LMSC-D148159

APRIL 1970

This MANUAL
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MARCH 1971
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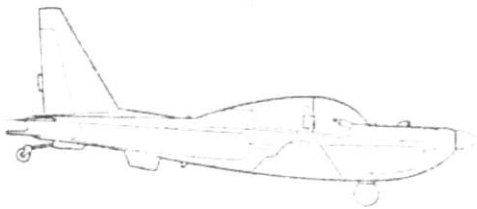
KURT
OLNEY

Marcus A Bartley

YO-3A AIRCRAFT



OPERATOR'S HANDBOOK

This MANUAL
CAME WITH
YO-3A 69-1807
That WAS USED
BY LDWF
AND FBI

KURT
OLNEY

AIRBORNE SYSTEMS
Research & Development Division
Lockheed Missiles & Space Company
Sunnyvale, California

N42457

WARNING

Personnel performing instructions involving operations, procedures, and practice which are included or implied in this technical manual shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, death, or an aborted mission.

This page covers WARNINGS in general. Detail WARNINGS are found in each Chapter and MUST be observed.

STARTING AIRCRAFT

Starting procedures and practices defined in this Technical Manual must be followed correctly. Failure to do so may result in personal injury or loss of life.

Coordinate all cockpit actions with ground observer.

Ensure that all ground safety locks are installed, aircraft is properly chocked or tied down, rear blast area is clear, and fire guard is posted.

OPERATION OF AIRCRAFT ON GROUND

If at any time unusual or suspicious engine noises are heard (such as loud humming, knocking, pounding noises, or metal-to-metal contact), the engine must be shut down immediately.

If there is no rise in oil pressure within 30 seconds, or if acceleration is uneven or intermittent and egt rises rapidly, abort start, clear engine, and investigate cause.

GROUNDING AIRCRAFT

Personnel must familiarize themselves with the ground handling and servicing safety precautions contained in this Technical Manual.

HIGH VOLTAGE

High voltage exists in the electronic equipment compartment.

CANOPY EJECT SAFETY LOCKS

Prior to entering the aircraft ensure that canopy eject safety locks are installed.

HANDLING FUEL

All equipment connected to the aircraft must be grounded.

Avoid spillage.

No smoking shall be allowed in the vicinity.

OPERATOR'S HANDBOOK

YO-3A AIRCRAFT

Contract DAAJ01-69-C-0059

LMSC-D148159

APRIL 1970

Lockheed

MISSILES & SPACE COMPANY

A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

SUNNYVALE, CALIFORNIA

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations. * Total number of pages in this manual is 141 consisting of the following:

Page No.	Change No. **	Page No.	Change No. **	Page No.	Change No. **
Title Page	0	5-3 and 5-4	1	10-1	0
A	0	5-5 to 5-7	0	10-2 Blank	0
iii to vi	1	5-8 and 5-9	0	10-3 to 10-6	1
vii and viii	0	5-10 to 5-16	0	10-7 to 10-9	0
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4-14 Blank	0	8-8 Blank	0	A-1 and A-2	1
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*On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.
**Zero in this column indicates an original page.

TABLE OF CONTENTS

Chapter 1
INTRODUCTION

Section 1
SCOPE

IMPORTANT

In order to obtain complete information and derive maximum benefits from this handbook, it is necessary to read this chapter carefully and thoroughly.

1-1. This handbook, issued expressly for operators, is an official document for Army Model YO-3A aircraft, serial No. 69-18000 and subsequent. The purpose of this handbook is to provide you with the latest information and performance data derived from flight test programs and operational experiences. The study and use of this handbook will enable you to perform assigned missions and duties with maximum efficiency and safety.

1-2. Your ability and experience are recognized. It is not the function of this handbook to teach the pilot how to fly; basic flight principles and elementary instructions are not included. The contents of this handbook will provide you with a general knowledge of Army Model YO-3A aircraft, its flight characteristics, and specific normal and emergency operating procedures.

1-3. Reports necessary to comply with the Army Safety Program are prescribed in detail in AR 385-40.

1-4. The index lists, in alphabetical order, subjects under a topic which may be of significance to the operator. This listing is not a repetition of paragraph titles, but an extensive listing of subjects that will aid the operator in the use of the handbook.

1-5. The Appendix contains a list of applicable references.

Section II

GENERAL

1-6. SCOPE.

1-7. The contents of this manual are arranged under chapters and sections as indicated in the Table of Contents. A brief description of each chapter is provided in Section I of the applicable chapters.

1-8. Distribution, revision, and authorization for issue are controlled by the LMSC Airborne Systems Product Support organization.

1-9. Notes, cautions, and warnings, used to emphasize important and critical instructions, are used for the following conditions:

NOTE

An operating procedure, condition, etc., which is essential to highlight.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, will result in damage to or destruction of equipment.

WARNING

An operating procedure, practice, etc., which, if not correctly followed, will result in personnel injury or loss of life.

Chapter 2
DESCRIPTION

Section I
SCOPE

2-1. GENERAL.

2-2. This chapter provides the operator with information that will familiarize him with the YO-3A aircraft and all systems, controls, and indicators that contribute to the physical act of flying the aircraft.

2-3. This chapter is not designed to provide instructions on the complete mechanical and electrical workings of the various systems. Therefore, each is described only in enough detail to make comprehension of that system sufficiently complete to allow for its safe and efficient operation. More complete details on aircraft systems and equipment are contained in LMSC-D148160, "Organizational Maintenance Handbook, YO-3A Aircraft."

Section II

SYSTEMS AND CONTROLS DESCRIPTION

2-4. THE AIRCRAFT.

2-5. The YO-3A aircraft (Fig. 2-1) is a lightweight observation aircraft manufactured by Lockheed Missiles & Space Company of Sunnyvale, California. The two-place aircraft is a single-engine, all-metal (except for fabric ailerons and rudder and fiberglass engine cowl, aft canopy, exhaust shroud, wing-root fairings, and wheel-well fairings), low-wing monoplane of semimonocoque construction. The main landing gear consists of two electrically actuated, retractable, air/hydraulic main struts and wheels. The tail wheel is steerable and releases to full swivel after 30 degrees of tail-wheel turn.

2-6. The aircraft, which is specifically designed for observation, is characterized by its relatively large wingspan and large canopy area. The aircraft is powered by a Continental six-cylinder, horizontally opposed, air-cooled, fuel-injected engine. The six-bladed wooden propeller is driven through a 3.33:1 pulley-and-belt reduction system. Pilot and observer are seated tandem, with the observer forward.

2-7. AIRCRAFT DIMENSIONS.

2-8. The general physical features and overall dimensions of the aircraft are shown in Fig. 2-2.

Fig. 2-1 YO-3A Aircraft

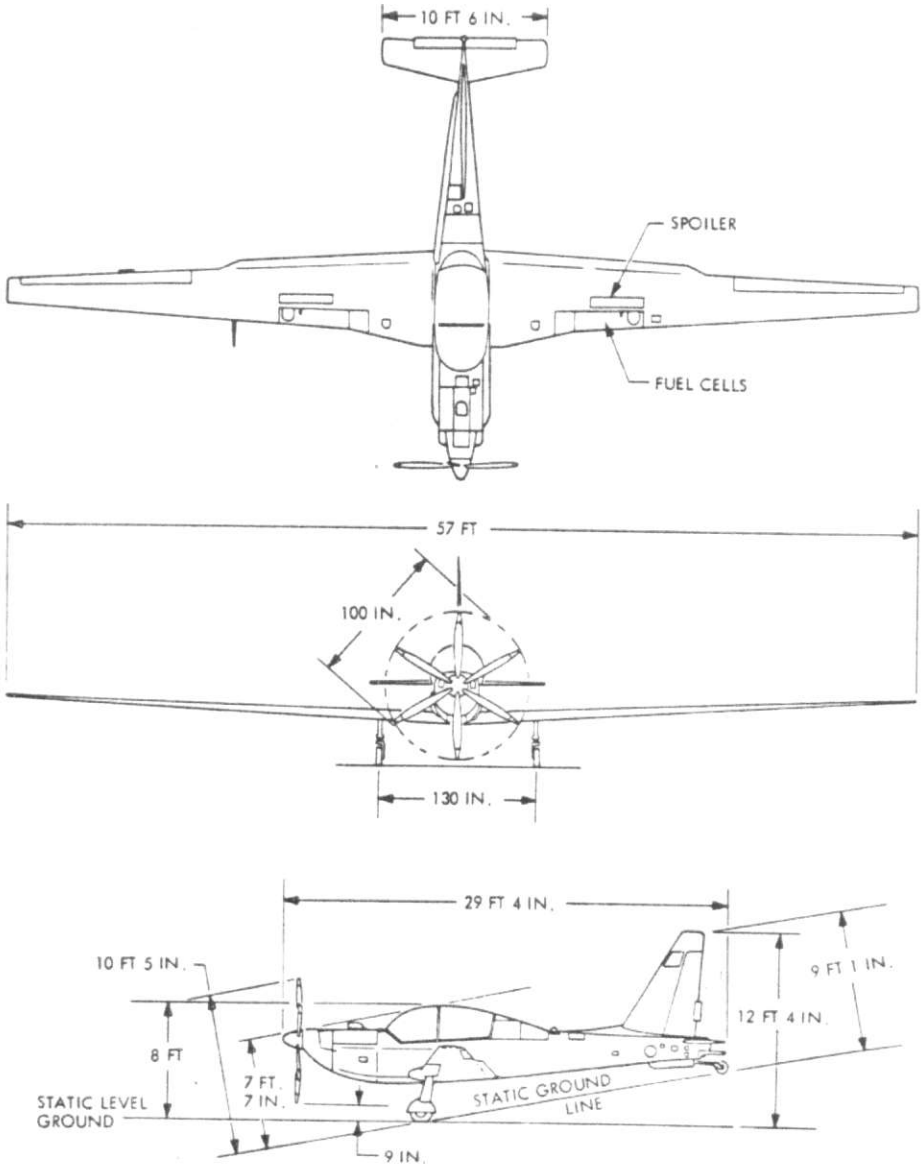


Fig. 2-2 Physical Features and Overall Dimensions of Aircraft

general arrangements of equipment and servicing points are shown in Fig. 2-3.

2-9. TURNING RADIUS AND GROUND CLEARANCE.

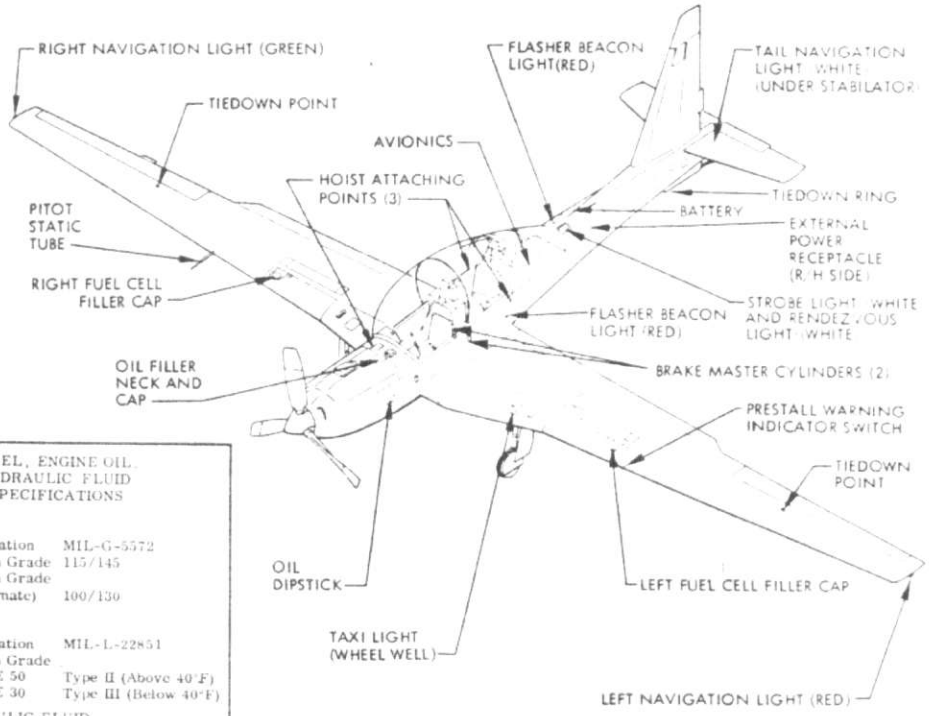
2-10. The minimum turning radius and ground clearances are shown in Fig. 2-4.

2-11. GROSS WEIGHT.

2-12. The normal gross weight of the aircraft is 3,800 pounds.

2-13. ENGINE.

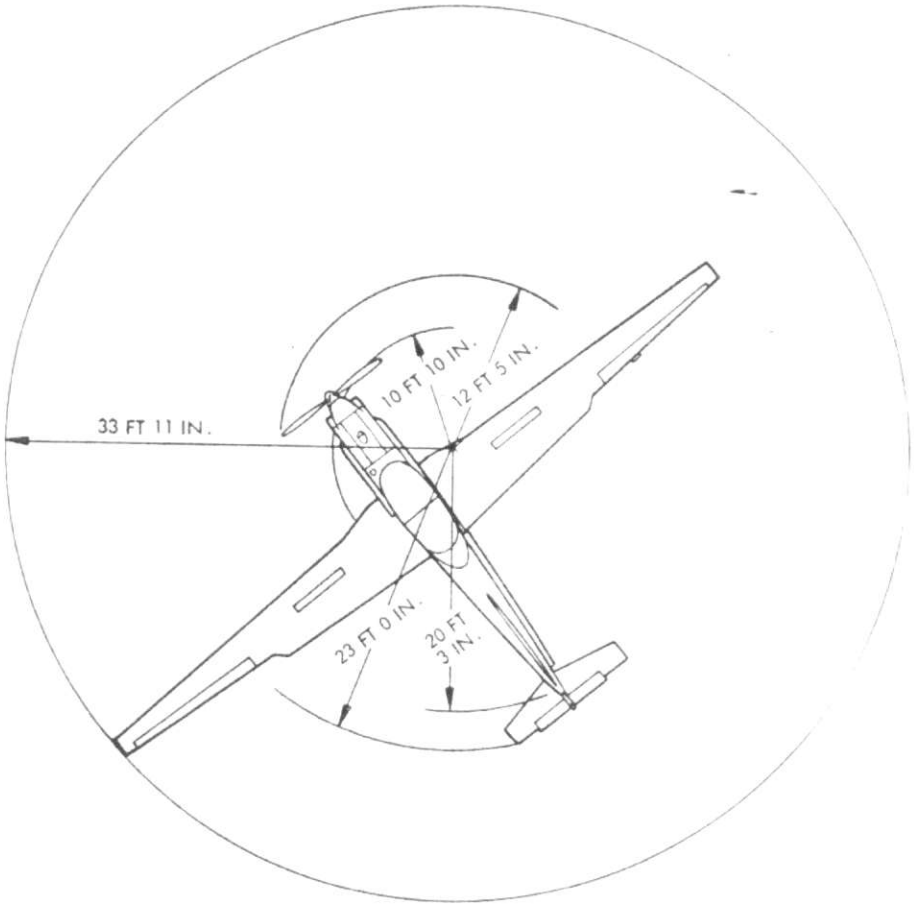
2-14. The engine is a Continental Model No. IO-360D with standard sea-level maximum takeoff horsepower rating of 210 at 2800 rpm. The engine has a wet-sump oil system, dual magnetos, and continuous flow injection system, which supplies metered fuel to the individual cylinders through injection nozzles. The engine controls (Fig. 2-5) are mounted on two quadrants. The pilot's quadrant incorporates controls for the throttle, mixture, and propeller; the observer's quadrant has only a throttle control. The observer's quadrant is located on the left side of the fuselage, just forward of the observer's seat, and the pilot's quadrant is located in a like position, just forward of the pilot's seat. The throttles are mechanically interconnected to provide simultaneous control.



FUEL, ENGINE OIL, HYDRAULIC FLUID SPECIFICATIONS

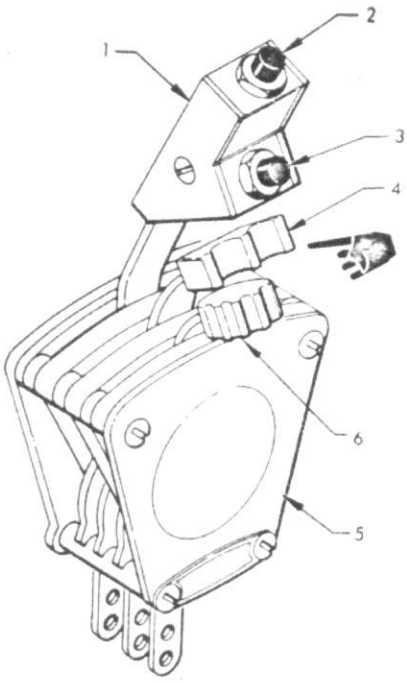
FUEL	
Specification	MIL-G-5572
Aviation Grade	115/145
Aviation Grade (Alternate)	100/130
OIL	
Specification	MIL-L-22851
Aviation Grade	
SAE 50	Type II (Above 40°F)
SAE 30	Type III (Below 40°F)
HYDRAULIC FLUID	
Specification	MIL-H-5606

Fig. 2-3 General Arrangement and Servicing Diagram

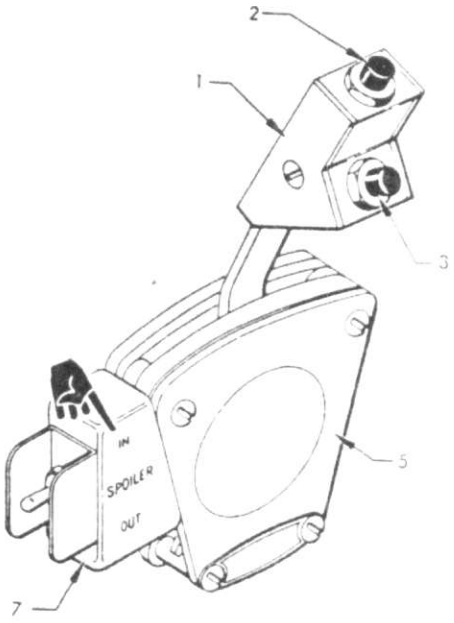


VERTICAL CLEARANCES	
VERTICAL STABILIZER	9 FT 1 IN.
WING TIPS	4 FT 0 IN.
PROPELLER MAXIMUM MINIMUM	 2 FT 1 IN. 9 IN.

Fig. 2-4 Turning Radius and Ground Clearance



PILOT'S QUADRANT



OBSERVER'S QUADRANT

1. THROTTLE
2. MICROPHONE SWITCH
3. INTERPHONE SWITCH
4. PROPELLER CONTROL
5. ENGINE CONTROL QUADRANT
6. MIXTURE CONTROL LEVER
7. SPOILER ACTUATOR SWITCH

Fig. 2-5 Engine Control Quadrant

2-15. FUEL INJECTION SYSTEM.

2-16. The continuous-flow fuel injection system consists of a combination engine-driven fuel pump and manually operated fuel mixture control assembly, a combination air throttle and fuel metering control assembly, a fuel manifold valve, and fuel injection nozzles.

2-17. THROTTLE.

2-18. The throttles (8, Fig. 2-6, and 3, Fig. 2-7) are mechanically connected to the engine fuel injection system by a push-pull type linkage. The full forward position of the throttle is maximum power, and the full aft position is engine idle.

2-19. MIXTURE CONTROL LEVER.

2-20. The mixture control lever (6, Fig. 2-6), on the aft quadrant only, enables the pilot to regulate the fuel-air mixture to the engine to obtain efficient engine operation and maximum fuel economy. The full forward position of the mixture control lever is full rich and the full aft position is idle cutoff. Manual leaning is accomplished by adjusting the lever between the rich and idle cutoff positions.

2-20A. PROPELLER CONTROL LEVER.

2-20B. The propeller control level (4, Fig. 2-5), on the pilot's quadrant only, enables the pilot to control the pitch of the propeller blades. The full forward position of the propeller control is the high rpm position, and the full aft position is the low rpm position.

2-21. ALTERNATE AIR CONTROL (ALT AIR KNOB).

2-22. If the air filter system for the engine air throttle becomes clogged, the pilot can select alternate air (unfiltered air from the engine compartment) by pulling out the ALT AIR knob on the pilot's instrumen panel (10, Fig. 2-6). The normal position of this knob, however, is all the way in.

2-23. ENGINE COOLING.

2-24. Air for engine cooling enters through two openings in the nose cowling. The air passes over the engine and exits through a cowl flap in the aft portion of the lower engine cowl and through the side cowls. Acoustic soundproofing has been added to the engine compartment.

2-25. COWL FLAP CONTROL.

2-25A. The cowl flap is controlled by a COWL FLAP CONTROL toggle switch (73, Fig. 2-6), on the lower left portion of the pilot's instrument panel. When the cowl flap toggle switch is depressed the cowl flap is opened. Reverse action (toggle switch "up") will close the cowl flap. An amber COWL FLAP OPEN warning light located on the instrument panel (47, Fig. 2-6) comes on when the cowl flap is open and will remain on until the cowl flap is closed.

2-26. IGNITION SYSTEM.

2-27. The engine is equipped with a dual ignition system that fires two spark plugs in each cylinder. The voltage required to ignite the fuel-air mixture is supplied by two engine-driven magnetos. The right magneto fires the upper spark plugs on the right side of the engine and the lower spark plugs on the left. The left magneto fires the upper spark plugs on the left and the lower spark plugs on the right. The magneto circuit is controlled by the use of a conventional rotary-type switch mounted on the pilot's instrument panel.

2-28. IGNITION SWITCH. The engine ignition switch (72, Fig. 2-6) controls the ignition system. The four switch positions, designated counterclockwise, are: BOTH, L, R, and OFF. The engine is started and operated in the BOTH position. The L and R positions are for ignition checking purposes only. The OFF position will ground the magnetos, thus stopping the engine. An ignition cutoff switch (16, Fig. 2-7) is provided on the observer's right-hand instrument panel. This switch functions to ground both magnetos, thus stopping the engine.

2-29. ENGINE AIR INDUCTION SYSTEM.

2-30. The engine air induction system provides filtered air to the engine air throttle. A schematic

diagram of the system is shown in Fig. 2-8. Principal components of the system are an air scoop, air box (containing the air filter), ducts for either filtered air or alternate air, and a gate valve. The gate valve is manually controlled by the ALT AIR knob on the pilot's instrument panel. Under normal operating conditions, air enters the air box, passes through the filter and filtered air duct, and enters the gate valve. If the air filter becomes clogged, the pilot can pull out the ALT AIR knob, thereby shutting off the filtered air at the gate valve and assuring unfiltered air to be drawn from the engine compartment.

2-31. STARTER SYSTEM.

2-32. The starter system operates on dc power from the battery or from the APU. It consists of a starter button relay and a direct-cranking starter motor located at the rear top of the engine.

2-33. START BUTTON. A press-type starter button (71, Fig. 2-6), labeled ENGINE START, controls the electric starter. When the ENGINE START button is depressed, a relay energizes the starter. Electrical power for energizing the starter is supplied by the battery or from an external power source.

2-34. TACHOMETER. An electrically driven tachometer (43, Fig. 2-6, and 14, Fig. 2-7) is located on the upper left side of the pilot's instrument panel and the extreme right side of the observer's instrument panel.

2-35. CYLINDER HEAD TEMPERATURE GAGE. The cylinder head temperature gage (41, Fig. 2-6), located at the left center of the pilot's instrument panel, is calibrated in degrees Centigrade, with a range of 0° to 300° in 10° increments. It is operated by means of a bayonet-type thermocouple plugged into an adapter located in the underside of No. 4 cylinder.

2-36. MANIFOLD PRESSURE GAGE. The manifold pressure gage (70, Fig. 2-6) is located at the left center of the pilot's instrument panel and has a range of 10 to 75 inches of mercury.

2-37. EXHAUST GAS TEMPERATURE INDICATOR. The exhaust gas temperature indicator (49, Fig. 2-6) is located on the upper portion of the pilot's instrument panel and has a range of 1200° F to 1700° F. A front adjustable reference pointer is provided.

2-38. ENGINE GAGE UNIT. The engine oil pressure and oil temperature are displayed on an engine gage unit (60, Fig. 2-6). Oil pressure is calibrated in psi, with a range of 0 to 200 psi. Oil temperature is calibrated in degrees Centigrade with a range of -70° to 150°.

2-39. FUEL PRESSURE GAGE. The fuel pressure gage is located on the upper left corner of the pilot's instrument panel (42, Fig. 2-6) and measures "metered fuel pressure." Fuel pressure is calibrated in psi, with a range of 0 to 25 psi.

2-40. PROPELLER.

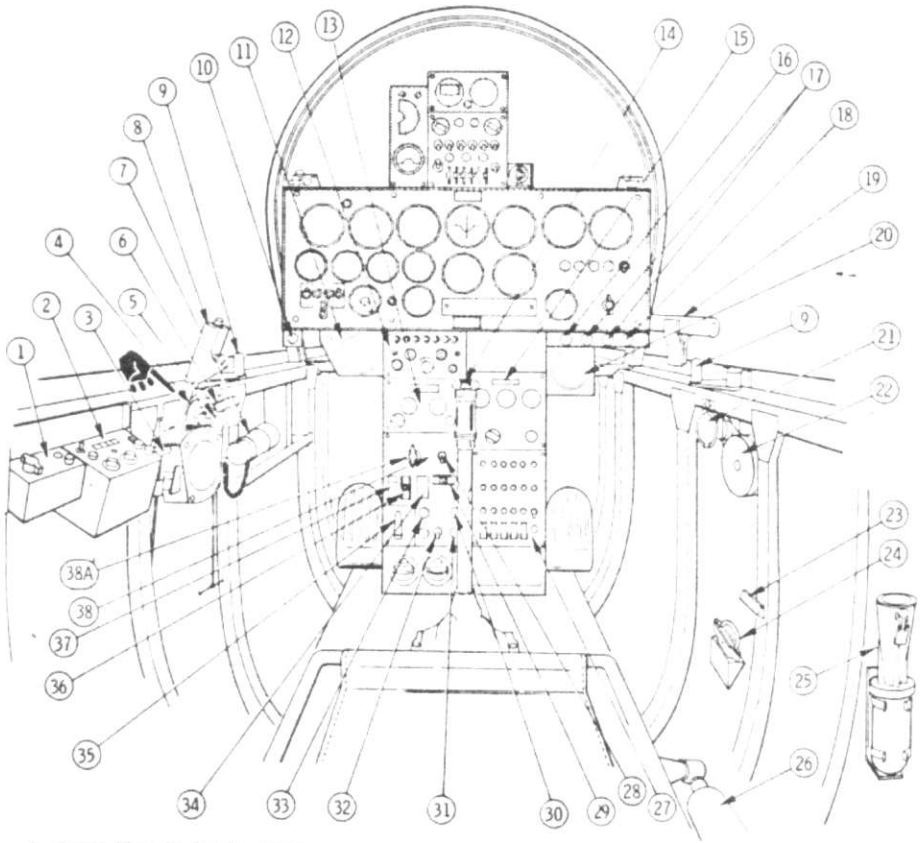
2-41. The YO-3A is equipped with a constant-speed, governor-regulated, three-blade, 100-inch-diameter propeller. The propeller consists of hub, three wooden blades, bulkhead assembly, fitting, spinner, and slot cover.

2-42. REDUCTION DRIVE SYSTEM.

2-43. The reduction drive system provides a propeller rpm reduction of 3.33:1 to the engine crankshaft rpm through a system consisting of a flywheel drive shaft assembly, propeller drive shaft assembly, 12 V-belts, and a reduction housing assembly.

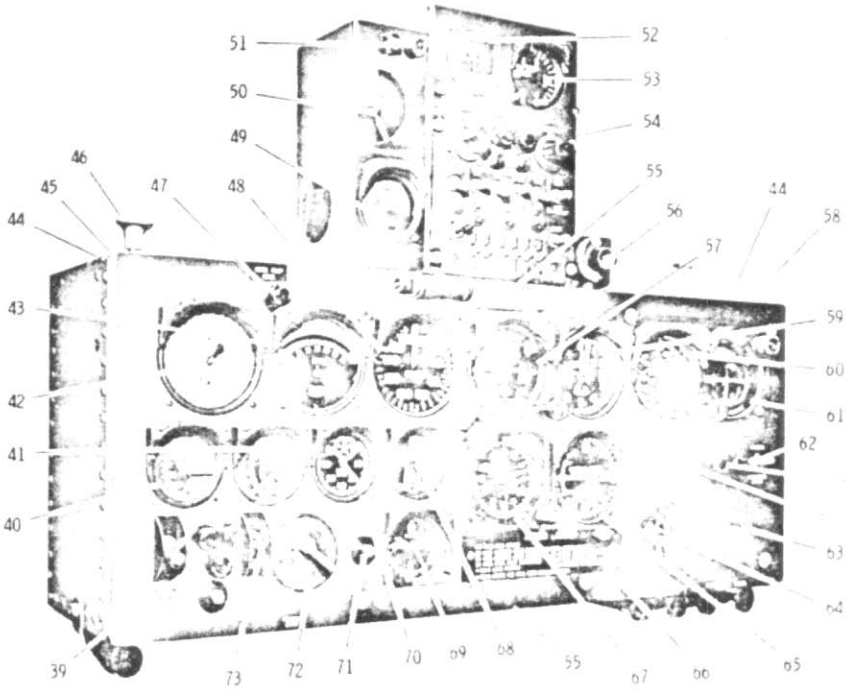
2-44. OIL SUPPLY SYSTEM.

2-45. Oil for engine lubrication is supplied from a sump mounted on the bottom of the engine. The oil is drawn from the sump by an engine-driven, gear-type oil pump, through an oil suction screen to the suction side of the pump. Oil under pressure is then forced through the oil pressure screen, through the oil cooler, and out to the engine. Oil returns to the sump by gravity flow. A "vernatherm" temperature control valve located in the oil cooler adapter regulates oil temperature. The oil filler neck is located aft on the upper left side of the engine. It



1. TACAN CONTROL PANEL - C2010
2. ADF CONTROL PANEL - C7392
3. LANDING GEAR EMERGENCY RELEASE
4. PROPELLER CONTROL
5. SPOILER EMERGENCY RELEASE CABLE
6. MIXTURE
7. MAP LIGHT
8. THROTTLE QUADRANT
9. CANOPY RELEASE
10. ALTERNATE AIR
11. AZIMUTH & ELEVATION READOUT INDICATOR
12. ICS CONTROL PANEL - C6533
13. VHF CONTROL PANEL - ARC114
14. SPOILER ACTUATOR CONTROL SWITCH
15. UHF CONTROL PANEL - ARC116
16. CABIN AIR CONTROL
17. CREW COMPARTMENT ENVIRONMENT CONTROLS
18. PARKING BRAKE
19. CRASH AXE
20. TACAN INDICATOR - ID663
21. TRIM CONTROL INDICATOR
22. TRIM CONTROL
23. MAP CLIP
24. CANOPY EMERGENCY RELEASE
25. RELIEF BOTTLE
26. FIRE EXTINGUISHER
27. SWITCH/CIRCUIT BREAKER PANEL
28. TAXI LIGHT SWITCH
29. FUEL PUMP BOOST
30. LASER FIRING INDICATOR LIGHT
31. LASER OPERATING INDICATOR LIGHT
32. SAFE SWITCH
33. MISSION EQUIPMENT POWER ON LIGHT
34. ALTERNATOR WARNING PANEL
35. FUEL SELECTOR
36. MAIN ALTERNATOR SWITCH
37. MAIN BUS TRIM
38. STANDBY ALTERNATOR SWITCH (NOT SHOWN)
38A. GROUND-OFF-FLIGHT SWITCH

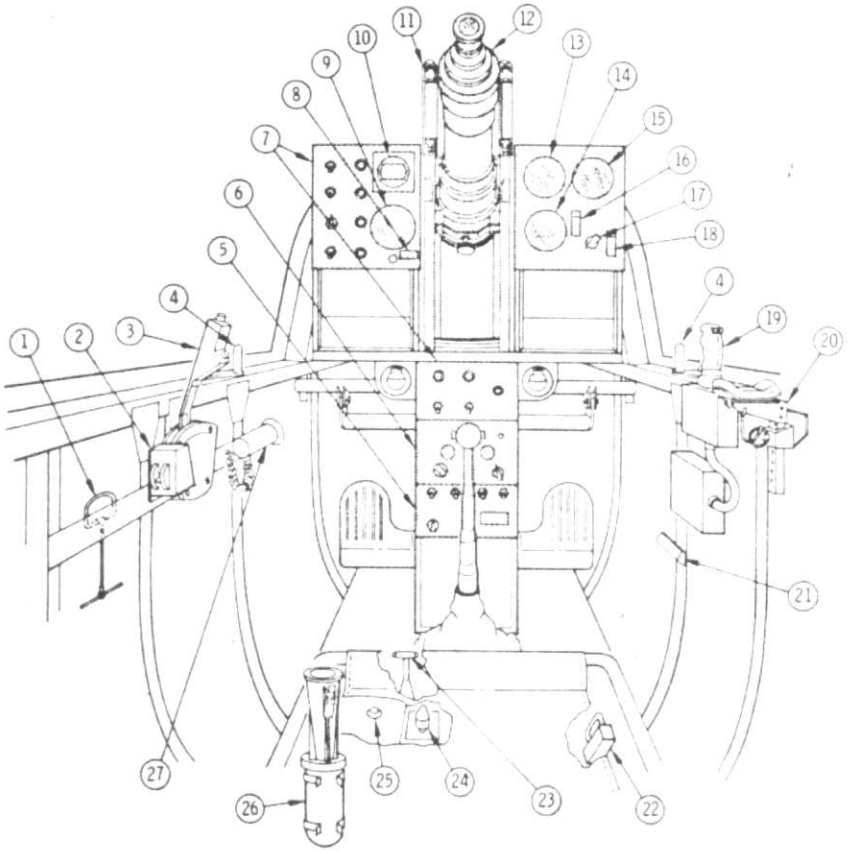
Fig. 2-6 Pilot's Compartment Arrangement



INSTRUMENT PANEL DETAIL

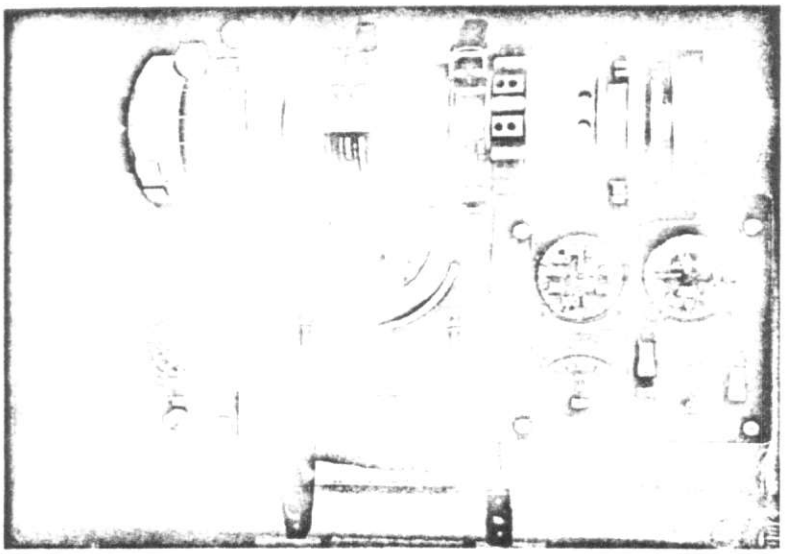
39. LANDING GEAR GROUP
40. OUTSIDE AIR TEMPERATURE
41. CYLINDER HEAD TEMPERATURE
42. FUEL PRESSURE GAGE
43. TACHOMETER
44. LOW FUEL INDICATOR (NOT SHOWN)
45. FUEL GAGE - L.H. (NOT SHOWN)
46. FUEL SHUTOFF CONTROL
47. COWL FLAP OPEN INDICATOR
48. AIRSPEED INDICATOR
49. EXHAUST GAS TEMPERATURE GAGE
50. SPOILER POSITION INDICATOR
51. SPOILER OPEN INDICATOR
52. MAGNETIC COMPASS
53. ACCELEROMETER
54. IFF CONTROL PANEL - C6280
55. DEVIATION CARD HOLDER (MAGNETIC COMPASS)
56. MAP LIGHT MOUNTING POST (ALTERNATE POSITION)
57. ATTITUDE GYRO
58. FUEL GAGE - R.H. (NOT SHOWN)
59. ALTIMETER
60. ENGINE GAGE UNIT - OIL PRESS., OIL TEMP
61. TACAN INDICATOR - ID387
62. MAGNETIC/DIRECTIONAL GYRO SWITCH
62A. CHIP DETECTOR WARNING LIGHT (NOT SHOWN)
62B. STANDBY INVERTER SWITCH (NOT SHOWN)
63. RHEOSTAT - PANEL DIM
64. VOLTAMMETER
65. VERTICAL SPEED INDICATOR
66. PLACARD
67. ADF INDICATOR - ID1351
68. TURN-AND-BANK INDICATOR
69. CLOCK
70. MANIFOLD AIR PRESSURE
71. START BUTTON
72. IGNITION SWITCH
73. COWL FLAP CONTROL

Fig. 2-6 Pilot's Compartment Arrangement (Contd.)

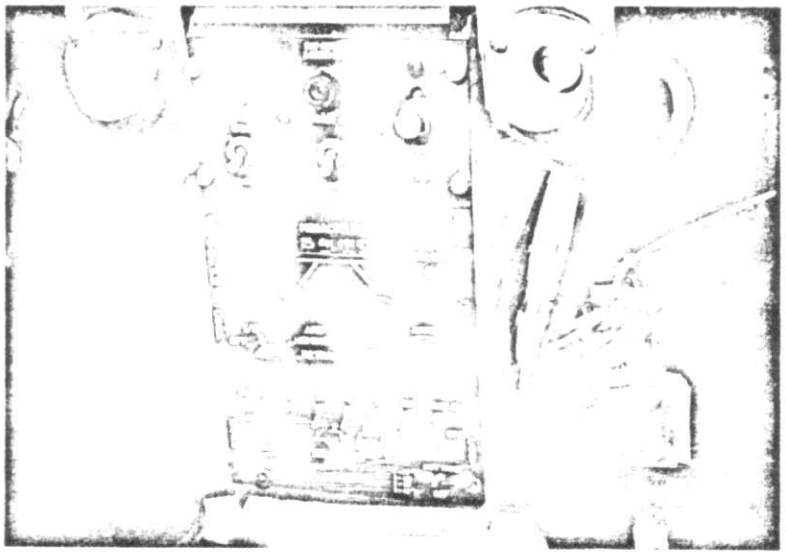


1. SPOILER EMERGENCY RELEASE
2. SPOILER ACTUATOR CONTROL SWITCH
3. THROTTLE QUADRANT
4. CANOPY RELEASE
5. I.C.S. CONTROL PANEL – C6533
6. V.H.F. CONTROL PANEL – ARC 114
7. MISSION EQUIPMENT CONTROL PANELS
8. DEVIATION CARD HOLDER
9. AZIMUTH & ELEVATION READOUT INDICATOR
10. MAGNETIC COMPASS
11. OCULAR SECTION CRADLE SUPPORT CLAMPS
12. NIGHT VIEWING AERIAL PERISCOPE
13. AIRSPEED INDICATOR
14. TACHOMETER
15. ALTIMETER
16. IGNITION CUT-OFF SWITCH
17. RHEOSTAT-PANEL DIM
18. TAXI LIGHT
19. HAND CONTROLLER
20. ARM REST
21. MAP CASE OR CLIP
22. CANOPY EMERGENCY RELEASE
23. LANDING GEAR EMERGENCY RELEASE
24. FUEL SELECTOR
25. MIKE FOOT SWITCH
26. RELIEF BOTTLE
27. MAP LIGHT

Fig. 2-7 Observer's Compartment Arrangement



INSTRUMENT PANEL DETAIL



SUB-PANEL DETAIL

Fig. 2-7 Observer's Compartment Arrangement (Contd.)

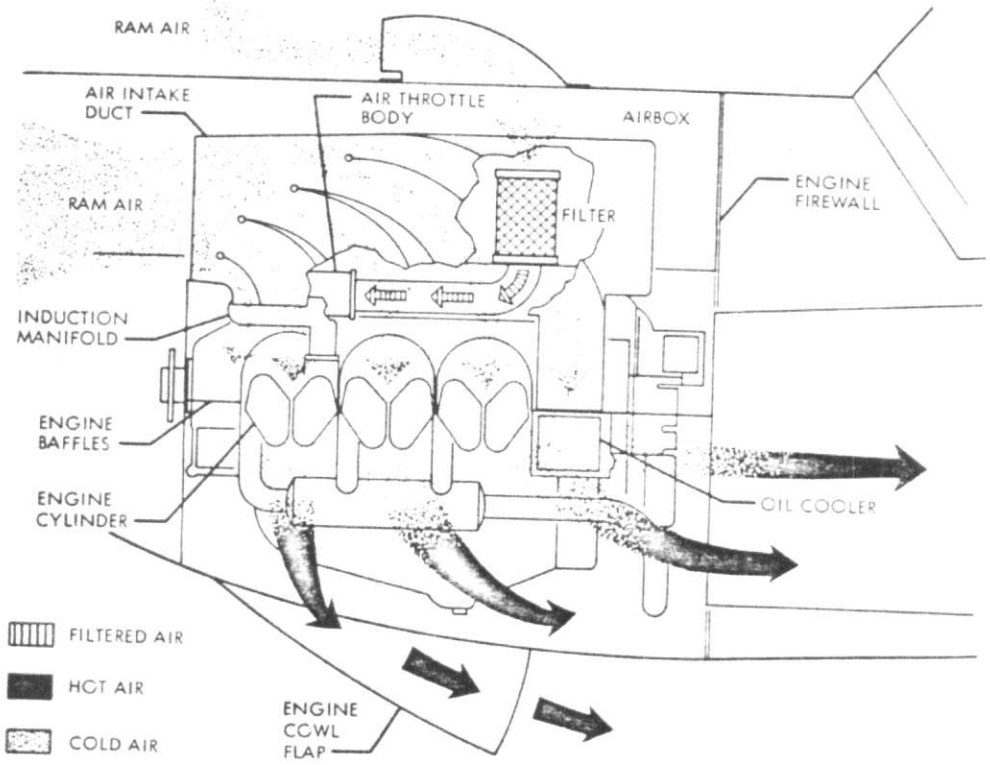


Fig. 2-8 Engine Air Induction Schematic

is accessible through an access panel in the engine cowl. (See Fig. 2-3.) Nine U.S. quarts are required to fill the sump. The oil supply is measured by an oil dipstick (Fig. 2-3), located aft on the mid left side of the engine. The dipstick is accessible through an access panel in the left engine cowl. See Fig. 2-3 for oil specification and grade.

2-45A. CHIP DETECTOR WARNING LIGHT. A chip detector warning light (62A, Fig. 2-6) is located on the right side of the pilot's instrument panel. If a large metal chip or a collection of small metal particles bridges the electrical insulation gap between the magnet and body of the chip detector, located in the engine oil sump, the electrical circuit is completed, and the warning light (amber) illuminates. The warning light has a push-to-test feature.

2-46. FUEL SUPPLY SYSTEM.

2-47. Fuel is supplied to the engine from two fuel cells, located in a removable section of the leading edge of each wing, outboard of the main landing gear (Fig. 2-3). Each cell holds a minimum of 87.55 pounds of 115/145 grade fuel. (See Table 2-1.) Fuel flows from these tanks through check valves to a manually controlled fuel selector valve, a fuel pump boost, a fuel strainer, emergency fuel shutoff valve, and an engine-driven fuel pump and mixture control assembly. (See Fig. 2-9.) A chamber in the engine-driven fuel pump separates the vaporized fuel, which is returned to each fuel cell in use through a vapor return line.

Table 2-1
FUEL QUANTITY DATA

Tank	No.	Usable Fuel (lb)	Unusable Fuel (lb)	Total Weight (lb)
Left	1	87	0.55	87.55
Right	1	87	0.55	87.55

Note: The amount of usable fuel will be reduced if the fuel temperature is above 32°F. This reduction will be 1% for each increment of 15°F increase.

2-48. FUEL SELECTOR VALVE. A rotary-type fuel selector valve and an emergency fuel shutoff valve are incorporated in the fuel system. The fuel selector valve handles are located on the lower left of the pilot's switch panel (35, Fig. 2-6) and on the left rear corner of the observer's control stick pedestal (24, Fig. 2-7). The fuel selector valve handle controls the fuel selector valve through mechanical linkage and has three positions: L, R, and OFF. The OFF position seals off fuel cells from the system and allows no fuel to pass beyond the selector valve.

WARNING

Fuel starvation can occur if the aircraft is held in a yawed condition for more than 30 seconds with tanks less than 1/8 full.

2-49. A control for the emergency fuel shutoff valve is located on the top left corner of the pilot's instrument panel (46, Fig. 2-6) and is normally safety-wired, using soft copper wire to prevent inadvertent operation. Pulling the control knob will shut off the fuel supply to the engine.

2-50. FUEL PUMP BOOST TOGGLE SWITCH. A fuel pump boost toggle switch (29, Fig. 2-6) is located just below the pilot's main instrument panel adjacent to the azimuth and elevation readout indicator. The switch is marked FUEL PUMP BOOST and has three positions: LOW (actuates to the left and is spring-loaded to return to the OFF position), OFF (midposition), and HIGH (right position). The FUEL PUMP BOOST switch must be held in LOW position to operate the pump at low speed (which supplies a sufficient amount of fuel for priming and starting the engine). The HIGH position of the FUEL PUMP BOOST switch is used for engine operation only if the engine-driven fuel pump should fail, or for vapor purging in extremely hot weather.

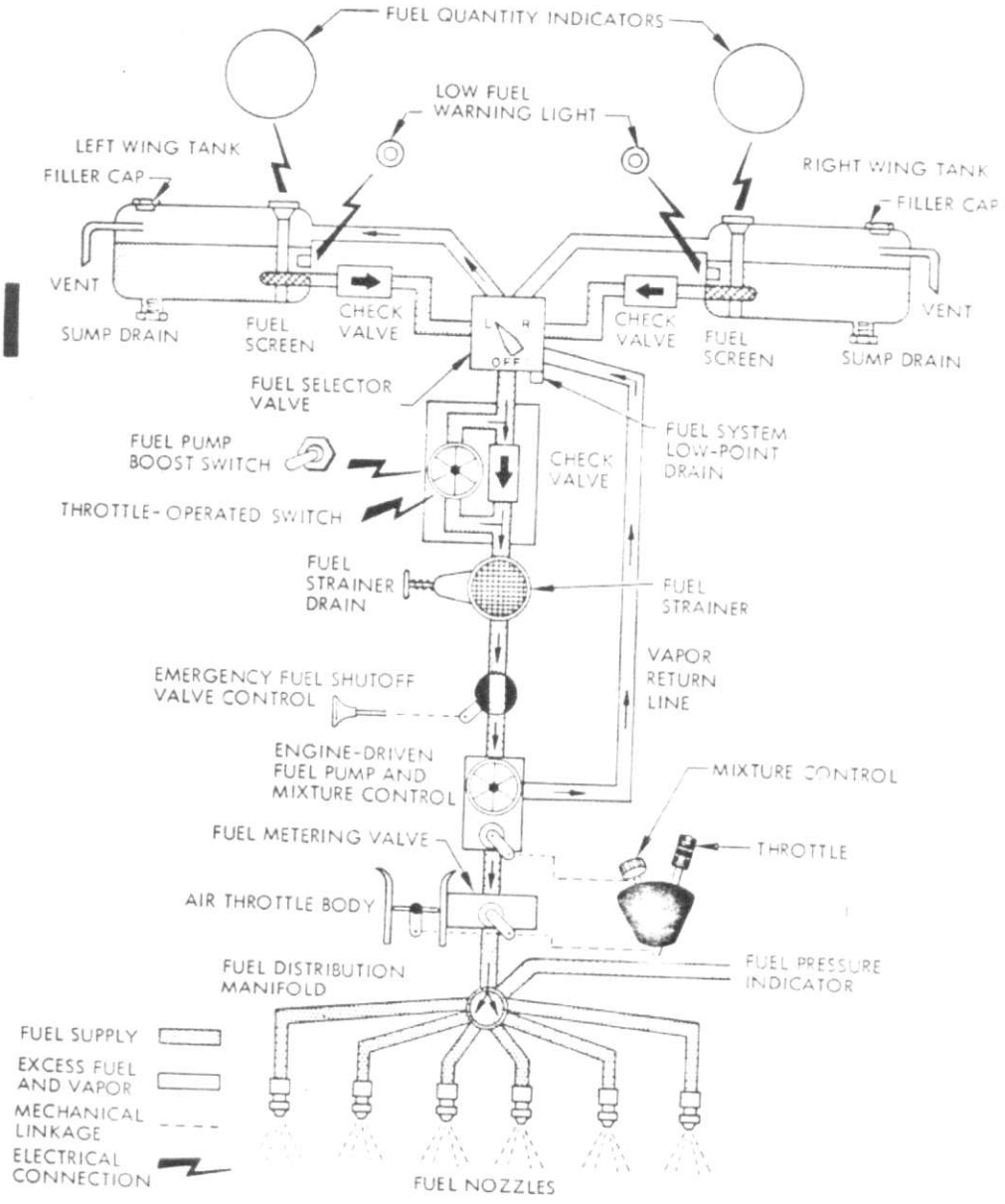


Fig. 2-9 Aircraft Fuel System

WARNING

Do not use the fuel pump boost during normal engine operation. The engine-driven pump produces a fuel/air ratio considerably richer than best power. For vapor elimination, the fuel pump boost may be used with the engine operating and the switch in HIGH position; however, it may be necessary to lean the mixture to prevent an excessively rich mixture.

2-51. FUEL PUMP BOOST MICROSWITCH (OBSERVER'S QUADRANT). A microswitch is located in the observer's control quadrant to control the fuel pump boost when the pump toggle switch is in the HIGH position. When the switch is in this position, the pump operates at one of two flow rates, depending on the setting of the throttle. With the pilot's or observer's throttle set above 1800 rpm, the pump is operating at maximum capacity, supplying sufficient fuel flow to maintain flight. When the throttle is moved below 1800 rpm, the flow rate is automatically reduced, preventing an excessively rich mixture during periods of reduced engine power.

2-52. FUEL DRAIN VALVES. Each fuel cell (see Fig. 2-3) contains a self-locking drain valve located at the bottom of the cell. The valves are used to drain water and sediment from the fuel cells. The fuel strainer, located in the left wing root, and the fuel selector valve each have drain valves. The drain valve on the bottom of the fuel selector valve is the low-point drain in the fuel system.

2-53. FUEL QUANTITY INDICATORS. Two capacitance-type fuel quantity indicators located near the top left and right corners of the pilot's instrument panel (45, 58, Fig. 2-6) display pounds of fuel remaining in each fuel cell. A low-level warning light (44, Fig. 2-6) on each fuel quantity indicator comes on when 18 pounds of fuel remain in the left tank and 11 pounds of fuel remain in the right tank.

2-54. ELECTRICAL POWER SUPPLY SYSTEM.

2-55. The aircraft electrical system is powered by a 28-volt dc bus, supplied by the main (belt-driven) alternator during normal operations and by a standby (engine-driven) alternator in the event that the main alternator fails. An 11-ampere-hour nickel-cadmium battery floats on the bus with either alternator selection. If the main alternator fails, transfer to the standby alternator is effected by lifting the guarded switch marked STANDBY ALTERNATOR and raising the switch.

2-55A. If selection of the standby alternator does not return power to the direct current bus system, perform the following steps:

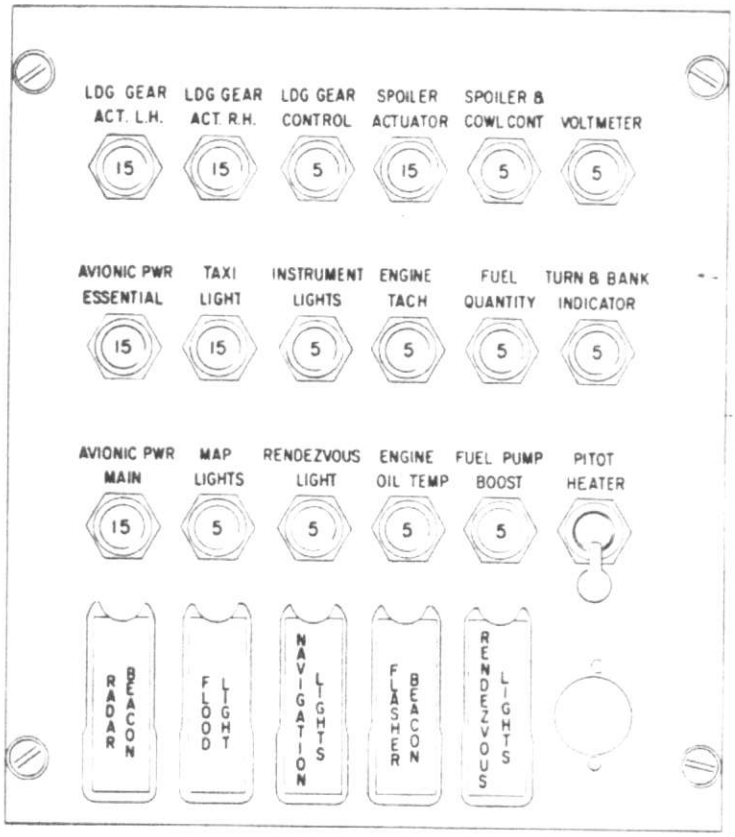
a. Close guard on standby alternator switch.

b. Move alternator ON-OFF switch to OFF.

c. Lift guard and raise BUS TRIM SWITCH. (37, Fig. 2-6). With the main bus isolated, the battery is capable of supplying the essential bus load for a minimum of 30 minutes with the alternator inoperative or switched off. The equipment that operates from the main bus and essential bus is identified in Fig. 2-11.

2-56. EXTERNAL POWER RECEPTACLE. The dc power supply system can be connected to an external power source for engine starting and all other ground electrical services through the external power receptacle (Fig. 2-3), located on the right side of the aircraft. The receptacle is protected by a spring-loaded door. When external power is connected to the aircraft electrical system the GRD-OFF-FLT switch must be in the GRD position. With this switch in the GRD position the aircraft battery is isolated from the system.

2-57. CIRCUIT BREAKERS. All electrical circuits of the aircraft (with the exception of the starter) are protected from overload by manual-reset, push-pull or toggle-type circuit breakers located on the pilot's subpanel (27, Fig. 2-6). A detailed view of the circuit breaker panel is shown in Fig. 2-10. The pitot heater, radar beacon, floodlight, navigation lights, flasher beacon, and rendezvous lights are protected by toggle-type circuit breakers which also function as switches. In addition, the toggle-type circuit breakers (with the exception of the breaker for the pitot heater) have protecting safety covers to provide against inadvertent switching. With the covers closed, the circuit breakers are OFF. Should an overload condition occur, the circuit breakers will



FRONT VIEW

Fig. 2-10 Circuit Breaker Panel (Pilot's Compartment Only)

either pop out or trip, breaking the circuit. A push-button type circuit breaker can be reset by pushing it in, thus reenergizing the circuit; a toggle-type circuit breaker can be reset by switching it to the "on" position. If a circuit breaker trips a second time, the circuit should not be energized again.

CAUTION

Circuit breakers should not be pulled out or reset without a thorough understanding of all the effects and results. A circuit breaker that continues to pop out after being reset could result in an electrical fire, and further attempts to reset it should be discontinued.

2-58. GROUND-OFF-FLIGHT SWITCH. The GRD-OFF-FLT switch (38, Fig. 2-6) is located on the center left portion of the pilot's subpanel. The switch is used to disconnect the battery from the aircraft electrical supply system either when the engine is to be shut down or when external power is connected via the external power receptacle. The switch has three positions: GRD, OFF, and FLT. When the switch is in the FLT position, the battery is connected directly to the 28-volt dc bus. When in the GRD position, the switch disconnects the battery from the circuit but allows power to flow from the external

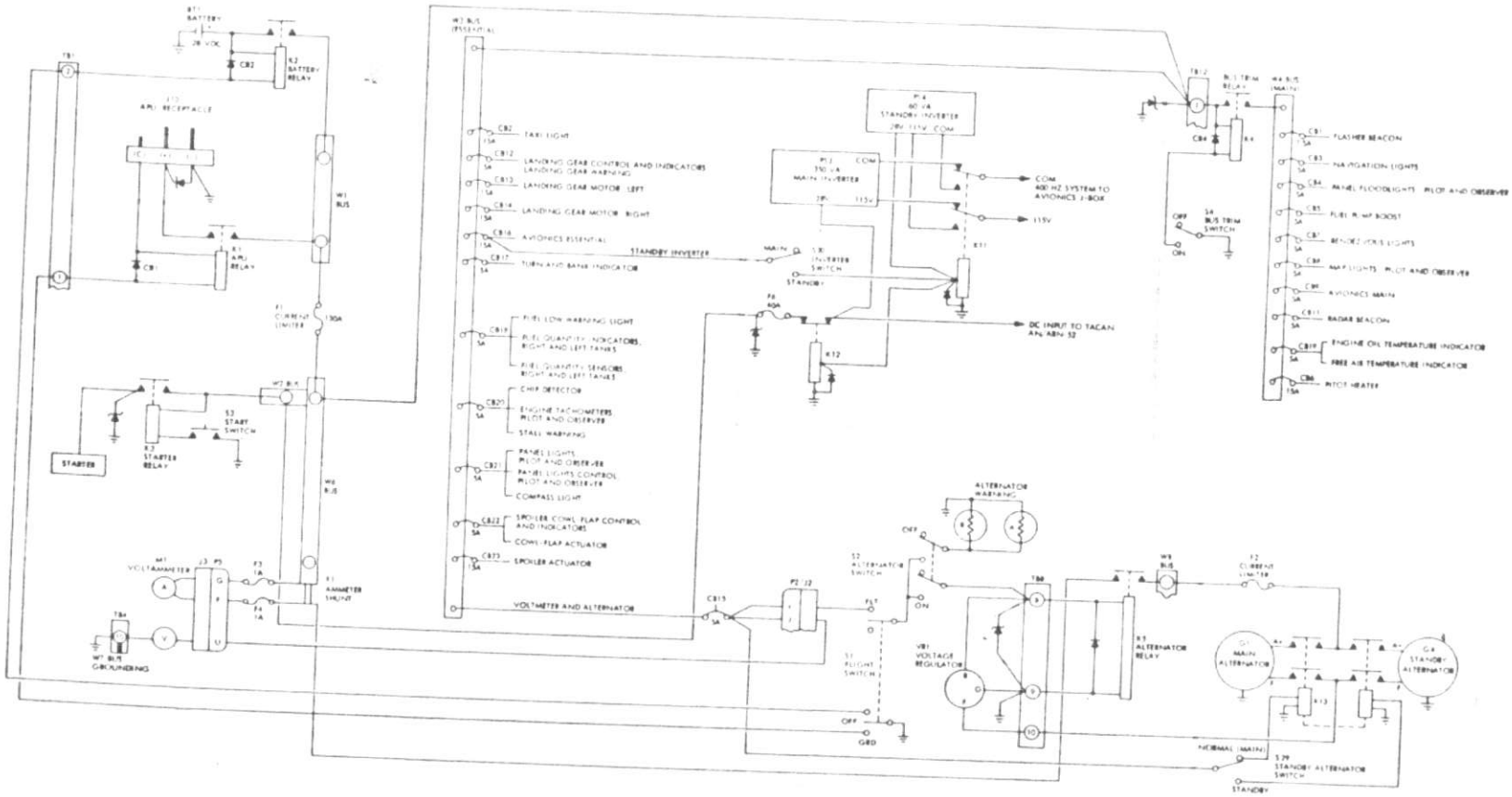


Fig. 2-11 Power Distribution Schematic, Simplified

power supply via the external power receptacle.

2-59. MAIN BUS TRIM SWITCH. The MAIN BUS TRIM switch (37, Fig. 2-6) is located on the lower left portion of the pilot's subpanel. This switch is used to isolate the main bus from the essential bus in the event a reduced power load is desirable (as in the case of alternator failures). The switch has two positions: ON and OFF. When in the OFF position, only the essential bus receives power.

2-60. ALTERNATOR SWITCHES. The main alternator switch (36, Fig. 2-6) and the standby alternator switch (38, Fig. 2-6) are located on the lower left portion of the pilot's subpanel. The main alternator switch has two positions – ON and OFF. In the OFF position, the main alternator switch disconnects the main or standby alternator (if selected) from the aircraft electrical system. With the main alternator switch in the ON position, and the standby alternator switch in the OFF position, the main alternator will supply direct current to the 28-volt dc bus. During normal operation, the main alternator switch is in the ON position, and the standby alternator switch is in the OFF position.

WARNING

The main alternator switch must be positioned at ON for the main alternator or the standby alternator to supply direct current to the dc bus.

2-61. ALTERNATOR WARNING PANEL. The alternator warning panel (34, Fig. 2-6) is located on the center left portion of the pilot's subpanel. This panel, labeled ALT. WARN LIGHT, contains two lights: an amber light that illuminates when the voltage of the alternator in service drops below 26 volts, and a red light that comes on when voltage of the alternator in service exceeds 30 volts. Illumination of the red light indicates excessive voltage from the alternator which may damage the battery or avionics components.

2-61A. STATIC INVERTERS. A main inverter converts 28 volts dc to 115 volts ac for the attitude gyro, gyromagnetic compass, and TACAN. In an emergency, a standby static inverter can provide power for the attitude gyro and gyromagnetic compass, but it does not have sufficient capacity to operate the TACAN. The main inverter is on whenever the GRD-OFF-FLT switch (38A, Fig. 2-6) is in either the FLT or GRD position, if an APU is operating, and the standby inverter switch (62B, Fig. 2-6) is in the OFF position. When the standby inverter is turned on by lifting the switch (62B, Fig. 2-6), the TACAN and main inverter are isolated from the electrical system. A failure

of the main inverter can be detected visually by the appearance of OFF flags in the TACAN course indicator and bearing distance heading indicators, the attitude gyro, and the gyromagnetic compass.

2-62. VOLTAMMETER. The voltammeter (64, Fig. 2-6) is located on the lower right portion of the pilot's instrument panel. This instrument indicates the magnitude of current flowing from the alternator, as well as the voltage present at the bus bar at any given time.

2-63. FLIGHT CONTROL SYSTEM.

2-64. Conventional stick and rudder pedal controls are provided in both the observer's and pilot's compartments. The primary flight control surfaces (ailerons, stabilator, and rudder) are activated by mechanical linkage and control cables. The stabilator contains a trim tab that can be manually adjusted in flight by use of a trim tab control wheel located on the right side of the pilot's compartment.

2-65. CONTROL STICKS. Aileron and stabilator control is maintained by a control stick in each compartment. The sticks are mechanically interconnected to permit control from either compartment. The forward control stick can be telescoped upward when needed.

2-66. RUDDER PEDALS. Two sets of interconnected rudder pedals are provided to mechanically operate the rudder and the steerable tail wheel. The position of the pedals can be adjusted 1 inch fore and aft.

2-67. STABILATOR TRIM TAB CONTROL WHEEL. A stabilator trim tab control wheel (22, Fig. 2-6) is located on the right side of the pilot's compartment. The control wheel is mechanically connected to the trim tab by cables and a screw-jack actuator.

2-68. STABILATOR TRIM TAB POSITION INDICATOR. A stabilator trim tab position indicator (21, Fig. 2-6) is located on the right side of the pilot's compartment, just forward of the trim tab control wheel. The indicator shows whether the tab is in NEUTRAL, NOSE UP, or NOSE DOWN position.

2-69. RUDDER AND AILERON TRIM TABS. Fixed, ground-adjustable trim tabs are provided for the rudder and right aileron.

2-70. SPOILERS. The spoilers are actuated by an electric linear actuator that drives a torque tube interconnecting the spoilers. The mechanism that connects the actuator to the torque tube has a fail-safe release mechanism. The spoiler open indicator light (51, Fig. 2-6) comes on whenever the spoilers are open. The position of the spoilers is indicated on the spoiler position indicator (50, Fig. 2-6).

2-71. SPOILER ACTUATOR CONTROL SWITCHES. The position of the spoilers is controlled by either the spoiler actuator switch on the pilot's control stick (14, Fig. 2-6) or the observer's switch (2, Fig. 2-7) located on the aft end of the observer's throttle quadrant. Aft movement of the spoiler actuator switch on the pilot's control stick opens the spoilers to the OPEN position; forward movement of the switch closes the spoilers to the CLOSED position. Upward movement of the spoiler actuator switch on the observer's throttle quadrant closes the spoilers to the CLOSED position; downward movement of the switch opens the spoilers to the OPEN position.

2-72. SPOILER EMERGENCY RELEASE CABLE CONTROL. A spoiler emergency release control is located in both the pilot's and observer's compartments. In the pilot's compartment the control (5, Fig. 2-6) is situated between the throttle quadrant and the map light. In the observer's compartment the control (1, Fig. 2-7) is located immediately aft of the throttle quadrant. This cable is spring-loaded and, when actuated, disengages the torque tube, allowing air pressure to force the spoiler control surfaces to the CLOSED position. After flight tests or demonstration of the spoiler emergency release control in flight, the spoilers can be made operable by moving the spoiler switch (7, Fig. 2-5 or 14, Fig. 2-6) to the CLOSED position, thereby reengaging the torque tube to the spoiler actuator.

2-73. LANDING GEAR SYSTEM.

2-74. The landing gear system consists of two retractable main landing gear assemblies and one steerable tail wheel assembly, each having a single wheel. (See Fig. 2-2). The main landing gear assemblies have air/oil oleo-type shock absorber struts. Tail wheel suspension is of the cantilever spring type. Tail wheel steering is accomplished (for deflections to 30 degrees) by use of the rudder control system. Deflections over 30 degrees result in unlimited swiveling. A spring override has been provided in the tail wheel steering system to minimize the effects of induced loads on the rudder control system.

2-75. The main landing gear assemblies retract into a wheel well in the leading edge of the wing, and the opening is covered by doors that are faired to the wing contour. A positive-acting, electrically actuated mechanical linkage extends and retracts the main landing gear. The normal retraction time is 10 seconds; extension time is 7 seconds. Each gear has a separate actuator. A squat switch has been incorporated in the right-hand strut to prevent inadvertent retraction of the gear on the ground. In an emergency, the main landing gear assemblies can be extended and locked in the down position by actuating the release handle (3, Fig. 2-6, and 23, Fig. 2-7). Actuation of this handle permits the gear to be lowered by gravity, and a latch and mating hook ensures the locking of the gear in the down position.

2-76. LANDING GEAR INDICATOR AND CONTROL GROUP. The landing gear indicator and control group (39, Fig. 2-6) is located on the lower left portion of the pilot's instrument panel. This group contains the landing gear actuator switch (LDG GEAR CONTROL) and the gear-down indicators. The two green indicator lights come on when the landing gear are down and locked. The amber operating light comes on whenever the landing gear are in motion during lowering or raising operation.

2-77. A landing gear audible warning is provided when the throttle is retarded and the landing gear switch is in the up position. This warning is produced by a tone generator and is heard in the pilot's and observer's headsets. Depressing the LDG GEAR BUZZER cutoff switch with the throttle retarded deactivates the tone signal. When the throttle is advanced, the warning buzzer/tone circuit is reset so that the next time the throttle is retarded with the landing gear switch in the up position the tone will sound.

2-78. BRAKE SYSTEM.

2-79. Multi-disc, hydraulic brakes on the main wheels are applied by toe pressure on the front or rear rudder pedals. Rotation of the pedals actuates the hydraulic brake cylinders. The parking brake is set by lifting the safety locking clip, depressing the rudder pedals, and pulling out the push-pull handle marked PARK (18, Fig. 2-6), which is located at the lower right corner of the pilot's instrument panel. (This safety clip has been added to prevent inadvertent activation.)

2-80. INSTRUMENTS.

2-81. The following paragraphs provide general information concerning the aircraft instrument systems. Information concerning engine instruments will be found under the earlier subsection covering the engine; in like manner, instrument data covering other aircraft subsystems will be found in the description of that particular subsystem. Instrument markings are illustrated in Chapter 7.

2-82. PILOT'S COMPARTMENT INSTRUMENTS. The pilot's compartment contains a full complement of flight and aircraft systems instruments. The identity and location of these instruments are given in Fig. 2-6.

2-83. OBSERVER'S COMPARTMENT INSTRUMENTS. The observer's compartment contains the minimum instruments for safe flight under VFR conditions. The instruments (Fig. 2-7) are mounted on a shock-mounted panel in the upper right portion of the compartment.

2-84. ELECTRICALLY OPERATED INSTRUMENTS. Instruments operating on power from the aircraft 28-volt dc electrical system include the turn-and-bank indicator, automatic direction finder (ADF) azimuth indicator, course indicator, tachometer, oil temperature, fuel gages, and free-air temperature gage. The attitude gyro and gyromagnetic compass use 115-volt, 400-cycle power developed by the static inverter or the standby static inverter.

2-85. PITOT-STATIC SYSTEM. The airspeed indicator (48, Fig. 2-6, and 13, Fig. 2-7) uses the difference between impact and static air pressure. The altimeter (59, Fig. 2-6, and 15, Fig. 2-7) is calibrated in feet and uses a Kollsman window. A vertical speed indicator (65, Fig. 2-6) is calibrated in feet per minute. The pitot-static system provides static pressure to the altimeters and vertical speed indicator, and static and impact pressures to the airspeed indicators. The pitot-static tube (Fig. 2-3), which can be heated electrically, is mounted on the right wing.

2-86. MAGNETIC COMPASS. The magnetic compass (52, Fig. 2-6, and 10, Fig. 2-7) is used for setting the directional gyro when the MAGNETIC/DIRECTIONAL GYRO SWITCH (62, Fig. 2-6) is in the DIRECTIONAL GYRO position, and for emergency purposes. Compass deviation cards (55, Fig. 2-6, and 8, Fig. 2-7) indicate magnetic deviation steering corrections.

2-87. GYROMAGNETIC COMPASS. A remote gyromagnetic compass transmitter is located in the left wing. It provides a visual display when the MAGNETIC/DIRECTIONAL GYRO switch (62, Fig. 2-6) is placed in the MAGNETIC position. Heading information is displayed on the ID-1351 and ID-663 indicators (67 and 20, Fig. 2-6).

2-88. CLOCK. An 8-day, stem-wind clock (69, Fig. 2-6) is located on the instrument panel in the pilot's compartment.

2-88A. ACCELEROMETER. The accelerometer (53, Fig. 2-6) indicates the vertical acceleration of the aircraft. The instrument is capable of indicating from 0 to +4 g and from 0 to -2 g (±0.1 g). The primary pointer indicates instantaneous acceleration. Two secondary pointers indicate maximum positive g and maximum negative g reached during a particular maneuver. These secondary pointers can be reset to 0 by depressing the PUSH TO SET button on the instrument face.

2-89. EMERGENCY EQUIPMENT.

2-90. CRASH AXE.

2-91. A crash axe (19, Fig. 2-6) is located inside the aircraft on the lower right side of the canopy. This axe is accessible to both the pilot and observer and can be used to break the canopy for emergency egress.

2-92. HAND-OPERATED FIRE EXTINGUISHER.

2-93. A dry chemical fire extinguisher is mounted in a bracket near floor level to the right of the pilot's seat (26, Fig. 2-6). This extinguisher is effective in combatting electrical and fuel-type fires. The contents of this extinguisher are not toxic.

2-94. SAFETY BELTS AND SHOULDER HARNESSES.

2-95. A safety belt and shoulder harness, with associated inertia reel, are supplied for each crew member. The safety belts are bolted to brackets on the fuselage. The inertia reel for the front compartment is mounted beneath the shoulder harness bar; the reel in the rear compartment is mounted on the overturn structure. The controls for the inertia reels are located on the left side of the pilot's and observer's seats. The forward position is "locked"; the rear position is "automatic" (unlocked).

2-96. PRE-STALL WARNING.

2-97. A pre-stall warning system gives the pilot advance warning of a stall. This system takes into account the aircraft weight, angle of bank, attitude, acceleration, and air density. The system consists of a wing detector unit that closes a circuit upon approach to a stall, causing a tone generator signal to be heard in the pilot's and observer's headsets. There is no provision for deactivating the prestall warning signal except by pulling circuit breaker CB20.

2-98. CANOPY.

2-99. A transparent, acrylic, one-piece canopy (Fig. 2-3) encloses the two flight compartments.

The canopy is hinged at the rear end and can be rotated up manually to the vertical position to permit ingress and egress. The inside canopy release handles (9, Fig. 2-6, and 4, Fig. 2-7) are located on the canopy railings on both sides of the pilot's and observer's flight compartments. The canopy locking mechanism is released from outside the aircraft by means of a T-handle that projects through the canopy on both sides of the aircraft. The outside handles are located exactly opposite, and are mechanically connected to, the pilot's inside canopy release handles.

WARNING

The outside emergency canopy control is located below the T-handle normally used to unlock the canopy from the outside. When opening the canopy from the left side of the aircraft be sure to avoid the emergency eject control. Use the T-handle.

The canopy can be latched in a partially open position for ground operations, but it must be closed and locked during flight.

CAUTION

During landing operations do not attempt to raise the canopy to the vent position until the aircraft has been brought to a stop.

2-100. CANOPY EMERGENCY RELEASE CONTROL.

2-101. A canopy emergency release control (24, Fig. 2-6, and 22, Fig. 2-7) is located on the lower right side of the pilot's and observer's flight compartments, just above floor level. The canopy will be ejected when the emergency ejection ring is pulled. The emergency control for ejecting the canopy from outside the aircraft is located on the left side of the fuselage, just below the canopy at the pilot's compartment. This release control is marked DANGER above the release latch and CANOPY EJECT below the latch.

2-102. CANOPY SAFETY LINE.

2-103. A canopy safety line is provided as flyaway equipment. The safety line is designed for two purposes: it is used to secure the canopy when the aircraft is on the ground, and it provides a means for controlling the movement of the canopy during raising and lowering operations. The line has two pip pins, connected by a short steel cable, that plug into receptacles in the canopy frame and fuselage for securing the canopy. An attached 15-foot nylon web is used by ground crewmen to raise or lower the canopy. The safety line must be used whenever the canopy is to be raised or lowered.

CAUTION

Do not raise the canopy after a landing (or after ground operations in which the canopy has been closed) until ground crewmen have connected the canopy safety line and are ready to assist with raising the canopy.

2-104. SEATS.

2-105. The seats are constructed of tubular steel frames with nylon bottom and back. The seat bottom accommodates a seat-type parachute. The seats can be adjusted upward a total of 2 inches in 1-inch increments. Adjustment is accomplished on the ground by removing the fasteners, adjusting the seat, and reinstalling the fasteners.

2-106. AUXILIARY EQUIPMENT.

2-107. The following items of auxiliary equipment are covered in Chapter 6:

a. Heating and Ventilation System
b. Defogging
c. Pitot Heater
d. Lighting Equipment
e. Miscellaneous Equipment

2-108. DESTRUCTION OF AIRCRAFT.

2-109. In case the aircraft must be abandoned, use the crash axe, small arms fire, and any other devices at hand to render equipment inoperable. Destroy the aircraft by burning as follows:

a. Open fuel drains.
b. Puncture fuel tanks.
c. From a safe distance, ignite fuel.

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b. Puncture fuel tanks.
c. From a safe distance, ignite fuel.

Chapter 3
NORMAL PROCEDURES

Section I
SCOPE

3-1. GENERAL.

3-2. This chapter deals with the procedures required to ensure safe and efficient operation of the YO-3A aircraft. The YO-3A mission equipment is described in LMSC-687534, YO-3A Mission Equipment Preliminary Operating and Maintenance Manual (POMM) (C).

3-3. The procedural steps contained in this chapter are presented in checklist form and cover flights from the time the flight is planned until it is completed and the aircraft is left properly parked and secured. These checklists include the steps necessary to ensure safe flight under all conditions (night, instrument etc.).

Section II

FLIGHT PROCEDURES

3-4. CHECKLISTS.

3-5. Checklists used by pilots operating this aircraft include (1) the normal and emergency procedures and (2) the condensed normal and emergency procedures. The normal and emergency procedures are contained in Chapters 3 and 4, respectively, and include explanatory material, notes, cautions, and warnings.

3-6. The condensed pilot's checklist is issued to the pilot. This checklist outlines procedures to be followed under specified operating conditions and situations.

3-7. PREPARATION FOR FLIGHT.

3-8. Prior to flight, the pilot should assure that all information in this manual that is applicable to the proposed mission is complied with.

3-9. FLIGHT RESTRICTIONS.

3-10. For limitations imposed on the aircraft, refer to Chapter 7, Operating Limitations.

3-11. FLIGHT PLANNING.

3-12. The required fuel, airspeed, and power settings for takeoff, climb, cruising, and landing may be determined by reference to the performance data contained in Chapter 14.

3-13. TAKEOFF AND LANDING DATA CARD.

3-14. For a discussion of the takeoff and landing data card and the proper means of filling it out refer to paragraph 14-26, Chapter 14.

3-15. WEIGHT AND BALANCE.

3-16. Normally, recommended weight and cg limits for this aircraft are not exceeded by loading arrangements employed during training or tactical operations for which the aircraft is designed. (Refer to Chapter 12, Weight and Balance Computation for weight control data.)

WARNING

Do not operate this aircraft without an occupant in the front seat or without mission equipment installed unless appropriate ballast weights have been added as described in Chapter 12. Disregard of this warning will result in a critical balance problem.

3-17. PREFLIGHT CHECK.

3-18. APPROACHING THE AIRCRAFT.

a. Landing gear safety pins – INSTALLED.

b. Chocks – IN PLACE.

c. APU – IN PLACE.

3-19. BEFORE EXTERIOR CHECK.

3-20. PILOT'S COMPARTMENT. Perform the before exterior check for the pilot's compartment as follows:

a. Canopy lanyard – INSTALLED.

b. Canopy eject safety locks – INSTALL.

c. Control lock – REMOVE.

d. DA Form 2408-13 – CHECK. Check status of aircraft.

WARNING

Check status of ballast entry. Do not operate this aircraft without an occupant in the front seat and mission equipment installed unless appropriate ballast weights have been installed. Disregard of this warning will result in a critical balance problem.

e. Pilot's seat – CHECK. Check security of seat mounting.

f. Trim tab – ZERO. Rotate full up and full down, then set to zero.

g. Canopy emergency release handle – STOWED.

h. Relief bottle – CHECK. Check installed and secure.

i. Fire extinguisher – CHECK. Check installed and secure.

j. Emergency landing gear release handle – STOWED.

k. Mixture control – IDLE CUTOFF. Check movement through quadrant, then idle cutoff.

l. Throttle – CLOSED. Check movement through quadrant, then closed.

m. Emergency spoiler release handle – STOWED.

n. Propeller – HIGH RPM. Check movement through quadrant, then set high rpm.

o. ALT AIR control knob – IN. Check for binding by pulling to full out position, then return to full in position.

p. Landing gear switch – CHECK. Ascertain that landing gear switch is in the DOWN position.

q. Ignition switch – OFF.

r. Clock – SET.

s. Emergency fuel shutoff knob – ON (DOWN) AND SAFETIED.

t. Gyro compass switch – MAGNETIC.

u. Accelerometer – ZERO.

v. Radio and avionics switches – OFF.

w. Fuel tank selector – LEFT.

x. Main bus trim switch – ON AND GUARD DOWN.

y. Alternator switch – ON.

z. Standby alternator switch – OFF.

aa. Standby inverter switch – OFF.

ab. Fuel pump boost switch – OFF.

ac. Taxi light switch – OFF.

ad. External lights switches – OFF AND GUARDS DOWN.

ae. Pilot heat switch – OFF.

af. Circuit breakers – SET.

ag. APU – ON.

ah. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

ai. Fuel pump boost switch – CHECK. Check operation by opening throttle full and placing switch in HIGH position. Close throttle and listen for pump switching to low ratio. Observe fuel pressure gage throughout this check, and conduct check as briefly as possible to preclude engine flooding.

aj. Fuel quantity gages – CHECK. Check fuel quantity.

ak. Warning lights – CHECK. Press to test and adjust for glare.

al. Interior and exterior lights – CHECK. Check operation as required for day or night operation. Leave navigation lights (including flashing beacons) ON until checked.

am. Spoilers – CHECK. Check operation and then open full. Check warning light on and position indicator OPEN.

an. Cowl flap – CHECK. Check operation and then open full. Check warning light on.

ao. MISSION EQUIP. switch – OFF.

3-21. OBSERVER'S COMPARTMENT. Perform the before exterior check for the observer's compartment as follows:

a. Canopy emergency release bottle pressure – CHECK (1550-1650 psi).

b. Radio and avionics switches – OFF.

c. Taxi light switch – OFF.

d. Ignition cutout switch – OFF AND GUARD DOWN AND SAFETIED.

e. Relief Bottle – CHECK. Check installed and secure.

f. Observer's seat – CHECK. Check security of seat mounting.

g. Warning lights – CHECK. Press to test and adjust for glare.

h. All mission equipment switches – OFF.

i. Fuel selection valve-control shaft and stops – CHECK. Check for foreign material entrapment.

j. If mission equipment is to be used, perform daily inspection in accordance with POMM, LMSC-687534.

WARNING

If observer's compartment is to be unoccupied, secure seat belt and shoulder harness, and stow stick before flight.

3-22. EXTERIOR CHECK.

3-23. Perform exterior check following walkaround sequence depicted in Fig. 3-1.

Fuselage, Right Side

a. ADF sense antenna – CHECK.

b. General Condition – CHECK. Check skin for dents, cracks, loose or missing screws and rivets, and obvious damage.

c. Exhaust system – CHECK. Check visible portions of muffler, exhaust pipe, bellows, and hardware for condition, security, and signs of exhaust leaks. Check muffler assembly housing for damage, security, and obstructions.

d. Inverter air vent – CHECK.

e. All access covers – CLOSED AND SECURE.

f. Battery drain hose – CHECK. Check for security and evidence of battery solution spillage.

Empennage

a. Vertical stabilizer – CHECK. Check for security, general condition, dents, loose screws, and rivets.

b. Stabilator – CHECK. Check for security, condition, play at hinge bolts, and travel.

c. Trim tab – CHECK. Check for faired position and condition.

d. Rudder – CHECK. Check for security of attachment at hinges, play, travel, and condition of fabric covering. Check fixed tab for security.

e. Tail wheel – CHECK. Check fairing, support tube, steering cables, and springs for general condition and security. Check support tube for alignment by sighting visually from rear to front.

f. Tire – CHECK. Check for cuts, bruises, wear and inflation.

g. Tiedown eyebolt – REMOVE.

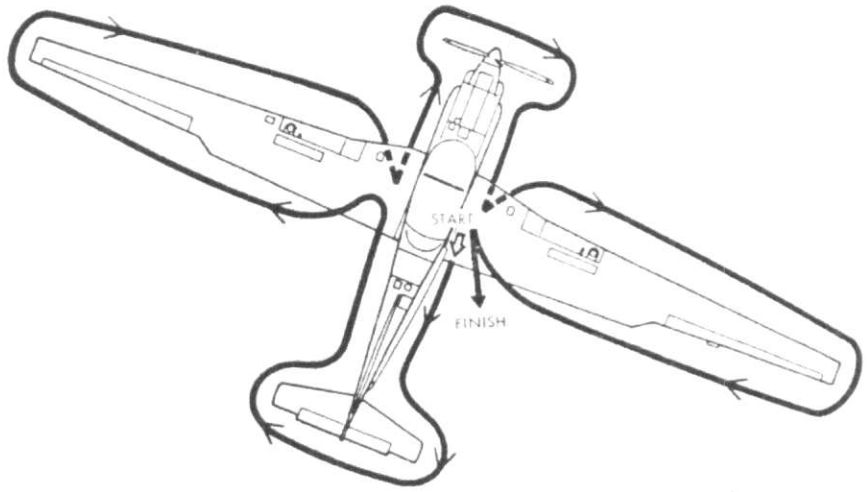


Fig. 3-1 Exterior Check Walkaround Sequence

h. Tail light – CHECK. Check for operation, cleanliness, security, and damage.

i. Tail cone – CHECK. Check tail cone for obvious damage, security, and missing screws.

Fuselage, Left Side

a. General condition – CHECK. Check skin for dents, cracks, loose or missing screws and rivets, and obvious damage.

b. All access covers – CLOSED AND SECURE.

c. IRI dome – CHECK. Check condition, security.

d. Top flashing beacon – CHECK. Check condition, security, and operation.

e. Rendezvous lights – CHECK. Check condition, security, and operation.

Left Wing

a. Fuel cell vent – CHECK. Check security and for obstruction, and for caulking around vent hose.

b. Upper spoiler – CHECK. Check for dents, cracks, distortion, and extension. Examine spoiler fittings for signs of wear or losseness. Sniff-check spoiler area for fuel odors.

c. Wing – CHECK. Check general condition, skin for damage such as buckling, cracking splitting, distortion, or dents.

d. Aileron – CHECK. Check for freedom of movement, travel, signs of excessive wear at hinges, security of bonding cables, fabric covering for condition, and signs of contact between wing and aileron. Check aileron pushrod jam nut for tightness, and rod end for freedom.

e. Wingtip and navigation light – CHECK. Check condition, security, and operation.

f. Tiedown eyebolt – REMOVE.

g. Stall warning vane – CHECK.

h. Access covers – CHECK. Closed and secure.

i. Lower spoiler – CHECK. Check for dents, cracks, distortion, and proper extension. Examine spoiler fittings for signs of wear or looseness.

j. Fuel cell – CHECK. Check immediate cell area for evidence of fuel leaks. Check fuel level visually. Check fuel cap seal for integrity, and ensure that cap is tightly installed with lock mechanism trailed aft.

k. Fuel cell drain – DRAIN AND CHECK FOR LEAKS.

Left Landing Gear

a. General condition – CHECK. Check for alignment and distortion.

b. Oleo – CHECK. Check for leaks and proper strut extension (approximately 2-1/2 inches).

c. Brake lines – CHECK. Check for leaks, damage, deterioration, and security of attachment.

d. Brake assembly – CHECK. Check for signs of excessive heating, condition, and wear.

e. Tire – CHECK. Check for cuts, bruises, wear, inflation, and slippage marks.

f. Actuator and linkage – CHECK. Check for general condition, integrity, and operating clearance. Check emergency downlocks disengaged.

g. Taxi light – CHECK. Check condition and security.

h. Wheel-well area – CHECK. Check area for general condition, obstructions, and foreign matter.

i. Landing gear doors – CHECK. Check for misalignment, damage, and excessive play.

j. Safety pin and chock – REMOVE (IF NO ALERT CREW AVAILABLE).

Forward Lower Fuselage

a. ADF antenna housing – CHECK. Check for security and damage.

b. Lower flashing beacon – CHECK. Check for security, damage, and operation.

c. Fuel pump boost drain hose – CHECK. Check for leakage.

d. Main fuel strainer – CHECK. Check for leakage.

e. Fuel selector valve drain – CHECK. Check for leakage.

f. Wing root area – CHECK. Check general condition and for evidence of fuel leaks.

g. Forward payload – CHECK. Check for security of attachment and signs of damage.

Engine and Propeller

a. Cowl flap – CHECK. Check cowl flap for damage, excessive play, and proper extension (6-1/2 – 7 in.).

b. Lower engine area – CHECK. Check area for evidence of fuel and oil leaks.

c. Oil sump plug – CHECK. Check tight and properly safetied.

d. Drain lines – CHECK. Check lines and grommets for condition, alignment, and signs of excessive leakage.

e. Oil level – CHECK. Check dipstick.

f. Oil filler access cover – CHECK. Ascertain that oil filler access cover is secure.

g. Engine cowling – CHECK. Check general condition, alignment, and for missing or loose screws and locks. Check for evidence of fuel, oil, and exhaust leaks.

h. Engine air intakes – CHECK. Check openings for obstructions and foreign matter or damage.

i. Propeller – CHECK. Check blades and spinner assembly for nicks, damage, and security.

j. Engine cowling – CHECK. Check general condition, alignment, and for missing or loose screws and locks. Check for evidence of fuel, oil, and exhaust leaks.

k. Engine air intake – CHECK. Check opening for obstructions and foreign matter or damage.

l. Wing root area – CHECK. Check general condition and for evidence of fuel leaks.

m. Forward exhaust system – CHECK.

Right Landing Gear

a. General condition – CHECK. Check for alignment and distortion.

b. Oleo – CHECK. Check for leaks and proper strut extension (approximately 2-1/2 inches).

c. Brake lines – CHECK. Check for leaks, damage, deterioration, and security of attachment.

d. Brake assembly – CHECK. Check for signs of excessive heating, condition, and wear.

e. Tire – CHECK. Check for cuts, bruises, wear, inflation, and slippage marks.

f. Actuator and linkage – CHECK. Check for general condition, integrity, and operating clearance. Check emergency downlocks disengaged.

g. Squat switch – CHECK. Check for security and general condition.

h. Wheel-well area – CHECK. Check area for general condition, obstructions, and foreign matter.

i. Landing gear doors – CHECK. Check for misalignment, damage, and excessive play.

j. Safety pin and chock – REMOVE (IF NO ALERT CREW AVAILABLE).

Right Wing

a. Wing – CHECK. Check general condition, skin for damage such as buckling, cracking, splitting, distortion, or dents.

b. Fuel cell – CHECK. Check immediate cell area for evidence of fuel leaks. Check fuel level visually. Check fuel cap seal for integrity, and ensure that cap is tightly installed with lock mechanism trailed aft.

c. Fuel cell drain – CHECK. Drain and check for leakage.

d. Lower spoiler – CHECK. Check for dents, cracks, distortion, and proper extension. Examine spoiler fittings for signs of wear or looseness.

e. Access covers – CHECK. Closed and secure.

f. Pitot static tube – Remove cover and check pitot static tube for condition and security of mounting. Check openings for obstructions.

g. Tiedown eyebolt – REMOVE.

h. Wingtip and navigation light – CHECK. Check condition, security, and operation.

i. Aileron – CHECK. Check for freedom of movement, travel, signs of excessive wear at hinges, security of bonding cables, fabric covering for condition, and signs of contact between wing and aileron. Check aileron pushrod jam nut for tightness, and rod end for freedom.

j. Aileron fixed tab – CHECK. Check for damage and security of attachment.

k. Upper spoiler – CHECK. Check for dents, cracks, distortion, and proper extension. Examine spoiler fittings for signs of wear or looseness. Sniff-check spoiler area for fuel odors.

l. Fuel cell vent – CHECK. Check security and for obstruction, and for caulking around vent hose.

m. Canopy safety eject locks – REMOVE.

3-24. BEFORE STARTING ENGINE.

3-25. Before starting the engine, perform the following steps:

a. Seat belt and shoulder harness – FASTEN AND ADJUST.

b. Parking brake – SET.

c. Canopy safety locks – REMOVE.

d. Canopy – CLOSE. Check for cleanliness, cracking and crazing.

e. Crash axe – SECURE.

f. Canopy safety line – REMOVE.

g. Fire guard – Posted and standing by with fire extinguisher.

h. Avionics equipment – ON. Check all navigation and communication equipment required for the mission. (For this check set GRD-OFF-FLT switch at GRD position; if no auxiliary power unit is available check avionics equipment after engine start.)

i. Avionics equipment and GRD-OFF-FLT switch – OFF.

j. Fuel tank selector – LEFT TANK.

3-26. STARTING ENGINE.

3-27. To start the engine use the following procedure:

a. Throttle – SET. Set at one-third open.

b. Mixture control – FULL RICH.

c. Propeller – HIGH RPM.

d. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

NOTE

If engine is to be started with GRD – OFF-FLT switch in FLT position, pull avionics PWR essential and avionics PWR main circuit breakers to reduce electrical load on aircraft battery. After engine starts, push circuit breakers in.

e. Pilot signals engine start – CLEAR AREA.

f. Ignition switch – BOTH.

g. For normal start, hold fuel pump boost switch in LOW position until 4 – 5 psi indicated on fuel pressure gage, and hold until engine is running.

h. Start button – PRESS. Press until engine starts (do not exceed starter duty cycle, 30 seconds).

CAUTION

Release start button as soon as engine starts. Never engage starter while propeller is still turning as damage to engine and starter drives may result.

NOTE

If engine is hot, press and hold start button until propeller turns six to eight blades. Continue start and hold fuel pump boost switch in LOW position until 4 – 5 psi indicated on fuel pressure gage.

NOTE

If engine does not start promptly, move mixture control to idle cutoff without changing throttle position. When engine starts, move mixture control to FULL RICH.

NOTE

If engine is flooded, use the following procedure:

1. Throttle – FULL OPEN.
2. Mixture control – IDLE CUTOFF.
3. Pilot signals engine start – CLEAR AREA.
4. Engage starter for 10 second to rid cylinders of excess fuel.
5. Throttle – ONE-THIRD OPEN.
6. Fuel pump boost switch – ON.
7. Slowly advance mixture control until fuel pressure indicates 5 psi.
8. After engine starts, release fuel pump boost switch.

i. Oil pressure – CHECK. If no oil pressure indication within 30 seconds, shut down engine immediately and investigate.

j. RPM – Smoothest idle

k. GRD-OFF-FLT switch – FLT.

l. Radio communications and interphone equipment – ON.

m. APU – DISCONNECT. Signal for disconnect.

n. Alternator voltage warning lights – OUT.

o. Voltammeter – CHECK INDICATIONS.

WARNING

If fuel tank ran dry on previous flight, momentary fuel starvation can occur (even though tank has been refilled) because of air entrapment in the fuel line system. Momentary use of low boost when changing tanks is required to assure that no engine fuel starvation occurs.

p. Fuel tank selector – SWITCH. Switch to right tank and momentarily apply low boost until engine runs rough. Release boost pump, and switch back to left tank.

3-28. ENGINE GROUND OPERATION.

CAUTION

Limit ground operation to 5 minutes maximum prior to taxiing.

3-29. BEFORE TAXIING.

3-30. Before taxiing the aircraft, perform the following steps:

a. Spoilers – CLOSE. Check warning light out and position indicator CLOSED.

b. Avionics equipment – ON.

c. ARN-52 TACAN – TURN ON IF REQUIRED.

d. Flashing beacons – AS REQUIRED.

e. Taxi clearance – OBTAIN.

f. Landing gear safety pins – REMOVE.

g. Chocks – SIGNAL GROUND CREWMAN TO REMOVE.

h. Parking brake – RELEASE.

3-31. TAXIING.

3-32. Use the following procedure while taxiing:

CAUTION

Make S-turns during taxiing as necessary to observe and avoid ground obstacles.

CAUTION

When taxiing on other than a hard surface use extreme caution since there is minimum clearance between the landing gear fairing and the ground.

a. Brakes – CHECK. Test brakes on initial roll when starting to taxi.

NOTE

Steer aircraft with rudder pedals, using brakes only for sharp turns.

CAUTION

Riding the brakes causes unnecessary brake wear and engine overheating. Maintain sufficient engine rpm (approximately 1400) to ensure engine cooling.

CAUTION

To ensure maximum propeller life, exercise extreme care when operating from unusually rough or graveled runways.

b. Flight instruments – FUNCTIONAL CHECK. Check while the aircraft is in motion and during turns.

c. Defogging system – CHECK. Check for sufficient air flow for defogging canopy.

3-33. ENGINE RUNUP.

CAUTION

Do not exceed 5 minutes from end of taxiing until takeoff.

3-34. Perform the engine runup as follows:

CAUTION

Do not exceed idle rpm unless oil temperature has reached at least 24° C.

NOTE

Head aircraft into the wind for ground runup.

CAUTION

Stick should be held fully back to avoid nose-up during runup. Exercise care to ensure that aircraft does not roll forward.

a. Parking brakes – SET.

b. Engine instruments – WITHIN LIMITS.

c. Mixture – FULL RICH.

d. Throttle – ADVANCE to 1700 RPM.

e. Magneto – CHECK. (1) Move ignition switch to L position and note engine rpm. (2) Return switch to BOTH position to clear other set of spark plugs. (3) Move switch to R position and note rpm. (4) Return switch to BOTH position. (The difference between the two magnetos should be no more than 50 rpm.) (5) If no drop in speed is observed when operating on either magneto alone, switch circuit should be inspected for loose connection.

f. Propeller – EXERCISE. Move propeller control level from high rpm to low rpm and return propeller lever to high rpm (full forward).

WARNING

Verify that propeller pitch change is occurring by noting change in engine rpm. Cold engine oil in the propeller hub may impair pitch change. Takeoff in this condition will result in engine overspeed before liftoff.

g. Alternate air – CHECK OPERATION. Operate engine at 1700 rpm. With ALT AIR knob all the way in, note engine speed and manifold pressure. Pull ALT AIR knob out; if engine speed decreases slightly, air valve is operating properly. Return knob all the way forward.

h. Alternator – STANDBY ALTERNATOR. Turn standby alternator on, and check alternator warning light. Turn standby alternator off, and check that there is no alternator warning light.

i. Static inverter – STANDBY INVERTER. Turn standby alternator on and check that no OFF flags appear in attitude gyro and gyromagnetic compass. Turn standby static inverter off and check that no OFF warning flags appear in flight instruments and TACAN.

j. Throttle – REDUCE TO IDLE.

k. Idle mixture – CHECK. Slowly move mixture control toward lean position. Engine rpm should increase no more than 50 rpm before engine cuts out. Return mixture control to FULL RICH position.

l. Magneto ground out – CHECK.

3-35. BEFORE TAKEOFF.

WARNING

Do not use the fuel pump boost during normal engine operation. The engine-driven pump produces a fuel/air ratio considerably richer than best power. For vapor elimination, the fuel pump boost may be used with the engine operating and the switch in the HIGH position, however, it may be necessary to lean the mixture to prevent an excessively rich mixture.

3-36. Accomplish the following steps before takeoff.

a. Canopy – CHECK LOCKED.

b. Spoilers – CLOSED (warning light out).

c. Cowl flap – FULL OPEN (warning light on).

d. Fuel tank selector – LEFT TANK.

e. Fuel pump boost switch – OFF.

f. Pitot heat – AS REQUIRED.

g. Circuit breakers – SET.

h. Flashing beacons – AS REQUIRED.

i. Trim tab – SET.

j. Flight controls – CHECK. Check for free movement.

k. Shoulder harness – LOCKED.

l. Flight instruments – CHECK AND SET.

m. Engine instruments – CHECK. Check within limits.

n. Alternate air – FULL FORWARD.

3-37. TAKEOFF.

3-38. Taking off in accordance with the following steps will produce the results shown in Chapter 14. Refer to Chapter 4 for emergency takeoff procedures.

3-39. NORMAL TAKEOFF.

3-40. Accomplish normal takeoff as follows:

a. Propeller – HIGH RPM.

b. Throttle – ADVANCE. Slowly advance throttle to full open. Tachometer should read 2800 rpm.

c. Mixture – FULL RICH.

NOTE

For operations from fields of density altitude greater than sea level, the mixture should be set to lean for maximum performance (full throttle and 2800 rpm) in accordance with placard adjacent to fuel pressure indicator. These settings are as follows:

Altitude (feet)	Pressure (psi)
1000	13.7 to 15.1
2000	13.1 to 14.5
3000	11.6 to 13.1
4000	11.4 to 12.5
5000	10.8 to 12.0

d. Lift tail at approximately 38 knots IAS.

e. Fly aircraft off at approximately 60 knots IAS, allowing airspeed to increase to best climb rate (70-75 knots IAS).

WARNING

Do not attempt to rotate aircraft into climb attitude at less than 60 knots IAS.

CAUTION

To avoid possible stall-out of gear retraction motors, retraction should be started when airspeed reaches 70 knots IAS.

3-40A. MAXIMUM PERFORMANCE TAKEOFF.

3-40B. Accomplish maximum performance takeoff in the same manner as normal takeoff except rotate aircraft at 58 knots IAS and climb at 61 knots IAS until obstacles are cleared.

3-41. CROSSWIND TAKEOFF.

NOTE

During crosswind takeoffs, maintain a tail-high attitude to keep the aircraft on the ground until an airspeed of approximately 65 knots IAS is reached. Pull aircraft off with a positive movement, and correct for drift. See Fig. 14-4 in Chapter 14 for crosswind takeoff and landing chart.

3-42. NIGHT TAKEOFF.

3-43. Execute a night takeoff in the same manner as a day takeoff.

3-44. AFTER TAKEOFF AND CLIMB.

3-45. After takeoff, perform the following steps:

a. Landing gear – RETRACT. Retract landing gear and check that indicator lights are out (gear-up condition).

b. Climb power – Full throttle and propeller high rpm (2800 rpm) at best climb speed (70-75 knots IAS).

c. Mixture control – SET. Adjust to placard fuel pressures.

d. Stabilator trim tab wheel – ADJUST. trim aircraft for climb or cruise attitude as appropriate.

e. Cowl flap – ADJUST. Adjust as required for engine cooling.

CAUTION

Conduct climb within engine temperature limits. If temperature limits are reached level off until temperature decreases to within allowable limits before resuming climb.

3-46. CRUISE CHECK.

3-47. During cruise check, perform the following steps:

a. Power setting – SELECT. Select power setting as desired in accordance with data in Chapter 14.

b. Mixture control lever – LEAN. If the exhaust gas temperature indicator is not used, pull the mixture control back until there is a drop in rpm. (Normally a slight rise in rpm will occur just before this decrease.) Enrich the mixture to the point where the engine runs smooth and the rpm stabilizes. Changes in density altitude and power will require a change in mixture setting.

NOTE

A more precise method of obtaining optimum mixture setting for fuel management is to use the exhaust gas temperature (EGT) indicator. Lean mixture to peak EGT, then enrich 1 EGT gage division (25° F) below peak temperature. If, during leaning to peak EGT, the engine runs rough, enrich to smooth running, then further enrich 1 EGT gage division (25° F) below the temperature at smooth running.

CAUTION

An excessively lean mixture can lead to high cylinder head temperatures and detonation that may cause engine damage.

c. Fuel quantity – CHECK.

d. Fuel tank selector – RIGHT TANK.

e. Cowl flap – CLOSED.

WARNING

Left tank has fuel reserve of 15 pounds (equivalent to 10 percent reserve) when low-level warning light comes on, and right tank has 11 pounds when low-level warning light comes on. Therefore, fuel should be used from right tank until low-level warning light comes on (11 pounds remaining); at this time switch to left tank, or, in the case of maximum endurance, switching should be initiated when fuel is depleted in right tank.

3-48. FLIGHT CHARACTERISTICS.

3-49. Refer to Chapter 8 for information on aircraft flight characteristics.

3-50. DESCENT (NORMAL GLIDE).

3-51. During normal descent, proceed as follows:

a. Mixture control – ADJUST. Adjust for smooth operation.

b. Throttle – CLOSE. Close throttle and establish a normal descent at 76 knots IAS and trim.

c. Adjust rate of descent with spoilers.

d. Pitot heat – AS REQUIRED.

NOTE

Periodically clear the engine by momentarily opening and closing the throttle. This prevents the engine from loading up and fouling the spark plugs.

e. Fuel tank selector – LEFT TANK.

3-52. BEFORE LANDING.

WARNING

Do not use the fuel pump boost during normal engine operation. The engine-driven pump produces a fuel/air ratio considerably richer than best power.

3-53. Before landing, accomplish the following steps:

a. Mission EQUIP. switch – OFF.

b. Removable ocular (observer's compartment) – STOWED.

c. Fuel tank selector – LEFT TANK.

d. Mixture control – FULL RICH.

e. Propeller – HIGH RPM.

f. Landing gear – DOWN. Extend landing gear; check green indicator lights on, amber light off.

g. Harness – LOCK.

h. Defogging system – Adjust as necessary to prevent canopy fogging.

i. Cowl flap – AS REQUIRED.

j. Spoilers – AS REQUIRED.

k. Parking brake – CHECK. Check that brake is off.

3-54. LANDING.

3-55. NORMAL LANDING.

3-56. The normal landing technique as listed below will produce the results shown in Table 14-6, Chapter 14. Sideslips can be safely executed during approach to a landing if necessary. Either a wheel or three-point landing may be executed. See Fig. 3-2 for a typical landing pattern and recommended procedures. Refer to Chapter 4 for emergency landing procedures.

a. Throttle – CLOSE. On downwind leg, opposite the point of intended touchdown, smoothly close the throttle and establish a normal glide.

b. Spoilers – As desired for appropriate rate of descent.

c. Open spoilers full at touchdown.

d. Control stick – After aircraft is on the ground, hold control stick full back.

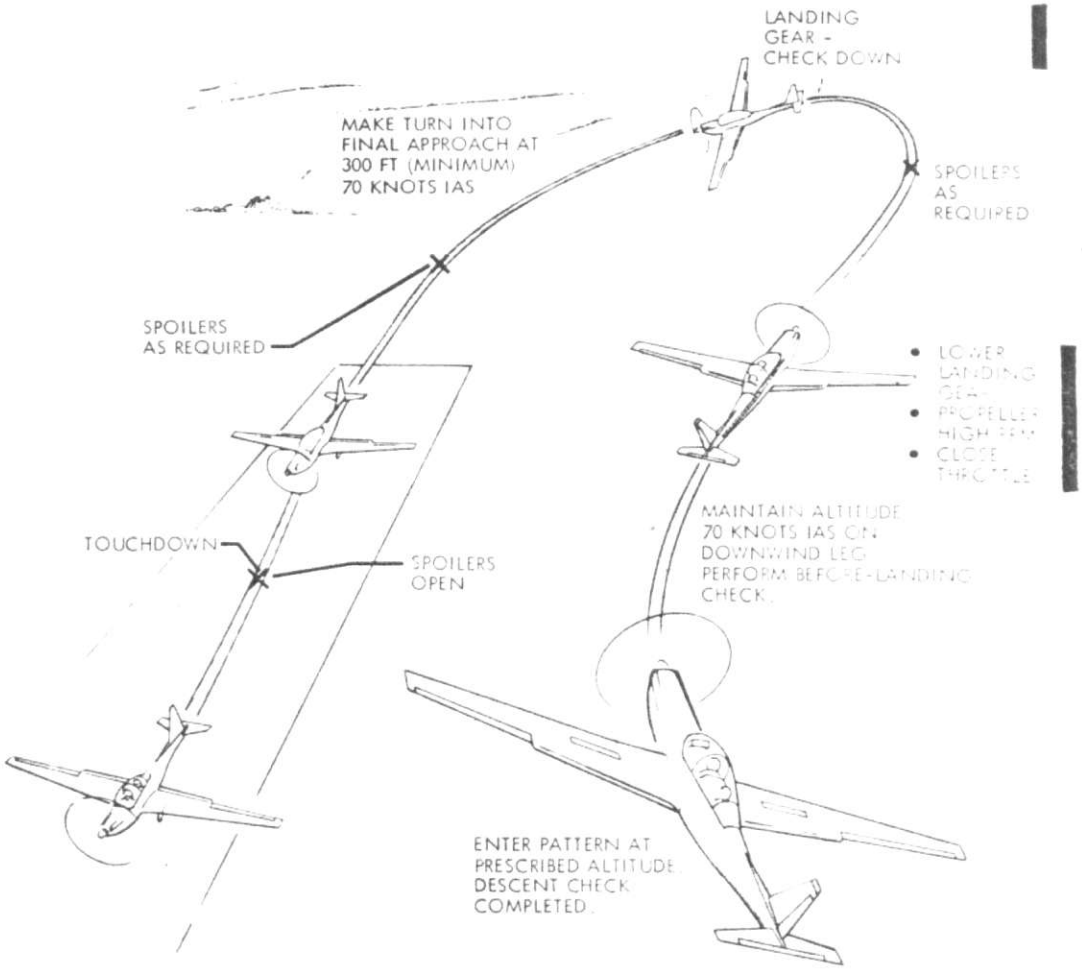


Fig. 3-2 Typical Landing Pattern

3-57. CROSSWIND LANDING.

3-58. Perform crosswind landing as follows:

a. Spoilers – Use spoilers to touch down at desired spot.

b. Use either wing-low, crab, or combination method of drift correction.

c. Either a three-point or wheel landing may be executed.

d. Maintain a higher airspeed than for normal landing.

e. Just at touchdown, open spoilers full and correct for crab.

f. Turn off runway before performing after-landing check.

3-59. MINIMUM-RUN LANDING.

3-60. Accomplish minimum-run landing as follows:

a. Spoilers – Use as necessary to touch down at runway end. Open spoilers full at touchdown.

b. Maintain power-off glide speed as shown in Table 14-6, Chapter 14.

c. Begin flare so as to be in three-point attitude at touchdown, opening spoilers full just prior to touchdown.

d. Upon contact with the ground, apply necessary braking to stop in minimum distance.

CAUTION

Hold control stick full back when using brakes, to prevent nosing over.

e. Turn off runway before performing the after-landing check.

3-61. NIGHT LANDING.

3-62. For night landing, proceed as follows:

NOTE

Use spoilers on final approach to control rate of descent.

a. Execute three-point landing, using spoilers to control rate of descent.

b. Use taxi light as desired.

3-63. GO-AROUND PROCEDURE.

3-64. In the event a go-around becomes necessary, proceed as follows:

a. Propeller – HIGH RPM.

b. Throttle – MAXIMUM POWER.

c. Mixture – ADJUST. Adjust full rich (or for maximum power in accordance with placard if field density altitude is above 3,000 feet).

d. Spoilers – CLOSED.

e. Trim tab – SET.

f. Landing gear – UP.

g. Cowl Flap – FULL OPEN.

3-65. AFTER LANDING.

3-66. After landing, perform the following steps:

CAUTION

During landing operations do not attempt to raise the canopy to the vent position until the aircraft has been brought to a stop.

NOTE

After-landing checks may be performed immediately after turning off the active runway. Priority during the landing roll should be placed on maintaining directional control.

a. Cowl flap – FULL OPEN.

b. Spoilers – CLOSED. Close spoilers when safe taxi speed has been attained.

c. All unnecessary avionics – OFF.

d. Pitot heat switch – OFF.

e. Flashing beacons – AS REQUIRED.

3-67. ENGINE SHUTDOWN.

CAUTION

Do not raise the canopy after a landing (or after ground operations in which the canopy has been closed) until ground crewman have installed the canopy safety line.

3-68. To shut down the engine, proceed as follows:

NOTE

Prior to shutdown, perform post-flight check of magnetos and mixture.

a. Magnetos – CHECK (see para 3-34d).

b. Avionics – OFF.

c. Mixture control – IDLE CUTOFF.

WARNING

Do not turn the propeller on a hot engine even with the ignition switch in the OFF position; the engine could "kick" as a result of auto-ignition of a small amount of fuel remaining in the engine.

d. Ignition switch – OFF (AFTER ENGINE STOPS).

e. All switches – OFF.

f. GRD-OFF-FLT switch – OFF.

g. Fuel tank selector – OFF.

h. Control – LOCKED.

i. Canopy safety line – INSTALL BEFORE OPENING CANOPY.

3-69. BEFORE LEAVING THE AIRCRAFT.

3-70. Before leaving the aircraft, perform the following steps:

a. Wheel chocks – IN PLACE.

b. Parking brake – OFF.

c. Canopy ejection safety lock – INSTALL AS NECESSARY.

d. DA Form 2408 – MAKE ENTRIES.

CAUTION

Make appropriate entries in DA Form 2408 covering any limits that have been exceeded during the flight. Entries must also be made when, in the pilot's judgment, the aircraft has been exposed to unusual or excessive operations, such as engine overspeed, hard landings, excessive braking action, high cylinder head or oil temperatures, excessive in-flight "g" loads, etc.

e. Canopy – CLOSE AND LOCK.

f. Landing gear safety pins – INSTALL.

g. Pitot static tube cover – INSTALL.

h. Tiedown – Install eyebolts and tie down aircraft.

Chapter 4
EMERGENCY PROCEDURES

Section I
SCOPE

4-1. GENERAL.

4-2. This chapter contains what are considered the best procedures for coping with various emergencies that you may encounter during takeoff, flight, and landing (emergencies associated with auxiliary equipment are not considered here; refer to Chapter 6).

Every emergency presents a different problem; nevertheless, a thorough knowledge of the basic procedures outlined in this chapter will enable you to better cope with emergencies that you may encounter. It is important that you determine the nature of any difficulty before taking corrective action.

Section II

ENGINE

4-3. ENGINE FAILURE.

NOTE

If engine quits during taxi-out or during flight, pull out AVIONICS PWR ESSENTIAL and AVIONICS PWR MAIN circuit breakers before attempting to restart engine on aircraft battery. After engine restart, push circuit breakers in.

4-4. Engine failures fall into two main categories: those occurring instantly and those with ample indication before failure. The instant failure is rare and usually occurs only if ignition or fuel flow fails completely. Most engine failures are gradual and afford the alert pilot ample indication that he may expect a failure. An extremely rough-running engine, loss of oil pressure, excessive cylinder-head temperature under normal flight conditions, and fluctuating rpm are indications that a failure is imminent. When indications point to an engine failure, the pilot should land as soon as possible. If the chip detector warning light comes on, the pilot should land as soon as practicable to investigate the cause.

4-5. ENGINE FAILURE DURING TAKEOFF.

4-6. If malfunction occurs when the remaining runway is insufficient for stopping and the nature of malfunction will permit flight, continue takeoff, circle field, and land immediately. If malfunction occurs before liftoff and is of such nature as to make flight impossible, proceed as follows:

a. Throttle – CLOSE.
b. Spoilers – OPEN.
c. Control stick – FULL BACK.
d. Brakes – APPLY.
e. Mixture control lever – IDLE CUTOFF.
f. Ignition switch – OFF.
g. GRD-OFF-FLT switch – OFF.
h. Fuel selector – OFF.

NOTE

Maneuver as necessary to avoid obstacles.

4-7. ENGINE FAILURE AFTER TAKEOFF.

4-8. If engine fails immediately after takeoff, proceed as follows:

a. Maintain control of aircraft.

b. Landing gear – considering your attained altitude (and therefore time available) and the nature of the terrain in the landing area, retract or extend landing gear as appropriate.

WARNING

Land straight ahead, changing direction only enough to miss obstacles. Do not try to turn back to the field; making a crash landing straight ahead with the aircraft under control is much better than turning back and taking a chance of an uncontrolled roll into the ground.

c. Mixture control lever – IDLE CUTOFF.
d. Emergency fuel cutoff – PULL UP.
e. Ignition switch – OFF.
f. GRD-OFF-FLT switch – OFF (UNLESS LANDING GEAR, SPOILERS, LIGHTS, OR RADIO IS REQUIRED).

4-9. ENGINE FAILURE DURING FLIGHT – EMERGENCY RESTART.

4-10. If the engine fails during flight and you elect to attempt an emergency restart, proceed as follows:

a. Maintain maximum distance glide speed (75 knots IAS).

NOTE

Select best possible area for landing in case restart is unsuccessful.

b. If failure is due to fuel starvation, activate boost pump in the high mode until fuel pressure is obtained (4.0 psi).

c. Fuel selector valve handle – LEAVE ON EXISTING TANK IF TANK HAS NOT BEEN DEPLETED. If unable to obtain fuel pressure reading of 4 psi, change tanks and repeat.

d. Mixture control lever – LEAVE IN CRUISE POSITION. If engine will not run with fuel pump boost off, adjust proper fuel pressure with mixture control, and place fuel pump boost switch in HIGH position.

e. Propeller – HIGH RPM.

f. Alternate air knob – PULL OUT.

g. Throttle – AS NECESSARY.

4-11. If steps a through f of paragraph 4-10 have been taken and the engine does not restart, shut down as follows and make decision to execute forced landing or to bail out.

4-12. ENGINE SHUTDOWN IN FLIGHT.

4-13. If it becomes necessary to shut down the engine in flight, proceed as follows:

a. Radio call – ACCOMPLISH.

b. IFF Transponder – EMER.

c. Throttle – CLOSE.

d. Mixture control lever – IDLE CUTOFF.

e. Fuel pump boost switch – OFF.

f. Fuel selector valve handle – OFF.

g. Ignition switch – OFF.

h. GRD-OFF-FLT switch – OFF (UNLESS LANDING GEAR, SPOILERS, LIGHTS, OR RADIO IS REQUIRED).

4-14 to 4-16. (Deleted)

4-17. MAXIMUM GLIDE.

4-18. If engine fails during flight, maximum gliding distance can be obtained by maintaining the airspeed shown in Fig. 4-1. To establish maximum glide, proceed as follows:

a. Landing gear – RETRACTED.

b. Spoilers – CLOSED.

c. Trim tab – ADJUST. Adjust to relieve stick pressure.

d. Propeller – LOW RPM.

4-19. LANDING WITH ENGINE INOPERATIVE.

4-20. Use of spoilers during landing is recommended if the ground is rough or if the landing area is limited. The pilot must determine whether conditions necessitate a gear-up landing or a landing with the gear extended. (See Section V, this chapter, for landing and ditching emergency procedures.)

4-20A. PROPELLER FAILURE.

4-20B. If the linkage to the propeller governor fails, a spring on the governor automatically sets the governor to control the propeller in full increase rpm (2800 rpm). The governor and propeller will continue to function in a constant-speed mode at 2800 rpm. Adjust throttle as required for flight.

4-20C. If a failure of the propeller governor occurs and the propeller goes into low pitch (high rpm), proceed as follows:

a. Throttle – ADJUST. Maintain rpm within limits (2800 rpm). Reduce airspeed to low-speed cruise.

b. Spoilers – RETRACTED.

c. Propeller control lever – CYCLE. Move several times from high rpm to low rpm; attempt to restore governing.

NOTE

If governing cannot be restored, sufficient power is available to maintain flight with spoilers retracted. Land as soon as possible.

4-20D. If a failure of the propeller governor occurs and the propeller goes into high pitch (low rpm), proceed as follows:

a. Throttle – ADJUST. Adjust throttle as necessary to sustain flight.

b. Spoilers – RETRACTED.

c. Propeller control lever – CYCLE. Move several times from low to high rpm; attempt to restore governing.

NOTE

If governing cannot be restored, sufficient power is available to maintain flight with spoilers retracted. Land as soon as possible.

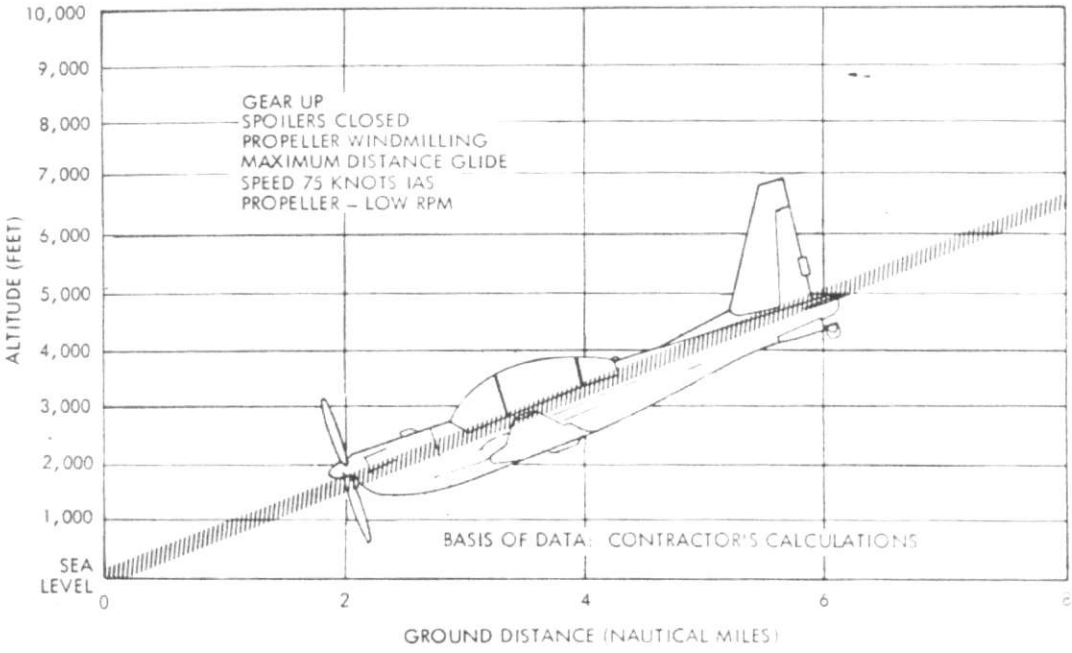


Fig. 4-1 Maximum Glide Distance

Section III

FIRES

4-21. FIRE.

4-22. ENGINE FIRE DURING START.

4-23. If fire is located in the air-induction system during ground operation, proceed as follows:

a. Throttle – OPEN.

b. Starter button – PRESS. Continue cranking engine; the fire may be sucked through the engine and extinguished.

c. Mixture control lever – IDLE CUTOFF (IF FIRE IS NOT EXTINGUISHED).

d. Fuel selector valve handle – OFF.

e. Ignition switch – OFF.

f. GRD-OFF-FLT switch – OFF.

g. Hand fire extinguisher – USE AS REQUIRED.

4-24. ENGINE FIRE DURING FLIGHT.

WARNING

If the fire is of a very serious nature and if there is sufficient altitude, immediately eject canopy and bail out. If the fire is not too serious you may decide to shut down the engine on the probability that the fire will then extinguish itself.

4-25. If you elect to stay with the aircraft for any reason, follow this procedure:

a. Flight-compartment heat control – CLOSED (TO PREVENT SMOKE FROM ENTERING FLIGHT COMPARTMENTS).

b. Mixture control lever – IDLE CUTOFF.

c. Emergency fuel shutoff – PULL UP.

d. Ignition switch – OFF.

e. GRD-OFF-FLT switch – OFF (IF NOT REQUIRED FOR SPOILERS, LIGHTS, OR RADIO).

NOTE

Do not attempt to restart engine after fire goes out. Make an emergency landing or bail out.

4-26. FUSELAGE FIRE.

4-27. In case of fuselage fire, proceed as follows:

a. GRD-OFF-FLT switch – OFF.

b. All ventilators – CLOSED (TO ELIMINATE DRAFTS).

c. Hand fire extinguisher – USE.

NOTE

If fire cannot be extinguished, land as soon as possible or bail out.

4-28. WING FIRE.

4-29. In case of wing fire, proceed as follows:

a. Taxi light switch – OFF.

b. Navigation light switch – OFF.

c. Pitot heat switch – OFF.

NOTE

Slip aircraft away from burning wing in effort to extinguish flames. Land as soon as possible or bail out.

4-30. ELECTRICAL FIRE.

4-31. Circuit breakers isolate most electrical circuits and automatically interrupt power to prevent a fire when a short occurs. If necessary, however turn GRD-OFF-FLT switch OFF to remove power from all electrical equipment and land as soon as possible. If electrical power is essential, as during instrument flight or for lowering of landing gear, an attempt to identify and isolate the shorted circuit may be feasible. This can be accomplished as follows:

a. GRD-OFF-FLT switch – OFF.

b. Turn off all remaining switches (except ignition).

c. GRD-OFF-FLT switch – FLT.

d. Standby alternator switch – ON. If alternator circuit is shorted, return switch to OFF.

e. Voltammeter – MONITOR FOR ABNORMAL INDICATION AS EACH SWITCH AND CIRCUIT BREAKER IS REINSTATED ONE AT A TIME.

WARNING

A circuit breaker that continues to pop out after being reset could result in an electrical fire, and further attempts to reset it should be discontinued.

WARNING

Do not lower landing gear electrically unless the nature of any fire in the aircraft is known to be independent of the landing gear circuits.

4-32. SMOKE AND FUMES ELIMINATION.

4-33. To eliminate smoke and fumes from the flight compartment, proceed as follows:

NOTE

Make sure fire is either extinguished or will not be aggravated by draft.

a. Flight compartment heat control – CLOSED.

b. Defogging system control – OFF.

c. Vent control – OPEN.

d. Canopy vents – OPEN.

WARNING

Since there is a strong possibility that during canopy ejection the canopy could strike the vertical stabilizer and damage it, be prepared to bail out when the canopy is ejected. Consider this possibility when contemplating canopy ejection.

e. If smoke or fumes persist, prepare to bail out.

f. If canopy has been ejected and control can be maintained, land as soon as possible.

Section IV

AIRCRAFT SYSTEMS

4-34. FUEL SYSTEM FAILURE.

4-35. In event of engine-driven fuel pump failure, proceed as follows:

a. Fuel-pump boost switch – HIGH.

b. Fuel pressure gage – MONITOR AND SET REQUIRED FUEL PRESSURE WITH MIXTURE CONTROL.

c. Land as soon as possible.

4-36. ELECTRICAL POWER FAILURE.

4-37. If a complete electrical failure occurs, or if it becomes necessary to disconnect the battery (GRD-OFF-FLT switch to OFF) and alternators from the electrical system, a landing should be made as soon as possible. Instrument flying cannot be accomplished under these conditions, as all radio and navigation equipment and flight instruments will be inoperative.

4-37A. INVERTER FAILURE.

4-37B. A main static inverter failure will cause OFF flags to appear in the attitude gyro, direction gyro, and TACAN course indicator and bearing distance heading indicators. When the OFF flags appear, proceed as follows:

a. Alternator warning panel – CHECK. No indicator lights (failure may be caused by alternator).

b. Standby inverter – ON.

NOTE

With standby inverter on, TACAN is inoperative.

4-38. ALTERNATOR FAILURES.

4-39. If the main alternator fails, transfer to the standby alternator is effected by lifting the guarded switch marked STANDBY ALTERNATOR and raising the switch. If selection of the standby alternator does not return power to the direct current bus system, perform the following steps:

a. Close guard on standby alternator switch.

b. Move alternator ON-OFF switch to OFF.

c. Lift guard and raise BUS TRIM SWITCH. With the main bus isolated, the battery is capable of supplying the essential bus load for a minimum of 30 minutes with the alternator inoperative or switched off. The equipment that operates from the main bus and essential bus is identified in Fig. 2-11.

4-40. With the MAIN BUS TRIM switch in the OFF position, the battery will supply power to the essential equipment for a minimum of 30 minutes, assuming an 85-percent battery charge. Switch off additional equipment on the essential bus as appropriate to further conserve battery power.

4-40A. A main or standby alternator failure will be indicated by the alternator warning lights (34, Fig. 2-6).

4-41. FLIGHT CONTROL SYSTEM FAILURE.

4-42. RUDDER/AILERONS/STABILATOR.

4-43. It may be possible to use the rudder to execute wide-radius turns if aileron control fails; similarly, it may be possible to use ailerons to maintain directional control if the rudder fails. In either case, however, execute maneuvers carefully.

WARNING

In event of failure or damage to the flight control system, thoroughly determine controllability of aircraft at safe bailout altitude before attempting to land.

4-44. If stabilator control fails but is effective enough to maintain level attitude, a safe landing can be accomplished by appropriate use of spoilers and engine power.

4-45. SPOILERS.

4-46. If other than normal spoiler operation is noticed during landing, do not attempt to take off again without having spoiler system checked. If spoilers cannot be closed in flight, actuate the spoiler emergency release control. Actuation of this control disengages the torque tube interconnecting the spoilers, allowing air pressure and spring pressure to force the spoiler closed

WARNING

The aircraft has insufficient power to maintain level flight with the spoilers fully extended. After an inflight emergency that requires use of the emergency spoiler release, the spoilers should not be used again until the spoiler system has been inspected and the cause of the emergency corrected.

4-47. LANDING GEAR EMERGENCY EXTENSION.

4-48. If the landing gear electrical system fails (or if required for some other reason), the landing gear can be lowered manually by actuating the emergency landing gear release lever (3, Fig. 2-6, Chapter 2). The emergency landing gear extension system is designed only to lower the gear.

4-49. Manually extending the gear will be easier if you reduce airspeed first. Use the following procedure:

a. Landing gear circuit breakers – PULL OUT (LANDING GEAR CONTROL AND INDICATOR, RT LG MOTOR, LT LG MOTOR).

b. Emergency landing gear extension control – ACTUATE.

c. Landing gear control and indicator circuit breaker – IN.

d. Landing gear switch – DOWN.

e. Landing gear electrical position indicator – CHECK. Check indicator to ascertain that gear are down. (Two green lights.)

CAUTION

Emergency extension of landing gear requires reset of actuator linkage by maintenance personnel prior to next landing gear retraction.

Section V

LANDING AND DITCHING

4-50. LANDING EMERGENCIES (EXCEPT DITCHING).

4-51. GEAR-DOWN LANDING.

4-52. If you decide that a gear-down landing is best proceed as follows:

a. Safety belt and shoulder harness – FASTENED.

b. Shoulder harness – LOCKED.

NOTE

Before locking shoulder harness, turn off all switches not readily accessible with harness locked.

c. Propeller – HIGH RPM.

d. Make a normal approach and, if possible, choose a hard surface to land on. Use spoilers as necessary.

e. When sure of making the intended landing area, perform the following steps:

(1) Throttle – CLOSE.

(2) Mixture control lever – IDLE CUTOFF.

(3) Ignition switch – OFF.

(4) Fuel selector valve handle – OFF.

(5) Emergency fuel shutoff – PULL OUT.

(6) Spoilers – AS NECESSARY.

(7) Landing gear – DOWN.

(8) GRD-OFF-FLT switch – OFF (BEFORE CONTACT).

f. Keep wings level and make touchdown as gentle as conditions permit.

NOTE

Before landing on extremely rough terrain, you should decide whether to eject the canopy just before or at touchdown to avoid the possibility that the canopy will "jam" during a rough landing, making crew egress difficult.

WARNING

Do not prematurely eject the canopy, as the ejected canopy could strike the tail structure and cause damage and resultant loss of control.

WARNING

Keep head and hands clear of canopy when using emergency canopy release.

g. If canopy has not been ejected, raise canopy manually by using canopy release handles on right- and left-hand sides of flight compartment. If necessary, use crash axe.

4-53. LANDING WITH A FLAT TIRE.

4-54. If a tire is flat at the time of landing, or if a blowout occurs during the landing roll, be alert for possible ground loop toward side having flat tire and proceed as follows:

a. Spoilers – AS REQUIRED.

b. Land to the edge of the runway opposite the flat tire.

c. Land in three-point attitude, keeping the wing high on the side of the flat tire.

d. Maintain directional control with steerable tail wheel, ailerons, and with braking action on good wheel.

e. Shut down engine as a fire precaution in case of a ground loop.

4-55. EMERGENCY ENTRANCE.

4-56. To gain emergency entrance into the flight compartment, actuate the outside canopy emergency release on the LEFT-HAND side of the fuselage (see Fig. 4-2).

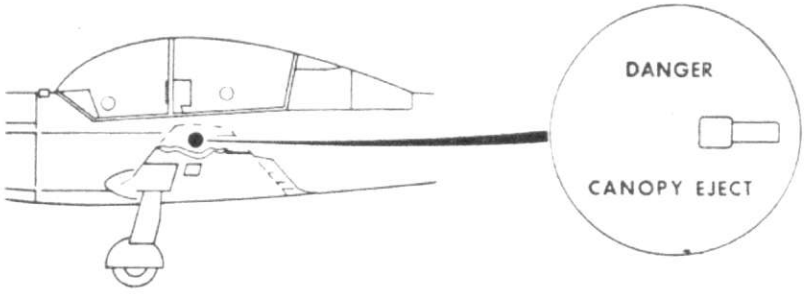


Fig. 4-2 Location of Outside Emergency Canopy Release

WARNING

Keep head and hands clear of canopy when using emergency canopy release.

4-57. DITCHING.

4-58. The aircraft should be ditched only as a last resort. Since all emergency equipment is carried by the pilot and observer, there is no advantage in riding the aircraft down. However, if ditching is unavoidable, proceed as follows:

a. Follow radio distress procedures.

b. IFF transponder – EMER.

c. See that no equipment will foul you when you leave the aircraft.

d. Unbuckle parachute, but make sure that life jacket is still fastened to you, tighten and lock safety belt and shoulder harness.

NOTE

Before locking shoulder harness, turn off all switches not readily accessible with harness locked.

e. Landing gear – DOWN.

f. Spoilers – AS REQUIRED.

g. GRD-OFF-FLT switch – OFF.

h. Canopy – EJECT.

WARNING

Do not prematurely eject the canopy, as the ejected canopy could strike the tail structure and cause damage and resultant loss of control.

WARNING

Keep head and hands clear of canopy when using emergency canopy release.

i. Ignition switch – OFF (JUST BEFORE IMPACT).

NOTE

Make a normal approach with power, if possible, and flare out to normal landing attitude. Touch down just above stalling speed with tail low. Unless wind is high or sea is rough, plan approach heading parallel to any uniform swell pattern and try to touch down along wave crest or just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

j. Exit immediately, as the aircraft may sink rapidly because of damage or swamping.

k. Do not inflate underarm life jacket until clear of aircraft.

Section VI

BAILOUT

4-59. PREPARATION FOR BAILOUT.

4-60. To prepare for bailout, proceed as follows:

a. Airspeed – REDUCE. Reduce airspeed as much as possible.

b. Trim control – ADJUST. Trim aircraft to fly hands off.

c. Radio call – ADVISE LOCATION AND INTENTIONS.

d. IFF transponder – EMER.

e. Helmet – DISCONNECT RADIO CORDS.

f. Safety belt and shoulder harness – UNFASTEN.

4-61. CANOPY EJECTION.

4-62. To eject canopy in flight, proceed as follows:

WARNING

Keep head and hands clear of canopy when using emergency canopy release.

WARNING

Be prepared for immediate bailout as the ejected canopy could strike the tail structure and cause damage and resultant loss of control.

a. Emergency canopy release control – EJECT CANOPY.

4-63. BAILOUT.

4-64. Be watchful at all times that sufficient altitude remains for successful bailout. The minimum altitude above the terrain at which bailout can be safely accomplished may depend upon the type of parachute being used. Only seat-pack parachutes are authorized for flights in this aircraft.

Chapter 5
AVIONICS

Section I
SCOPE

5-1. GENERAL.

5-2. This chapter covers the electronic equipment configurations installed in YO-3A aircraft. It includes brief descriptions of the electronic equipments, their technical characteristics, their capabilities, and their locations.

5-3. The interrelationships of the various avionics subsystems and the functions of the individual equipment items making up these subsystems are described in this chapter. Operating instructions are given for all signal equipment installed in the aircraft.

Section II

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT

5-4. TABLE OF COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT.

5-5. Table 5-1 contains a list of the communications and associated electronic equipment installed in the aircraft. The table indicates the common names, use, operator, range, location of controls, and remarks that may be of interest to using personnel.

5-6. ELECTRONIC AND ASSOCIATED EQUIPMENT

5-7. POWER SUPPLY. Electrical power is supplied to the communications, navigation and identification (avionics) equipment from the aircraft 28-volt dc supply. In the event of alternator failures (or if for some other reason it becomes necessary to reduce the power load on the battery), the pilot will switch to the essential bus, thus disabling some of the signal electronic equipment. During normal operation, however, all avionics equipment is energized when the GRD-OFF-FLT switch is in either the FLT or GRD position and the switch on the individual equipment is in its "on" position. The main standby static inverter provides ac power to operate the associated electronics equipment.

CAUTION

Operation of avionics equipment on battery only should be avoided to prevent battery power drainage.

NOTE

TACAN will not operate when standby inverter is in use.

5-8. AVIONICS CIRCUIT BREAKERS. Two 15-ampere circuit breakers for the signal electronic equipment are located on the switch and circuit breaker panel (pilot's subpanel, 27, Fig. 2-6, Chapter 2). One of these circuit breakers protects the main bus circuit, and the other protects the essential bus circuit. The circuit breakers may be pulled out to completely disable the avionics gear; pushing them in resets them. Additional bimetallic-strip-type circuit breakers are provided in the avionics junction box to protect the individual avionics units from excessive dc currents. These breakers, rated at 4 amperes, are designed to cycle open and closed automatically when excessive current flow occurs.

5-9. MICROPHONE SWITCHES (PILOT'S COMPARTMENT). The microphone switches for the pilot's compartment are located on the pilot's throttle quadrant. (See Fig. 5-1.) Two separate microphone switches are provided: one, marked INT, is used for the interphone system; the second, marked MIC, is used for radio voice communications.

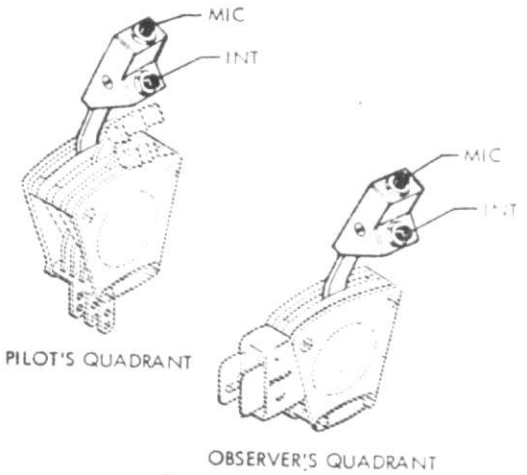


Fig. 5-1 Microphone Switches, Pilot's and Observer's Throttle Quadrants

Table 5-1

COMMUNICATIONS AND ASSOCIATED ELECTRONICS EQUIPMENT

Common Name (Type)	Designation	Use	Operator	Range	Location of Controls	Remarks
Communication Control Panel	C-6533/ARC	Crew communications and/or radio reception and transmission control	Pilot and observer	Interior of aircraft	Pilot's and observer's compartments	Only pilot's set has homing capability
VHF/FM Set	AN/ARC-114	Two-way voice communications and FM homing	Pilot and observer	Line of sight	Pilot's and observer's compartments	Simultaneous transmission from both VHF/FM radios not possible. Only pilot's set has homing capability
VHF/AM Set	AN/ARC-115	Two-way voice communications	Pilot	Line of sight	Pilot's compartment	Optional (complete provisions for) in lieu of UHF/AM set
UHF/AM Set	AN/ARC-116	Two-way voice communications	Pilot	Line of sight	Pilot's compartment	
Antenna Group						
FM, VHF, UHF		Two-way voice communications	Pilot and Observer	Line of sight		See Antenna Location Diagram, Fig. 5-4, for various antenna configurations
Sense, FM Homing		Navigation and direction finding	Pilot	Long range line of sight		
Loop		Navigation	Pilot	Long range		
TACAN		Navigation	Pilot	Line of sight		
X-Band		Radar transponder	Pilot	Line of sight		
IFF		IFF transponder	Pilot	Line of sight		
Automatic Direction Finder Set	AN/ARN-59	Navigation and direction finding	Pilot	Long range	Pilot's compartment	
TACAN	AN/ARN-52	Navigation, direction, and distance finding	Pilot	Line of sight	Pilot's compartment	
IFF	APX-72	Aircraft identification, position, emergency conditions	Pilot	Line of sight	Pilot's compartment	
Gyromagnetic Compass	AN/ASN-43	Navigation	Pilot		Pilot's compartment	
Battery	BB-432/A					
Static Inverter	LMSC No. 5508691-1	Converts 28-volt dc into 115-volt ac and 26-volt ac to provide power for the attitude gyro, gyromagnetic compass, and TACAN				The standby inverter will provide power for the attitude gyro and the gyromagnetic compass. TACAN will not operate when the standby inverter is in use.

5-10. MICROPHONE SWITCHES (OBSERVER'S COMPARTMENT). As in the pilot's compartment, two separate microphone switches, marked INT and MIC, are installed on the observer's throttle quadrant. These press-to-talk switches are used in the same way as the pilot's switches. However, unless the observer is flying the aircraft, for interphone operation he normally will use the microphone switch mounted on the floor of the observer's compartment (25, Fig. 2-7, Chapter 2). This switch controls the observer's microphone for interphone communications only.

5-11. DESCRIPTION AND OPERATION OF COMMUNICATIONS EQUIPMENT.

5-12. COMMUNICATIONS EQUIPMENT.

5-12A. The communications equipment installed in YO-3A aircraft consists of the following: the pilot's VHF/FM command and homing radio set (AN/ARC-114); the observer's VHF/FM radio set, which features two way

voice communication but not homing capability, and either a VHF/AM radio set (AN/ARC-115) or a UHF/AM radio set (AN/ARC-116).

5-13. COMMUNICATION CONTROL PANELS. Two identical communication control panels, one in each flight compartment (12, Fig. 2-6, Chapter 2; 5, Fig. 2-7, Chapter 2), provide a means by which the pilot or observer can select and control the various radio equipment and the interphone system. Any receiver/transmitter for voice transmission and all receiver circuits can be monitored.

5-14. OPERATING CONTROLS. All operating controls and panel lamps are mounted on the front panel of each communication control unit (Fig. 5-2). The operating controls consist of seven receiver ON-OFF toggle switches, a HOT MIKE toggle switch, a six-position rotary selector switch, and a volume control. The functions of these controls are indicated in Table 5-2.

5-15. OPERATING THE COMMUNICATION CONTROL UNIT.

5-16. RADIO TRANSMISSION. The communication control circuits route audio signals to the VHF FM, VHF/AM, or UHF/AM transmitters for use during radio transmission. The desired transmitter is selected by rotating the rotary selector switch to the transmitter position (1, 2, 3, 4, or 5) assigned to that particular transmitter. A sidetone will be heard from the radio set to indicate that transmission is being accomplished. To transmit radio messages, use the MIC press-to-talk switch located on the throttle quadrant. The microphone output will modulate the selected radio transmitter, and the message will be transmitted on the frequency selected for that transmitter.

NOTE

Simultaneous transmission from both VHF FM radios is not possible. Prior to transmitting on either FM radio set, the crew member desiring to transmit will inform the other crew member, via interphone, that he is going to transmit, and also inform him when he has completed his transmission.

RECEIVER SWITCHES

1 – ARC-114 (PILOT)
2 – ARC-116
3 – ARC-115
4 – NOT USED
5 – ARC-114 (OBSERVER)
AUX – NOT USED
NAV – ADF AUDIO, TACAN AUDIO

FUNCTION SELECTOR POSITIONS

1 – ARC-114 (PILOT)
2 – ARC-116
3 – ARC-115
4 – NOT USED
5 – ARC-114 (OBSERVER)

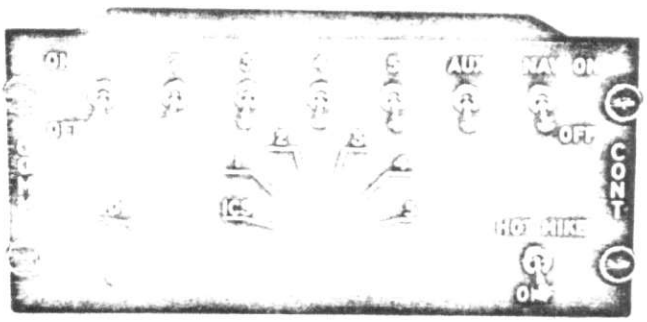


Fig. 5-2 Communication System Control Panel

Table 5-2

COMMUNICATION SYSTEM CONTROL PANEL CONTROLS AND FUNCTIONS
(SEE FIG. 5-2)

Control	Function
Receiver switches: (spst toggle)	In ON Position:
Switch 1	Connects pilot's VHF/FM receiver audio line to headset.
2	Connects pilot's UHF/AM receiver audio line to headset.
3	Connects pilot's VHF/AM receiver audio line to headset.
4	Not used.
5	Connects observer's VHF/FM receiver audio line to headset.
AUX receiver switch	Not used.
NAV receiver switch	Connects ARN-89 ADF receiver and TACAN audio lines to headset.
VOL control	Adjusts headset volume level (except warning tone). NOTE The IFF audio line is connected to the amplifier input and is continually monitored.
Selector switch (six-position rotary)	Provides for selection and control of radio transmitters. Switch Position ICS — Enables interphone operation when INT microphone switch or observer's floor-mounted switch is depressed. 1 — Enables pilot's VHF/FM transmitter when MIC press-to-talk switch is depressed. 2 — Enables UHF/AM transmitter (pilot's compartment only) when MIC press-to-talk switch is depressed. 3 — Enables VHF/AM transmitter when MIC press-to-talk switch is depressed. 4 — Not used. 5 — Enables observer's VHF/FM transmitter when MIC press-to-talk switch is depressed.
HOT MIKE switch (spst toggle)	In HOT MIKE position, permits hands-free intercommunication on the interphone line.
Lamps DS1, DS2	Indicates application of radio panel light power; does not indicate application of power required for operation.

5-17. RADIO RECEPTION. Any, or all, of the receiver audio signals can be selected by the pilot or observer through use of the receiver toggle switches on the communication control panel. The receivers associated with selected transmitters are automatically monitored when their particular transmitters are selected. To monitor any other receiver, the pilot or observer can turn on the associated receiver switch.

5-18. INTERPHONE OPERATION. The interphone system can be used regardless of the position of the rotary selector switch on the communication control panel. (The ICS position is not normally used because interphone operation is accomplished by means of individual INT switches on the pilot's and observer's throttle quadrants and the floor switch in the observer's compartment. As indicated previously, the observer's floor switch operates in the interphone mode only; for radio transmissions from the observer's station it is necessary to use the MIC switch on the observer's throttle quadrant.)

To turn interphone on:

a. GRD-OFF-FLT switch – GRD (FLT is APU is unavailable).

b. VOL control (communication control panel) – AS DESIRED.

To transmit over interphone:

a. Transmitter selector switch (communication control panel) – ANY POSITION.

b. INT switch (pilot's or observer's) – DEPRESS. Depress the INT press-to-talk switch (pilot's or observer's) and speak into the microphone. Sidetone will be heard, indicating proper operation. Release the press-to-talk switch when the message is completed. If hand-free interphone operation is desired, set the HOT MIKE switch to the on (up) position. Regardless of selector switch position, all speech will be applied to the interphone line. Set the switch at OFF when hot-microphone operation is not required; any noise picked up by the microphone will appear on the interphone line.

NOTE

The observer's foot switch is used in lieu of the MIC pushbutton and will key the unit selected by the transmitter selector.

5-19. DESCRIPTION OF VHF/FM RADIO SET AN/ARC-114.

5-20. The VHF/FM Radio Set AN/ARC-114 provides two-way communications between air-to-air or air-to-ground radio units. The operating modes of the VHF/FM radio set are listed in Table 5-3, and a functional block diagram of the VHF/FM communication system is shown in Fig. 5-3. The set contains a multichannel, tunable main receiver/transmitter and a fixed-tuned guard receiver. The main channel receiver/transmitter operates on any one of 920 channels, spaced in 50-kilohertz (kHz) increments. The guard receiver is fixed tuned in the 40.0- to 41.0-Megahertz (MHz) frequency range. The set will home on any frequency-modulated signal within the frequency range of 30.00 to 75.95 MHz (pilot's set only). The antenna system for the VHF/FM radio consists of the FM communications antenna (3, Fig. 5-4) and the single-element FM homing antenna (2, Fig. 5-4).

Table 5-3
OPERATING MODES OF VHF/FM RADIO SETS (AN/ARC-114)

Unit	Mode 1	Mode 2	Mode 3	Mode 4
Pilot's	X	O	R	H
Observer's	O	X	R	XR

X – Transmit
O – Inoperative
R – Receive
H – Homing

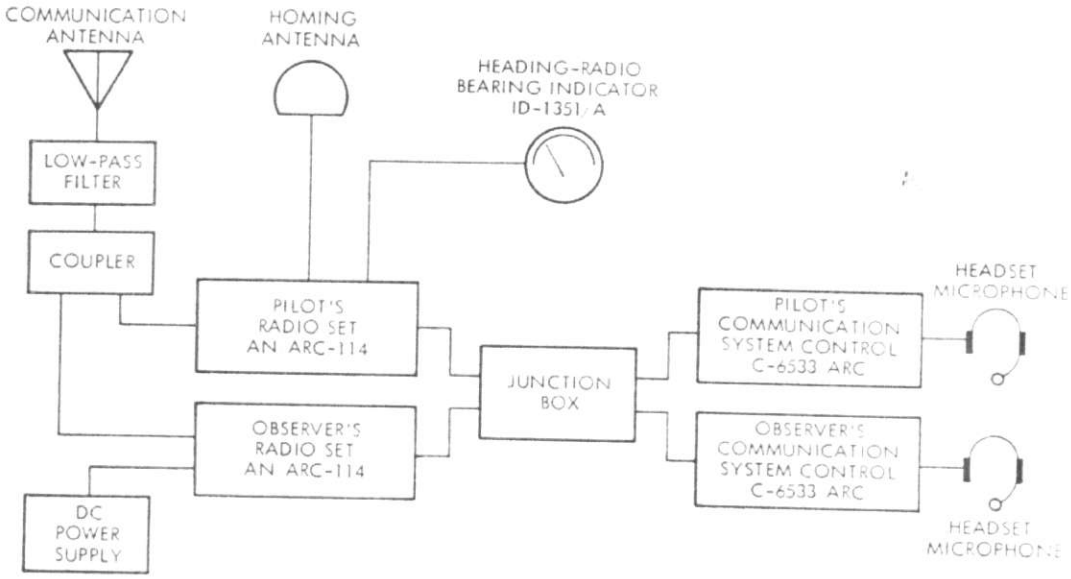
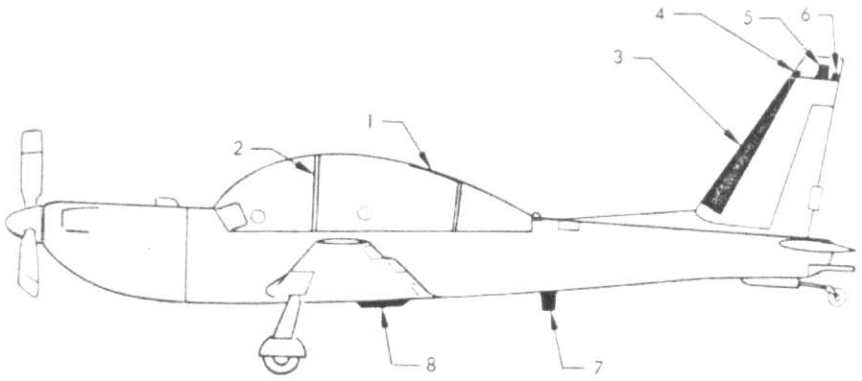


Fig. 5-3 VHF/FM Communication System Functional Block Diagram



1. ADF SENSE
2. VHF/FM HOMING
3. VHF/FM COMMUNICATIONS
4. RADAR BEACON (NOT USED)
5. COMBINED VHF/UHF AM COMMUNICATIONS
6. IFF
7. TACAN
8. ADF LOOP

Fig. 5-4 Antenna Location Diagram

5-21. AN/ARC-114 CONTROL PANELS. One AN/ARC-114 control panel, marked VHF FM COMM, is located on the pilot's instrument subpanel, (13, Fig. 2-6, Chapter 2), and a second identical control panel is located on the observer's subpanel (6, Fig. 2-7, Chapter 2). The controls on each panel and their related functions are as follows (see Fig. 5-5):

a. MEGACYCLES INDICATOR – displays the frequency to which the main receiver/transmitter is tuned.

b. LEFT-HAND MEGACYCLES CONTROL KNOB – tunes the main receiver/transmitter in 1-MHz steps, as indicated by the first two digits on the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

c. RIGHT-HAND MEGACYCLES CONTROL KNOB – tunes the main receiver/transmitter in 0.05 MHz (50-kHz) steps, as indicated by the last two digits of the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

d. RCVR TEST PUSHBUTTON – when depressed, injects a noise signal into the main receiver to provide an audible indication that the receiver is performing properly.

e. FUNCTION SELECTOR SWITCH – a rotary, five-position switch that selects the operating mode of the radio. With the switch at OFF, power is removed from the radio. With the switch at T/R, the radio functions as a transceiver on the selected frequency. With the switch on T/R GUARD, the radio functions as a transceiver on the selected frequency and also receives the guard frequency. With the switch at HOMING, the set will provide homing signals to directional indicator ID-1351A (67, Fig. 2-6, Chapter 2) and may also be operated as a transceiver on the main channels displayed on the MEGACYCLES indicator. The RETRAN position is not used.

f. SQUELCH SCREWDRIVER ADJUSTMENT – used by maintenance personnel to adjust the level at which receiver signals are squelched.

g. AUDIO CONTROL KNOB – adjusts the level of the audio output.

5-22. The pilot's VHF/FM radio set is connected to the communication control panel at receiver switch No. 1 and at the No. 1 position of the transmitter selector switch. (The observer's VHF/FM set is connected to receiver Switch No. 5 and at the No. 5 transmitter position.)

5-23. AN/ARC-114 OPERATION.

5-24. RADIO RECEPTION.

To turn set on and receive:

a. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

b. Receiver switch No. 1 (communication control panel) – ON

c. Function selector switch (radio panel) – T/R

d. AUDIO control knob – AS DESIRED.

CAUTION

Operation of the FM homing system is unreliable between 52 and 76 MHz. Caution should be exercised since false crossover indications are observed in the 52 and 76 MHz frequency range.

5-25. T/R GUARD MODE.

a. Turn the radio set on as described in paragraph 5-24.

b. Place the function selector switch in T/R GUARD position.

c. Operate the radio set in the same manner as for T/R operation.

NOTE

Guard channel reception is not affected by the settings of the megacycles controls. If guard channel signals are heard while receiving signals on a main receiver communication channel, detune the main receiver by rotating the megacycles control to an open channel. This will permit only the priority guard channel signal to be monitored.

NOTE

If traffic is heard on the guard channel and mission operation permits, switch main receiver to guard frequency and provide whatever communications assistance is required (i.e., relay of messages answering distress calls, etc.).

5-26. HOMING MODE (PILOT'S RADIO ONLY).

a. Turn the radio on as described in paragraph 5-24.

b. Place the function selector switch in HOMING position.

c. Adjust the megacycles controls for the desired homing frequency.

NOTE

If desired, the audio output of the radio set may be monitored during the homing operation.

d. Observe the homing output indication on bearing-heading indicator ID-1351A.

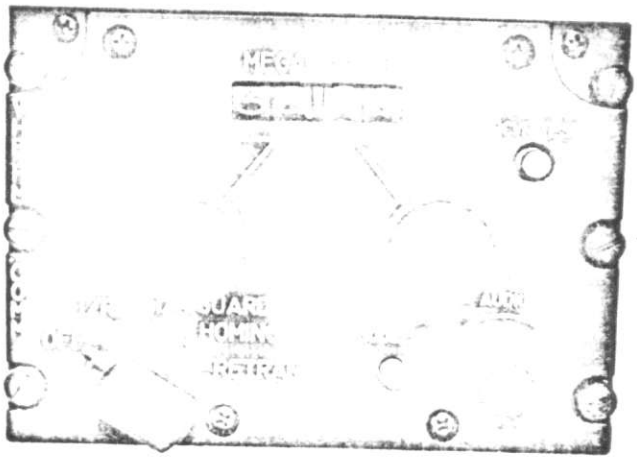


Fig. 5-5 AN/ARC-114 Control Panel

5-27. RADIO TRANSMISSION.

NOTE

Simultaneous transmission from both VHF/FM radios is not possible. Prior to transmitting on either FM radio set, the crew member desiring to transmit will inform the other crew member, via interphone, that he is going to transmit, and also inform him when he has completed his transmission.

To transmit:

a. Turn the radio on as described in paragraph 5-24.

b. Place the transmitter selector switch (communication control panel) in the No. 1 position (for pilot's set) or the No. 5 position (for observer's set).

c. Function selector switch (radio panel) – T/R.

d. Frequency selector controls (radio panel) – AS DESIRED.

e. Microphone switch (MIC) – DEPRESS. Speak into microphone.

5-28. RADIO SHUTDOWN.

To turn set off:

a. Function selector switch (both radio panels, pilot's and observer's compartments) – OFF. The function selector switch on both the pilot's and observer's radio panels must be in the OFF position before both VHF/FM sets are off.

5-29. DESCRIPTION OF VHF/AM RADIO SET AN/ARC-115.

5-30. The VHF/AM Radio Set AN/ARC-115 is an airborne radio communications set that provides air-to-air or air-to-ground communications within the frequency range of 116.000 to 149.975 MHz. The main receiver and transmitter operate on any one of 1,360 channels, spaced in 25-kHz increments. The guard receiver is fixed tuned in the 119- to 124-MHz frequency range. Principal components of the VHF/AM radio set are a receiver, a transmitter, a control panel, and an antenna. The control panel provides a means of selecting the mode of operation, adjusting the audio output level, selecting the desired receiver and transmitter frequency, and adjusting the squelch (accomplished by maintenance personnel). The antenna (5, Fig. 2-4) is mounted at the tip of the vertical stabilizer.

5-31. AN/ARC-115 CONTROL PANEL. The AN/ARC-115 control panel (Fig. 5-6), marked VHF AM COMM, is located on the right-hand side of the pilot's subpanel (15, Fig. 2-6, Chapter 2). The controls and their related functions are as follows:

a. LEFT-HAND MEGACYCLES INDICATOR – displays the frequency to which the main receiver/transmitter is tuned.

b. LEFT-HAND MEGACYCLES CONTROL KNOB – A rotary control that tunes the main receiver/transmitter in 1-MHz steps, as indicated by the first three digits on the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

c. RIGHT-HAND MEGACYCLES CONTROL KNOB – a rotary control that tunes the main receiver/transmitter in 25-kHz steps, as indicated by the last three digits of the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

d. RCVR TEST PUSHBUTTON – when depressed injects a noise signal into the main receiver to provide an audible indication that the receiver is performing properly.

e. FUNCTION SELECTOR SWTICH – a five-position rotary switch that sets the operating mode of the radio. With the switch at OFF, power is removed from the radio. With the switch at T/R, the radio functions as a transceiver on the selected frequency. With the switch at T/R GUARD, the radio functions as a transceiver on the selected frequency and receives the guard frequency. The D/F and RETRAN positions are not used.

f. SQUELCH SCREWDRIVER ADJUSTMENT – used by maintenance personnel to adjust the level at which receiver signals are squelched.

g. AUDIO CONTROL KNOB – a rotary control that adjusts the level of the audio output.

5-32. The VHF/AM radio set is connected to the communication control panel at receiver switch No. 3 and the No. 3 position of the transmitter selector switch.

5-33. AN/ARC-115 OPERATION.

5-34. RADIO RECEPTION.

To turn set on and receive:

a. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

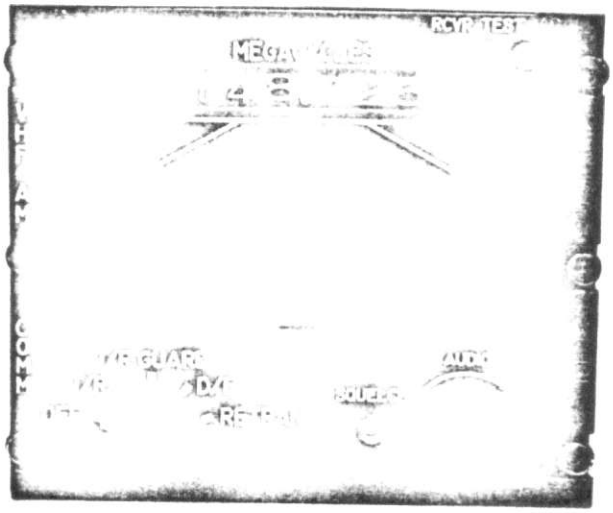


Fig. 5-6 AN/ARC-115 Control Panel

NOTE

If traffic is heard on the guard channel and mission operation permits, switch main receiver to guard frequency and provide whatever communications assistance is required (i.e., relay of messages, answering distress calls, etc.).

b. Receiver switch No. 3 (communication control panel) – ON.

c. Function selector switch (radio panel) – T/R.

d. AUDIO control knob – AS DESIRED.

5-35. T/R GUARD MODE.

a. Turn the radio set on as described in paragraph 5-34.

b. Place the function selector switch in the T/R GUARD position.

c. Operate the radio set in the same manner as for T/R operation.

NOTE

Guard channel reception is not affected by the settings of the megacycles controls. If guard channel signals are heard while receiving signals on a main receiver communication channel, detune the main receiver by rotating the megacycles control to an open channel. This will permit only the priority guard channel signal to be monitored.

5-36. RADIO TRANSMISSION.

To transmit:

a. Turn the radio on as described in paragraph 5-34.

b. Place the transmitter selector switch (communication control panel) in the No. 3 position.

c. Function selector switch (radio panel) – T/R.

d. Frequency selector controls (radio panel) – AS DESIRED.

e. Microphone switch (MIC) – DEPRESS. Speak into the microphone.

5-37. RADIO SHUTDOWN.

To turn set off:

a. Function selector switch – OFF.

5-38. DESCRIPTION OF UHF/AM RADIO SET AN/ARC-116.

5-39. The UHF/AM Radio Set AN/ARC-116 provides two-way voice communications, air-to-air or air-to-ground, within the frequency range of 225.00 to 399.95 MHz. The main receiver and transmitter operate on any one of 3,500 channels, spaced in 50-kHz increments. The guard receiver is fixed tuned in the 238- to 248-MHz frequency range. Principal components of the UHF/AM radio set are a receiver, a transmitter, a control panel, and an antenna. The control panel provides the means of selecting the mode of operation, adjusting the audio output level, selecting the desired receiver and transmitter frequency, and adjusting the squelch level (accomplished by maintenance personnel). The antenna (5, Fig. 2-4) is mounted at the tip of the vertical stabilizer.

5-40. AN/ARC-116 CONTROL PANEL. The AN/ARC-116 control panel (Fig. 5-7), marked UHF AM, is located on the right-hand side of the pilot's subpanel (15, Fig. 2-6, Chapter 2). The controls and their related functions are as follows:

a. MEGACYCLES INDICATOR – displays the frequency to which the receiver/transmitter is tuned.

b. LEFT-HAND MEGACYCLES CONTROL KNOB – a rotary control that tunes the main receiver/transmitter in 10-MHz steps, as indicated by the first two digits of the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

c. CENTER MEGACYCLE CONTROL KNOB – a rotary control that tunes the main receiver/transmitter in 1-MHz steps, as indicated by the third digit of the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

d. RIGHT-HAND MEGACYCLES CONTROL KNOB – a rotary control that tunes the main receiver/transmitter in 50-kHz steps, as indicated by the last two digits of the MEGACYCLES indicator. (The guard receiver is fixed tuned.)

e. RCVR TEST PUSHBUTTON – when depressed, injects a noise signal into the main receiver to provide an audible indication that the receiver is performing properly.

f. FUNCTION SELECTOR SWITCH – a five-position rotary switch that sets the operating mode of the radio. With the switch at OFF, power is removed from the radio. With the switch on T/R, the radio functions as a transceiver on the selected frequency. With the switch on T/R GUARD, the radio functions as a transceiver on the selected frequency and receives the guard frequency. The D/F and RETRAN positions are not used.

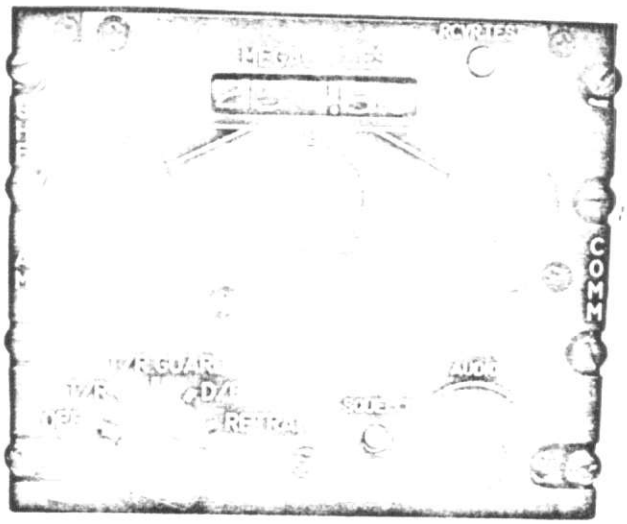


Fig. 5-7 ARC-116 Control Panel

g. SQUELCH SCREWDRIVER ADJUSTMENT – used by maintenance personnel to adjust the level at which receiver signals are squelched.

h. AUDIO CONTROL KNOB – a rotary control that adjusts the level of the audio output.

5-41. The UHF/AM radio set is connected to the communication control panel at receiver switch No. 2 and at the No. 2 position of the transmitter selector switch.

5-42. AN/ARC-116 OPERATION.

5-43. RADIO RECEPTION.

To turn set on and receive:

a. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

b. Receiver switch No. 2 (communication control panel) – ON.

c. Function selector switch (radio panel) – T/R.

d. AUDIO control knob – AS DESIRED.

5-44. T/R GUARD MODE.

a. Turn the radio set on as described in paragraph 5-43.

b. Place the function selector switch in the T/R GUARD position.

c. Operate the radio set in the same manner as for T/R operation.

NOTE

Guard channel reception is not affected by the settings of the megacycles controls. If guard channel signals are heard while receiving signals on a main receiver communication channel, detune the main receiver by rotating the megacycles control to an open channel. This will permit only the priority guard channel signal to be monitored.

NOTE

If traffic is heard on the guard channel and mission operation permits, switch main receiver to guard frequency and provide whatever communications assistance is required (i.e., relay of messages, answering distress calls, etc.).

5-45. RADIO TRANSMISSION.

To transmit:

5-56. ADF CONTROL PANEL. The ADF control panel (2, Fig. 2-6, Chapter 2), marked ADF RCVR, is located on the left-hand side of the pilot's compartment, adjacent to the throttle quadrant. The controls and their related functions are as follows (see Fig. 5-8):

a. AUDIO CONTROL KNOB – a rotary control that adjusts the signal output level. With the function selector switch at COMP, the AUDIO control adjusts the audio output. With the switch at ANT or LOOP, the AUDIO control adjusts the RF gain of that portion of the system.

b. FUNCTION SELECTOR SWITCH – a four-position rotary switch used to select the direction-finding mode. When the switch is at OFF, the radio compass receiver is off. With the switch at the COMP position, the receiver is turned on, and the automatic direction-finding mode is activated. In the ANT position, the system functions as an AM radio receiver. With the switch at the LOOP position, the manual direction-finding mode is activated, requiring manual rotation of the loop antenna.

c. LOOP L-R CONTROL SWITCH – used during the manual direction-finding mode. The switch is a potentiometer-type, spring-loaded, return-to-center control with clockwise and counterclockwise selection available. With the switch rotated toward R, the loop antenna rotates clockwise. Antenna rotation speed increases as the switch is advanced toward R. Rotation of the switch counterclockwise rotates the loop antenna in the counterclockwise direction at the same variable speeds as described for clockwise rotation.

d. COARSE TUNE CONTROL KNOB – a rotary control that tunes the receiver in 100-kHz steps, as indicated by the first two digits of the KILOCYCLES indicator.

e. FINE TUNE CONTROL KNOB – a rotary control that tunes the receiver within the range selected by the coarse tune control knob.

f. KILOCYCLES INDICATOR – displays the frequency to which the receiver is tuned.

g. TUNE INDICATOR – provides an indication of relative strength while tuning radio receiver to a specific radio signal.

h. CW-VOICE-TEST SWITCH – a three-position toggle switch spring-loaded away from the TEST position. With the switch set at CW and the function selector switch at COMP, a tone oscillator provides an audible tone for tuning to a CW station. Setting the switch at CW and the function selector switch at ANT or LOOP enables the BFO to permit tuning to a CW station. With the CW-VOICE-TEST switch set at VOICE, the receiver operates as an AM receiver. With the switch held on the TEST position and the function selector switch at COMP, the goniometer slews through 180 degrees for checking the automatic direction-finding mode of the system.

5-57. AN/ARN-89 OPERATION.

To turn set on:

a. GRD-OFF-FLT switch – GRD (FLT if APU is not available).

b. NAV switch (communication control panel) – ON

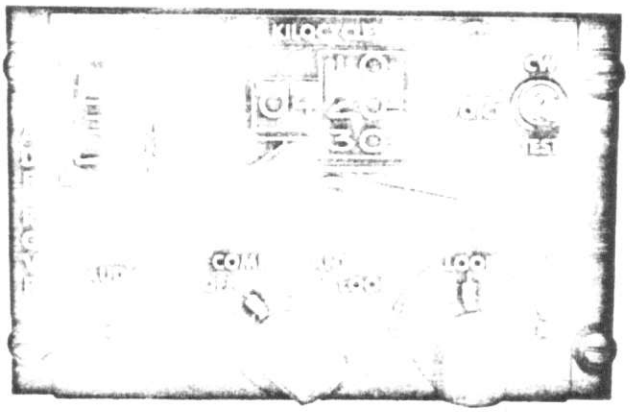


Fig. 5-8 ADF Control Panel

To use set as a radio receiver:

a. Function selector switch – ANT POSITION.

b. Kilocycles coarse and fine tuning controls – AS DESIRED.

c. CW-VOICE-TEST switch – VOICE (CW POSITION FOR CW RECEPTION).

d. Fine tuning control – ADJUST. Adjust for maximum (upward) deflection on TUNE indicator.

e. AUDIO control – AS DESIRED.

To operate set in COMP mode:

a. Turn the ADF set on (as described in steps a. and b., paragraph 5-57).

b. Function selector switch – COMP POSITION.

c. ID-1351A bearing-heading indicator – Observe the indicated relative bearing of the radio transmitter from the aircraft.

NOTE

To test the ADF system, set the CW-VOICE-TEST toggle switch to TEST. Check to see that the ID-1351A bearing-heading indicator display changes by 180 degrees. After test, return the CW-VOICE-TEST switch to VOICE for normal operation.

To operate set in ANT mode:

a. Turn the ADF set on (as described in steps a. and b., paragraph 5-57).

b. Function selector switch – ANT POSITION.

c. Headset – MONITOR. Monitor the received information by listening in the headset.

To operate set in LOOP mode:

a. Turn the ADF set on (as described in steps a. and b., paragraph 5-57).

b. Function selector switch – LOOP POSITION.

c. LOOP L-R switch – ROTATE. Rotate switch to left (L) or right (R) position to obtain audio and tuning indicator null. Release switch to return to center position.

NOTE

In this mode of operation two null positions, separated by 180 degrees, may be obtained.

To turn ADF set off:

a. Function selector switch – OFF.

5-58. BEARING-HEADING INDICATOR ID-1351A. The ID-1351A bearing-heading indicator (67, Fig. 2-6, Chapter 2) is used in conjunction with the gyromagnetic compass, the AN/ARN-89 Automatic Direction Finder Set, and the AN/ARC-114 VHF/FM radio receiver (homing mode). In the automatic direction-finding mode, the ID-1351A bearing-heading indicator gives the relative bearing of a signal being received via the ADF receiver. The indicator also has the following features: a station-passage meter, which indicates that the aircraft is progressing toward or away from an FM station; a compass-power warning flag, which shows "OFF" when the compass system is not receiving power or when a malfunction occurs; an FM steering indicator with associated on-off indicator; a compass-system synchronizing knob, which is used to align the compass card; and an FM signal-strength indicator. Input to the bearing indicator is supplied from the ADF radio receiver. Inputs to the signal-strength indicator, the FM steering indicator, and the station-approach indicator are supplied by the VHF/FM radio receiver.

5-59. DESCRIPTION OF TACAN SET AN/ARN-52(V).

5-60. TACAN Set AN/ARN-52(V) is an airborne navigational system that operates in conjunction with a selected fixed ground station beacon or with another cooperating aircraft equipped with TACAN. The set operates on any of 126 channels in the UHF (1,000 MHz) band. In the receive (REC) mode of operation, the set provides continuous information on the bearing (azimuth angle) from the aircraft to the selected beacon. In the transmit/receive (T/R) mode of operation, the set provides continuous information on the line-of-sight distance from the aircraft to the selected beacon in addition to bearing information. In the T/R and REC modes, the beacon is identified by an identity tone signal heard in the headset when the NAV switch on the communication system control panel is ON.

In the air-to-air mode of operation, the TACAN set provides continuous information on the line-of-sight distance between two cooperating aircraft when each is equipped with TACAN. The maximum operating range of the equipment in any of the three modes of operation is approximately 300 miles, but actual range is, of course, a function of altitude.

5-61. C-2010/ARN-52(V) TACAN CONTROL PANEL. The TACAN control panel, marked TACAN, is located on the extreme left-hand side of the pilot's compartment (1, Fig. 2-6, Chapter 2). The controls and their functions are as follows (see Fig. 5-9):

a. CHAN CONTROL KNOB – selects any of 126 TACAN channels.

b. VOL CONTROL KNOB – adjusts the level of the station identity tone.

c. FUNCTION SELECTOR SWITCH – a rotary, four-position switch that selects the operating mode of the TACAN set. With the switch at OFF, power is removed from the set. With the switch at REC the system is in the receive mode and the set will provide bearing and identity information for a selected TACAN beacon. With the switch at T/R, the system provides bearing and identity signals and also slant-range distance to a selected TACAN beacon. With the switch at A/A, the system indicates the line-of-sight distance to another aircraft equipped with TACAN.

d. PANEL LAMPS – two panel lamps provide panel illumination.

5-62. TACAN NAVIGATION INSTRUMENTS. Bearing and distance information from the TACAN set is displayed on the ID-387/ARN TACAN Course Indicator and the ID-663/U TACAN Bearing-Distance-Heading Indicator (BDHI). (See Fig. 5-10.) The course indicator shows whether the selected course leads to or from the selected TACAN beacon and the amount of course deviation from the selected bearing. The BDHI shows the bearing (azimuth angle) from the aircraft to a selected ground TACAN beacon measured clockwise from magnetic north and the distance (slant range) to that station. The BDHI also functions as a readout device for the gyromagnetic compass system and for the ADF system (needle No. 2).

5-63. AN/ARN-52(V) OPERATION.

5-64. TURNON PROCEDURE. This paragraph describes the general procedure for turning on the TACAN set. See paragraphs 5-65 through 5-67 for operation of the set in the various operational modes.

NOTE

The TACAN set must be turned on prior to taxi and takeoff, if required. When the TACAN set is turned on, the power failure warning flags will appear on the artificial horizon and the gyro compass course indicator. This is a normal condition, and the flags should disappear and the system assume normal appearance within 30 seconds.

To turn set on:

a. GRD-OFF-FLT switch – GRD (FLT is APU is not available).

b. Receiver NAV switch (communication control panel) – ON.

c. Function selector switch – AS DESIRED (see paragraphs 5-65 through 5-67).

d. CHAN control knob – SELECT DESIRED TACAN CHANNEL.

e. Allow 3 minutes for warmup of the set.

f. VOL control knob – AS DESIRED.

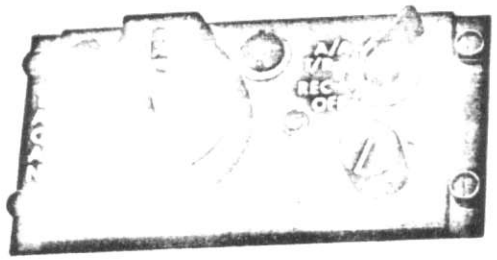


Fig. 5-9 TACAN Control Panel

(a) ID-387/ARN TACAN Course Indicator

(b) ID-663/U TACAN Bearing-Distance-Heading Indicator (BDHI)

Fig. 5-10 TACAN Navigation Instruments

5-65. RECEIVE (REC) MODE. In the receive mode of operation, the TACAN set receives signals from a selected TACAN beacon, and these signals provide bearing information.

To operate set in receive mode:

a. Turn the TACAN set on as described in paragraph 5-64.

b. Function selector switch – REC POSITION.

c. CHAN control knob – SELECT DESIRED TACAN CHANNEL.

d. VOL control knob – AS DESIRED.

e. The bearing pointer of the BDHI will indicate the bearing from the aircraft to the selected TACAN beacon.

f. Note the TACAN bearing reading on the BDHI. Adjust the SET knob on the TACAN course indicator so that the TACAN bearing appears in the window. Orient the aircraft to fly the course prescribed by the TACAN bearing. The vertical needle of the course indicator should be in the center. The function of this needle is to indicate deviation from the selected TACAN bearing. Deviation of the vertical needle to the right of center indicates that the aircraft is to the left of the desired radial. Deviation of the vertical needle to the left of center indicates that the aircraft is to the right of the desired radial. With the aircraft flying the TACAN bearing as indicated on the BDHI and the SET knob on the course indicator adjusted to this TACAN bearing, a "FROM" indication of the course indicator TO-FROM indicator will be observed. When the aircraft passes over the TACAN beacon while flying the same radial, a "TO" indication will be observed. The station identity Morse coded letter group (identity tone) will be heard clearly over the headset. The volume of the identity tone is controlled by the VOL control on the TACAN control panel (Fig. 5-9). The bearing alarm flag on the course indicator will not be in view.

g. Turn the aircraft right or left, as appropriate, to arrive at the desired course. When the aircraft is on the desired radial the vertical needle of the course indicator is centered, the identity tone can be clearly heard, and the TO-FROM indicator on the course indicator indicates whether the aircraft is flying on the selected radial or the reciprocal of the selected radial. The bearing alarm flag on the course indicator will not be in view.

5-66. TRANSMIT-RECEIVE (T/R) MODE. In the transmit-receive mode of operation, the TACAN set transmits interrogation signals that initiate reply signals from a selected TACAN beacon. The set uses the reply signals to derive line-of-sight distance to the beacon. It also receives signals from the beacon that provide bearing information (as described in paragraph 5-65).

To operate set in transmit-receive mode:

a. Turn the TACAN set on as described in paragraph 5-64.

b. Function selector switch – T/R POSITION.

c. CHAN control knob – SELECT DESIRED TACAN CHANNEL.

d. VOL control knob – AS DESIRED.

e. The distance numerals of the distance indicator should rotate during the search mode and then stop

abruptly, indicating the distance of the aircraft from the beacon. The distance flag alarm should be in view during the search mode and out of view after distance lock-on is achieved. The distance indicator should then continuously track the distance between the aircraft and the beacon. The bearing pointer of the BDHI will indicate the bearing of the aircraft from the selected beacon (see steps e. through g., paragraph 5-65).

5-67. AIR-TO-AIR (A/A) MODE. In the air-to-air mode of operation, the TACAN set in each cooperating aircraft transmits interrogation signals that initiate reply signals from the corresponding TACAN set in another aircraft. Each set uses the received reply signals to derive line-of-sight distance.

To operate set in air-to-air mode:

NOTE

Operation in the air-to-air mode requires prearrangement with a cooperating aircraft. The second aircraft must be equipped with TACAN equipment that is set to the air-to-air mode of operation and tuned to a channel 63 channels away from the channel setting of the TACAN set in the first aircraft. In addition, the line-of-sight distance between the two aircraft cannot exceed 300 miles. One aircraft may reply to as many as five others, but the TACAN set will display only the distance to one of the five other aircraft. Bearing information is not provided in the air-to-air mode.

a. Turn on the TACAN set as described in paragraph 5-64.

b. Function selector switch – A/A POSITION.

c. CHAN control knob – SELECT DESIRED TACAN CHANNEL.

d. VOL control knob – AS DESIRED.

e. The distance indicator on the BDHI should lock-on and continuously track the distance between the two aircraft. The distance flag alarm should be in view during the search mode and out of view after lock-on is achieved.

5-68. SHUTDOWN PROCEDURE.

To turn set off:

a. Function selector switch (TACAN control panel) – OFF.

b. Receiver NAV switch (communication control panel) – OFF.

5-69. RADAR BEACON (RT-855-UPN-25).

5-70. DESCRIPTION. Complete provisions have been made for installation of the radar beacon in the YO-3A aircraft. The radar beacon (4, Fig. 5-4) is a solid-state encoder/transponder that increases the capabilities of X-band radars by receiving pulsed interrogations from a radar set and then transmitting pulsed replies of much greater signal strength in the same frequency band. Equipment adjustment and mode selection are accomplished by maintenance personnel.

5-71. OPERATION. When the beacon transponder is installed, the pilot can enable it by turning on the safety guarded toggle switch marked RADAR BEACON (pilot's circuit breaker panel, 27, Fig. 2-6, Chapter 2).

5-72. IFF EQUIPMENT.

5-73. DESCRIPTION.

5-74. The IFF equipment consists of a transponder system that automatically presents positive information on aircraft identification, position, and emergency conditions (if they exist) to suitably equipped aircraft or surface facilities within the operational range of the system. The receiver section operates on a frequency of 1,030 MHz, and the transmitter section operates on a frequency of 1,090 MHz. Specially coded identification of position (IP) and emergency signals may be transmitted to interrogating stations when conditions warrant. The range of the IFF unit is limited to line-of-sight transmission and is dependent on the altitude of the aircraft.

5-75. The IFF transponder will respond only to an interrogation signal from an external source corresponding to the modes and codes preset in the IFF control box and in the transponder itself. The transponder can be operated in any one of the following categories, each of which may be selected by the pilot at the IFF transponder control panel (see paragraph 5-79):

(1) Low-sensitivity operation

(2) Normal-sensitivity operation

(3) Identification of position

(4) Emergency operation

5-76. Three independent coding modes are available to the pilot. The first three modes may be used independently or in combination. Mode 1 provides 32 possible code combinations, any one of which may be selected in flight. Mode 2 provides 4,096 possible code combinations, but only one is available since the Mode 2 selection dials are not available in flight and must be preset on the ground. Mode 3/A provides 4,096 possible codes, any one of which may be selected in flight. Modes C and 4 are not presently used.

5-77. SYSTEM COMPONENTS. The IFF system installed in this aircraft consists of Transponder Set C-6280 (P)/APX (IFF Transponder Control Panel) and the RT859/APX-72 REC/TRAN IFF Antenna (6, Fig. 5-4). The transponder control panel provides power to the IFF transceiver, selects the modes and categories of operation, and controls the mode code settings (except for Mode 2).

5-78. INTERROGATION/RESPONSE SEQUENCE. Figure 5-11 is a simplified functional block diagram of the IFF system, showing the interrogation and response sequence. Incoming signals, consisting of pairs of pulses spaced to form a code, are transmitted to the receiver in the aircraft, which transfers them to the decoder. The decoder checks the signals for valid code and proper mode. If valid, the decoded signals are sent to the encoder, which prepares the coded reply. The coded reply is then sent through the transmitter and antenna for transmission to the interrogating source.

5-79. IFF TRANSPONDER CONTROL PANEL C-6280(P)/APX. The IFF transponder control panel (54, Fig. 2-6, Chapter 2) is located at the top center of the pilot's compartment. All operating and mode code select switches for the IFF transponder are located on the face of the transponder control panel (Fig. 5-12), except for the Mode 2 code select switches, which are on the transponder itself, located on the equipment deck behind the pilot. Table 5-4 contains a list of the controls and indicators on the transponder control panel and brief descriptions of the control functions.

5-80. IFF CODE HOLD CONTROL AND INDICATOR. This feature is not used in the YO-3A aircraft.

5-81. OPERATION OF IFF UNIT.

5-82. PRELIMINARY STEPS. Perform the preliminary steps (a. through g., below) before proceeding to the starting procedure (paragraph 5-83).

a. MASTER control knob (IFF transponder control panel) – OFF.

b. IDENT-MIC switch – OUT.

c. M-1, M-2, M-3/A, M-C, and MODE 4 switches – OUT.

d. AUDIO LIGHT switch – OUT.

e. RAD-TEST-MON switch – OUT.

f. MODE 1 and 3/A select switches – SET. Set to required operational code.

g. MODE 2 code select switch (on remote IFF transponder) – CHECK PRESET TO DESIRED CODE.

5-83. STARTING PROCEDURE. Check preliminary control settings (a. through g., above) for proper positions, then perform the following starting procedures:

a. GRD-OFF-FLT switch – GRD (If APU is not available).

b. MASTER control knob (IFF transponder control panel) – SET. Select one of the following switch positions, as appropriate:

STBY – one minute for standard temperature conditions and two minutes under extreme ranges of operating temperature.

LOW – low receiver sensitivity for receiving high-energy signals.

NORM – normal receiver sensitivity.

EMER – refer to paragraph 5-86.

c. M-1, M-2, and M-3/A switches – ON as required, refer to paragraph 5-84.

d. AUDIO-LIGHT switch – OUT.

e. IDENT-MIC switch – OUT (refer to paragraph 5-85).

f. RAD-TEST-MON switch – OUT.

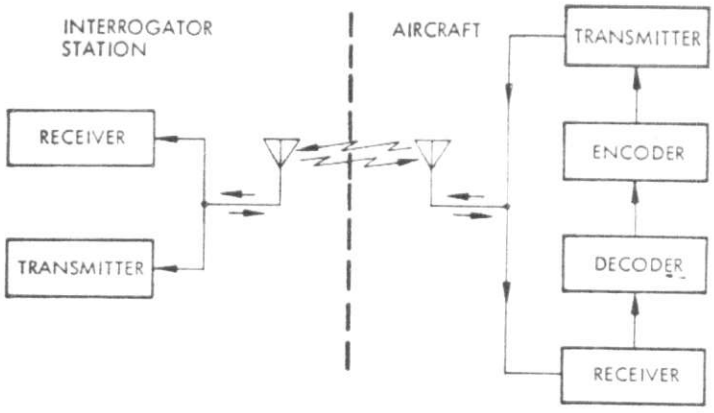


Fig. 5-11 IFF System Simplified Functional Block Diagram

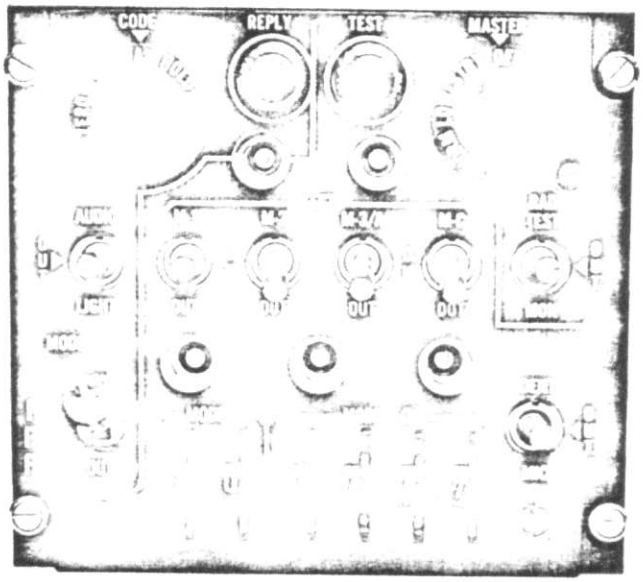


Fig. 5-12 IFF Transponder Control Panel

Table 5-4

IFF TRANSPONDER CONTROL PANEL CONTROLS AND FUNCTIONS

Control	Position	Function
MASTER control	OFF	Turns transponder off.
	STBY	Places transponder in warmup (standby) condition.
	LOW	Applies power to operate transponder, but at reduced receiver sensitivity.
	NORM	Applies power to operate transponder at normal receiver sensitivity.
	EMER	Transmits emergency reply signals to Mode 1, 2, or 3/A interrogations regardless of mode control settings.
IDENT-MIC switch	IDENT	When momentarily actuated (switch has spring-loaded return), initiates identification of position reply for approximately 25 seconds.
	OUT	Prevents triggering of identification of position reply.
	MIC	Not used.
M-1 switch	ON	Enables transponder to reply to Mode 1 interrogations.
	OUT	Disables reply to Mode 1 interrogations.
	TEST	Not used.
M-2 switch	ON	Enables the transponder to reply to Mode 2 interrogations.
	OUT	Disables reply to Mode 2 interrogations.
	TEST	Not used.
M-3/A switch	ON	Enables the transponder to reply to Mode 3/A interrogations.
	OUT	Disables reply to Mode 3/A interrogations.
	TEST	Not used.
M-C switch	OUT	Not used.
MODE 1 code select switches		Selects and indicates Mode 1 two-digit reply code number.
MODE 3/A code select switches		Selects and indicates Mode 3/A four-digit reply code number.
TEST indicator		Lights when the transponder responds properly to a Mode 1, 2, or 3/A test, or when depressed.
MODE 4 switch	OUT	Not used.
CODE control		Functions of this switch are operationally classified.
AUDIO-LIGHT switch	OUT	Not used.
REPLY indicator		Not used.
RAD-TEST-MON switch	RAD TEST	Enables transponder to reply to TEST mode interrogations from an AN/APM-123A(V), or equivalent. Other functions of this switch position are classified.
	MON	Not used.
	OUT	Disables the RAD TEST.

5-84. NORMAL OPERATION. For normal operation of the IFF unit, set the controls of the transponder control panel as follows:

a. MASTER control – SET. Set to LOW or NORM as required.

b. M-1, M-2, and M-3/A switches – ON (unless operational requirements indicate that only specific modes are to be used, then all other mode switches will be OUT).

c. AUDIO-LIGHT switch – OUT.

d. IDENT-MIC switch – OUT (refer to paragraph 5-85).

e. RAD-TEST-MON switch – OUT.

5-85. IDENTIFICATION OF POSITION (I/P) OPERATION. The IFF unit will transmit identifying signals to all interrogating stations on Modes 1, 2, and 3/A when the IDENT-MIC switch on the transponder control panel is set to IDENT. Transmission of the I/P signal will occur in these modes even if the mode enable switches are in the OUT position. For I/P operation, use the following procedure.

a. Momentarily hold the IDENT-MIC switch in the IDENT position (spring-loaded return) and then release it. This action will cause the transponder to transmit the I/P signal for a period of approximately 30 seconds to all interrogating stations on Modes 1, 2, and 3/A.

b. Repeat as required.

5-86. EMERGENCY OPERATION. During an aircraft emergency or distress situation, the IFF unit may be used to transmit specially coded emergency signals on Modes 1, 2, and 3/A to all interrogating stations. These emergency signals will be transmitted as long as the MASTER control on the transponder control panel remains in the EMER position. For emergency operation, set the controls on the transponder control panel as follows:

a. Pull the MASTER control knob outward and rotate to the EMER position.

b. Let the MASTER control remain in the EMER position for the duration of the emergency.

c. When the emergency is over, return the MASTER control to the NORM or LOW position.

5-87. STOPPING PROCEDURE. To turn the IFF unit off, set the controls on the transponder control panel as follows:

a. MASTER control knob – OFF.

b. IDENT-MIC switch – OUT.

c. M-1, M-2, M-3/A, M-C, and MODE 4 switches – OUT.

d. GRD-OFF-FLT switch – OFF (UNLESS POWER PROVIDED BY THIS SWITCH IS NEEDED FOR OTHER PURPOSES).

Section III

DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

5-88. AUTHORITY FOR DEMOLITION.

5-89. The demolition procedures given in paragraph 5-90 will be used to prevent the enemy from using or salvaging the avionics equipment installed in this aircraft. Demolition of the equipment will be accomplished only upon order of the commander.

5-90. METHODS OF DESTRUCTION.

5-91. Any of the methods of destruction given below may be used. The time available and the tactical situation will determine the method to be used when destruction of equipment is ordered.

a. Smash. Smash front panels, cases, covers, switches, and controls; open the cases, remove and smash all circuit boards and other components; use sledges, axes, hammers, crowbars, and any other heavy tool available.

b. Cut. Cut interconnecting cables; use axes, handaxes (crash axe), machetes, or other similar tools.

WARNING

Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

c. Burn. Burn the technical manual first. Burn as much of the equipment as possible; use gasoline, oil, flame throwers, and similar tools. Use incendiary grenades to complete the destruction of unit interiors.

d. Bend. Bend panels and cabinets.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter destroyed parts in slit trenches or foxholes, or throw them into nearby streams.

Chapter 6
AUXILIARY EQUIPMENT

Section 1
SCOPE

6-1. GENERAL.

6-2. This chapter contains information on auxiliary equipment that: (1) is not electronically operated and (2) does not affect flying characteristics of the aircraft. The information contained herein is of non-technical nature, its purpose being to familiarize the pilot with basic operation of the equipment and any emergency instructions that may apply.

Section II

HEATING, VENTILATION, AND DEFOGGING SYSTEM

6-3. HEATING, VENTILATION, AND DEFOGGING SYSTEM.

6-4. A manually controlled air-distribution system (Fig. 6-1) supplies heated or ambient ram air to the forward section of the canopy and to both crew stations.

6-5. Ram air enters the system through a scoop at the top of the fuselage, just forward of the canopy. This air is routed through three ducts. One delivers air to four adjustable air outlets (two in each flight compartment). A second duct delivers air through an exhaust-stack heater to a temperature control valve, and a third duct delivers air directly to the temperature control valve. Air (hot ram, or a mixture of the two, as selected) then flows through a single duct to an on-off valve and from there to a distribution valve (controlled by knob marked DEFOG). The distribution valve routes selected air to the canopy through the defog air outlet in the observer's compartment or through the fixed floor air outlet, which is also in the observer's compartment. With the distribution valve in open position, selected air flows only to the defog air outlet; in the full closed position, all selected air flows to the fixed floor outlet. Intermediate settings of the valve can also be selected.

6-5A. Cockpit ventilation can be augmented by ram air from four ventilators located in the canopy, on the right and left sides of both cockpits. The ventilators are adjusted manually by moving them in or out or they can be rotated 360 degrees. (These ventilators are not shown in Fig. (6-1).

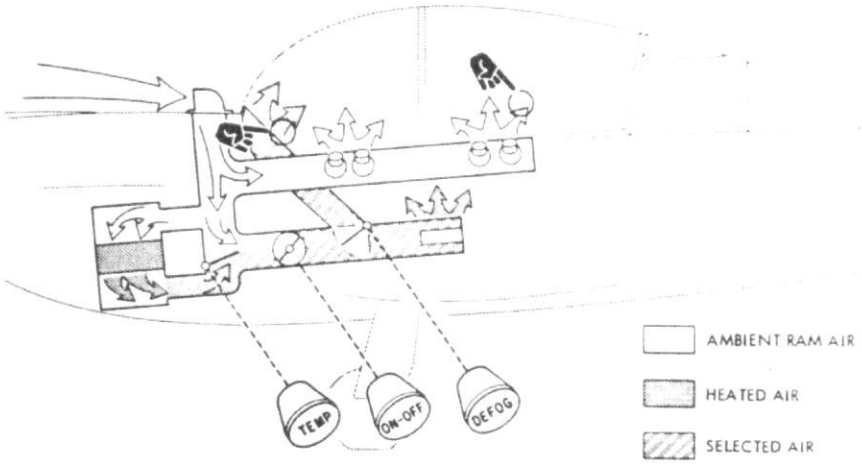


Fig. 6-1 Heating, Ventilation, and Defogging System

6-6. HEATING, VENTILATION, AND DEFOGGING CONTROLS.

6-7. The control panel for the heating, ventilation, and defogging system is located on the extreme lower right portion of the pilot's instrument panel (17, Fig. 2-6, Chapter 2). The panel contains three control knobs: ON-OFF, TEMP, and DEFOG.

6-8. ON-OFF CONTROL KNOB. When the ON-OFF control knob is pulled out to its fullest extension, ram air, either heated or unheated (depending on the setting of the temperature control valve), flows to the distribution valve. With the ON-OFF control knob pushed fully forward, flow of selected air to the distribution valve stops. The amount of ram air flow is controlled by selecting intermediate positions of the ON-OFF control knob.

6-9. TEMP CONTROL KNOB. When the TEMP control knob is pulled out to its fullest extension, only heated air flows to the on-off valve. With the TEMP control knob pushed fully forward, only ambient ram air is delivered to the on-off valve. A mixture of heated and ambient ram air can be obtained by moving the TEMP control knob to intermediate settings.

6-10. DEFOG CONTROL KNOB. When the DEFOG control knob is pulled out to its fullest extension, all selected air is delivered to the defog air outlet. With the control knob pushed fully forward, all selected air is delivered to the fixed floor air outlet. Intermediate settings of the DEFOG control knob provide partial distribution of selected air to the defog air outlet and to the fixed air outlet on the floor.

6-11. ADJUSTABLE AIR OUTLETS. Two adjustable air outlets are provided for each flight compartment. These are swivel-type, variable nozzles that can be adjusted to control the direction and amount of air flow or they can be closed completely.

6-12. EMERGENCY OPERATION OF HEATING AND VENTILATING SYSTEM.

6-13. Should fumes or smoke from the heating system enter the flight compartments or should the selected air become excessively hot, push both the ON-OFF knob and the TEMP control knob all the way forward.

6-14. PITOT HEATER.

6-15. An electrical pitot heater is provided in the pitot tube to prevent formation of ice in the pitot head. The heater receives its power from the 28-volt dc essential bus and is protected by a circuit breaker.

CAUTION

The pitot heater should not be operated on the ground since the absence of airstream may cause the unit to overheat.

6-16. PITOT HEATER SWITCH.

6-17. The pitot heater is controlled by a two-position switch. The switch is located on the pilot's switch and circuit breaker panel. The switch is marked PITOT HEATER and has two positions: ON and OFF. The switch receives its power from the 28-volt dc essential bus and is protected by a circuit breaker.

Section III

LIGHTING EQUIPMENT

6-18. LIGHTING EQUIPMENT.

6-19. When the MAIN BUS TRIM switch (37, Fig. 2-6, Chapter 2) is in the ON position, all exterior lighting circuits receive power from the 28-volt dc main bus. These circuits are protected by circuit breakers (Fig. 2-11, Chapter 2) that can be controlled from the pilot's instrument panel. (See Fig. 2-6, Chapter 2.)

6-20. When the MAIN BUS TRIM switch is in the OFF position (which isolates the essential bus from the rest of the aircraft electrical system), the following external lighting circuits will not be operative (see Fig. 2-10, Chapter 2):

a. Navigation lights
b. Rendezvous lights
c. Flashing beacon lights

6-21. EXTERIOR LIGHTING.

6-22. Exterior lighting consists of a taxi light, three navigation lights, two rendezvous lights, and two flashing beacon lights. The taxi light is mounted in the left wheel well. The navigation lights consist of a red light on the left wing tip, a green light on the right wing tip, and a white light on the tail. The two flashing beacon lights are mounted on the top and bottom of the fuselage, slightly aft of the canopy. Each contains a large red lens.

6-23. TAXI LIGHT SWITCH.

6-24. The taxi light switch is located on the pilot's switch panel. The switch is marked TAXI LIGHT and has two positions: ON and OFF. The switch receives power from the 28-volt dc essential bus and is protected by a circuit breaker.

6-25. NAVIGATION LIGHTS SWITCH.

6-26. The navigation lights switch is marked NAVIGATION LIGHTS and is located on the pilot's switch and circuit breaker panel. It has two positions: ON and OFF. The switch receives power from the 28-volt dc main bus and is protected by a circuit breaker.

6-27. RENDEZVOUS LIGHT SWITCH.

6-28. The rendezvous light switch is marked RENDEZVOUS LIGHT and is located on the pilot's switch and circuit breaker panel. It has three positions: OFF, INCANDESCENT, and STROBE. The switch receives power from the 28-volt dc main bus and is protected by a circuit breaker.

6-29. FLASHING BEACONS LIGHT SWITCH.

6-30. The flashing beacons light switch is located on the pilot's switch and circuit breaker panel. The switch is marked FLASHER BEACON and has two positions: ON and OFF. The switch receives power from the 28-volt dc main bus and is protected by a circuit breaker.

WARNING

Turn off flashing beacon during IFR (visible moisture) conditions to prevent possibility of pilot vertigo sensations induced by reflections of flashing beacon against clouds.

6-31. INTERIOR LIGHTS.

6-32. The interior lights consist of instrument lights, two map lights (one in each flight compartment), radio control panel lights, and an instrument panel floodlight. The two map lights are equipped with red plastic filters and are mounted on swivel-type mounting brackets. They can be adjusted in any direction or can be pulled from their stowage brackets and used as handlights. In addition, the map light in the pilot's flight compartment can be plugged into an alternate mounting socket located on the upper right portion of the pilot's instrument panel just to the right of the IFF unit. An instrument panel floodlight is located on the upper portion of the pilot's instrument panel. This light has a red filter that can be rotated to provide pale red light when desired.

6-33. INSTRUMENT LIGHT RHEOSTAT SWITCH.

6-34. An instrument light rheostat switch marked DIM PANEL is located on the pilot's instrument panel. To turn the instrument lights on, turn the dial clockwise. To dim the lights or turn them off, turn the dial counterclockwise to the desired setting or to off. The switch receives power from the 28-volt dc essential bus and is protected by a circuit breaker.

6-35. INSTRUMENT PANEL FLOODLIGHT SWITCH.

6-36. The instrument panel floodlight is turned off when the MAIN BUS TRIM switch is turned off. The switch is located on the pilot's subpanel (37, Fig. 2-6).

6-37. MAP LIGHT SWITCH.

6-38. An integral, knob-type switch is contained in the map light located in the pilot's and observer's flight compartments. The map light and switch receive power from the 28-volt dc main bus and are protected by a circuit breaker.

Section IV

MISCELLANEOUS EQUIPMENT

6-39. MOORING PROVISIONS.

6-40. Three removable tiedown rings are provided, one on each wing and one on the tail.

6-41. CANOPY SAFETY LINE.

6-42. A canopy safety line is provided as flyaway equipment. The safety line is used to secure the canopy when the aircraft is on the ground, and it provides a means for controlling the movement of the canopy during raising and lowering operations. The safety line is described in Chapter 2.

Chapter 7
OPERATING LIMITATIONS

Section I
SCOPE

7-1. GENERAL.

7-2. This chapter covers aircraft and engine limitations that must be observed during normal flight operations.

7-3. Limitations pertaining to specialized phases of operation are not covered in this chapter; these will be found in Chapter 4, Emergency Procedures, in Chapter 10, Weather Operations, and in Chapter 12, Weight and Balance Data.

Section II

LIMITATIONS

7-4. INTRODUCTION.

7-5. Operating limitations are derived from flight tests and operational experience. The limitations described here are for your protection; adherence to them will enhance your safety and enable you to obtain maximum utility from the aircraft and its equipment. Instrument markings showing various operation limitations are shown in Fig. 7-1.

NOTE

If any of the operational limitations indicated in Fig. 7-1 are exceeded, make an appropriate entry in DA Form 2408. This entry should include the duration of such operation and the causes, if known.

Instrument markings not discussed in the text are self-explanatory. Additional limitations on operational procedures, aerobatics, and loading are described in the following paragraphs.

7-6. MINIMUM CREW REQUIREMENTS.

7-7. The minimum crew required for this aircraft is one pilot in the rear flight compartment. The front flight compartment accommodates an observer.

WARNING

When operating with pilot only, ballast is required for proper center of gravity. See Chapter 12, Weight and Balance.

In an emergency, the observer can fly the aircraft from the front flight compartment, but this compartment contains limited flight controls and instruments.

7-8. ENGINE LIMITATIONS.

7-9. Normal engine limitations are indicated in Fig. 7-1. The maximum allowable engine speed is 2800 rpm.

WARNING

When engine speed exceeds the operating limits, the aircraft should be landed as soon as possible at the nearest base. The reason for the overspeed (if known), the maximum rpm, and the duration of such operation will be entered in DA Form 2408 and reported to the Maintenance Officer. Overspeed between 2800 and 3400 rpm will necessitate a special inspection of the engine before further flight. Overspeed between 3400 and 3600 rpm will necessitate a more stringent special inspection. (See Organizational Maintenance Handbook for YO-3A Aircraft, LMSC-D145160-1-1.) If engine speed exceeds 3600 rpm, the engine must be removed for overhaul.

CAUTION (Deleted)

7-10. PROPELLER LIMITATIONS.

7-11. The maximum allowable propeller speed is 2800 engine rpm. Propeller overspeed up to 3000 engine rpm requires visual inspection of the propeller hub and blades. Overspeeds greater than 3000 engine rpm require removal and inspection of the propeller assembly.

7-12. AIRSPEED LIMITATIONS.

7-13. The following airspeed limitations are the flight envelope limits for structural loads.

Maximum speed (Spoilers closed)	133 knots IAS
Maximum speed (Spoilers open)	133 knots IAS
Cowl flap open	87 knots IAS
Landing gear retraction	70 knots IAS
Landing gear extension	87 knots IAS
Maneuvering speed (3,800 lb gross weight)	96 knots IAS
Maneuvering speed (3,100 lb gross weight)	87 knots IAS
Maximum speed (rough air)	100 knots IAS

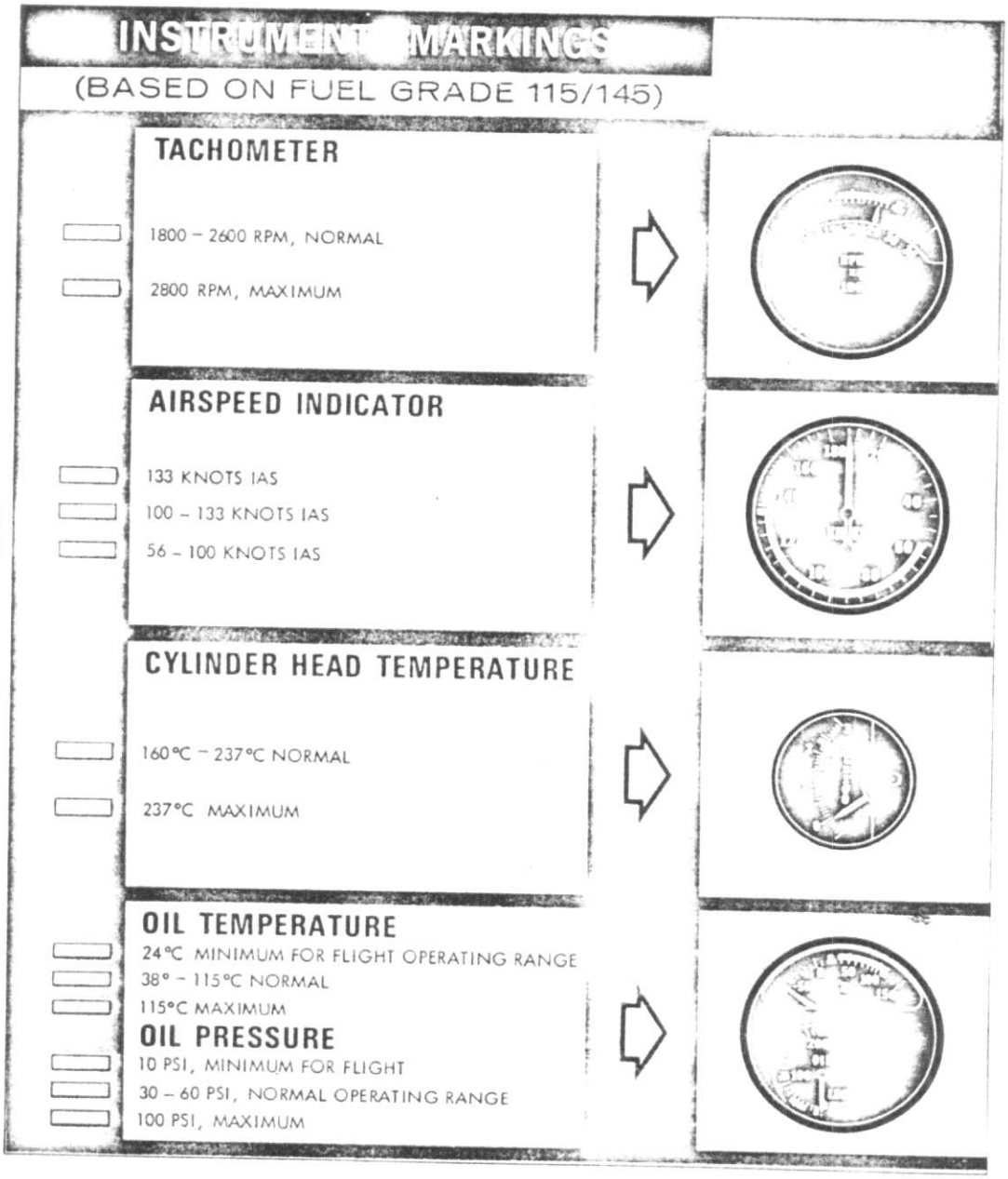


Fig. 7-1 Instrument Markings (Sheet 1 of 2)

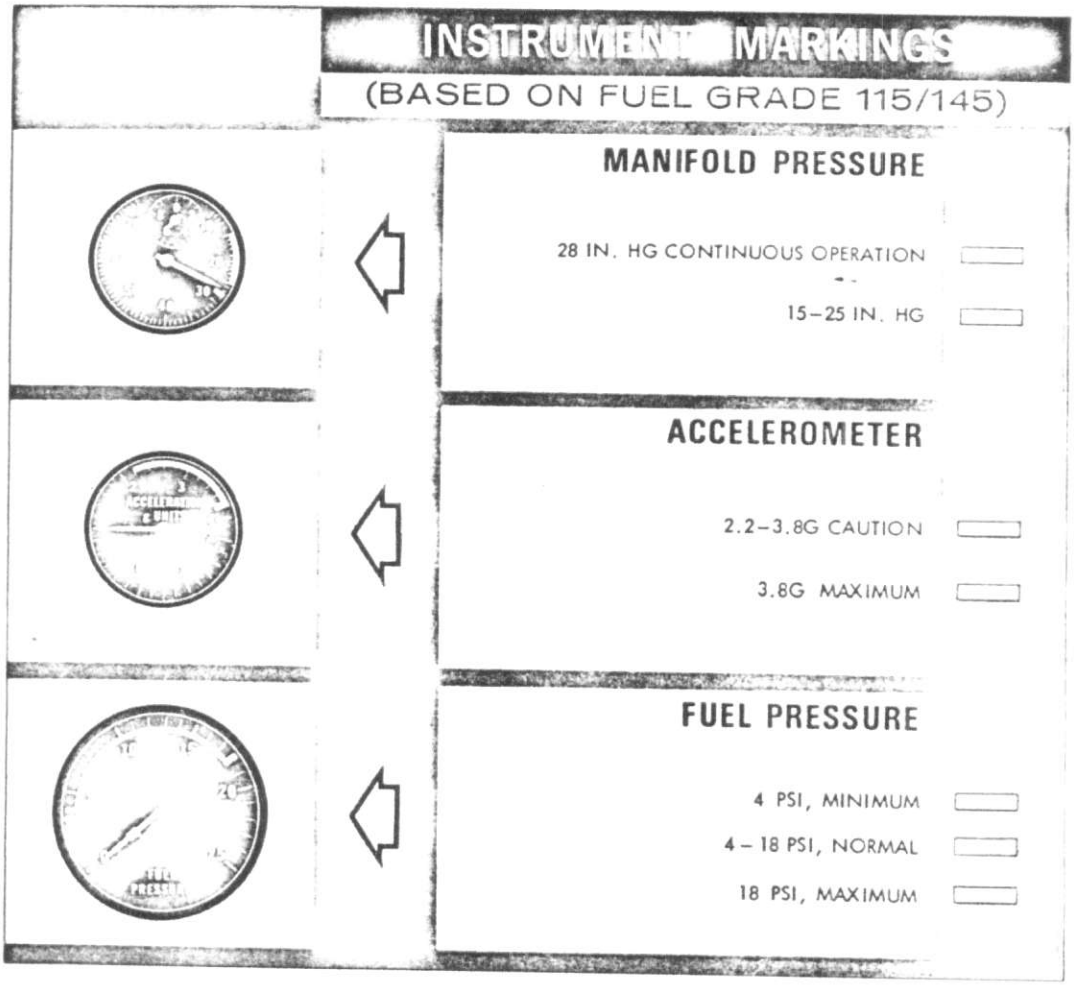


Fig. 7-1 Instrument Markings (Sheet 2 of 2)

7-14. MANEUVERS.

7-15. As noted in paragraph 7-13, the maximum maneuvering speed for this aircraft is 87 to 96 knots IAS, depending on gross weight. This is the maximum speed at which abrupt or full control deflections may be used. At light weight the maximum load factor can be reached at a lower air speed. All acrobatics and spins are prohibited. See Fig. 7-2 for the structural design flight envelope for the YO-3A aircraft.

WARNING

This airplane is intended for nonacrobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), and turns in which the angle of bank is not more than 60 degrees.

WARNING

Avoid abrupt rudder deflections that exceed pedal forces of 250 pounds. Limit rudder deflections and sideslips to the envelope shown in Fig. 7-2A.

7-16. ACCELERATION LIMITATIONS.

7-17. The maximum maneuvering load factors for gross weights up to 3,800 pounds are as follows:

Maximum positive maneuver . . .	+3.8 (spoilers closed)
	+2.2 (spoilers open, above maneuvering speed)
Maximum negative maneuver . . .	-1.3 (spoilers open or closed)
Maximum unsymmetrical maneuver	+3.0

Load factors exceeding these limitations are prohibited because such maneuvers impose severe structural loads for which this aircraft was not designed.

CAUTION

Intentional negative load factor maneuvers should not be performed because engine oil will escape from the oil system vent.

If load limitations are exceeded, exercise extreme care in proceeding to nearest available airport. Land as soon as possible, using caution in approach and landing so as to impose minimum stresses on the aircraft.

7-18. CENTER-OF-GRAVITY LIMITATIONS.

7-19. Normally, the recommended weight or cg limits for this aircraft will not be exceeded by loading arrangements employed during training or normal tactical operations for which the aircraft is designed. Refer to Chapter 12, Fig. 12-3, for gross weight and center-of-gravity limitations.

WARNING

When the aircraft is operated with the front seat empty or with the mission equipment removed, ballast weight must be installed for proper center of gravity. (See Chapter 12, Weight and Balance.)

WARNING

Carrying of external stores is not authorized.

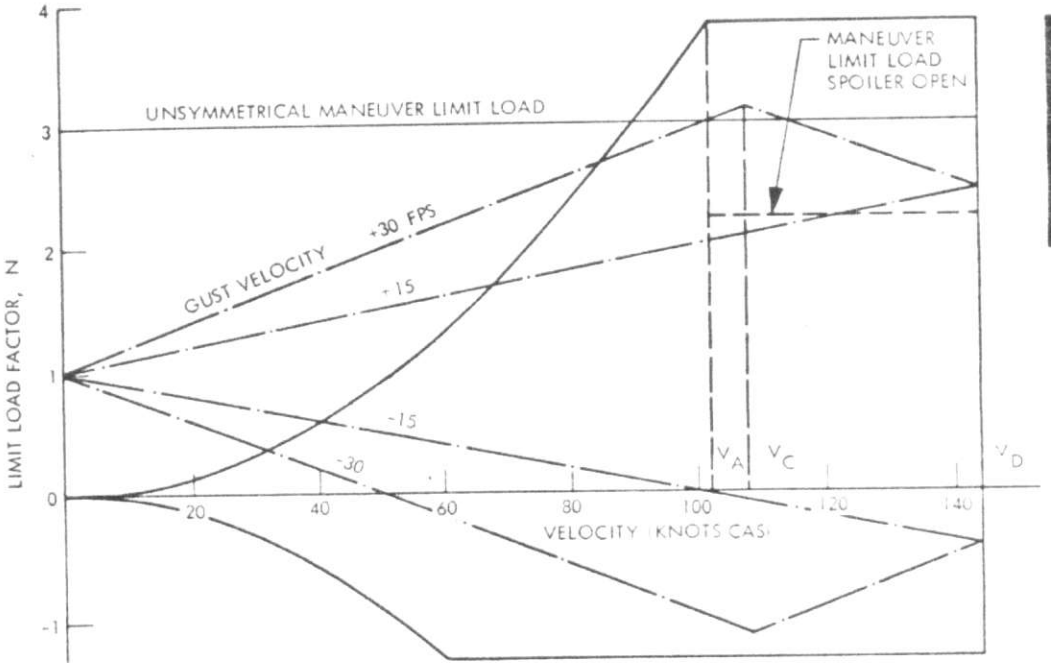


Fig. 7-2 Velocity/Load Factor Flight Envelope for Gross Weight of 3,300 Pounds

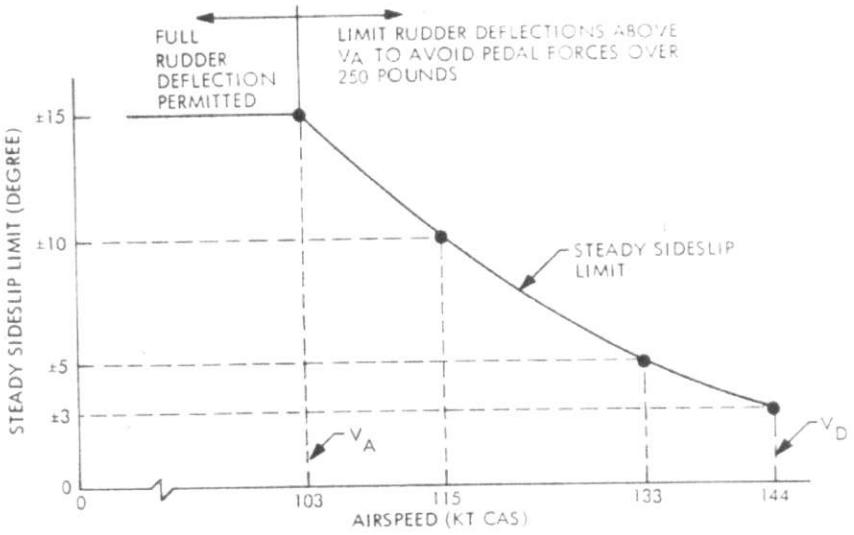


Fig. 7-2A Sideslip Limit Rudder Trimmed to 70 KT CAS

Chapter 8
FLIGHT CHARACTERISTICS

Section I
SCOPE

8-1. GENERAL.

8-2. The purpose of this chapter is to inform the pilot of any unique flight characteristics of YO-3A aircraft

Section II

MANEUVERS

8-3. MANEUVERING FLIGHT.

8-4. The YO-3A aircraft exhibits conventional flight characteristics except for the use of spoilers during rapid descents or landings.

8-5. STALLS.

8-6. NORMAL STALL CHARACTERISTICS.

8-7. The normal stall characteristics of the aircraft are conventional and mild. Stall warning is characterized by light buffeting of the controls and airframe. Full stall is reached with the stick aft and a stick force of 70 to 75 pounds. Stall is followed by pitch-down at a maximum rate of about 25 degrees/second with a slight tendency to roll off the right wing.

NOTE

Stall characteristics are not significantly affected by aircraft configuration, i.e., "clean" or power approach or spoiler extension.

8-8. ACCELERATED STALL CHARACTERISTICS.

8-9. Stalls in accelerated flight are similar to normal stalls, with no significant difference in the characteristics. However, stalls in a turn will be accompanied by a high rate of descent. Structural limitations of the aircraft will be exceeded if accelerated stalls are performed above 95 knots IAS.

8-10. PRACTICE STALLS.

8-11. Practice stalls should include power-on and power-off stalls in straight and turning flight with recovery initiated both prior to and following the downward pitch of the nose. Retard throttle smoothly for power-off stalls; use low cruise power settings for power-on stalls. Characteristics of the power-on stall are similar to those of the power-off stall.

8-12. PRACTICE STALL – POWER OFF, STRAIGHT AHEAD.

8-13. For power-off straight-ahead practice stalls proceed as follows:

a. Retard throttle smoothly to closed position.

b. Raise nose to landing attitude and hold until stall occurs.

c. Execute stall recovery with stick forward and power as required for minimum altitude loss.

NOTE

In stalls with spoilers open, the spoilers should be closed during recovery to minimize loss of altitude.

8-14. PRACTICE STALL – POWER ON, STRAIGHT AHEAD.

8-15. For power-on, straight-ahead practice stalls proceed as follows:

a. Retard throttle smoothly to approximately low cruise power.

b. Raise nose above horizon until stall occurs.

c. Execute stall recovery with stick forward and power as required for minimum altitude loss.

NOTE

In stalls with spoilers open, the spoilers should be closed during recovery to minimize loss of altitude.

8-16. PRACTICE STALL – POWER ON, 20-DEGREE BANK.

8-17. For power-on, 20-degree-bank practice stalls proceed as follows:

a. Retard throttle smoothly to approximately one-third-open position.

b. Establish coordinated climbing turn with about 20 degrees of bank.

c. While turning, steadily raise nose approximately 4 degrees above horizon until stall occurs.

d. Make stall recovery with stick forward and power as required for minimum altitude loss.

8-18. PRACTICE STALL - POWER OFF, 40-DEGREE BANK.

8-19. For power-off, 40-degree-bank practice stalls proceed as follows:

a. Retard throttle smoothly to closed position.

b. After excess speed is dissipated in straight flight, roll into slight nose-high gliding turn with about 40 degrees of bank.

c. While turning, steadily raise nose slightly above horizon until stall occurs.

d. Make stall recovery with stick forward and power as required for minimum altitude loss.

8-20. STALL SPEEDS.

8-21. See Fig. 8-1 for stall speeds.

8-22. STALL RECOVERY.

8-23. The intended mission of the aircraft dictates slow flight, approach, and climbout speeds that are close to actual stalling speeds. For these reasons stall recovery should be made with minimum loss in altitude. The aircraft can be flown out of the stall by using a slight amount of forward stick with simultaneous application of full throttle. If spoilers are open, close them as the aircraft accelerates. An excessive amount of altitude will be lost if the stick is moved quickly forward in an attempt to dive the aircraft to regain flying speed.

Aircraft Attitude	Stall Speed	
	Knots CAS	Knots IAS
 Level Flight	60	56
 20-Degree Bank	62	58
 40-Degree Bank	69	64
 60-Degree Bank	85	79

Data Basis: USAAVSCOM (corrected for GW)
Data As Of: Mar 1971

Notes: (1) Aircraft gross weight 3,800 lb.
(2) Stall speed is approximately the same for power on and power off, "clean" or power approach, spoilers open or closed.

Fig. 8-1 Stall Speeds

8-24. SPINS.

8-25. Spins are prohibited.

WARNING

Spin characteristics of the aircraft have not been investigated by flight tests.

8-26. SPIN RECOVERY.

WARNING

Spin recovery procedure has not been determined by flight test.

8-27. DIVES.

8-28. Dives and recovery from dives must be limited to the structural design flight envelope shown in Fig. 7-2, Chapter 7. The structural design limit dive speed is 133 knots IAS. Spoilers may be opened at all speeds within this envelope to limit overspeed.

8-29. At dive speeds up to 133 knots IAS, the engine will not overspeed with the throttle reduced.

8-30. Aircraft trim changes and control characteristics during dives are conventional. The fixed trim tab rudder requires increasing left rudder force at speeds greater than trim speed.

CAUTION (Deleted)

Section III

FLIGHT CHARACTERISTICS

8-31. FLIGHT CONTROLS.

8-32. Aileron forces are light, however, rudder and stabilator control forces are moderately heavy for this aircraft. Stabilator trim is effective throughout the range of flight speeds. Rudder trim is accomplished by a ground-adjustable tab which results in zero rudder force for directional trim at one airspeed only. This tab is set for the airspeed at which the aircraft will be predominately flying (normally low cruise speed). On extension of the spoilers a slight nose-up pitching moment will be experienced, on retraction of spoilers a slight nose-down pitching moment will be experienced.

Chapter 9
SYSTEMS OPERATION

Section I
SCOPE

This chapter is not applicable to YO-3A aircraft.

Chapter 10

WEATHER OPERATIONS

Section 1
SCOPE

10-1. GENERAL.

10-2. The purpose of this chapter is to provide information relative to operation under conditions of instrument flight (including night flying). In addition, procedures are given for operation under various weather and climatic conditions, such as extreme cold and hot weather, turbulent-air flight, and thunderstorm operations.

10-3. With the exception of some repetition of text necessary for emphasis, clarity, or continuity of thought, this chapter contains only those procedures that differ from, or are in addition to, the normal operating instructions found in Chapter 3.

Section II

INSTRUMENT FLIGHT

10-4. INSTRUMENT PROCEDURES.

10-5. Although this aircraft is adequately equipped for instrument flight, the pilot should avoid instrument weather because of the absence of de-icing equipment and because of the lack of an adjustable (inflight) rudder trim tab. The lack of de-icing equipment imposes a serious handicap when flying in visible moisture at or below freezing temperatures. During instrument flight, an airspeed (75 knots IAS) is recommended for climb, cruise, descent, and holding patterns. Nevertheless, since a competent instrument pilot could operate this aircraft safely in limited instrument conditions and it may sometimes be necessary to fly in instrument weather, the following instrument procedures are provided.

NOTE

When the TACAN set is turned on, the power failure warning flags will appear on the artificial horizon and the gyro compass course indicator. This is a normal condition, and the flags should disappear and the system assume normal appearance within 30 seconds.

10-6. INSTRUMENT TAKEOFF.

NOTE (Deleted)

10-7. Accomplish instrument takeoffs as follows:

a. Complete the normal taxi and before-takeoff procedures described in Chapter 3.

b. Pitot heat – ON.

c. Align aircraft with runway.

d. Gyromagnetic compass – CHECK.

e. Attitude indicator – ADJUST. Adjust for proper relative position with the miniature aircraft.

f. Altimeter – ADJUST. Adjust to current altimeter setting and verify with known field elevation.

WARNING

Turn off flashing beacon during IFR (visible moisture) conditions to prevent possibility of pilot vertigo sensations induced by reflections of flashing beacon against clouds.

g. Throttle – OPEN. Advance throttle slowly to minimize torque effect.

h. Directional indicators – MAINTAIN ORIGINAL INDICATION UNTIL AIRCRAFT IS AIRBORNE.

i. Climb out at a positive rate of climb, slowly increasing airspeed to 75 knots IAS.

j. Stabilator trim tab control wheel – ADJUST.

10-8. INSTRUMENT CLIMB.

10-9. Normal climb procedures and power settings are given in Chapter 3. Climbing normal-rate turns may be safely executed. Above 1,000 feet a two-needle-width turn (6 degrees/second) may be executed.

10-10. INSTRUMENT CRUISING FLIGHT.

10-11. The aircraft has satisfactory instrument characteristics at normal cruising speed. There is no adjustable aileron or rudder trim system on this aircraft; therefore, the pilot will have to devote attention to aircraft heading and wing position during instrument cruising flight.

10-12. INSTRUMENT DESCENT.

10-13. Normal enroute descents or radar controlled descents to approach altitudes are made with a "clean" configuration at 75 knots IAS, adjusting throttle to maintain 500 feet/minute rate of descent. With the exception of the need to hold rudder pressure to main-

tain heading, flight characteristics are conventional in descents with any combination of power, airspeed, and spoilers, in the normal operating range. Limit banks to standard rate turns if rate of descent is more than 500 feet per minute.

NOTE

Prior to letting down through an overcast, turn pitot heater ON.

10-14. HOLDING.

10-15. Holding in this aircraft normally presents no problem except for the need to hold rudder pressure to maintain heading. Enter the holding pattern and maintain recommended instrument cruising airspeed of 80 knots IAS, unless there is considerable delay or the fuel reserve is low. In such cases reduce power to low speed (70 knots IAS).

10-16. INSTRUMENT APPROACHES.

10-17. Preparations for instrument approaches should include a thorough study of approach charts and obstacles in the letdown area; determination that the rate of descent required at 70 knots IAS follows the prescribed glide path into the field; selection of a minimum altitude; and a study of the go-around procedure. Approach charts should be reviewed prior to letdown so that only occasional reference to them will be necessary during the landing approach.

10-18. All instruments and radio equipment should be carefully checked for proper operation, and the steps in paragraph 3-52, Chapter 3, should be accomplished.

10-19. Figure 10-1 shows a typical pattern for ADF approach. A typical radar approach is depicted in Fig. 10-2.

10-20. NIGHT FLYING.

10-21. Instrument flight and night flight are closely related in many points of technique. Takeoff, climb, and landing will require instrument reference whenever visual orientation becomes uncertain. Individual lighting for each instrument is provided in the instrument panel. Be sure you are thoroughly familiar with the lighting equipment of the aircraft and know the location of all switches in the pilot's compartment. Before a night takeoff, complete the steps in paragraph 3-35, Chapter 3. Leave the navigation and required flight compartment lights on during takeoff and normal climbs and cruise unless mission requirements preclude such operation. During night weather flight, turn off the flashing beacon lights to prevent any distraction created by cloud reflections. To penetrate an electrical storm at night, turn flight compartment lights on full bright (after removing red filters). This will prevent momentary blindness from lightning flashes. During normal VFR flight, unfiltered lights should be used sparingly.

WARNING

When making VFR takeoffs in areas of limited horizon references, reference to the flight instruments is recommended to avoid flying back to the ground after takeoff.

10-22. Before each night flight, check the following items:

a. Taxi light – CHECK OPERATION.
b. Navigation lights – CHECK OPERATION.
c. Instrument lights – CHECK OPERATION.
d. Map light – CHECK OPERATION.
e. Flashlight – CHECK OPERATION.

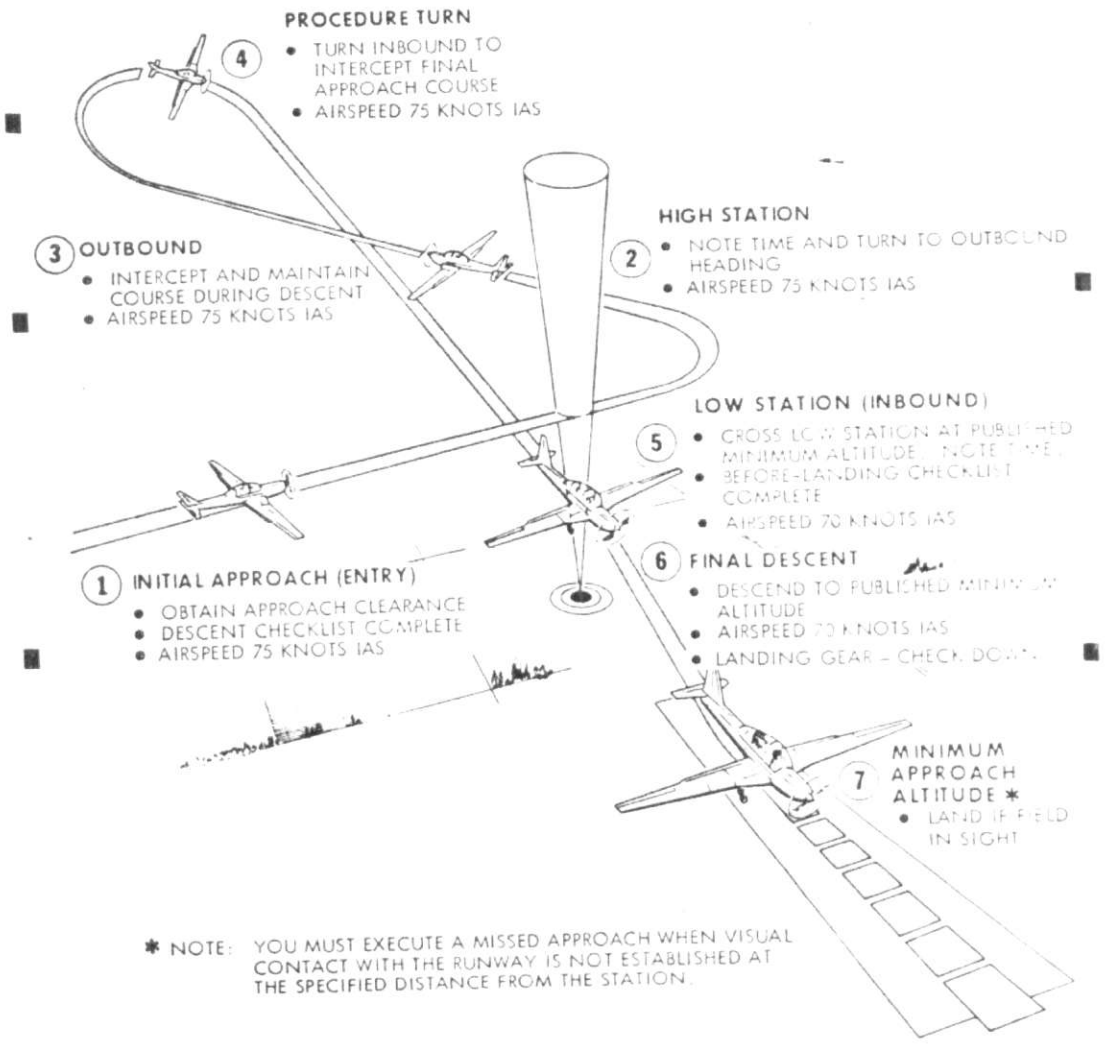


Fig. 10-1 Typical Pattern for ADF Approach

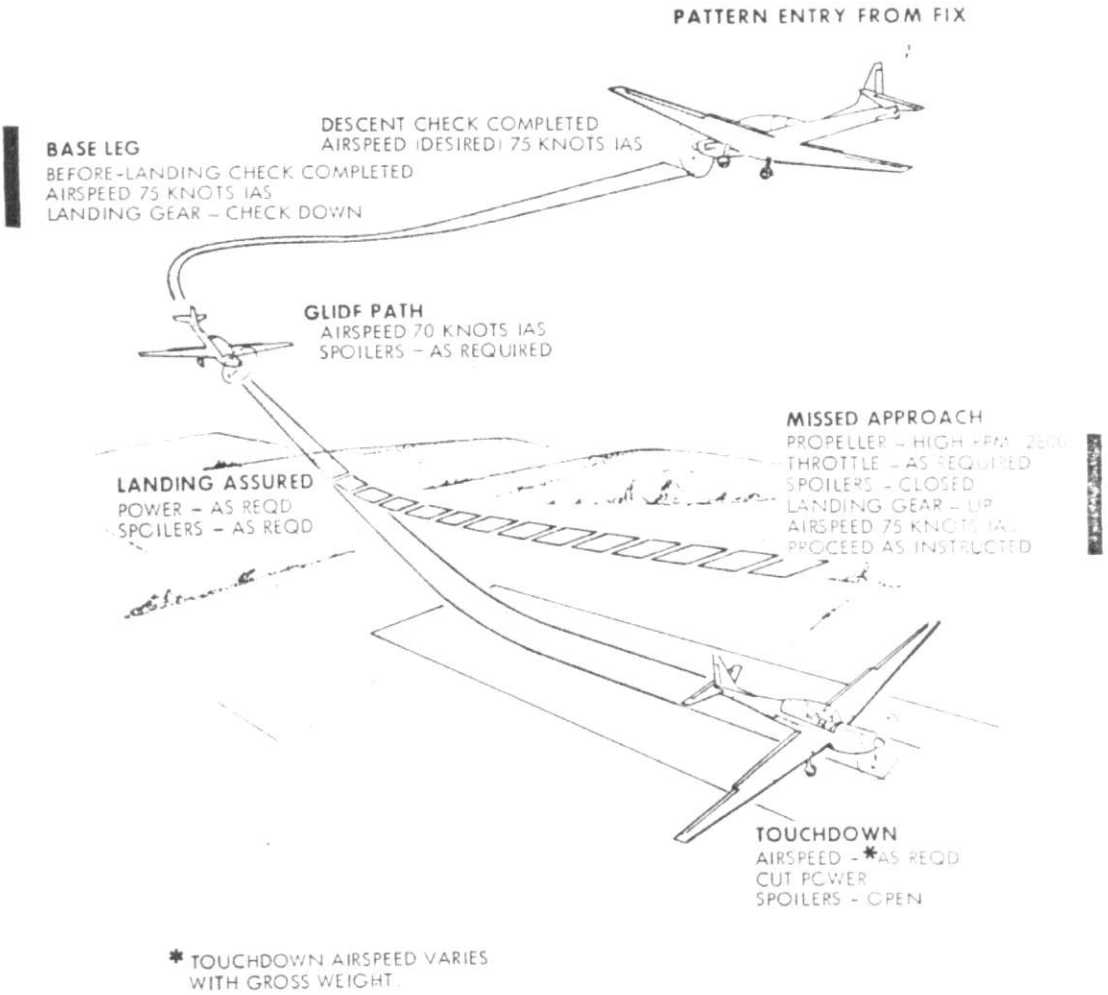


Fig. 10-2 Typical Pattern for Radar Approach

Section III

COLD-WEATHER OPERATIONS

10-23. COLD-WEATHER PROCEDURES.

10-24. In extremely cold weather the engine may be difficult to start. External power should be used for all cold-weather starts to conserve battery power. There is no oil dilution system for the YO-3A aircraft. If temperatures below 0° F are expected, the aircraft should be moved indoors at least 2 hours before starting. This will allow ample time for the aircraft to warm.

10-25. BEFORE ENTERING AIRCRAFT.

10-26. Before entering the aircraft perform the following steps:

a. Perform exterior inspection as outlined in paragraph 3-22, Chapter 3.

b. Engine preheating – AS NECESSARY. The engine compartment can be preheated, if necessary, by using a portable ground heater with the engine cover in place.

c. Tires – CHECK. In extremely cold weather check tires not frozen to ground or to chocks.

d. Parking brake – CHECK. Check that parking brake was not left on, discs free of ice.

e. With ignition switch OFF, pull propeller through several times by hand.

10-27. ON ENTERING AIRCRAFT.

10-28. Actuate controls through a complete cycle of movement to ascertain that there are no obstructions, and particularly to determine whether any controls are frozen. To conserve the battery, use external power source to operate all electrical and radio equipment. Refer to Chapter 3 and perform interior inspection.

10-29. BEFORE STARTING ENGINE.

10-30. Refer to Chapter 7 for normal engine operating limitations.

NOTE

If the engine does not start during the first few attempts or if engine firing diminishes in strength, preheat should be applied to the engine.

a. Hold FUEL PUMP BOOST switch in the LOW position.

NOTE

After cold-weather starts, use care to avoid engine stoppage, as this will cause moisture to condense on spark-plug points, making a restart difficult.

b. After engine is running smoothly, release FUEL PUMP BOOST switch to OFF. The flight-compartment heater may now be turned on, and the canopy defogging control adjusted as required.

WARNING

In cold weather, make sure that all instruments have warmed up sufficiently to ensure normal operation. Check for sluggish instruments during taxiing.

10-31. TAXI AND TAKEOFF.

10-32. Taxi and takeoff procedures for visual flight are the same as those described in paragraphs 3-29 through 3-40, Chapter 3. For instrument takeoffs, refer in addition to paragraph 10-6, this chapter.

10-33. CLIMB.

10-34. Climb performance is improved during cold-weather operation. Follow recommended climb speeds as given in Table 14-4, Chapter 14. (Refer to Chapters 3 and 10, as appropriate.)

10-35. DESCENT.

10-36. Use power in letdowns to maintain proper airspeed.

10-37. LANDING.

10-38. Avoid landing in mud or snow wherever possible. After landing, open spoilers. Apply brakes intermittently and carefully.

10-39. ENGINE SHUTDOWN.

10-40. Refer to paragraph 3-67, Chapter 3, for engine shutdown procedures.

10-41. BEFORE LEAVING AIRCRAFT.

10-42. Before leaving the aircraft perform the following steps:

a. Parking brake – OFF (This keeps brakes from freezing.)

b. Wheels and controls – Chock wheels and secure ailerons, stabilator, and rudder with exernal locks, as appropriate.

c. Fill fuel cells to avoid condensation in tanks.

d. Drain fuel drains of condensate.

e. If the engine is expected to be idle for several days, the battery should be removed.

CAUTION

Battery should be kept fully charged at all times in cold climates.

CAUTION

When attaching canopy cover, avoid scratching the plexiglas with metal fasteners on the cover or with other hard objects.

10-43. ICE, SNOW, AND RAIN.

10-44. A takeoff should not be attempted if the aircraft is covered with frost, sleet, or snow because takeoff distance will be greatly increased. Do not fly this aircraft into known icing conditions. Because of the lack of anti- or de-icing equipment on this aircraft, ice will be likely to adhere to the leading edge of wings, empennage, propeller, and on the canopy. (The canopy defogging apparatus will partially remove canopy ice during moderate icing conditions.) As ice forms on the aircraft during flight, the flight controls will become sluggish, and cruising speed will be decreased. Prior to entering any icing conditions (if unavoidable), turn the pitot heat switch ON.

WARNING

Stalling speed will be higher if frost or ice has formed on the surfaces of the aircraft.

10-45. No special precautions are required during flight in rain or snow other than keeping constantly alert for icing conditions and remembering that visibility is reduced considerably. If a landing is to be made on a field covered in spots by water, or if soft sod is suspected, a full-stall, tail-low landing should be made to preclude the possibility of nosing over. A tail-low takeoff should also be made when these conditions exist.

Section IV

HOT-WEATHER OPERATIONS

10-46. HOT-WEATHER PROCEDURES.

10-47. Hot-weather procedures differ from normal procedures mainly in that added precautions must be taken to protect the aircraft from damage due to high temperature and dirt or dust. Particular care should be taken to prevent dirt or sand from entering the various aircraft parts and systems (engine, fuel system, pitot static system, etc.). If the area of operation is dusty, all filters should be checked more frequently than under normal conditions. Units incorporating plastic or rubber parts should be protected as much as possible from wind-blown dirt or sand and from excessive temperatures. Tires should be checked frequently for blistering, cracking, and proper inflation. Normal starting procedures are recommended for hot-weather operation. Ground testing should be complete, but accomplished as quickly as possible to prevent engine overheating. It may be necessary for the fuel pump boost to be on during ground operation to prevent a vapor lock in the fuel system.

CAUTION

Limit ground operation to 5 minutes maximum, prior to taxiing.

CAUTION

Riding the brakes causes unnecessary brake wear and engine overheating. However, sufficient engine rpm must be maintained to ensure engine cooling.

NOTE

Head aircraft into the wind for ground runup.

CAUTION

Do not exceed 5 minutes from end of taxiing until takeoff.

Section V

TURBULENCE AND THUNDERSTORM OPERATIONS

10-48. TURBULENT AIR AND THUNDERSTORMS.

10-49. Plan your flight so that it requires the least possible exposure to known turbulence or thunderstorm activity. Some tactical missions, however, may make penetration of such areas necessary. In this case, prepare the aircraft before entering such areas as described in the following paragraphs.

10-50. TURBULENT AIR PENETRATION SPEEDS.

10-51. Power setting and pitch attitude are the keys to proper flight technique in turbulent air. If turbulence is encountered, it is recommended that the aircraft be flown at or near 80 knots IAS to reduce stresses and improve flying qualities.

10-52. APPROACHING A STORM.

NOTE

Proximity to thunderstorm activity can be determined by visual inspection (buildups in the daytime, lightning at night) and by "crash static" on radio equipment. If thunderstorms are detected, alter course to avoid them. If thunderstorms are encountered, select penetration altitude considering local terrain. If a landing is anticipated, be aware of the high winds accompanying thunderstorm activity.

10-53. Before entering a thunderstorm, establish the desired penetration speed, and maintain that speed throughout the storm. Prepare the aircraft as follows:

a. Propeller – SET (2600 RPM).

b. Mixture control lever – ADJUST. Adjust for smooth operation.

c. Pitot heat switch – ON.

d. Throttle – ADJUST. Adjust as necessary to obtain penetration speed of 75 knots IAS.

e. Directional and attitude indicators – PROPER SETTINGS.

f. All loose equipment – SECURED.

g. Safety belt – TIGHTENED.

h. Shoulder harness inertia reel lock lever – LOCKED.

i. Radios – turn off any radio equipment rendered useless by static.

j. At night, turn flight compartment lights full bright (after removing red filters) to minimize blinding effect of lightning flashes.

10-54. IN THE STORM.

10-55. While in the storm observe the following procedures:

a. Maintain power setting and pitch attitude (established before entering the storm) throughout the storm.

b. Devote all attention to flying the aircraft.

c. Expect turbulence, precipitation, and lightning, and do not allow them to cause undue concern.

d. Maintain attitude, and concentrate principally on holding level attitude by reference to the attitude indicator.

e. Maintain original heading. Do not make turns unless absolutely necessary.

f. Do not "chase" the airspeed indicator, since doing so will result in extreme attitudes. If a sudden gust should be encountered while the aircraft is in a nose-high attitude, a stall could result. However, do not allow excessive airspeed to build up since the structural loads on the aircraft are affected by airspeed.

g. Use as little stabilator control as possible to maintain attitude to minimize stresses imposed on the aircraft.

h. The altimeter may be unreliable in thunderstorms because of differential barometric pressures within the storm. A large gain or loss in altitude readings may be expected. Make allowance for this error in determining safe altitude.

NOTE

Normally, the least turbulent area in the thunderstorm will be at altitudes from zero to 6000 feet above the terrain. Altitudes between 10,000 and 20,000 feet are usually the most turbulent.

Chapter 11
CREW DUTIES

Section I
SCOPE

This chapter is not applicable to YO-3A aircraft.

Chapter 12
WEIGHT AND BALANCE DATA

Section I
SCOPE

12-1. GENERAL.

12-2. This chapter contains information necessary for computation of weight and balance conditions for YO-3A aircraft.

12-3. Sufficient data are provided so that, with a knowledge of the basic weight and moment of the aircraft, the operator can compute conditions for any combination of weight and balance.

Section II

INTRODUCTION

12-4. PURPOSE.

12-5. The aircraft weight and balance must be accurately determined and maintained within design limits at all times. This will ensure that the aircraft stability and control characteristics, flight performance, and structural loads are within the design envelope. The aircraft weight and balance is determined by the procedure described herein using the charts and forms shown.

12-6. CHARTS AND FORMS.

12-7. The standard system of weight and balance control requires the use of several different charts and forms. They are identified as follows:

a. Chart C – Basic Weight and Balance Record, DD Form 365C.

b. Chart E – Loading Data, Charts, and Graphs.

c. Form F – Weight and Balance Clearance Form F, DD Form 365F.

12-8. RESPONSIBILITY.

12-9. The aircraft manufacturer inserts all aircraft identifying data on the various charts and forms. All charts, including one sample Weight and Balance Clearance Form F, if applicable, are completed at time of delivery. This record is the basic weight and balance data of the aircraft at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician.

12-10. AIRCRAFT WEIGHINGS.

12-11. The aircraft must be weighed periodically as required by pertinent directives or when:

a. The pilot reports unsatisfactory flight characteristics (nose or tail heaviness).

b. Major modifications or repairs are made.

c. The basic weight data contained in the records are suspected to be in error.

12-12. The basic weight and cg location can be only as accurate as the scale equipment employed.

Section III

DEFINITIONS

12-13. WEIGHT DEFINITIONS.

12-14. BASIC WEIGHT. The basic weight of the aircraft is that weight which includes all fixed operating equipment and trapped fuel and oil, to which it is only necessary to add variable or expendable load items for various missions. The basic weight condition is established with the wheels down and the canopy closed.

NOTE

The basic weight of the aircraft varies with structural modifications and changes in fixed operating equipment.

12-15. OPERATING WEIGHT. The operating weight of the aircraft is the basic weight plus those variable items which remain substantially constant for a given type of mission. The items include oil, crew, and emergency and extra equipment that may be required.

12-16. GROSS WEIGHT. The gross weight is the total weight of the aircraft and its contents.

a. The takeoff gross weight is the operating weight plus any variable load items that vary with the mission. Takeoff gross weight includes fuel.

b. The landing gross weight is the takeoff gross weight minus expended fuel.

12-17. BALANCE DEFINITIONS.

12-18. REFERENCE DATUM. The reference datum is an imaginary vertical plane slightly aft of the nose of the aircraft from which all horizontal distances are measured for balance purposes. Diagrams of the aircraft show this reference datum as balance station zero.

12-19. ARM. Arm for balance purposes, is the horizontal distance in inches from the reference datum to the cg of the item. Arms may be determined from the aircraft diagram in Chart E (see paragraph 12-27).

12-20. MOMENT. Moment is the weight of an item multiplied by its arm. Once the pilot determines the total moment for a given load configuration (see Table 12-1 and note), he can easily calculate the resulting cg and compare it with the cg envelope illustrated in this section (Fig. 12-3) to verify that the aircraft is within stability limits.

12-21. AVERAGE ARM. Average arm is the arm obtained by adding the weights and adding the moments of a number of items and dividing the total moment by the total weight.

12-22. BASIC MOMENT. Basic moment is the sum of the moments of all items making up the basic weight. When using data from an actual weighing of an aircraft, the basic moment is the total moment of the basic aircraft with respect to the reference datum.

12-23. CENTER-OF-GRAVITY (CG). Center-of-gravity is the point about which an aircraft would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the gross weight of the aircraft.

12-24. CG LIMITS. CG limits are the extremes of movement which the cg can have without making the aircraft unsafe to fly. The cg of the loaded aircraft must be within these limits at takeoff, in the air, and on landing. In some cases, separate takeoff and landing limits may be specified.

Section IV

CHART EXPLANATIONS

12-25. CHART C — BASIC WEIGHT AND BALANCE RECORD. (See Fig. 12-1.)

12-26. Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes in service. At all times, the last weight and moment entry is considered the current weight and balance status of the basic aircraft.

12-27. CHART E — LOADING DATA. (See Fig. 12-2.)

12-28. The loading data given in Chart E are intended to provide information necessary to work a loading problem for the aircraft. From the loading graphs or tables, weight and moment can be obtained for variable load items and can be added arithmetically to the current basic weight and moment (from Chart C) to obtain the gross weight and moment. Table 12-1 contains an example of a weight and balance computation that illustrates how the weight and balance moment can be computed. The computation results are entered on Form F (See Section V, this Chapter).

12-29. CG ENVELOPE. (See Fig. 12-3.)

12-30. If the aircraft is loaded within the forward and aft cg limits, the calculated cg will fall numerically within the cg envelope shown in Fig. 12-3. The effect on the cg of the expenditure in flight of fuel may be checked by subtracting the weight and moment of consumed fuel from the takeoff gross weight and moment and checking the new moment with the cg envelope. This check should be made to determine whether the cg will remain within limits during the entire flight.

12-31. LOADING DATA. (See Tables 12-2 through 12-7.)

12-32. Table 12-2 contains fuel-loading data for the two wing fuel cells for various quantities of fuel remaining. Table 12-3 gives oil-loading data. Table 12-4 is a crew loading table. Miscellaneous loading data are given in Table 12-5. Table 12-6 provides loading data for payload equipment. Table 12-7 provides loading data and ballast requirements when the aircraft is flown without NVAP payload equipment without observer, or both.

WARNING

Do not operate this aircraft without an occupant in the front seat or without mission equipment installed unless appropriate ballast weights have been installed. Disregard of this warning will result in a critical balance problem.

12-33. WEIGHT LIMITATIONS CHART. (See Fig. 12-4.)

12-34. Figure 12-4 shows the weight limitations of the YO-3A aircraft, including the maximum gross weights at takeoff and landing.

12-35. LIMIT FLIGHT LOAD FACTORS. (See Fig. 12-5.)

12-36. Figure 12-5 shows the limit flight load factors, including the positive and negative "g" load limits.

12-37. VELOCITY/LOAD FACTOR FLIGHT ENVELOPE. (See Fig. 7-2 in Chapter 7.)

12-38. The velocity/load factor flight envelope for aircraft gross weight of 3,800 pounds is shown in Fig. 7-2 (Chapter 7).

12-39. WEIGHT AND BALANCE CLEARANCE FORM (FORM 365F).

12-40. A weight and balance clearance form (DD Form 365F) with sample entries is shown in Fig. 12-6.

CHART C — BASIC WEIGHT AND BALANCE RECORD

(Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

AIRPLANE MODEL: YO - 3A (SAMPLE ONLY) | SERIAL NO: | PAGE NO: 1

DATE	ITEM NO IN	ITEM NO OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ARM	MOMENT[1]/100	REMOVED (−) WEIGHT	ARM	MOMENT[1]/100	RUNNING TOTAL BASIC AIRPLANE WEIGHT	MOMENT[1]/100	INDEX[1]
			BASIC AIRCRAFT AS DELIVERED							3103	26047	

SAMPLE

[1] Units constant with Basic Unit [2] Balance computer index

DD FORM 1 SEPT 54 365C Previous editions of this form may be used until stocks are exhausted

Fig. 12-1 Chart C — Basic Weight and Balance Record

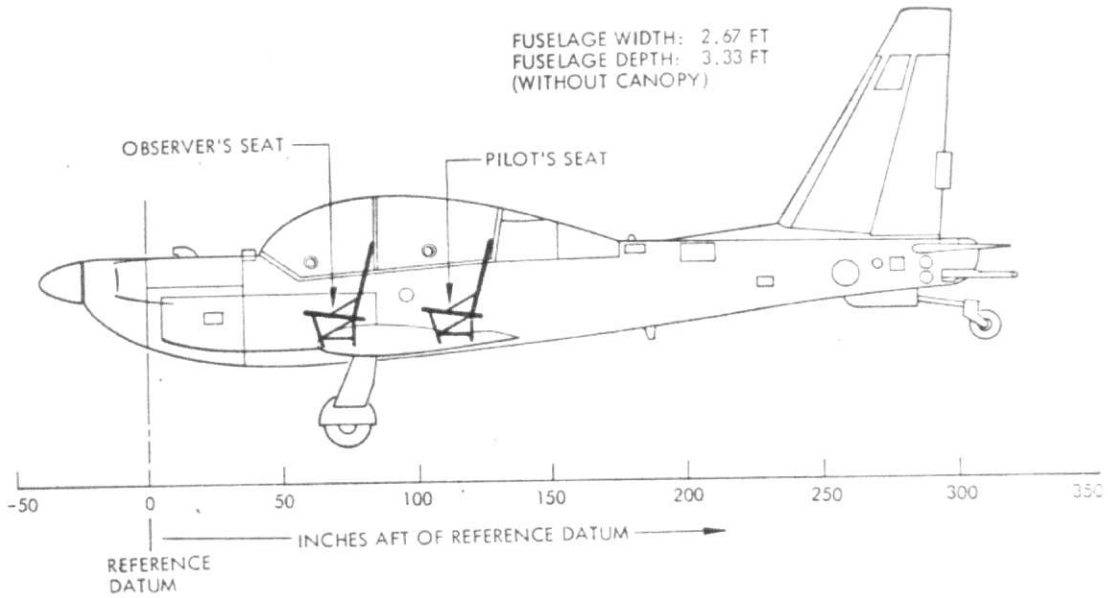
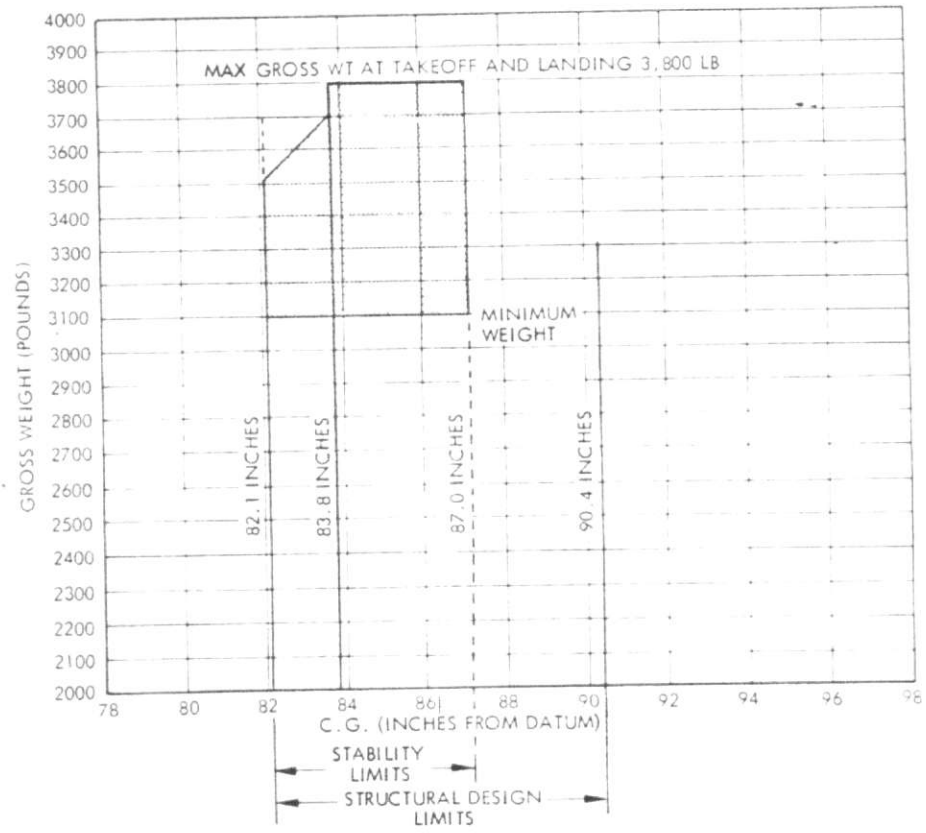


Fig. 12-2 Chart E – Loading Data

Table 12-1
WEIGHT AND BALANCE COMPUTATION EXAMPLE

Item	Weight (lb)	Arm (in.)	Moment (in.-lb)
Aircraft at Basic Weight	3,102.9	83.9	260,471
Usable Fuel (29 gal)	174.0	81.3	14,146
Usable Oil (7 qt)	12.7	20.0	254
Observer and Parachute	225.0	74.1	16,673
Pilot and Parachute	225.0	117.9	26,528
Total	3,739.6	85.1	318,072

Notes: (1) This figure varies for individual aircraft. The LTD is not included in the aircraft basic weight.
(2) The results of the weight and balance computation are entered in Form F (Section V, this Chapter).



OPERATE WITHIN THIS ENVELOPE

CAUTION

OBSERVE MAXIMUM
GROSS WEIGHT LIMITS

Fig. 12-3 Center-of-Gravity Envelope

Table 12-2
FUEL LOADING DATA

Gallons	Weight (lb)	Moment (wing tank arms ≈1.3)
2	12	976
4	24	1,951
6	36	2,929
8	48	3,902
10	60	4,878
12	72	5,854
14	84	6,829
16	96	7,805
18	108	8,780
20	120	9,756
22	132	10,732
24	144	11,707
26	156	12,683
28	168	13,658
30	180	14,634
32	192	15,610

Total Fuel Capacities

Tank	Gallons
Left	15.1
Right	15.1

Table 12-3
OIL LOADING DATA

Quarts	Weight (lb)	Arm (in. aft datum)	Moment
9	16.4	20	328

Table 12-4
CREW LOADING TABLE

Crewmember	Weight (lb)	Arm (in. aft datum)	Moment
Pilot	225	117.9	26,528
Observer	225	74.1	16,673

Table 12-5
MISCELLANEOUS LOADING DATA
(TYPICAL)

General Dimensions	
Wing Span	684 in. (57 ft 0 in.)
Length	353 in. (29 ft 5 in.)
Height (max)	150 in. (12 ft 6 in.)
Wheel Base	234 in. (19 ft 6 in.)
Tread (at gross weight)	130 in. (10 ft 10 in.)
Centroids of Load Items (Inches Aft Datum) (Fig. 12-2)	
Observer	74.1
Pilot	117.9
Oil	20.0
Fuel	81.3
Basic Weight (Pounds)	3,103 (Typical)
Distance (Inches Aft Datum) (Fig. 12-2)	
Center-of-Gravity at Basic Weight	83.9 (Typical)
Centerline of Main Wheels at Basic Weight	68.5
Centerline of Tail Wheel at Basic Weight (Weight and dimensions are approximate.)	311.1

Table 12-6

PAYLOAD EQUIPMENT LOADING TABLE

	Item	Weight (lb)	Arm (in.)	Moment (in.-lb)
NVAP Payload	NVAP (including fairing, seal, clamp, etc.)	174.2	44.8	7,809
	Force Rate Controller	2.4	66.4	159
	NVAP Electronics Box	15.2	208.2	3,165
	IRI Optical and Mech.	6.6	207.0	1,366
	IRI Electronics Box	7.5	207.3	1,555
LTD Payload	Laser Transmitter	13.5	49.5	668
	Laser Power Supply	8.7	146.7	1,276
	EMI Shunt Filter	7.7	147.8	1,138
	LTD Cable Assembly	12.5	105.8	1,323

Table 12-7

BALLAST REQUIREMENTS

Item	Weight (lb)	Arm (in.)	Moment (in.-lb)
Ballast – Sta. 0	100	0	0
Ballast – Sta. 12.5	50	12.5	625

Notes: (1) When aircraft is operated with either observer or NVAP payload equipment removed, add 100-lb ballast at Sta. 0.

(2) When aircraft is operated with both observer and NVAP payload equipment removed, add 100-lb ballast at Sta. 0 plus 50-lb ballast at Sta. 12.5.

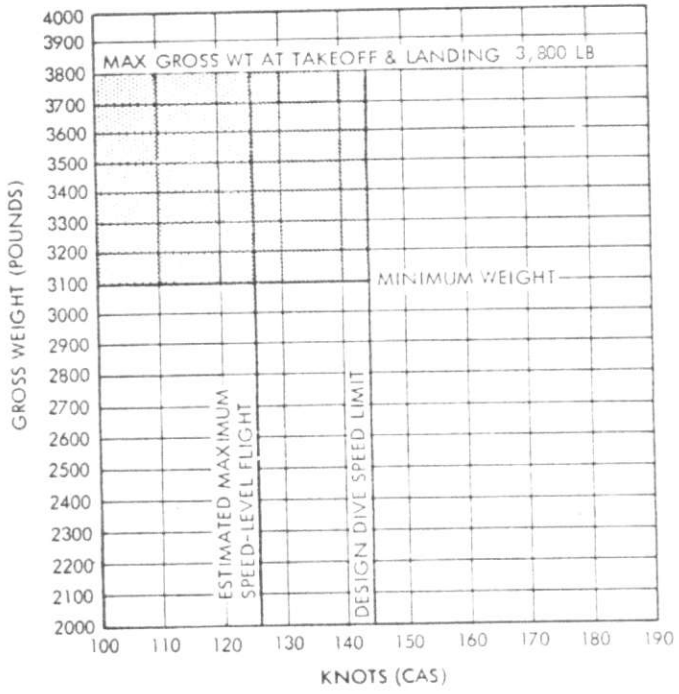


Fig. 12-4 Weight Limitations Chart

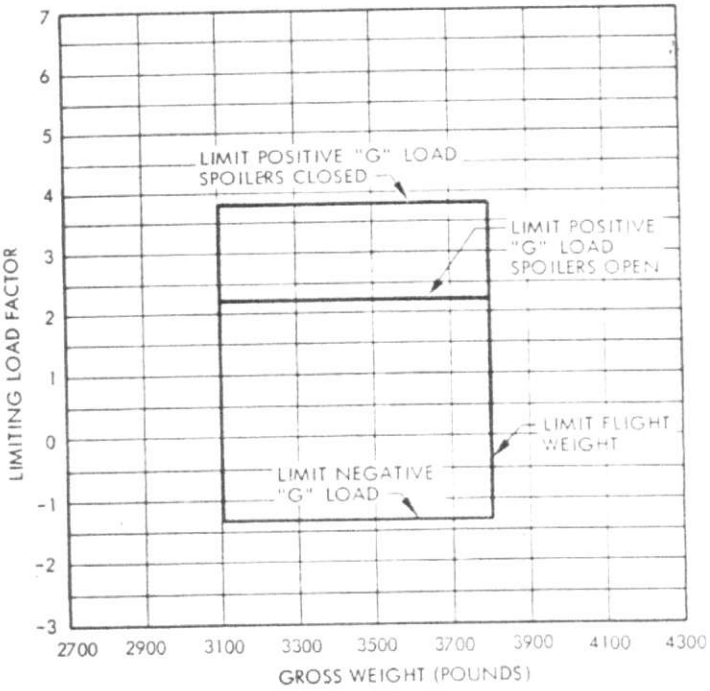


Fig. 12-5 Limit Flight Load Factors

Section V

WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365F (TYPICAL)

WEIGHT AND BALANCE CLEARANCE FORM F
TACTICAL
(USE REVERSE FOR TRANSPORT MISSIONS)

FOR USE IN T.O. 1-1B-40, AN 01-1F-40 & TM 55-405-12

DATE: 6 Mar 70	AIRCRAFT TYPE: YO-3A	FROM: Mountain View	HOME STATION: MOFFET FIELD
MISSION/TRIP/FLIGHT NO: FLIGHT 8	SERIAL NO: 180XX	TO: Crows Landing	PILOT: LT BIRD

REMARKS: Flight operation to be with both crewmen

SAMPLE

REF	ITEM	WEIGHT	INDEX OR MOM.
1	BASIC AIRCRAFT (From Chart C)	3103	2067.2
2	OIL (7 QT)	13	2.4
3	DISTRIBUTION OF LOAD		
	COMPT. — CREW NO. — CREW WEIGHT — BAGGAGE — CARGO AND MISC.		
	AFT — 1 — 225	225	202.5
	FWD — 2 — 225	225	180.0
	COMPUTER PLATE NO. (If used)		
	Pertinent instructions to the pilot for shifting load and crew during takeoff and landing should be noted above.		
	CORRECTIONS (Ref. 11) — COMPT. — ITEM — CHANGES (+ or −) WEIGHT — INDEX OR MOM.		
4	OPERATING WEIGHT		
5	AMMUNITION — COMPT. — ROUNDS — CALIBER		
6	BOMBS, ROCKETS, ETC. — FORWARD		
	AFT		
	EXTERNAL		
	ROCKETS		
7	FUEL — BUILT IN (220 GAL)	1471	437.2
	BOMB BAY (GAL)		
	EXTERNAL (GAL)		
8	WATER INJ. FLUID (GAL)		
9	JATO OR RATO		
10	TAKEOFF CONDITION (Unmodified)	3574	1307.0
11	CORRECTIONS (If required)	2	
12	TAKEOFF CONDITION (Optional)	3576	1307.0
13	TAKEOFF C. G. IN % M. A. C. OR IN.	25.1 IN.	
14	JATO OR RATO		
15	BOMBS		
	AMMUNITION		
	FUEL	1516	1110.8
	TOTAL WEIGHT REMOVED		
	TOTAL WEIGHT ADDED		
	NET DIFFERENCE (Ref. 11)	0	
16	ESTIMATED LANDING CONDITION	3574	1307.0
17	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.	82.2 IN.	

LIMITATIONS

*GROSS WT. TAKEOFF (Gr.)	*GROSS WT. LANDING (Gr.)
3800	3800

	FROM	TO (% M. A. C. OR IN.)
*PERMISSIBLE C. G. TAKEOFF	83.8	87 IN.
*PERMISSIBLE C. G. LANDING	83.8	87 IN.

* Enter constant used
* Enter values from current applicable T. O. TM
* Applicable to gross weight (Ref. 12)
* Applicable to gross weight (Ref. 15)

COMPUTED BY (Signature): TM Herman
WEIGHT AND BALANCE AUTHORITY (Signature): R Henderson
PILOT (Signature): LT Bird

DD FORM 1 SEPT 54 365F

Fig. 12-6 Weight and Balance Clearance Form F

Chapter 13
AIRCRAFT LOADING

Section I
SCOPE

This chapter is not applicable to YO-3A aircraft.

Chapter 14
PERFORMANCE DATA

Section I
SCOPE

14-1. GENERAL.

14-2. The information and charts in this chapter provide performance data for the YO-3A aircraft that will aid the pilot in preflight and inflight mission planning. The performance data contained herein are derived primarily from three sources: Army flight test data, manufacturer's flight test data, and estimated data (where no actual data are available at time of printing). Where a distinction among the types of data is important the data source is designated.

Section II

CHARTS

14-3. AIRSPEED MEASUREMENT.

14-4. Indicated airspeed (IAS) is the actual instrument indication for some given flight condition. Factors such as an altitude other than standard sea level, errors of the instrument, and errors due to installation and compressibility will create variance between the IAS and actual flight speed.

14-5. Calibrated airspeed (CAS) is the result of correcting the IAS for installation and instrument errors. The instrument error for a properly functioning instrument is small (±2 knots), and can be disregarded. Installation errors are usually larger and must be considered. An installation correction table is shown in Table 14-1. To obtain CAS the corrections must be added to the IAS.

14-6. Equivalent airspeed (EAS) is the result of correcting the CAS for compressibility effects. For the YO-3A, the compressibility effects are negligible and can be disregarded. Therefore, the EAS and CAS are essentially the same for the YO-3A aircraft.

14-7. True airspeed (TAS) is the result of correcting EAS for density altitude. For the YO-3A, TAS can be obtained by correcting CAS for density altitude. A means of obtaining the TAS is to multiply the CAS by the altitude density ratio $(1/\sigma)$. The altitude density ratio may be obtained from the density altitude chart (Fig. 14-1).

14-8. TEMPERATURE CONVERSION CHART.

14-9. The temperature conversion chart (Fig. 14-2) is included to provide a ready method of converting degrees centigrade to degrees fahrenheit, or degrees fahrenheit to degrees centigrade.

14-10. AIRSPEED CONVERSION CHART.

14-11. The airspeed conversion chart (Fig. 14-3) is used to convert miles per hour to knots, or knots to miles per hour.

14-12. TAKEOFF DISTANCES – FEET TABLE.

14-13. The takeoff distances – feet table (Table 14-2) shows minimum takeoff performance from a smooth runway using maximum power. Distances are shown for pressure altitude at sea level, 1,000, 2,500, and 5,000 feet and for ambient temperatures of 15°C and 35°C. The distances shown are based on minimum ground run and distance to clear a 50-foot obstacle. Performance for normal takeoff technique, as outlined in Chapter 3, can be obtained by increasing the minimum distances given in Table 14-2 by 10 percent.

14-14. EFFECTS OF HEAD- AND TAILWINDS ON TAKEOFF AND LANDING DISTANCES.

14-15. The effects of head- and tailwinds on takeoff and landing distances (ground roll) are shown in Table 14-3. Any increase or decrease in takeoff distances caused by winds should be applied to the takeoff and landing distances shown in Table 14-2 and 14-6.

14-16. TAKEOFF AND LANDING CROSS-WIND CHART.

14-17. The takeoff and landing cross-wind chart (Fig.14-4) is used to determine both the headwind and crosswind component, and whether a safe takeoff or landing can be accomplished under various crosswind conditions. For this purpose the chart is divided into two areas: recommended and not recommended.

14-18. CLIMB TABLE FOR NORMAL POWER.

14-19. Distances during a climb, time to climb, and fuel used in a climb can be determined from the climb table for maximum power (Table 14-4). Climb performance can be found for climbs from sea level and

for inflight climbs between 5,000- and 10,000-foot altitudes. The data shown are based on maximum power (full throttle), spoilers closed, and airspeed for maximum rate of climb as shown.

14-20. FLIGHT OPERATION CHARACTERISTICS.

14-21. The flight operation characteristics table (Table 14-5) shows the approximate range that can be obtained under maximum-speed, maximum-range, maximum-endurance, and low-speed cruise flight conditions at sea level and 5,000-feet pressure altitude. Under each of these flight conditions, the airspeed is given, as well as the approximate power settings, fuel flow, and nautical miles per gallon of fuel.

14-22. FUEL FLOW/METERED FUEL PRESSURE CONVERSION CHART.

14-23. Figure 14-5 shows fuel flow in pounds per hour and gallons per hour versus metered fuel pressure in pounds per square inch.

14-24. LANDING DISTANCES – FEET TABLE.

14-25. Table 14-6 shows the total distance required to clear a 50-foot obstacle and minimum landing ground roll for a smooth, hard-surface runway with spoilers open at altitudes of sea level, 2,500, and 5,000 feet. Approach speeds for the minimum-distance technique are contained in the table, however, correction factors to determine distances using normal landing techniques as outlined in Chapter 3 can be found by increasing the minimum distances by 20 percent. (See Table 14-3 for effects of head- and tailwinds on landing distances.)

14-26. TAKEOFF AND LANDING DATA CARD.

14-27. The takeoff and landing data card is reproduced in Fig. 14-6. Information required to fill out the data card can be obtained from charts and tables contained in this chapter. This information may then be reviewed by the pilot as a checklist item prior to takeoff and landing.

14-28. CONDITIONS.

14-29. Make the following entries:

a. GROSS WEIGHT – Gross weight of aircraft at takeoff.

b. RUNWAY LENGTH – Obtained from Base Operations.

c. OAT – Obtained from metro.

d. WIND – Obtained from metro.

e. PRESSURE ALTITUDE – Obtained from metro.

14-30. TAKEOFF.

14-31. Make the following entries:

a. TAKEOFF DISTANCE – See Table 14-2 for distance required for takeoff.

b. TAKEOFF SPEED – See Table 14-2 for required takeoff airspeed.

c. CLIMB SPEED – See Table 14-2 for initial climb speed.

14-32. LANDING IMMEDIATELY AFTER TAKEOFF.

14-33. Make the following entries:

a. APPROACH SPEED – See Table 14-6 for best approach speed.

b. LANDING GROUND ROLL – Distance required to bring aircraft to a complete stop after touchdown. See Table 14-6.

14-34. LANDING.

14-35. Make the following entries:

a. FIELD ELEVATION – Obtained from Base Operations or tower.

b. LANDING GROSS WEIGHT – Takeoff gross weight minus weight of fuel required to complete the mission.

c. APPROACH SPEED – Best airspeed for approach. See Table 14-6 for required approach speed.

d. LANDING GROUND ROLL – Distance required to bring aircraft to a complete stop after touchdown. See Table 14-6.

TABLE 14-1

AIRSPEED INSTALLATION CORRECTION TABLE

Add Correction to Corrected Instrument Reading (IAS) to Obtain Calibrated Airspeed

IAS (Knots)	Correction (Knots)
50	+ 3.5
60	+ 4.5
70	+ 5.2
80	+ 6.1
90	+ 7.0
100	+ 7.9
110	+ 8.8
120	+ 9.6
130	+ 10.4
140	+ 11.1

Remarks: The above airspeed corrections apply to the aircraft in the "clean configuration" or with landing gear down.

Data Basis: USAAVSCOM flight test
Data as of: Mar 1970

Table 14-2

TAKEOFF DISTANCES – FEET

Concrete Runway, No Wind, Gross Wt 3,800 lb

Pressure Altitude (ft)	Air Temp. +15° C (59° F)		Air Temp. +35° C (95° F)	
	Ground Roll	Clear 50 ft	Ground Roll	Clear 50 ft
SL	1,720	2,150	2,210	2,670
1,000	1,960	2,410	2,500	2,970
2,500	2,260	2,720	3,050	3,540
5,000	2,930	3,430	~5,000	6,000

Remarks: Distances shown are minimum. For normal takeoff, increase distances shown by approximately 10 percent. (For effects of head- and tailwinds see Table 14-3.)
Propeller – three blades, constant speed, 2800 rpm.
Rotation speed at liftoff – 58 knots IAS.
Climb speed over 50-foot obstacle – 61 knots IAS.

Data basis: Contractor flight test and calculation

Data as of: Mar 1971

EXAMPLE:
IF AMBIENT TEMPERATURE IS 27°C AND PRESSURE ALTITUDE IS SEA LEVEL, THE DENSITY ALTITUDE IS 1,500 FEET AND $\frac{1}{\sqrt{\sigma}} = 1.02$.

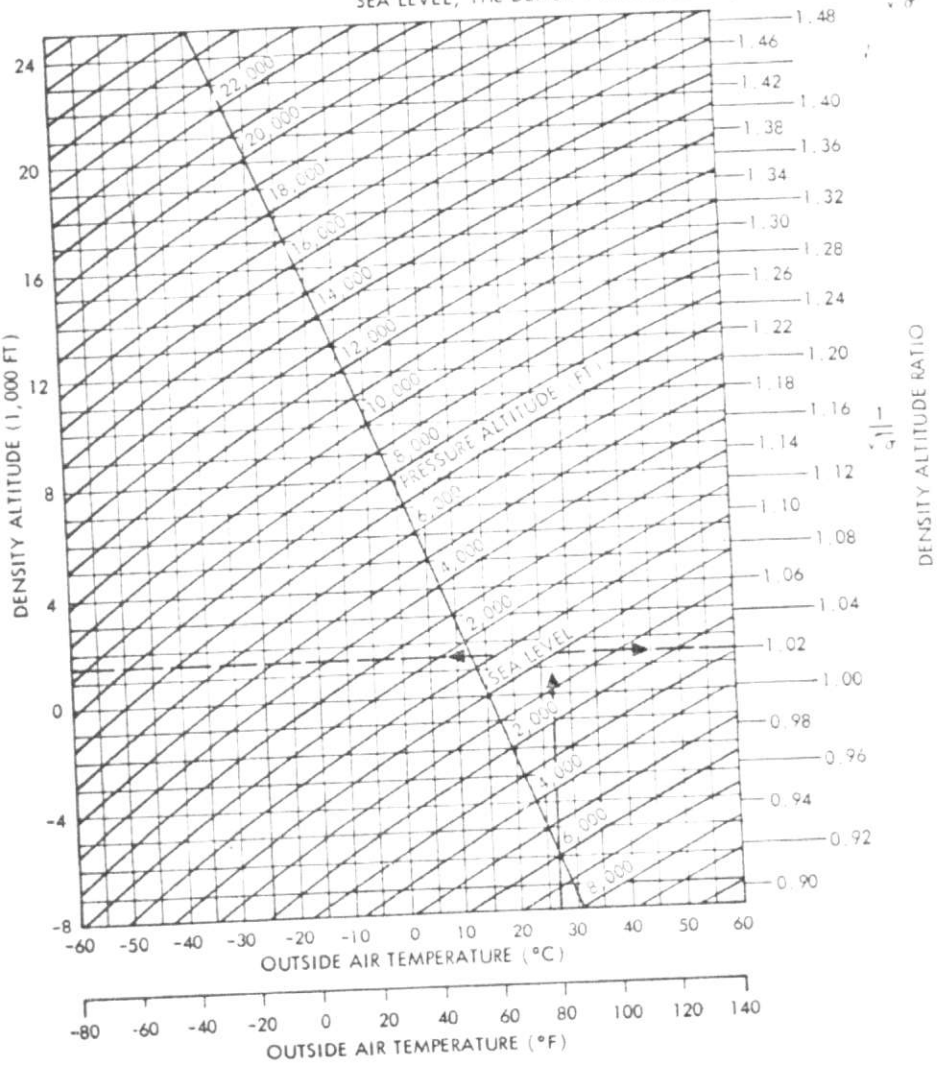


Fig. 14-1 Density Altitude Chart

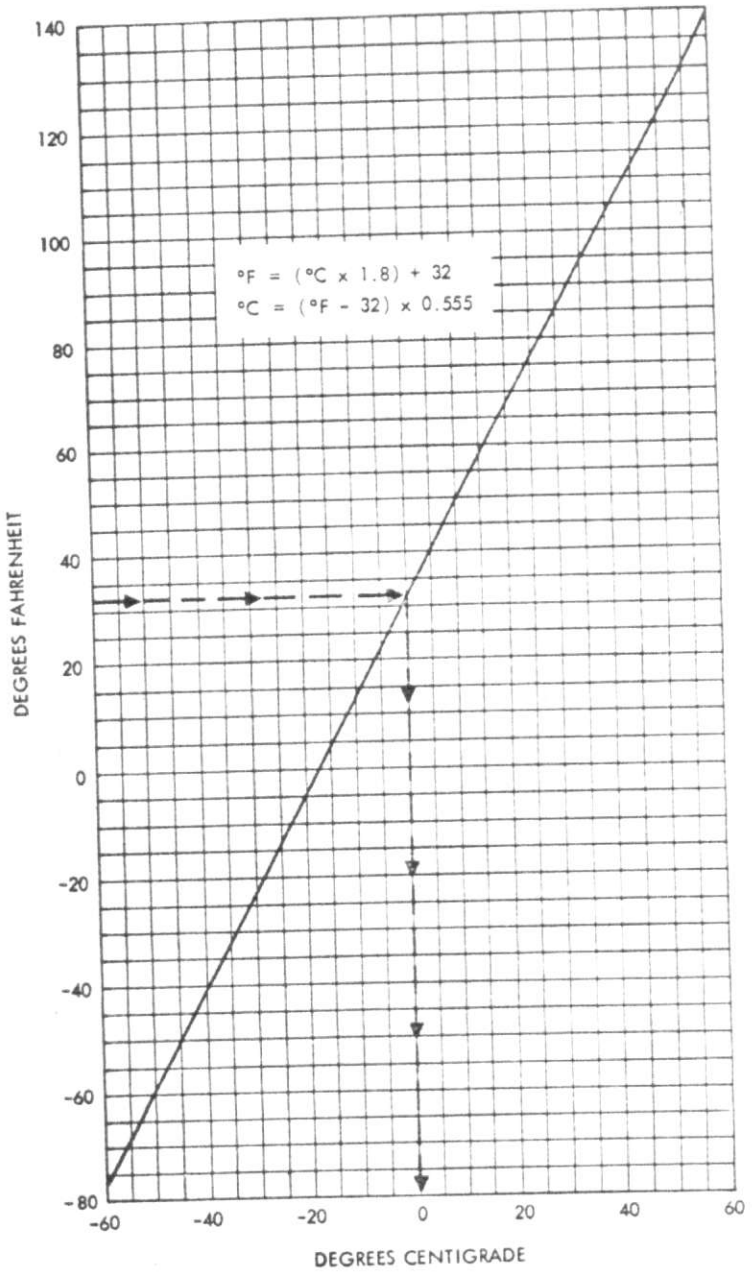


Fig. 14-2 Temperature Conversion Chart

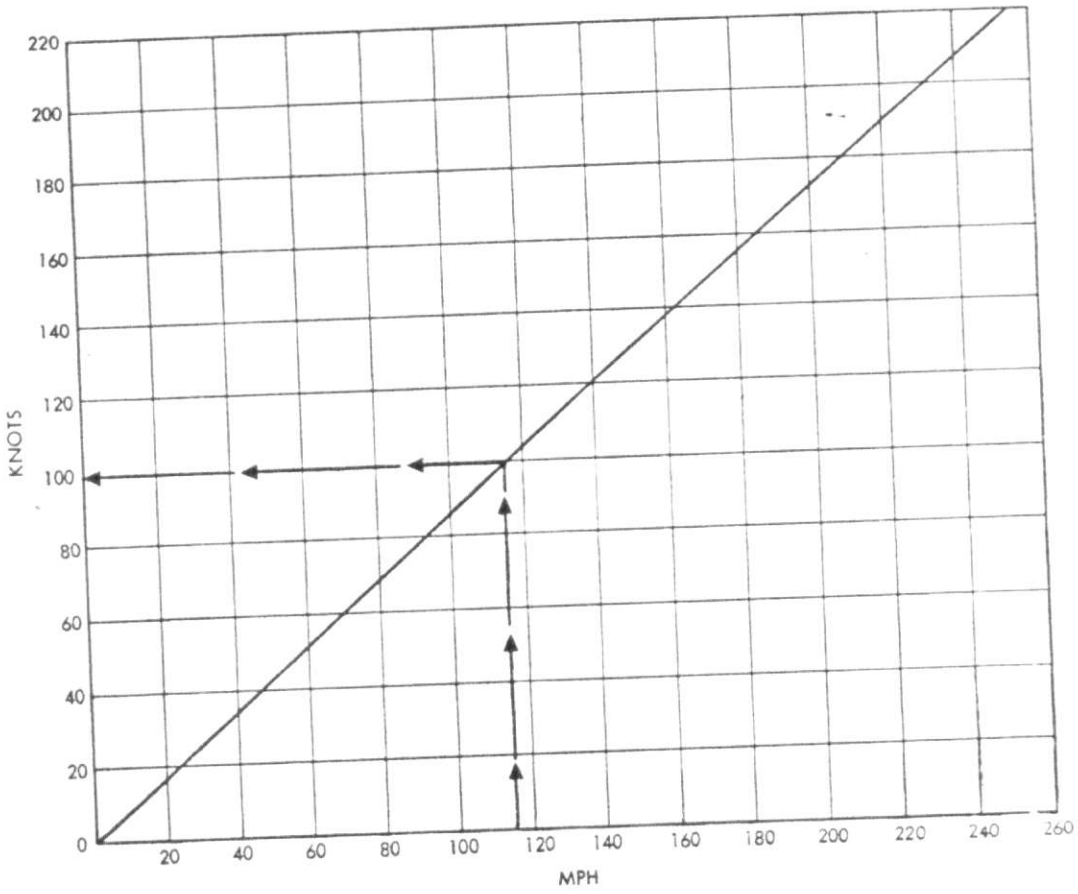


Fig. 14-3 Airspeed Conversion Chart

Table 14-3

EFFECT OF HEAD- AND TAILWINDS ON
TAKEOFF AND LANDING DISTANCE (APPROX.)

Takeoff Distance – (% Change)	6 Knots Headwind – 19% Decrease
	12 Knots Headwind – 36% Decrease
	18 Knots Headwind – 50% Decrease
	6 Knots Tailwind – 21% Increase
	12 Knots Tailwind – 44% Increase
	18 Knots Tailwind – 69% Increase
Landing Distance – (% Change)	6 Knots Headwind – 19% Decrease
	12 Knots Headwind – 36% Decrease
	18 Knots Headwind – 50% Decrease
	6 Knots Tailwind – 21% Increase
	12 Knots Tailwind – 44% Increase
	18 Knots Tailwind – 69% Increase

Remarks: These percentages are approximate and are based on

$$\frac{S_2}{S_1} = \left[1 - \frac{V_W}{V_1}\right]^2 \text{ where}$$

Where S_1 = zero wind takeoff distance
S_2 = takeoff distance with winds
V_W = Headwind velocity
V_1 = Liftoff airspeed

Table 14-4

CLIMB TABLE FOR NORMAL POWER

Standard Day, Gross Wt 3,800 lb

Pressure Altitude (ft)	Airspeed TAS (KT)	Airspeed CAS (KT)	Airspeed IAS (KT)	Approximate			
				From Sea Level			Rate of Climb (fpm)
				Fuel (lb)	Time (min)	Distance (nm)	
SL	78	78	72	8.0	0	0	615
5,000	82	76	71	23.0	10.0	13.0	450
10,000	86	74	69	41.0	25.0	33.0	285

Remarks: Climb at full throttle; best mixture.
Propeller – three blades, constant speed, 2800 rpm.
Fuel to climb from SL includes 8 lb takeoff allowance.

Data basis: Contractor flight test and calculation

Data as of: Mar 1971

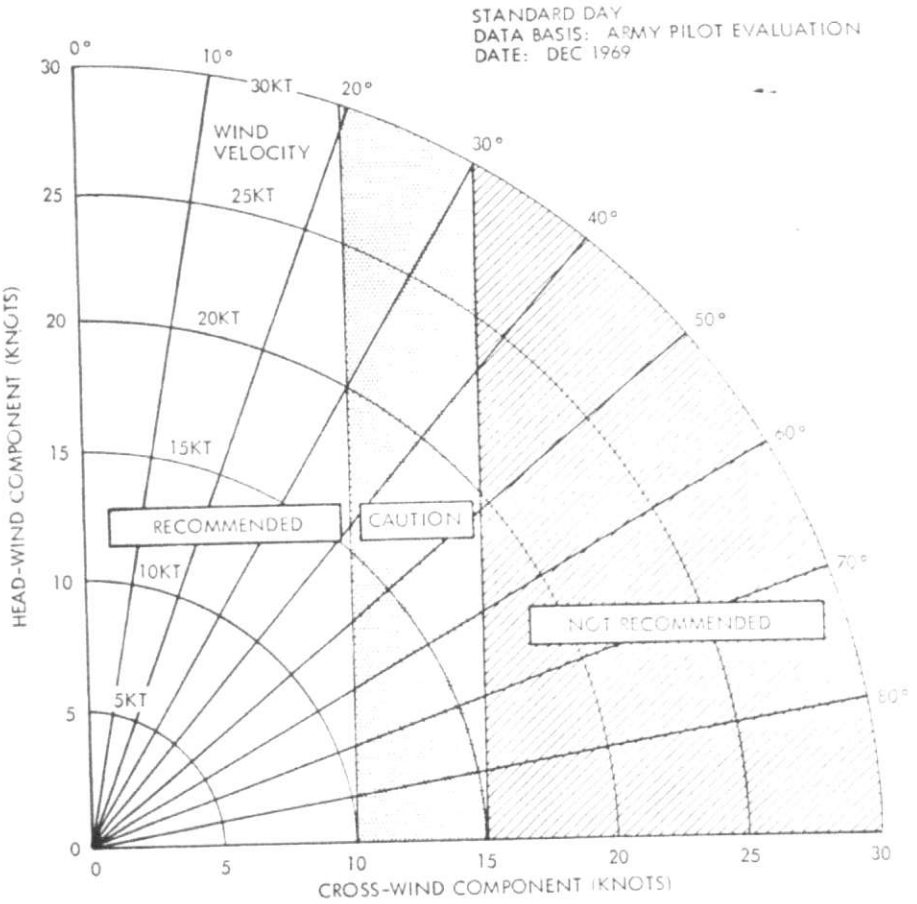


Fig 14-4 Takeoff and Landing Cross-Wind Chart (Standard Day)

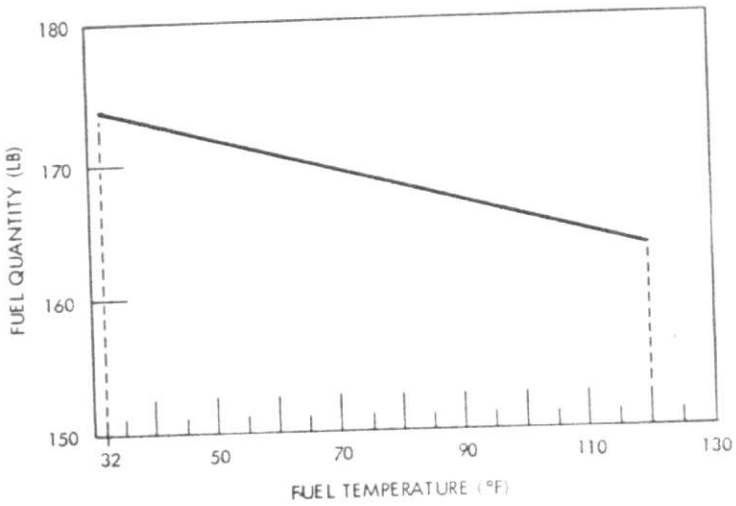


Fig. 14-4A Quantity of Usable Fuel for Specific Fuel Temperatures

Table 14-5

FLIGHT OPERATION CHARACTERISTICS
Standard Day, Gross Wt 3,800 lb

Flight Condition	Pressure Altitude (ft)	Airspeed			Approximate						
		TAS (KT)	CAS (KT)	IAS (KT)	Manifold Pressure (in. -Hg)	RPM	Fuel Flow (lb/hr)	Specific Range (nm/lb)	Specific Range (nm)	Duration (hr)	Fuel Pressure (psi)
Maximum Speed	SL	126	126	116	27	2800	96	1.31	–	–	15.4
	5,000	123	114	106	22	2800	80	1.54	–	–	12.2
High-Speed Cruise	SL	97	97	90	21	2600	46	2.10	310	3.2	6.7
	5,000	104	97	90	20	2600	49	2.13	280	2.7	7.1
Maximum Range	SL	81	81	75	18	2600	36	2.24	330	4.1	5.7
	5,000	87	81	75	17	2600	39	2.26	300	3.5	6.2
Low Speed Cruise	SL	75	75	70	17	2600	33	2.23	325	4.4	4.4
	5,000	80	75	70	16	2600	36	2.25	295	3.7	4.7

Remarks: Manual lean mixture, except rich mixture at maximum speed.
No wind conditions.
Usable fuel: 174 lb (29 gal).
Reserve fuel: 18 lb (10 percent of usable).
Taxi and takeoff fuel allowance: 8 lb (5 min at full throttle).

Data basis: Contractor flight test and calculation

Data as of: Mar 1971

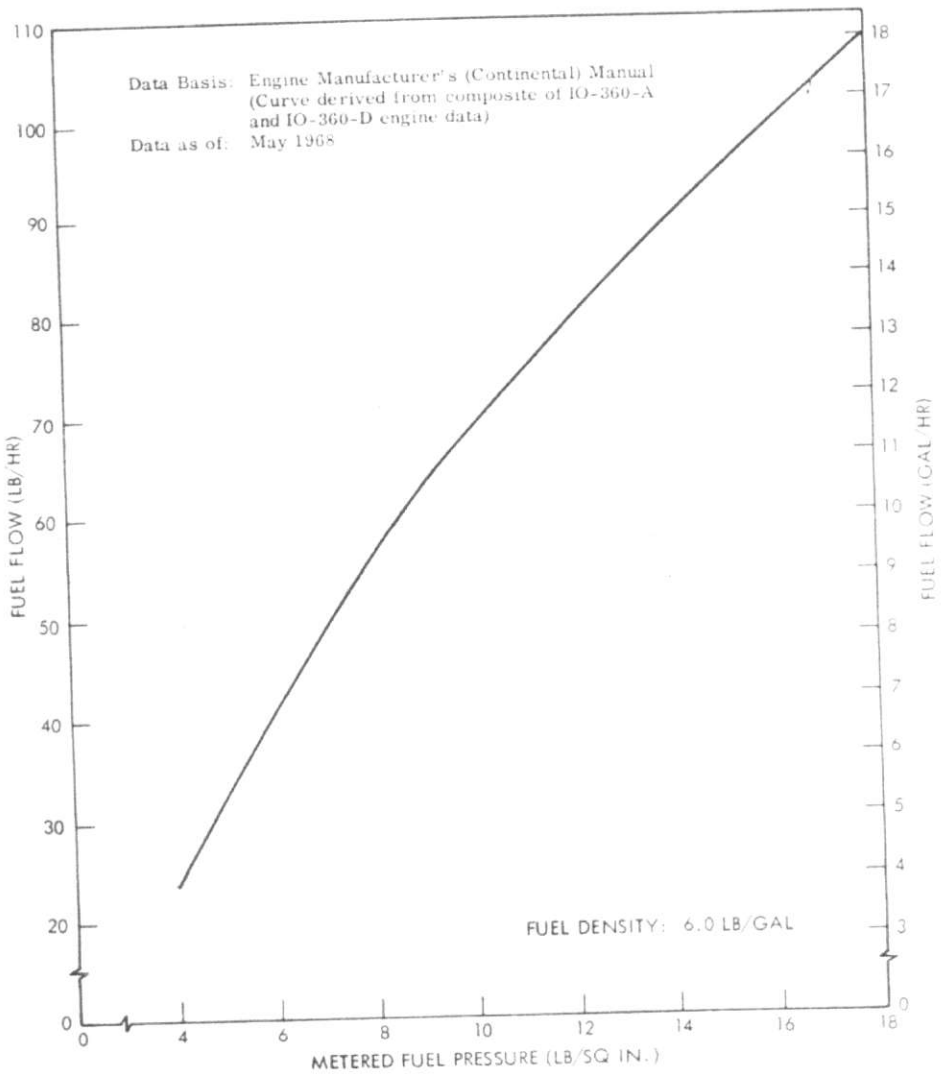


Fig. 14-5 Fuel Flow/Metered Fuel Pressure Conversion Chart

Table 14-6

LANDING DISTANCES – FEET

Standard Day, Gross Wt 3,800 Lb

Best IAS for Approach		Spoilers Open, Hard Surface, No Wind, Power Off					
		At Sea Level		At 2,500 ft		At 5,000 ft	
Power On (Knots)	Power Off (Knots)	Ground Roll	Clear 50 ft	Ground Roll	Clear 50 ft	Ground Roll	Clear 50 ft
63	63	1,020	1,830*	1,100	1,910	1,185	1,995

*Without spoilers this distance is 2,800 ft.

Remarks: Landing distances shown are minimum. For normal landing use 70 knots IAS approach speed and increase ground roll distances shown approximately 25 percent. (For effects of head- and tailwinds see Fig. 14-3.)

Data Basis: Contractor flight test (corrected for GW)

Data as of: Mar 1971

TAKEOFF AND LANDING
DATA CARD

CONDITIONS

GROSS WEIGHT _____

RUNWAY LENGTH _____

OAT _____

WIND _____

PRESSURE ALTITUDE _____

TAKEOFF

TAKEOFF DISTANCE _____

TAKEOFF SPEED _____

CLIMB SPEED _____

TAKEOFF AND LANDING
DATA CARD (CONT.)

LANDING IMMEDIATELY AFTER TAKEOFF

APPROACH SPEED _____

LANDING GROUND ROLL _____

LANDING

FIELD ELEVATION _____

LANDING GROSS WEIGHT _____

APPROACH SPEED _____

LANDING GROUND ROLL _____

Fig. 14-6 Takeoff and Landing Data Card

Appendix
REFERENCES

AR 95-2	Flight Regulations for Army Aircraft
AR 95-16	Weight and Balance – Army Aircraft
AR 310-1	Military Publications: Index of Administrative Publications
AR 310-3	Military Publications: Department of the Army Publications – Preparation, Coordination, and Approval
AR 310-25	Dictionary of United States Army Terms (Short Title: AD)
AR 310-50	Authorized Abbreviations and Brevity Codes
AR 385-40	Accident Reporting and Records
AR 710-12	Army Aircraft Inventory, Status, and Flying Time
DA PAM 108-1	Index of Army Films, Transparencies, GTA Charts, and Recordings
DA PAM 310-1	Index of Administrative Publications
DA PAM 310-2	Index of Blank Forms
DA PAM 310-3	Index of Doctrinal, Training, and Organizational Publications
DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders
FM 21-5	Military Training Management
FM 21-6	Techniques of Military Instructions
LMSC-D148160	Organizational Maintenance Handbook, YO-3A Aircraft
LMSC-D148161	Illustrated Parts Breakdown, YO-3A Aircraft
LMSC-687534	Preliminary Operating and Maintenance Manual, YO-3A Mission Equipment (C)
LMSC-D148160PMD	YO-3A Aircraft Preventive Maintenance Daily Inspection Checklist
LMSC-D148160PMI	YO-3A Aircraft Preventive Maintenance Intermediate Inspection Checklist
LMSC-D148160PMP	YO-3A Aircraft Preventive Maintenance Periodic Inspection Checklist
TB 55-1500-311-25	Test Flights and Maintenance Operational Checks for Army Aircraft
TB 55-9150-200-25	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TB 746-93-2	Painting and Marking of Army Aircraft

TM 1-215	Attitude Instrument Flying
TM 1-225	Navigation for Army Aviation
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 5-200	Camouflage Materials
TM 11-5821-259-20	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radio Set AN/ARC-114
TM 11-5821-260-20	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radio Set AN/ARC-115
TM 11-5821-261-20	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Radio Set AN/ARC-116
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