.

    Check that the amber (ARMED) light extinguishes and the green (SAFE) light illuminates.

20. Repeat steps 9 through 19 for each module - Checked.

21. Master arm switch - SAFE.

22. Firing mode select switch - OFF.

23. Ground override switches - NORMAL.

24. Electrical power - As required.

25. Spare gunsight bulbs - Checked.

26. Spare gun work light bulbs - Checked.

BEFORE STARTING ENGINES.

1. Preflight/thru-flight checks - Complete.

2. Exterior, interior checks - Complete.

3. Interior lights - As required.

BEFORE TAKEOFF.

1. Equipment and cargo compartment Secured.

   Check that all gunnery equipment is secure.

2. Parachute and safety belt - On and adjusted.

AFTER TAKEOFF—CLIMB.

1. Gun azimuth and elevation - Set.

   Gunner will request from the pilot, or navigator/safety officer, azimuth and elevation to be used.

WARNING

Assure guns are electrically safed before performing azimuth and elevation adjustments.

PRE-STRIKE.

1. Crew stations - Checked.

2. Safing bars - Removed.

3. Ammunition - Advanced.

   Rotate barrel cluster counterclockwise until two rounds of ammunition drop out spent brass chute.

4. Loading sectors - Removed.

5. Safing sectors and housing covers - Installed.

6. Safing bars - Installed.

7. Firing rate switches - As required.

8. Burst mode switches - As required.

9. Burst length timers - Set as required.

10. Notify pilot - PRE-STRIKE checklist completed.

STRIKE.

1. STRIKE checklist. - Acknowledged.

2. Safing bar - Removed.

3. Drive motor - Connected.

4. Module gun switch - FIRE.

5. Firing power switches - ON as required.

6. Notify pilot - Guns on line.

AFTER FIRING.

1. Firing power switches - OFF.

2. Drive motor - Disconnected.

3. Gun switches - SAFE AND LOAD.

4. Guns - Clear.

   Rotate barrel cluster one complete revolution to assure no ammunition is present in the gun.

5. AFTER FIRING checklist - Complete.

   Notify pilot of gun and ammunition status.

LOADING.

1. Firing power switch - OFF.

2. Drive motor - Disconnected.

3. Module gun switch - SAFE AND LOAD.

4. Safing sector and housing cover - Removed.

5. Safing bar - Removed.

6. Gun - Clear.

7. Loading sector - Installed.

8. Loader - Load position.

   Check microswitch.

NOTE

If a partial load is to be loaded, rotate barrel cluster counterclockwise until a round appears at the loader. Rotate barrel cluster clockwise, exposing the first empty sprocket in loader.

9. Rounds counter - Set.

   Set rounds counter as required. Assure that counter indicates number of rounds in module.

10. Link container - Installed.

11. Ammunition container - Positioned.

    Place the container on stand so that the double link may be fed into the loader without twisting of the ammunition belt.

12. Ammunition - Load.

    Insert ammunition belt, double link first, into loader and rotate gun barrels clockwise until ammunition feeds into loader.

13. Drive motor - Connected.

CAUTION

Manually load last 50 rounds to prevent damage to module.

14. Ammunition - Loaded.

    Press load button on module control box and complete loading.

15. Drive motor - Disconnected.

16. Safing bar - Installed.

17. Loader - Fire position.

18. Link container - Removed.

NOTE

For subsequent loading, proceed to PRE-STRIKE and STRIKE checklists.

POST STRIKE.

1. Firing power switches - OFF.

2. Module gun switch - SAFE AND LOAD.

3. Drive motor - Disconnected.

4. Safing sector and housing cover - Removed.

5. Clearing solenoid - Disconnected.

6. Loader - Load position.

7. Gun - Clear.

WARNING

Rotate barrel cluster counterclockwise one revolution, checking that gun is clear of ammunition.

8. Loading sector - Installed.

9. Safing bar - Installed.

10. Repeat steps 2 through 9 for each module - Checked.

11. Crew stations - Secure.

    Notify pilot - Guns safe and clear; ammunition status.

12. Cargo compartment - Secured.

BEFORE LEAVING THE AIRCRAFT.

1. Dust covers - Installed.

2. Forms 781 and 781C - As required.

   All guns and modules will be inspected for serviceability and all discrepancies entered in Form 781 and gunner's report. Form 781C will be completed on ammunition status.

NIGHT OBSERVATION SIGHT (NOS) OPERATOR.

The Night Observation Sight (NOS) operator must be proficient in operation of the night observation sight. He must have a complete knowledge of the fire control system and be able to coordinate his duties with other crewmembers.

PREPARATION FOR FLIGHT.

1. Maps and charts - Obtained and completed.
2. Professional and personal equipment Checked.
3. Time hack - Obtained.
4. Weather and mission briefing - Attended.
5. Emergency survival equipment - Checked.

EXTERIOR CHECK.

1. Antennas and radomes - Checked.

   Check for security and condition.

INTERIOR CHECK (POWER OFF).

1. Form 781 - Checked.
2. NOS power switch - OFF.
3. NOS yoke - Checked.

   Check NOS yoke for hairline cracks.

4. NOS wing/hex nuts - Checked.

   Assure that the two wing nuts or self-locking hex nuts which secure NOS to yoke are tight.

5. Azimuth and elevation brake knobs - Checked.

   Check for free movement of friction knob.

6. C rings - Checked.

   Assure that C rings on end of elevation and azimuth brake screws are installed.

CAUTION

Turning brake knobs fully ccw will force C rings from brake screw.

7. Ease of movement of NOS - Checked.
8. NOS lenses - Checked for damage and cleanliness.

NOTE

If lenses need cleaning, maintenance personnel should perform this function since special equipment is required.

9. Iris control - Checked.

   Check visually for smooth operation and mechanical stops; return to full ccw position.

10. Daylight cover - Checked.

    a. Polaroid lens - Closed for day operations.

    b. Daylight cover - Removed and stowed for night operations.

INTERIOR CHECK (POWER ON).

1. Interior lights - Checked.
2. Interphone and mixer panel - Checked.
3. NOS battery - Checked.

CAUTION

NOS battery must be installed with positive terminal facing oscillator chamber.

4. Oscillator chamber cap - Secure.

WARNING

Operators will not remove oscillator from chamber except for purposes of urgent in-flight maintenance. Severe shock may result if oscillator terminal and ground are touched simultaneously.

5. Eyepiece assembly - Checked.

   Assure that assembly is seated tightly.

6. Power switch - On.

CAUTION

Avoid overloading NOS. Do not point NOS at any bright objects or NOS will blank out. Image will reappear when light overload is removed.

NOTE

If no picture, check for proper installation of battery, oscillator, and image tube in place.

7. Iris control/daylight cover - Adjusted.

NOTE

During daylight hours, set polaroid lens cover for minimum light. Adjust as necessary.

8. NOS crosshairs - Focused.

   Focus with eyepiece focus ring.

9. Range focus - Set

   Set range focus ring at infinity.

10. NOS and daylight sight alignment - Checked.

   Select a distant object and assure that both crosshairs are centered on the same point.

11. Power switch - Off.

12. SLAD panels - Checked.

13. NOS guidance - Checked.

   Move NOS forward, aft, up, and down when directed by the navigator.

14. Consent switches - Checked.

   Check consent switches in accordance with navigator's instructions.

15. Fire control system ground check - Complete.

NOTE

Completed in conjunction with the navigator. The navigator will direct NOS movements to center movable reticle, then tighten brake knobs. Do not move NOS until notified that navigator's checks are complete.

16. NOS - Stowed.

   NOS stowed for takeoff and brake knobs adjusted.

BEFORE STARTING ENGINES.

1. Emergency survival equipment - Checked, parachute fitted.
2. Preflight/thru-flight checks - Complete.
3. Interior lights - Set.
4. Daylight lens cover - Removed.

BEFORE TAXI.

1. Illuminator control - Checked.
   a. Elevation movement: UP-DOWN
   b. Azimuth movement: FWD-AFT

BEFORE TAKEOFF.

1. NOS seat - Stowed.

   Stow NOS seat in the up position.

2. Parachute - On.
3. Safety belt - Fastened.

AIRBORNE SENSOR ALIGNMENT (As Required).

1. Procedure - Checked.
   a. Position NOS reticle on alignment point. Alignment point must be detectable by NOS and visible to pilot. A small, defined point is desirable. NOS operator will track target and notify pilot when tracking.

PRE-STRIKE.

1. Crew stations - Checked (restraining harness secured).
2. NOS - Checked.
   a. Power switch - On.
   b. Iris control - Adjusted.

      Adjust iris control, with ambient light or illuminator on IR, for usable picture.
   c. Crosshairs - Focused.

      Focus NOS reticles for sharpness using focus ring.
   d. Range focus - Focused.

      Position NOS to 30° depression angle and adjust range focus ring for sharp, clear picture.

STRIKE.

1. Target - Acquired, identified, and tracked.
2. Consent switch - Depressed.

WARNING

The consent switch(es), located on the right and left grips of the NOS, will not be depressed until positive target identification has been made.

AFTER FIRING.

1. Consent switch - Released.

   NOS will continue an irregular search pattern.

POST STRIKE.

1. Iris control - CCW.
2. NOS power switch - OFF.
3. NOS - Secured.
4. NOS seat - Stowed in up position.
5. Crew stations - Secure.

DESCENT.

1. Safety belt - Fastened.

AFTER LANDING.

1. NOS station - Policed.
2. Interior lights - Off.
3. Inoperative equipment - Noted in Form 781.

SECTION IX

ALL-WEATHER OPERATION

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The following information is contained in T.O. 1C-119G-1.

INSTRUMENT FLIGHT PROCEDURES.

RADIO RANGE, ADF, VOR, TACAN APPROACH.

RADAR AND ILS APPROACH.

ICE AND RAIN.

TURBULENCE AND THUNDERSTORMS

OPERATION IN TURBULENT AIR.

Power setting and pitch attitude are the keys to proper flight technique in turbulent air. The power setting and pitch attitude required for the desired penetration airspeed and established before entering the storm will, if maintained throughout the storm, result in a constant airspeed, regardless of any false readings of the airspeed indicator. Do not attempt to change power settings every time your airspeed indicator fluctuates. Rapid changes in horizontal gust velocity or heavy rain clogging the pitot tube may cause the airspeed to fluctuate momentarily as much as 60 knots. Specific instructions for preparing to enter a storm and flying in it are given in the following paragraphs.

CAUTION

Flight through a thunderstorm should be avoided if it is at all possible. However, since circumstances may force you at some time to enter a zone of severe turbulence, you should be familiar with the techniques recommended for flying under such conditions.

APPROACHING THE STORM.

Flying under conditions of extreme turbulence, such as through thunderstorms, should be avoided.

The possibility remains, that flight through a storm may be a matter of military necessity.

It is imperative that you prepare the aircraft prior to entering a zone of turbulent air. Prepare the aircraft as follows:

1. Disengage autopilot.
2. Pitot heater switch - ON.
3. Carburetor air switches - HOT, as required.

   Maintain a minimum of 15°C whenever flying through visible moisture.

4. Power adjusted as necessary to obtain penetration speed - 40 knots above the power-off stall. See figure 6-1.
5. Check gyro instruments for proper settings.
6. Safety belts - Tightened (check crewmembers and passengers).
7. Turn off any radio equipment rendered useless by static.
8. At night, turn cockpit lights full bright to minimize blinding effect of lightning.

NOTE

Do not lower wing flaps or landing gear, as this will result in loss of aerodynamic efficiency.

IN THE STORM.

Normally, the least turbulent area in a thunderstorm will be at any altitude of less than 6000 feet above the terrain. Altitudes between 10,000 feet and 20,000 feet are usually the most turbulent. Optimum turbulent air penetration speed is 40 knots above power-off stall speed. See figure 6-1.

1. Maintain power setting and pitch attitude (as established before entering the storm) throughout the storm. Hold these constant and your airspeed will be approximately constant, regardless of your airspeed indicator.
2. Devote full attention to flying the aircraft.
3. Expect turbulence, precipitation, and lightning. Do not permit these conditions to cause undue concern.
4. Maintain level attitude. Concentrate principally on holding a level attitude by reference to the attitude indicator.
5. Do not chase the airspeed indicator, since doing so will result in extreme aircraft attitudes. If a sudden gust should be encountered while the aircraft is in a nose-high attitude, a stall might easily result. A heavy rain, by partly blocking the pitot tube pressure heads may decrease the indicated airspeed by as much as 60 knots.
6. Use as little elevator and rudder control as possible in order to minimize the stresses imposed on the aircraft. Avoid sudden maneuvers.
7. Operate deicing and anti-icing controls as necessary to prevent formation of ice on propellers and lifting surfaces.
8. The altimeter may be unreliable in thunderstorms because of differential barometric pressure within the storm. A gain or loss of several thousand feet may be expected. Make allowances for this error in determining minimum safe altitude.

The following information is contained in T.O. 1C-119G-1.

NIGHT FLYING.

COLD WEATHER PROCEDURES.

HOT WEATHER PROCEDURES.

DESERT PROCEDURES.

PERFORMANCE DATA

appendix I

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NOTE

Performance charts, contained in this appendix, are presented in a format similar to the charts contained in T.O. 1C-119G-1.

Explanations and sample problems for the following charts are provided in this appendix:

Airspeed Installation Correction

Takeoff Gross Weight Limit

Takeoff Distances

Variation Of Takeoff Ground Run

With Runway Surface Condition

With Runway Gradient

Takeoff Acceleration

Standard Instrument Departure

Landing Distances

Variation Of Landing Ground Run

With Runway Condition Reading

With Runway Gradient

Refer to T.O. 1C-119G-1 for explanations, sample problems, and methods of reading other charts.

MISCELLANEOUS DATA

part 1

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MISCELLANEOUS DATA.

Except for the following all information is contained in T.O. 1C-119G-1.

AIRSPEED INSTALLATION CORRECTION.

The Airspeed Installation Correction chart, figure A1-1, provides a means for converting indicated airspeed (IAS) to calibrated airspeed (CAS) in order to compensate for errors introduced into the airspeed as a result of the characteristics of the pitot-static system installation on AC-119G aircraft. Two distinct installation correction factors are associated with these aircraft: "in ground effects" when the aircraft is in the proximity of the ground, such as during takeoff and landing, and "out of ground effects" for other airborne performance features. Airspeed conversions are variable for both "in ground effects" and "out of ground effects" as depicted on the correction chart.

Use of the Chart.

To convert indicated airspeed (IAS) to calibrated airspeed (CAS), enter the chart along the vertical scale with the known IAS and move to the right to the intersection of the IAS line and the desired "in ground effect" or "out of ground effect" plotted line. Move vertically downward from this point to the horizontal CAS scale and read CAS directly from the scale. Interpolation is required for determining points representing intermediate values between those indicated.

Example.

GIVEN: Indicated airspeed 125 knots, out of ground effect.

FIND: Calibrated airspeed from figure A1-1.

1. Enter the chart from the vertical scale along the 125 knots IAS line and move horizontally to the right to the "out of ground effect" plotted line.

2. Move vertically downward from this point to the CAS scale and read 128 knots CAS.

MODEL: AC-119G

AIRSPEED INSTALLATION CORRECTION

EFFECTIVE: ALL WEIGHTS AND CONFIGURATIONS

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

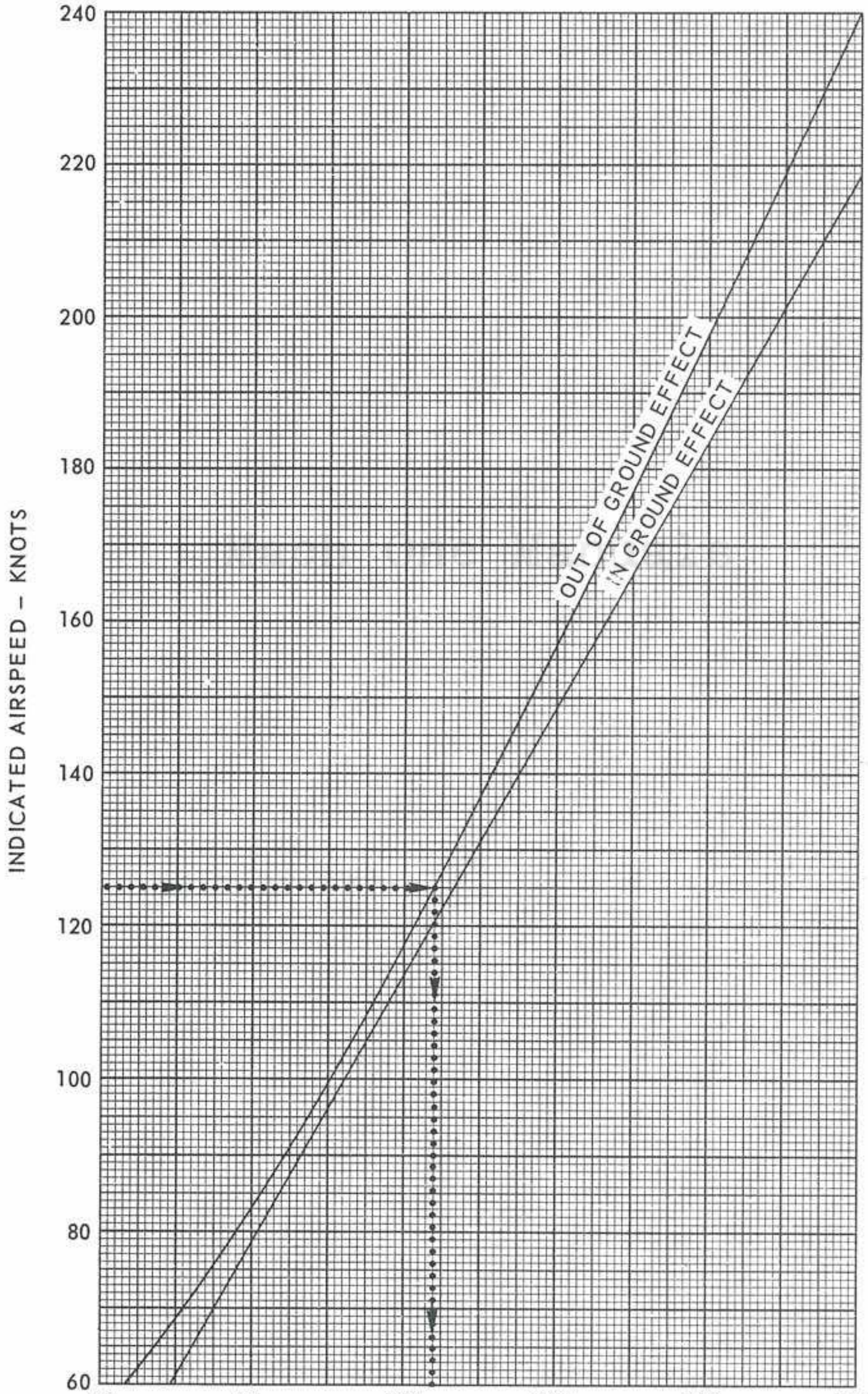

Figure A1-1

MODEL: AC-119G

TEMPERATURE CONVERSION

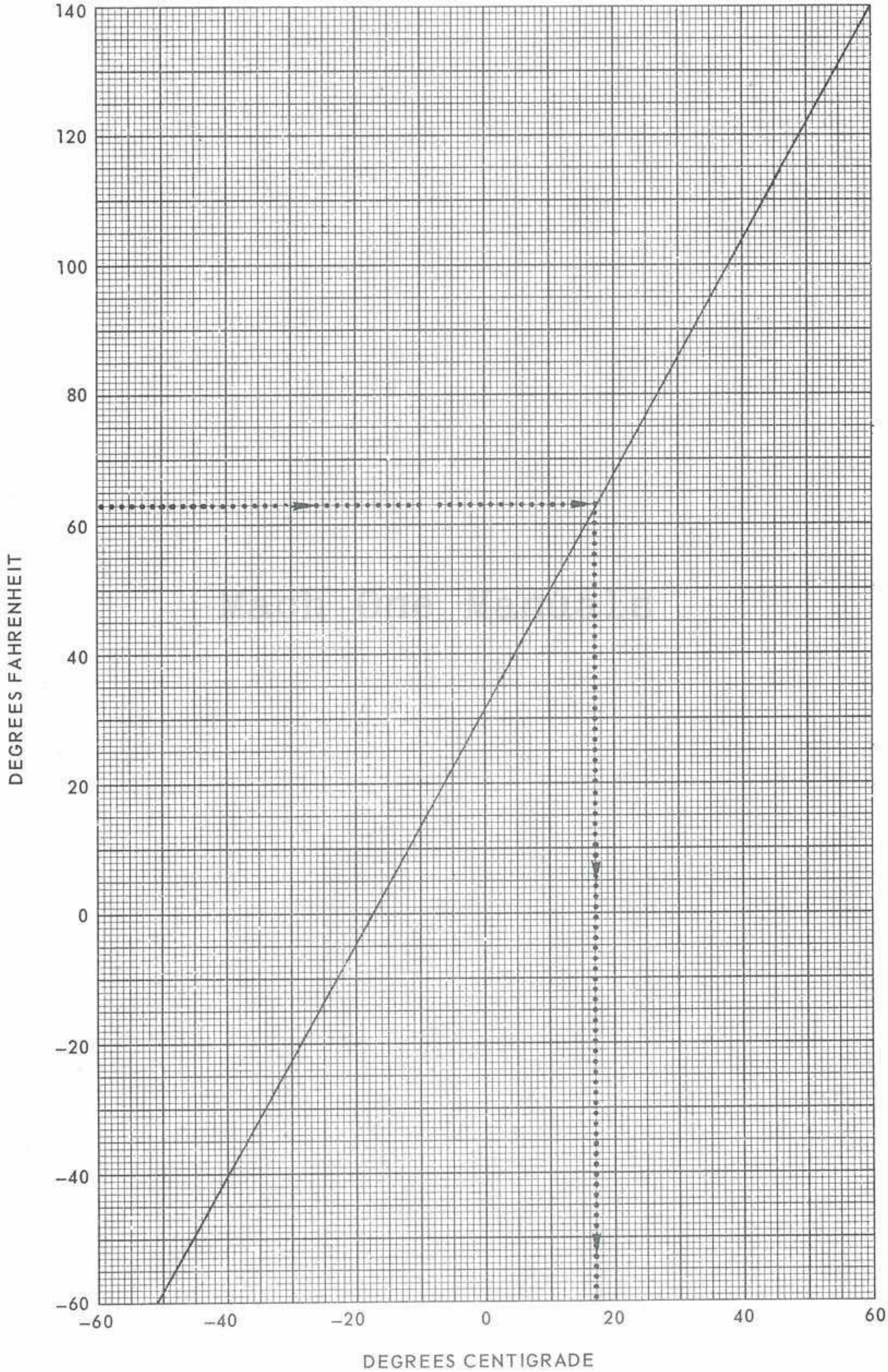

Figure A1-2

MODEL: AC-119G

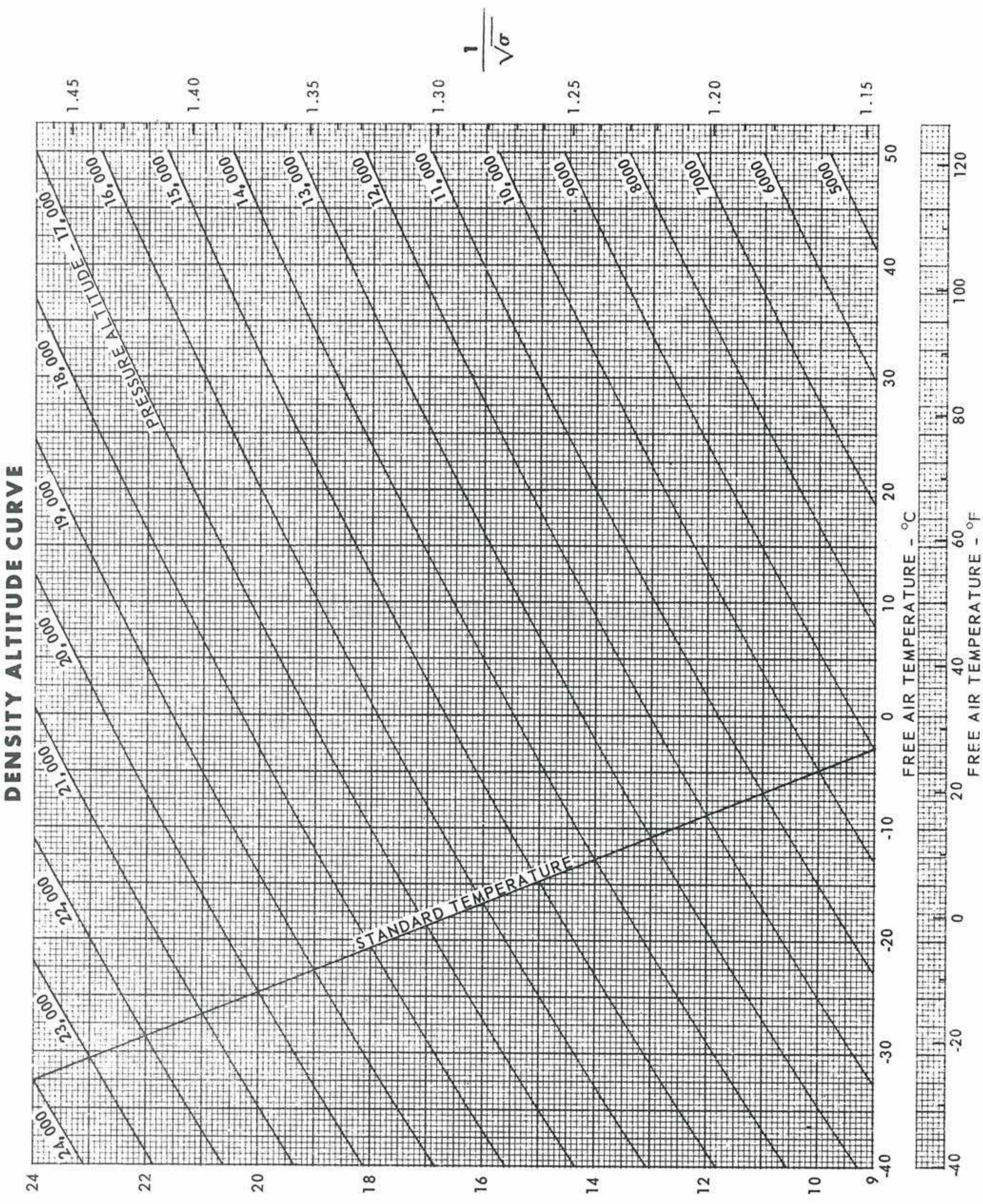

Figure A1-3

MODEL: AC-119G

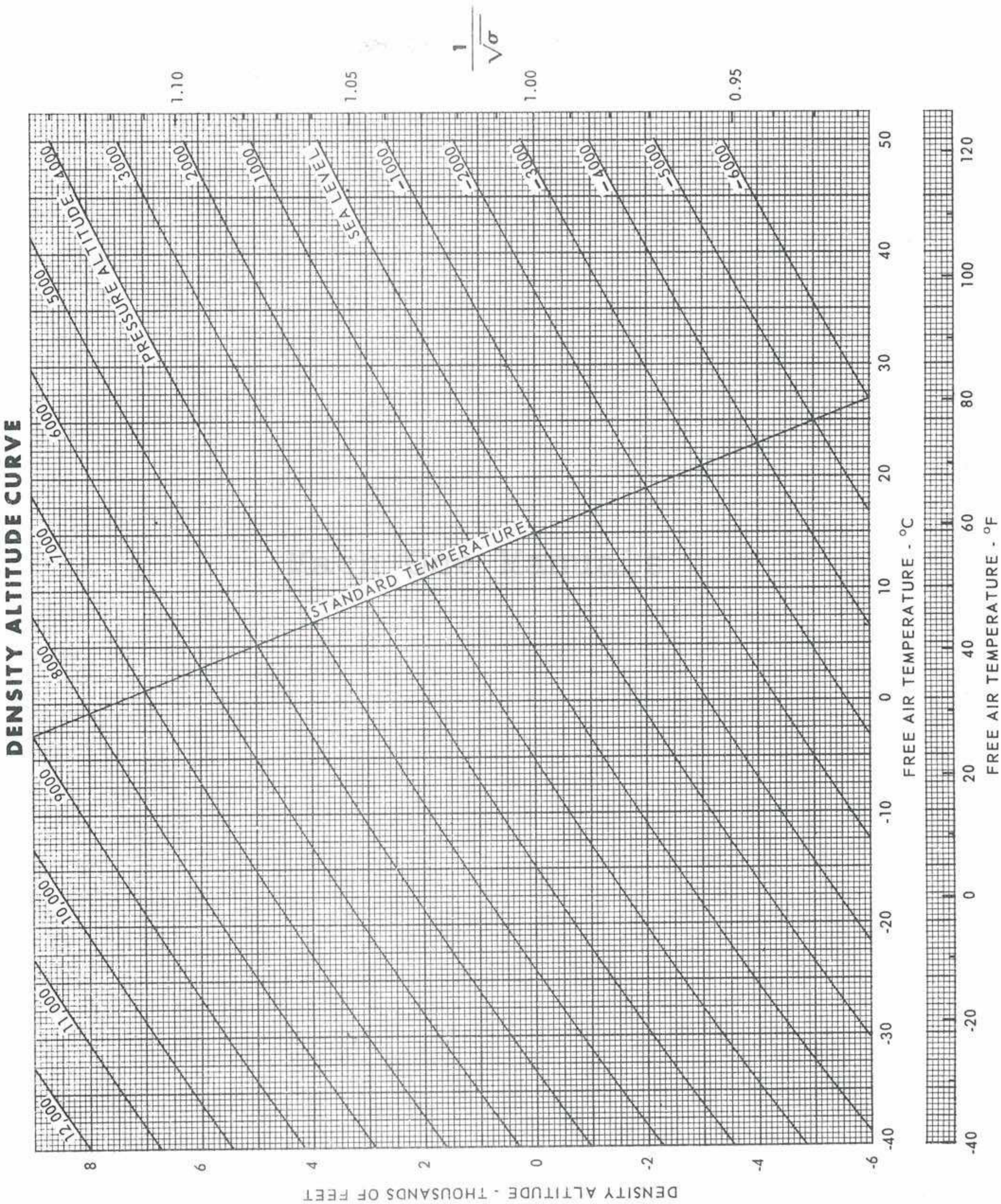

Figure A1-4

ENGINE DATA

part 2

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ENGINE POWER SCHEDULE
Standard Day — Fuel 115/145

ENGINE: R3350-89B **SUPERCHARGER RATIO: Low**

POWER RATING	BHP at Sea Level	MIXTURE	RPM	ALTITUDE – FEET													
				Sea Level		2000		4000		6000		8000		10,000		12,000	
				MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)	MAP (in. Hg)	TOP (psi)
Maximum Wet	3500	RICH	2900	57.5	171.4	57.0	171.4	56.5	171.4								
Maximum Dry	3250	RICH	2900	59.5	159.1	58.5	159.1	57.5	159.1								
METO	2600	RICH	2600	48.5	142.0	48.0	143.0	47.0	144.0	46.5	145.0	45.8	146.0				
Cruise	1980	RICH	2400	39.0	117.2	38.5	118.0	38.0	119.0	37.5	120.0	37.0	121.0	36.5	122.0		
Cruise	1720	RICH	2300	36.0	106.2	36.0	107.0	35.5	109.0	35.0	110.0	35.0	111.0	34.5	112.0	33.5	
Cruise	1720	Manual Lean	2300	40.0	106.2	40.0	107.0	40.0	109.0	40.0	110.0	40.0	111.0	40.0	112.0	40.0	113.0
Cruise	1672	Manual Lean	2250	40.0	105.5	40.0	106.2	40.0	108.1	40.0	109.0	40.0	109.6	40.0	110.1	40.0	111.1
Cruise	1624	Manual Lean	2200	40.0	104.8	40.0	105.5	40.0	107.2	40.0	108.0	40.0	108.2	40.0	108.3	40.0	109.3
Cruise	1575	Manual Lean	2150	40.0	104.0	40.0	104.7	40.0	106.3	40.0	107.0	40.0	106.8	40.0	106.4	40.0	107.4
Cruise	1528	Manual Lean	2100	40.0	103.3	40.0	103.9	40.0	105.4	40.0	106.0	40.0	105.4	40.0	104.6	40.0	105.6
Cruise	1481	Manual Lean	2050	40.0	102.6	40.0	103.2	40.0	104.5	40.0	105.0	40.0	104.0	40.0	102.7	40.0	103.7
Cruise	1435	Manual Lean	2000	40.0	101.9	40.0	102.4	40.0	103.6	40.0	104.0	40.0	102.6	40.0	100.9	40.0	101.9
Cruise	1390	Manual Lean	1950	40.0	101.2	40.0	101.6	40.0	102.7	40.0	103.0	40.0	101.2	40.0	99.0	40.0	100.0
Cruise	1345	Manual Lean	1900	40.0	100.5	40.0	100.9	40.0	101.9	40.0	102.0	40.0	99.8	40.0	99.0	40.0	99.0
Cruise	1299	Manual Lean	1850	40.0	99.7	40.0	100.1	40.0	101.0	40.0	101.0	40.0	98.4	40.0	99.0	40.0	99.0
Cruise	1255	Manual Lean	1800	40.0	99.0	40.0	99.3	40.0	100.1	40.0	100.0	40.0	97.0	40.0	99.0	40.0	99.0
Cruise	1168	Manual Lean	1700	40.0	97.6	40.0	97.8	40.0	98.3	40.0	98.0	40.0	98.0	40.0	98.0	40.0	98.0
Cruise	1083	Manual Lean	1600	40.0	96.1	40.0	96.2	40.0	96.5	40.0	96.0	40.0	98.0				
Cruise	1000	Manual Lean	1500	40.0	94.7	40.0	94.7	40.0	94.7	40.0	97.0						

CONDITIONS:

1. MAP and TOP values are limiting. Corrections, as applicable, are listed below.
2. Do not exceed a 2.0 in. Hg difference in MAP between engines when operating at the same power and fuel/air ratio except when using carburetor heat.
3. Power settings to the left of the heavy black line develop quoted BHP without benefit of inflight ram air pressure. Power settings to the right of the line require ram air effect to develop quoted BHP.
4. Above 2300 rpm and below 2600 rpm, MAP may be increased 1/4 in. Hg for each 6°C rise above standard temperature, but must be decreased 1/4 in. Hg for each 6°C drop below standard.
5. All power settings above 2300 rpm will be RICH mixture.
6. Spark control will be in retard position at all power settings above 2300 rpm.

DATA AS OF: 5 OCTOBER 1961

DATA BASIS: SP2166B(WAD)- FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

Figure A2-1

ENGINE POWER SCHEDULE

Standard Day — Fuel 115/145

ENGINE: R3350-89B **SUPERCHARGER RATIO: High**

POWER RATING	BHP at 10000 feet	MIXTURE	RPM	ALTITUDE – FEET 10,000 MAP (in. Hg)	10,000 TOP (psi)	12,000 MAP (in. Hg)	12,000 TOP (psi)	14,000 MAP (in. Hg)	14,000 TOP (psi)	16,000 MAP (in. Hg)	16,000 TOP (psi)	18,000 MAP (in. Hg)	18,000 TOP (psi)	20,000 MAP (in. Hg)	20,000 TOP (psi)
Maximum Dry	2500	RICH	2600	51.5	136.5	51.0	138.0	50.5	138.0	50.0	139.0				
METO	2400	RICH	2600	49.5	131.1	49.0	132.0	48.5	132.0	48.0	133.0	47.5	134.0		
Cruise	1780	RICH	2400	39.5	105.3	39.0	106.0	38.5	106.0	38.5	107.0	38.0	108.0	37.5	109.0
Cruise	1600	RICH	2300	37.0	98.8	36.5	99.5	36.5	100.3	36.0	101.0	35.5	100.4	35.0	101.7
Cruise	1600	Manual Lean	2300	40.0	98.8	40.0	99.5	40.0	100.3	40.0	101.0	40.0	100.4	40.0	101.0
Cruise	1560	Manual Lean	2250	40.0	98.3	40.0	99.0	40.0	99.8	40.0	100.5	40.0	99.9	40.0	101.0
Cruise	1515	Manual Lean	2200	40.0	97.8	40.0	98.5	40.0	99.3	40.0	100.0	40.0	99.5	40.0	101.0
Cruise	1475	Manual Lean	2150	40.0	97.3	40.0	98.0	40.0	98.7	40.0	99.5	40.0	99.0	40.0	100.0
Cruise	1430	Manual Lean	2100	40.0	96.8	40.0	97.5	40.0	98.2	40.0	99.0	40.0	98.5	40.0	99.0
Cruise	1390	Manual Lean	2050	40.0	96.3	40.0	97.0	40.0	97.7	40.0	98.5	40.0	97.0		
Cruise	1350	Manual Lean	2000	40.0	95.8	40.0	96.5	40.0	97.2	40.0	98.0	40.0	97.0		
Cruise	1310	Manual Lean	1950	40.0	95.3	40.0	96.0	40.0	96.6	40.0	97.5				
Cruise	1270	Manual Lean	1900	40.0	94.9	40.0	95.5	40.0	96.1	40.0	97.0				
Cruise	1230	Manual Lean	1850	40.0	94.4	40.0	94.9	40.0	95.6	40.0	96.4				
Cruise	1190	Manual Lean	1800	40.0	93.9	40.0	94.4	40.0	95.1	40.0	95.9				
Cruise	1150	Manual Lean	1750	40.0	93.4	40.0	93.9	40.0	94.5						
Cruise	1110	Manual Lean	1700	40.0	92.9	40.0	93.4	40.0	94.0						
Cruise	1075	Manual Lean	1650	40.0	92.4	40.0	92.9	40.0	93.5						
Cruise	1035	Manual Lean	1600	40.0	91.9	40.0	92.4	40.0	93.0						
Cruise	1000	Manual Lean	1550	40.0	91.4	40.0	91.9	40.0	92.4						
Cruise	960	Manual Lean	1500	40.0	90.9	40.0	91.4	40.0	91.9						

CONDITIONS:

1. MAP and TOP values are limiting. Corrections, as applicable, are listed below.
2. Do not exceed a 2.0 in. Hg difference in MAP between engines when operating at the same power and fuel/air ratio except when using carburetor heat.
3. Power settings to the left of the heavy black line develop quoted BHP without benefit of inflight ram air pressure. Power settings to the right of the line require ram air effect to develop quoted BHP.
4. Above 2300 rpm and below 2600 rpm, MAP may be increased 1/4 in. Hg for each 6°C rise above standard temperature, but must be decreased 1/4 in. Hg for each 6°C drop below standard.
5. All power settings above 2300 rpm will be RICH mixture.
6. Spark control will be in retard position at all power settings above 2300 rpm.

DATA AS OF: 5 OCTOBER 1961
DATA BASIS: SP2166B(WAD)-FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

Figure A2-2

MODEL: AC-119G

POWER SCHEDULE CURVE

ENGINE: R3350-89B

LOW BLOWER

DATA AS OF: 1 NOVEMBER 1968
DATA BASIS: CALCULATED

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. MAP and TOP values are limiting. Corrections, as applicable, are listed below.
2. Do not exceed a 2.0 in. Hg difference in MAP between engines when operating at the same power and fuel/air ratio except when using carburetor heat.
3. Above 2300 rpm and below 2600 rpm, MAP may be increased 1/4 in. Hg for each 6°C rise above standard temperature, but must be decreased 1/4 in. Hg for each 6°C drop below standard.
4. All power settings above 2300 rpm will be RICH mixture.
5. Spark control will be in retard position at all power settings above 2300 rpm.

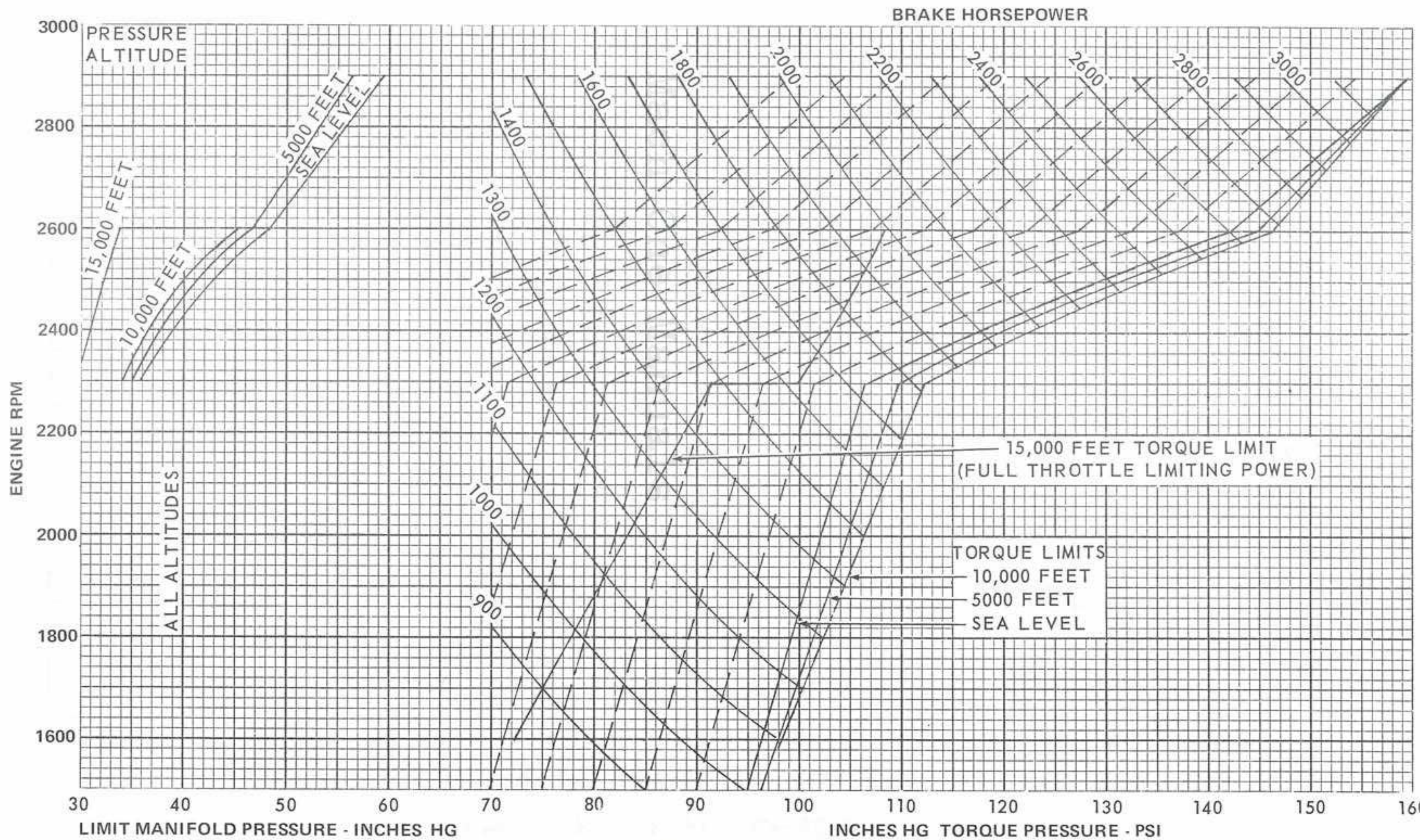


Figure A2-3

MODEL: AC-119G

POWER SCHEDULE CURVE

ENGINE: R3350–89B

HIGH BLOWER

DATA AS OF: JANUARY 1971
DATA BASIS: CALCULATED

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. MAP and TOP values are limiting. Corrections, as applicable, are listed below.
2. Do not exceed a 2.0 in. Hg difference in MAP between engines when operating at the same power and fuel/air ratio except when using carburetor heat.
3. Above 2300 rpm and below 2600 rpm, MAP may be increased 1/4 in. Hg for each 6°C rise above standard temperature, but must be decreased 1/4 in. Hg for each 6°C drop below standard.
4. All power settings above 2300 rpm will be RICH mixture.
5. Spark control will be in retard position at all power settings above 2300 rpm.

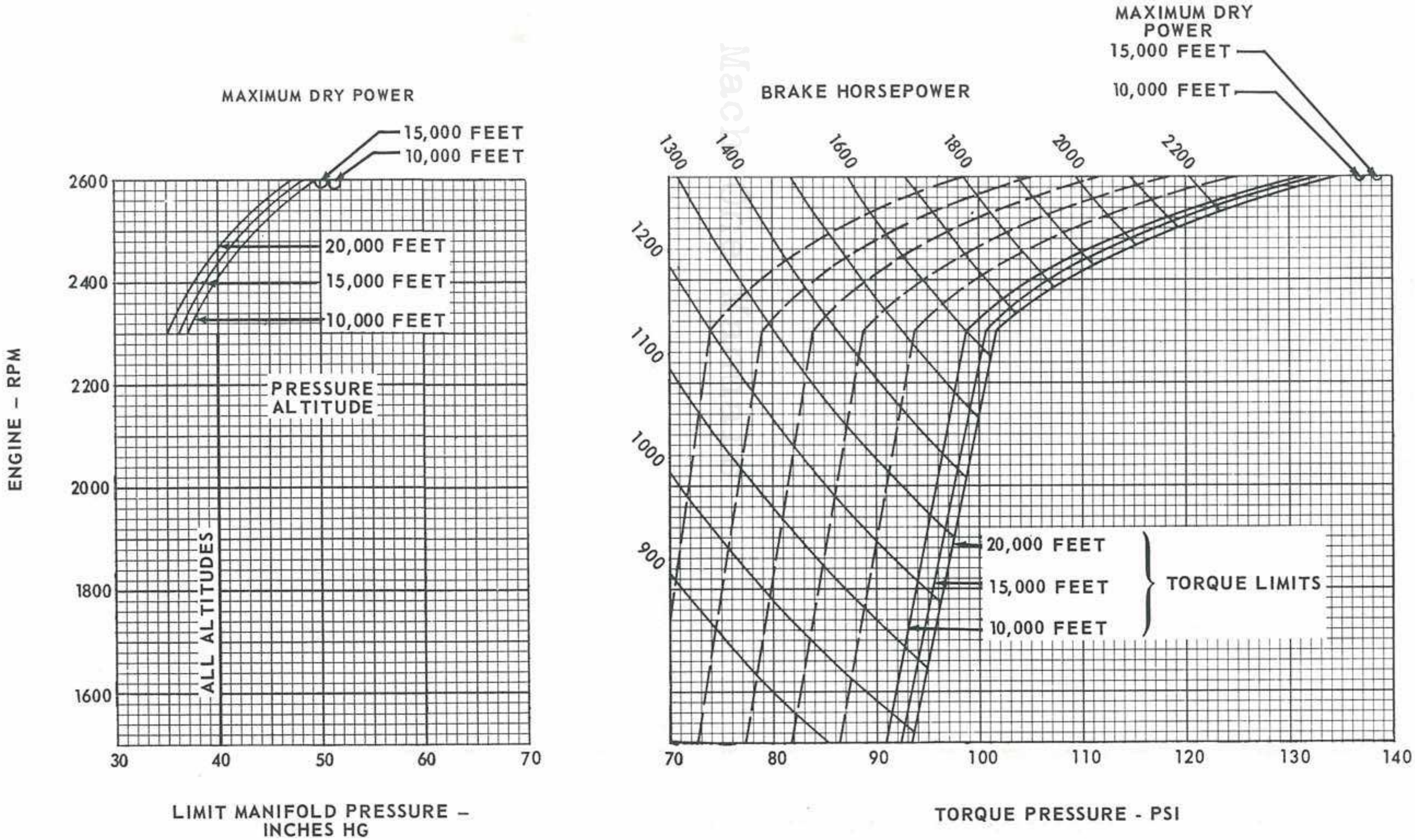


Figure A2-4

MODEL: AC-119G

LIMIT MANIFOLD PRESSURE

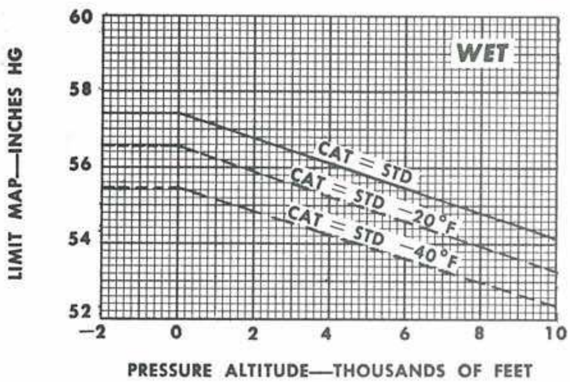
ENGINE: R3350–89B

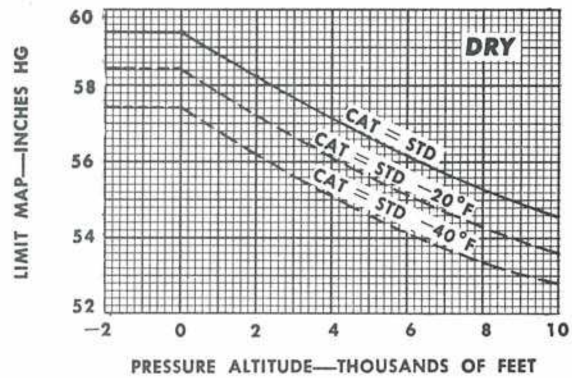
MAXIMUM POWER

CONDITIONS:

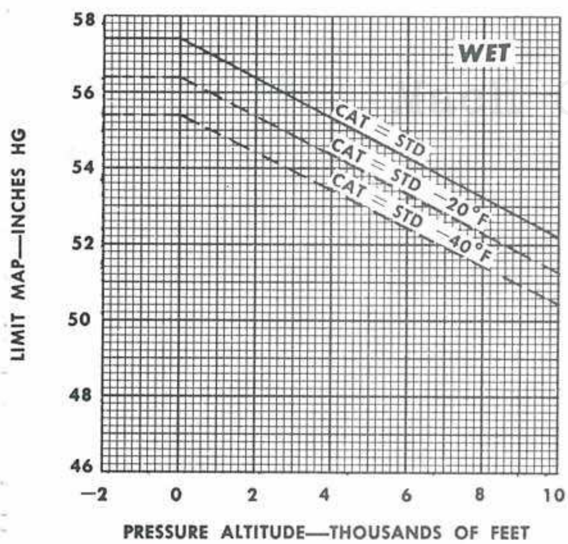
1. Low blower operation.
2. Standard day temperature.
3. 2900 rpm.

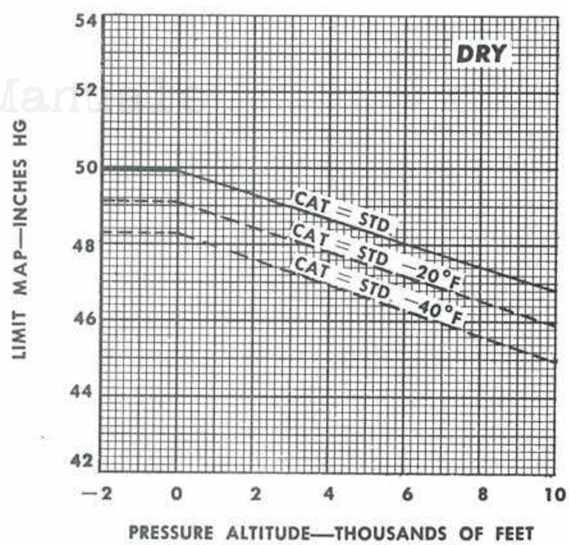
NORMAL FUEL — GRADE 115/145



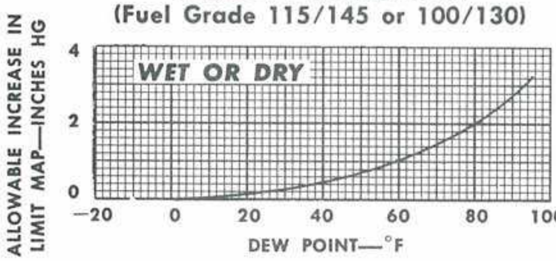


ALTERNATE FUEL — GRADE 100/130





HUMIDITY CORRECTION
(Fuel Grade 115/145 or 100/130)



KEY

Figure A2-5

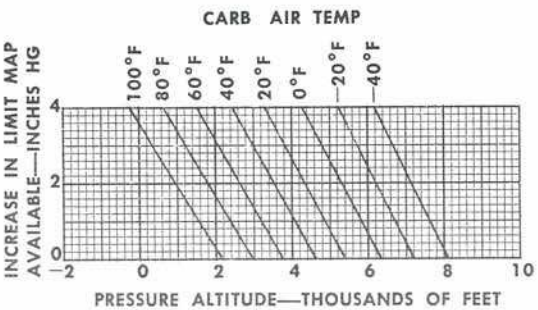
MODEL: AC-119G

BRAKE HORSEPOWER AVAILABLE

ENGINE: R3350–89B

MAXIMUM WET POWER

NORMAL FUEL — GRADE 115/145



CONDITIONS:
1. Low blower operation.
2. 2900 rpm.
3. Mixture—RICH.
4. Water injection.

DATA AS OF: 1 SEPTEMBER 1962
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

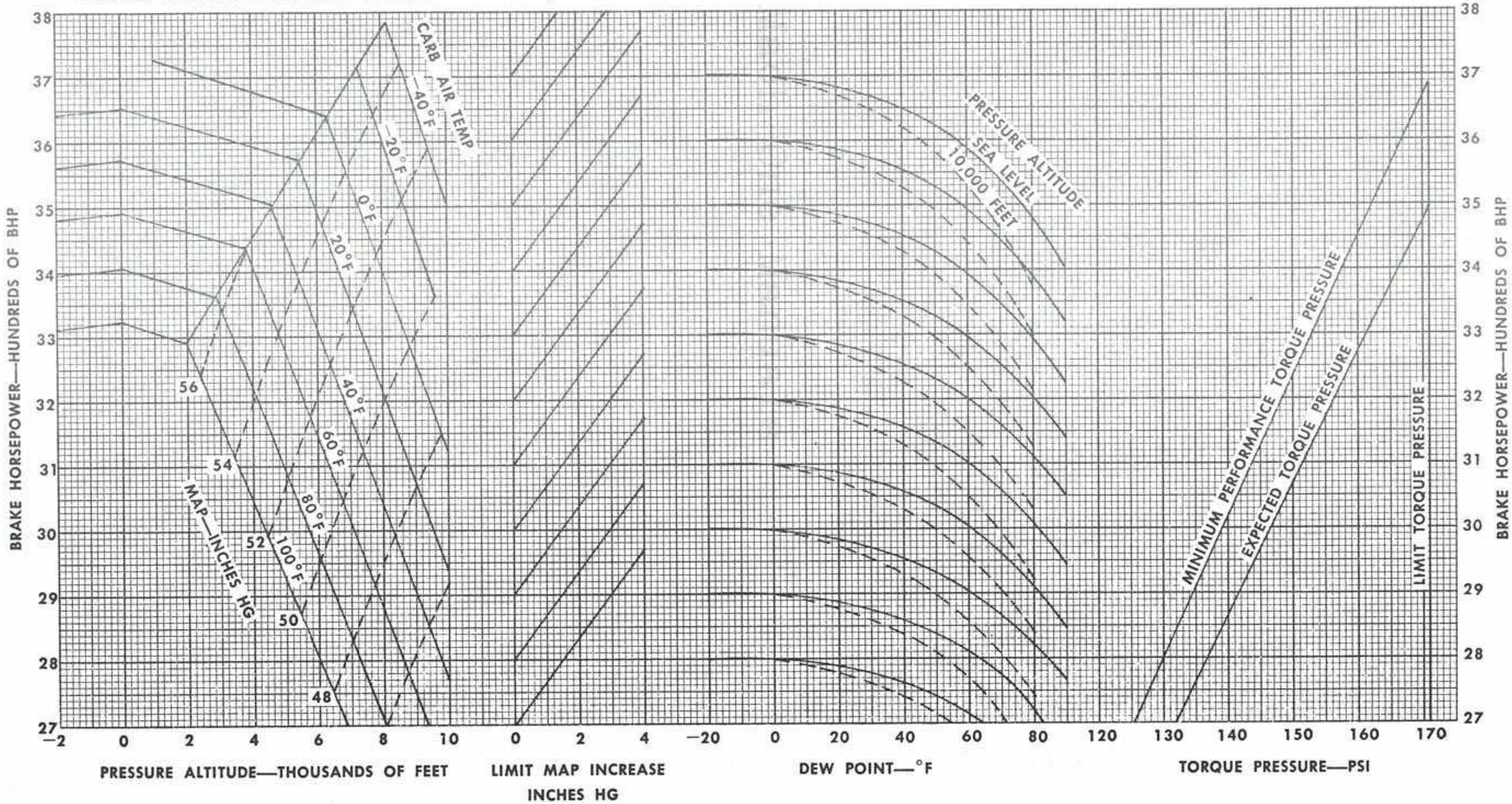


Figure A2-6

MODEL: AC-119G

BRAKE HORSEPOWER AVAILABLE

ENGINE: R3350–89B

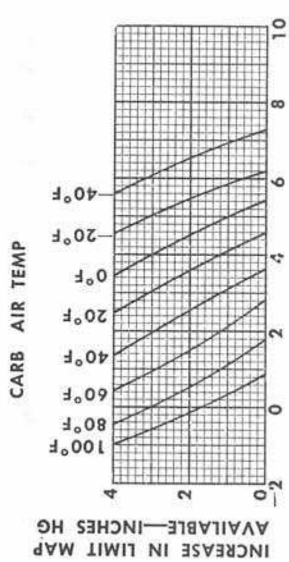
MAXIMUM DRY POWER

NORMAL FUEL — GRADE 115/145

DATA AS OF: 1 SEPTEMBER 1962
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

CONDITIONS:
1. Low blower operation.
2. 2900 rpm.
3. Mixture—RICH.



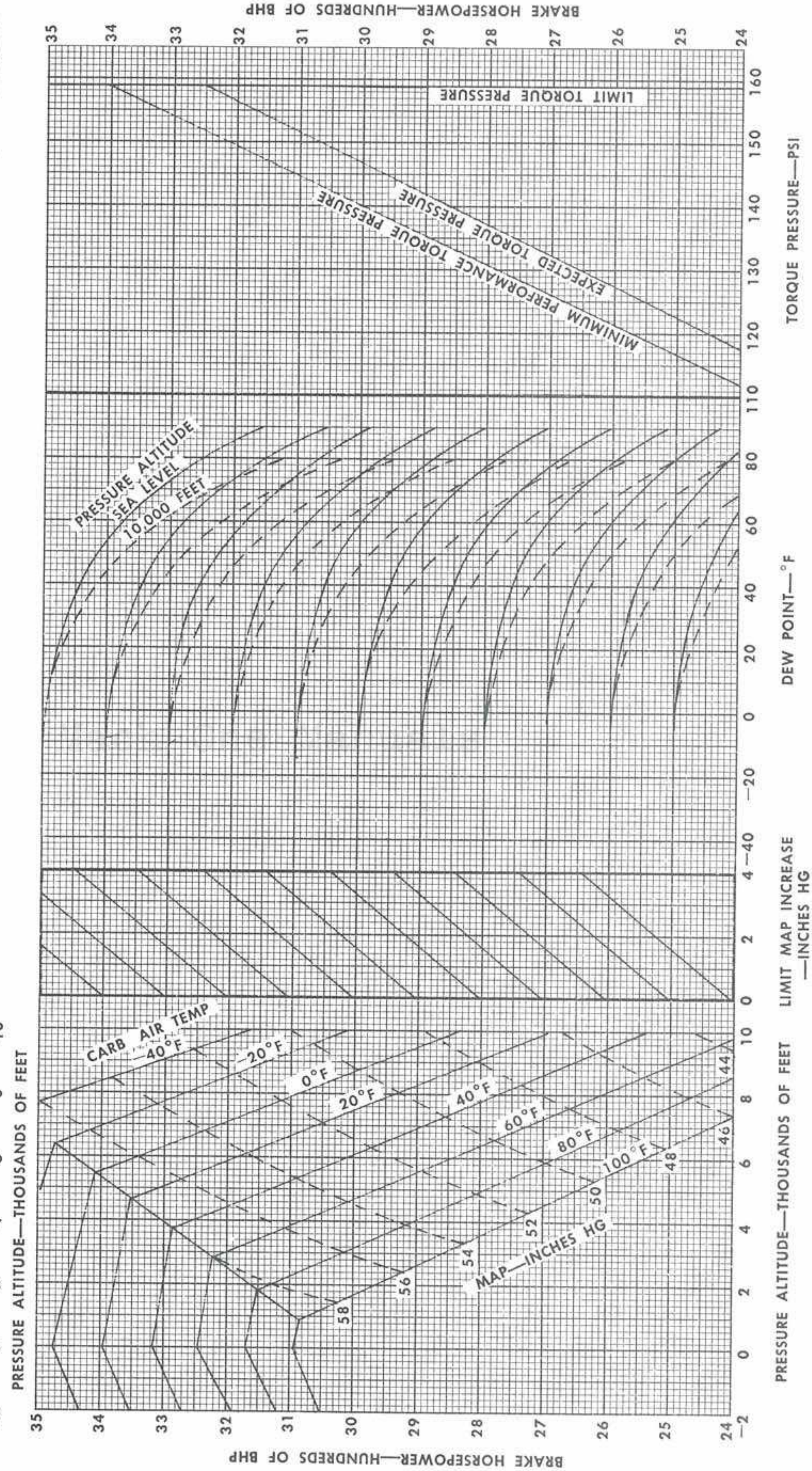


Figure A2-7

MODEL: AC-119G

BRAKE HORSEPOWER AVAILABLE

ENGINE: R3350-89B

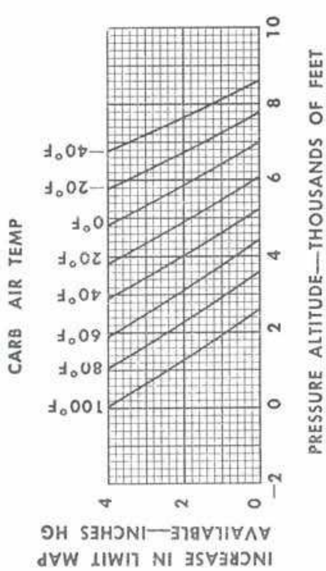
MAXIMUM WET POWER

ALTERNATE FUEL — GRADE 100/130

DATA AS OF: 1 SEPTEMBER 1962
DATA BASIS: FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6 LB/GAL

CONDITIONS:
1. Low blower operation.
2. 2900 rpm.
3. Mixture—RICH.
4. Water injection.



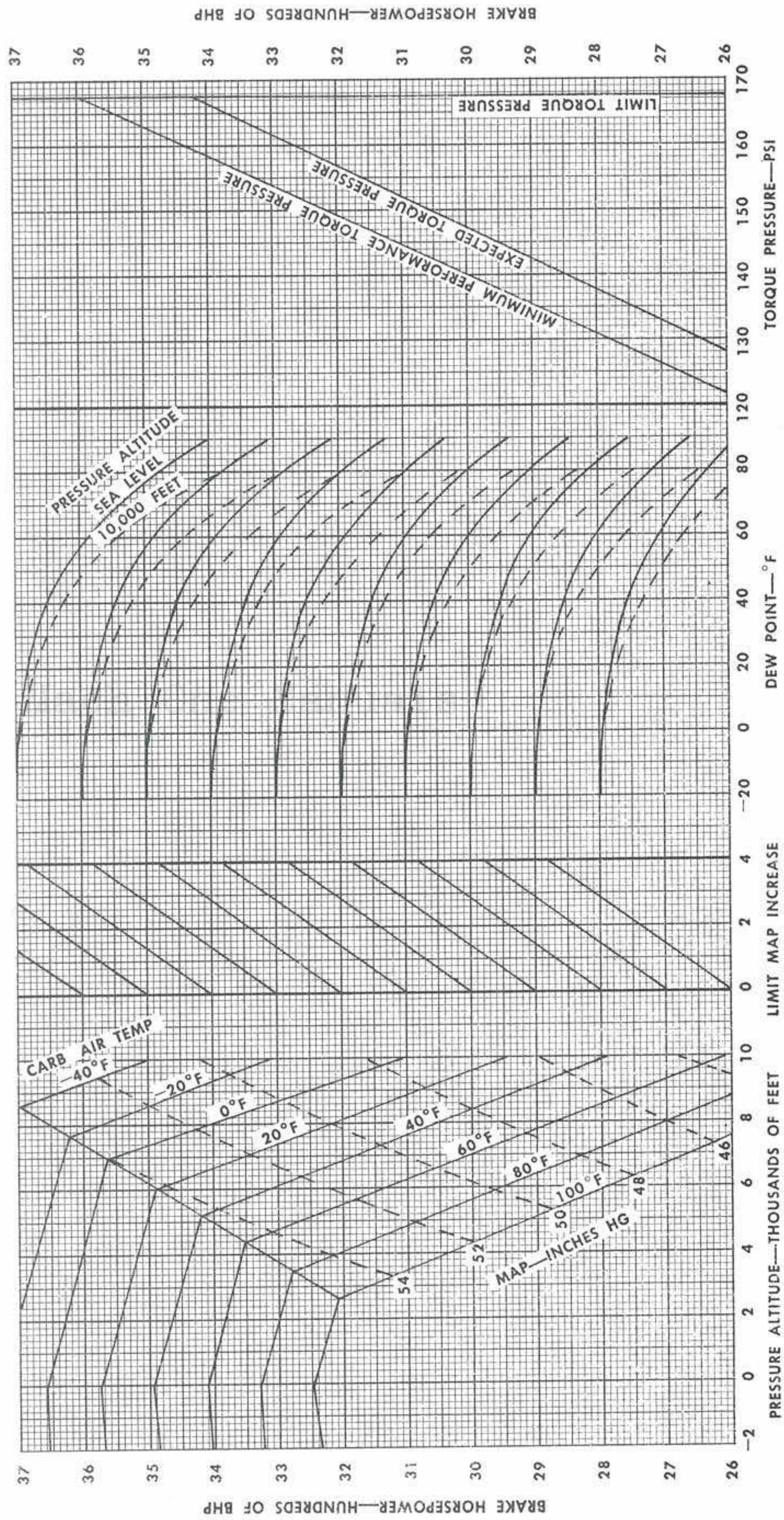


Figure A2-8

MODEL: AC-119G

BRAKE HORSEPOWER AVAILABLE

ENGINE: R3350–89B

MAXIMUM DRY POWER

ALTERNATE FUEL — GRADE 100/130

CONDITIONS:
1. Low blower operation.
2. 2900 rpm.
3. Mixture—RICH.

DATA AS OF: 1 SEPTEMBER 1962
DATA BASIS: FLIGHT TEST

FUEL GRADE: 100/130
FUEL DENSITY: 6 LB/GAL

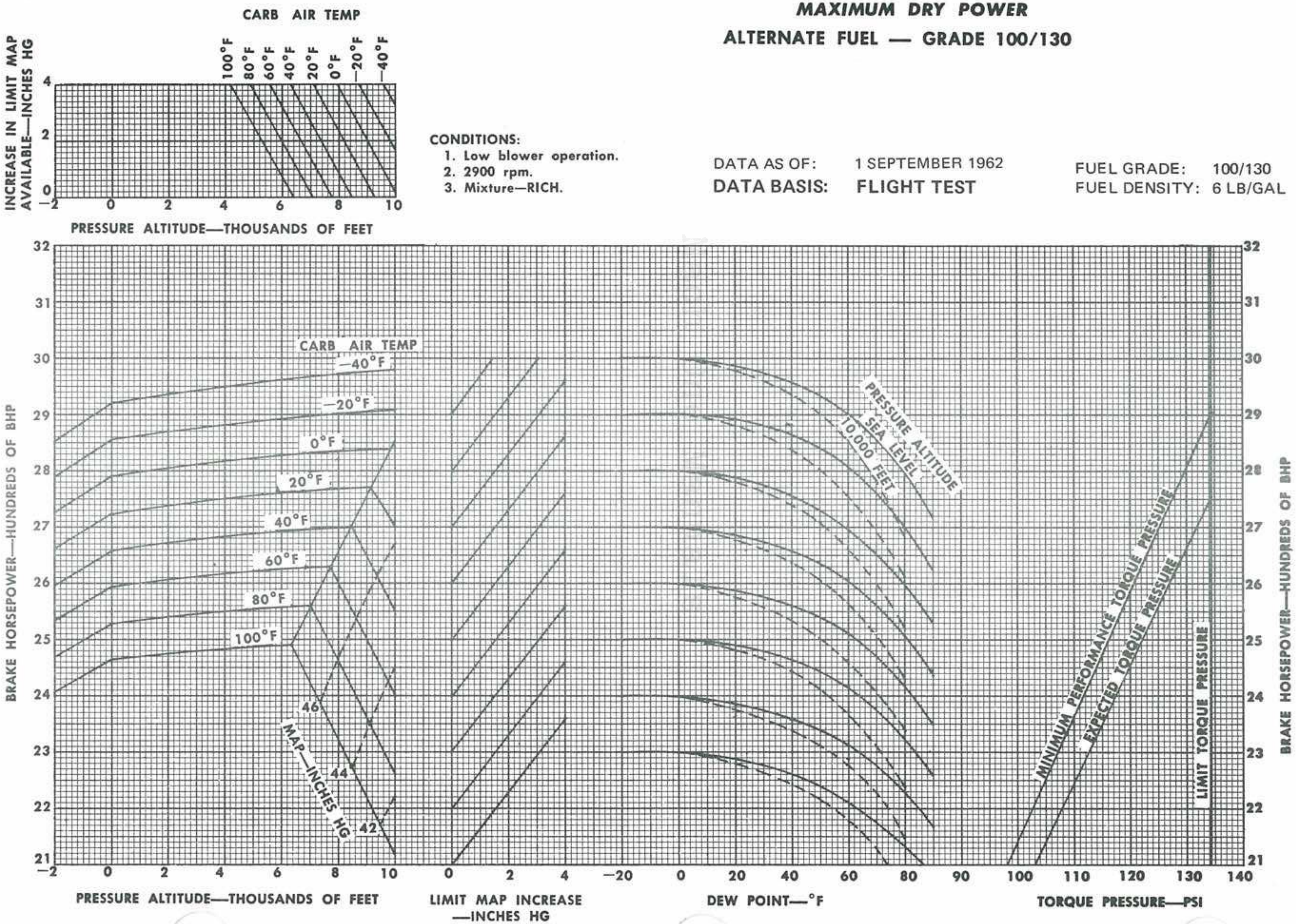


Figure A2-9

FUEL FLOW VERSUS BRAKE HORSEPOWER (LOW BLOWER)

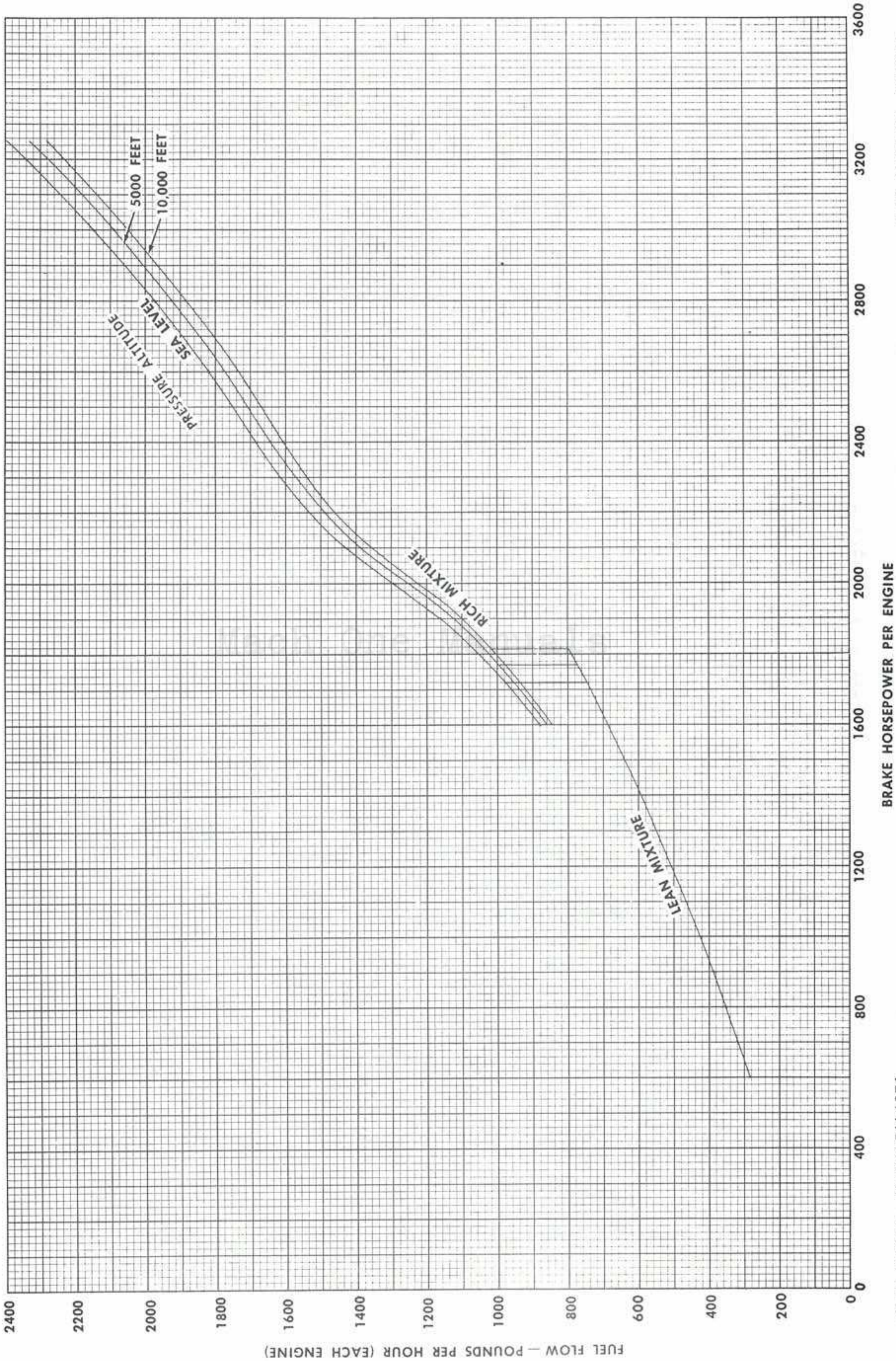
MODEL: AC-119G

ENGINE: R3350-89B

FUEL GRADE 115/145

CONDITIONS:

1. Standard day temperature assumed.
2. Power set in accordance with power schedule curves.



FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

Figure A2-10

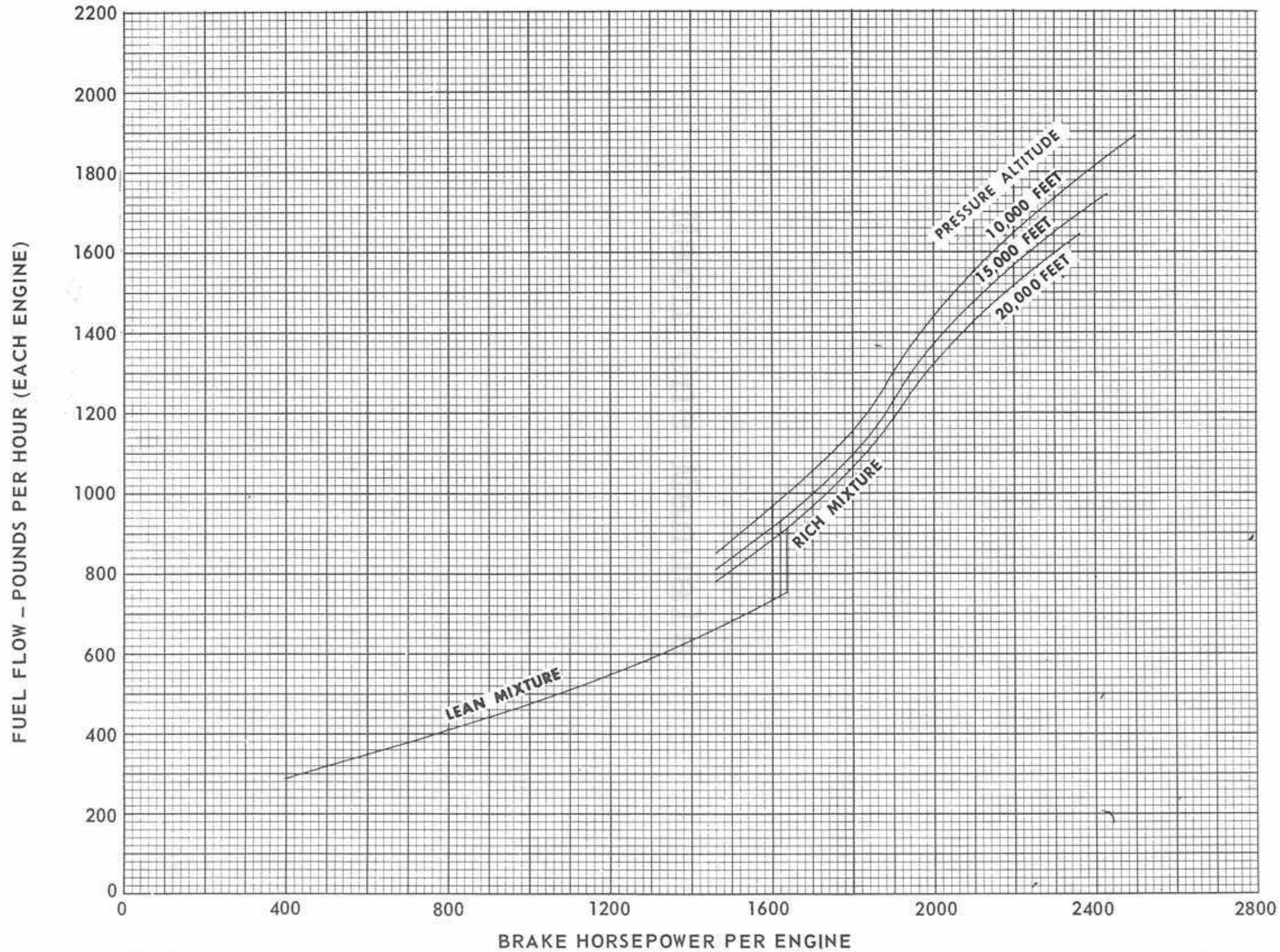
CONDITIONS:
1. Standard day temperature assumed.
2. Power set in accordance with power schedule curves.

MODEL: AC-119G

FUEL FLOW VERSUS BRAKE HORSEPOWER (HIGH BLOWER)

ENGINE: R3350-89B

FUEL GRADE 115/145



DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

Figure A2-11

TAKEOFF DATA

part 3

table of contents

TAKEOFF DATA.

Except for the following all information is contained in T.O. 1C-119G-1.

TAKEOFF GROSS WEIGHT LIMIT.

In order to provide a margin of safety in the event of an engine failure, gross weight limitations are imposed for takeoff. By observing the recommended weight limitation, a positive rate of climb of 100 feet per minute is possible, with gear up, cowl flaps closed, and one engine feathered; provided the climbout is flown at the recommended single-engine climb speed. (Refer to Recommended Single Engine Climb Speeds, Section III.) Since atmospheric conditions, available engine power, and aircraft configuration largely determine the performance of the aircraft, the Takeoff Gross Weight Limit charts are constructed so that the effects of these variables may be introduced on sheet 1. Density altitude lines, which combine the effects of pressure altitude and free air temperature, are plotted on the chart, and engine power, expressed in terms of torque pressure (at 2900 rpm), is shown along the bottom of the chart versus a rate of climb index. On sheet 2, flap setting lines are plotted on the chart and gross weight is shown on the bottom of the chart versus the rate of climb index. Two sets of charts are presented; one for use with gear up which is based on recommended single-engine climb speed and one with gear down which is based on 1.1 V_s or feathered propeller V_{mc} whichever is greater. By comparing the two sets of charts, it will be noted that the effect of flap setting on the limit gross weight is small in comparison to the substantial gross weight decrease when the aircraft is flown with gear down at takeoff speed.

NOTE

Although the primary chart for determining the takeoff gross weight limit is the one with gear up, aircraft performance with gear down should also be considered.

Use Of The Charts.

In order to determine the takeoff gross weight limit, enter the gear up or gear down chart at the bottom with torque pressure and proceed upward vertically to the density altitude line, then horizontally left and read the rate of climb index. Go to sheet 2 with this point and read horizontally to the right until the applicable flap setting line is reached. Vertically below, read takeoff gross weight limit on the scale at the bottom of the chart.

NOTE

Normally, the gross weight limit should be established using the minimum performance torque pressure obtained from the Brake Horsepower Available charts, figures A2-6 through A2-9. Urgent missions may be planned on the basis of expected torque pressure at the discretion of the Commander.

Example.

GIVEN: takeoff at a density altitude of 800 feet and flaps 0°; minimum performance torque pressure of 156 psi.

FIND: takeoff gross weight limit (gear up).

1. Select the appropriate chart (figure A3-1, sheet 1) and enter the bottom of the chart with 156 psi torque pressure.

2. Proceed vertically upward to a density altitude of 800 feet (interpolate visually), then horizontally left to the rate of climb index and read 1.66.

3. Enter sheet 2 at the left with this point and move horizontally to the right until the FLAPS 0° R/C = 100 FPM line is intercepted.

4. Vertically below, read 63,000 pounds on gross weight scale.

TAKEOFF DISTANCES.

Takeoff performance of the aircraft is expressed in terms of ground run distance to the liftoff point and total distance required to clear a 50-foot obstacle. These distances are significant in that they represent the level, hard-surface runway space required to allow the aircraft to accelerate to a takeoff speed (V_{to}) high enough to develop the lift necessary to overcome the gross weight. Therefore, any plot of takeoff performance must take into consideration the expected range of takeoff gross weights. Likewise, any other significant factors affecting the lift capability of the aircraft must be included. Among these are density altitude and wing flap setting. Other factors, though having little or no effect on lift, also influence the takeoff performance because of their effect on acceleration and the distance required to reach V_{to}. The most important of these is engine power which is represented in the charts by torque pressure. Wing flap setting also affects the acceleration of the aircraft by adding to the total drag, although this disadvantage is more than offset by the added lift. The effect of headwinds upon the takeoff performance is always to reduce the ground run distance as well as the total distance required to clear a 50-foot obstacle. At first glance, however, it might appear that the "no wind" lines and the "40-knot headwind" lines in the 50-foot obstacle portion of the chart are reversed, since any selected ground run (with headwind) value results in a shorter total distance to clear 50 feet when read from the "no wind" line than when read from the "40-knot headwind" line. However, this portion of the chart is not intended to be used without the preceding section which converts ground run distance (no wind) to ground run distance (with headwind). When the effect of wind is analyzed beginning at the ground run distance (no wind) scale, the proper relationship is observed. Another significant factor affecting the takeoff performance of the aircraft is pilot technique. In order to achieve the performance plotted on the charts, the aircraft must be flown off at V_{to} (takeoff speed). Furthermore, if clearance over a 50-foot obstacle is required in a specified distance, the takeoff is made at V_{to} and the immediate climb-out over the obstacle is made at V_{50}. A tabular plot of these speeds and stalling speed versus gross weight is included on each chart. These speeds are based on a specified percentage of stall speed (V_s) which varies as a function of gross weight. For standard takeoff performance, the following percentages have been established:

V_s = power-off stall speed
V_{to} = takeoff speed; 1.1 x V_s
V_{50} = obstacle clearance speed; 1.2 x V_s

For maximum performance:

V_s = power-on stall speed (3200 BHP)
V_{to} = takeoff speed; 1.05 x V_s
V_{50} = obstacle clearance speed; 1.05 x V_s

NOTE

Due to the fact that the speed relationships expressed above apply only to calibrated airspeeds, a slightly different relationship is observed between the indicated airspeeds tabulated on the charts.

Another consideration is that if takeoff speed is increased takeoff ground run distance will also increase. This increase in takeoff ground run distance can be determined by referring to TAKEOFF ACCELERATION.

Effect Of Runway Surface Condition.

The most ideal condition for a takeoff is a dry, hard-surface runway with no surface imperfections such as cracks or wrinkles in the paving. The ground run data contained in the Takeoff Distance charts are based on this condition, and consequently are valid without correction at most permanent operating fields. When a hard-surface runway is covered with standing water, additional rolling friction is encountered, even though the surface may not be deformed or softened by the water. Consequently, a correction factor must be applied to the data taken from the charts. Still more rolling friction develops on sod runways or unpaved gravel strips since the wheels tend to sink in and must roll over small obstructions such as stones, grass, and surface irregularities. The correction for runway surface condition may be applied graphically using figure A3-8, Variation Of Takeoff Ground Run With Runway Surface Condition.

Effect of Runway Gradient.

When the takeoff runway is not level, the ground run distance should be increased (uphill) or decreased (downhill) in accordance with the runway gradient (slope). This correction is applied graphically using figure A3-9, Variation Of Takeoff Ground Run With Runway Gradient. Since all of the other variables affecting takeoff performance are already included in the level ground run distance, the slope correction graph is valid for any takeoff configuration.

Use Of the Charts.

In order to determine the level ground run required for standard takeoff in the no-wind condition on a dry, hard-surface runway, first select the appropriate Takeoff Distance chart and enter at the left edge with the proper density altitude. Follow the guide lines upward to the right as far as the vertical line corresponding to the minimum performance torque pressure of the engine.

NOTE

> Normally, takeoff performance should be checked using the minimum performance torque pressure obtained from the Brake Horsepower Available Charts, figures A2-6 through A2-9. Urgent missions may be planned on the basis of expected torque pressure at the discretion of the Commander.

From this point read horizontally to the right until the applicable gross weight line is reached. Interpolate visually, if necessary, to the nearest 1000 pounds. Vertically below, read level ground run distance (no wind). To determine the benefit of headwind, continue reading downward, following the headwind guide lines to the horizontal line representing the existing headwind. Again, a visual interpolation will probably be necessary. From this point, drop vertically downward and read level ground run distance (with headwind). Total distance required to clear a 50-foot obstacle may now be checked by continuing to read downward until the applicable headwind line is intercepted; thence horizontally to the scale at the left.

If the runway is other than a dry, hard-surface runway, the level ground distance (with wind) must be corrected to the existing runway surface conditions. Refer to figure A3-8, and select the rolling coefficient of friction corresponding to the runway surface which is most like the actual runway to be used. Enter the chart at the left edge with the level ground run (with wind), and follow the guide lines upward to the right until the vertical line corresponding to the rolling coefficient of friction is reached. The corrected ground run distance is then determined by proceeding horizontally back to the scale at the left.

In order to determine the ground run required on a sloping runway, the level ground run must be corrected by entering figure A3-9 at the left with level ground run distance. Read horizontally across to the reference line in the center of the chart, then follow the guide lines to the right for an uphill slope, or to the left for a downhill slope until the vertical line corresponding to the runway gradient is reached. The corrected ground run distance is then determined by proceeding horizontally back to the scale at the left. Total distance to clear a 50-foot obstacle on a sloping runway exceeds the sloping ground run distance by the same amount as for a level runway.

Example.

GIVEN: takeoff in a 10-knot headwind from a dry, soft-turf runway, at a gross weight of 65,000 pounds, flaps 0°, at a density altitude of 2000 feet, minimum performance torque pressure of 156 psi. Runway gradient 2% uphill.

FIND: ground run distance without headwind and with headwind, total distance required to clear a 50-foot obstacle, takeoff speed (V_{to}) and speed to clear a 50-foot obstacle (V_{50}).

1. Select figure A3-3 for this problem and erect a vertical line at the 156-psi torque pressure mark.

2. Enter the density altitude scale at the left edge of the chart with 2000 feet and follow the guide lines upward to the right until the 156-psi torque pressure line is reached.

3. From this point, move horizontally to the right until the 65,000-pound gross weight line is reached.

4. Drop vertically downward to the level ground run distance (no wind) scale and read level ground run of 3310 feet.

5. Since a headwind of 10 knots exists, determine ground run by following the headwind guide lines downward to the left until the horizontal 10-knot headwind line is reached.

6. From this point, drop vertically downward and read 2750 feet on the ground run distance (with wind) scale.

7. Visually interpolate the position of the 10-knot headwind line in the 50-foot obstacle portion of the chart.

8. Drop vertically downward from the ground run distance (with wind) scale and intercept the 10-knot headwind line.

9. From this point, move horizontally to the left and read 5000 feet required to clear a 50-foot obstacle.

10. From the table of indicated airspeeds, determine the takeoff speed and obstacle clearance speed by interpolation:

$$V_{to} = 102.5 \text{ knots IAS}$$

$$V_{50} = 114.5 \text{ knots IAS}$$

11. Refer to figure A3-8, Variation Of Takeoff Ground Run With Runway Surface Condition, for the rolling coefficient of friction of 0.070 opposite dry, soft turf, short grass and, on figure A3-8, draw a vertical line at the 0.070 mark on the rolling coefficient of friction scale at the bottom.

12. Enter the takeoff ground run scale at the left with 2750 feet, and following the guide lines upward to the right until the vertical line is reached.

13. Move back horizontally to the takeoff ground run scale and read 3350 feet.

14. Referring to figure A3-9, Variation Of Takeoff Ground Run With Runway Gradient, erect a vertical line at the 2% uphill mark on the gradient scale at the bottom of the chart.

15. Enter the takeoff ground run scale with 3350 feet, and read across horizontally to the vertical reference line in the center of the chart.

16. Follow the guide lines upward to the 2% vertical line.

17. Move back horizontally to the takeoff ground run scale and read 3825 feet.

18. Determine the difference between level ground run and total distance to clear a 50-foot obstacle prior to surface and slope corrections.

5000 ft - 2750 ft = 2250 ft

19. Add the difference to the uphill ground run to determine the corrected total distance:

3825 ft + 2250 ft = 6075 ft

TAKEOFF ACCELERATION.

By checking the acceleration of the aircraft prior to reaching refusal speed, the pilot can verify the takeoff data taken from the performance charts, and decide if the takeoff is proceeding satisfactorily. If this check is not made too early in the run, a second decision at refusal speed is not strictly necessary. The go no-go method of checking takeoff performance combines the acceleration check with the refusal speed check so that one decision is made at a selected runway marker. The marker selected is the one that is reached immediately prior to attaining refusal speed, and the minimum speed for continuing the takeoff, at the marker, is go no-go speed. The Takeoff Acceleration chart (figure A3-17) is used to determine the go no-go speed and the increased takeoff ground run distance due to an increased takeoff speed. In this chart, ground speed is plotted versus runway distance travelled so that any point on the chart represents a specific average acceleration. The curved lines on the chart connect points of corresponding acceleration; the steep lines representing rapid acceleration and the lower lines representing slow acceleration.

Use Of The Charts.

By entering the chart with predicted takeoff speed and distance, the average acceleration schedule is determined for two-engine operation. Then by working backward via the acceleration guide lines to the refusal speed, a corresponding refusal distance is determined. Go no-go airspeed is then determined by again working backward, down the acceleration curve to the first runway marker short of refusal distance. The increased takeoff ground run distance, because of an increased takeoff speed, is determined by entering the chart with the predicted takeoff speed and distance, then working forward via the acceleration guide lines to the increased airspeed and reading the corresponding distance. The speeds are converted into ground speed by subtracting headwinds or adding tailwinds.

NOTE

Runway markers are placed 1000 feet apart to show runway distance remaining (6, 5, 4, etc). If a runway is an exact multiple of 1000 feet, the high-numbered marker is placed 1000 feet from the start of the runway, and each succeeding marker shows exact distance remaining. If the runway is not an exact multiple of 1000 feet, the distance to the high-numbered marker is 1000 feet plus half of the spare length. In this case, the other half of the spare length must be added to each marker to obtain the exact distance remaining.

Example.

GIVEN: runway length 5000 feet, takeoff speed 110 knots, takeoff distance 1860 feet, refusal speed 106 knots, headwind component 7 knots, takeoff speed increased 10 knots.

FIND: go no-go marker, go no-go speed, and increased ground run due to increased takeoff speed.

1. Enter figure A3-17 at the 1860-foot takeoff distance point on the ground run distance scale on the bottom of the chart.

2. Enter the ground speed scale with a takeoff speed of 103 knots (corrected for wind 110-7), read horizontally across to the takeoff distance line, and plot a point at the intersection.

3. From the plotted point, move downward to the left, parallel to the acceleration guide lines until the 99 (106 - 7) knot refusal speed line is reached.

4. Move vertically downward and read refusal distance, 1680 feet on the distance scale.

5. Select the 1000 marker for go no-go speed check since it is the first marker short of refusal distance.

6. From the plotted point, again follow the acceleration guide lines downward to the left as far as the go no-go marker distance.

7. Move horizontally to the left and read 80 knots go no-go speed on the ground speed scale. Correct for wind, 80 + 7 = 87 knots.

8. From the plotted point of step 2, move upward to the right, parallel to the acceleration guide lines until the (120 - 7) 113 knot increased takeoff speed line is reached.

9. Move vertically downward and read the increased ground run distance, 2700 feet, on the distance scale.

STANDARD INSTRUMENT DEPARTURE.

A series of charts is presented that permits the pilot to rapidly estimate the horizontal distance, while flying at constant heading, to clear an obstacle of known height above the takeoff airport elevation. For a given horizontal distance, the obstacle height that can be cleared depends upon the climb angle. The climb angle is affected by the same factors that influence rate of climb. Thus, it can be expected that increase in engine power and decrease in gross weight will increase the climb angle, while increase in drag, such as caused by extended landing gear, increasing wing flap angle, and opening cowl flaps, will decrease the climb angle. The climb-out index shown in the charts is a quantity related to the climb angle.

The charts were constructed under the following conditions and assumptions: the zero-distance point on the charts is the point at which the aircraft attains a height of 50 feet above the airfield surface. Thus, the horizontal distance from standstill to this point must first be determined from the appropriate takeoff distance chart. The aircraft is then operated at the V_{50} speed for two engines operating, or the higher of the V_{50} or minimum control speed should an engine be lost in takeoff. A single-engine minimum control speed has been chosen at 113 KIAS, propeller windmilling, a value particular to sea level operation at Maximum Wet Power. This value is the same as the continued takeoff speed for a single-engine operation so presented in the Critical Field Length charts. During the initial takeoff climb to 50 feet, the landing gear is totally retracted. The charts are all based on the use of 2900 rpm and rich mixture, so that it is only necessary to provide a scale of torque pressure in order to account for the effect of engine power. Achievement of the performance indicated on the charts is therefore dependent upon operation of the aircraft substantially in conformance with the foregoing conditions.

NOTE

> For climb-out rpm other than 2900, enter the Climb-Out Index chart with an equivalent torque pressure as follows:

$$\text{Equiv. TOP} = \frac{2900}{(\text{RPM climb-out})\ (\text{TOP climb-out})}$$

Headwinds or tailwinds do not affect the rate of climb, but directly affect the ground speed and thus the climb angle relative to the ground. A headwind decreases ground speed, increases climb angle, and thus shortens the horizontal distance to an obstacle of given height, while a tailwind has the opposite effect. Data derived from these charts are simply modified to the prevailing wind condition by the following expression:

$$\text{Effective Horiz. Distance} = \text{Horiz. Distance Available} \times \frac{\text{TAS}}{\text{GS}}$$

The true ground speed (GS) being the true airspeed (TAS) minus the headwind or plus the tailwind.

Use Of The Charts.

Select desired gross weight, torque pressure, and density altitude 50 feet above the airport surface. Enter the Climb-Out Index chart for the particular number of reciprocating engines operating with that density altitude, project a line to the appropriate torque pressure (or equivalent torque pressure in the case of engine rpm other than 2900), and then vertically to the climb-out index scale. Interpolations are to be performed for torque pressures not directly shown by the chart lines. Enter the Horizontal Distance chart with the climb-out index determined and proceed horizontally to the selected gross weight. Then proceed vertically down to the horizontal distance scale, recording the value as that agreeing with the initial conditions. The effective distance that the obstacle is from the 50-foot takeoff location is first corrected for any prevailing wind and then added to the recorded horizontal distance. The procedures are then reversed and result in a density altitude. The difference between the initial airport altitude and the value represents the aircraft height obtained over the obstacle point.

Example.

GIVEN: gross weight 60,000 pounds, airport pressure altitude 1000 feet, two reciprocating engines operating at minimum performance torque pressure, 2900 rpm, water-alcohol injection, normal fuel CAT 72°F, dew point 70°F, flaps at 0°, 20-knot headwind, obstacle 550 feet high, 20,000 feet from the beginning of the runway.

FIND: the vertical height that the obstacle will be cleared. Select figures A3-18 through A3-25 for this problem.

1. Determine initial conditions.

   a. From figure A2-6, Brake Horsepower Available chart, find minimum performance TOP of 158 psi.

   b. From figure A3-3, Takeoff Distance chart, determine horizontal distance to attain 50 foot height of 3400 feet.

2. Enter Climb-Out Index chart, figure A3-18, at density altitude 2000 feet, proceed horizontally to TOP of 158 psi.

3. Project vertically downward and determine climb-out index 10.1.

4. Enter Horizontal Distance chart, figure A3-19, with this climb-out index, proceed horizontally to the gross weight of 60,000 pounds.

5. Project vertically downward and determine the initial takeoff effective horizontal distance of 14,500 feet.

6. Next, the horizontal distance available for climb-out is determined. Distance from beginning of runway to obstacle, 20,000 feet, diminished by

takeoff distance to 50-foot point, 3400 feet, leaving 16,600 feet. Correcting for wind effect gives the available horizontal distance, based on the tabulated speed of 110 KIAS which is 115 knots TAS when corrected for ambient conditions.

$$\text{Horiz. Dist.} = 16{,}600 \times \frac{115}{115\text{-}20} = 20{,}100 \text{ feet}$$

7. Adding this value to the determined initial takeoff distance of 14,500 feet yields the effective horizontal distance of 34,600 feet.

8. Using figures A3-20 and A3-21 and repeating steps 3 to 6 in reverse yields a density altitude of 4750 feet.

9. Return to figure A2-6, Brake Horsepower Available chart, with the pressure altitude of 4700 feet and determine new minimum performance torque pressure of 147 psi.

10. Return to Climb-Out Index chart, figure A3-20, with an index of 24 and the TOP of 147 psi yields a density altitude of 4260 feet which is the height attained at the obstacle location.

11. The clearance of the obstacle is then 4260 feet less the obstacle altitude of (2000 + 550) feet or 1710 feet.

MODEL: AC-119G

TAKEOFF GROSS WEIGHT LIMIT
MAXIMUM POWER
GEAR UP

ENGINE: R3350-89B (1)

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. Weight limits based on one engine inoperative, propeller feathered, and cowl flaps closed.
2. Landing gear retracted.
3. Operation at recommended single - engine climb speed.
4. Curve may be entered with torque pressure for maximum wet or dry power.

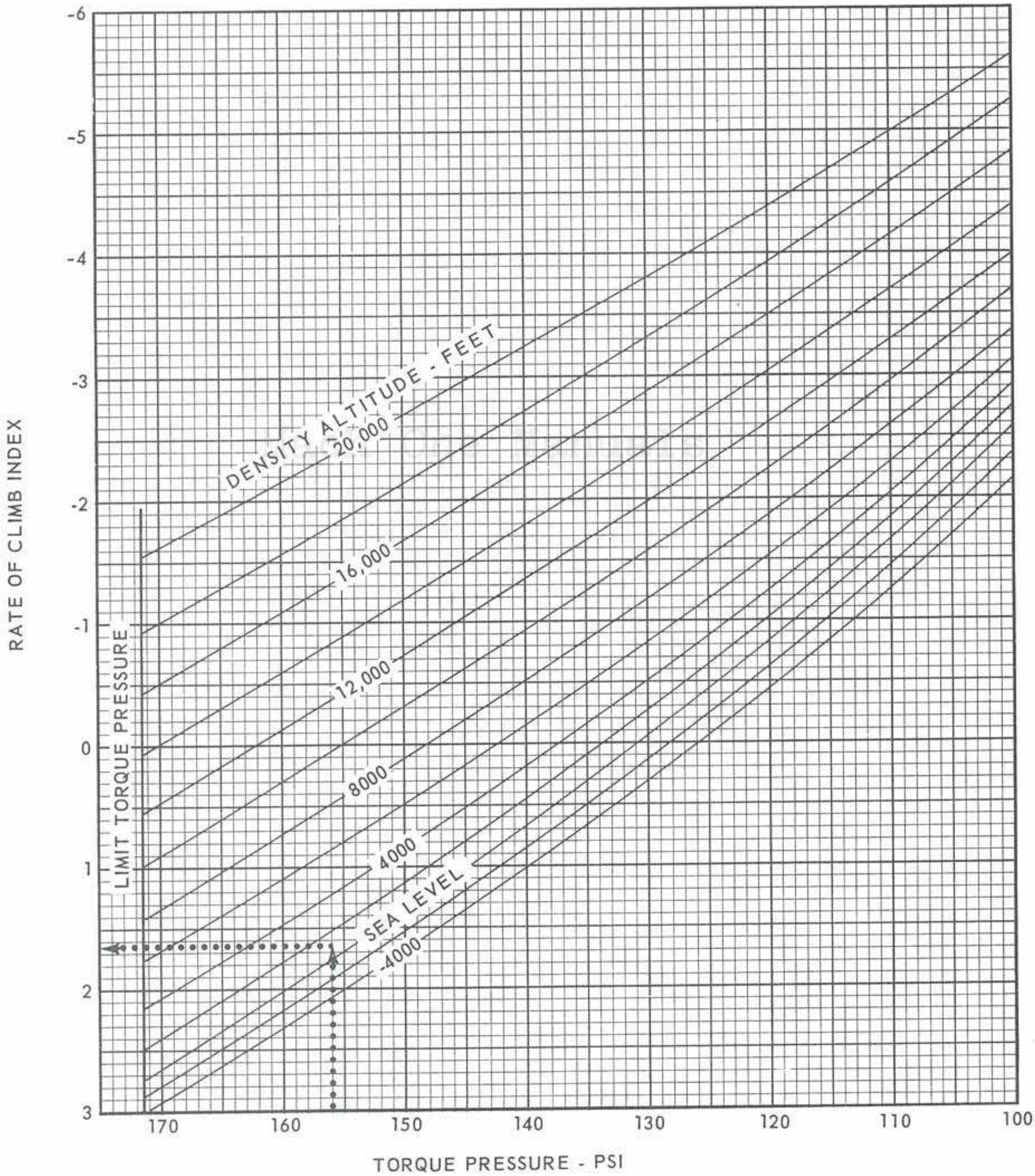


Figure A3-1 (Sheet 1 of 2)

MODEL: AC-119G

TAKEOFF GROSS WEIGHT LIMIT
MAXIMUM POWER
GEAR UP

ENGINE: R3350-89B (1)

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

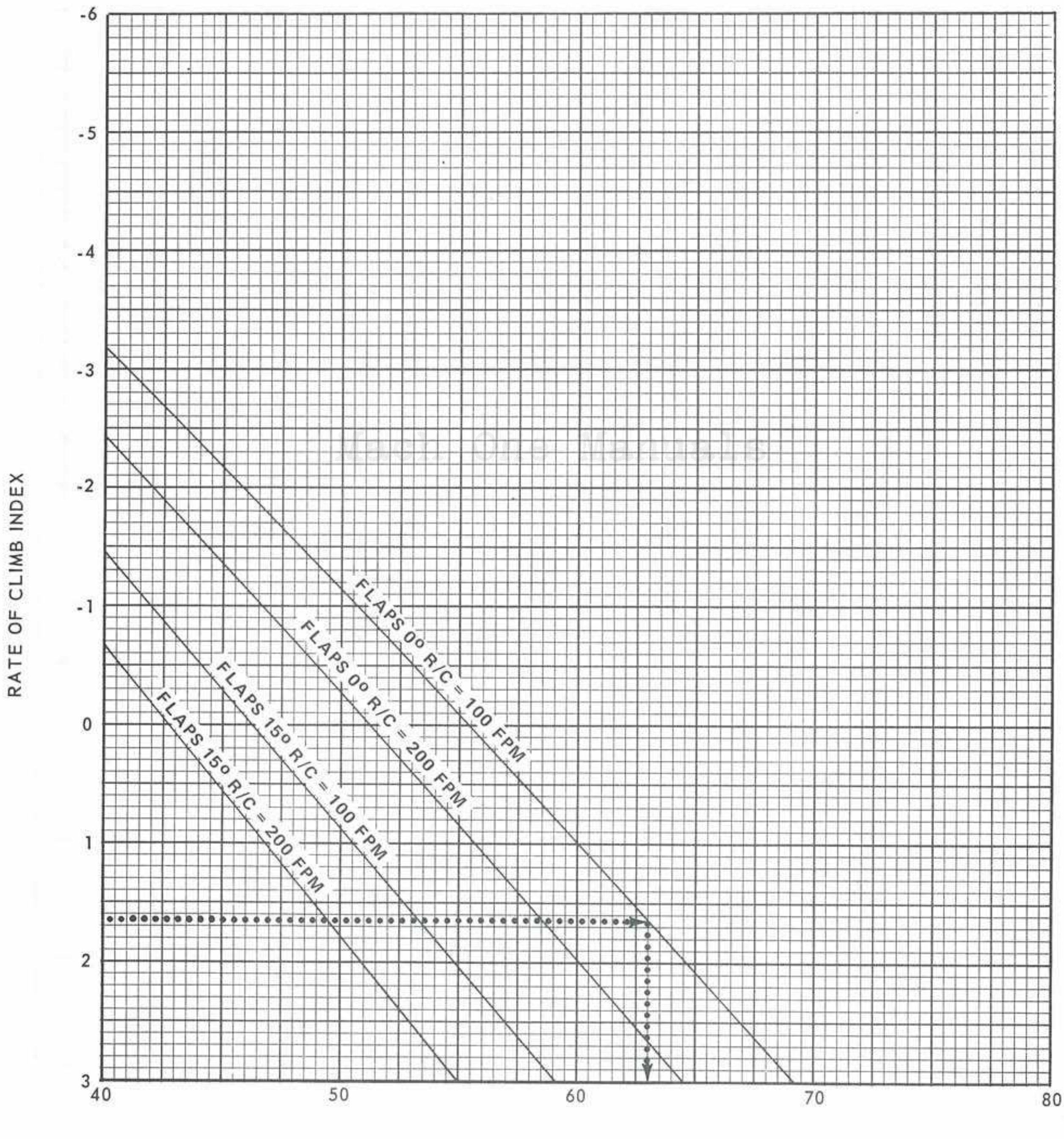


Figure A3-1 (Sheet 2 of 2)

MODEL: AC-119G

TAKEOFF GROSS WEIGHT LIMIT
MAXIMUM POWER
GEAR DOWN

ENGINE: R3350-89B (1)

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. Weight limits based on one engine inoperative, propeller feathered, and cowl flaps closed.
2. Landing gear extended.
3. Operation at V_{to} or feathered propeller V_{mc}, whichever is greater.
4. Curve may be entered with torque pressure for maximum wet or dry power.

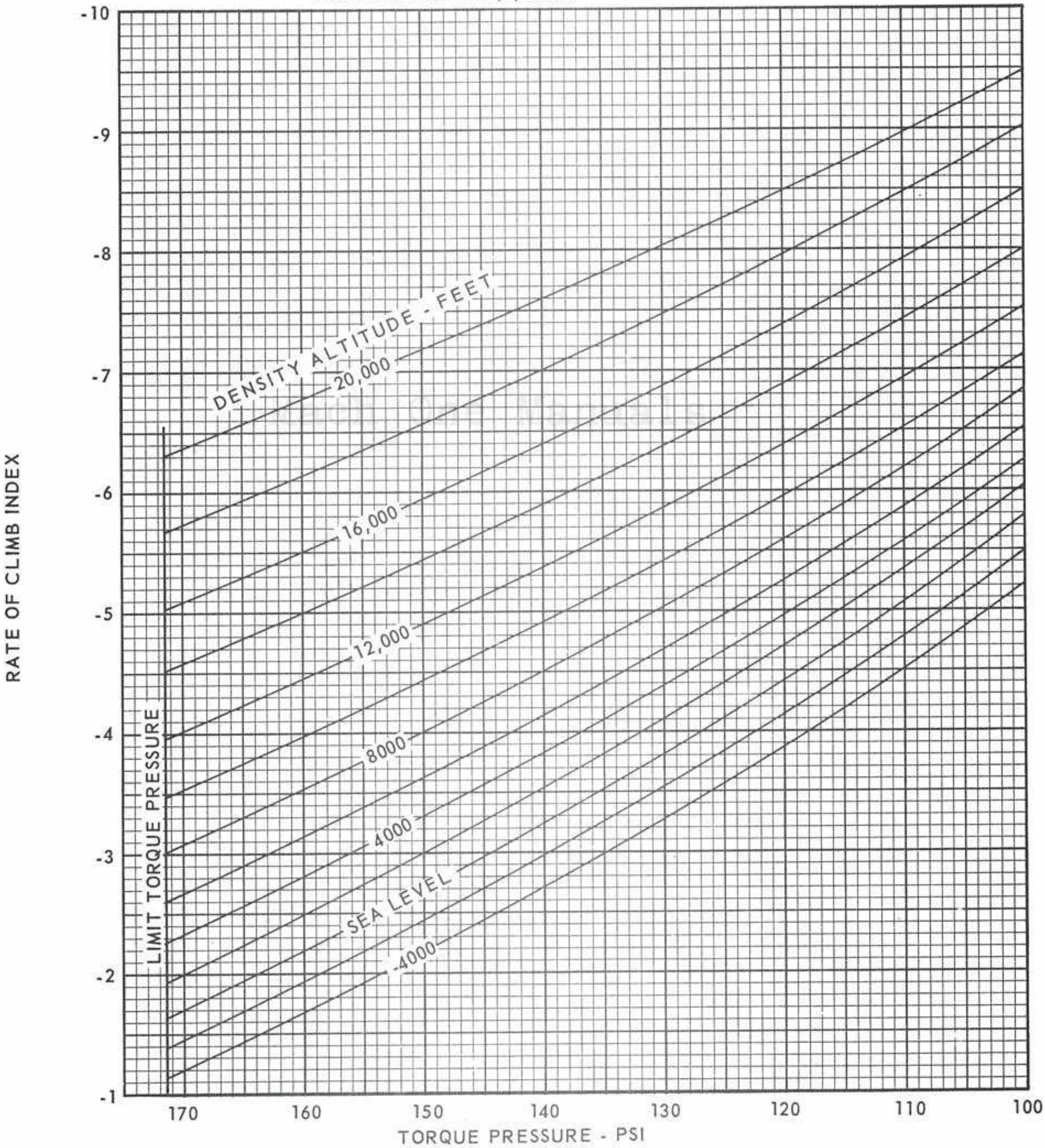


Figure A3-2 (Sheet 1 of 2)

MODEL: AC-119G

TAKEOFF GROSS WEIGHT LIMIT
MAXIMUM POWER
GEAR DOWN
ENGINE: R3350-89B (1)

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: **115/145 or 100/130**
FUEL DENSITY: **6 LB/GAL**

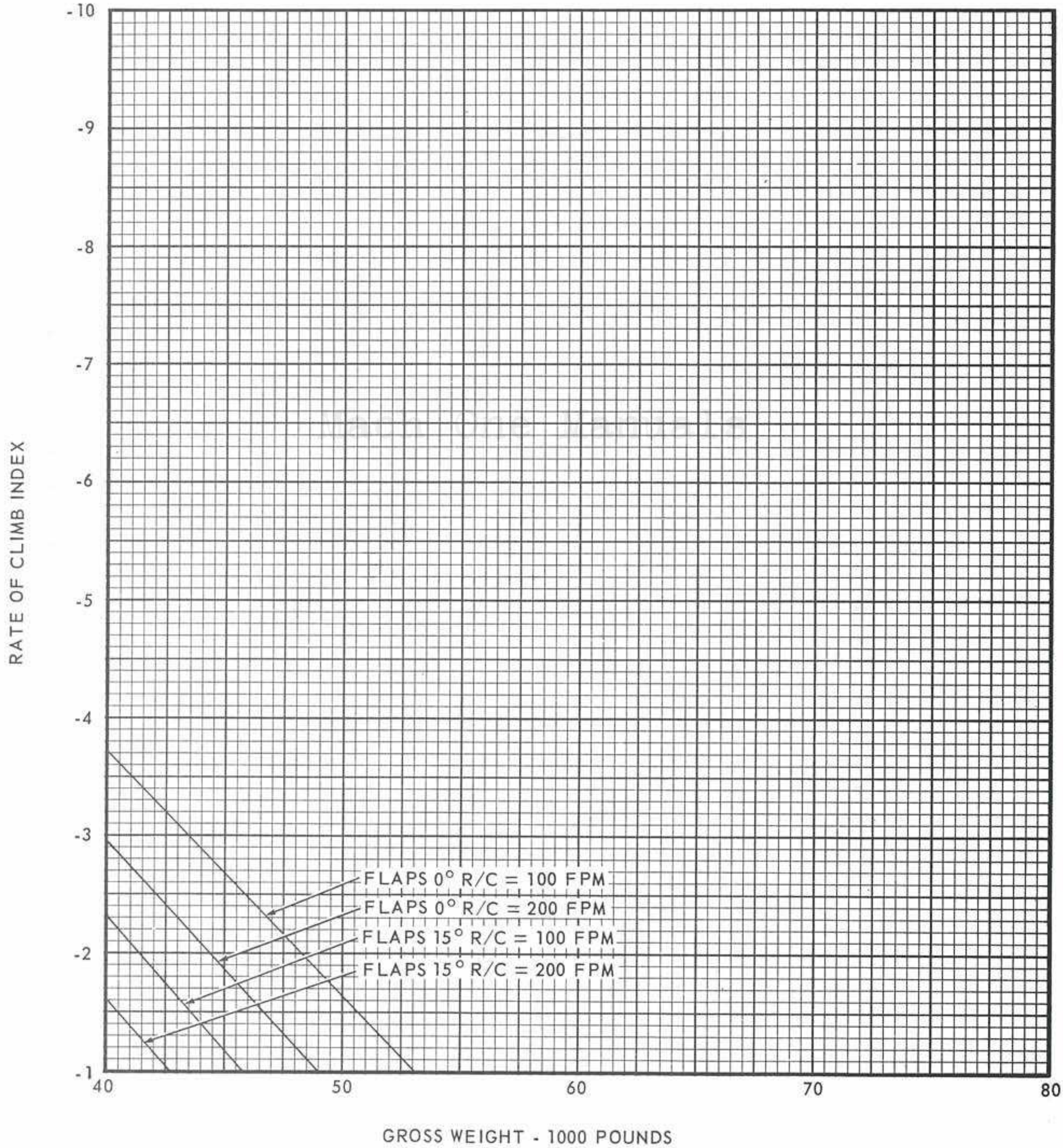


Figure A3-2 (Sheet 2 of 2)

MODEL: AC-119G

STANDARD TAKEOFF DISTANCE

ENGINES: R3350-89B (2)

MAXIMUM POWER

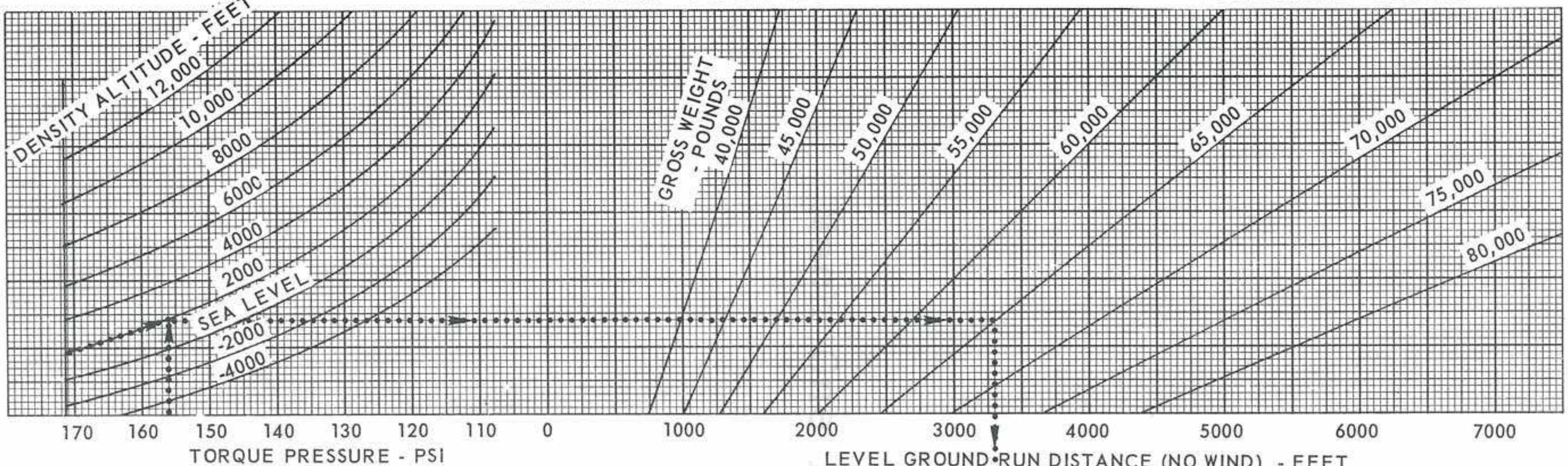
FLAPS 0°

CONDITIONS:

1. 2900 rpm and rich mixture.
2. V_s = power - off stall speed.
3. V_{to} = takeoff speed = 1.1 V_s.
4. V_{50} = obstacle clearance speed = 1.2 V_s.
5. Level, hard - surface runway (μ rolling = 0.025).

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS		
	V_s *	V_{to} *	V_{50} +
40,000	76	82	92
42,000	77	84	94
44,000	79	86	96
46,000	80	88	98
48,000	82	89	99
50,000	83	91	101
52,000	85	93	103
54,000	86	94	105
56,000	88	96	107
58,000	89	97	108
60,000	91	99	110
62,000	92	100	112
64,000	93	102	114
66,000	95	103	115
68,000	96	105	117
70,000	97	106	119
72,000	98	107	120
74,000	100	109	122
76,000	101	110	124
78,000	102	111	125
80,000	103	113	127

* IN GROUND EFFECT
\+ OUT OF GROUND EFFECT

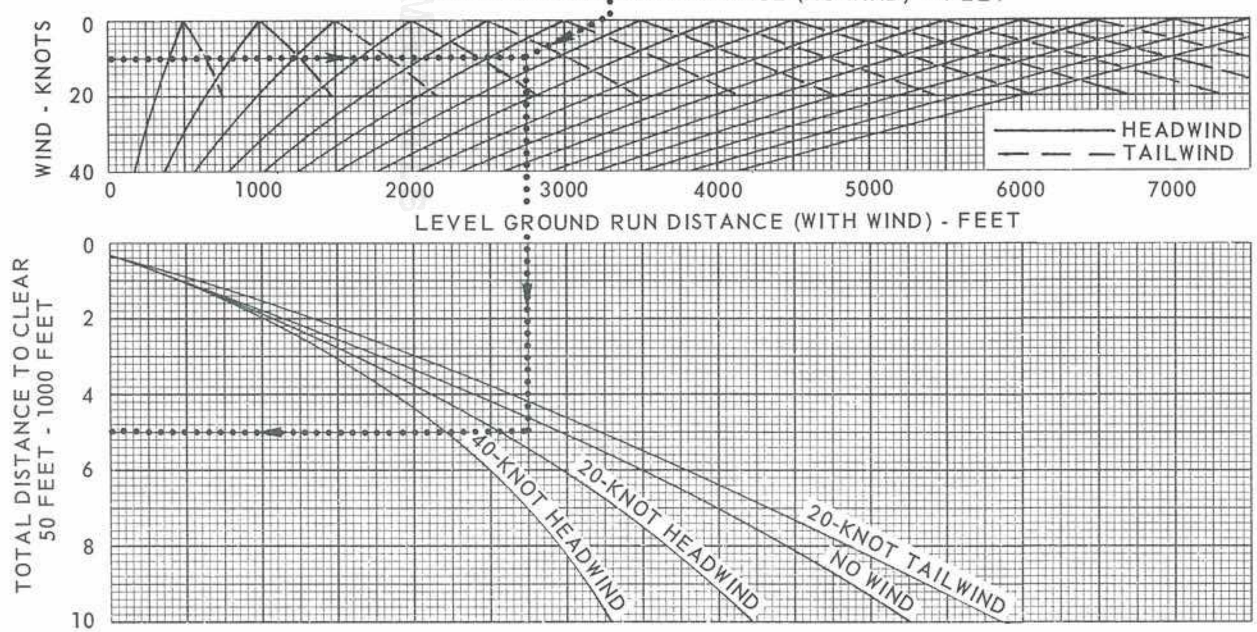


Figure A3-3

MODEL: AC-119G

MINIMUM RUN TAKEOFF DISTANCE

ENGINES: R3350-89B (2)

MAXIMUM POWER

FLAPS 15°

CONDITIONS:

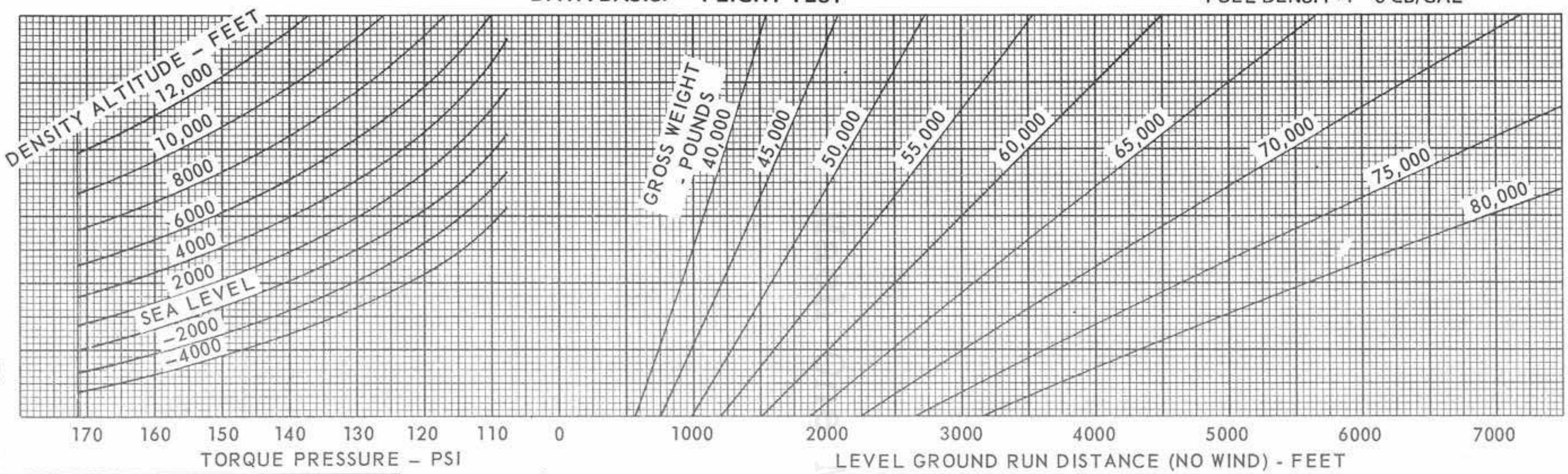
1. 2900 rpm and rich mixture.
2. V_s = power - off stall speed.
3. V_{to} = takeoff speed = 1.1 V_s.
4. V_{50} = obstacle clearance speed = 1.2 V_s.
5. Level, hard - surface runway (μ rolling = 0.025).

DATA AS OF: MARCH 1969

DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130

FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS		
	V_s*	V_{to}*	V_{50}+
40,000	72	79	89
42,000	74	81	90
44,000	76	82	92
46,000	77	84	94
48,000	79	85	95
50,000	80	87	97
52,000	81	89	99
54,000	83	90	100
56,000	84	92	102
58,000	85	93	104
60,000	87	95	105
62,000	88	96	107
64,000	89	97	108
66,000	91	99	110
68,000	92	100	112
70,000	93	101	113
72,000	94	103	115
74,000	95	104	116
76,000	97	105	118
78,000	98	107	119
80,000	99	108	121

* IN GROUND EFFECT

\+ OUT OF GROUND EFFECT

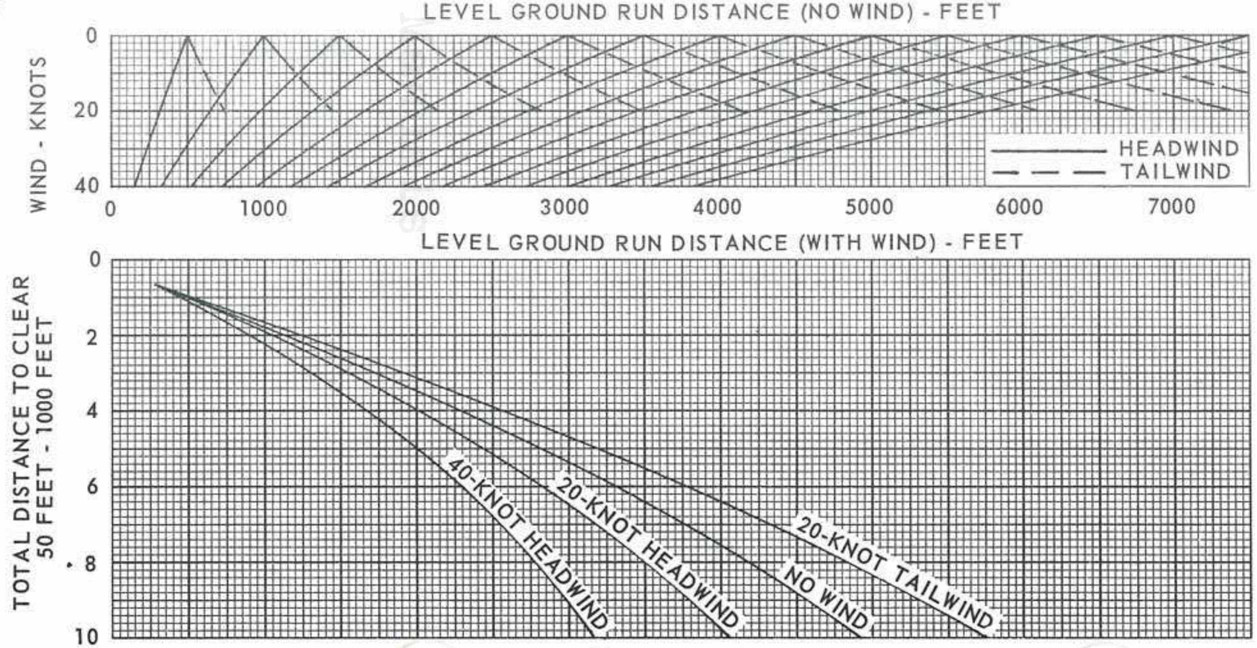


Figure A3-4

MODEL: AC-119G

STANDARD TAKEOFF DISTANCE @ V_{to} = 113 KIAS OR GREATER

ENGINES: R3350-89B (2)

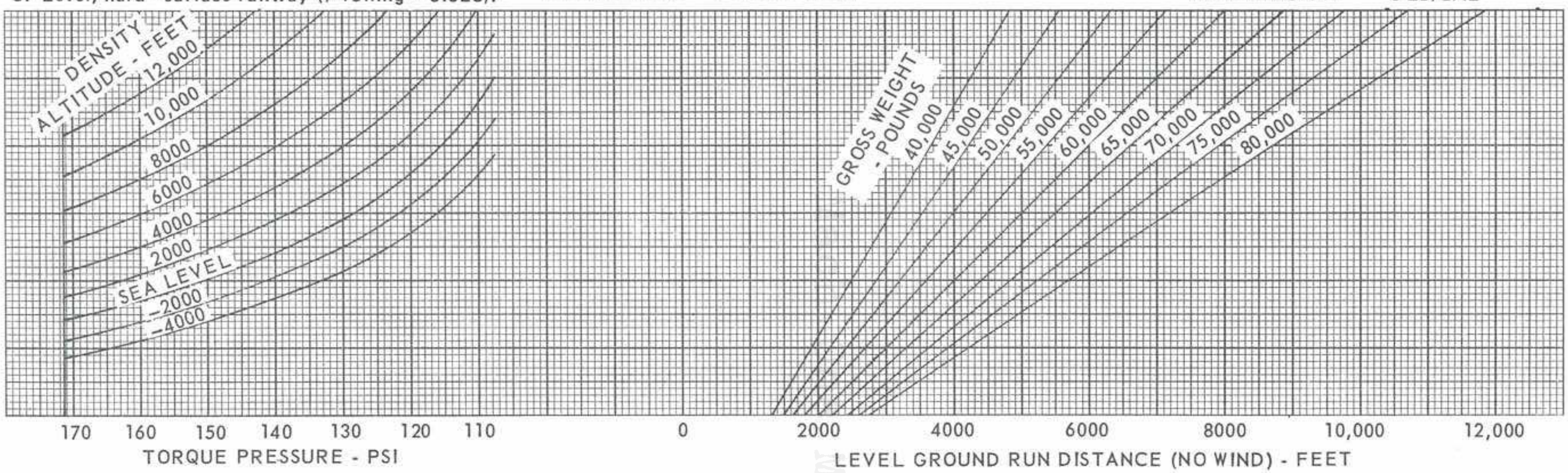
MAXIMUM POWER
FLAPS 0°

CONDITIONS:

1. 2900 rpm and rich mixture.
2. V_s = power - off stall speed.
3. V_{to} = takeoff speed = 1.1 V_s or 113 KIAS (whichever is greater).
4. V_{50} = obstacle clearance speed = 1.2 V_s or 113 KIAS (whichever is greater).
5. Level, hard - surface runway (μ rolling = 0.025).

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS		
	V_s*	V_{to}*	V_{50}+
40,000	76	113	113
42,000	77	113	113
44,000	79	113	113
46,000	80	113	113
48,000	82	113	113
50,000	83	113	113
52,000	85	113	113
54,000	86	113	113
56,000	88	113	113
58,000	89	113	113
60,000	91	113	113
62,000	92	113	113
64,000	93	113	114
66,000	95	113	115
68,000	96	113	117
70,000	97	113	119
72,000	98	113	120
74,000	100	113	122
76,000	101	113	124
78,000	102	113	125
80,000	103	113	127

+ OUT OF GROUND EFFECT * IN GROUND EFFECT

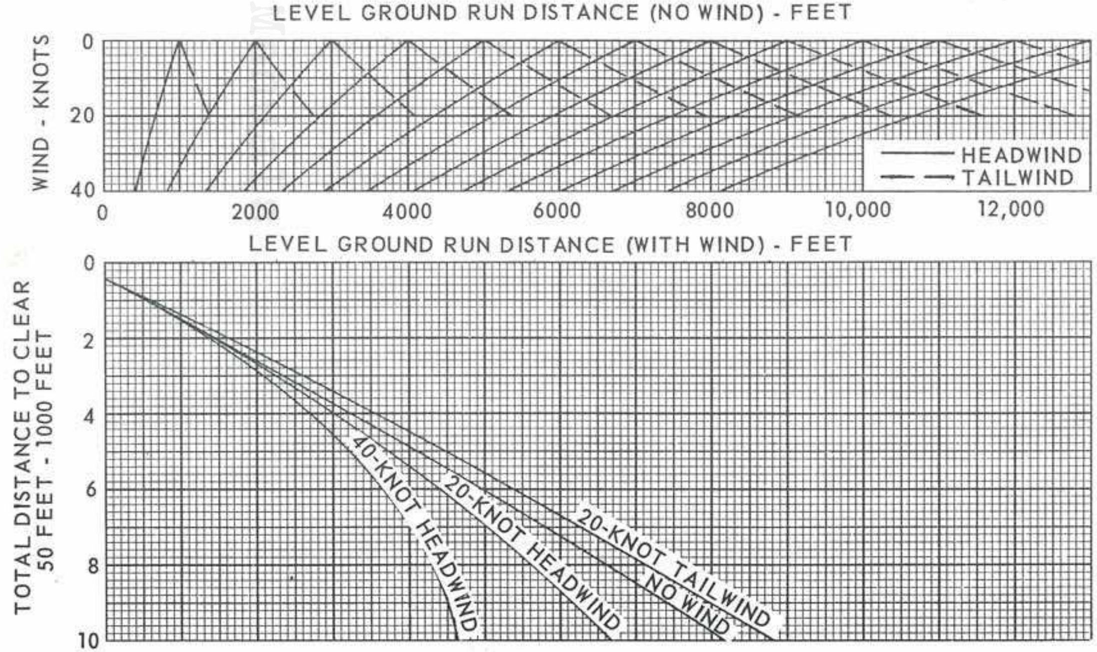


Figure A3-5

CONDITIONS:

1. 2900 rpm and rich mixture.
2. V_s = power - off stall speed.
3. V_{to} = takeoff speed = 1.1 V_s or 113 KIAS (whichever is greater).
4. V_{50} = obstacle clearance speed = 1.2 V_s or 113 KIAS (whichever is greater).
5. Level, hard - surface runway (μ rolling = 0.025).

MODEL: AC-119G

MINIMUM RUN TAKEOFF DISTANCE @ V_{to} = 113 KIAS OR GREATER

ENGINES: R3350-89B (2)

MAXIMUM POWER

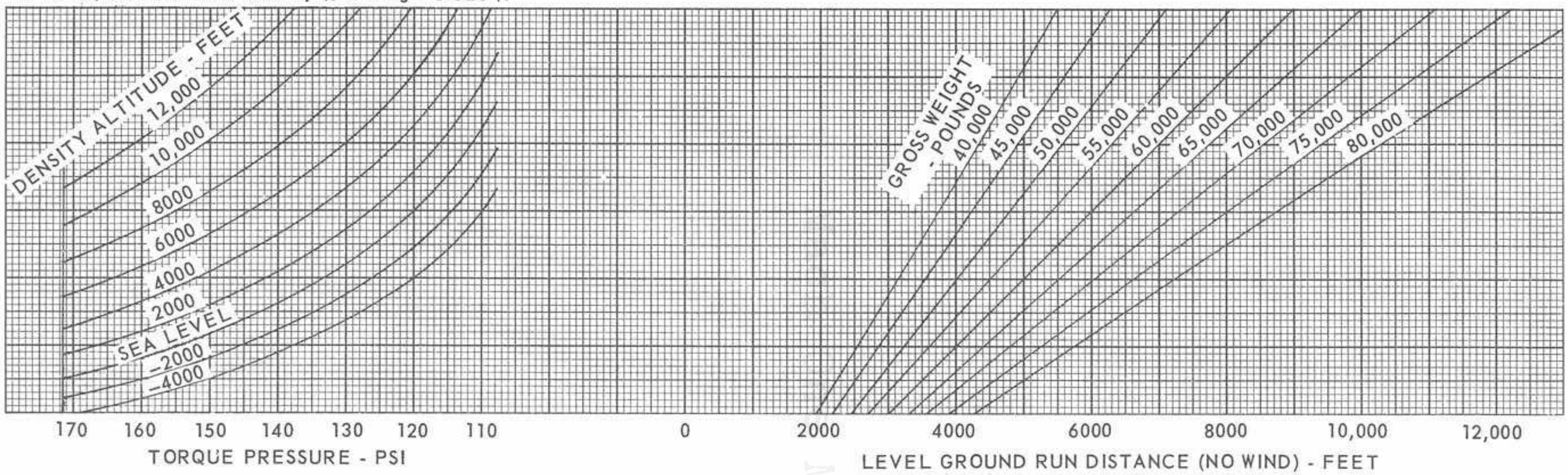
FLAPS 15°

DATA AS OF: MARCH 1969

DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130

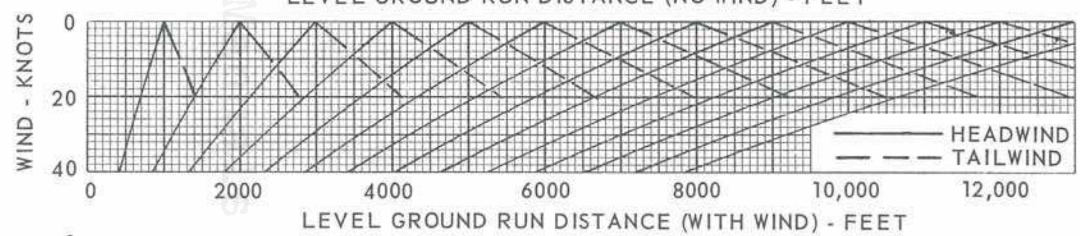
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS		
	V_s*	V_{to}*	V_{50}+
40,000	72	113	113
42,000	74	113	113
44,000	76	113	113
46,000	77	113	113
48,000	79	113	113
50,000	80	113	113
52,000	81	113	113
54,000	83	113	113
56,000	84	113	113
58,000	85	113	113
60,000	87	113	113
62,000	88	113	113
64,000	89	113	113
66,000	91	113	113
68,000	92	113	113
70,000	93	113	113
72,000	94	113	115
74,000	95	113	116
76,000	97	113	118
78,000	98	113	119
80,000	99	113	121

* IN GROUND EFFECT

\+ OUT OF GROUND EFFECT



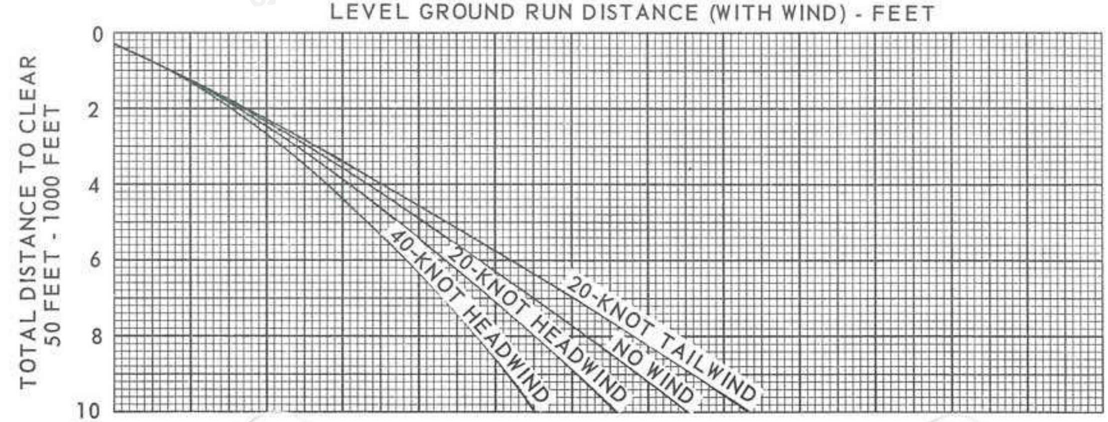


Figure A3-6

MODEL: AC-119G

MAXIMUM PERFORMANCE TAKEOFF DISTANCE

ENGINES: R3350-89B (2)

MAXIMUM POWER

FLAPS 15°

CONDITIONS:

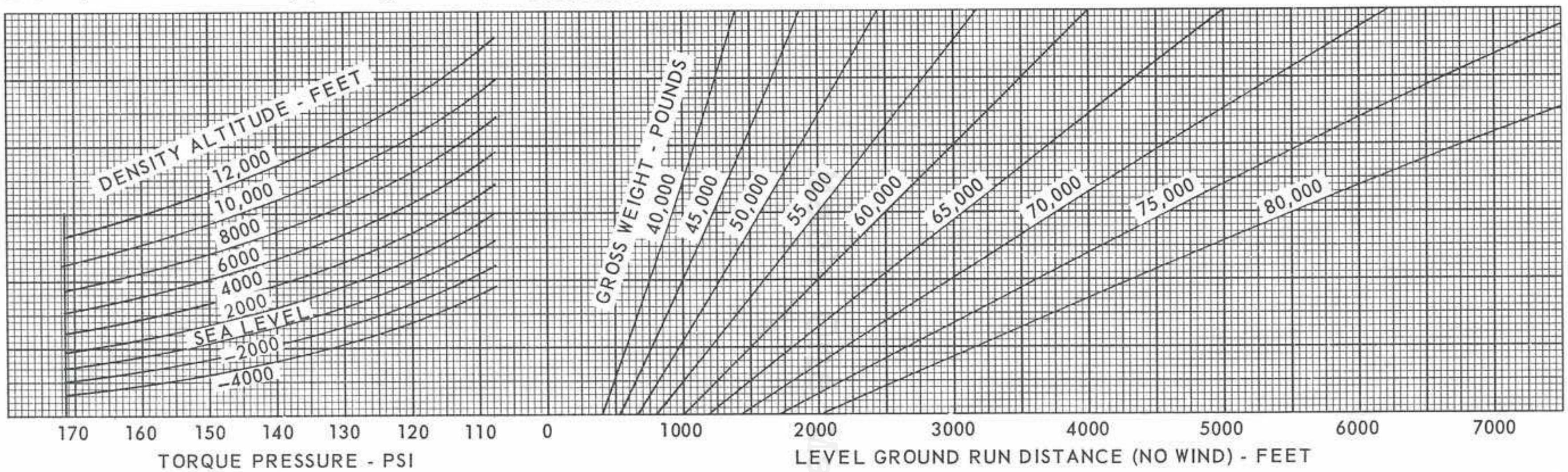
1. 2900 rpm and rich mixture.
2. V_s = power - on stall speed.
3. V_{to} = takeoff speed = 1.05 V_s.
4. V_{50} = obstacle clearance speed = 1.05 V_s.
5. Level, hard - surface runway (μ rolling = 0.025).

DATA AS OF: MARGH 1969

DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130

FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS		
	V_s*	V_{to}*	V_{50}+
40,000	67	69	75
42,000	68	71	76
44,000	69	72	78
46,000	71	74	79
48,000	72	75	80
50,000	73	77	81
52,000	75	78	82
54,000	76	79	83
56,000	77	80	85
58,000	78	82	86
60,000	79	83	87
62,000	81	84	88
64,000	82	85	89
66,000	83	87	90
68,000	84	88	91
70,000	85	89	92
72,000	86	90	93
74,000	87	91	94
76,000	88	92	95
78,000	89	93	96
80,000	90	94	97

* IN GROUND EFFECT
\+ OUT OF GROUND EFFECT

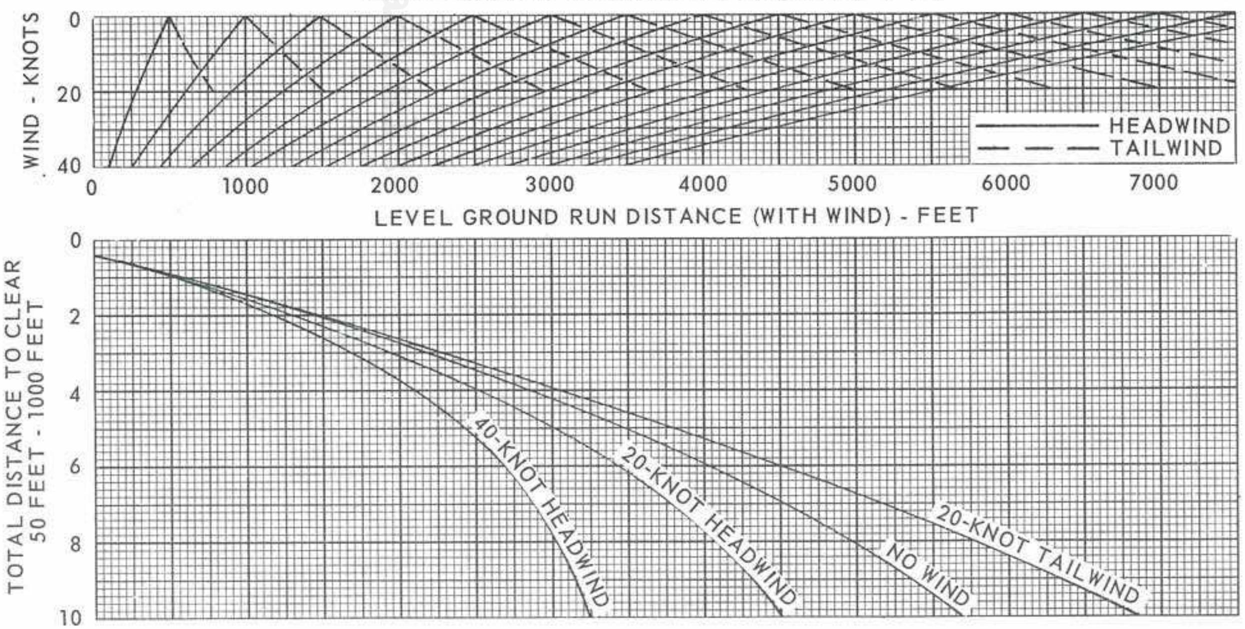


Figure A3-7

MODEL: AC-119G

VARIATION OF TAKEOFF GROUND RUN
WITH RUNWAY SURFACE CONDITION

RUNWAY SURFACE	ROLLING COEFFICIENT OF FRICTION
DRY HARD SURFACE	0.025
WET HARD SURFACE, STANDING WATER	0.050
DRY HARD TURF, SHORT GRASS	0.050
DRY SOFT TURF, SHORT GRASS	0.070
WET TURF	0.100
DRY SOFT GRAVEL, NO GRASS	0.100 - 0.300

DATA AS OF: 1 NOVEMBER 1968
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

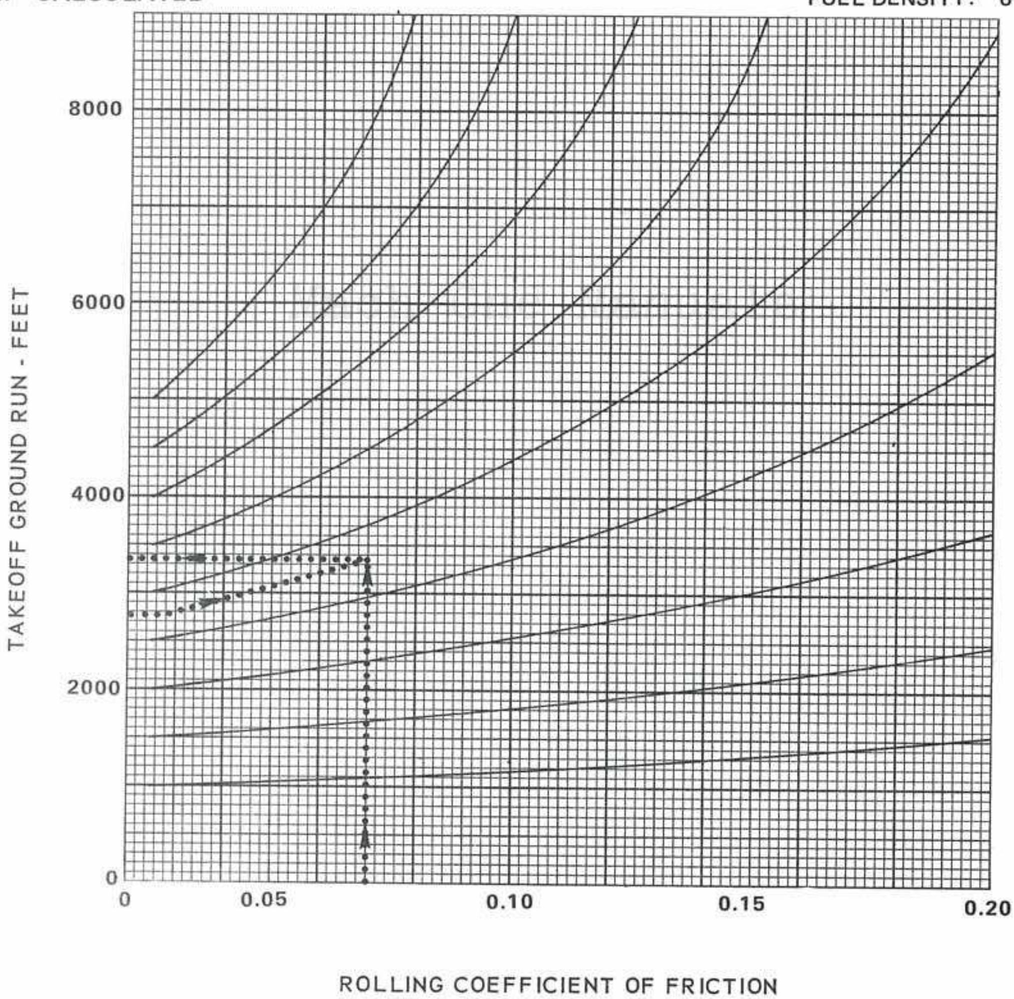


Figure A3-8

MODEL: AC-119G

VARIATION OF TAKEOFF GROUND RUN
WITH RUNWAY GRADIENT

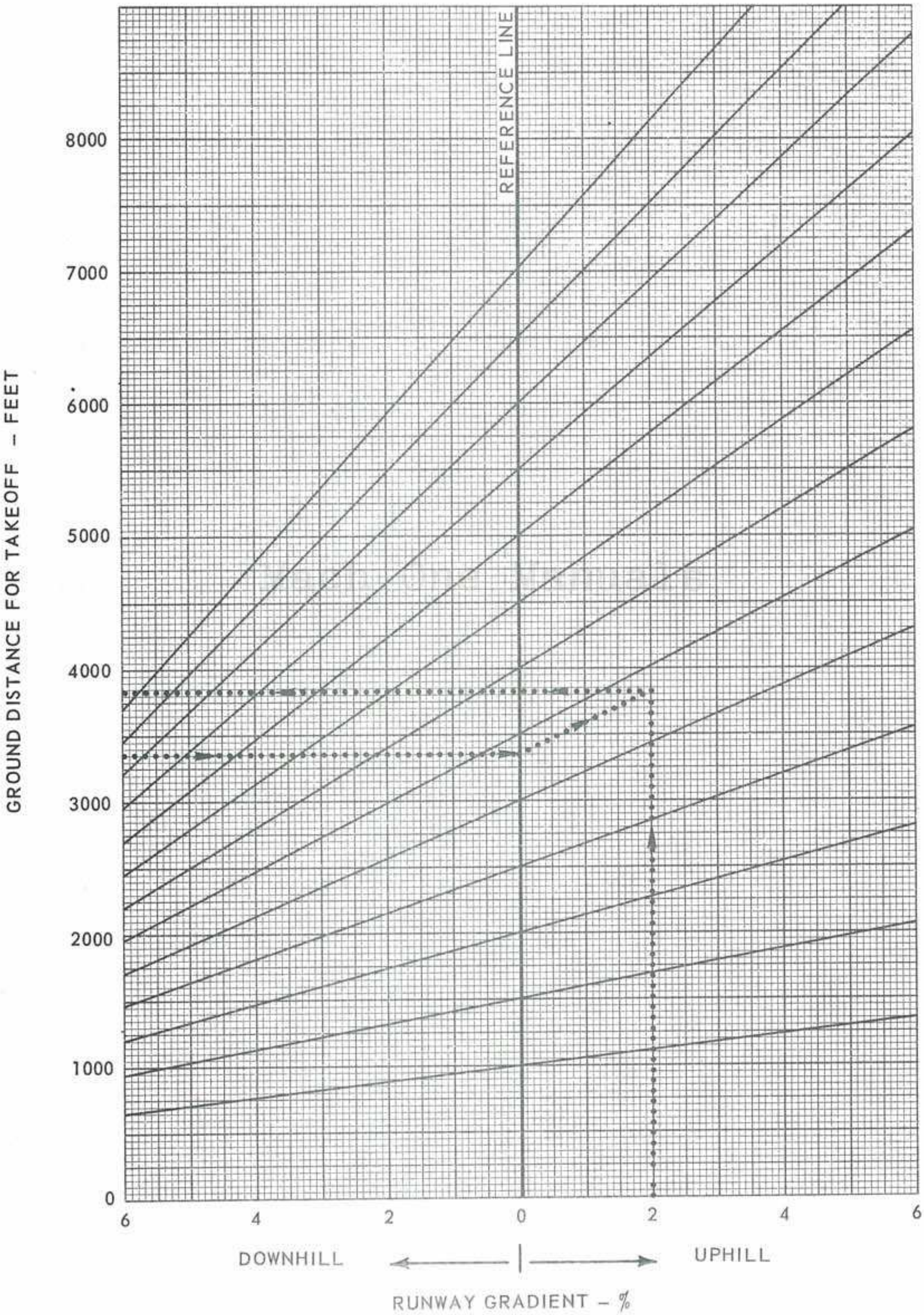


Figure A3-9

MODEL: AC-119G

CROSSWIND TAKEOFF
TWO-ENGINE OPERATION

DATA AS OF: 15 SEPTEMBER 1964
DATA BASIS: FLIGHT TEST

NOTES:

1. Enter chart using maximum wind gust velocity to determine minimum takeoff speed only. Use lowest given wind value to determine runway component (effective headwind) for computing takeoff distance, critical field length, and refusal speed.

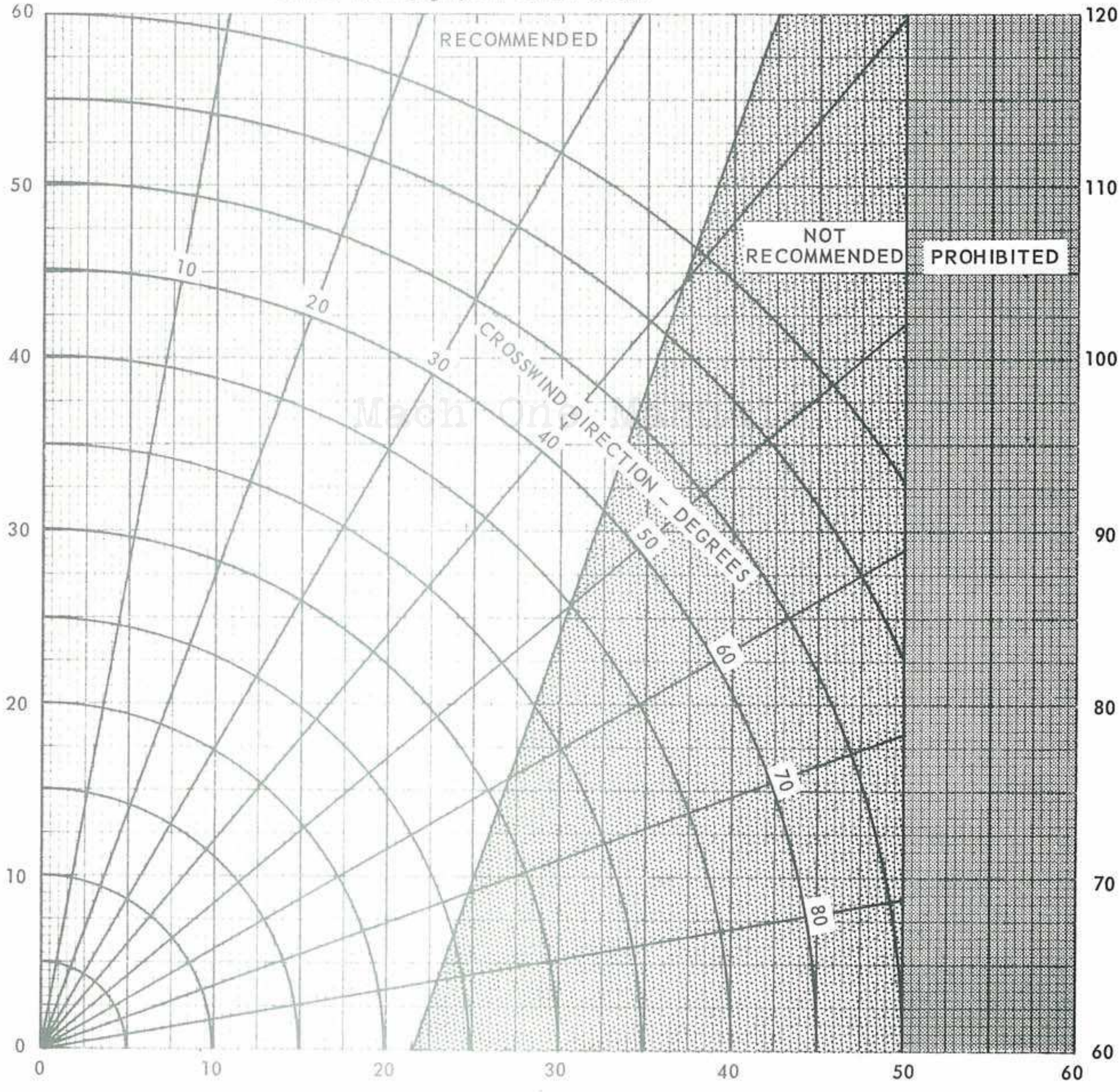


Figure A3-10

MODEL: AC-119G

CRITICAL FIELD LENGTH

ENGINES: R3350-89B (2)

MAXIMUM POWER

FLAPS 0°

CONDITIONS:

1. Dry, hard - surface runway, μrolling = 0.025, RCR = 23.
2. Brakes only for aborted takeoff, both propellers windmilling.
3. Data calculated on basis of full power applied prior to brake release.
4. Dead engine feathered for single - engine takeoff.
5. Refer to figure A3 - 13 for slippery runway condition.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

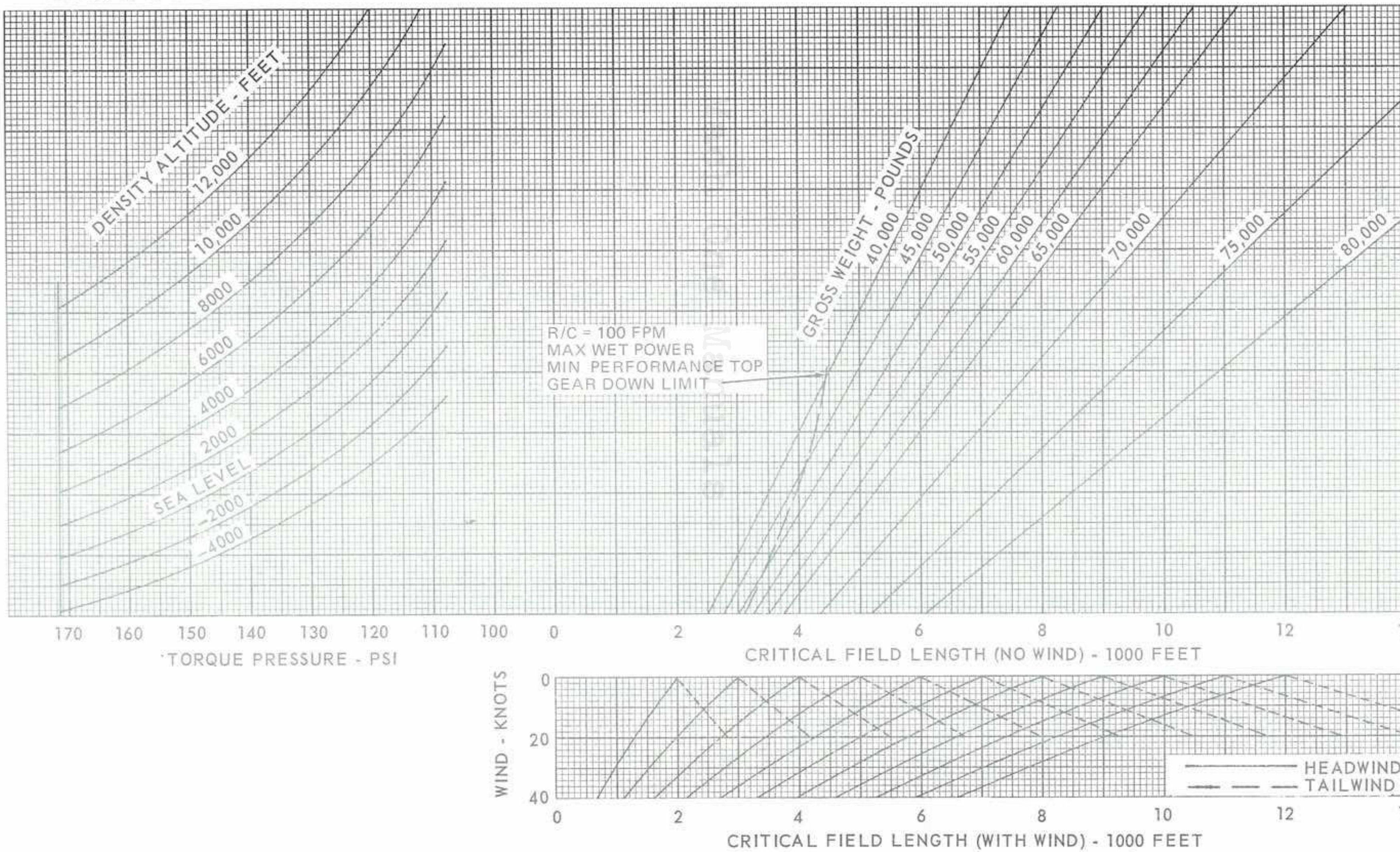


Figure A3-11

MODEL: AC-119G

CRITICAL FIELD LENGTH

ENGINES: R3350-89B (2)

MAXIMUM POWER

FLAPS 15°

CONDITIONS:

1. Dry, hard - surface runway, μ rolling = 0.025, RCR = 23.
2. Brakes only for aborted takeoff, both propellers windmilling.
3. Data calculated on basis of full power applied prior to brake release.
4. Dead engine feathered for single - engine takeoff.
5. Refer to figure A3 - 13 for slippery runway correction.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

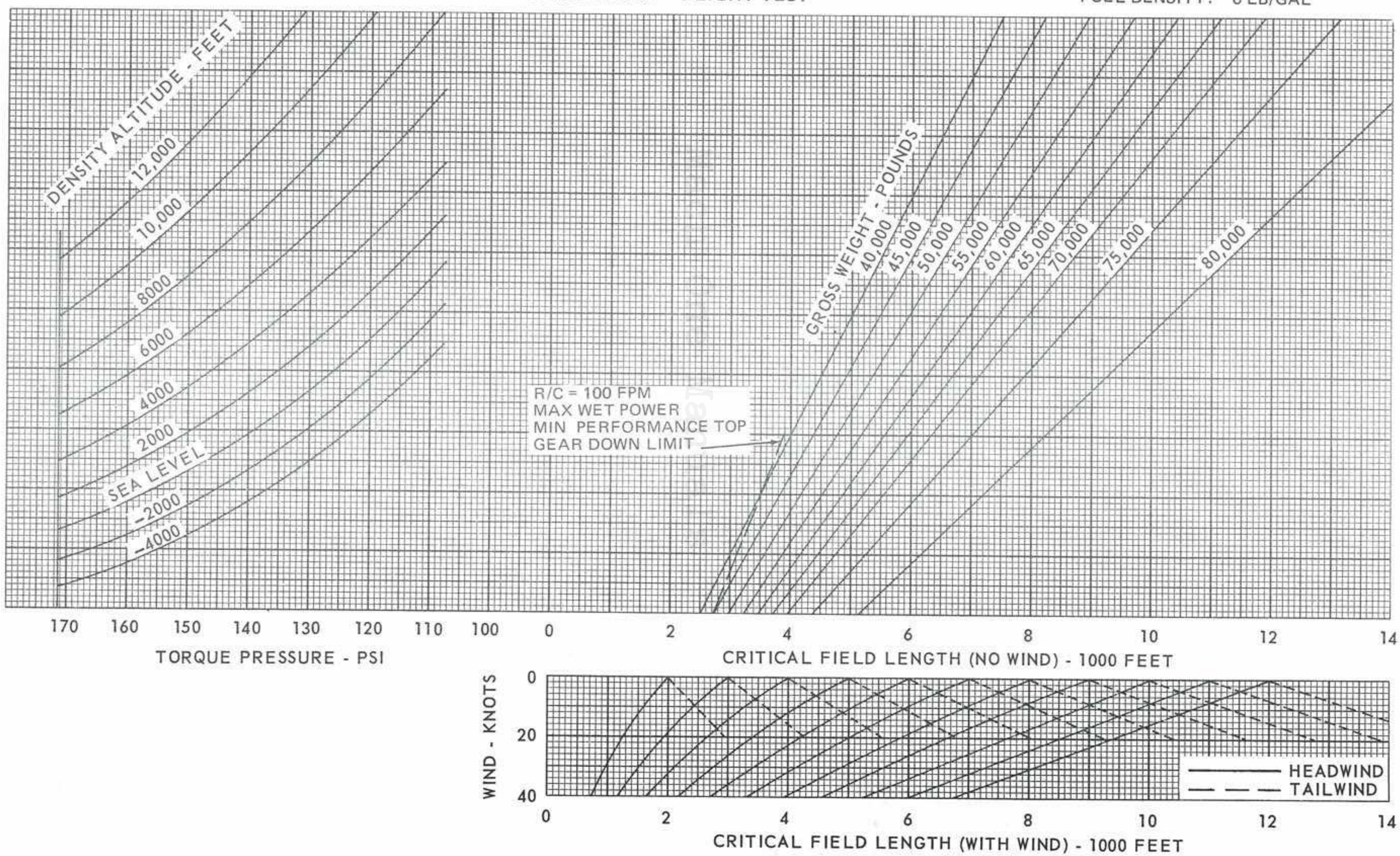


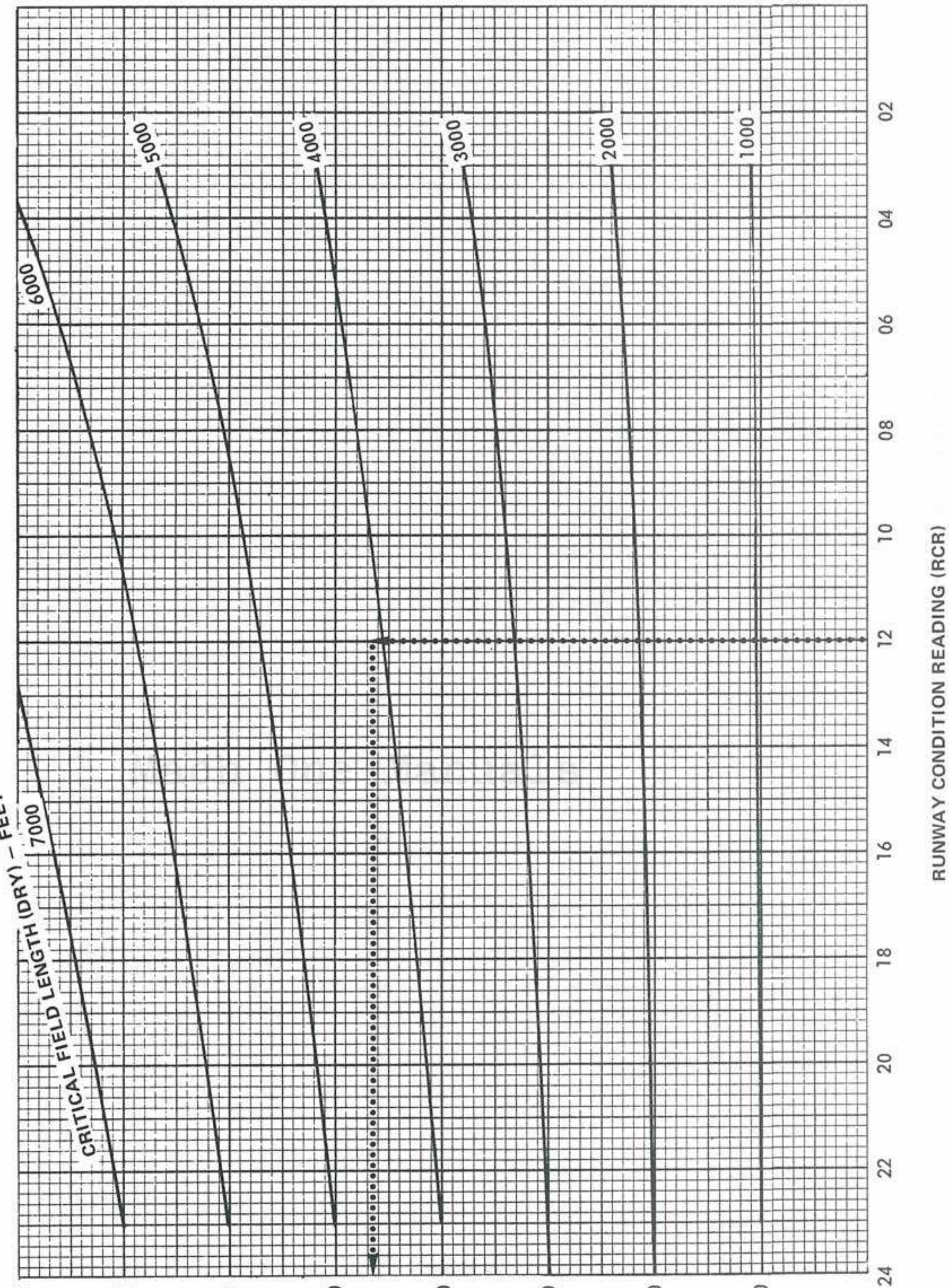
Figure A3-12

MODEL: AC-119G

VARIATION OF CRITICAL FIELD LENGTH WITH RUNWAY CONDITION READING (RCR)

DATA AS OF: 15 SEPTEMBER 1964
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



NOTE: IF RCR IS NOT AVAILABLE, FOR DRY RSC (ICAO GOOD) USE RCR 23, FOR WET RSC (ICAO MEDIUM) USE RCR 12, FOR ICY RSC (ICAO POOR) USE RCR 05.

Figure A3-13

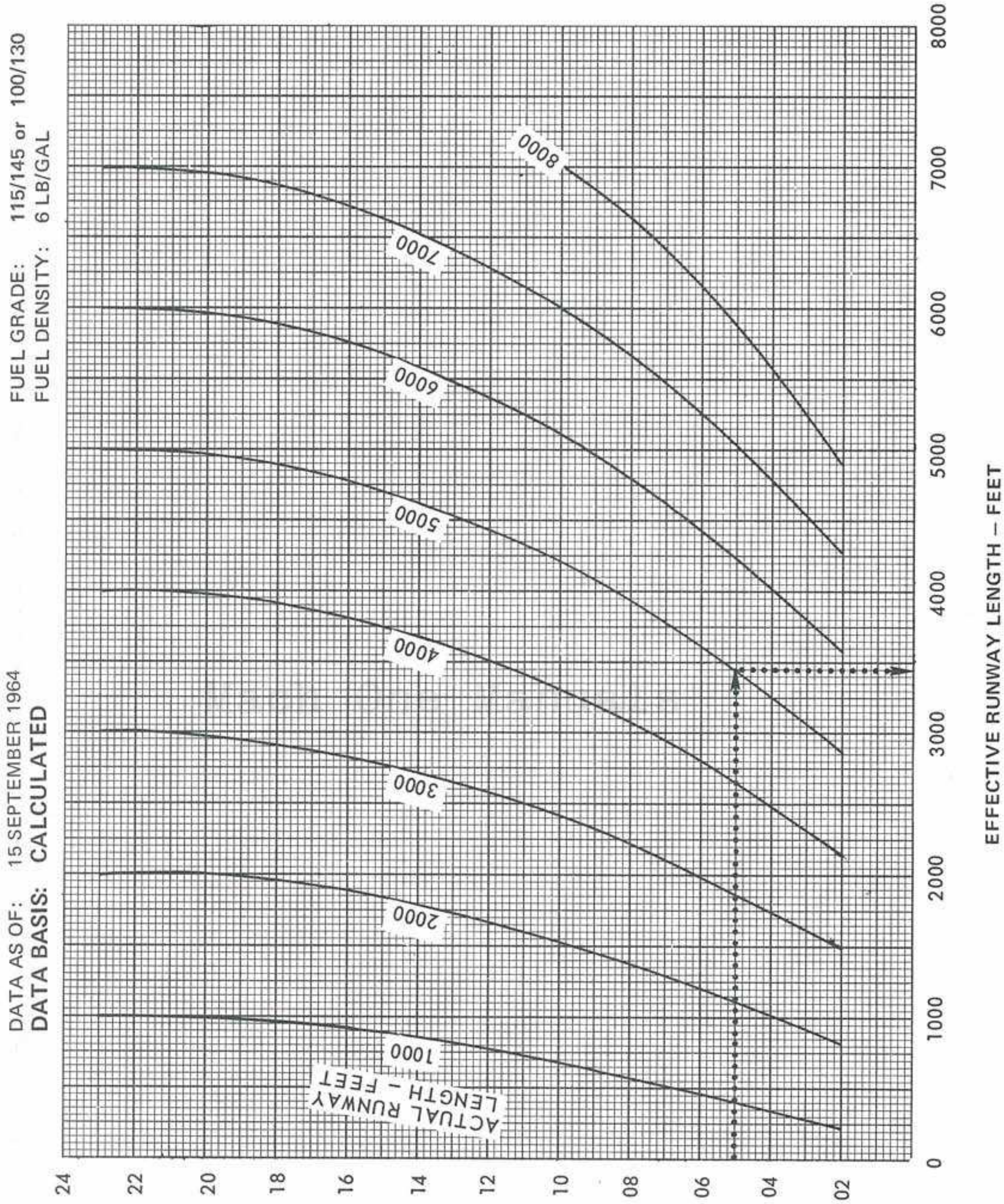
MODEL: AC-119G

EFFECTIVE RUNWAY LENGTH

FOR DETERMINATION OF REFUSAL SPEED
WITH RUNWAY CONDITION READING (RCR)

DATA AS OF: 15 SEPTEMBER 1964
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



NOTE: IF RCR IS NOT AVAILABLE, FOR DRY RSC (ICAO GOOD) USE RCR 23, FOR WET RSC (ICAO MEDIUM) USE RCR 12, FOR ICY RSC (ICAO POOR) USE RCR 05.

Figure A3-14

MODEL: AC-119G

REFUSAL SPEED

ENGINES: R3350-89B (2)

MAXIMUM POWER

FLAPS 0°

CONDITIONS:

1. Brakes only for aborted takeoff, both propellers windmilling.
2. Effective runway length equals actual runway length corrected for RCR.
3. Data calculated on basis of full power applied prior to brake release.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

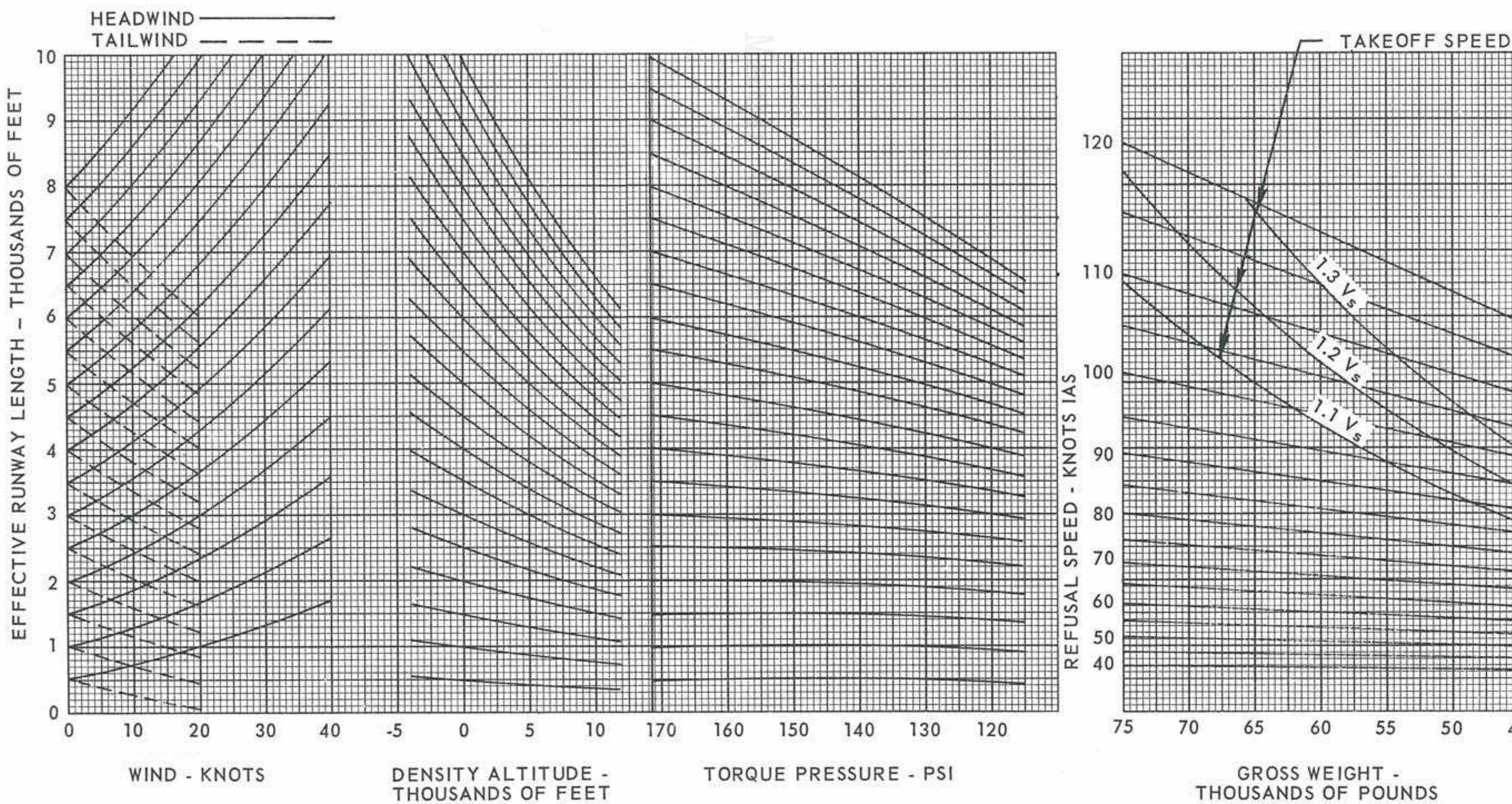


Figure A3-15

MODEL: AC-119G
REFUSAL SPEED
ENGINES: R3350-89B (2)
MAXIMUM POWER
FLAPS 15°

CONDITIONS:

1. Brakes only for aborted takeoff, both propellers windmilling.
2. Effective runway length equals actual runway length corrected for RCR.
3. Data based on full power applied prior to brake release.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

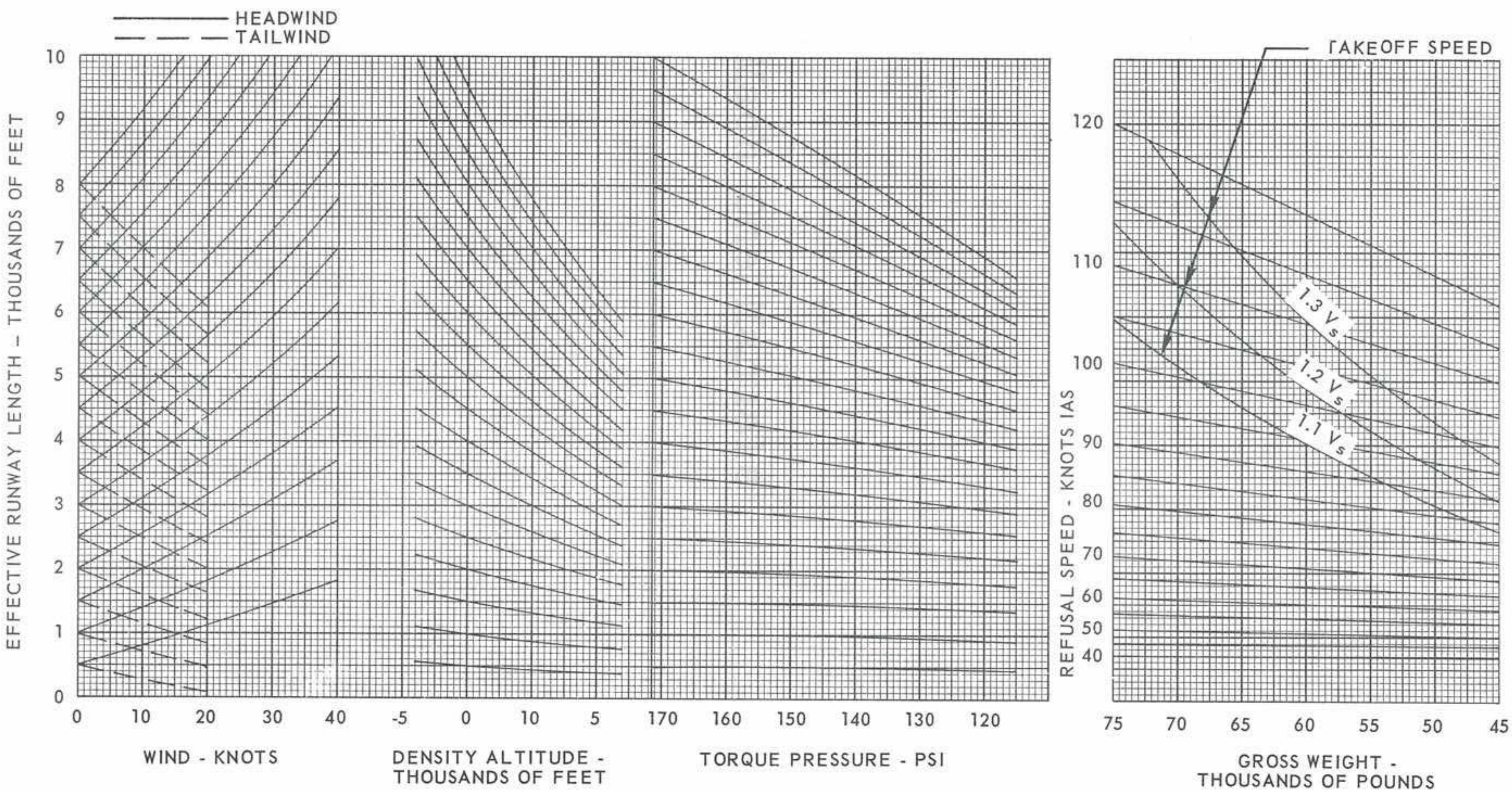


Figure A3-16

MODEL: AC-119G

TAKEOFF ACCELERATION

ENGINES: R3350-89B (2)

MAXIMUM POWER

DATA AS OF: 1 NOVEMBER 1968

DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130

FUEL DENSITY: 6 LB/GAL

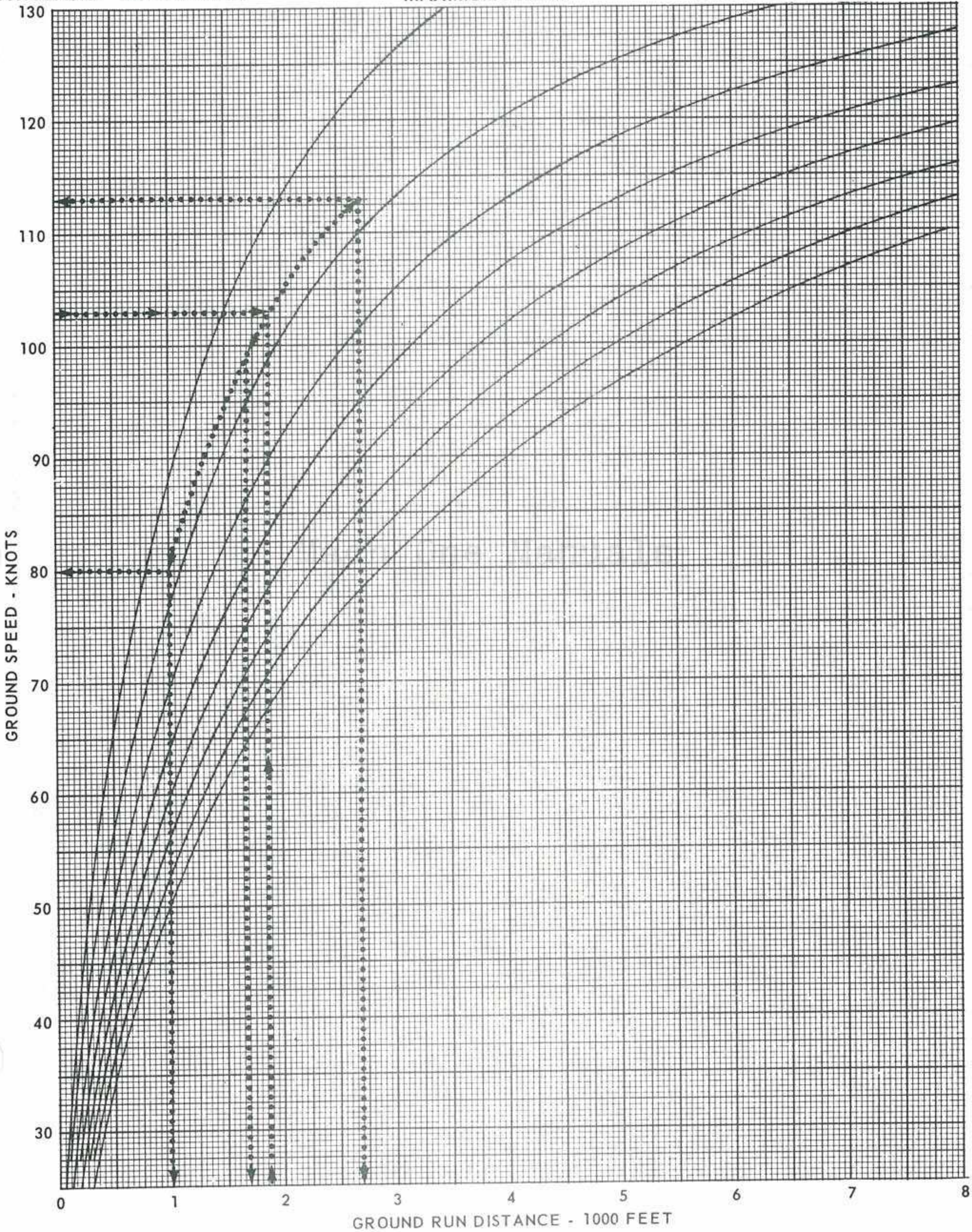


Figure A3-17

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – LOW ALTITUDE CLIMB-OUT INDEX

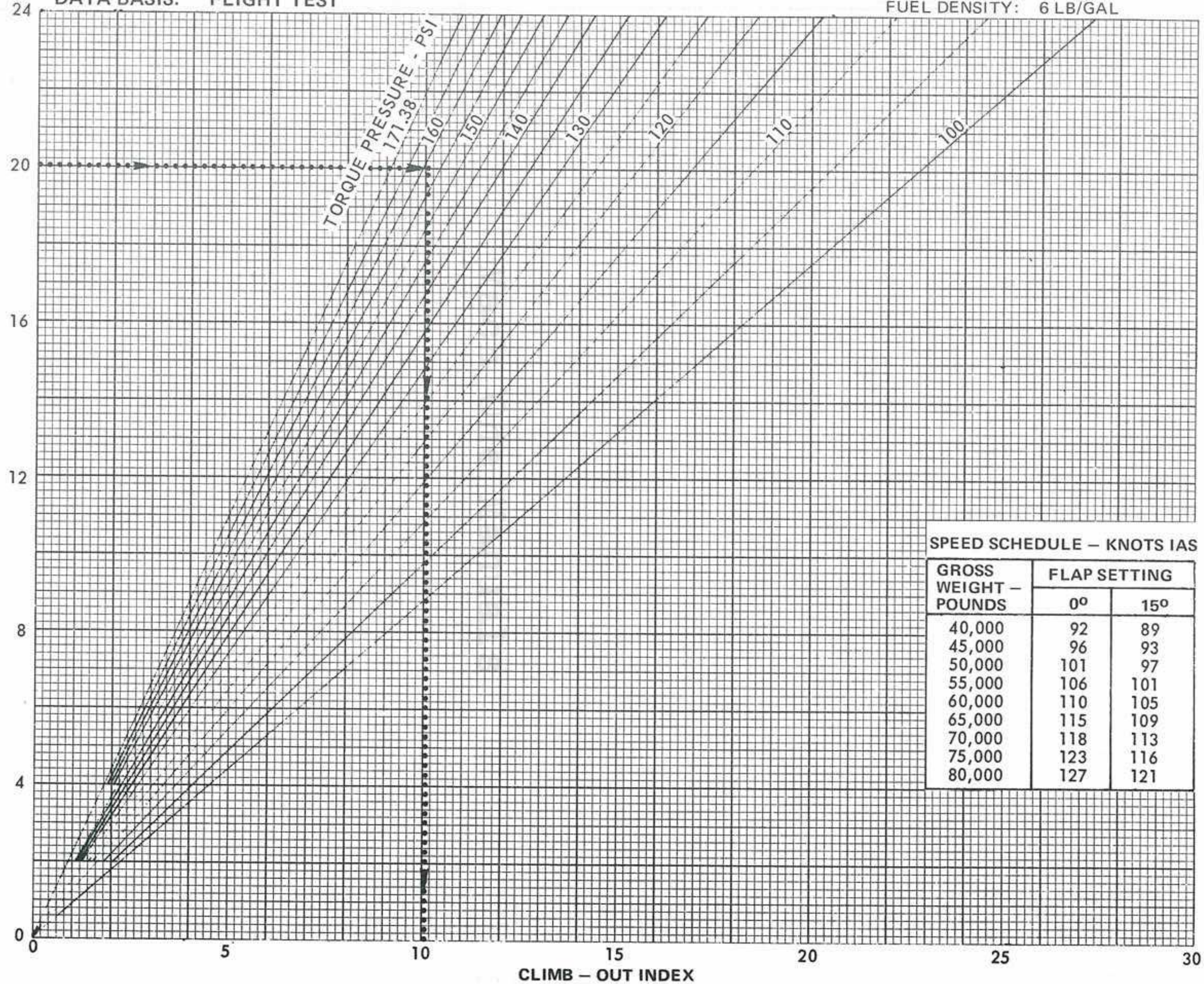
DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

ENGINES: R3350-89B (2)

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. 2900 rpm,rich mixture.
2. Speed = $1.2V_s$ power - off.
3. Landing gear up.



SPEED SCHEDULE – KNOTS IAS

GROSS WEIGHT – POUNDS	FLAP SETTING 0°	FLAP SETTING 15°
40,000	92	89
45,000	96	93
50,000	101	97
55,000	106	101
60,000	110	105
65,000	115	109
70,000	118	113
75,000	123	116
80,000	127	121

Figure A3-18

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – LOW ALTITUDE HORIZONTAL DISTANCE

ENGINES: R3350-89B (2)

CONDITIONS:

1. **2900 rpm, rich mixture.**
2. **Speed = 1.2V_S power - off.**
3. **Landing gear up.**

DATA AS OF: MARCH 1969
DATE BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

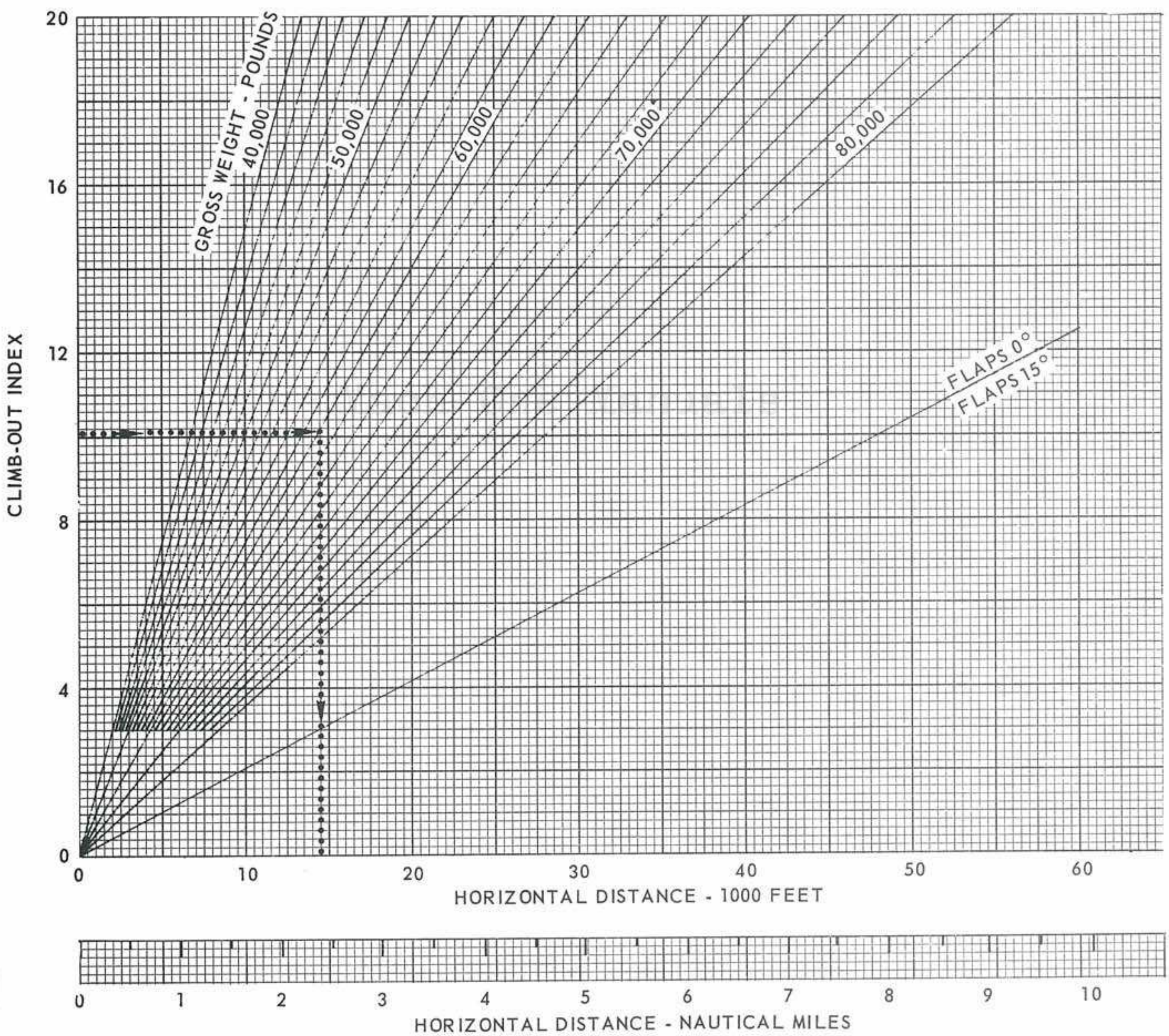


Figure A3-19

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – HIGH ALTITUDE CLIMB-OUT INDEX

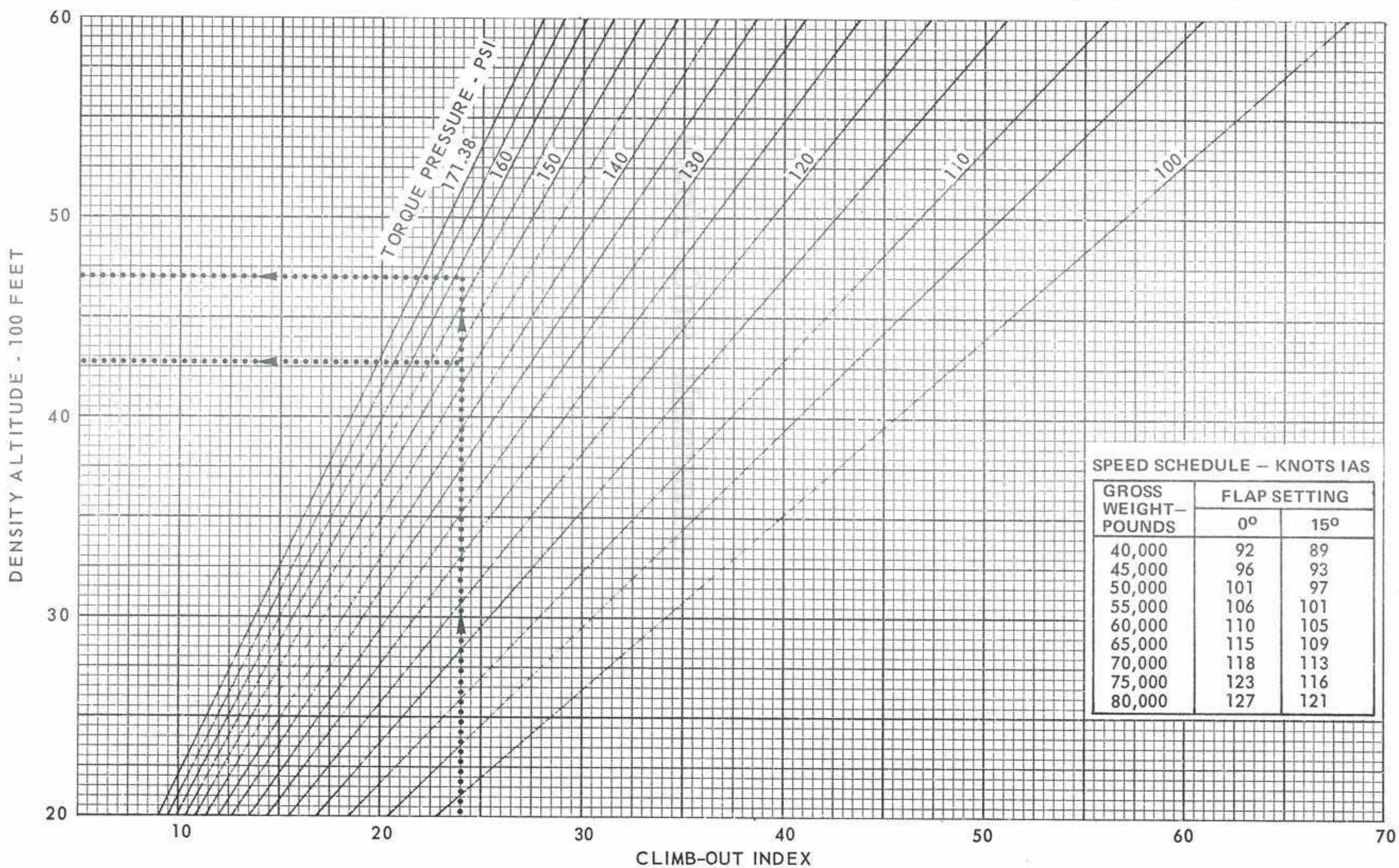
ENGINES: R3350-89B (2)

CONDITION:

1. 2900 rpm, rich mixture.
2. Speed = 1.2 V_S power - off.
3. Landing gear up.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



SPEED SCHEDULE – KNOTS IAS

GROSS WEIGHT– POUNDS	FLAP SETTING 0°	FLAP SETTING 15°
40,000	92	89
45,000	96	93
50,000	101	97
55,000	106	101
60,000	110	105
65,000	115	109
70,000	118	113
75,000	123	116
80,000	127	121

Figure A3-20

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE — HIGH ALTITUDE HORIZONTAL DISTANCE

ENGINES: R3350-89B (2)

CONDITIONS:

1. 2900 rpm, rich mixture.
2. Speed = 1.2 V_S power - off.
3. Landing gear up.

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

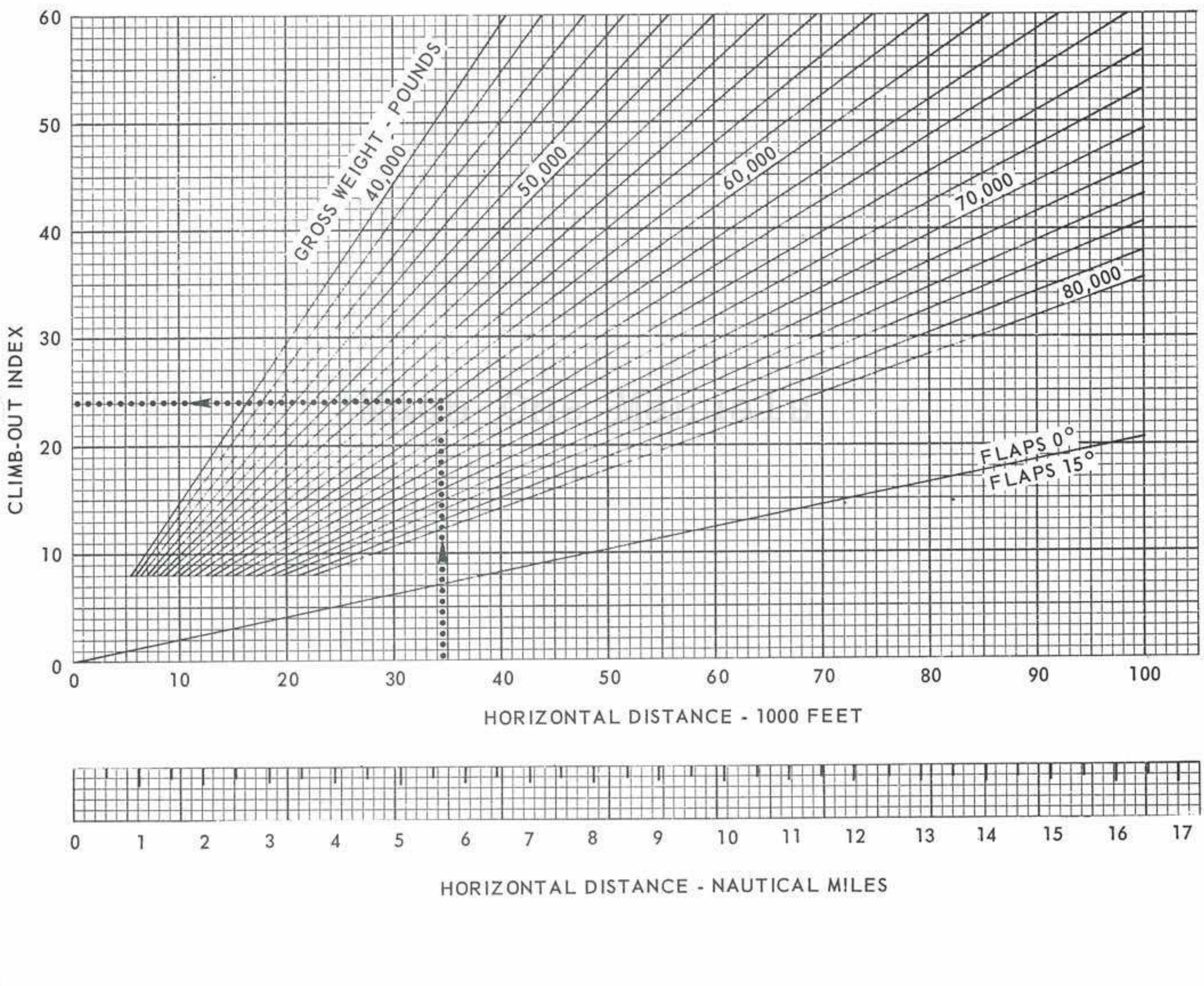


Figure A3-21

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – LOW ALTITUDE CLIMB-OUT INDEX

SINGLE-ENGINE OPERATION

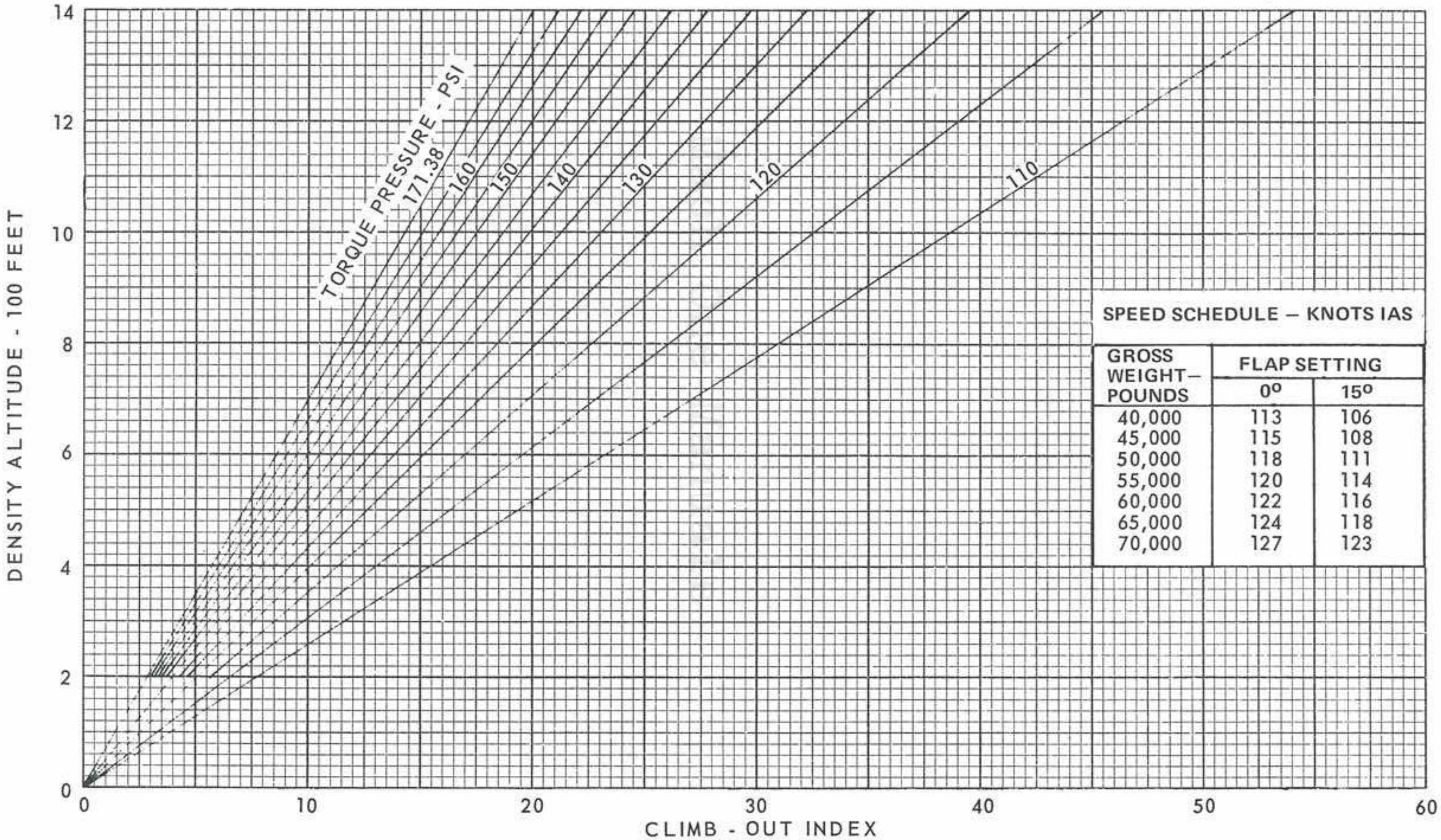
ENGINE: R3350-89B (1)

CONDITIONS:

1. 2900 rpm, rich mixture.
2. Speed = 106 knots IAS or recommended single-engine climb speed.
3. Landing gear up, propeller feathered, cowl flaps closed.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



SPEED SCHEDULE – KNOTS IAS

GROSS WEIGHT– POUNDS	FLAP SETTING 0°	FLAP SETTING 15°
40,000	113	106
45,000	115	108
50,000	118	111
55,000	120	114
60,000	122	116
65,000	124	118
70,000	127	123

Figure A3-22

CONDITIONS:

1. 2900 rpm, rich mixture.
2. Speed = 106 knots IAS or recommended single-engine climb speed.
3. Landing gear up, propeller feathered, cowl flaps closed.

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – LOW ALTITUDE HORIZONTAL DISTANCE

SINGLE-ENGINE OPERATION

ENGINE: R3350-89B (1)

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

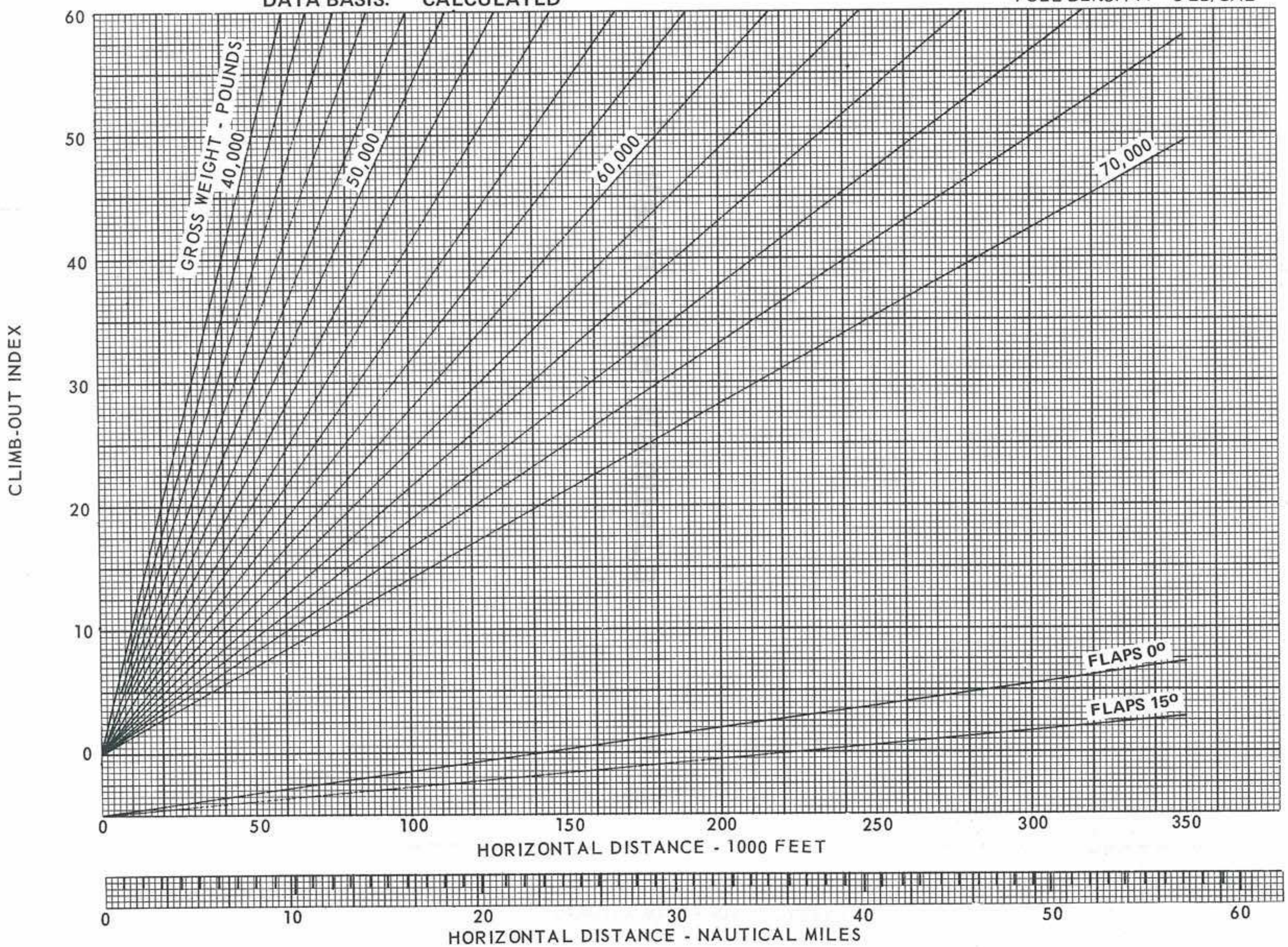


Figure A3-23

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE – HIGH ALTITUDE CLIMB-OUT INDEX

SINGLE-ENGINE OPERATION

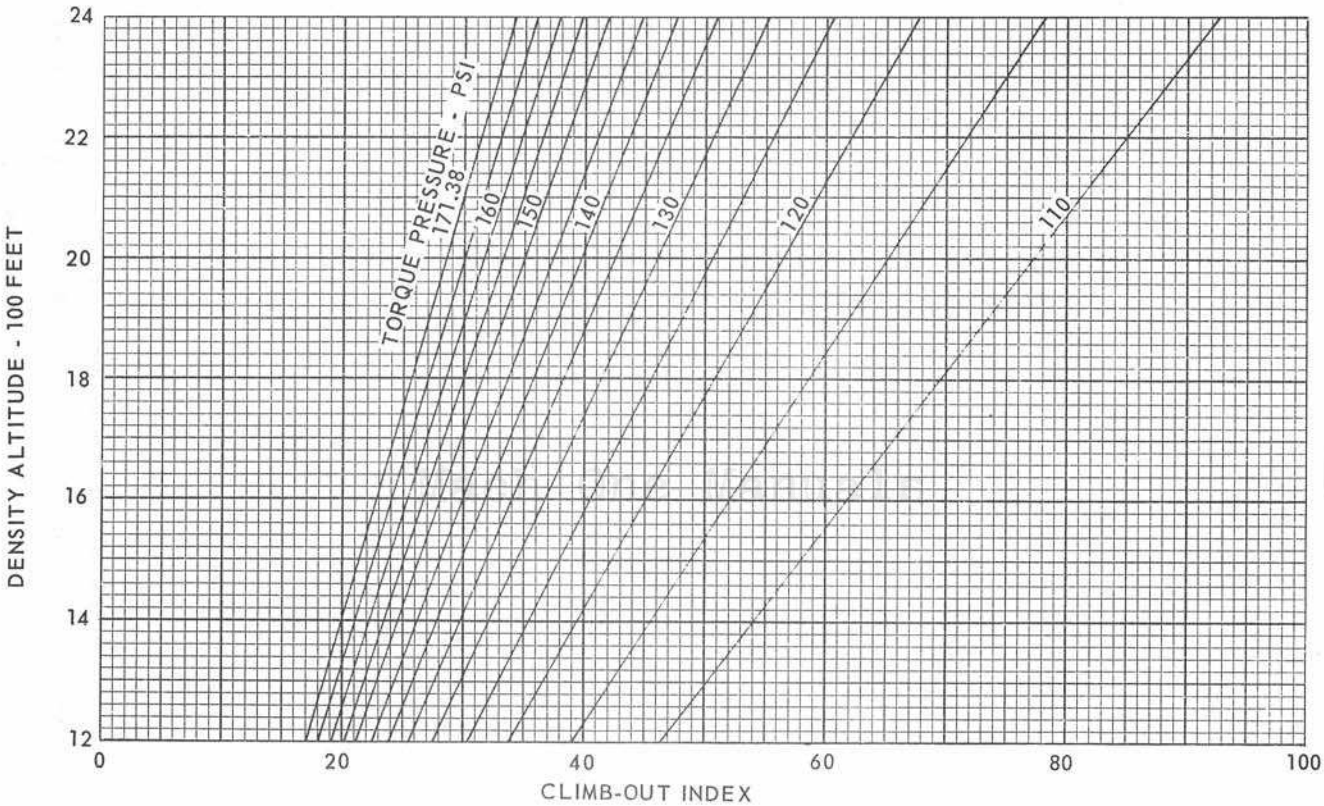
ENGINE: R3350-89B (1)

CONDITIONS:

1. 2900 rpm, rich mixture.
2. Speed = 106 knots IAS or recommended single-engine climb speed.
3. Landing gear up, propeller feathered, cowl flaps closed.

DATA AS OF: MARCH 1969
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



SPEED SCHEDULE - KNOTS IAS

GROSS WEIGHT – POUNDS	FLAP SETTING	
	0°	15°
40,000	113	106
45,000	115	108
50,000	118	111
55,000	120	114
60,000	122	116
65,000	124	118
70,000	127	123

Figure A3-24

CONDITIONS:

1. 2900 rpm, rich mixture.
2. Speed = 106 knots IAS or recommended single-engine climb speed.
3. Landing gear up, propeller feathered, cowl flaps closed.

MODEL: AC-119G

STANDARD INSTRUMENT DEPARTURE—HIGH ALTITUDE HORIZONTAL DISTANCE

SINGLE-ENGINE OPERATION

ENGINE: R3350-89B (1)

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

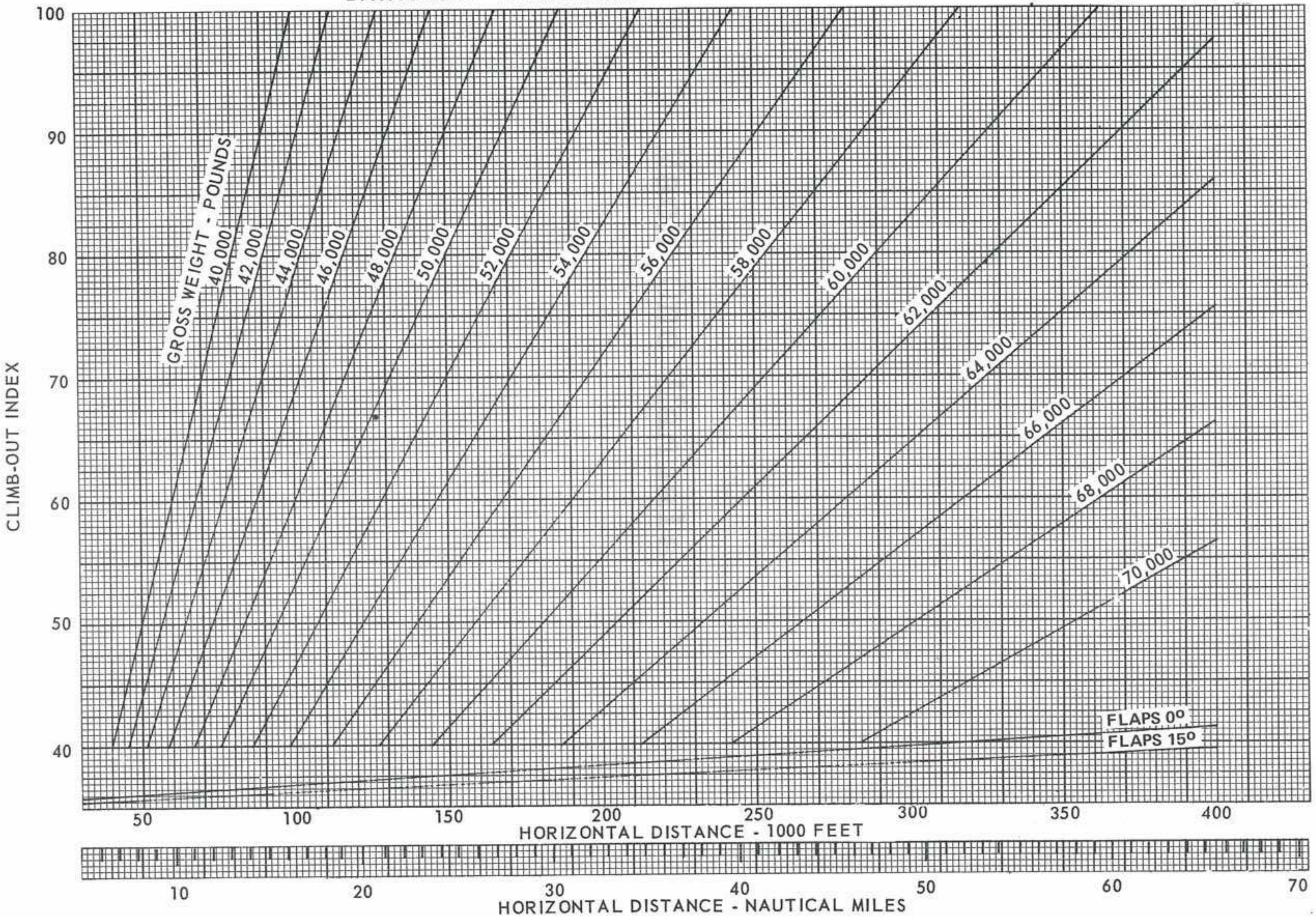


Figure A3-25

CLIMB DATA

part 4

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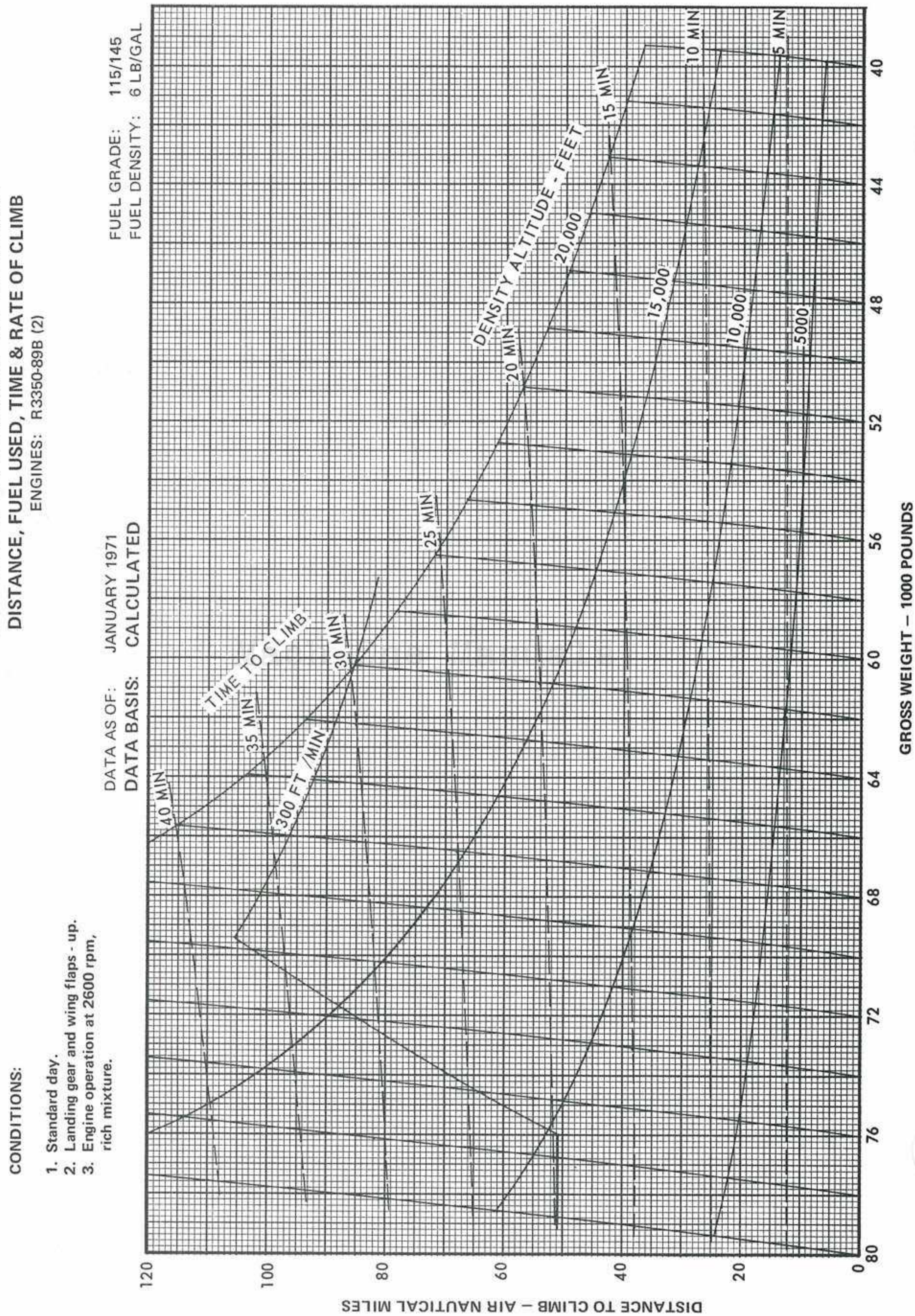
MODEL: AC-119G
GUNSHIP CONFIGURATION
CLIMB AT METO POWER AT 140 KNOTS IAS
DISTANCE, FUEL USED, TIME & RATE OF CLIMB
ENGINES: R3350-89B (2)
DATA AS OF: JANUARY 1971
DATA BASIS: CALCULATED
FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL
CONDITIONS:
1. Standard day.
2. Landing gear and wing flaps - up.
3. Engine operation at 2600 rpm, rich mixture.
DENSITY ALTITUDE - FEET
20,000
15,000
10,000
5000
TIME TO CLIMB
5 MIN
10 MIN
15 MIN
20 MIN
25 MIN
30 MIN
35 MIN
40 MIN
300 FT /MIN
GROSS WEIGHT – 1000 POUNDS
40
44
48
52
56
60
64
68
72
76
80
DISTANCE TO CLIMB – AIR NAUTICAL MILES
0
20
40
60
80
100
120

Figure A4-1

MODEL: AC-119G

SINGLE - ENGINE RATE OF CLIMB

MAXIMUM POWER

ENGINE: R3350-89B (1)

PROPELLER FEATHERED

CONDITIONS:

1. Landing gear and wing flaps - up.
2. Cowl flaps on inoperative engine closed.
3. Operation at recommended single - engine climb speed.
4. Engine operation at 2900 rpm, rich mixture.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

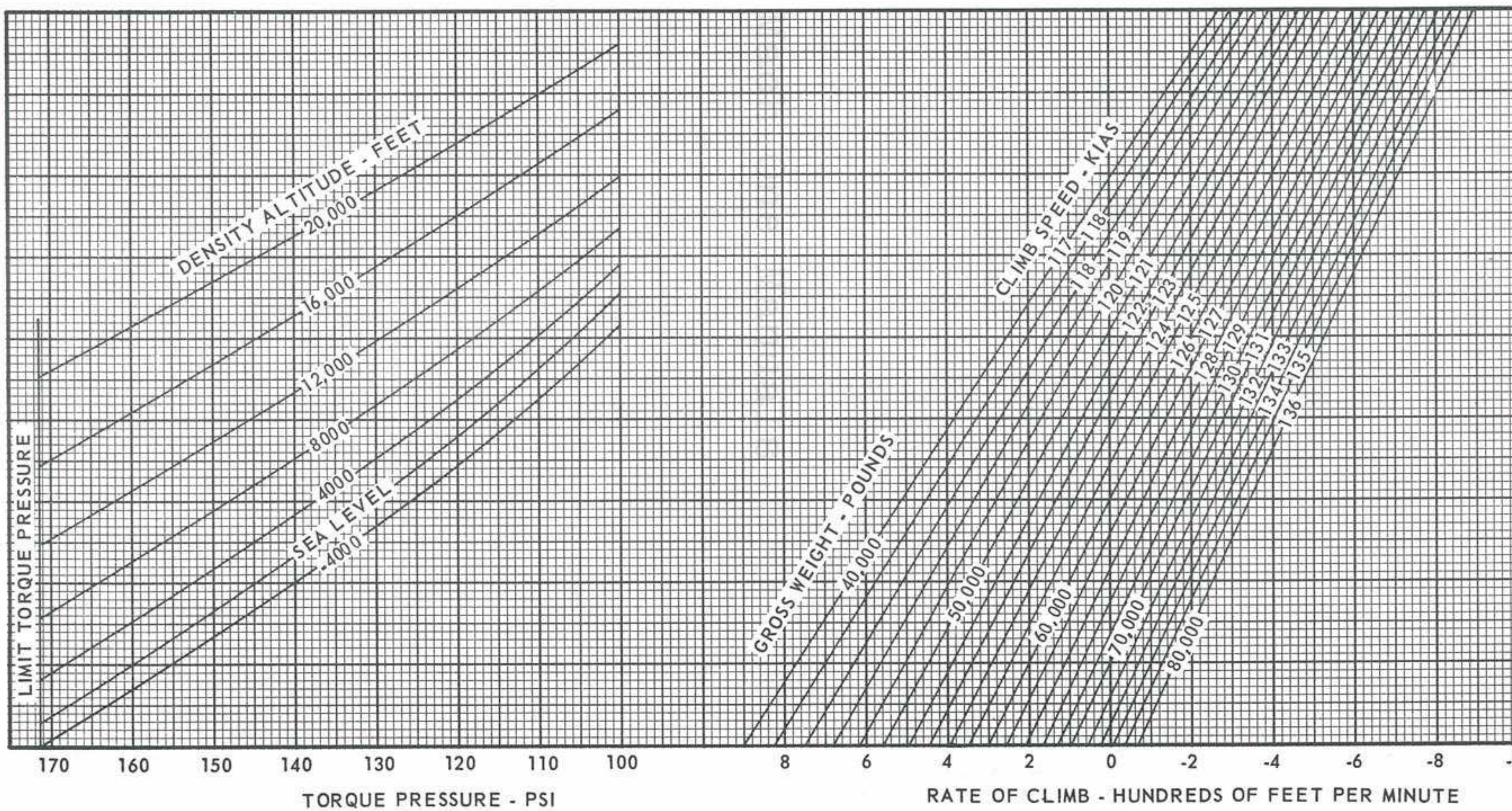

Figure A4-2

MODEL: AC-119G

SINGLE - ENGINE RATE OF CLIMB

METO POWER

ENGINE: R3350-89B (1)

PROPELLER FEATHERED

CONDITIONS:

1. Landing gear and wing flaps - up.
2. Cowl flaps on inoperative engine closed.
3. Operation at recommended single - engine climb speed.
4. Engine operation at 2600 rpm, rich mixture.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL

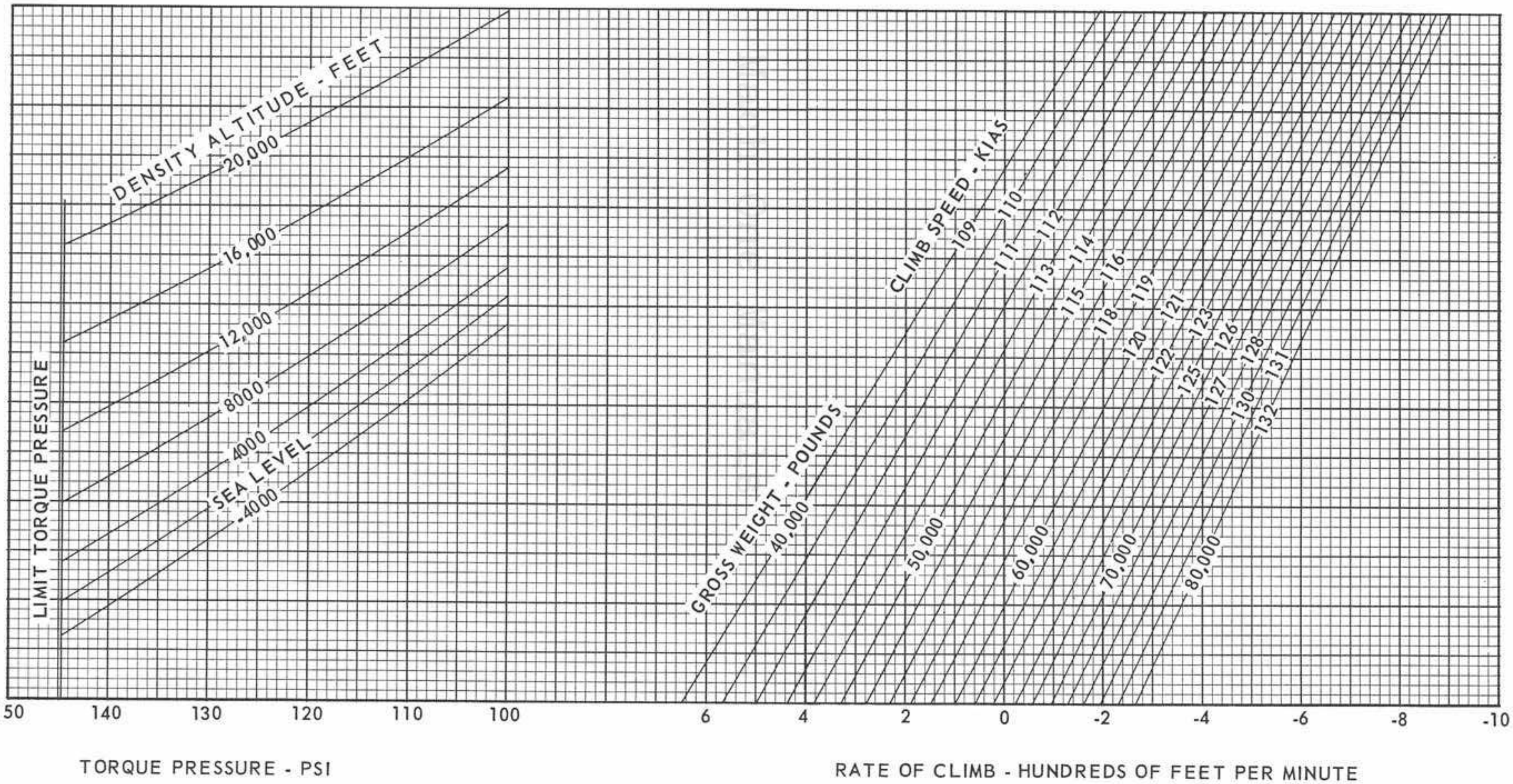

Figure A4-3

MODEL: AC-119G

EMERGENCY SERVICE CEILING

SINGLE-ENGINE OPERATION

ENGINE: R3350-89B (1)

PROPELLER FEATHERED

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

CONDITIONS:

1. Standard day.
2. Landing gear and flaps - up.
3. Cowl flaps on inoperative engine closed .
4. Operation at recommended single - engine climb speed.

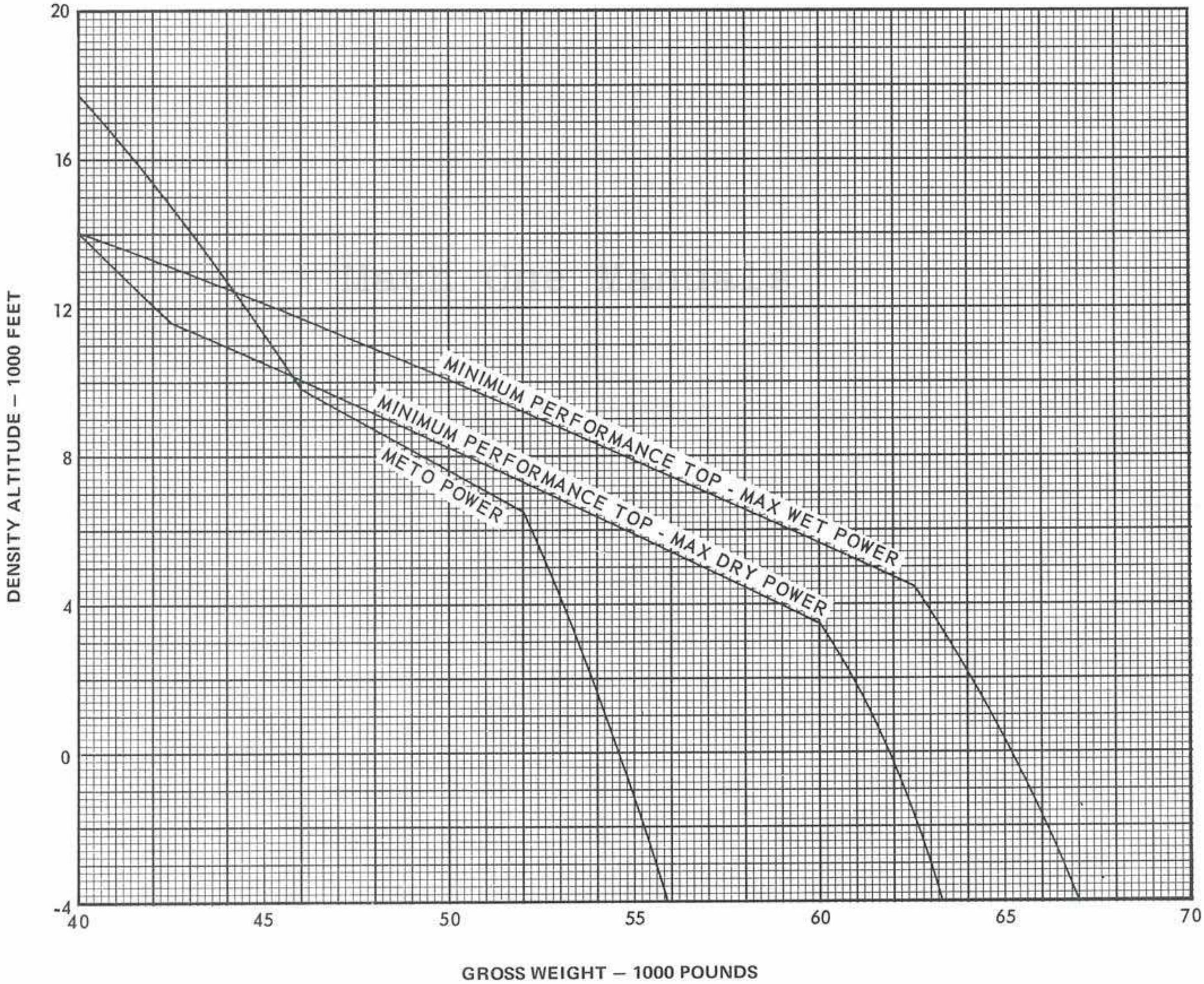

Figure A4-4

CRUISE DATA

part 5

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NOTE

The ferry configuration of the AC-119G is defined as front entrance door, paratroop doors, and gun port covers installed; guns retracted.

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

SEA LEVEL DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

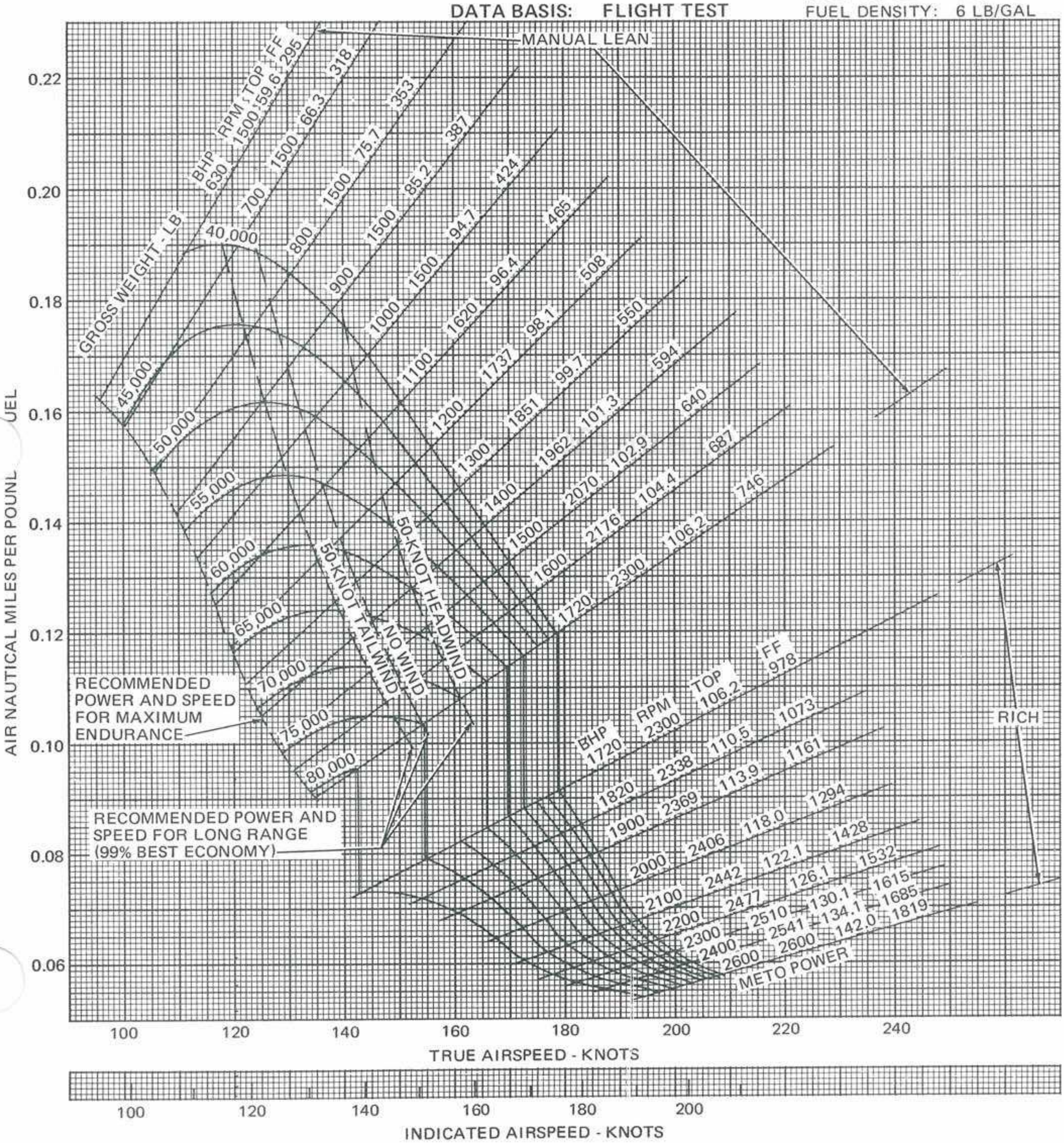


Figure A5-1

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

2000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 — FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST — FUEL DENSITY: 6 LB/GAL

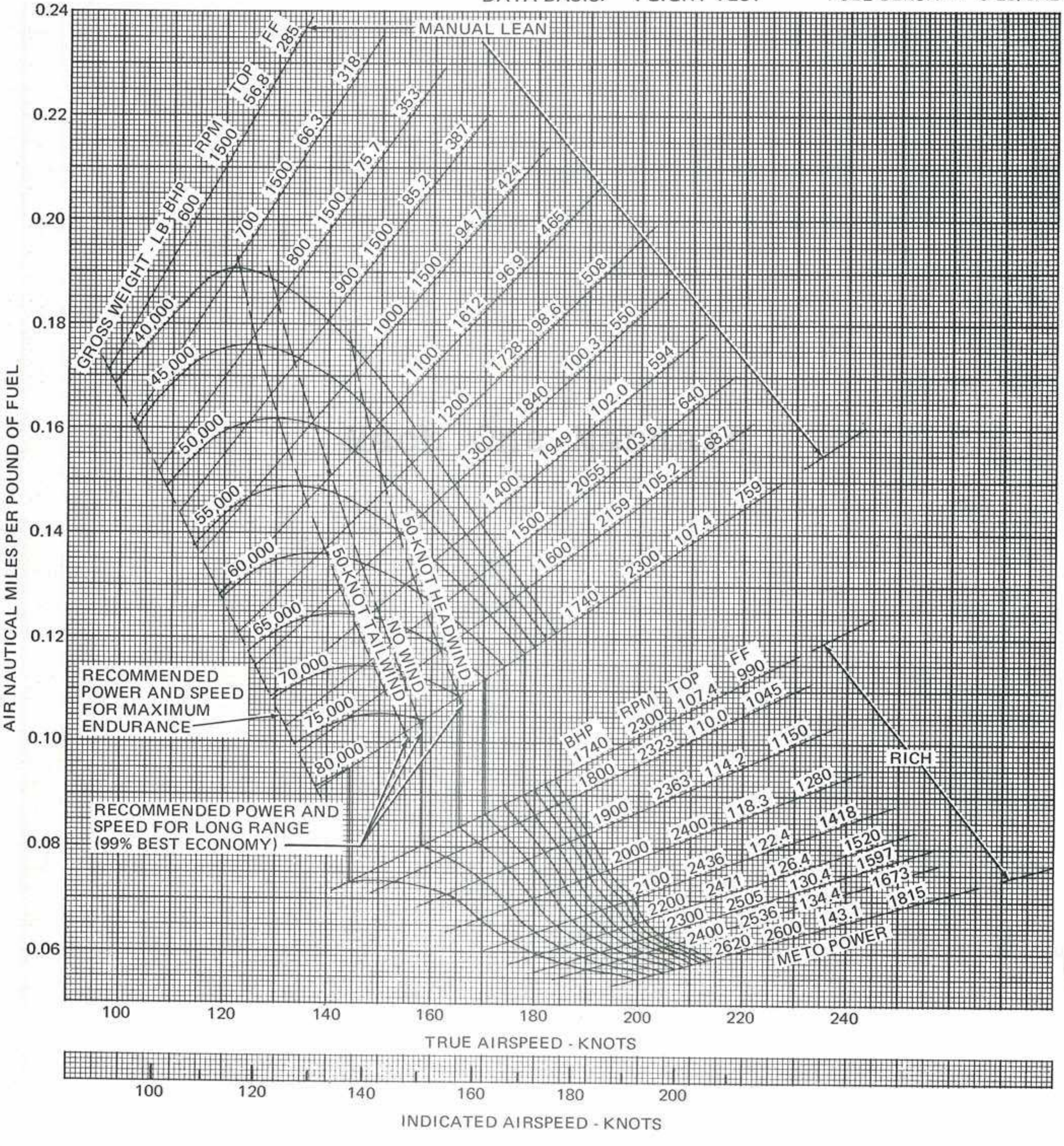


Figure A5-2

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

3000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

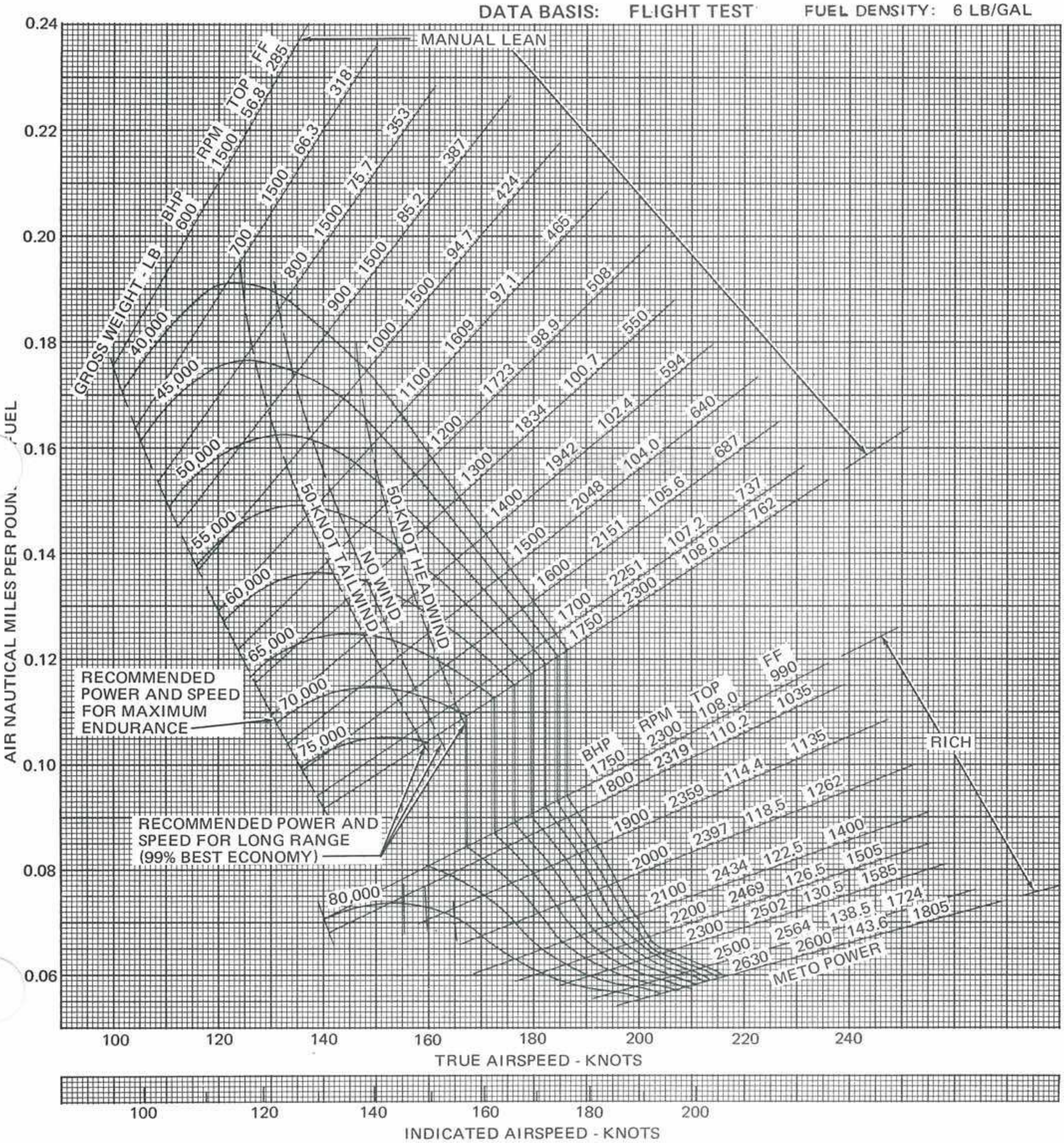


Figure A5-3

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

4000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 | FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST | FUEL DENSITY: 6 LB/GAL

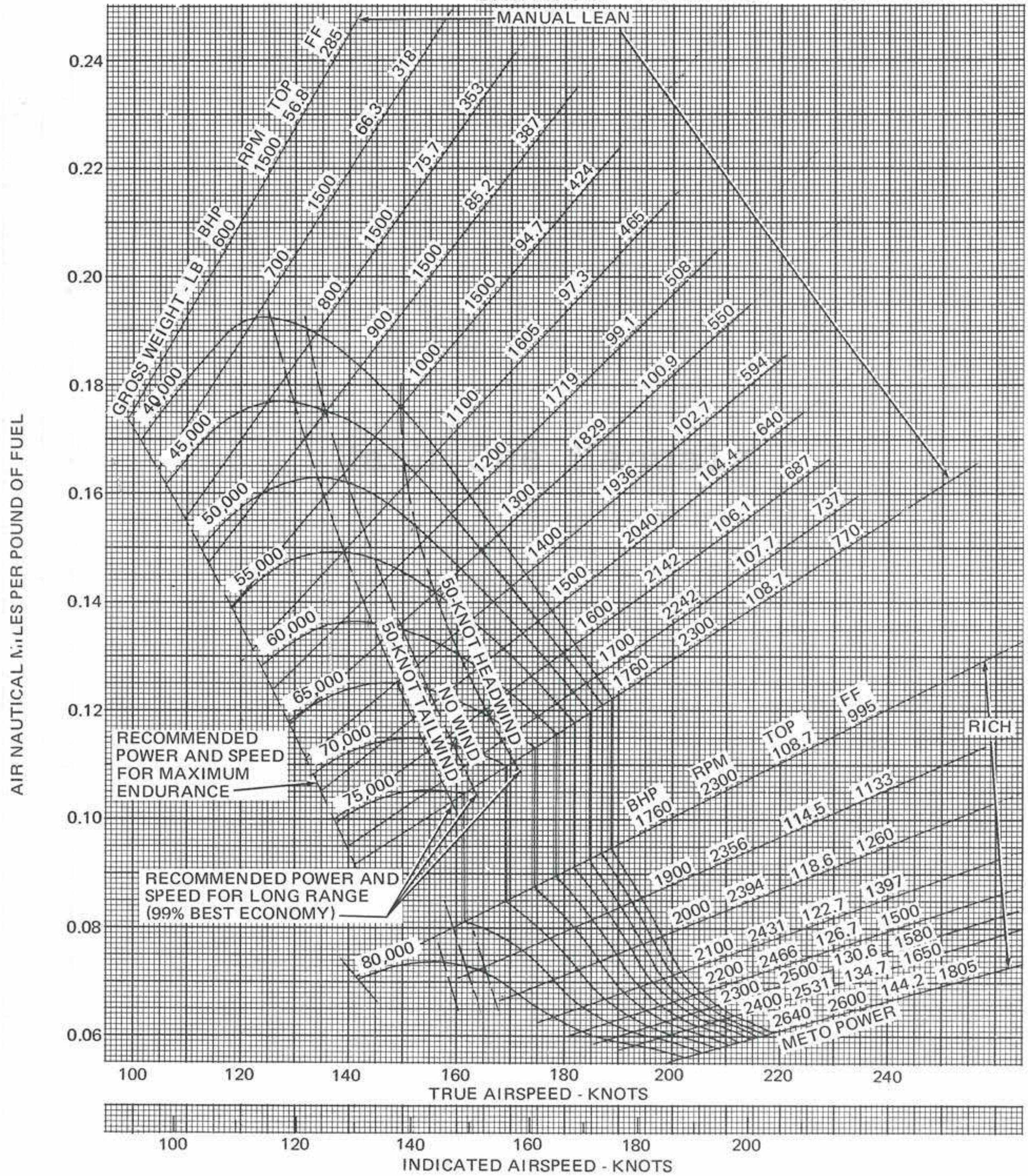


Figure A5-4

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

5000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

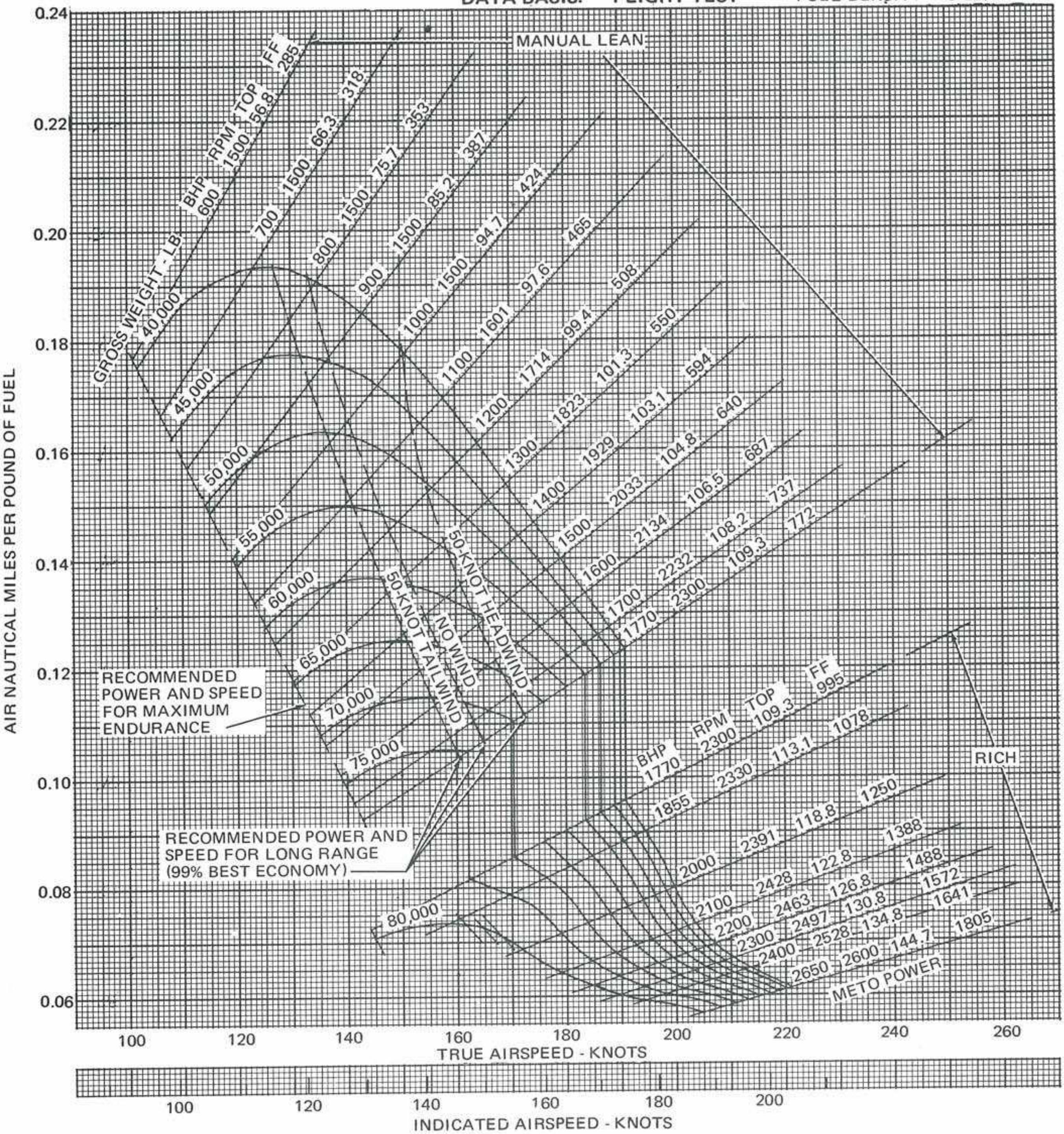


Figure A5-5

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

6000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

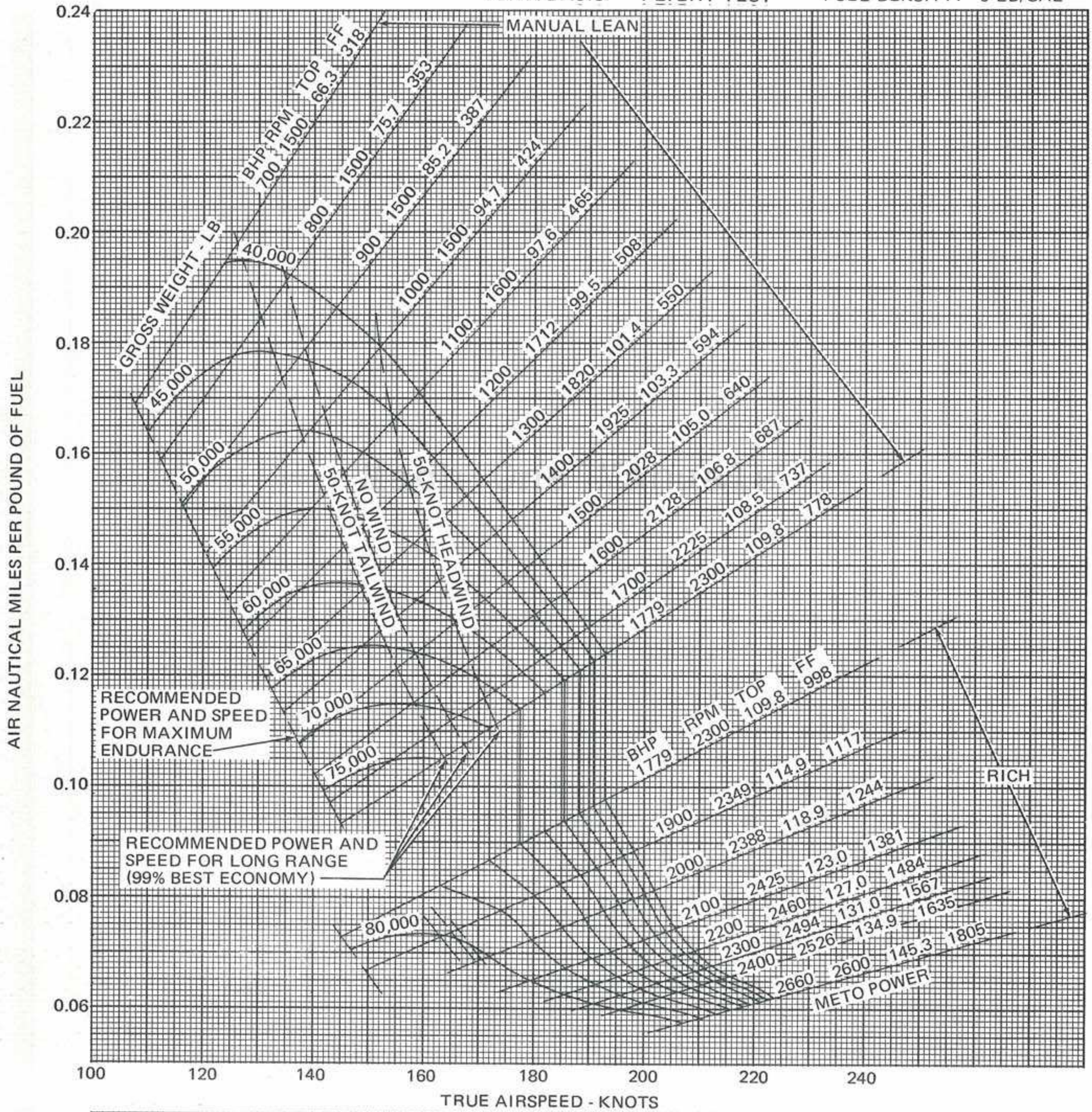


Figure A5-6

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

7000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 | FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST | FUEL DENSITY: 6 LB/GAL

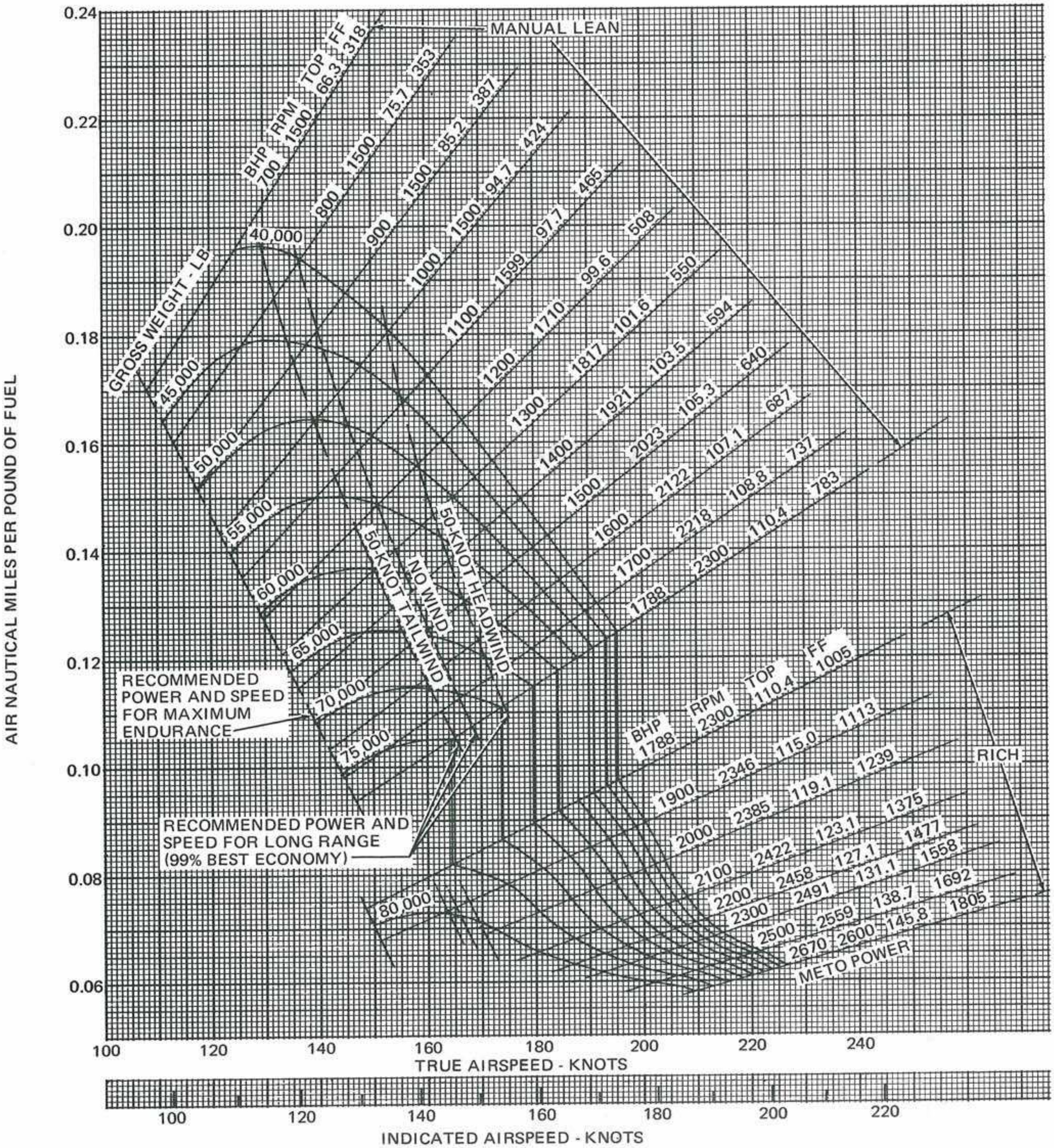


Figure A5-7

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

8000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971

DATA BASIS: FLIGHT TEST

FUEL GRADE: **115/145**

FUEL DENSITY: **6 LB/GAL**

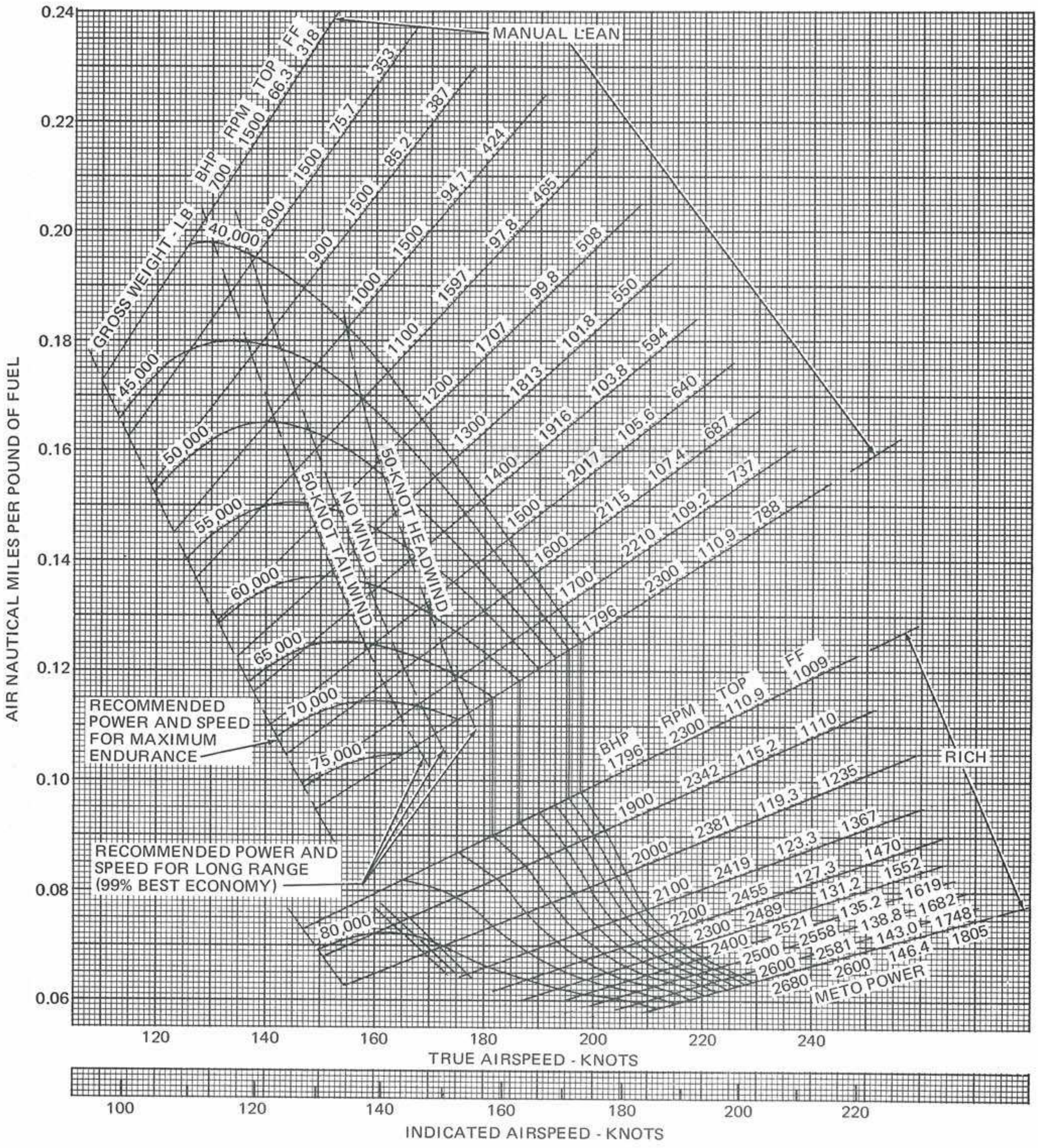


Figure A5-8

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

9000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION
LOW BLOWER

DATA AS OF: JANUARY 1971 — FUEL GRADE: 115/145
DATA BASIS: FLIGHT TEST — FUEL DENSITY: 6 LB/GAL

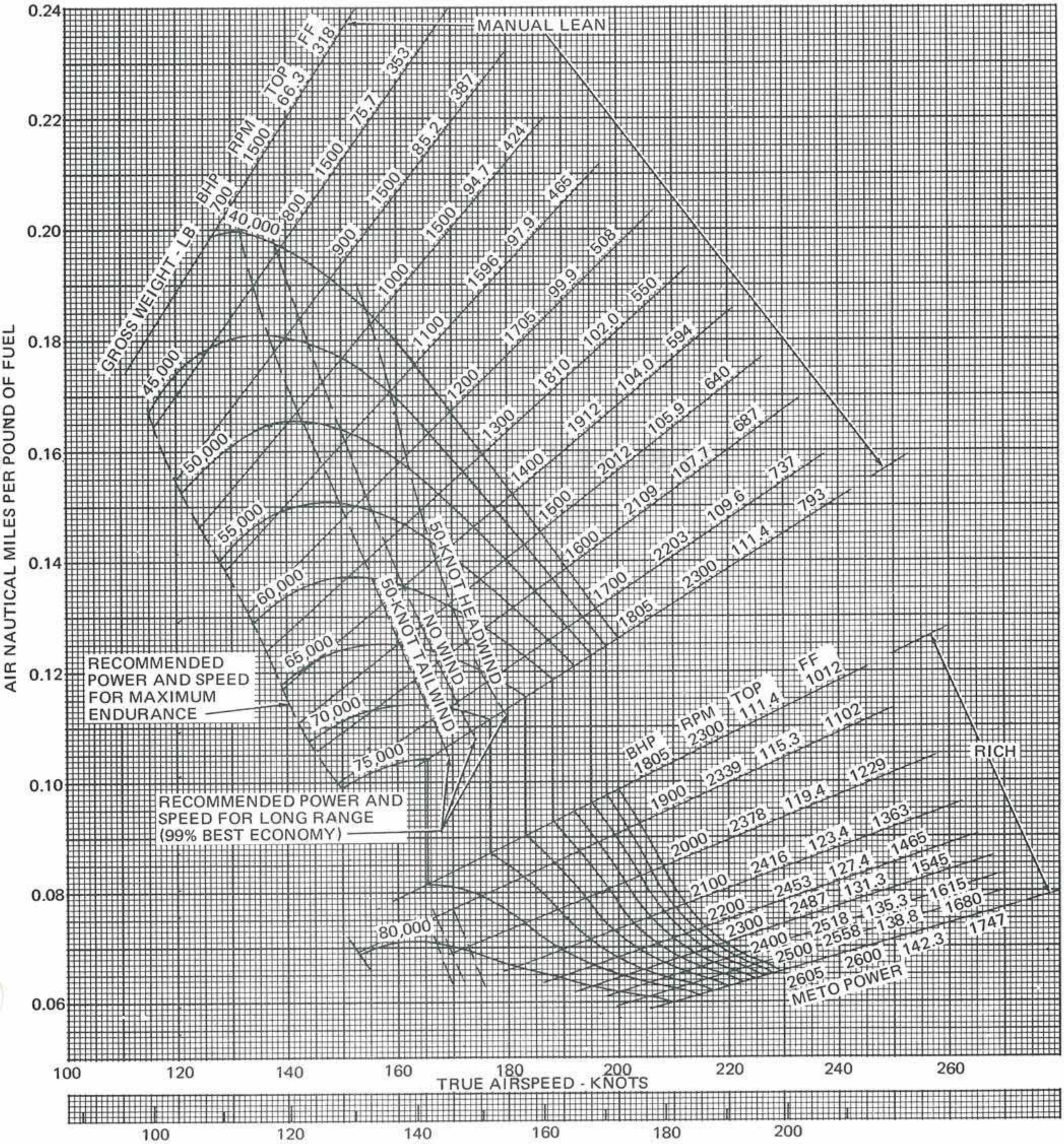


Figure A5-9

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

10,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

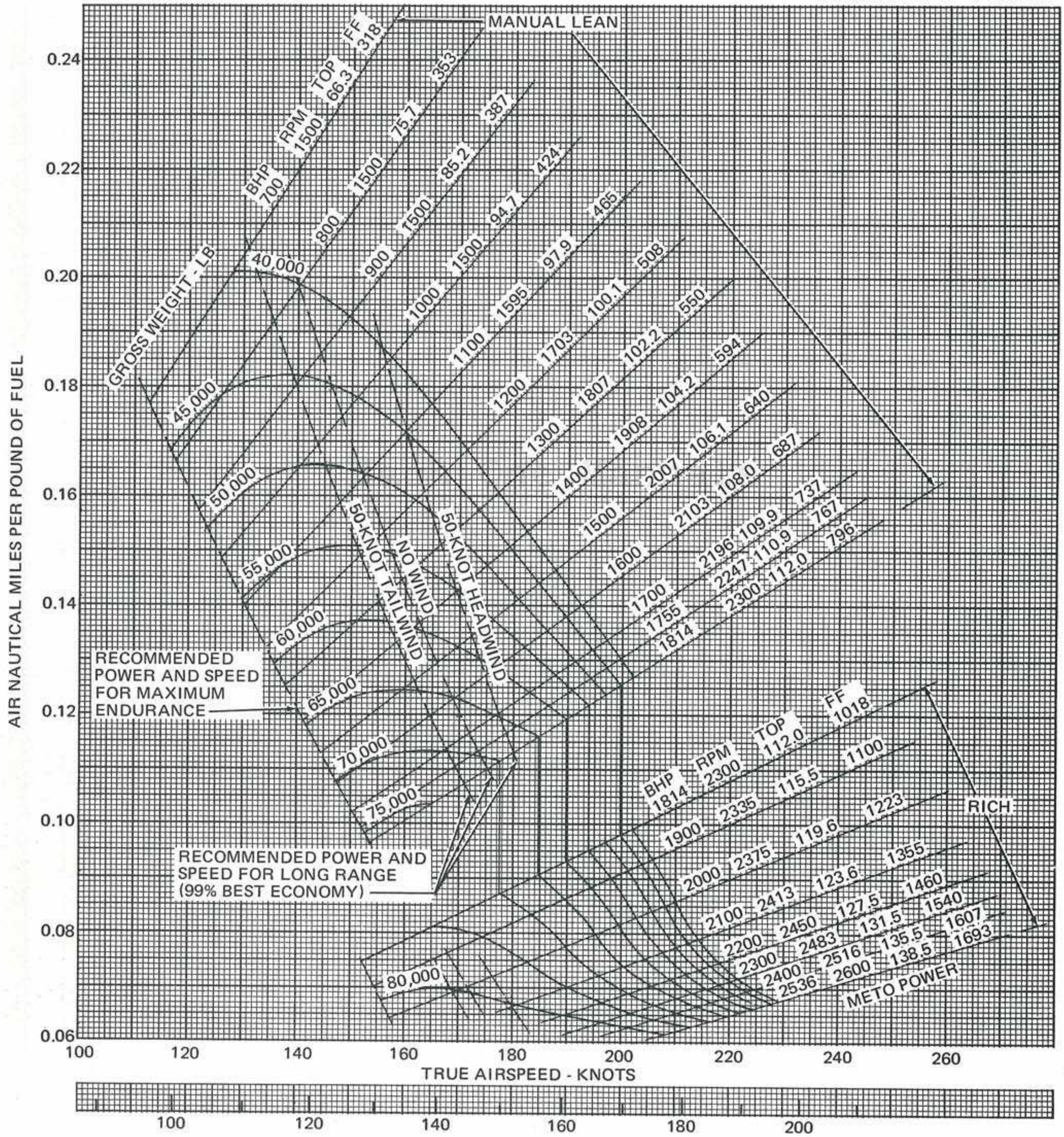


Figure A5-10

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

10,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

HIGH BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145
DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

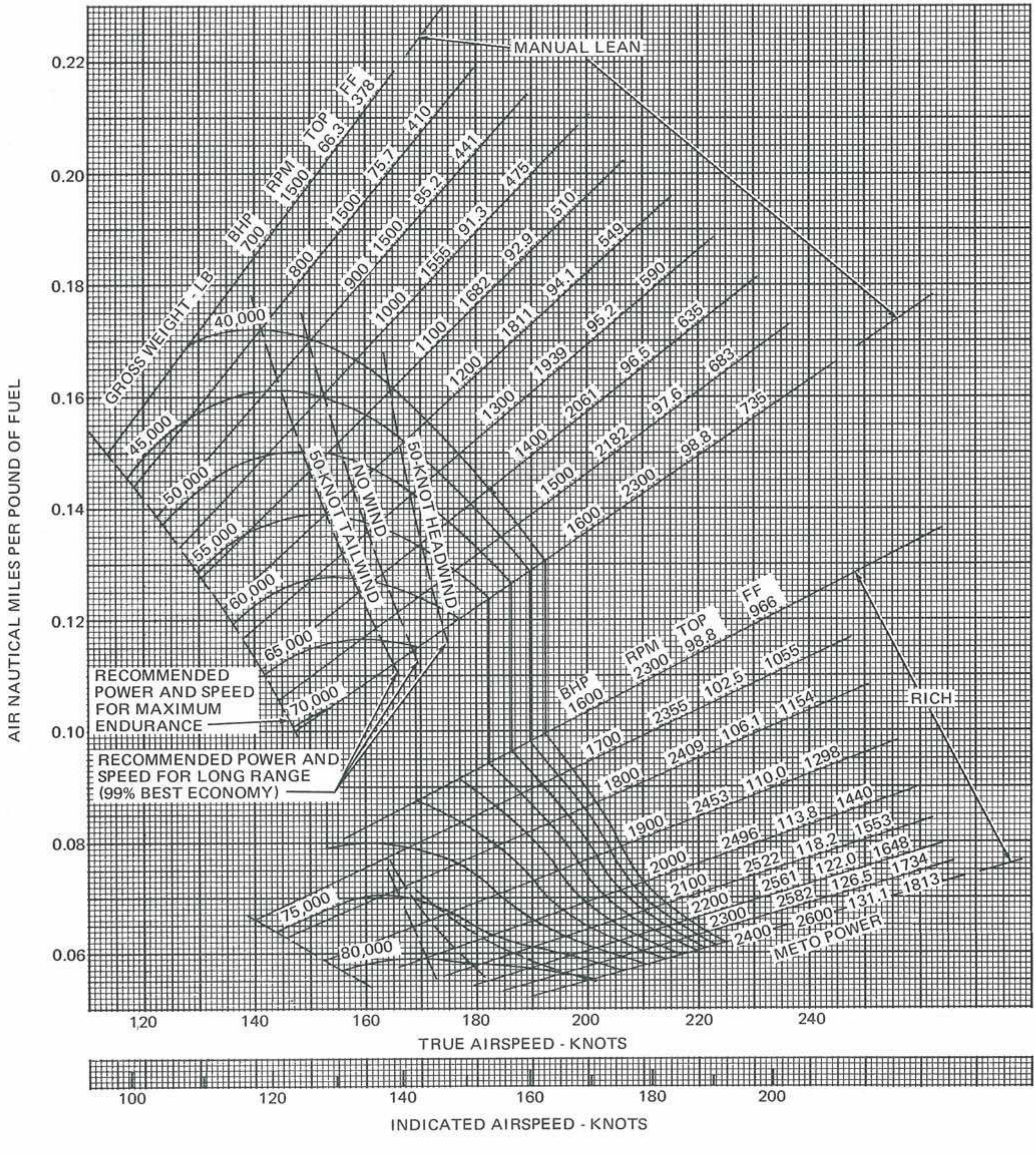


Figure A5-11

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

15,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

HIGH BLOWER

DATA AS OF: JANUARY 1971

DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145

FUEL DENSITY: 6 LB/GAL

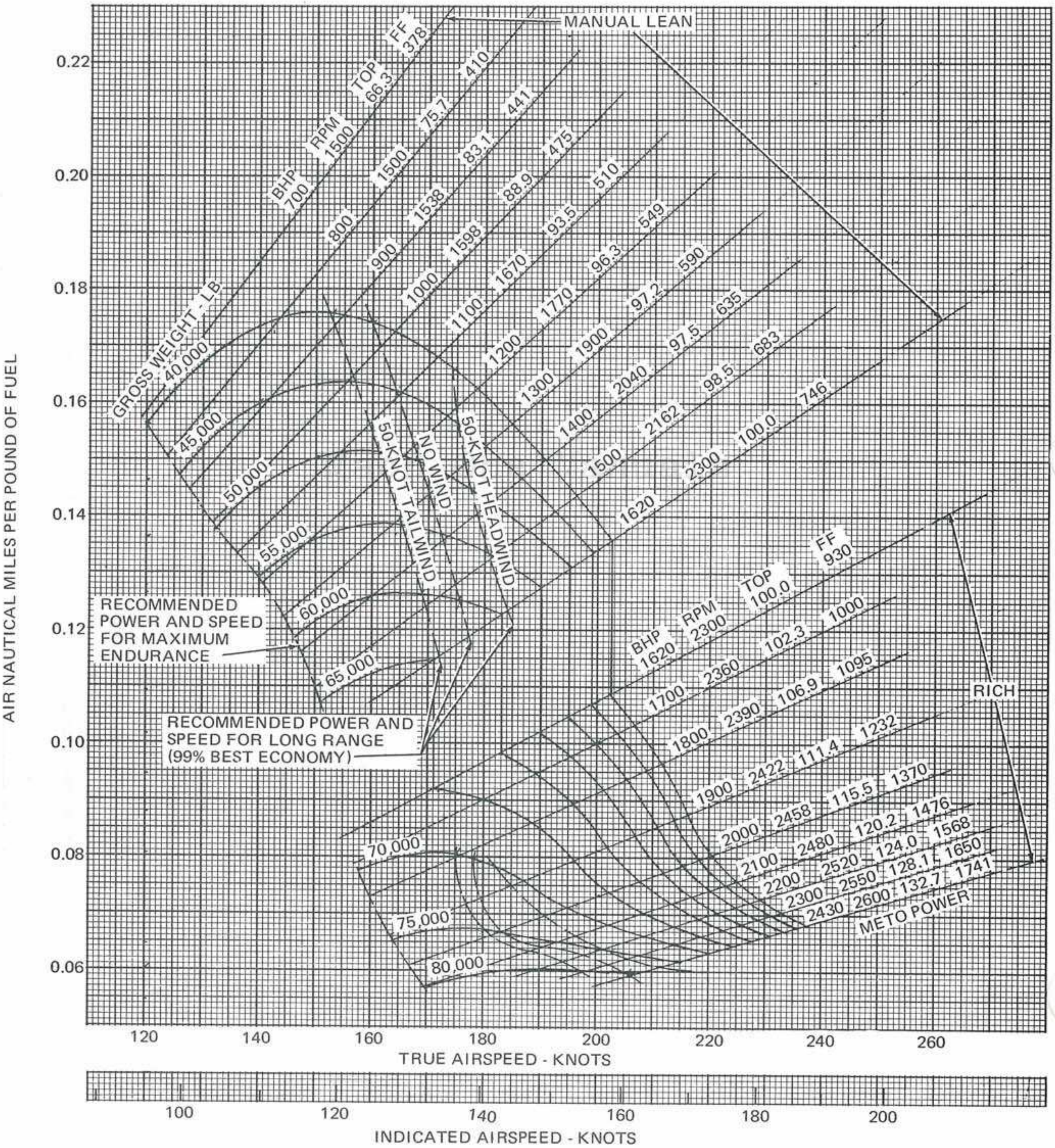


Figure A5-12

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

20,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

HIGH BLOWER

DATA AS OF: JANUARY 1971

DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145

FUEL DENSITY: 6 LB/GAL

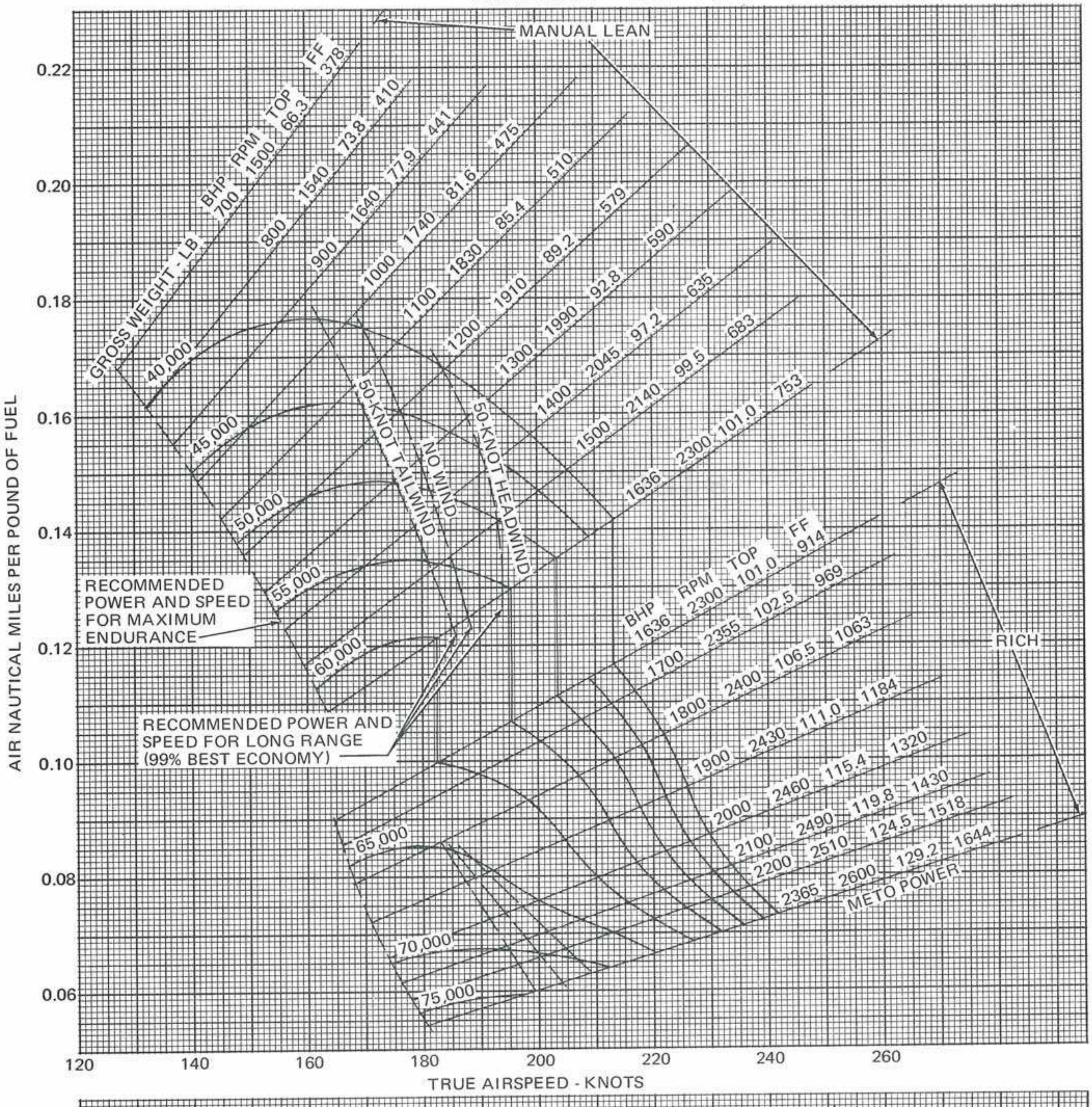


Figure A5-13

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engines — Power setting for long range (99% Best Economy)
4. Based on resetting power after each 2000-pound weight reduction.

MODEL: AC-119G
GUNSHIP CONFIGURATION

LONG RANGE PREDICTION—DISTANCE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

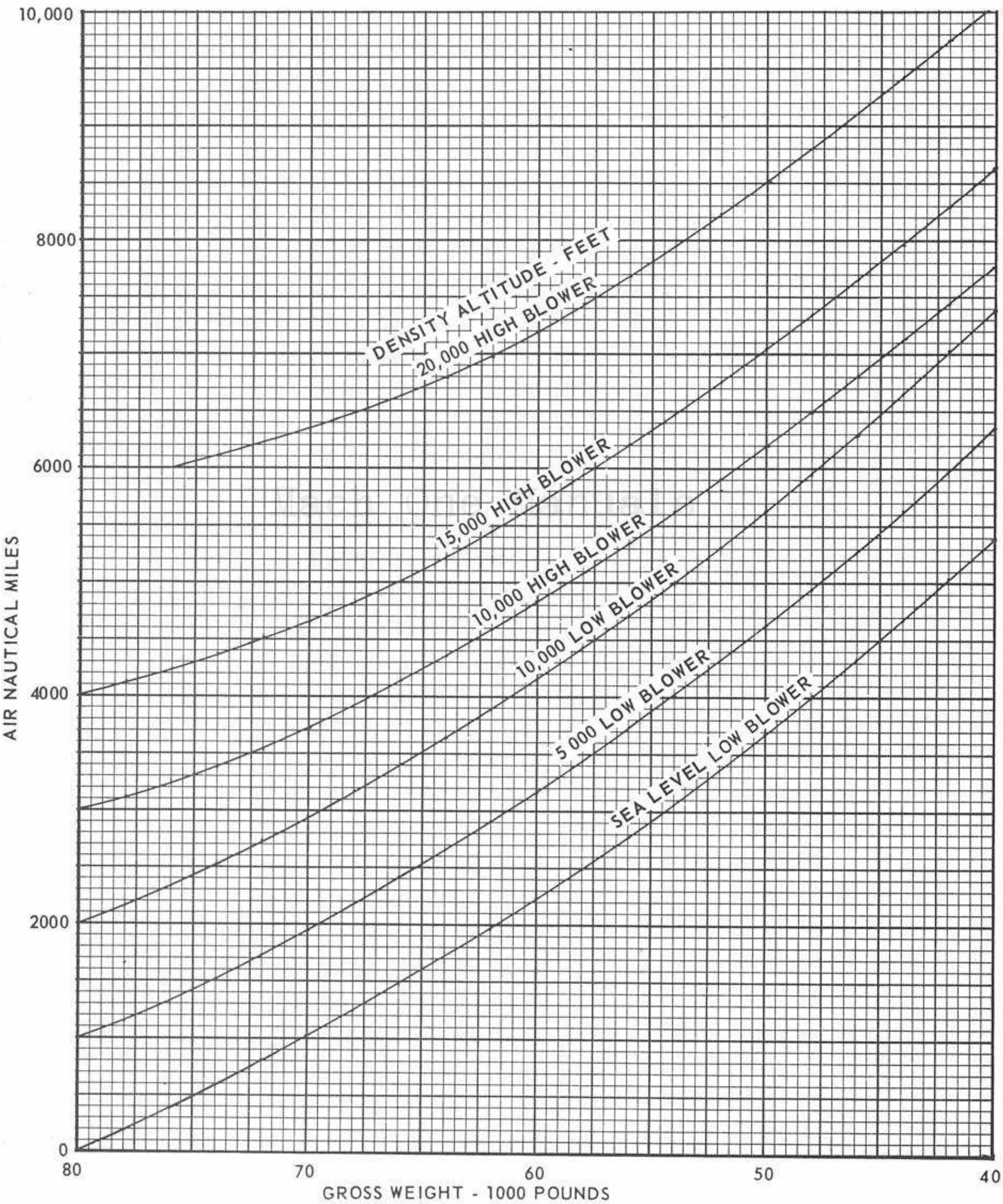


Figure A5-14

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engines — Power setting for long range (99% Best Economy)
4. Based on resetting power after each 2000-pound weight reduction.

MODEL: AC-119G
GUNSHIP CONFIGURATION

LONG RANGE PREDICTION — TIME

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

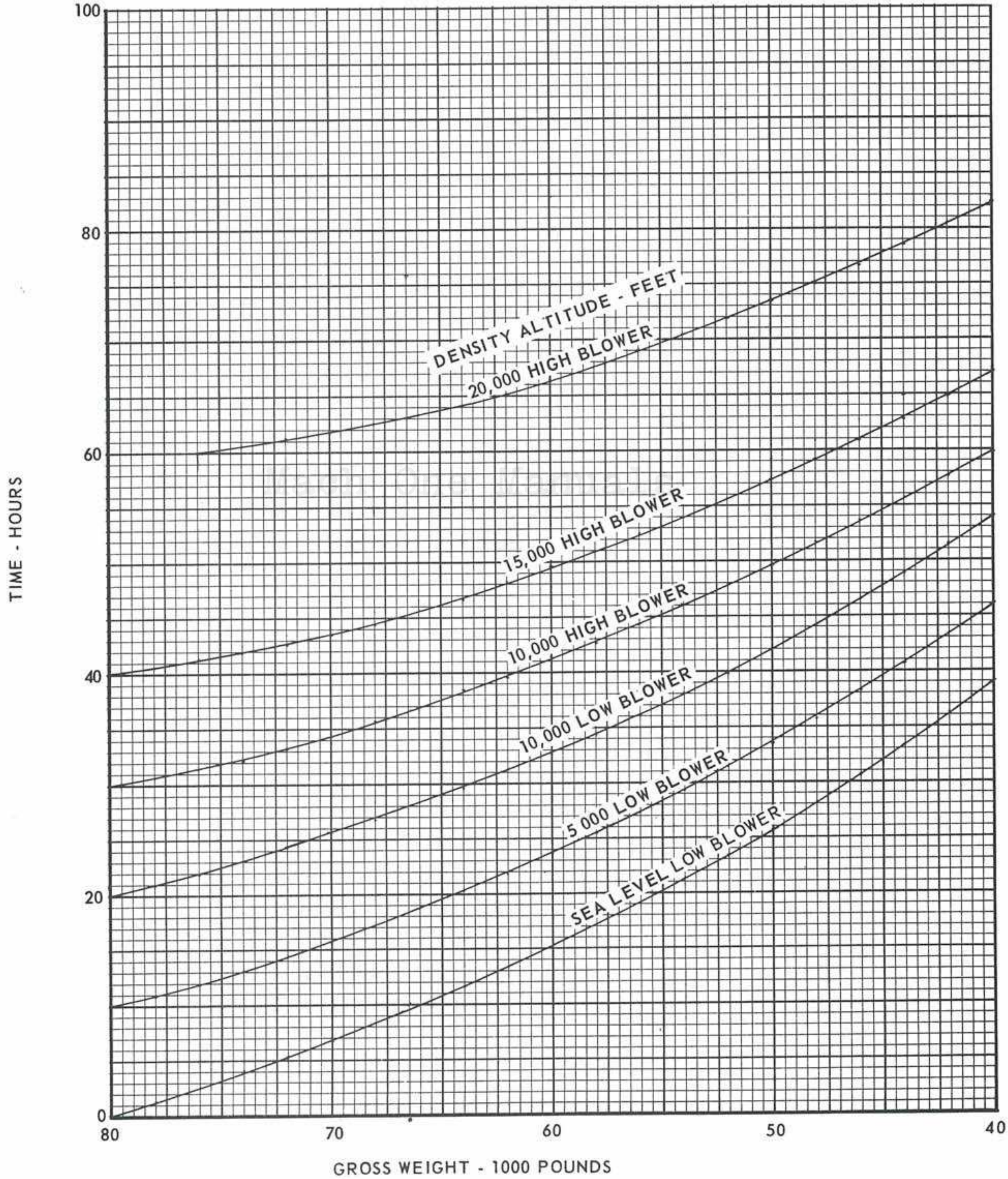


Figure A5-15

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

SEA LEVEL DENSITY ALTITUDE
ENGINE: R3350-89B (1)
SINGLE-ENGINE OPERATION
LOW BLOWER

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

DATA AS OF:	JANUARY 1971	FUEL GRADE:	115/145
DATA BASIS:	FLIGHT TEST	FUEL DENSITY:	6 LB/GAL

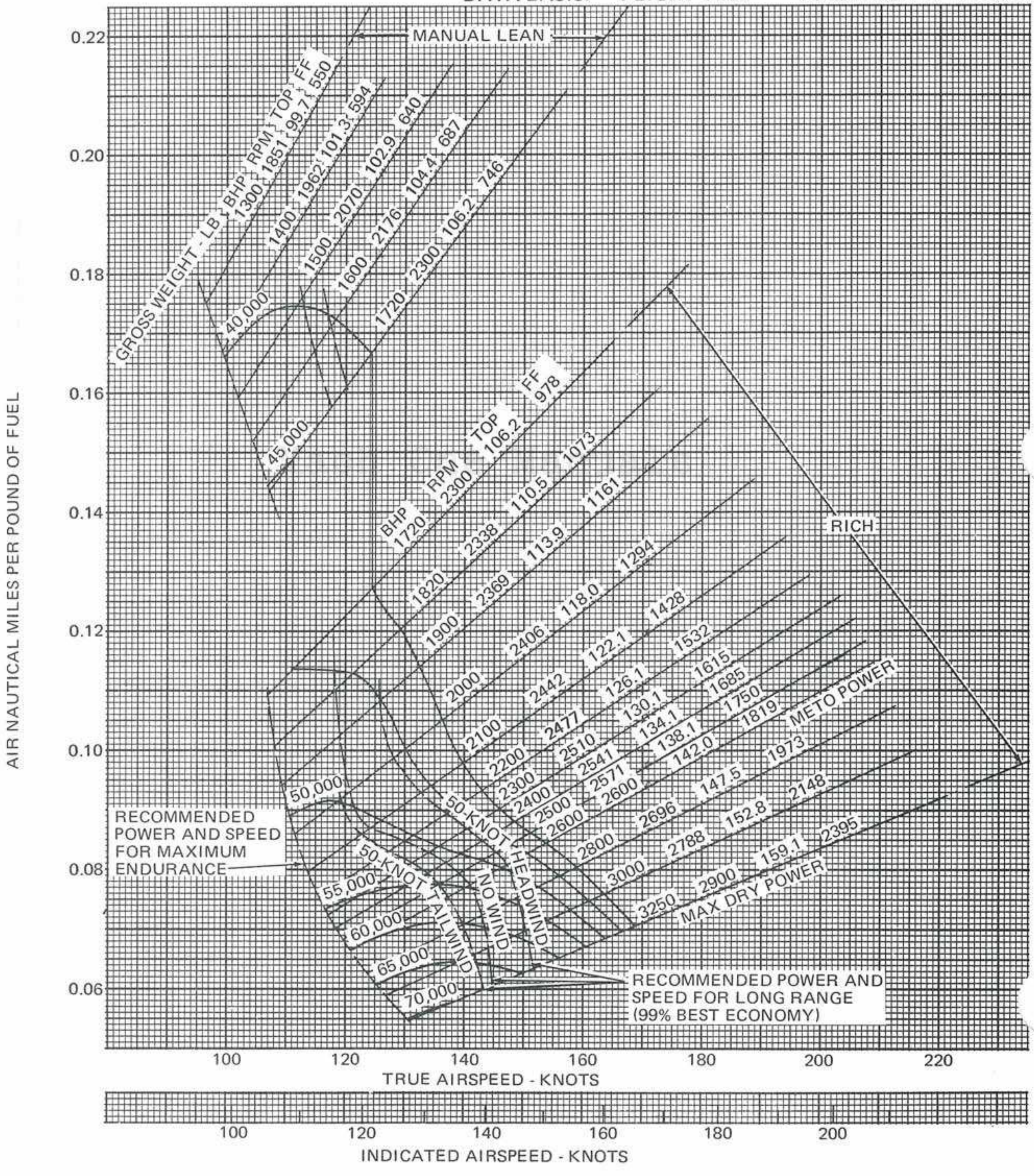


Figure A5-16

MODEL: AC-119G

GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

5000 FEET DENSITY ALTITUDE

ENGINE: R3350-89B(1)

SINGLE-ENGINE OPERATION

LOW BLOWER

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

DATA AS OF: JANUARY 1971 | FUEL GRADE: 115/145

DATA BASIS: **FLIGHT TEST** | FUEL DENSITY: 6 LB/GAL

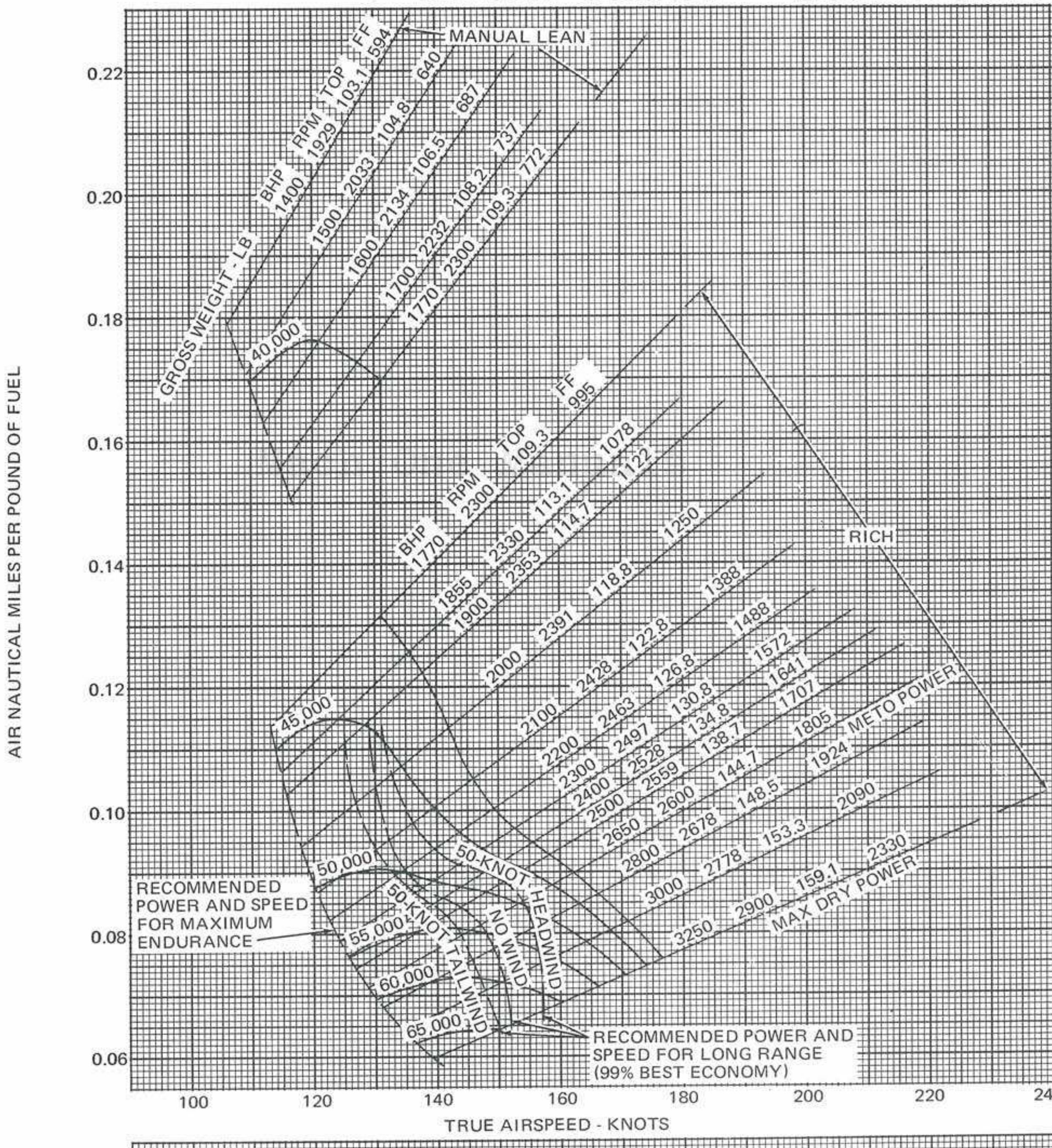


Figure A5-17

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
GUNSHIP CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

10,000 FEET DENSITY ALTITUDE

ENGINE: R3350-89B (1)

SINGLE-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 | FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST | FUEL DENSITY: 6 LB/GAL

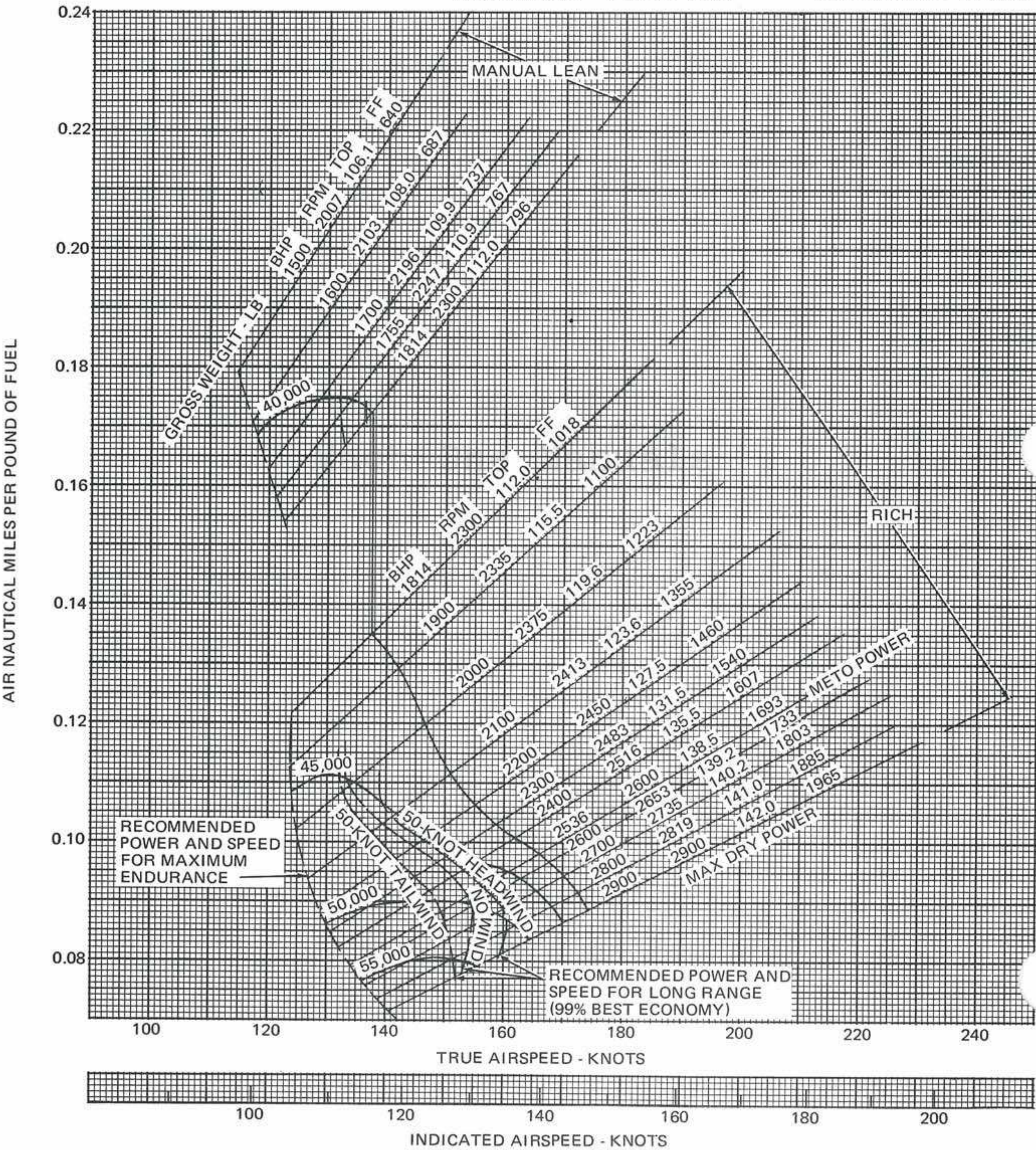


Figure A5-18

MODEL: AC-119G

GUNSHIP CONFIGURATION

LONG RANGE PREDICTION

ENGINE: R3350-89B (1)

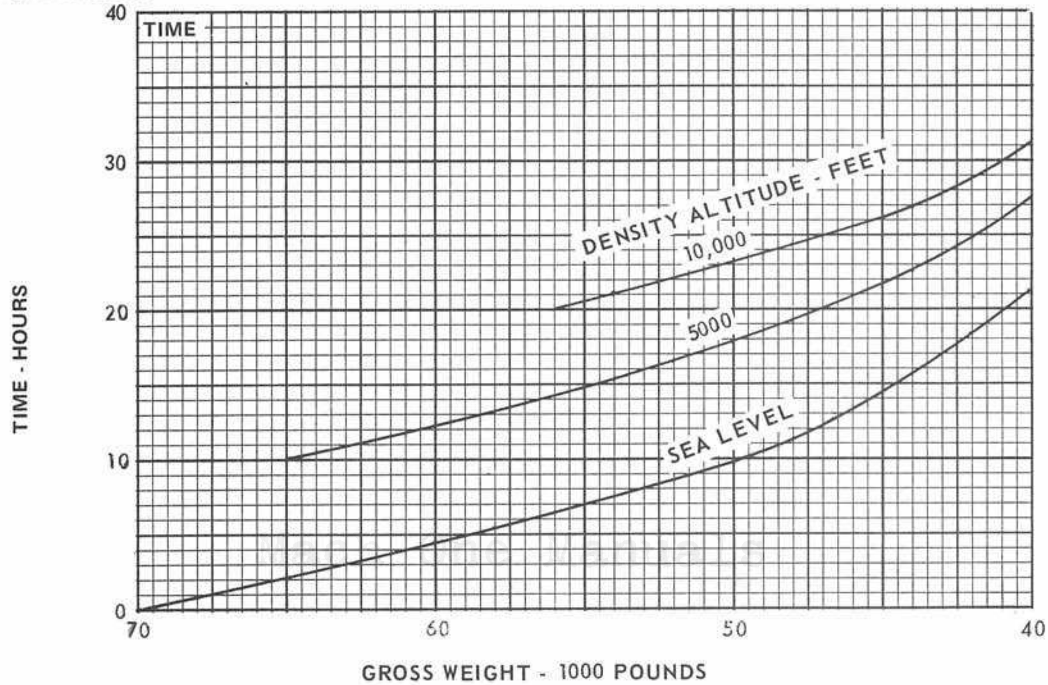
SINGLE-ENGINE OPERATION

LOW BLOWER

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engine — Power setting for long range (99% Best Economy).
4. Based on resetting power after each 2000-pound weight reduction.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST
FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL



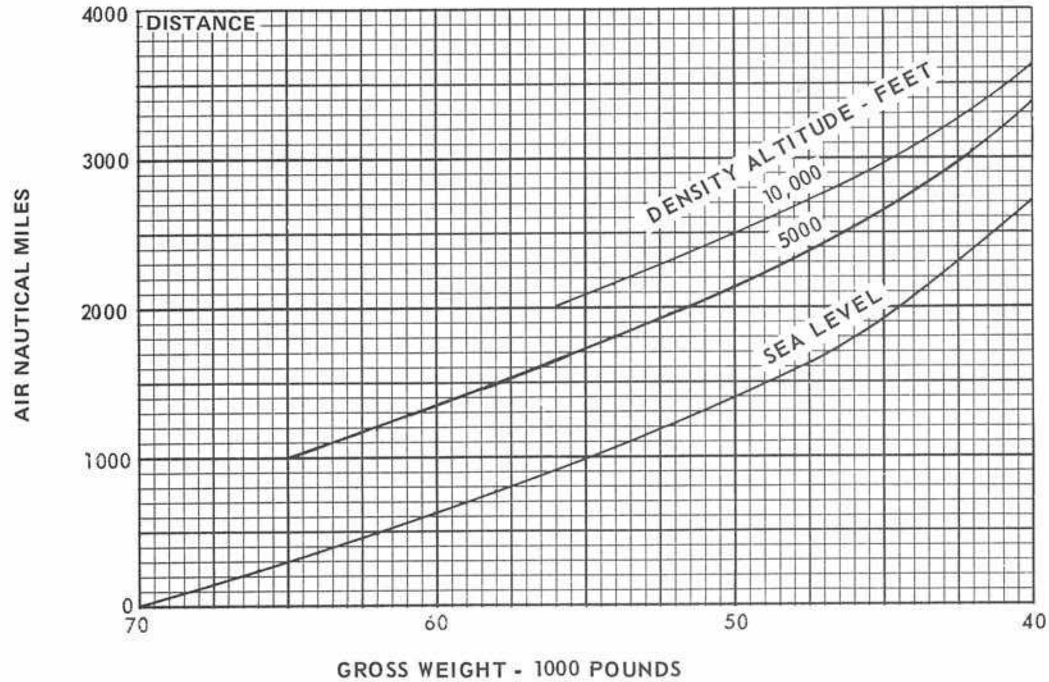


Figure A5-19

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

SEA LEVEL DENSITY ALTITUDE
ENGINES: R3350-89B (2)
TWO-ENGINE OPERATION
LOW BLOWER

DATA AS OF: JANUARY 1971 — FUEL GRADE: 115/145
DATA BASIS: FLIGHT TEST — FUEL DENSITY: 6 LB/GAL

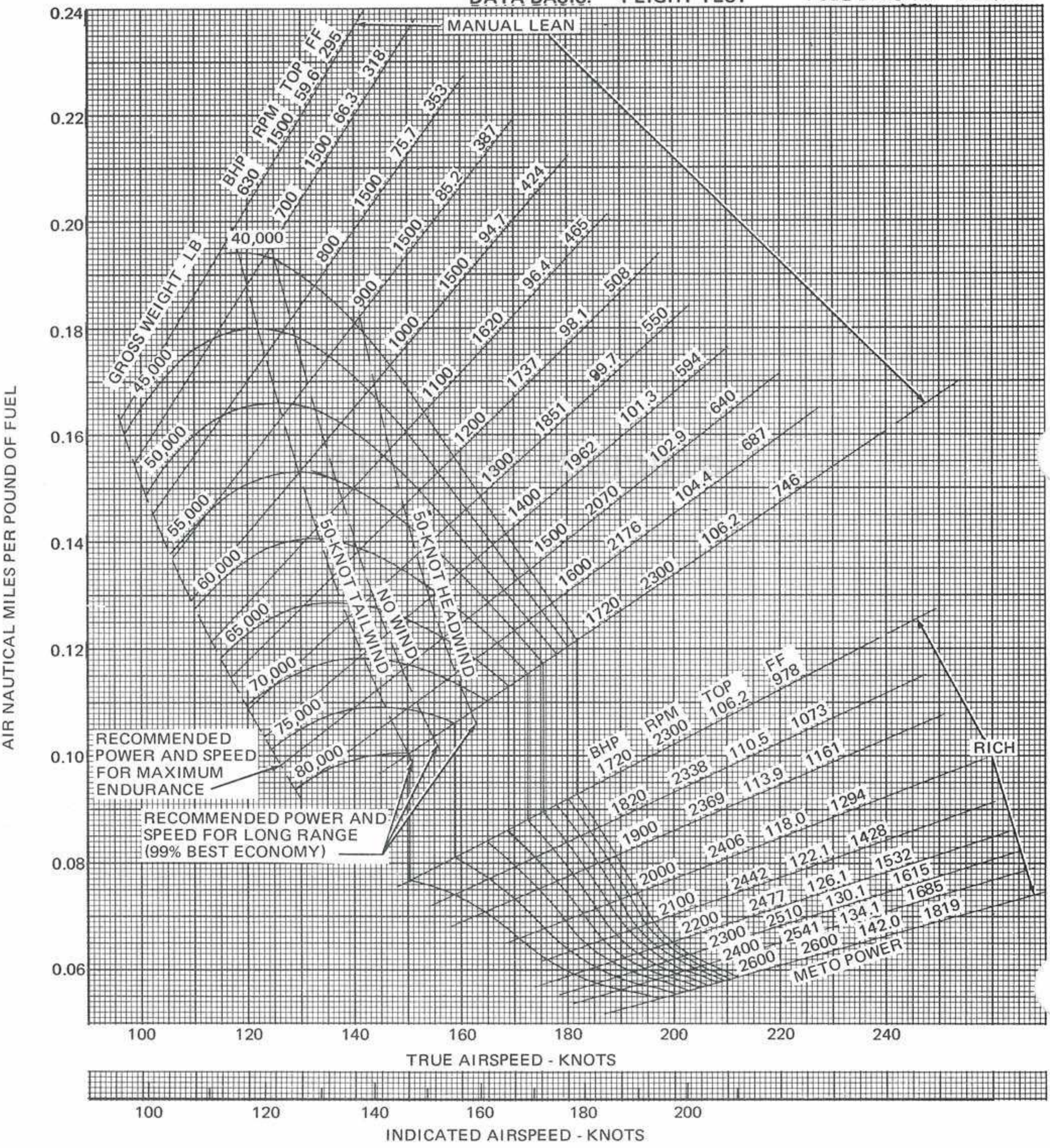


Figure A5-20

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

5000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

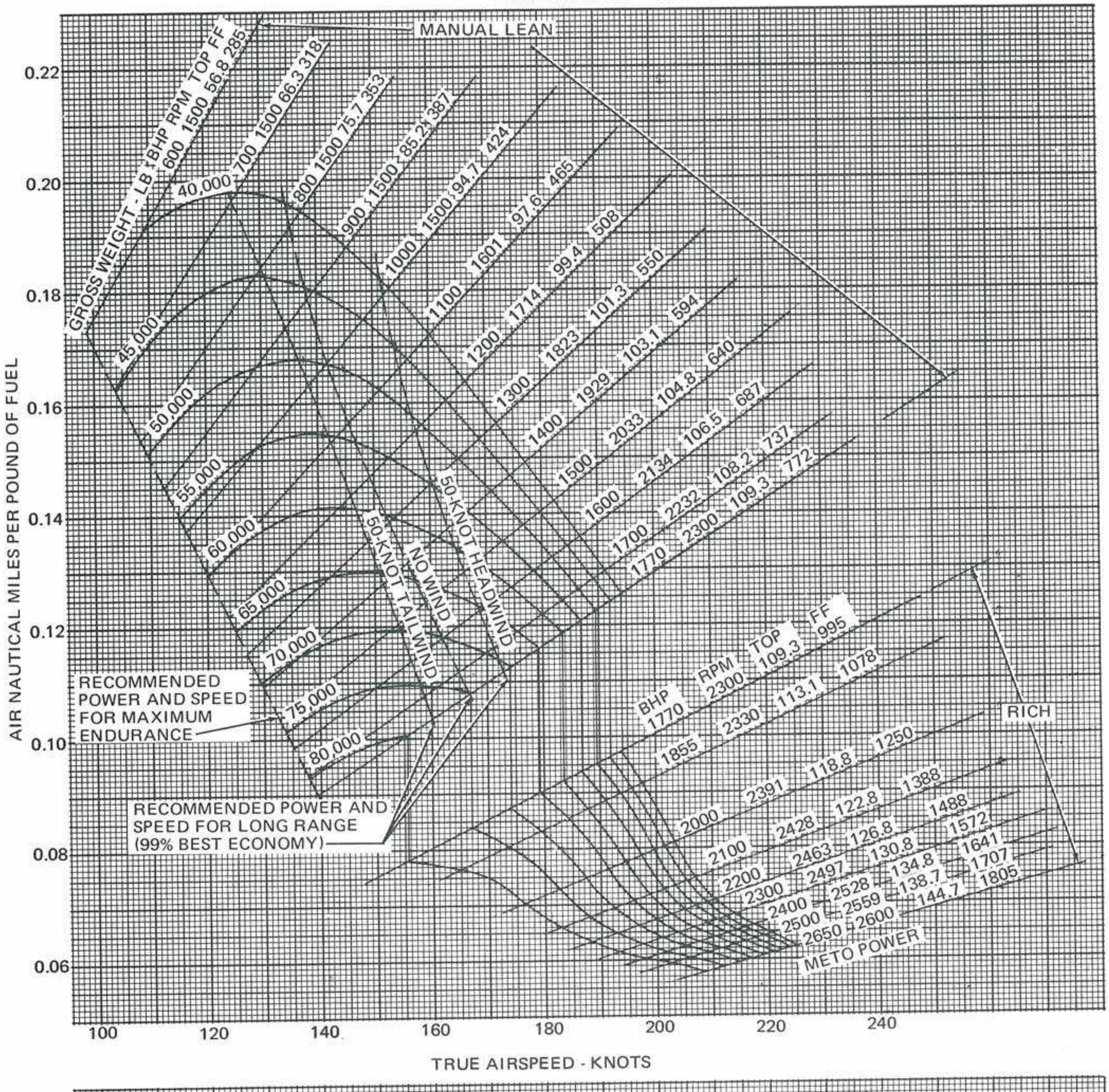


Figure A5-21

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

10,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 — FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST — FUEL DENSITY: 6 LB/GAL

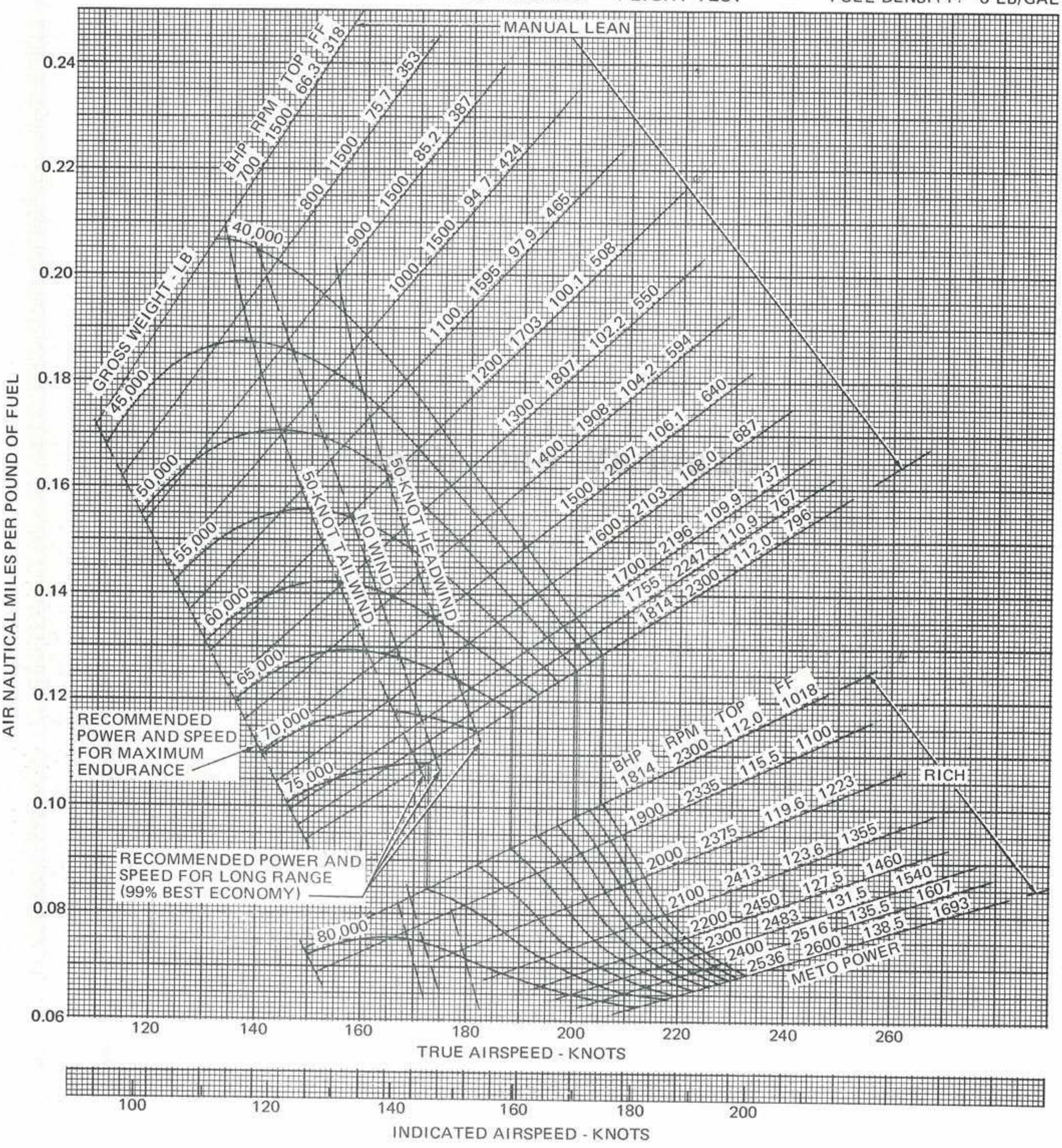


Figure A5-22

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

10,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

HIGH BLOWER

DATA AS OF:	JANUARY 1971	FUEL GRADE:	115/145
DATA BASIS:	FLIGHT TEST	FUEL DENSITY:	6 LB/GAL

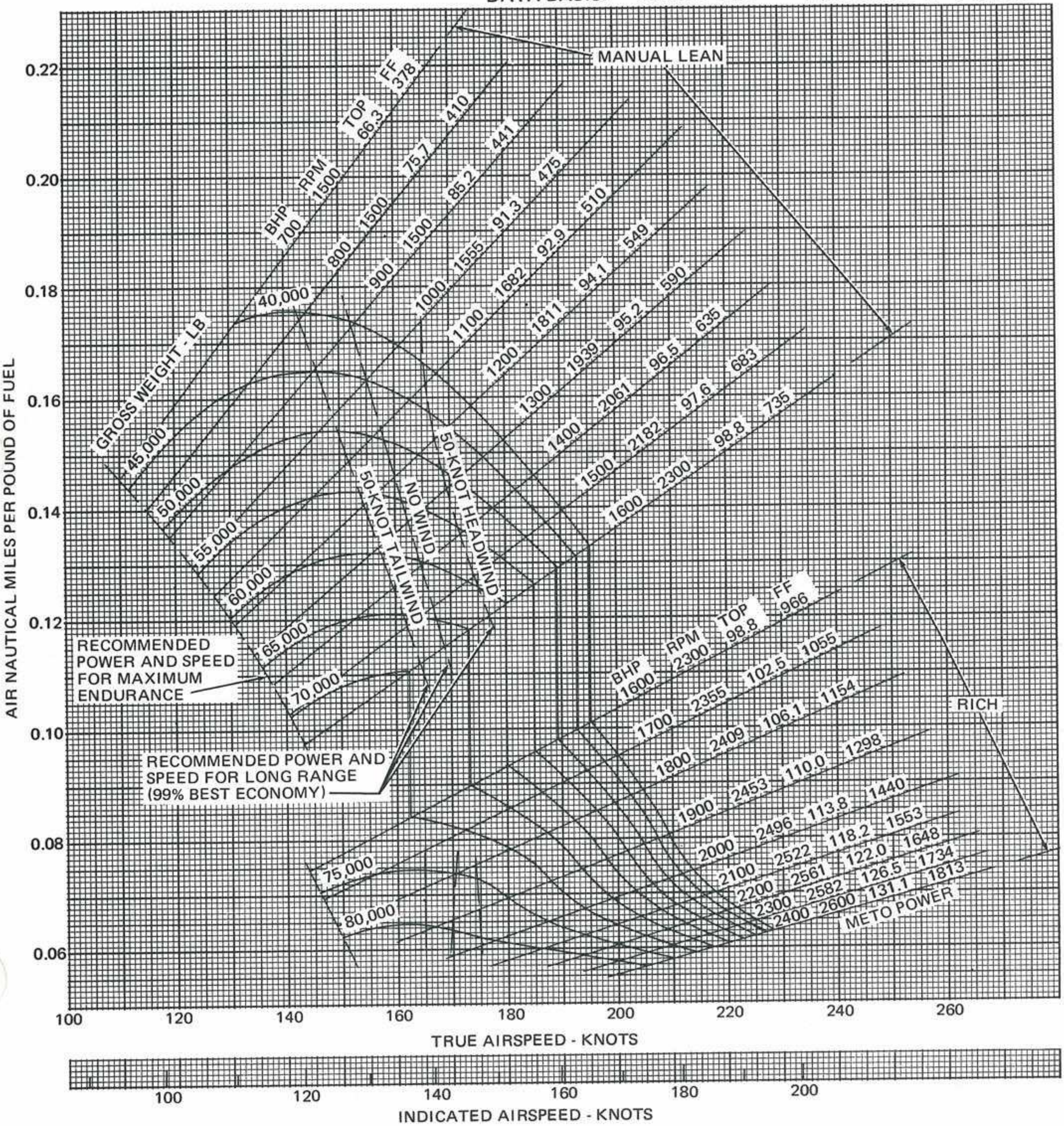


Figure A5-23

MODEL: AC-119G
FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

15,000 FEET DENSITY ALTITUDE

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION
HIGH BLOWER

CONDITIONS:

1. **Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.**
2. **Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.**
3. **Fuel flow values are based on flight test. Values designated as FF are for one engine.**

DATA AS OF: JANUARY 1971 FUEL GRADE: 115/145
DATA BASIS: FLIGHT TEST FUEL DENSITY: 6 LB/GAL

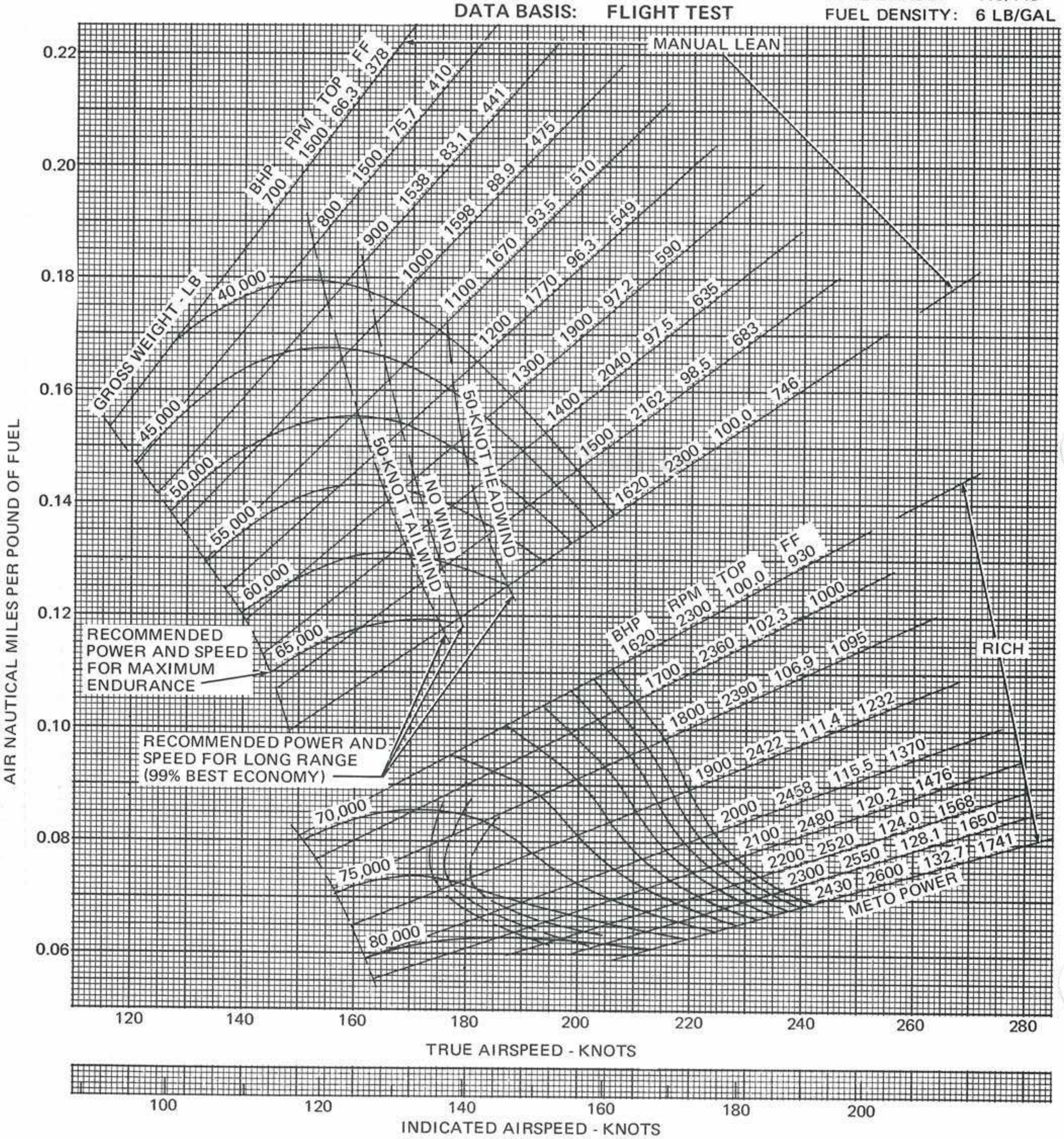


Figure A5-24

MODEL: AC-119G
FERRY CONFIGURATION

LONG RANGE PREDICTION–DISTANCE

ENGINES: R3350-89B (2)
TWO-ENGINE OPERATION

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engines – Power setting for long range (99% Best Economy).
4. Based on resetting power after each 2000-pound weight reduction.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

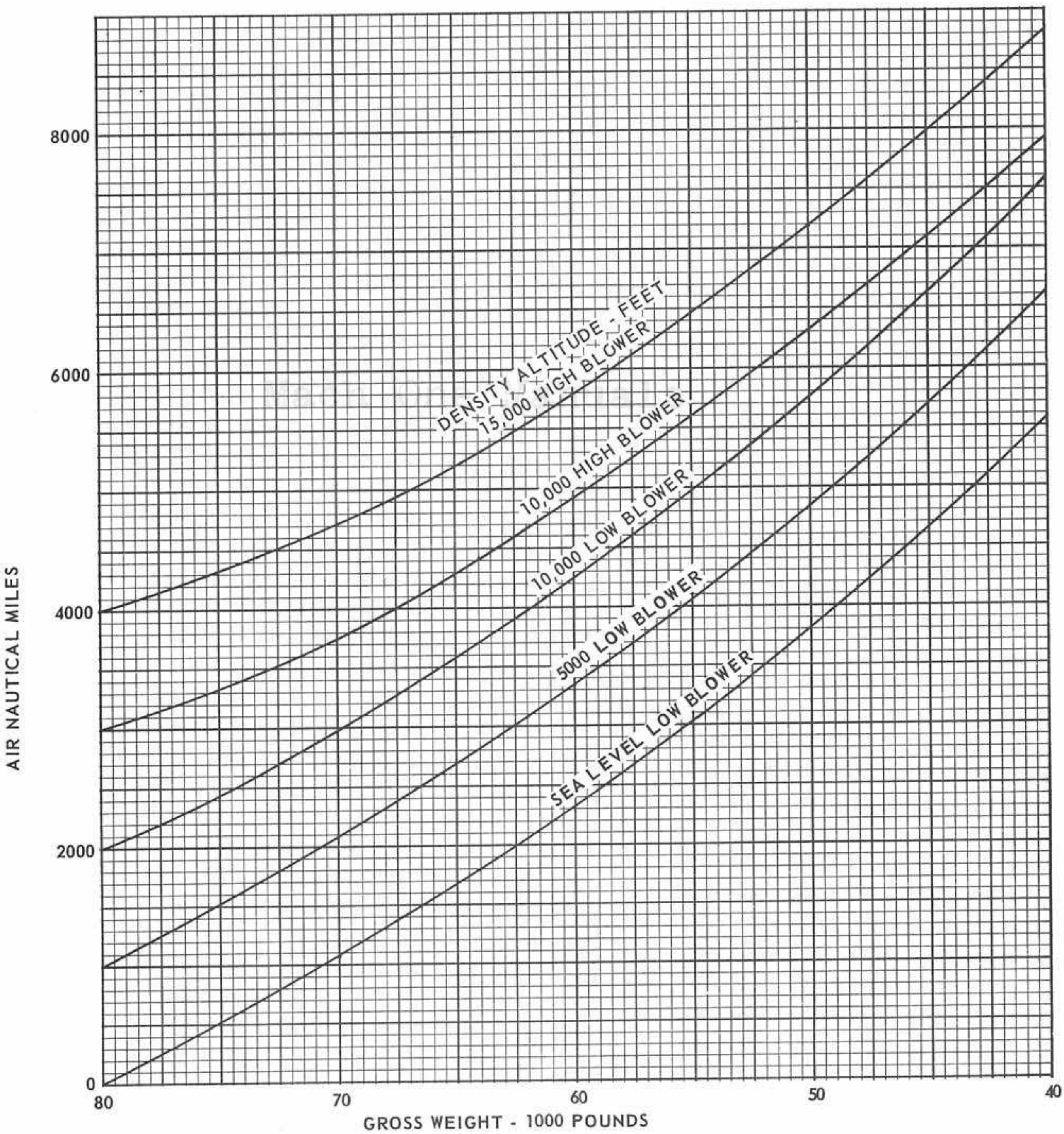


Figure A5-25

MODEL: AC-119G

FERRY CONFIGURATION

LONG RANGE PREDICTION — TIME

ENGINES: R3350-89B (2)

TWO-ENGINE OPERATION

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engines — Power setting for long range (99% Best Economy).
4. Based on resetting power after each 2000-pound weight reduction.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

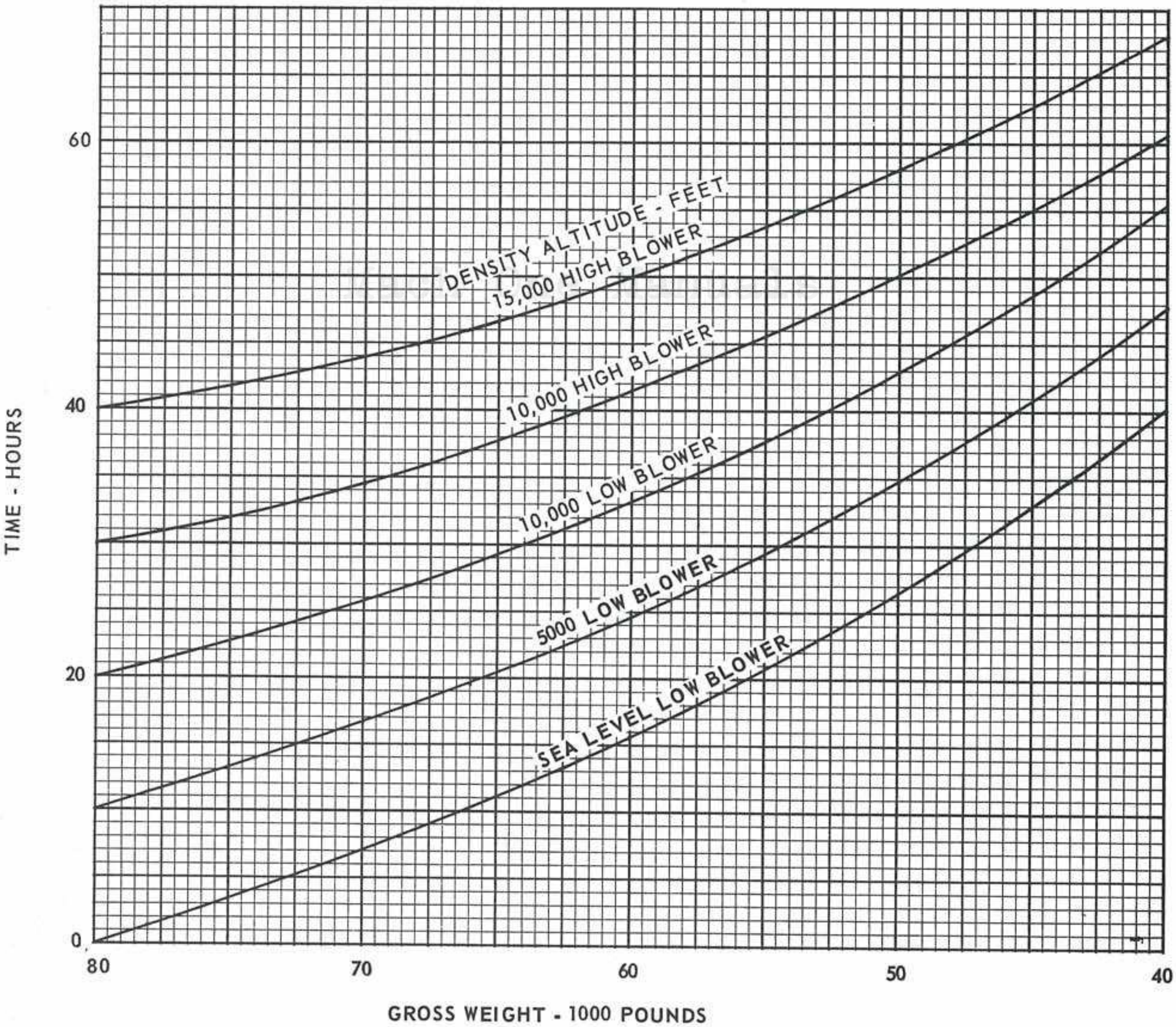


Figure A5-26

MODEL: AC-119G
FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

SEA LEVEL DENSITY ALTITUDE

ENGINE: R3350-89B(1)

SINGLE-ENGINE OPERATION
LOW BLOWER

CONDITIONS:

1. **Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.**
2. **Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.**
3. **Fuel flow values are based on flight test. Values designated as FF are for one engine.**

DATA AS OF:	JANUARY 1971	FUEL GRADE:	115/145
DATA BASIS:	**FLIGHT TEST**	FUEL DENSITY:	6 LB/GAL

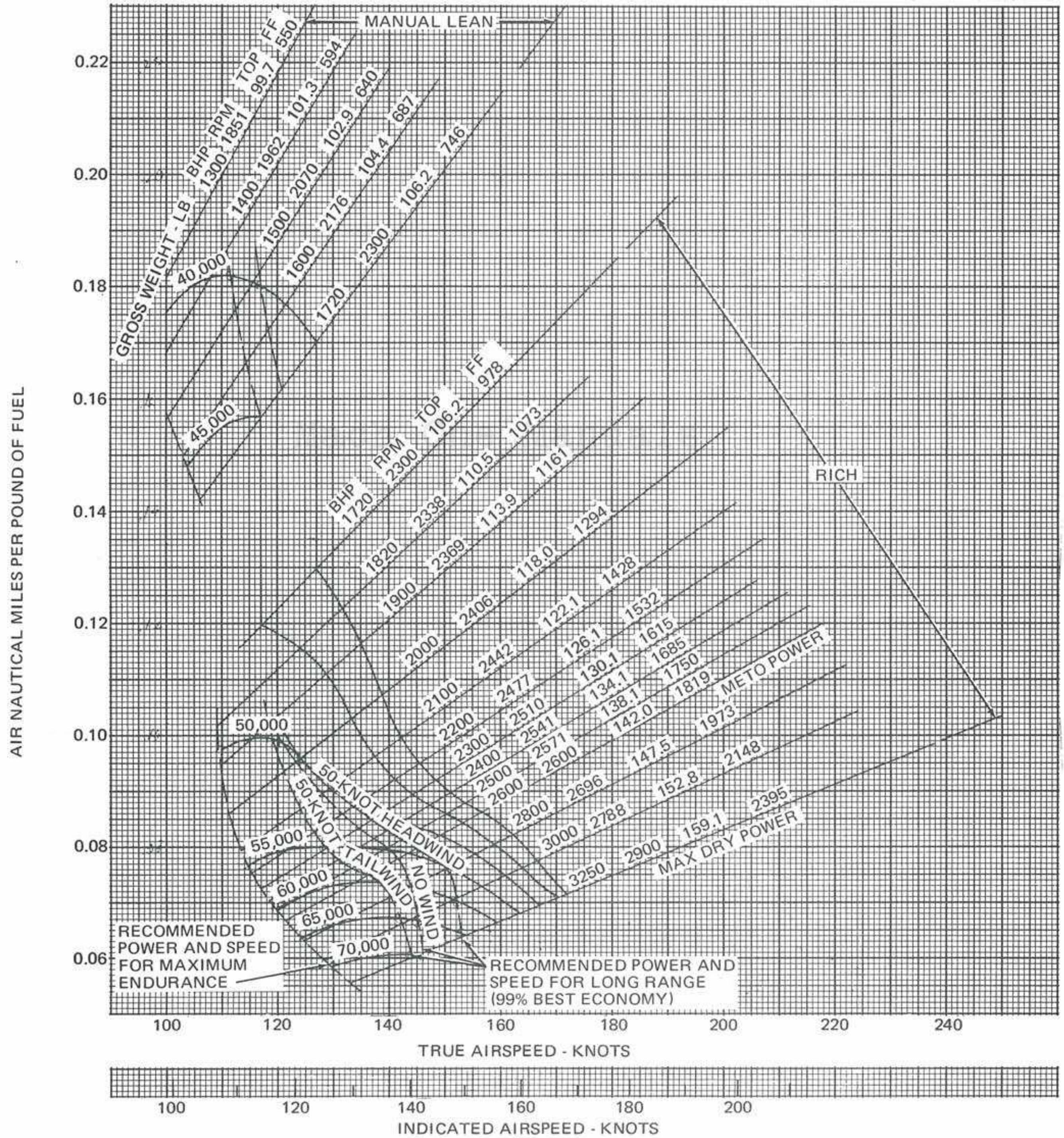


Figure A5-27

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G

FERRY CONFIGURATION

AIR NAUTICAL MILES PER POUND OF FUEL

5000 FEET DENSITY ALTITUDE

ENGINE: R3350-89B (1)

SINGLE-ENGINE OPERATION

LOW BLOWER

DATA AS OF: JANUARY 1971 — FUEL GRADE: 115/145

DATA BASIS: FLIGHT TEST — FUEL DENSITY: 6 LB/GAL

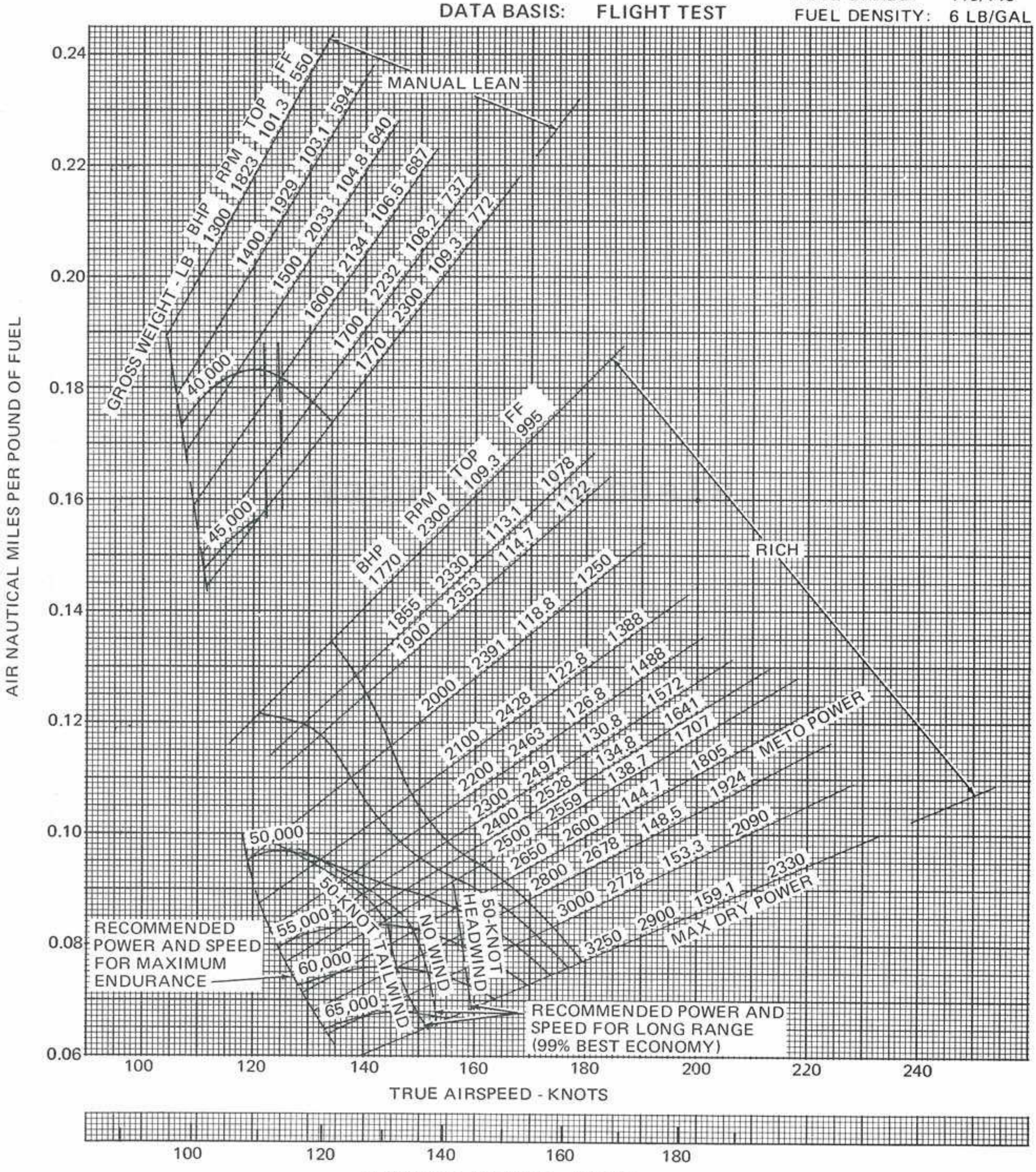


Figure A5-28

CONDITIONS:

1. Power settings are based on standard atmospheric conditions. If TOP is not available at specified rpm because of non-standard conditions, consult Power Schedule and Fuel Flow curves for alternate combination of rpm and TOP to set the required BHP.
2. Ground N. Mi/Lb = Air N. Mi/Lb x GS/TAS.
3. Fuel flow values are based on flight test. Values designated as FF are for one engine.

MODEL: AC-119G
FERRY CONFIGURATION
AIR NAUTICAL MILES PER POUND OF FUEL
10,000 FEET DENSITY ALTITUDE
ENGINE: R3350-89B (1)
SINGLE-ENGINE OPERATION
LOW BLOWER

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST
FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL

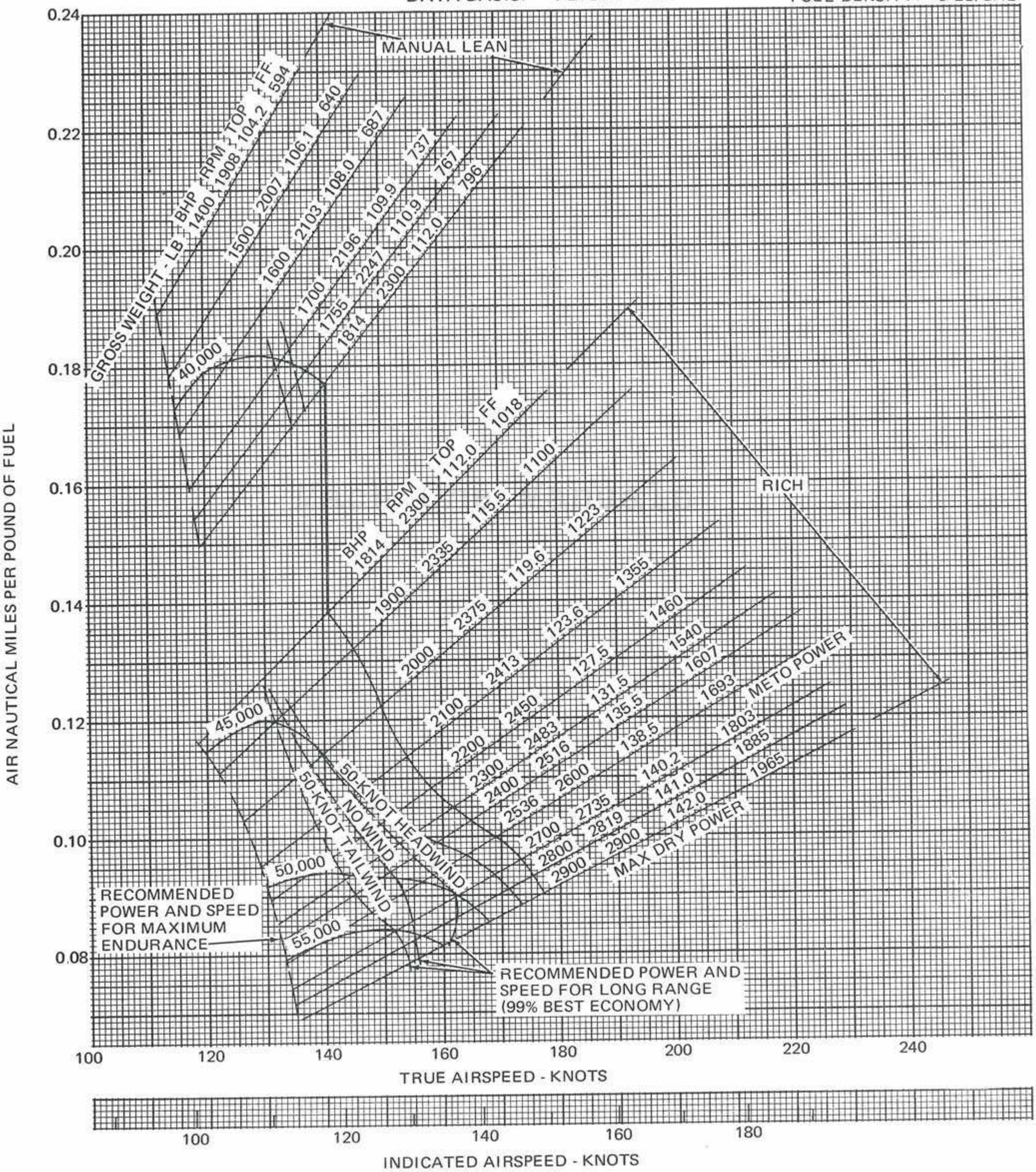


Figure A5-29

MODEL: AC-119G
FERRY CONFIGURATION

LONG RANGE PREDICTION

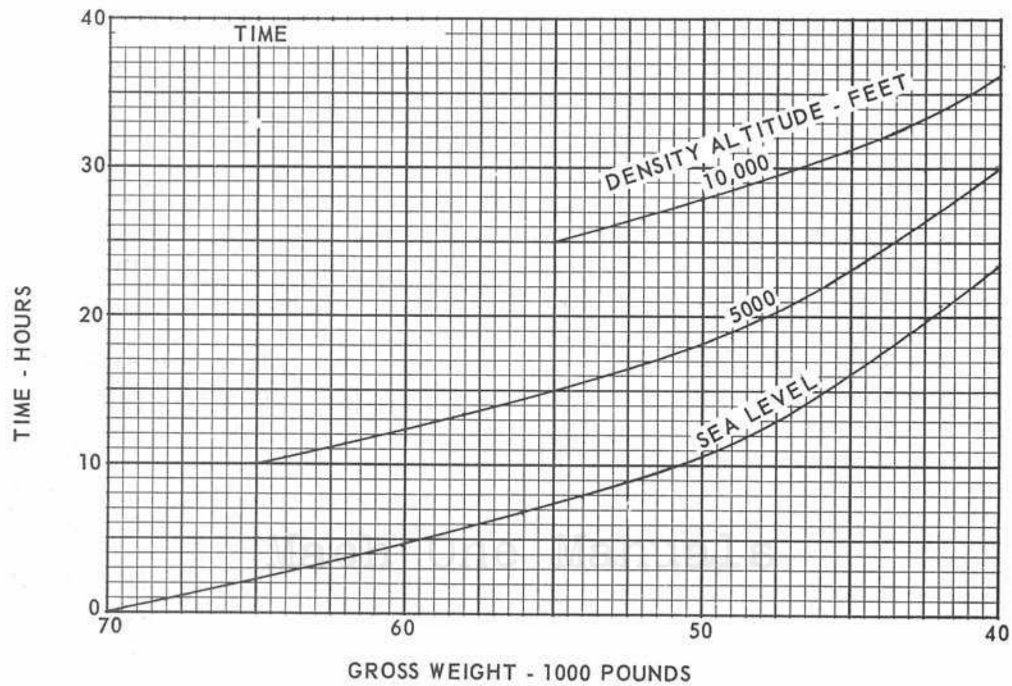
ENGINE: R3350-89B (1)
SINGLE – ENGINE OPERATION
LOW BLOWER

CONDITIONS:

1. Landing gear and flaps up.
2. Standard atmospheric conditions.
3. R3350-89B engine – Power setting for long range (99% Best Economy).
4. Based on resetting power after each 2000-pound weight reduction.

DATA AS OF: JANUARY 1971
DATA BASIS: FLIGHT TEST

FUEL GRADE: 115/145
FUEL DENSITY: 6 LB/GAL



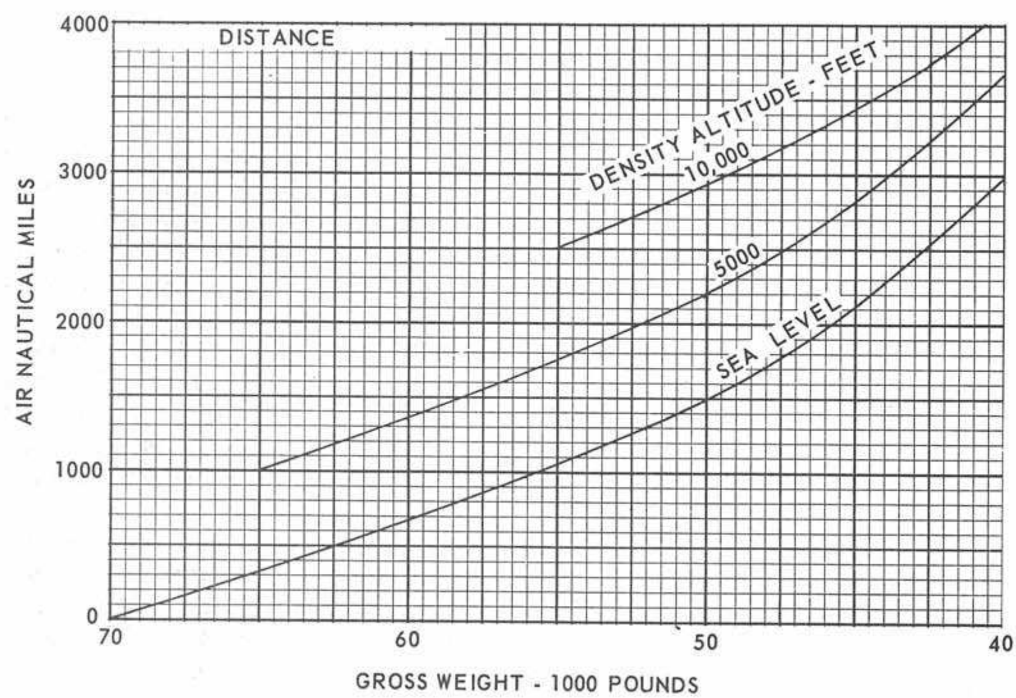


Figure A5-30

LANDING DATA

part 6

table of contents

LANDING DATA.

Except for the following all information is contained in T.O. 1C-119G-1.

LANDING DISTANCE CURVES.

The Landing Distance curves indicate the expected level ground run on a dry, hard-surface runway under various conditions of aircraft configuration, available means of deceleration, density altitude, gross weight, headwind, and obstacle clearance. Separate curves are provided for every combination of the first two of these factors. The aircraft configuration will be established well in advance of landing; however, for any given condition of aircraft configuration, the curve for brakes only as well as for brakes and reverse thrust should be kept under consideration, since loss of reverse thrust due to engine failure is not a predictable situation. The reliability of density altitude figures should be evaluated on the basis of whether the temperature and pressure readings are known to be taken at the runway, since temperature and, consequently, density altitude are often considerably higher at the runway than in surrounding areas. If headwind correction is to be used, the information should be obtained as shortly before landing as practicable and conservative values employed to compensate for the gusty and erratic nature of wind. Each curve includes a table of stall speed (V_s), approach speed (V_{app}), touchdown speed (V_{td}), and obstacle clearance speed (V_{50}) given in IAS for gross weights between 40,000 and 80,000 pounds at 2000-pound intervals.

Effect Of Runway Surface Condition.

Since the Landing Distance charts are based on the use of a dry, hard-surface runway, the ground run portion of the landing distance may be expected to increase considerably when a slippery runway is encountered, due to less effective braking action. Figure A6-8, Variation Of Landing Ground Run With Runway Condition Reading, provides a means of correcting the landing ground run to the existing runway surface conditions. Runway Condition Reading (RCR), as obtained from the weather forecast, may be applied directly to this chart. Should no RCR be available, the following typical readings may be used as a guide to determine an approximate runway condition reading.

RUNWAY SURFACE	RCR
Dry (ICAO Good)	23
Wet (ICAO Medium)	12
Icy (ICAO Poor)	05

Effect Of Runway Gradient.

When the landing runway is not level, the ground run distance should be increased (downhill) or decreased (uphill) in accordance with the runway gradient (slope). This correction is applied graphically using figure A6-9, Variation Of Landing Ground Run With Runway Gradient. Since all of the other variables affecting landing performance are already included in the level ground run distance, the slope correction graph is valid for any landing configuration.

Use Of the Curves.

With aircraft configuration and runway condition known, the two appropriate landing distances curves, one for brakes and reverse thrust and one for brakes only, may be selected. From known or assumed temperature and pressure altitude at the runway, a density altitude value may be taken from the Density Altitude curve. Enter the appropriate Landing Distance curve at the required density altitude value along the left-hand edge, and proceed horizontally to the point of intersection with the landing gross weight line. The gross weight values are shown at 5000-pound intervals; intermediate gross weights may be interpolated. By dropping vertically from the point of intersection, the level ground run distance (no wind) may be read from the scale at the bottom of the curve. If a wind correction is required, continue reading downward, following the wind guide lines to the horizontal line representing the existing wind. Again a visual interpolation will probably be necessary. From this point, drop vertically downward and read level ground run distance (with wind). If an obstacle is to be cleared on approach, the total landing distance required, including the distance from the obstacle to the touchdown point is presented in terms of percentage of ground run. This value is found by reading across horizontally to the right on the appropriate wind line until the proper gross weight line is intersected, then vertically downward to the reference line at the top of the lower portion of the chart. Following the guide lines, proceed downward and to the right until the correct density altitude line is intersected, then vertically downward to the percentage scale at the base of the chart.

If the runway is other than a dry, hard-surface runway, and a normal landing is planned, the level ground run distance (with wind) must be corrected to the existing runway surface conditions. Refer to figure A6-8, and enter the chart with the appropriate RCR and proceed vertically upward to the plotted curve. Following from this point, horizontally to the scale at the left, read the landing distance factor. The corrected ground run distance is then determined by multiplying this factor by the level ground run distance (with wind).

In order to determine the ground run required to stop the aircraft on a sloping runway, the level ground run must be corrected by entering figure A6-9 at the left edge with level ground run distance (with wind), corrected for RCR. Read horizontally across to the reference line in the center of the chart, then follow the guide lines to the right for a downhill slope, or to the left for an uphill slope, until the vertical gradient line is reached. The correct ground run distance is then determined by proceeding horizontally back to the distance scale at the left. Total distance to land over a 50-foot obstacle on a sloping runway, exceeds the ground run distance by the same amount as for a level runway. The entire procedure should be repeated using the Brakes Only curve to determine the landing distance which will be required should an engine failure occur enroute.

Example.

GIVEN: gross weight 55,000 pounds, wet, hard-surface runway (RCR = 12), 2% downhill slope, brakes and reverse thrust for stopping, 1400 feet density altitude, 10-knot headwind and no wind.

FIND: total landing distance, stall speed, and recommended airspeeds for approach, obstacle clearance, and touchdown.

1. Select the Landing Distances chart for flaps 40°, brakes and reverse thrust (figure A6-3).

2. Enter the Landing Distances curve at 1400 feet density altitude and proceed horizontally into the graph to the point of intersection with the 55,000 pound gross weight line. Drop vertically to the level ground run distance (no wind) scale and read 1550 feet.

3. Move to the corresponding point (1550 feet) on the reference line of the wind curve.

4. To determine total distance to clear a 50-foot obstacle, read horizontally to the right and stop at the 55,000 pound gross weight line (interpolated).

5. Proceed vertically below this point to the reference line at the top of the lower portion of the chart.

6. From the reference line, follow the guide lines down to the right to the correct density altitude of 1400 feet.

7. From this point proceed vertically downward to the scale at the base of the chart and read percentage of 155%.

8. Multiply 1550 feet ground run (no wind) by 155% to find a total landing distance of 2403 feet required to land over a 50-foot obstacle.

9. Should a headwind (for example, 10 knots) exist, determine the level ground run distance by proceeding downward along or parallel to the headwind guide lines until the 10-knot headwind line is intersected. Drop vertically from the point of intersection to the level ground run distance scale (with wind) and read 1275 feet.

10. Move from the point of intersection on the headwind curve horizontally into the obstacle clearance portion to the 55,000-pound (interpolated) headwind gross weight line.

11. Drop vertically from this point to the reference line at the top of the lower portion of the chart.

12. From this reference line, follow the guide lines downward to the density altitude of 1400 feet.

13. From this point follow vertically downward and read 162%.

14. Multiply 1275 feet level ground run distance (with 10-knot headwind) by 162% to find a total landing distance of 2066 feet to clear a 50-foot obstacle in a 10-knot headwind.

15. From the table of indicated airspeeds, interpolate the stall speed, approach speed, obstacle clearance speed and touchdown speed.

V_s	- 80.5 knots IAS
V_{app}	- 114.5 knots IAS
V_{50}	- 101.5 knots IAS
V_{td}	- 91.5 knots IAS

16. Referring to figure A6-8, Variation Of Landing Ground Run With Runway Condition Reading, erect a vertical line up from the RCR reading of 12 to intersect the curve.

17. From the point of intersection, proceed horizontally to the left and read a landing distance factor of 1.25.

18. Multiply 1550 feet (level ground run distance - no wind) by the landing distance factor of 1.25 to obtain a distance (corrected for runway surface condition) of 1938 feet.

19. Referring to figure A6-9, erect a vertical line at the 2% downhill mark on the gradient scale at the bottom of the chart.

20. Enter the landing ground run scale at the left with 1938 feet (level ground run) and read across horizontally to the vertical reference line in the center.

21. Follow the guide lines upward to the 2% downhill gradient line.

22. Move back horizontally to the landing ground run distance and read 2200 feet.

23. Determine the difference between the uncorrected level ground run (no wind) and the total distance over a 50-foot obstacle:

2403 ft - 1550 ft = 853 ft

24. Add the difference to the corrected downhill ground roll to determine the corrected total distance:

2200 ft + 853 ft = 3053 ft

NOTE

Repeat steps 16 through 24 using level ground run distance (with 10-knot headwind) to observe headwind effect on overall landing performance.

MODEL: AC-119G

CROSSWIND LANDING
TWO-ENGINE OPERATION

DATA AS OF: 15 SEPTEMBER 1964

DATA BASIS: FLIGHT TEST

NOTES:
1. Enter chart using maximum wind gust velocity to determine minimum landing speed only. Use lowest given wind value to determine runway component (effective headwind) for computing landing distance.

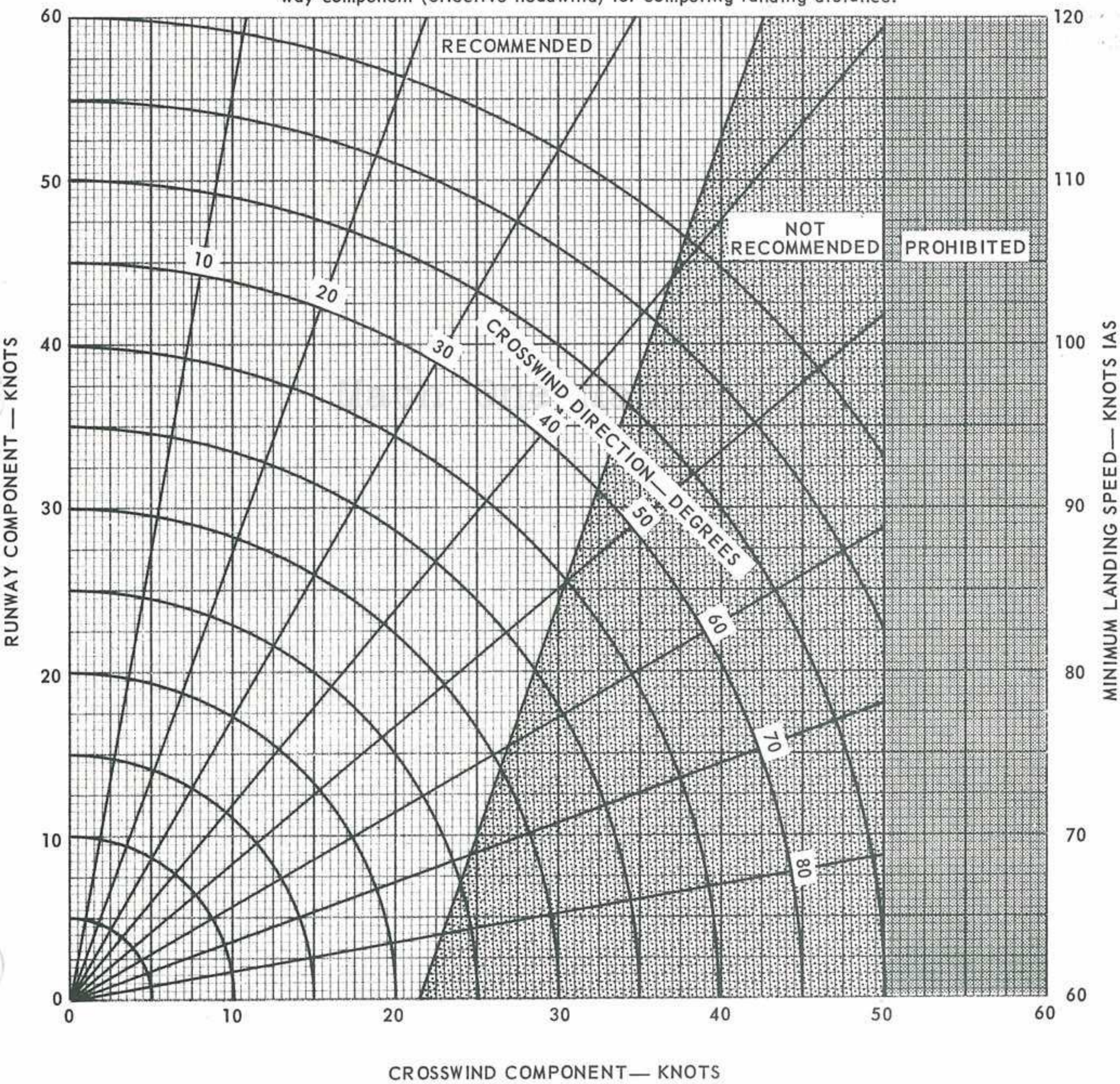


Figure A6-1

MODEL: AC-119G

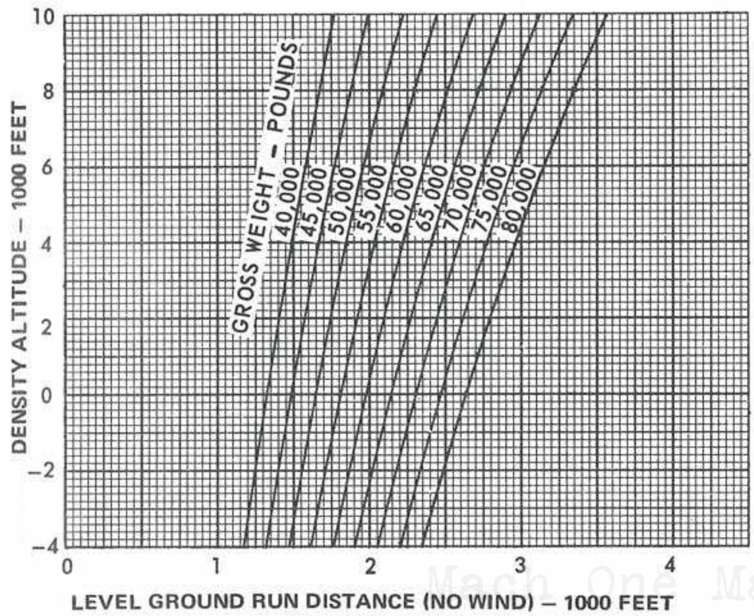
LANDING DISTANCES – FLAPS 40°

BRAKES ONLY

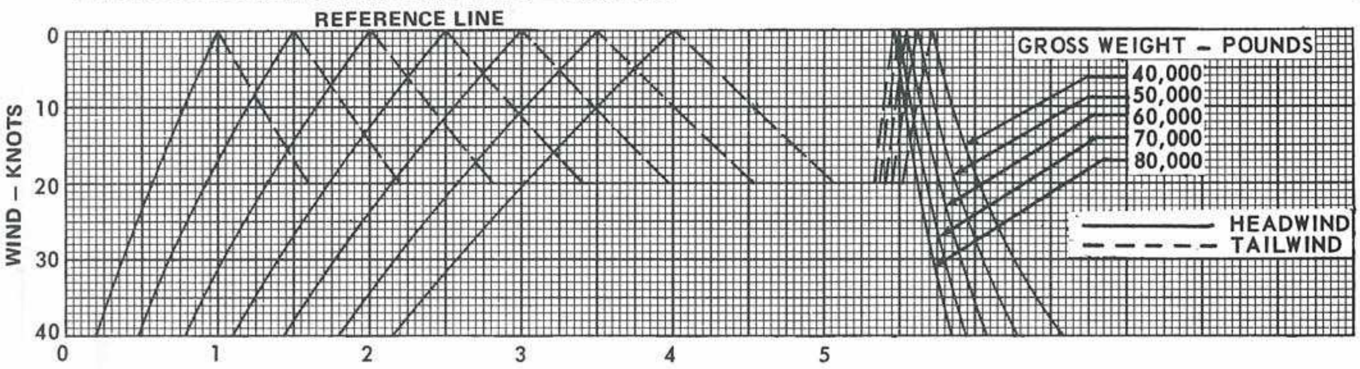
ENGINES: R3350-89B (2)

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	70	79	106	89
42,000	72	81	107	91
44,000	73	82	108	92
46,000	75	84	110	94
48,000	76	86	111	96
50,000	77	87	112	97
52,000	79	89	113	99
54,000	80	91	114	101
56,000	81	92	115	102
58,000	83	93	116	104
60,000	84	95	118	106
62,000	85	96	119	107
64,000	86	98	120	109
66,000	88	99	121	110
68,000	89	101	122	112
70,000	90	102	123	114
72,000	91	103	124	115
74,000	92	105	125	117
76,000	93	106	126	118
78,000	94	107	127	120
80,000	95	108	128	121



CONDITIONS:

1. Dry, hard-surface runway, μrolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   $V_{app} = V_s + 30$ knots = approach speed
   V_{td} = touchdown speed = 1.15 V_s
   V_{50} = obstacle clearance speed = 1.25 V_s
3. Landing attitude is held to 0.85 V_s when nose wheel is lowered.

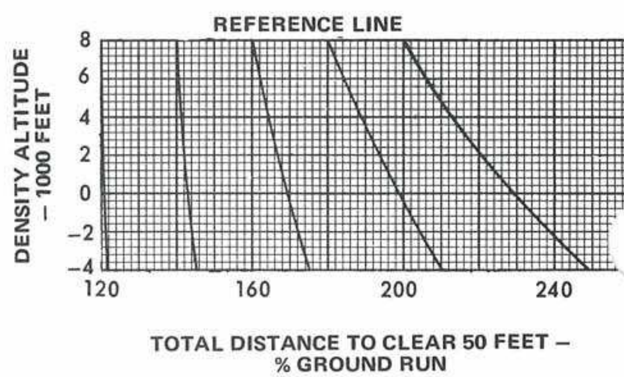


Figure A6-2

MODEL: AC-119G

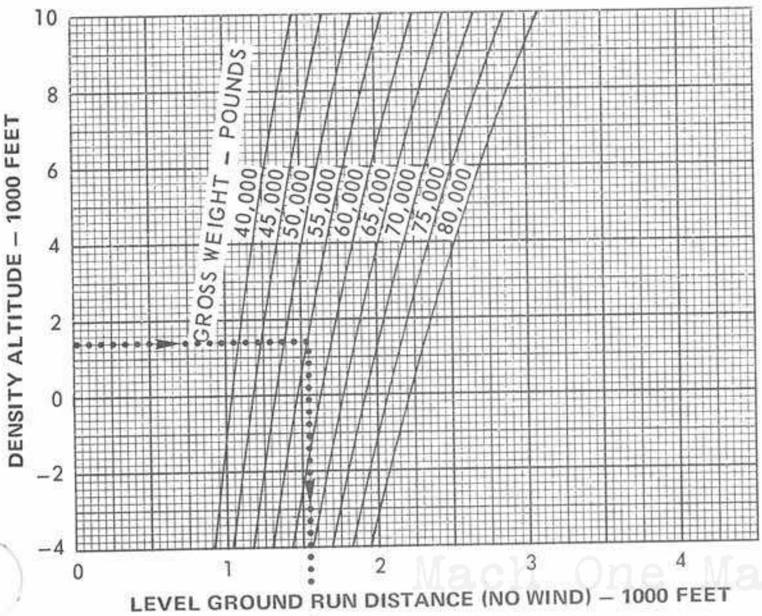
LANDING DISTANCES – FLAPS 40°

BRAKES & REVERSE THRUST

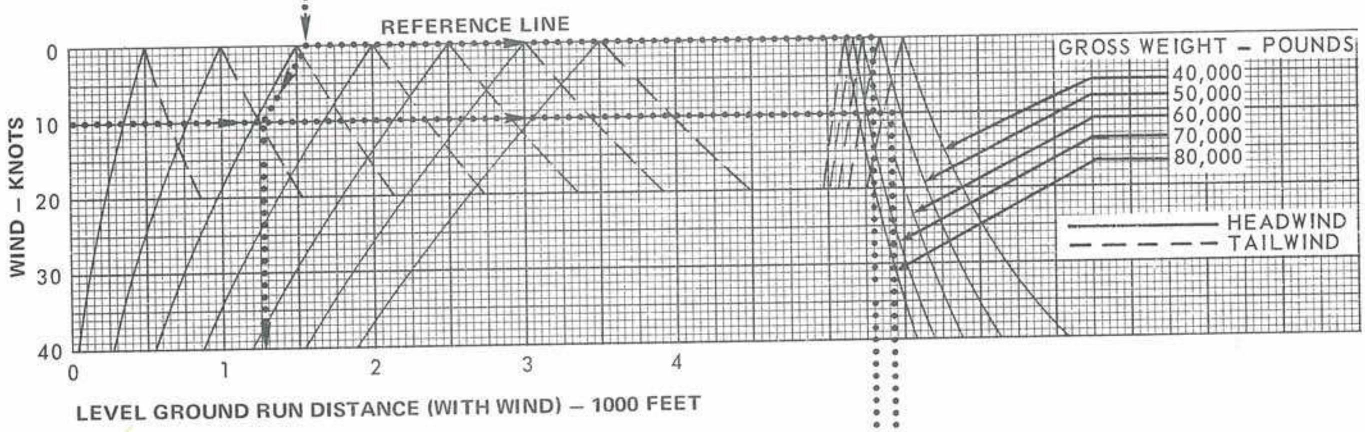
ENGINES: R3350-89B (2)

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	70	79	106	89
42,000	72	81	107	91
44,000	73	82	108	92
46,000	75	84	110	94
48,000	76	86	111	96
50,000	77	87	112	97
52,000	79	89	113	99
54,000	80	91	114	101
56,000	81	92	115	102
58,000	83	93	116	104
60,000	84	95	118	106
62,000	85	96	119	107
64,000	86	98	120	109
66,000	88	99	121	110
68,000	89	101	122	112
70,000	90	102	123	114
72,000	91	103	124	115
74,000	92	105	125	117
76,000	93	106	126	118
78,000	94	107	127	120
80,000	95	108	128	121



CONDITIONS:

1. Dry, hard-surface runway, μ rolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   $V_{app} = V_s + 30$ knots = approach speed
   V_{td} = touchdown speed = 1.15 V_s
   V_{50} = obstacle clearance speed = 1.25 V_s
3. Landing attitude is held to 0.85 V_s when nose wheel is lowered.
4. Full reverse thrust is applied when nose gear touches ground.

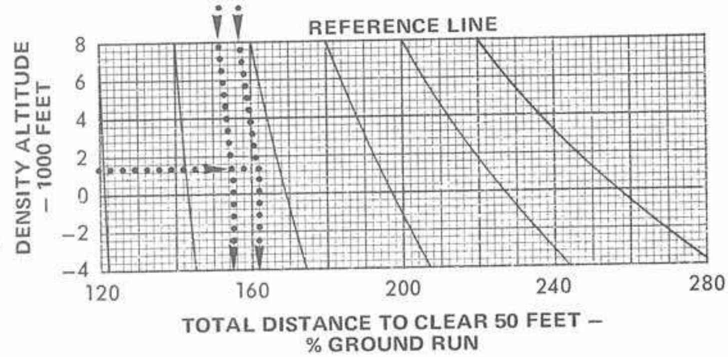


Figure A6-3

MODEL: AC-119G

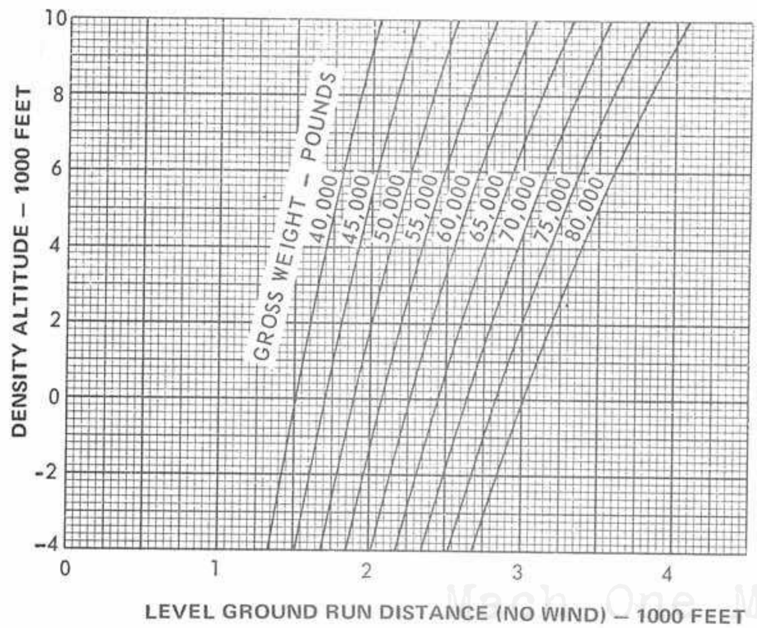
LANDING DISTANCES – FLAPS 15°

BRAKES ONLY

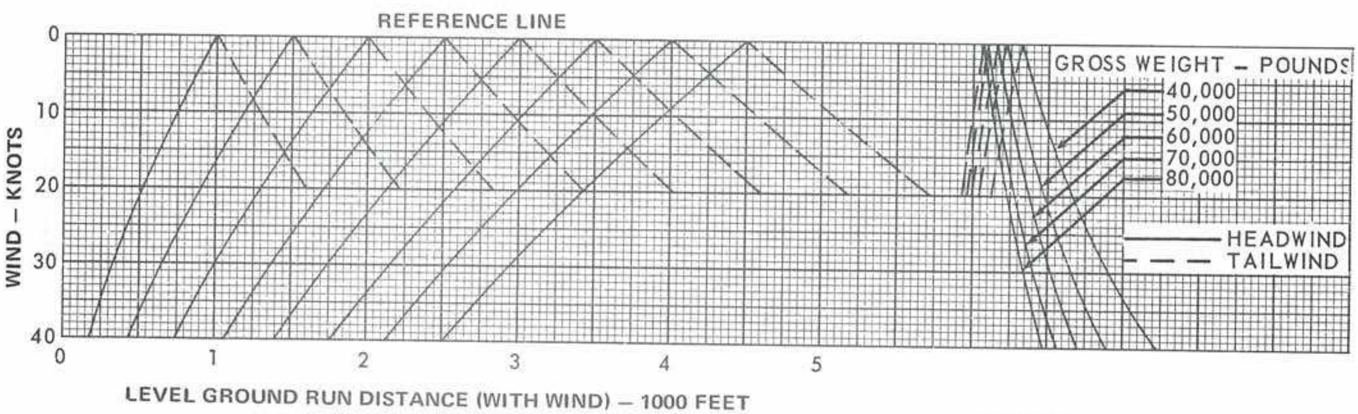
ENGINES: R3350-89B (2)

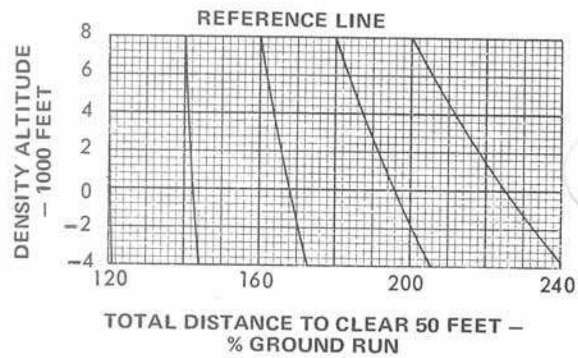
DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	72	82	108	92
42,000	74	84	109	93
44,000	76	85	110	95
46,000	77	87	112	97
48,000	79	89	113	99
50,000	80	90	114	101
52,000	81	92	115	102
54,000	83	94	117	104
56,000	84	95	118	106
58,000	85	97	119	108
60,000	87	98	120	109
62,000	88	100	121	111
64,000	89	101	122	113
66,000	91	103	124	114
68,000	92	104	125	116
70,000	93	106	126	118
72,000	94	107	127	119
74,000	95	108	128	121
76,000	97	110	129	123
78,000	98	111	131	124
80,000	99	112	132	126





CONDITIONS:

1. Dry, hard-surface runway, μ rolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   $V_{app} = V_s + 30$ knots = approach speed
   V_{td} = touchdown speed = $1.15\ V_s$
   V_{50} = obstacle clearance speed = $1.25\ V_s$
3. Landing attitude is held to $0.85\ V_s$ when nose wheel is lowered.

Figure A6-4

MODEL: AC-119G

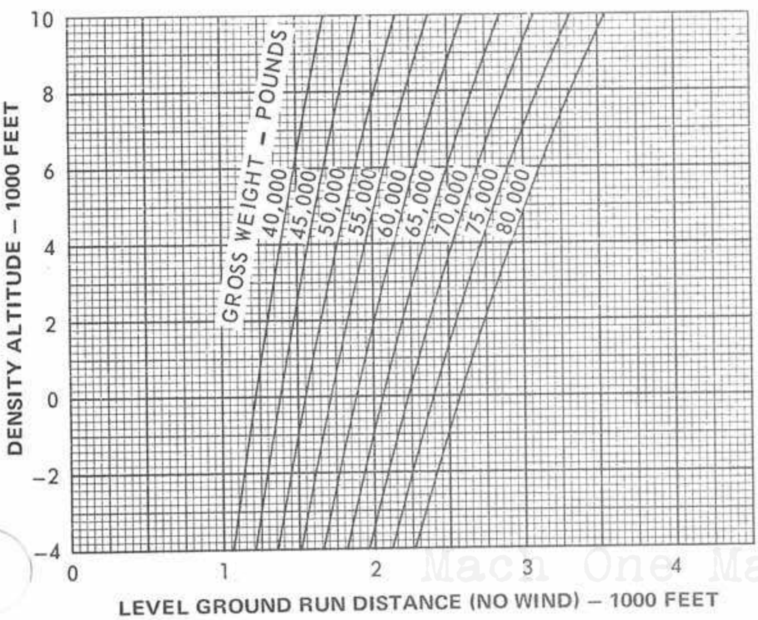
LANDING DISTANCES – FLAPS 15°

BRAKES & REVERSE THRUST

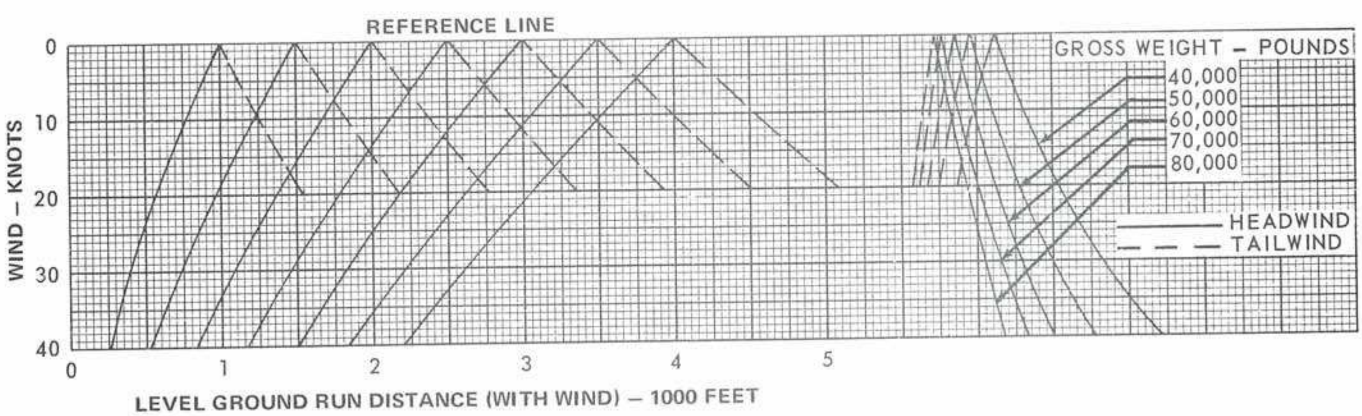
ENGINES: R3350-89B (2)

DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	72	82	108	92
42,000	74	84	109	93
44,000	76	85	110	95
46,000	77	87	112	97
48,000	79	89	113	99
50,000	80	90	114	101
52,000	81	92	115	102
54,000	83	94	117	104
56,000	84	95	118	106
58,000	85	97	119	108
60,000	87	98	120	109
62,000	88	100	121	111
64,000	89	101	122	113
66,000	91	103	124	114
68,000	92	104	125	116
70,000	93	106	126	118
72,000	94	107	127	119
74,000	95	108	128	121
76,000	97	110	129	123
78,000	98	111	131	124
80,000	99	112	132	126



CONDITIONS:

1. Dry, hard-surface runway, μ rolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   V_{app} = V_s + 30 knots = approach speed
   V_{td} = touchdown speed = 1.15 V_s
   V_{50} = obstacle clearance speed = 1.25 V_s
3. Landing attitude is held to 0.85 V_s when nose wheel is lowered.
4. Full reverse thrust is applied when nose gear touches ground.

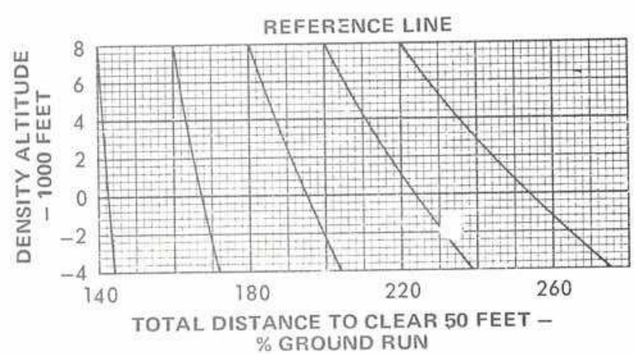


Figure A6-5

MODEL: AC-119G

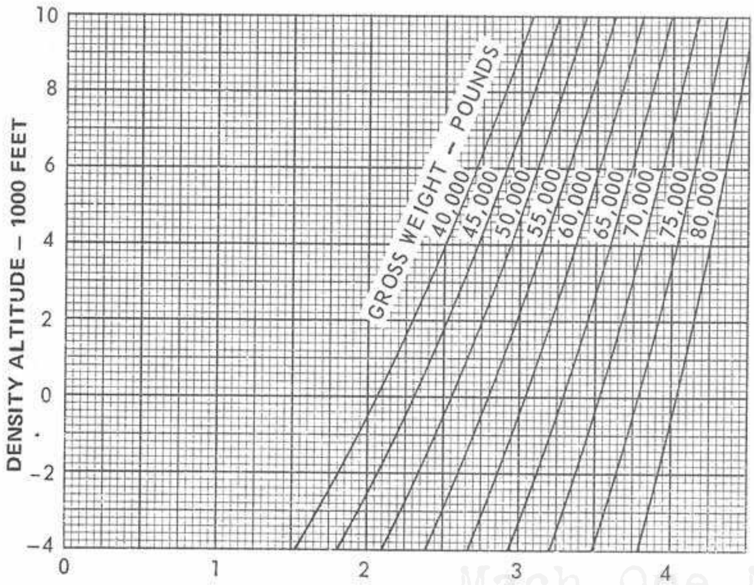
LANDING DISTANCES – FLAPS 0°

BRAKES ONLY

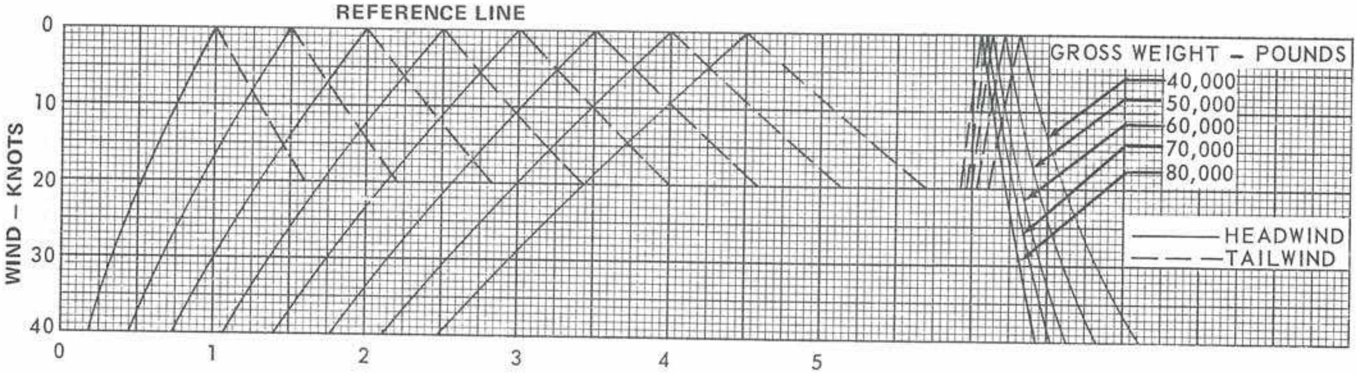
ENGINES: R3350-89B (2)

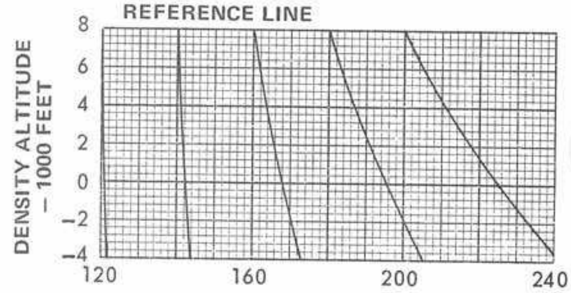
DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	76	86	110	95
42,000	77	87	112	97
44,000	79	89	113	99
46,000	80	91	115	101
48,000	82	93	116	103
50,000	83	95	117	105
52,000	85	96	118	107
54,000	86	98	120	109
56,000	88	100	121	111
58,000	89	101	122	113
60,000	91	103	124	114
62,000	92	104	125	116
64,000	93	106	126	118
66,000	95	107	127	120
68,000	96	109	129	122
70,000	97	110	130	123
72,000	98	112	131	125
74,000	100	113	132	127
76,000	101	115	134	129
78,000	102	116	135	130
80,000	103	117	136	132





CONDITIONS:

1. Dry, hard-surface runway, μ rolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   $V_{app} = V_s + 30$ knots = approach speed
   V_{td} = touchdown speed = $1.15\ V_s$
   V_{50} = obstacle clearance speed = $1.25\ V_s$
3. Landing attitude is held to $0.85\ V_s$ when nose wheel is lowered.

Figure A6-6

MODEL: AC-119G

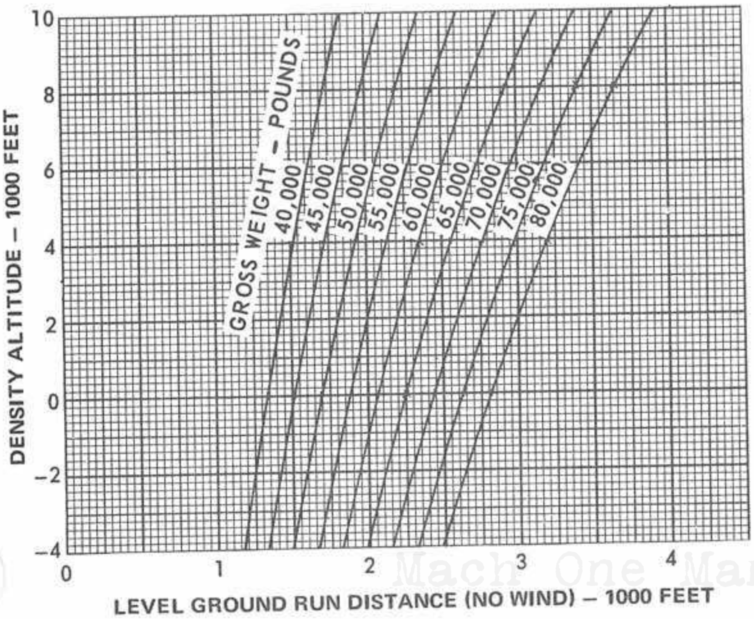
LANDING DISTANCES – FLAPS 0°

BRAKES & REVERSE THRUST

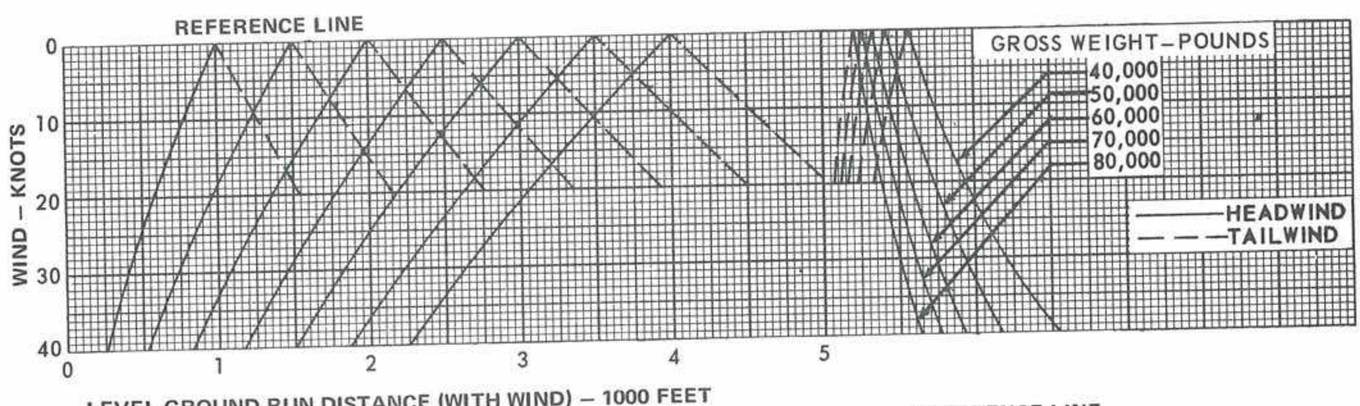
ENGINES: R3350-89B (2)

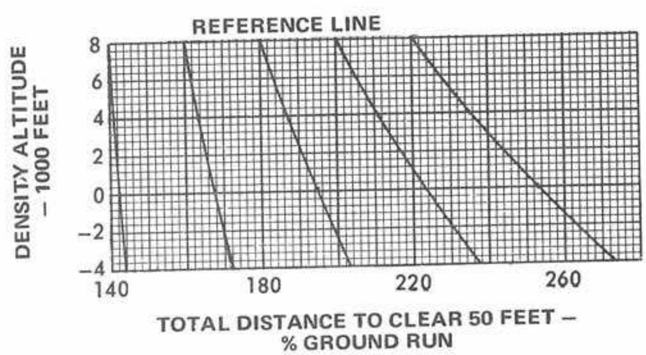
DATA AS OF: MARCH 1969
DATA BASIS: CALCULATED

FUEL GRADE: 115/145 or 100/130
FUEL DENSITY: 6 LB/GAL



GROSS WEIGHT - POUNDS	IAS - KNOTS			
	IN GROUND EFFECT		OUT OF GROUND EFFECT	
	V_s	V_{td}	V_{app}	V_{50}
40,000	76	86	110	95
42,000	77	87	112	97
44,000	79	89	113	99
46,000	80	91	115	101
48,000	82	93	116	103
50,000	83	95	117	105
52,000	85	96	118	107
54,000	86	98	120	109
56,000	88	100	121	111
58,000	89	101	122	113
60,000	91	103	124	114
62,000	92	104	125	116
64,000	93	106	126	118
66,000	95	107	127	120
68,000	96	109	129	122
70,000	97	110	130	123
72,000	98	112	131	125
74,000	100	113	132	127
76,000	101	115	134	129
78,000	102	116	135	130
80,000	103	117	136	132





CONDITIONS:

1. Dry, hard-surface runway, μ rolling = 0.025, RCR = 23.
2. V_s = power-off stall speed
   $V_{app} = V_s + 30$ knots = approach speed
   V_{td} = touchdown speed = 1.15 V_s
   V_{50} = obstacle clearance speed = 1.25 V_s
3. Landing attitude is held to 0.85 V_s when nose wheel is lowered.
4. Full reverse thrust is applied when nose gear touches ground.

Figure A6-7

MODEL: AC-119G

VARIATION OF LANDING GROUND RUN
WITH RUNWAY CONDITION READING

NOTE: If no RCR is available, use 23 for dry runway, 12 for wet runway, and 05 for icy runway. For ICAO report of good use 23, for medium use 12, and for poor use 05.

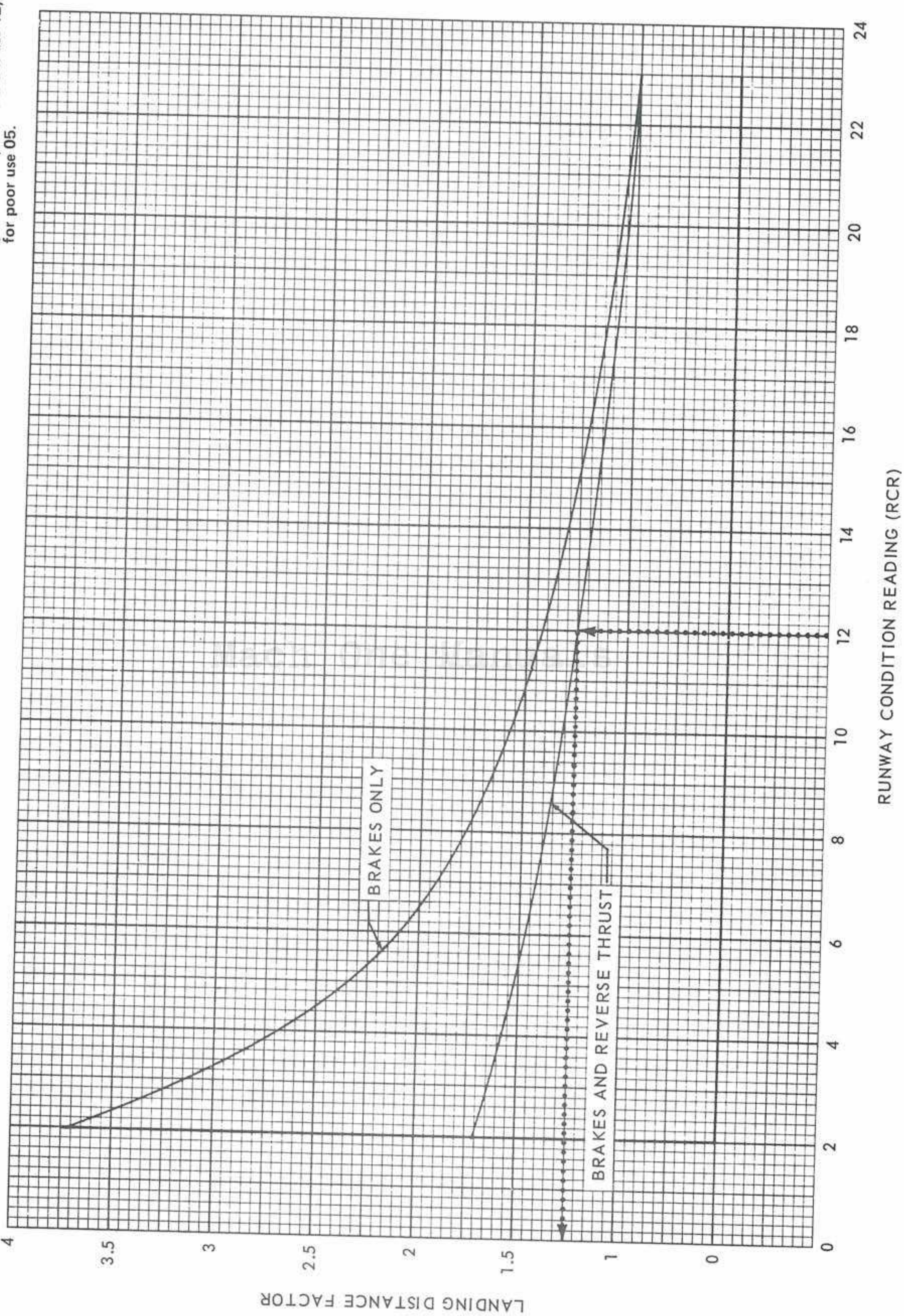


Figure A6-8

MODEL: AC-119G

VARIATION OF LANDING GROUND RUN
WITH RUNWAY GRADIENT

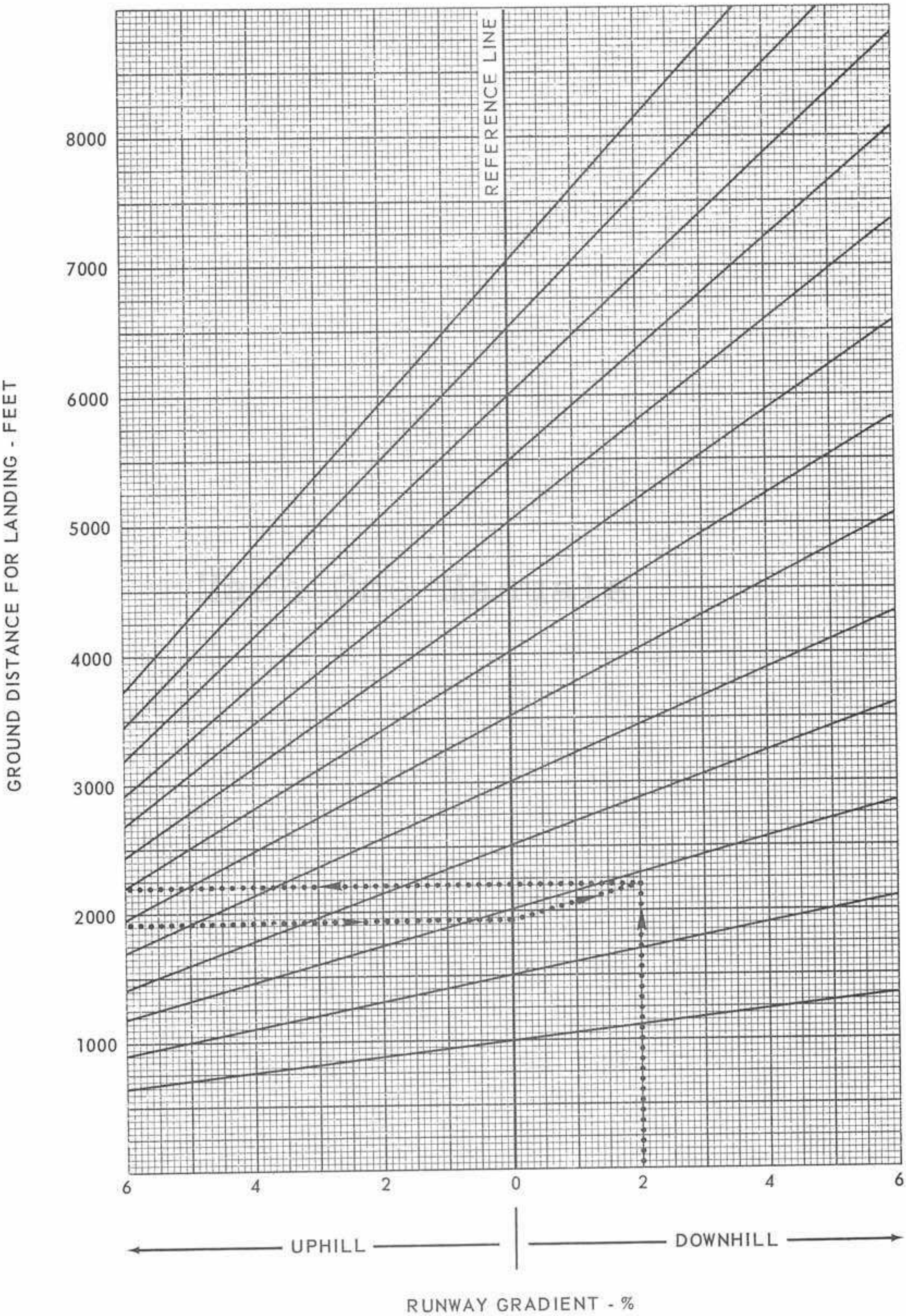


Figure A6-9

MISSION PLANNING

part 7

table of contents

Except for the following all information is contained in T.O. 1C-119G-1.

APU FUEL CONSUMPTION.

Although altitude may have some effect on the fuel consumption of the APU, it will consume approximately 122 pounds of fuel per hour at 100% load and 76.5 pounds per hour under no-load conditions.

DEFOULING FUEL CONSUMPTION.

When anticipated power settings to be used on cruise control missions are other than the appropriate defouling power, it is recommended that 80 pounds of fuel be figured for defouling purposes for each hour of the preflight estimated time enroute and destination reserve time, i.e., alternate/holding.

ALPHABETICAL INDEX

NOTE: * denote illustrations

A

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A Continued

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