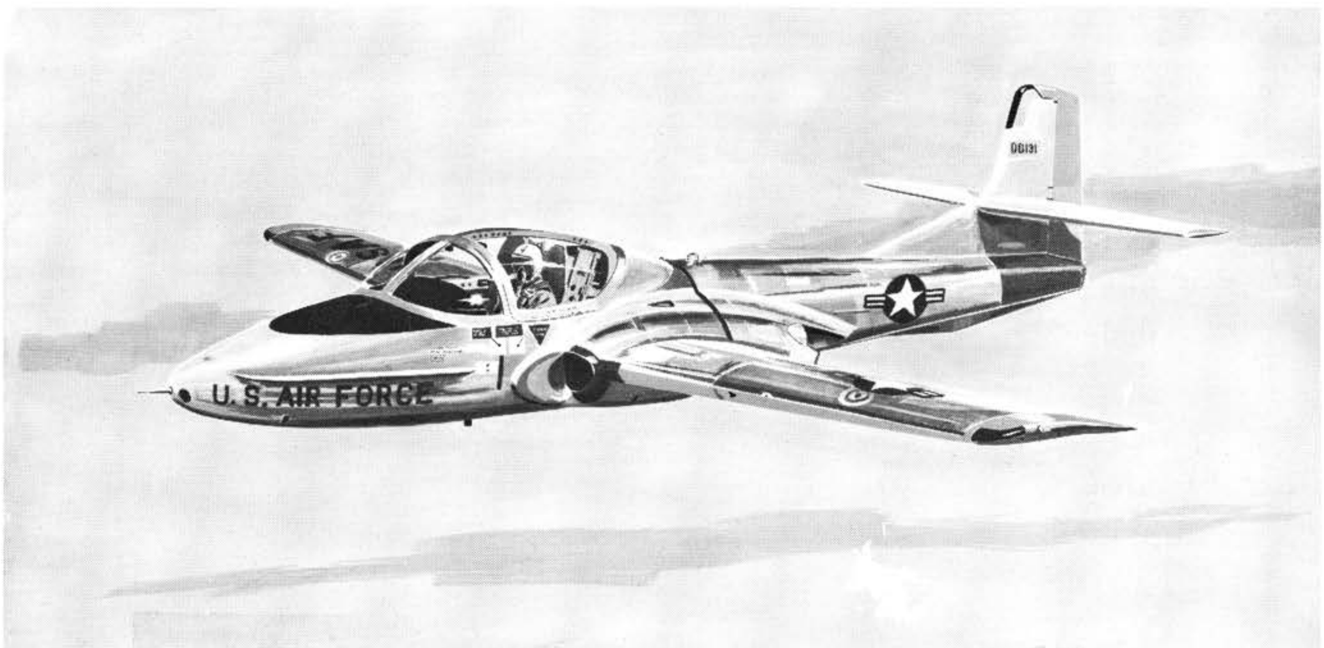
USAF SERIES T-37B AIRCRAFT

AF33(657)13854
AF33(657)14848

FLIGHT MANUAL



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15 MARCH 1965
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2-7	30 Apr 66	A3-7 thru A3-9	Original		
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2-11	Original	A4-6 Blank	Original		
2-12 thru 2-14	30 Apr 66	A4-7 thru A4-15	Original		
3-1	Original	A4-16 Blank	Original		
3-2	30 Apr 66	A5-1 thru A5-4	Original		
3-3	Original	A6-1 thru A6-3	Original		
3-4 thru 3-6	30 Apr 66	A6-4 Blank	Original		
3-7 thru 3-9	Original	A7-1 thru A7-5	Original		
3-10	30 Apr 66	A7-6 Blank	Original		
*3-11	15 Mar 67	A8-1 thru A8-4	Original		

CURRENT FLIGHT CREW CHECKLIST
T. O. 1T-37B-1 CL-1
CHANGED 15 MARCH 1967

* The asterisk indicates pages changed, added, or deleted by the current change.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

C-3
USAF

USAF ACTIVITIES.— In accordance with T. O. 00-5-2.

...table of contents.....

DON'T GAMBLE WITH YOUR LIFE

SCOPE

This manual contains the necessary information for safe and efficient operation of the T-37B. These instructions provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flying principles are avoided.

SOUND JUDGEMENT

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

PERMISSIBLE OPERATIONS

The flight manual takes a "positive approach" and limits restrictions to those conditions of flight that are injurious to the aircraft or crew member. All maneuvers are safe that stay within the published limits of acceleration (G Force), airspeed, altitude, and engine performance. Maneuvers that will exceed these limits are listed as prohibited maneuvers in Section V. Clearance must be obtained from ASD before any questionable operation is attempted which is not specifically prohibited in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA

Refer to T.O. 0-1-1-5A which is issued weekly and devoted solely to listing of all current Flight Manuals, Safety Supplements, Operational Supplements, and Checklists. Its frequency of issue and brevity assures an accurate, up-to-date listing of all these publications.

SAFETY SUPPLEMENTS

Information involving safety will be promptly forwarded to you by Safety Supplements. The title page of the Flight Manual and the title block of each Safety Supplement should also be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with but there is no point in restricting your operation by complying with a replaced or rescinded supplement.

OPERATIONAL SUPPLEMENTS

Operational Supplements are issued against Flight Manuals as non-safety of flight information so that the using command can achieve or maintain operational posture when new requirements or aircraft changes cannot be timely or adequately covered in the Flight Manual at the time of a scheduled revision or change.

CHECKLISTS

The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as separate technical orders — see the back of the title page for T.O. number and the date of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "Warnings," "Cautions," and "Notes" found throughout the manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which result in damage to equipment if not carefully followed.

Note

An operating procedure, technique, etc., which is considered essential to emphasize.

COMMENTS AND QUESTIONS

Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your Command Headquarters to Hq ASD, Wright-Patterson AFB, Ohio, Atten: ASZTS, 45433.

TIME COMPLIANCE TECHNICAL ORDER STATUS

The following is a list of TCTO's which are applicable to operation of the aircraft, and have been incorporated into the manual.

T.O. 1T-37-527 Installation of Escape Tool

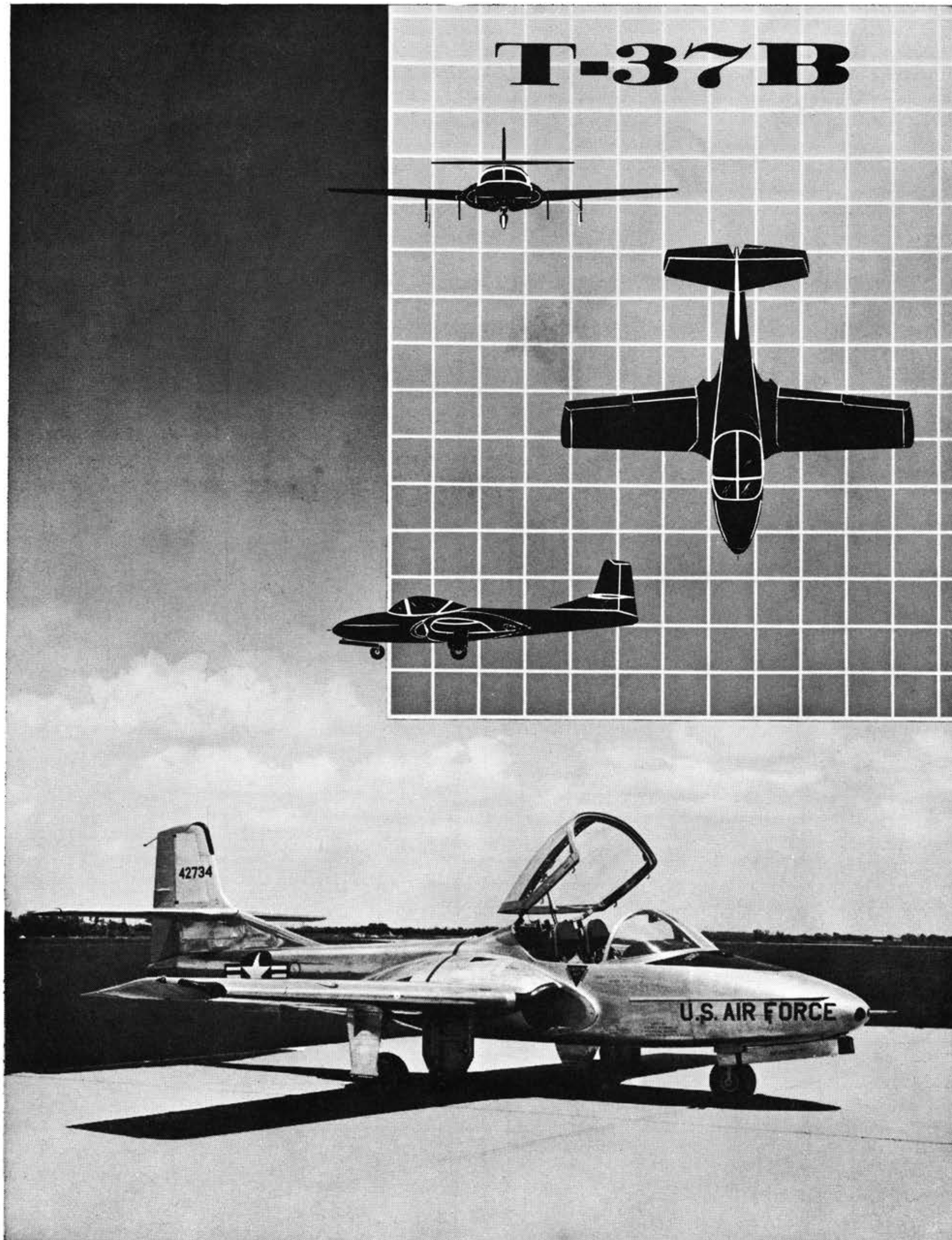
T.O. 1T-37-540 Installation of Canopy Downlock

T.O. 1T-37-546 Replacement of Canopy Glass Panels

SAFETY AND OPERATIONAL SUPPLEMENTS SUMMARY

Safety Supplements are numbered with "SS" immediately preceding the -1 contained in the basic publication number and are assigned consecutive dash numbers. Example: T.O. 1T-37B-SS-1-1, -2, -3, etc. Operational Supplements are bordered by black OS's and are assigned consecutive dash numbers. Example: T.O. 1T-37B-1S-1, -2, -3, etc. The letter "O" is omitted in the T.O. number to avoid confusion with numerical "zero." Existing Safety and Operational Supplements will not be renumbered and will remain effective until rescinded or replaced. The supplements you receive should follow in sequence and if you find you are missing one, check the Weekly Index of Safety Supplements T.O. 0-1-1-5A to see if it was issued and, if so, is still effective. That supplement may have been replaced or rescinded before you received your copy. If it is still active, see your Publications Distribution Officer and get your copy. It should be noted that a supplement number will never be used more than once. The following portion is to be filled in by you when you receive your Flight Manual, and to be added to as you receive additional supplements. Refer to Safety Supplement Index T.O. 0-1-1-5A for latest information if any questions arise.

Number	Date	Short Title	Disposition
T.O. 1T-37B-1S-1	12 Feb. 65	Icing Terminology	



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SECTION I

Description

TABLE OF CONTENTS

THE AIRCRAFT

The T-37B is a low-wing dual control jet trainer of all metal construction and side by side seating, manufactured by the Cessna Aircraft Company. Power for the aircraft is provided by two Continental turbojet engines. The aircraft is equipped with a two position speed brake, spoilers, for artifical stall warning, thrust attenuators, a jettisonable clamshell canopy and ejection seats. Other noteworthy features include full instrumentation and lighting for day and night flying and oxygen equipment. Aircraft ▲1 are equipped with a heating, ventilating and defrosting system; aircraft ▲2 are equipped with an air conditioning and defrosting system. The aircraft is designed for utility, ruggedness, and safety, and to provide a medium for pilot transition to heavier and faster jet aircraft.

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302
▲2 Aircraft 55-4302 and 56-3492 and on

DIMENSIONS

The overall dimensions of the aircraft under normal conditions of gross weight, tire and gear inflation are as follows:

Wing Span	33.80 feet
Length	29.30 feet
Height	9.20 feet
Wheel Base	7.75 feet
Wheel Tread	14.00 feet

Refer to Section II for minimum turning radius and ground clearances.

GROSS WEIGHT

The design gross weight of the aircraft is 6575 pounds. Refer to Section V for additional information.

ENGINES

Thrust is supplied by two Continental J69-T-25 engines. Approximate standard sea level maximum thrust rating for the engines is 1025 pounds each. The J69-T-25 engine is a centrifugal flow gas turbine engine. The engine has a single entry ram air inlet and a single stage axial flow turbine directly connected to the compressor on a common rotor shaft.

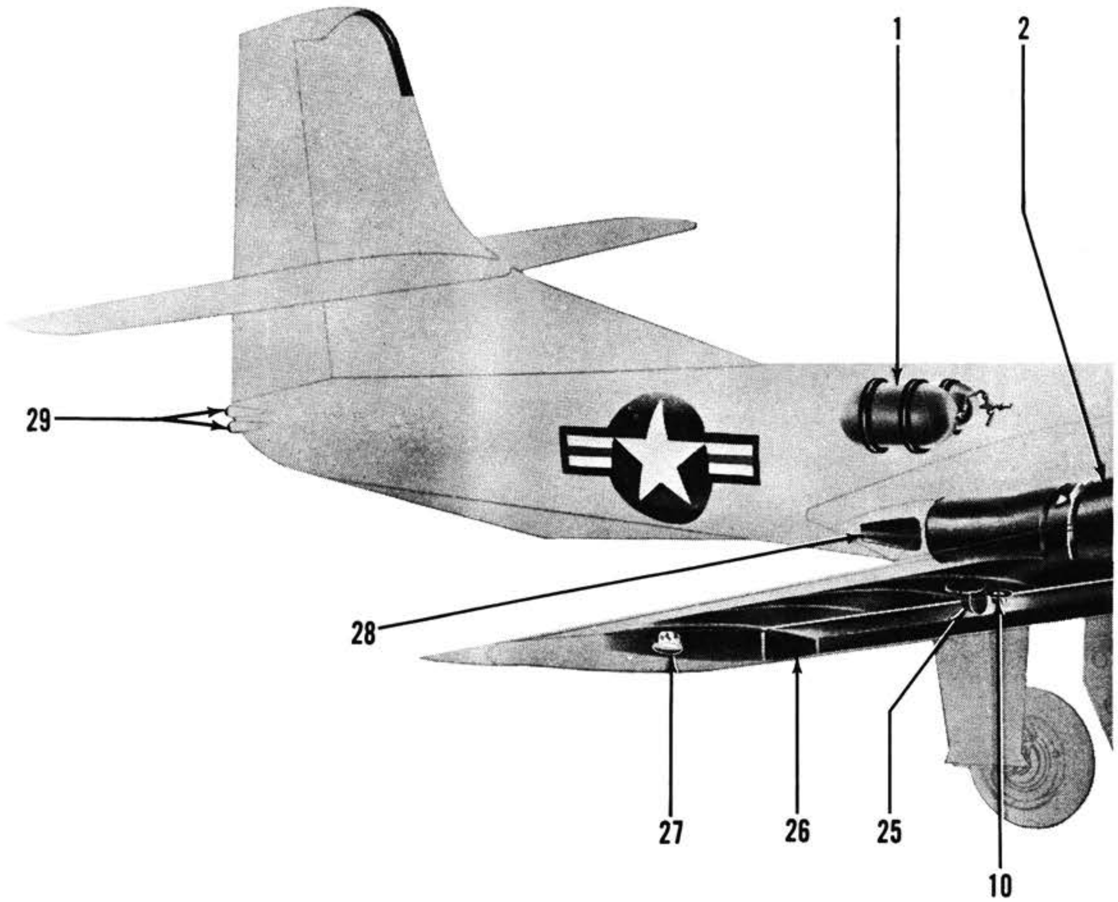
ENGINE FUEL CONTROL SYSTEM

Fuel flow requirements are established by the pilot's or instructor's throttle movements, and fuel flow to the engine is delivered and regulated by the engine fuel control system (figure 1-3). The system includes the engine-driven fuel pump unit and the fuel control unit.

Engine-Driven Fuel Pumps

The engine-driven fuel pump unit, consisting of a centrifugal pump and two gear-type pumps

GENERAL

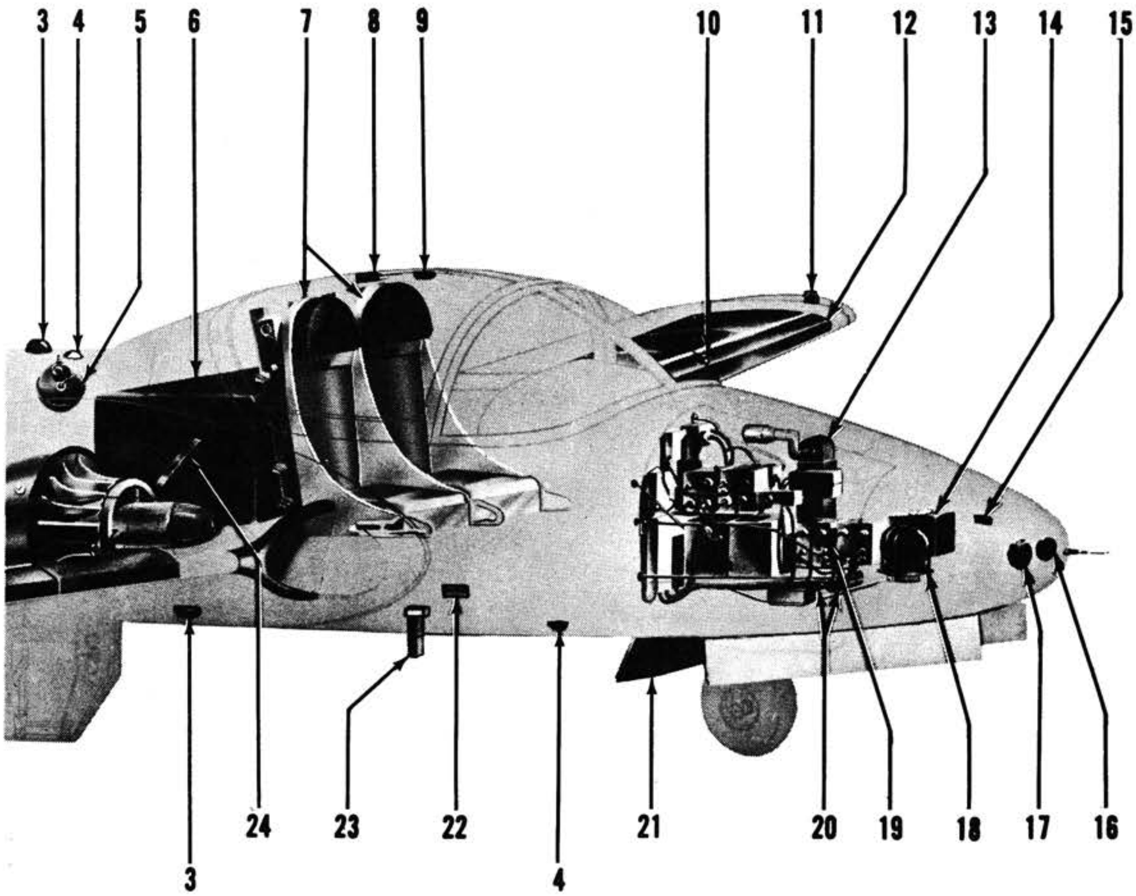


1. OXYGEN CYLINDERS
2. J69-T-25 ENGINE
3. ANTI-COLLISION BEACON
4. POSITION LIGHT
5. HYDRAULIC RESERVOIR
6. FUSELAGE FUEL TANK
7. EJECTION SEATS
8. VHF NAVIGATION ANTENNA
9. ESCAPE TOOL ⚠12
10. FUEL FILLER CAP
11. LEFT NAVIGATION LIGHT
12. LEFT WING FUEL TANK
13. AIR CONDITIONING UNIT ⚠2
14. BATTERY
15. EXTERNAL POWER RECEPTACLE

⚠2 Aircraft 55-4302 and 56-3492 and on
⚠12 Aircraft modified per T.O. 1T-37-527

Figure 1-1 (Sheet 1 of 2)

ARRANGEMENT



16. PASSING LIGHT
17. TAXI LIGHT
18. J-2 COMPASS CONTROL UNIT
19. RADIO EQUIPMENT
20. INVERTERS
21. SPEED BRAKE
22. STEP WELL
23. UHF COMMUNICATION ANTENNA
24. RIGHT SPOILER
25. RIGHT LANDING LIGHT
26. RIGHT WING FUEL TANK
27. RIGHT NAVIGATION LIGHT
28. RIGHT THRUST ATTENUATOR
29. TAIL NAVIGATION LIGHTS

Figure 1-1 (Sheet 2 of 2)

(figure 1-3), supplies the fuel pressure required for the proper operation of the fuel control unit. All fuel flowing through the pump unit must first pass through the centrifugal pump. This pump acts as a suction pump in case of boost pump failure and pressurizes the fuel to prevent the possibility of cavitation due to entrained vapors in the two gear-type pumps. The two gear-type pumps operate in parallel, each one having enough capacity to handle the fuel requirements of the engine under all operating conditions.

Fuel Control

The fuel control unit (figure 1-3) regulates the fuel flow to the engine. The unit contains a starting fuel solenoid valve, a speed governing element, and an acceleration control. The starting fuel solenoid valve regulates the fuel flow to the starting nozzles during the starting cycle. Since fuel flow through the fuel distributor increases as engine speed increases, the flow through the starting fuel nozzles is discontinued by releasing the ignition switch. The speed governing element regulates the fuel flow through the governor control valve to maintain the engine speed selected by the positioning of the throttle regardless of airspeed or altitude changes. Because the engine-driven fuel pump unit delivers more fuel than the engine requires, the speed governing element contains a bypass valve which allows the excess fuel to return to the fuel input line. The acceleration control prevents over-temperature and engine surge during rapid throttle movements.

Note

> Due to a pressure relief valve located within the fuel control unit, fuel will not be supplied to the fuel distributor with a throttle out of the CUT-OFF position until the engine reaches approximately 8 to 12% rpm. This does not apply to starting fuel flow.

THROTTLES

Four throttles (1, 2, 9, 10, figure 1-5) are provided, two on each quadrant. Each quadrant is marked CUT-OFF, IDLE, and 100%. The two sets of throttles are mechanically interconnected. Throttle movement, through the use of push-pull rods and torque tubes, mechanically actuates each engine fuel control unit. Lift type idle detents are included on the instructor's quadrant to prevent inadvertent positioning of either set of throttles from the IDLE to CUT-OFF position. The idle detents affect both sets of throttles. It is necessary to lift the instructor's throttles past the idle detent if engine shutdown is to be made. It is advisable to use instructor's throttles for all engine starts in order to have cut-off feature available.

Throttle Friction Knob

A throttle friction knob (6, figure 1-5) provides a means of increasing throttle friction. The friction knob can be overcome and will not prevent either crew member from manually positioning the throttles to a new setting.

ENGINE ICE WARNING SYSTEM

The engine ice warning system, warns the pilot of icing in the engine air inlet ducts. The engine ice warning light (10, figure 1-6), is amber in color and is illuminated once ice has formed on the ice detect probe which is located in the left engine air inlet duct. A heating element in the detect probe is automatically turned on after a brief period of icing. After the existing ice has been melted from the detect probe (approximately 5 seconds) the warning light will go out and remain out until the ice condition is repeated. This cycle will be repeated as long as icing conditions exist. Power for the warning light and ice detect probe is received from the 28 volt dc bus.

Note

> Retarding the throttles rapidly will cause the engine ice warning light to occasionally illuminate, due to negative pressure in the ice detect probe.

IGNITION SYSTEM

An ignition system, operating on 28 volt dc current from the bus, is provided for each engine. Each ignition system comprises an ignition coil, two fuel ignitors, and a two position channel guarded ignition switch. Ignition is used for all ground starting, but is not used to sustain combustion once the engine has started.

J69-T-25 ENGINE

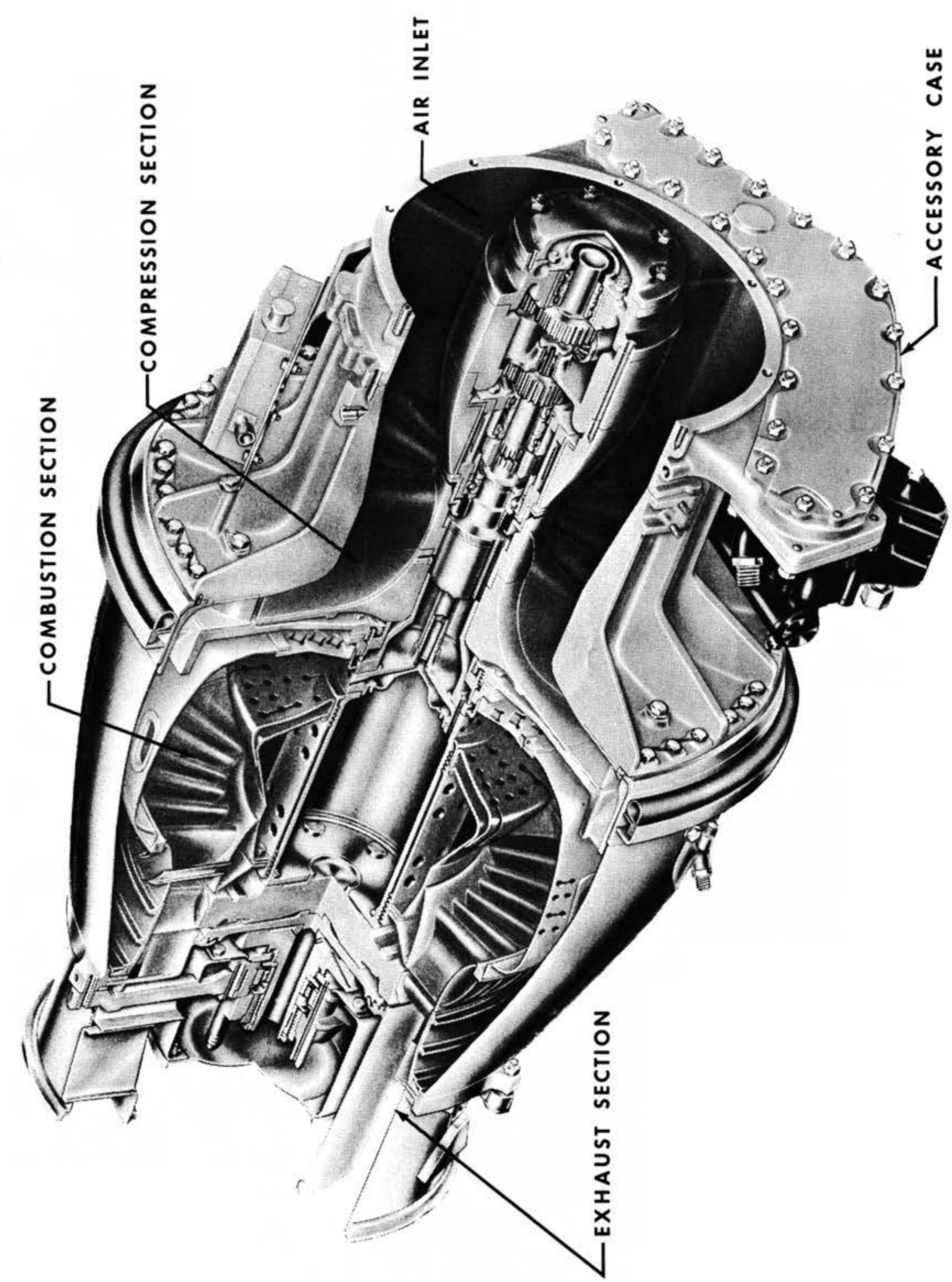


Figure 1-2

ENGINE FUEL CONTROL SYSTEM

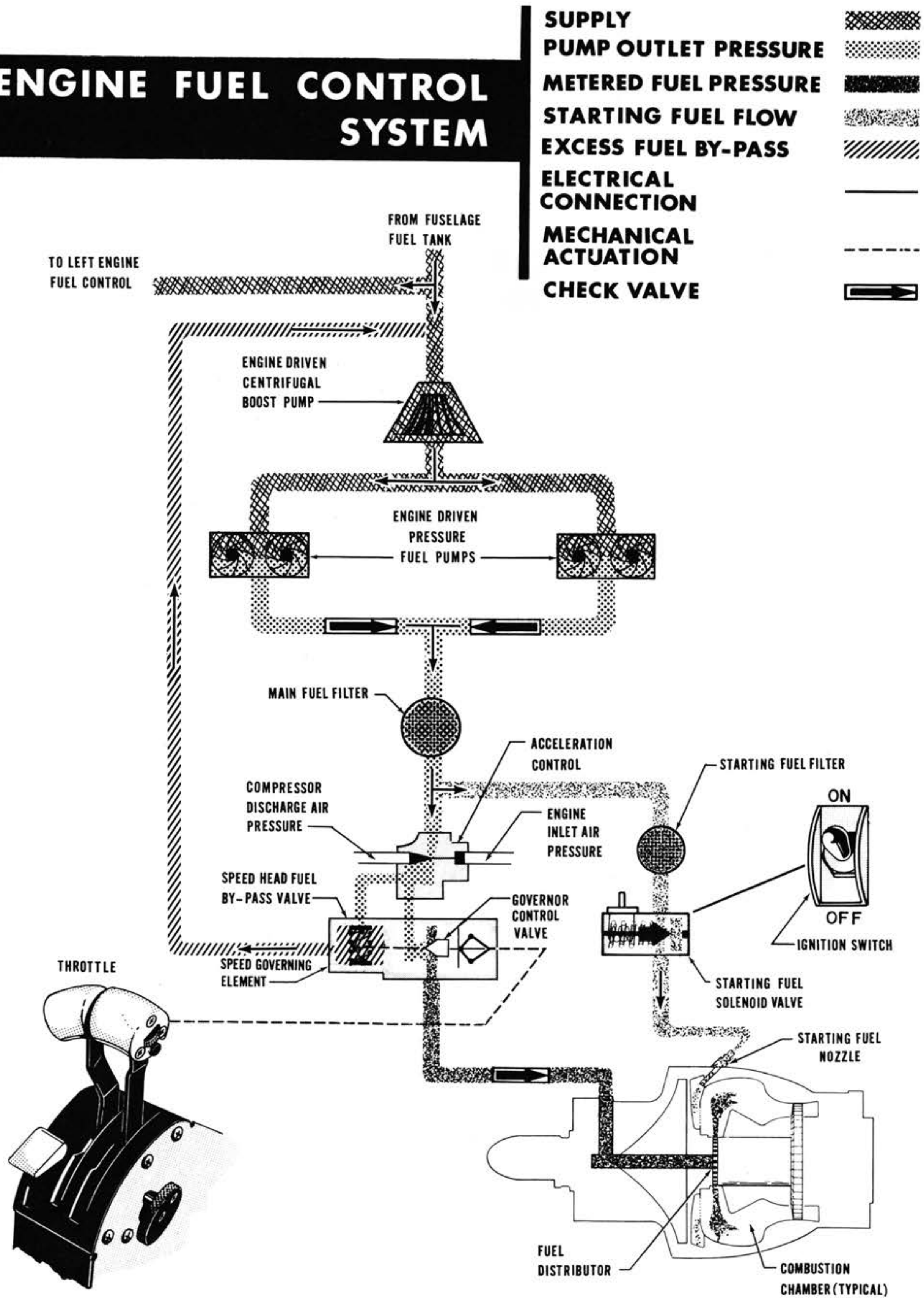


Figure 1-3

Ignition Switches

The ignition switches (15, 18, figure 1-9) actuate ignition and starting fuel to the engines. The switches are channel guarded and are marked Ignition and have positions ON and OFF. The switches are spring loaded to the OFF position. Positioning an ignition switch to ON, with the respective starter switch in the GND position, allows current to energize a starting fuel solenoid valve and the ignition coil for its respective engine. Once the engine has sustained combustion, the ignition switch should be released and allowed to return to the OFF position.

STARTING SYSTEM

A starting system, operating on 28 volt dc current from the bus is provided for each engine. Each starting system consists of a starter switch and a combination starter-generator located on the forward portion of the engine. An external power source is not required for starting the engine.

Starter Switches

The starter switches (14, 17, figure 1-9) are marked Starter, with positions GND, OFF, and AIR. The switches are channel guarded and are spring-loaded to the OFF position. All engine starts on the ground are made using the GND position. This permits power from the main bus to energize the starter. When the starter switch is positioned to the AIR position and released, a time delay relay is actuated which provides ignition and starting fuel for approximately 30 to 45 seconds to effect an airstart.

CAUTION

Flight tests have verified that holes may be burned in engine outer combusters when using AIR position of the starter switch. The AIR position of the starter switch should only be used during emergency low altitude engine restarts.

Ⓐ Aircraft 56-3562 and on
Ⓑ Aircraft 54-2729 thru 56-3561

ENGINE INSTRUMENTS

Tachometers

The tachometers (16, figure 1-6) are self-generating instruments that indicate engine speed in percentage of the rated rpm. They operate independently of the aircraft electrical system except for instrument lighting. On this aircraft the rated rpm is 21,730 rpm. Used in conjunction with the exhaust gas temperature indicator, this instrument enables engine power to be set without exceeding the engine limitations.

Exhaust Gas Temperature Indicators

The exhaust gas temperature indicators (14, figure 1-6), are self-generating instruments that indicate temperature in degrees centigrade. Electrical current for the exhaust gas temperature indicators is supplied by six thermocouples located in the tailpipe of each engine.

Fuel Flow Indicators

Fuel flow, in pounds per hour to each engine, is indicated by the fuel flow indicators (24, figure 1-6). The fuel flow indicators are powered from the 28 volt single phase ac bus.

Oil Pressure Gages Ⓐ

The oil pressure gages (25, figure 1-6), indicate oil pressure to the engines in pounds per square inch and are direct pressure operated gages.

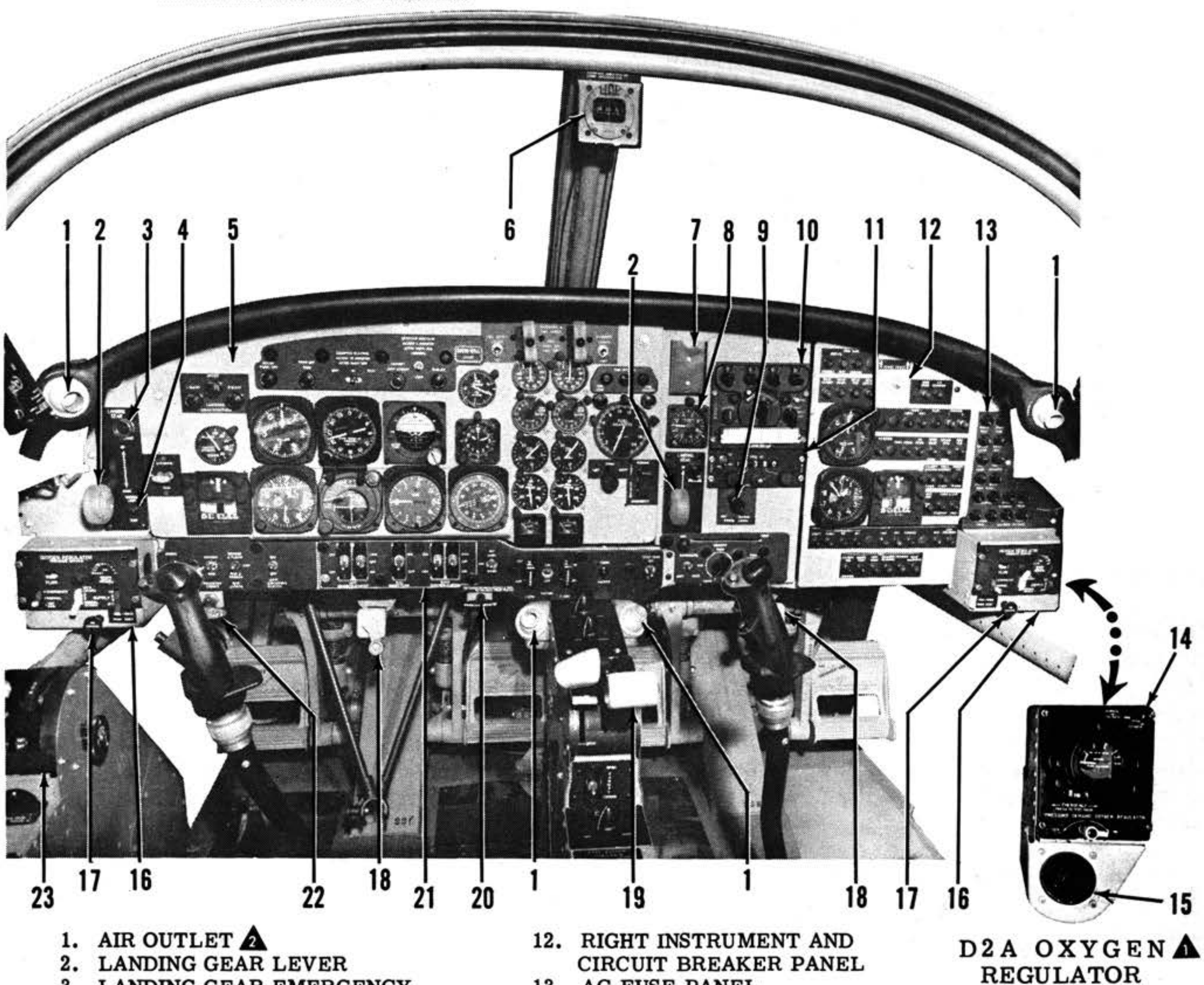
Oil Pressure Indicators Ⓑ

The oil pressure indicators (37, figure 1-6) are remote indicating instruments and are operated by the 28 volt single phase ac bus. The indicators indicate oil pressure in pounds per square inch.

OIL SUPPLY SYSTEM

Each engine has an independent oil system. The oil serves both for lubricating and cooling and is a completely automatic system requiring no control action by the pilot. The capacity of each oil system is 6 quarts of oil, of this amount 4.5 quarts is usable oil. The oil pump does not have an inverted flight scavenger element but

COCKPIT forward view



1. AIR OUTLET [2]
2. LANDING GEAR LEVER
3. LANDING GEAR EMERGENCY OVERRIDE SWITCH
4. LANDING GEAR WARNING LIGHT TEST SWITCH
5. LEFT INSTRUMENT PANEL
6. MAGNETIC COMPASS
7. MAGNETIC COMPASS CORRECTION CARD
8. ACCELEROMETER
9. RADIO LIGHTS RHEOSTAT
10. UHF COMMAND RADIO
11. VOR CONTROL PANEL
12. RIGHT INSTRUMENT AND CIRCUIT BREAKER PANEL
13. AC FUSE PANEL
14. D2A OXYGEN REGULATOR [1]
15. AIR-OUTLET [1]
16. MD-1 OXYGEN REGULATOR [2]
17. AIR CONTROL KNOB [2]
18. RUDDER PEDAL ADJUSTMENT CRANK
19. INSTRUCTOR's QUADRANT
20. PARKING BRAKE HANDLE
21. SWITCH PANEL
22. LANDING GEAR EMERGENCY "T" HANDLE
23. PILOT'S QUADRANT

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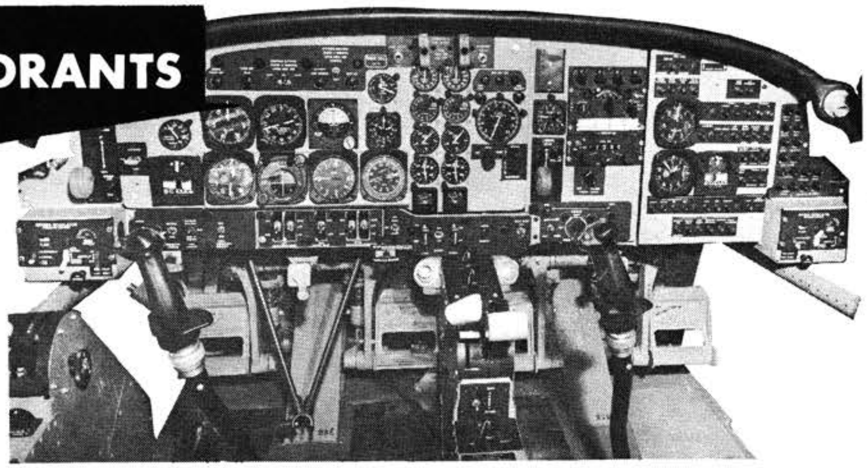
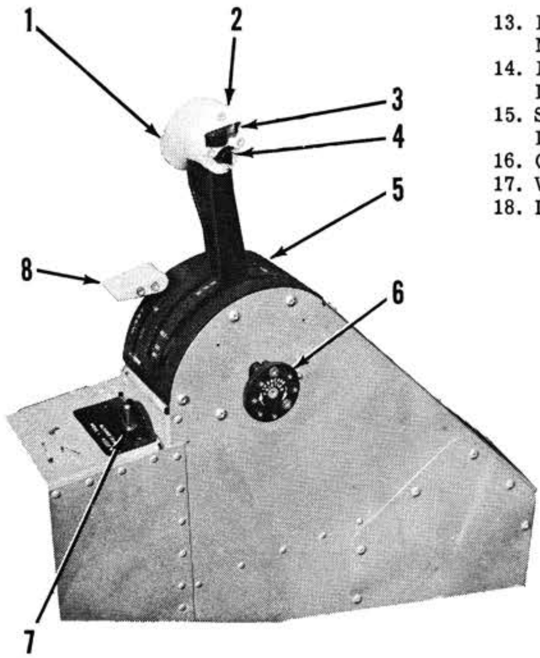
[1] Aircraft 54-2729 thru 56-3491 except 55-4302
[2] Aircraft 55-4302 and 56-3492 and on

Figure 1-4

CONTROL QUADRANTS



1. LEFT ENGINE THROTTLE
2. RIGHT ENGINE THROTTLE
3. SPEED BRAKE SWITCH
4. MICROPHONE SWITCH
5. PILOT'S QUADRANT
6. THROTTLE FRICTION KNOB
7. RUDDER TRIM SWITCH
8. WING FLAP LEVER
9. LEFT ENGINE THROTTLE
10. RIGHT ENGINE THROTTLE
11. SPEED BRAKE SWITCH
12. MICROPHONE SWITCH



13. PRIMARY FLIGHT INSTRUMENT LIGHT RHEOSTAT
14. PRIMARY INSTRUMENT LIGHT RHEOSTAT
15. SECONDARY INSTRUMENT LIGHT RHEOSTAT
16. CANOPY SWITCH
17. WING FLAP LEVER
18. INSTRUCTOR'S QUADRANT

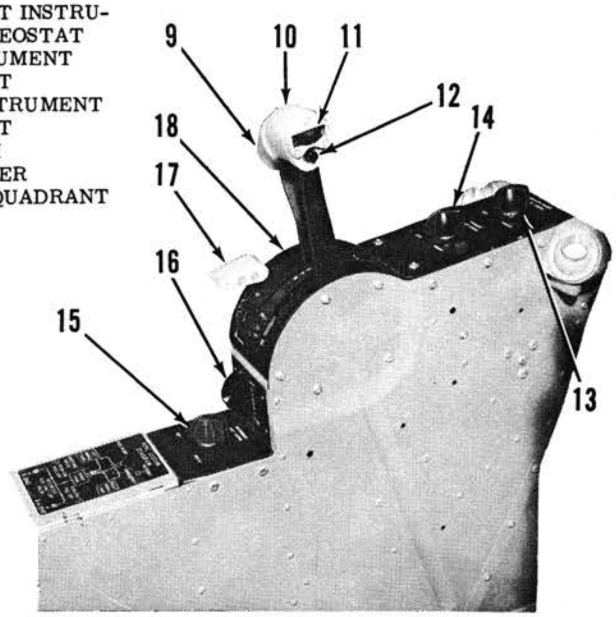


Figure 1-5

the engine will operate for 30 seconds inverted without difficulty. See figure 1-25 for oil specification.

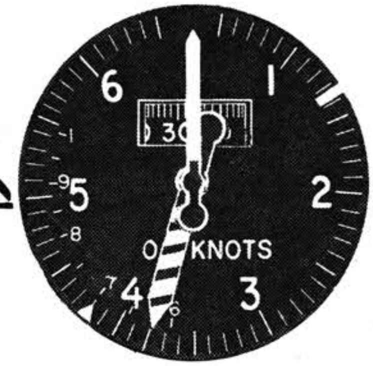
FUEL SUPPLY SYSTEM

Three fuel tanks are installed in the aircraft: one in the fuselage and one in each wing. Six interconnected fuel cells make one wing fuel tank. (See figure 1-10.) Fuel is supplied to the engines from the fuselage tank by an electrical fuel boost pump. In normal operation, fuel is transferred, under pressure, from the wing tanks to the fuselage tank in equal quantity by an electrical proportioner pump. The proportioner pump operates automatically when the fuel quantity in the fuselage tank drops below a preset level. In emergency operation, fuel is supplied to the fuselage tank from the wing tanks by gravity feed. The aircraft is refueled by means of two filler points, located in the outboard leading edge of each wing. Refer to figure 1-25 for fuel specification. Refer to Section VII for additional information on the fuel system management.

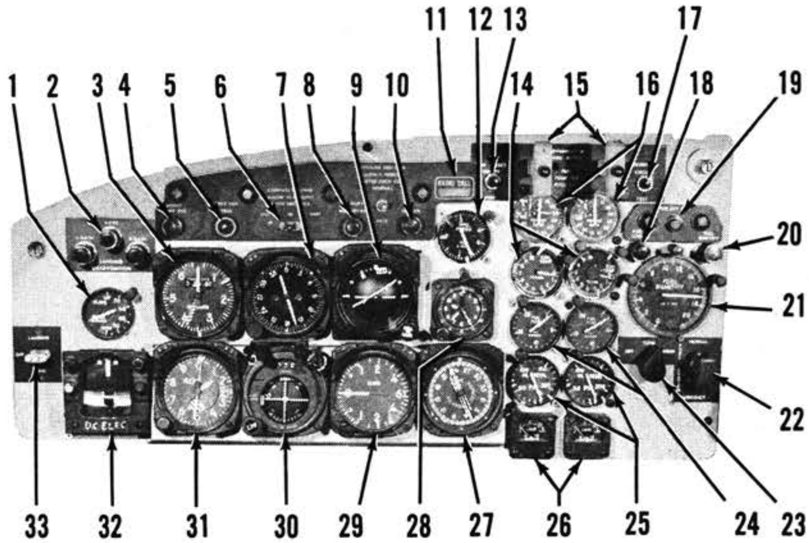
FUSELAGE TANK FUEL BOOST PUMP

A centrifugal pump is located inside the inverted flight chamber in the bottom of the fuselage tank. It supplies fuel under low, positive pressure to both engines. The pressure helps prevent high altitude engine surge. It also provides fuel to reprime the engine-driven fuel pump in the event of cavitation (air lock).

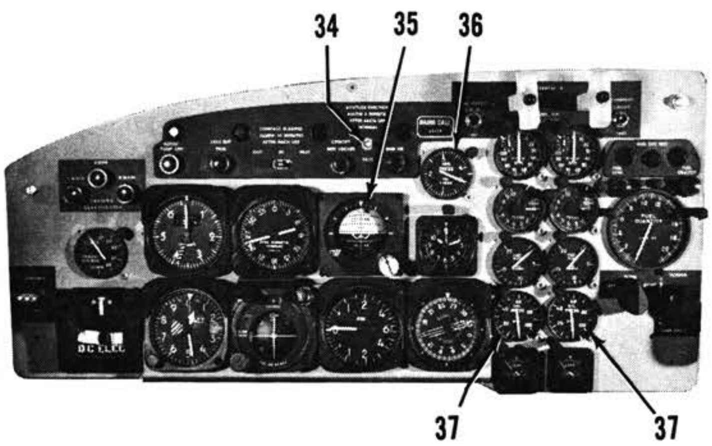
Left Instrument Panel



1. WING FLAP POSITION INDICATOR
2. LANDING GEAR POSITION INDICATOR LIGHTS
3. AIRSPEED INDICATOR
4. FUSELAGE TANK FUEL BOOST PUMP WARNING LIGHT
5. ELEVATOR TRIM TAB POSITION INDICATOR LIGHT
6. HEADING INDICATOR CUT-OUT AND FAST SLAVE SWITCH
7. HEADING INDICATOR
8. CANOPY NOT LOCKED WARNING LIGHT
9. J-8 ATTITUDE INDICATOR
10. ENGINE ICE WARNING LIGHT
11. RADIO CALL NUMBER
12. HYDRAULIC PRESSURE GAGE ▲
13. ENGINE FIRE DETECT TEST SWITCH
14. EXHAUST GAS TEMPERATURE INDICATORS
15. FUEL SHUTOFF "T" HANDLES
16. TACHOMETERS
17. ENGINE OVERHEAT DETECT TEST SWITCH
18. FUEL LOW LEVEL WARNING LIGHT
19. FUEL QUANTITY INDICATOR TEST SWITCH
20. GRAVITY FUEL LIGHT
21. FUEL QUANTITY INDICATOR
22. FUEL SYSTEM SWITCH
23. FUEL GAGING SELECTOR SWITCH
24. FUEL FLOW INDICATORS
25. OIL PRESSURE GAGES ▲
26. LOADMETERS
27. RADIO MAGNETIC INDICATOR (ID-250)
28. CLOCK
29. VERTICAL VELOCITY INDICATOR
30. COURSE INDICATOR (ID-351)
31. ALTIMETER
32. TURN AND SLIP INDICATOR
33. LANDING - TAXI LIGHT SWITCH



AIRCRAFT 54-2729 THRU 57-2352



34. MM-3 ATTITUDE INDICATOR FAST ERECTION SWITCH
35. MM-3 ATTITUDE INDICATOR
36. HYDRAULIC PRESSURE INDICATOR ▲3
37. OIL PRESSURE INDICATORS ▲3

AIRCRAFT 58-1861 AND ON

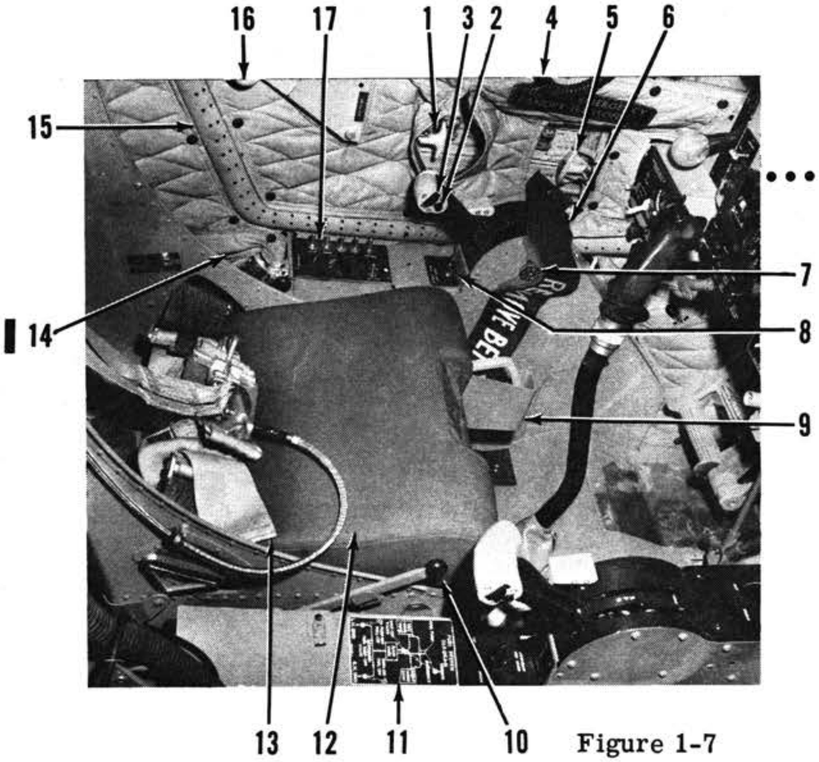
▲3 Aircraft 56-3562 and on
▲ Aircraft 54-2729 thru 56-3561

Figure 1-6

COCKPIT

▲2 Aircraft 55-4302 and 56-3492 and on

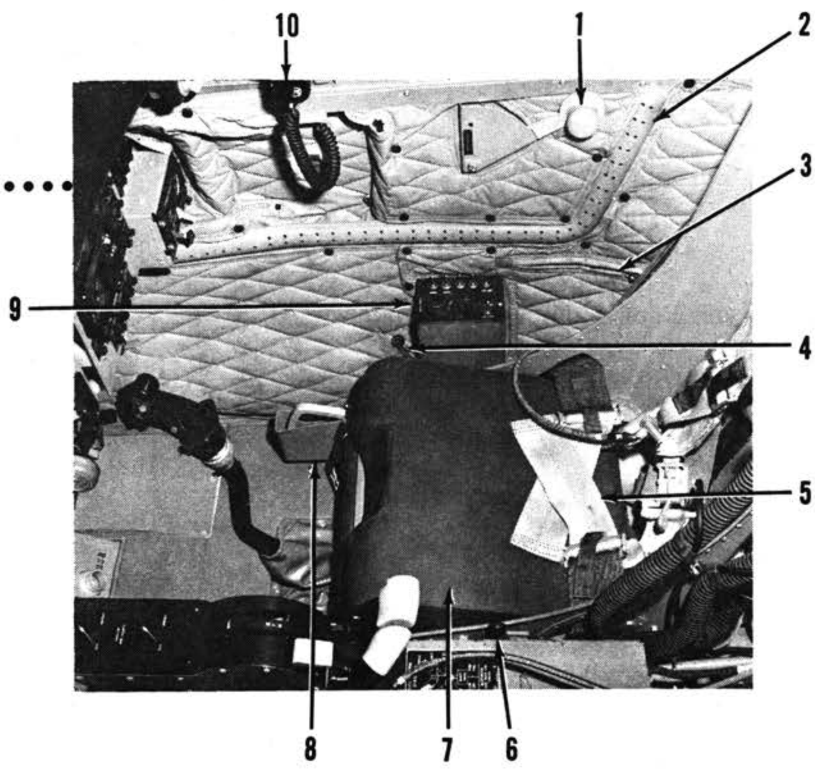
Left Side



1. CANOPY DE-CLUTCH "T" HANDLE
2. MICROPHONE BUTTON
3. SPEED BRAKE SWITCH
4. COCKPIT LIGHT
5. CANOPY JETTISON "T" HANDLE
6. CANOPY JETTISON "T" HANDLE SAFETY PIN
7. THROTTLE FRICTION KNOB
8. RUDDER TRIM TAB SWITCH
9. ARMING HANDLE GUARD
10. SEAT ADJUSTMENT LEVER
11. MAP AND DATA CASE
12. PILOT'S SEAT
13. SAFETY BELT
14. SAFETY PIN STOWAGE COMPARTMENT
15. PICCOLO TUBE ▲2
16. CANOPY DOWNLOCK HANDLE
17. INTERPHONE CONTROL PANEL

Figure 1-7

Right Side



1. CANOPY DOWNLOCK HANDLE
2. PICCOLO TUBE ▲2
3. MAP AND DATA CASE
4. SEAT ADJUSTMENT LEVER
5. SAFETY BELT
6. SHOULDER HARNESS LOCKING LEVER
7. INSTRUCTURE'S SEAT
8. ARMING HANDLE GUARD
9. INTERPHONE CONTROL HANDLE
10. COCKPIT LIGHT

Figure 1-8

Switch Panel

1. HOT AIR 'T' HANDLE ⚠1
2. TEMPERATURE CONTROL KNOB ⚠1
3. COLD AIR KNOB ⚠1
4. DEFROST CONTROL KNOB ⚠2
5. AIR TEMPERATURE CONTROL RHEOSTAT ⚠2
6. COCKPIT AIR LEVER ⚠2
7. AIR TEMPERATURE CONTROL SWITCH ⚠2
8. PITOT HEAT SWITCH
9. GEAR AUDIBLE SILENCING SWITCH
10. RIGHT GENERATOR SWITCH
11. BATTERY SWITCH
12. LEFT GENERATOR SWITCH
13. MAIN-SPARE INVERTER SWITCH
14. RIGHT STARTER SWITCH
15. RIGHT IGNITION SWITCH
16. FUSELAGE TANK FUEL BOOST PUMP SWITCH
17. LEFT STARTER SWITCH
18. LEFT IGNITION SWITCH
19. ANTI COLLISION BEACONS SWITCH
20. NAVIGATION LIGHTS SWITCH
21. WARNING LIGHTS DIM SWITCH

⚠1 Aircraft 54-2729 thru 56-3491 except 55-4302

⚠2 Aircraft 55-4302 and 56-3492 and on

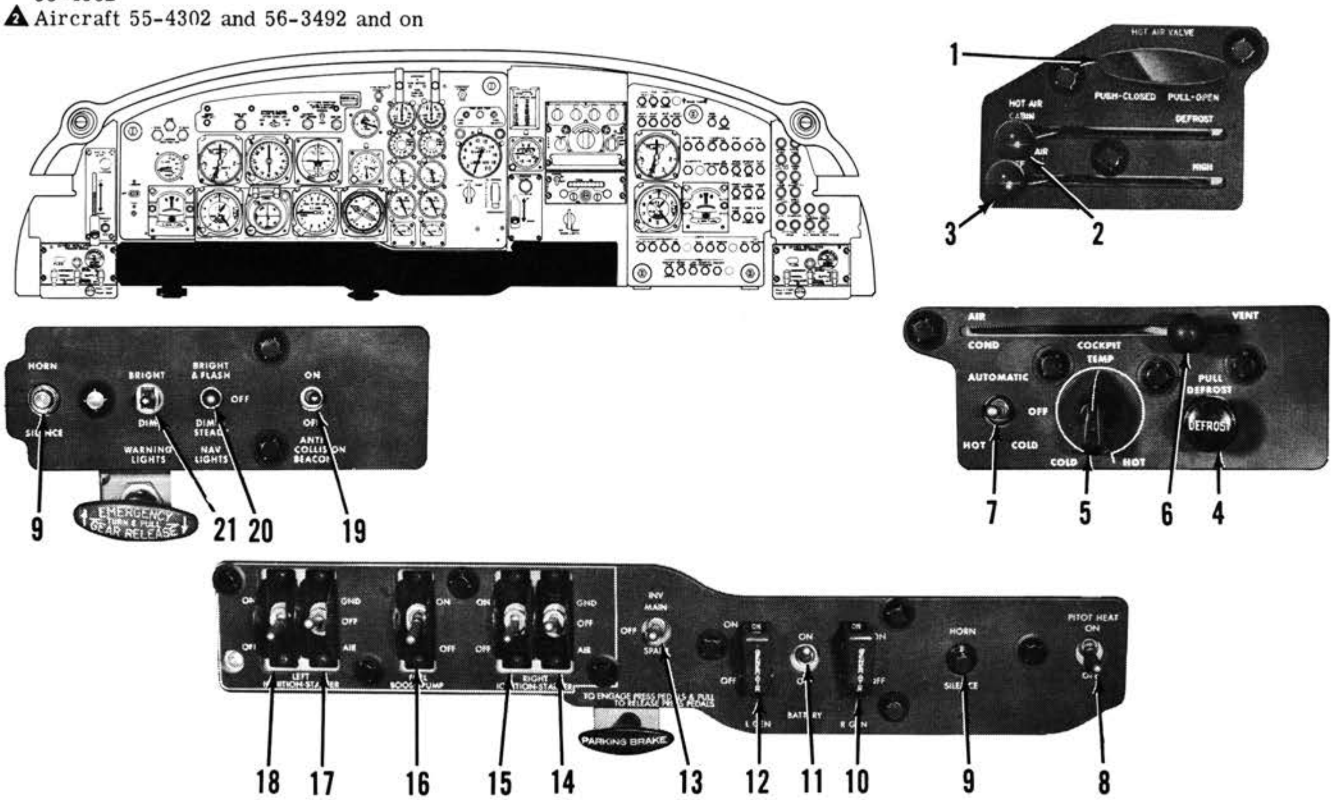


Figure 1-9

Fuselage Tank Fuel Boost Pump Switch

The fuselage tank fuel boost pump switch (16, figure 1-9) has ON and OFF positions. The switch is always in the ON position for normal flight conditions. Power for the switch is supplied by the 28 volt dc bus.

Fuselage Tank Fuel Boost Pump Warning Light

An amber fuselage tank fuel boost pump warning light (4, figure 1-6) provides the pilot with an indication that the fuselage tank fuel boost pump is not providing normal fuel pressure. The light, operated through the action of a pressure switch located in the fuel line, receives its electrical power from the 28 volt dc bus.

Note

The fuselage tank fuel boost pump warning light may flicker momentarily near zero "G" conditions due to a momentary lack of fuel at the fuselage tank boost pump inlet.

FUEL SHUTOFF "T" HANDLES

A fuel shutoff "T" handle (15, figure 1-6) for each engine is located on the top of the instrument panel. In the PUSH-ON position, a circuit to the motorized fuel shutoff valve is completed which permits 28 volt dc power to open the valves and lets fuel flow from the fuel boost pump to the engine fuel control. When the "T" handle is in the PULL-OFF position the

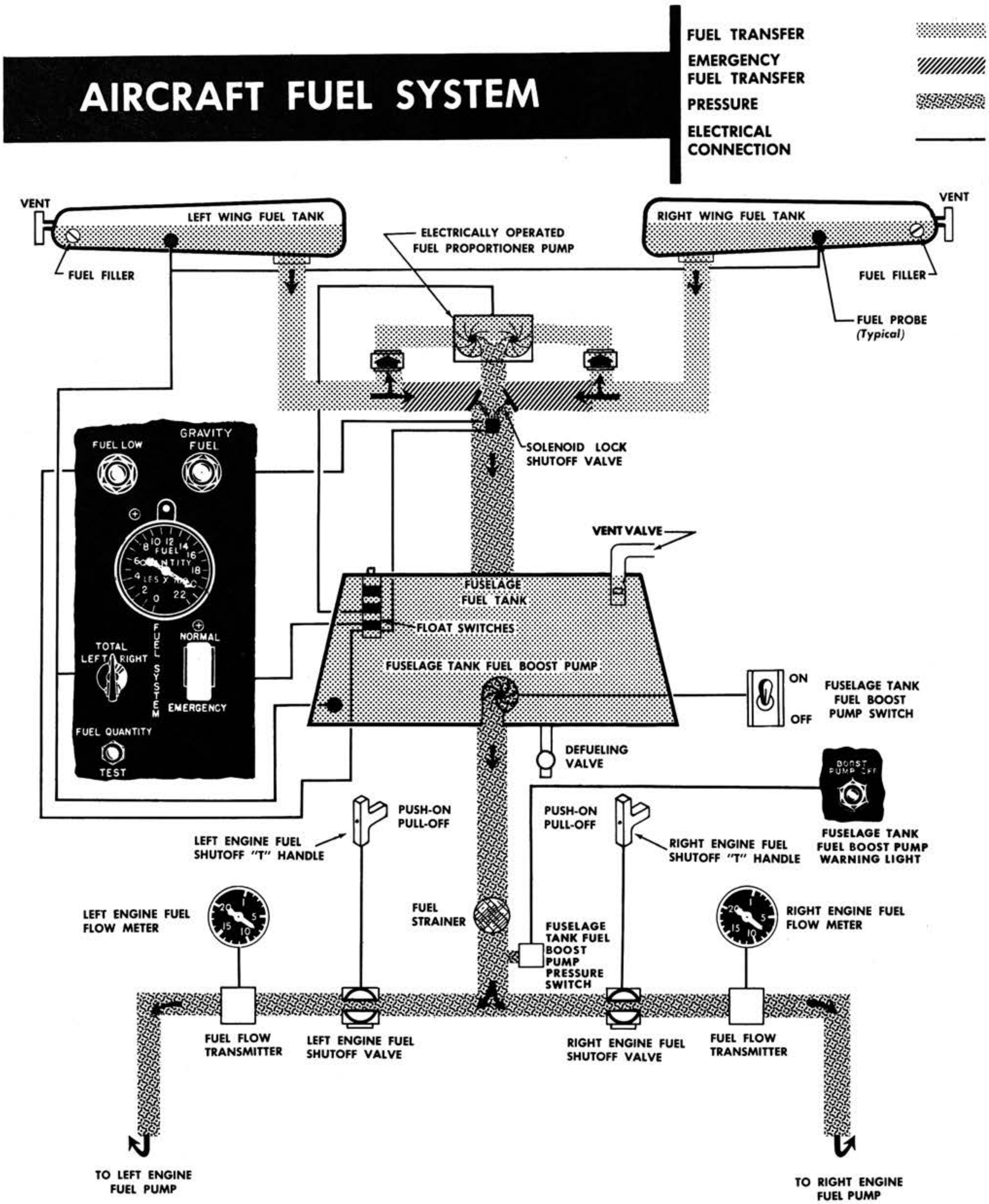
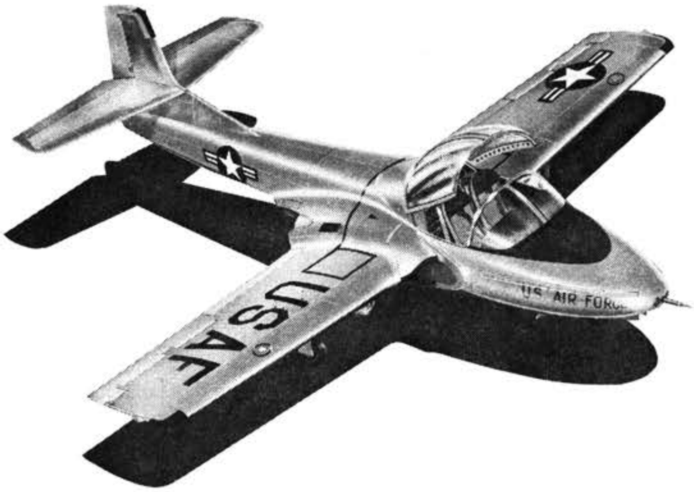

AIRCRAFT FUEL SYSTEM
FUEL TRANSFER
EMERGENCY FUEL TRANSFER
PRESSURE
ELECTRICAL CONNECTION
VENT
LEFT WING FUEL TANK
FUEL FILLER
ELECTRICALLY OPERATED FUEL PROPORTIONER PUMP
RIGHT WING FUEL TANK
VENT
FUEL FILLER
FUEL PROBE (Typical)
SOLENOID LOCK SHUTOFF VALVE
FUEL LOW
GRAVITY FUEL
FUEL QUANTITY
TOTAL
LEFT RIGHT
FUEL SYSTEM
NORMAL
EMERGENCY
FUEL QUANTITY TEST
VENT VALVE
FUSELAGE FUEL TANK
FLOAT SWITCHES
FUSELAGE TANK FUEL BOOST PUMP
ON
OFF
FUSELAGE TANK FUEL BOOST PUMP SWITCH
DEFUELING VALVE
BOOST PUMP OFF
FUSELAGE TANK FUEL BOOST PUMP WARNING LIGHT
PUSH-ON PULL-OFF
LEFT ENGINE FUEL SHUTOFF "T" HANDLE
PUSH-ON PULL-OFF
RIGHT ENGINE FUEL SHUTOFF "T" HANDLE
LEFT ENGINE FUEL FLOW METER
FUEL STRAINER
FUSELAGE TANK FUEL BOOST PUMP PRESSURE SWITCH
RIGHT ENGINE FUEL FLOW METER
FUEL FLOW TRANSMITTER
LEFT ENGINE FUEL SHUTOFF VALVE
RIGHT ENGINE FUEL SHUTOFF VALVE
FUEL FLOW TRANSMITTER
TO LEFT ENGINE FUEL PUMP
TO RIGHT ENGINE FUEL PUMP

Figure 1-10



FUEL QUANTITY Data

POUNDS OR U.S. GALLONS

TOTAL USABLE FUEL	GALLONS 309
	POUNDS 2008.5

Note:

POUNDS SHOWN ARE APPROXIMATE FOR STANDARD DAY CONDITIONS ONLY AND ARE BASED ON 6.5 POUNDS PER GALLON OF JP-4 FUEL.

TANKS	NO.	USABLE FUEL IN LEVEL FLIGHT
FUSELAGE	1	87 GALLONS 565.5 POUNDS
RIGHT WING	1	111 GALLONS 721.5 POUNDS
LEFT WING	1	111 GALLONS 721.5 POUNDS

Figure 1-11

motorized fuel shutoff valve is energized closed. For all normal operating conditions the fuel shutoff "T" handle should be in the PUSH-ON position. Only in an emergency condition should the PULL-OFF position be used. Each "T" handle also contains a 28 volt dc red light which is illuminated whenever an overheat or fire condition exists in a respective engine nacelle.

CAUTION

> The fuel shutoff "T" handles are electrical switches and movement is restricted to a very short travel. It takes up to 10 seconds for an engine to stop running after a fuel shutoff "T" handle has been positioned to the PULL-OFF position.

FUEL QUANTITY INDICATOR

A fuel quantity indicator (21, figure 1-6) indicates the quantity, in pounds, of total usable fuel remaining. The fuel quantity indicator receives its power from the single phase 115 volt ac bus.

FUEL GAGING SELECTOR SWITCH

The fuel gaging selector switch (23, figure 1-6) has three positions; LEFT, TOTAL, and RIGHT. The switch uses power from the 28 volt dc bus to complete a circuit between the fuel quantity indicator and the fuel cell probes. The switch is spring-loaded to the TOTAL position, indicating total fuel aboard. Fuel remaining in the left or right wing tank can be gaged by placing and holding the switch in the LEFT or RIGHT positions, respectively, until the reading on the fuel quantity indicator stabilizes.

Fuel Quantity Indicator Test Switch

The fuel quantity indicator test switch (19, figure 1-6) uses power from the 115 volt ac bus during the operational check of the fuel quantity indicator. Pushing in on the fuel quantity test switch returns the fuel quantity indicator needle to zero, indicating that the fuel gaging system is operating.

FUEL SYSTEM SWITCH

The fuel system switch (22, figure 1-6) provides both normal and emergency operation of the fuel system. The switch has two positions, NORMAL and EMERGENCY, with the switch guarded to the NORMAL position. The switch in the NORMAL position energizes the solenoid lock fuel shutoff valve to the closed position and alerts the fuel proportioner circuit. With the switch in the EMERGENCY position, the fuel proportioner pump circuit and the solenoid lock shutoff valve are de-energized. This allows the solenoid locked shutoff valve to open and the amber gravity feed light to illuminate, indicating that the fuel system is operating in the emergency gravity feed system. The fuel system receives its power from the 28 volt dc bus.

FUEL LOW LEVEL WARNING LIGHT

The fuel low level warning light (18, figure 1-6) will illuminate when fuel in the fuselage tank reaches a level of approximately 360 pounds. This light, operates through the action of a fuel low level float switch located in the fuselage tank and receives its power from the 28 volt dc bus.

FUEL GRAVITY FEED LIGHT

An amber light (20, figure 1-6) provides the pilot with an indication that the fuel system is on gravity feed. The gravity feed light is powered by the 28 volt dc bus through the operation of the solenoid lock fuel shutoff valve and the fuselage fuel tank float switches.

ELECTRICAL POWER SUPPLY SYSTEM

The aircraft is equipped with a direct current and an alternating current electrical power supply system. The dc system is powered by two engine-driven generators and a battery. The ac system is powered by one main inverter. A spare inverter is provided as a safety feature if the main inverter fails.

ELECTRICALLY OPERATED EQUIPMENT

For complete reference of power distribution to electrically operated equipment, refer to figure 1-13.

DC ELECTRICAL POWER DISTRIBUTION

The 28 volt dc power supply system is powered by two engine-driven 200 ampere generators and a 24 volt 34-ampere-hour battery. The battery, located in the left-hand nose section, is used to supply current to the dc bus if both generators fail. The dc generators function as starter-generators, cranking the engines until the engines have accelerated to operational speed and then cutting in as generators after engine speed reaches approximately 38 to 42% rpm. Higher than 42% rpm may be required for the generators to carry the equipment load and/or to compensate for low battery conditions. The generators and generator controls are protected by circuit breakers located in the left-hand nose section.

EXTERNAL POWER RECEPTACLE

The dc power system can be connected to an external power source through the external power receptacle (15, figure 1-1), located on the left-hand nose section.

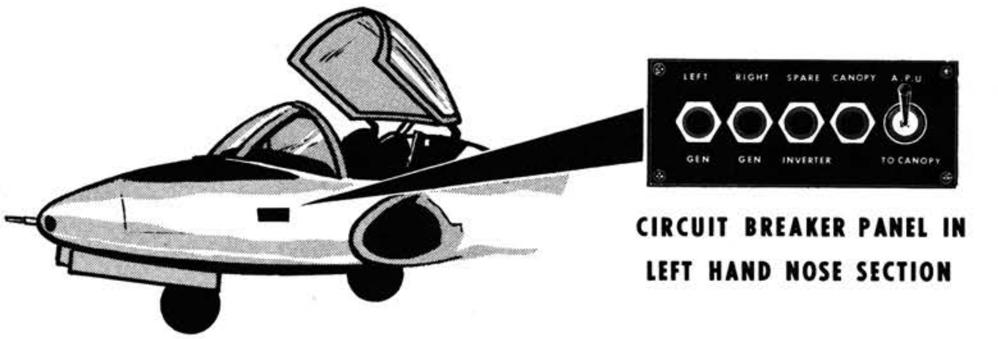
DC CIRCUIT BREAKERS

The dc electrical power supply system is protected by push-pull type circuit breakers (figure 1-12) mounted on two separate panels. Circuit breakers for the generators, canopy and the spare inverter are located on a panel in the left-hand nose section and are not accessible during flight. The remaining circuit breakers are located on the right instrument panel. The circuit breakers function to protect the dc power system by disengaging automatically whenever an overloaded or short circuit exists. Should a circuit breaker pop out, it can be reset by manually pushing in on the circuit breaker. A dc circuit can also be opened manually by pulling out on the respective circuit breaker for that line.

CAUTION

Circuit breakers should not be pulled or

Right Instrument Panel



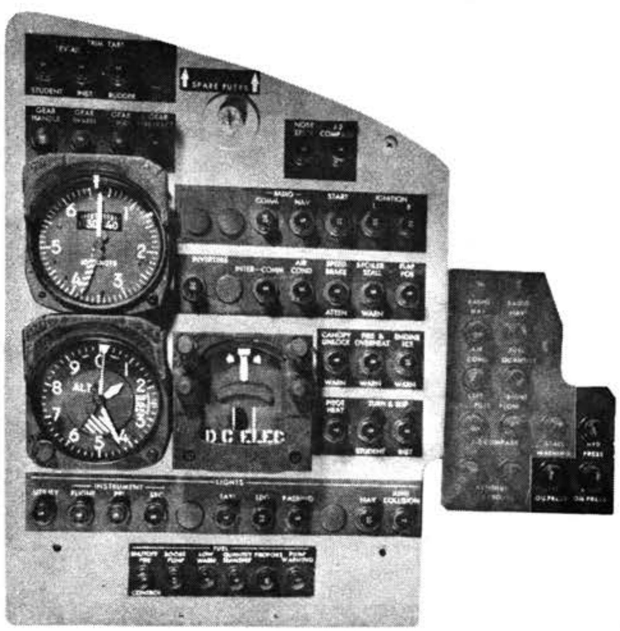
CIRCUIT BREAKER PANEL IN LEFT HAND NOSE SECTION

Aircraft 54-2729 thru 56-3491 except 55-4302

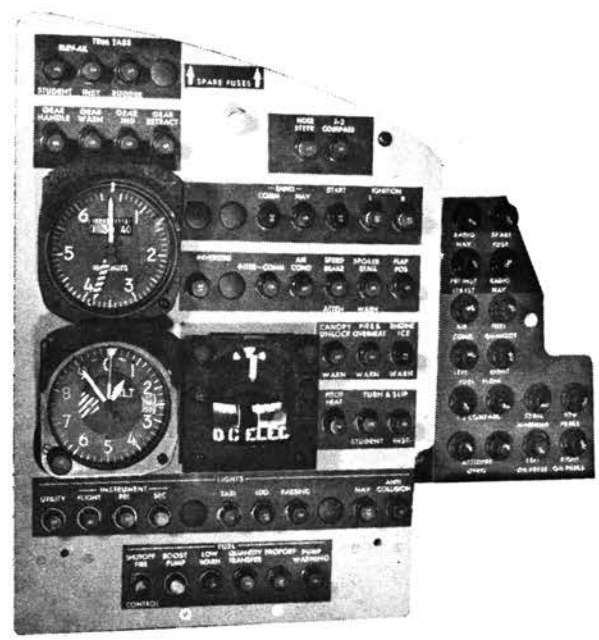
Aircraft 55-4302 and 56-3492 thru 56-3561

Figure 1-12 (Sheet 1 of 2)

and
CIRCUIT BREAKER PANEL
and
AC FUSE PANEL



Aircraft 56-3562 thru 57-2352



Aircraft 58-1861 and on

Figure 1-12 (Sheet 2 of 2)

Electrical Power

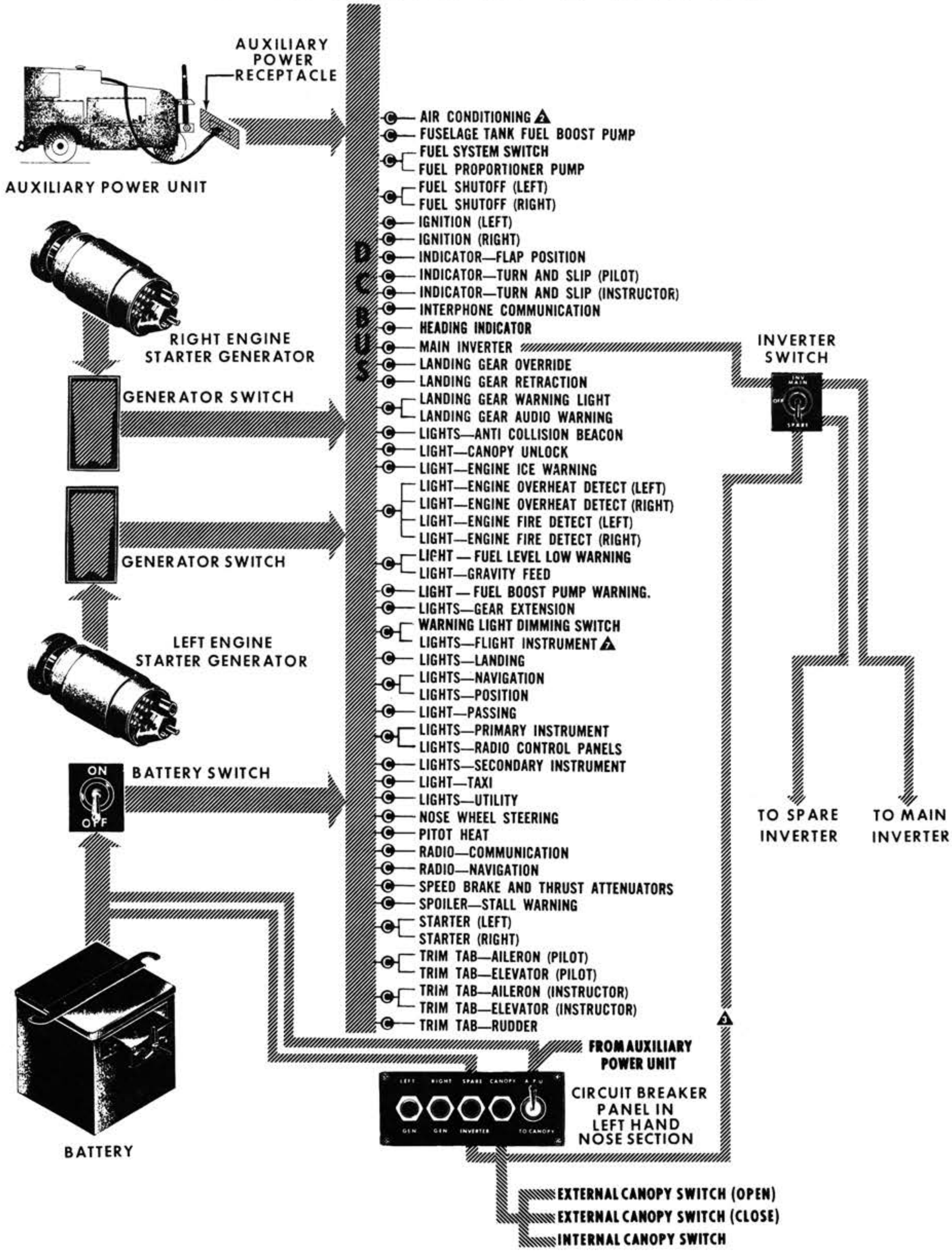
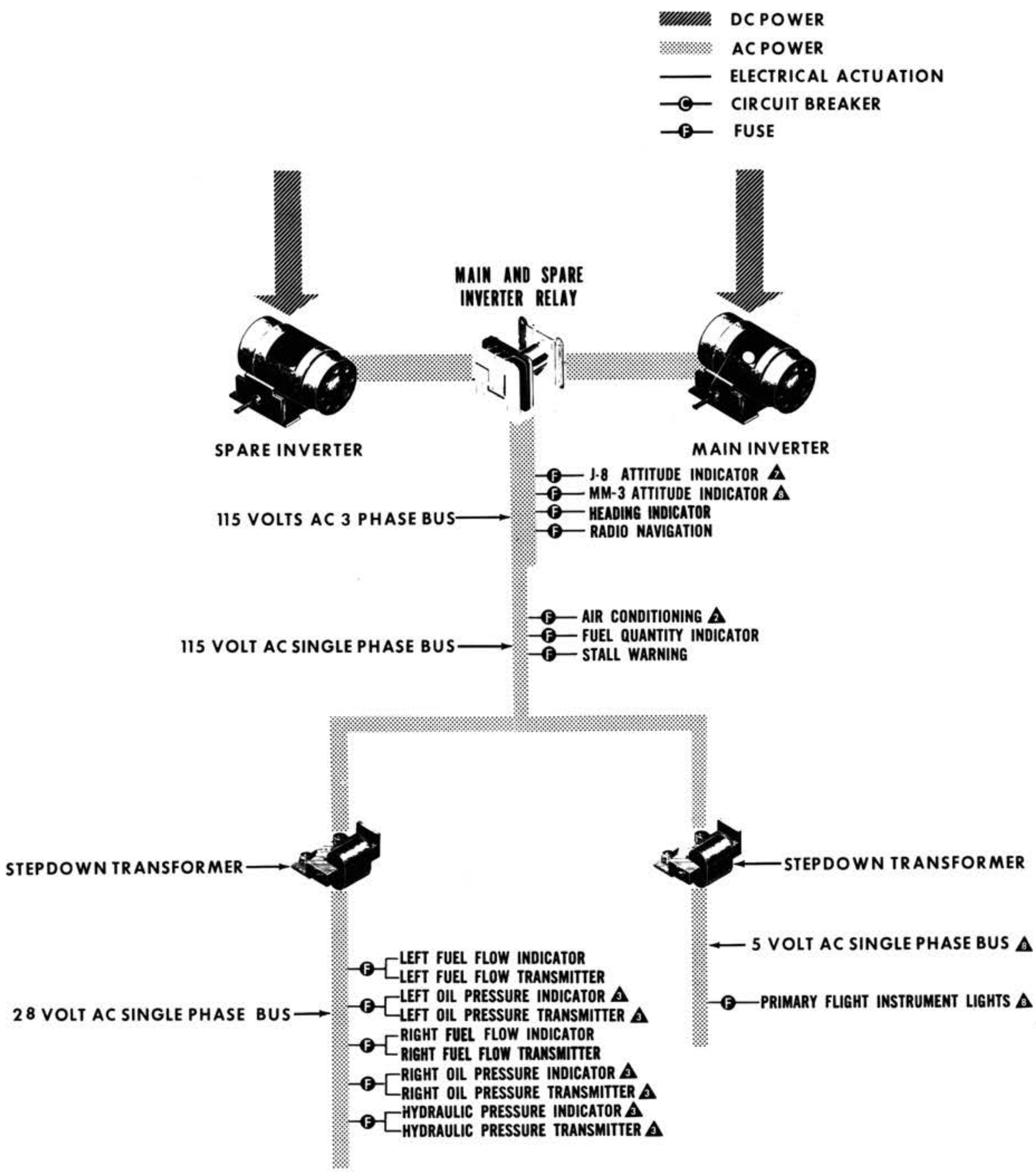


Figure 1-13 (Sheet 1 of 2)

Supply System



▲2 Aircraft 55-4302 and 56-3492 and on
▲3 Aircraft 56-3562 and on

▲7 Aircraft 54-2729 thru 57-2352
▲8 Aircraft 58-1861 and on

Figure 1-13 (Sheet 2 of 2)

reset without a thorough understanding of all the effects and results. Use of the circuit breakers can eliminate from the system some related warning system or interlocking circuit. 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.

BATTERY SWITCH

The battery switch (11, figure 1-9), has two positions, ON and OFF, which control the circuit accordingly. When the switch is in the ON position, the battery is connected directly to the 28 volt dc bus.

GENERATOR SWITCHES

The guarded dc generator switches (10, 12, figure 1-9), have two positions, ON and OFF and function to connect generator output to the 28 volt dc bus.

LOADMETERS

The loadmeters (26, figure 1-6), one for each generator, are calibrated to read from −0.1 to 1.25 and indicate the proportion of generator rated output being used.

AC ELECTRICAL POWER DISTRIBUTION

The ac power supply system is powered by a 250 va three phase 400 cycle main inverter. A spare inverter, identical to the main, is provided as a safety feature and when manually selected will assume the ac load of the aircraft if the main inverter fails. On aircraft [7] alternating current is distributed through three bus networks, and by the use of a transformer, supplies separate voltage systems. On aircraft [8] an additional bus network has been added. Power for the inverters is supplied by the aircraft's dc system.

INVERTER SWITCH

The inverter switch (13, figure 1-9) has three positions; MAIN, which is the position for all normal operation; SPARE, for manually selecting the spare inverter if the main inverter fails; and OFF. Normally, the main inverter supplies power for all ac operated equipment. When the inverter switch is in the SPARE position, power to the inverter will be supplied directly from the battery regardless of the position of the battery switch.

Note

Inverter failure can only be detected by observing the instruments receiving ac power.

AC FUSES

All of the ac circuits are protected by fuses (figure 1-12) which are replaceable during flight. Spare fuses are located above the dc circuit breaker panel on the under side of the glare shield.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (figure 1-14) consists of two engine-driven hydraulic pumps, one on each engine. Either pump is capable of maintaining full system pressure with only a slight increase in actuation time. The system supplies power to actuate the hydraulic components of the aircraft. Normal operation of the hydraulic power supply system is automatic when the engines are running. Any sudden surges in the system are absorbed by an air-charged accumulator which also holds reserve hydraulic fluid under system pressure for emergency use. A pressure regulator maintains a pressure of 1250 to 1550 psi on the system at all times during operation; however, a pressure relief valve, spring-loaded to relieve at a slightly higher pressure, protects the system in case of regulator failure. An air bottle, located in the nose wheel well is used for emergency landing gear extension in case of hydraulic power failure. Refer to figure 1-25 for hydraulic fluid specification.

Note

Occasionally a thumping noise may occur as the hydraulic pressure regulator recycles. This noise is common and should not be confused with engine malfunction.

[7] Aircraft 54-2729 thru 57-2352
[8] Aircraft 58-1861 and on

HYDRAULIC SYSTEM PRESSURE GAGE ▲

The hydraulic pressure gage (12, figure 1-6) is a direct reading instrument and indicates hydraulic pressure in pounds per square inch.

HYDRAULIC SYSTEM PRESSURE INDICATOR ▲

The hydraulic pressure indicator (36, figure 1-6) is a remote indicating instrument and is operated by the 28 volt single phase 400 cycle ac bus. The indicator indicates hydraulic pressure in pounds per square inch.

FLIGHT CONTROL SYSTEM

The flight control system comprises two groups of control surfaces, primary and secondary. The primary control surface group includes ailerons, elevators, and rudder. The secondary control surface group includes trim tabs for left aileron, left elevator, and rudder. The function of the primary control surface group is to provide the pilot with a means of controlling the aircraft. All of the primary control surfaces are manually operated, through a system of cables, pulleys, bellcranks, and push-pull rods. The function of the secondary control surface group is to provide an aerodynamic control for the surface to which they are attached and serves to hold that surface at a position that will result in a balancing or trimming of the aircraft for any normal attitude of flight. All of the trim tabs are electrically operated and are controllable from the cockpit.

CONTROL STICK GRIP

Aileron and elevator control is maintained by dual control sticks on individual yokes, interconnected to permit control of the aircraft using either control stick. Each control stick has a typical fighter-type control stick grip (figure 1-15), with a button-type switch controlling the aileron and elevator trim tabs and a button type switch controlling the nose wheel steering. A switch on the instructor's control stick grip only, is provided to cut out all incoming radio signals to both the pilot's and instructor's headset but permits intercommunication and transmission beyond the aircraft. The remaining control stick grip switches are non-functional.

▲ Aircraft 56-3562 and on
▲ Aircraft 54-2729 thru 56-3561

RUDDER PEDALS

Fore and aft movement on the rudder pedals controls the rudder position through mechanical linkage; toe pressure on the pedals operate the brakes. Each set of pedals is equipped with rudder pedal adjustments (18, figure 1-4).

AILERON AND ELEVATOR TRIM TAB SWITCH

Normal trim of the aileron and elevator trim tabs is provided through a five position, momentary toggle type, aileron and elevator trim tab switch (1, figure 1-15). The switch receives its power from the 28 volt dc bus, and is spring-loaded to the center off position. Moving the trim tab switch to the left or to the right actuates the aileron trim motor. The motor is geared down and actuates a push-pull rod which in turn positions the aileron trim tab up or down depending on which direction the switch was positioned. Pushing the switch forward or aft actuates the elevator trim tab motor. The elevator trim tab motor positions the elevator trim tab to the desired up or down position through a screwjack arrangement. When the elevator trim tab is in the neutral position, and the battery switch is ON, a green elevator tab position light (5, figure 1-6), will be illuminated.

WARNING

To avoid any possibility of overtrim in the event of limit switch malfunction, the aileron and elevator trim tab switch should be manually returned to the OFF position.

RUDDER TRIM TAB SWITCH

The rudder trim tab is electrically controlled through a switch (7, figure 1-5), mounted horizontally on the aft side of the pilot's quadrant. The switch is held to LEFT or RIGHT for corresponding rudder trim and spring-loaded to the OFF position. The rudder trim tab switch receives its power from the 28 volt dc bus.

CONTROL LOCK

Primary flight control surfaces can be locked in the neutral position by a control lock (figure 1-16), below the instrument panel on the pilot's side. When the control lock is rotated up and is attached to the control stick, all surface con-

Hydraulic Power

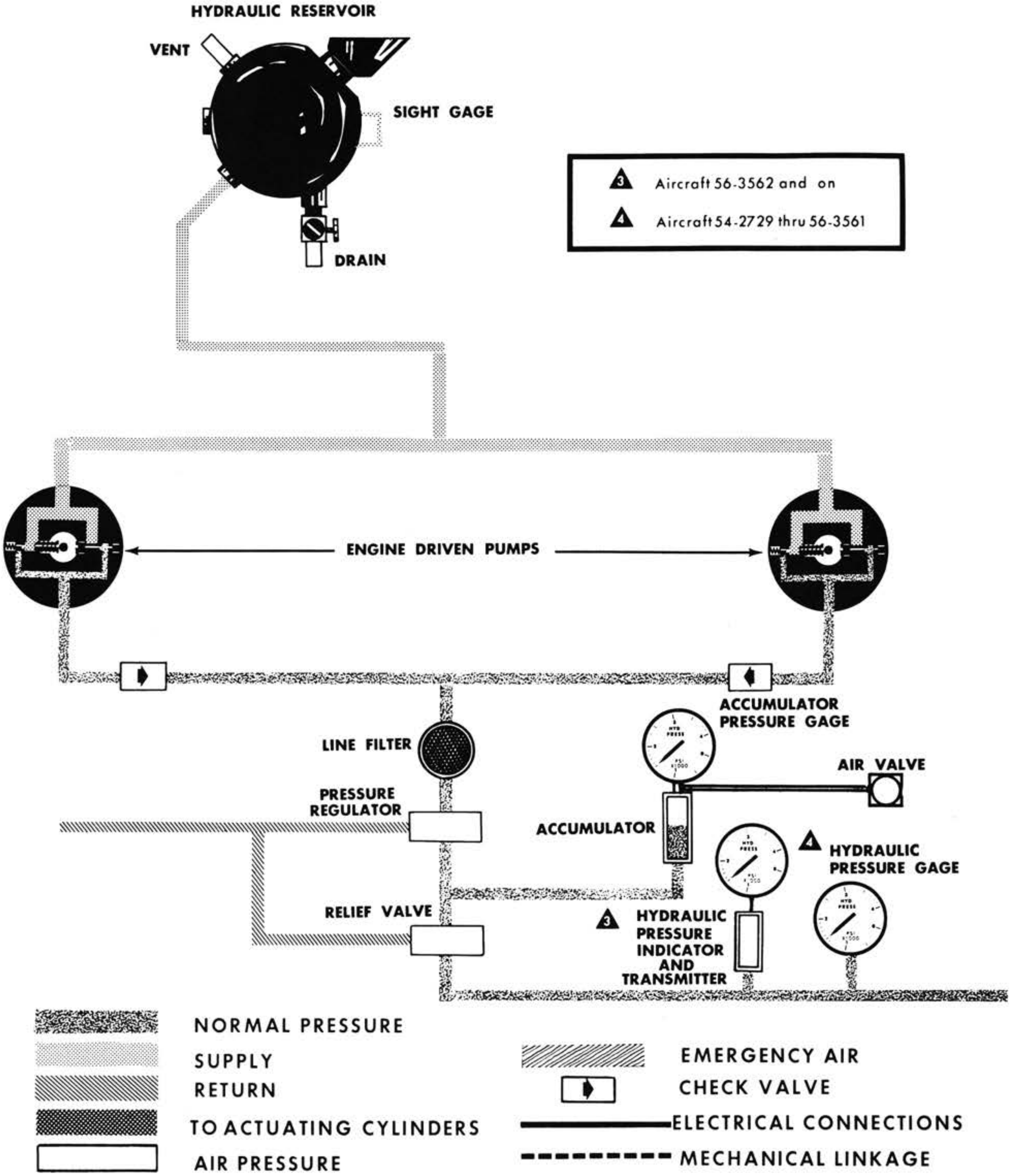


Figure 1-14 (Sheet 1 of 2)

Supply System

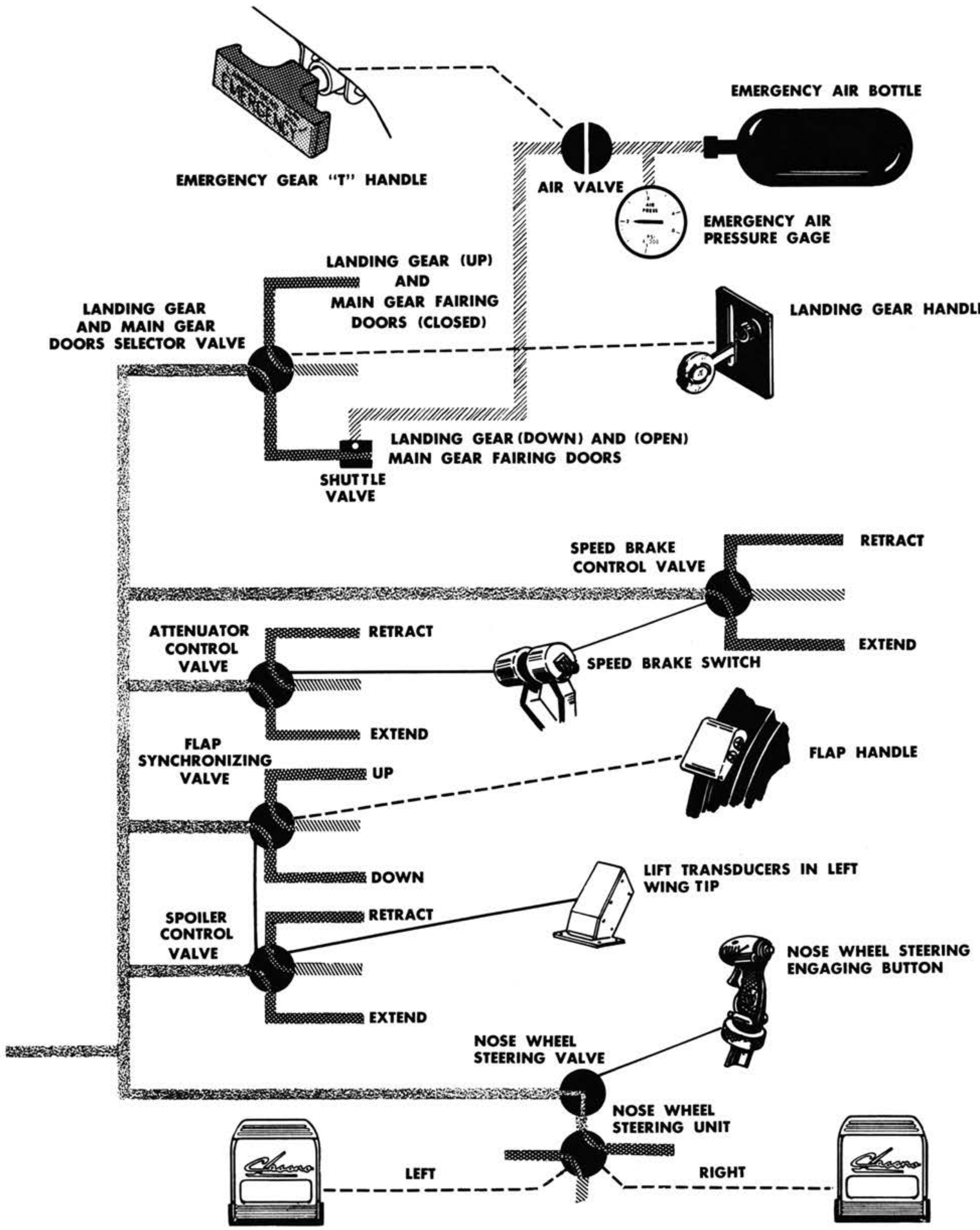


Figure 1-14 (Sheet 2 of 2)

trols are locked in neutral including the throttles which are locked in the IDLE thru CUT-OFF range.

WING FLAP SYSTEM

The hydraulically operated wing flaps are partial span, slotted, trailing edge type and extend from the aileron to the engine nacelle on each wing. The wing flaps are actuated by wing flap levers to all positions within a range of zero to 40 degrees. A flap blow up relief valve provides a slight wing flap retraction when the airspeed for flap down configuration is exceeded. A synchronizing unit insures the extension of both flaps at the same rate with a maximum divergence of three degrees.

WING FLAP LEVERS

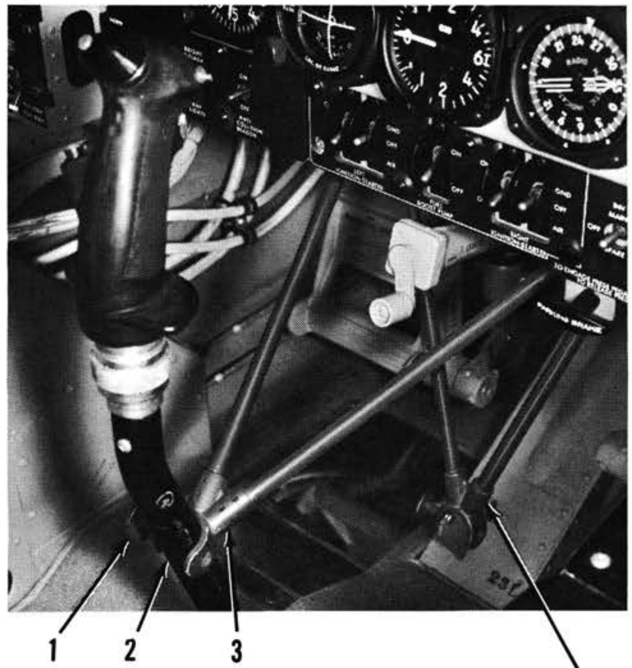
The wing flap levers (8, 17, figure 1-5) are labeled Flaps and have three marked positions; UP, HALF, and DOWN with a detent at the HALF position. The wing flap levers are mechanically connected to a flap selector valve. The flap selector valve governs the total travel distance of the flap actuating cylinders, permitting a flap down position of any desired setting.

CONTROL STICK GRIP

1. ELEVATOR AND AILERON TRIM TAB SWITCH
2. RADIO INTERRUPT CALL SWITCH (instructors only)
3. HAND REST
4. NOSE WHEEL STEERING SWITCH

Figure 1-15

CONTROL LOCK



CONTROL LOCK IN STOWED POSITION

1. PULL PIN
2. CONTROL STICK
3. CONTROL LOCK

Figure 1-16

WING FLAP POSITION INDICATOR

Position of the wing flaps is indicated by a 28 volt dc operated wing flap position indicator (1, figure 1-6). The indicator is marked in 10% increments from zero to 100% with 40 degrees of flap extension being 100% deflection.

SPOILER SYSTEM

The purpose of the spoilers (figure 1-17) is to provide sufficient stall warning for configuration with flaps extended. When the flaps are extended 25% or more, and the aircraft speed is reduced to 72 knots IAS or lower in level flight or proportionately higher speeds in accelerated and turning flight, a transducer vane located on the bottom of the left wing tip electrically actuates the hydraulically operated spoilers to the extended position. (When in the extended position, the spoilers create a turbulent airflow which is felt as aircraft buffet and occurs between four and 10 knots above the stall speed.) Either increasing the speed above 72 knots IAS or higher in accelerated and turning flight or

SPOILERS

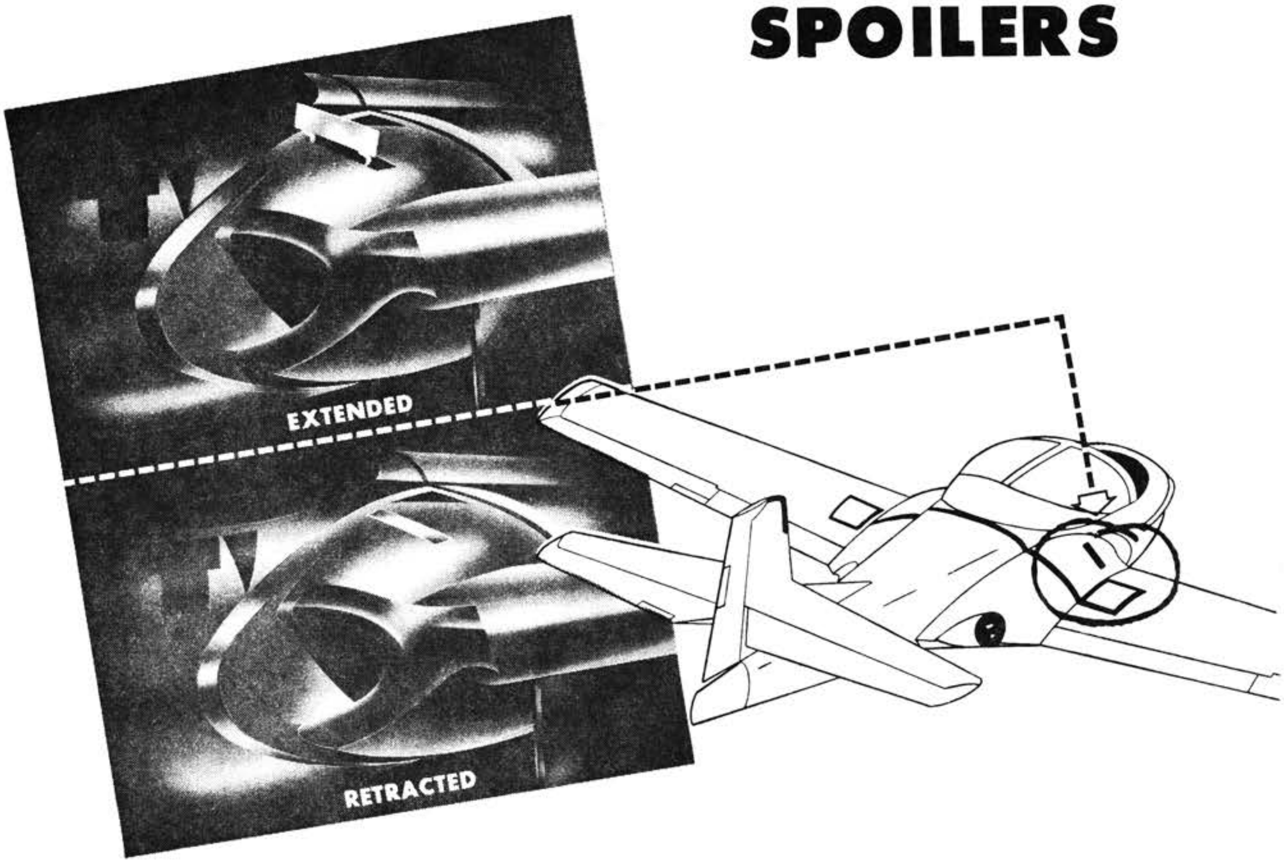


Figure 1-17

retracting the wing flaps to less than 25% will cause the spoilers to return to the retracted position.

SPEED BRAKE AND THRUST ATTENUATOR SYSTEM

The speed brake and thrust attenuators operate hydraulically through one system, using separate control valves. Both control valves are energized open by power from the 28 volt dc bus and are spring-loaded to the closed position.

SPEED BRAKE

The speed brake is located on the bottom side of the nose section just aft of the nose wheel well. The speed brake is hinged at the forward edge and when opened, extends down into the airstream. When retracted, the speed brake closes flush with the fuselage. There are no intermediate opened or closed positions, and there is no position indicator.

Speed Brake Switch

Each right engine throttle contains a speed brake switch (3, 11, figure 1-5), which electrically actuates the speed brake selector valve and the thrust attenuator selector valve. Each speed brake switch is marked IN and OUT with a SOLO override position included in the instructor's switch. The speed brake cannot be extended or retracted by the pilot until the instructor's speed brake switch is positioned to the SOLO position.

THRUST ATTENUATORS

The function of the thrust attenuator (figure 1-18) is to reduce effective thrust and still maintain a higher engine rpm. As an example,

Thrust ATTENUATORS

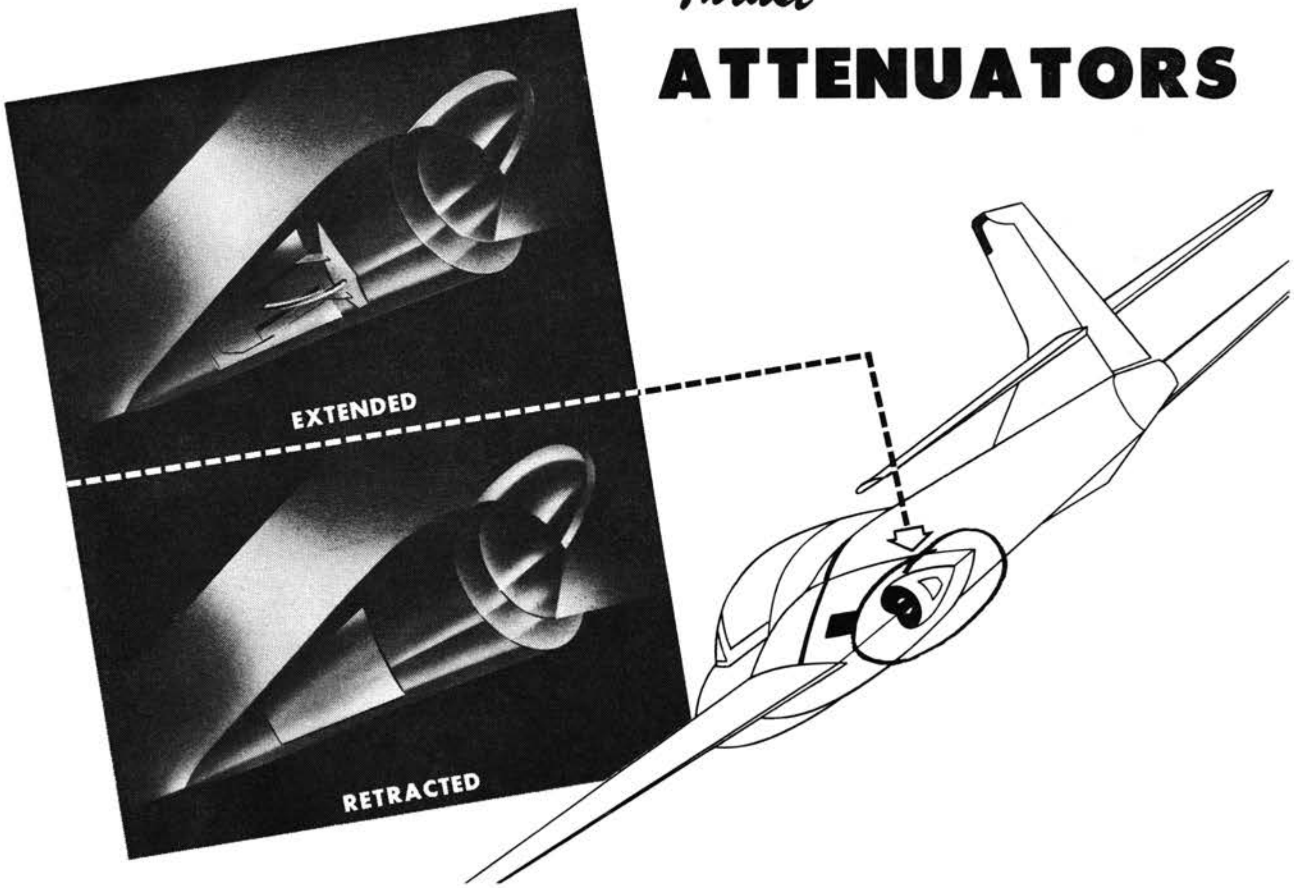


Figure 1-18

the effective thrust reduction is equivalent to reducing engine speed from 60% rpm to approximately 50% with thrust attenuator extended into the jet stream. The thrust attenuators operate simultaneously with the speed brake when either throttle on either quadrant is between IDLE and approximately 70% rpm. The attenuators retract when one throttle is placed in the CUT-OFF position and the other is above approximately 70% rpm.

CAUTION

> If either throttle is in any position between IDLE and approximately 70% rpm and the other is above 70% or is in cut-off, the thrust attenuators will be extended if the speed brake switch is in the OUT position.

LANDING GEAR SYSTEM

The conventional tricycle landing gear retracts and extends by power from the aircraft hydraulic power supply system. The landing gear positions are controlled mechanically by using either the pilot's or instructor's landing gear lever (2, figure 1-4). The main gear retracts inboard into the lower surface of the wing, and the nose gear retracts forward into the nose section of the fuselage. Each main gear has two doors; inboard and outboard. The nose gear is faired by split-type doors. The inboard main gear doors are actuated hydraulically and are operated by a sequencing valve in the landing gear system which synchronizes their opening and closing with the extension and retraction of the main gears. The inboard main gear doors engage the up lock hooks, which are hinged to the wing structure and assist in supporting the main gears in the up position. The outboard main gear doors are hinged to the wing and fastened on the bottom to the main gear strut. The nose wheel doors are actuated open and closed by mechanical linkages which are connected to the nose gear. Landing gear and door retraction time is approximately 10

Figure 1-19

seconds, while extension requires about eight seconds.

Note

Some aircraft make a thumping noise when the landing gear is extended, which is normal.

LANDING GEAR LEVERS

The landing gear levers (2, figure 1-4) consist of two interconnected levers with clear plastic wheel-shaped knobs. Each landing gear lever has two marked positions, UP and DOWN. Positioning either landing gear lever to the UP or DOWN position causes the landing gear to retract or extend when the weight of the aircraft is off the gear. The instructor's landing gear lever incorporates a solenoid controlled locking device which holds the lever in the DOWN position as long as the landing gear safety limit switches are de-energized. The pilot's landing gear lever is indirectly held in the DOWN position by the same solenoid controlled locking device.

LANDING GEAR EMERGENCY OVERRIDE SWITCHES

A landing gear emergency override switch (3, figure 1-4) is provided. The purpose of this switch is to supply electrical power to the solenoid lock which holds the landing gear levers in the DOWN position. Pressing either override switch and simultaneously lifting the landing gear lever will allow the landing gear to collapse while the weight of the aircraft is on the landing gear. Refer to figure 3-1, Landing Gear Override Switch. The landing gear emergency override switch receives its power from the 28 volt dc bus.

LANDING GEAR POSITION INDICATOR LIGHTS

The landing gear position indicator lights (2, figure 1-6) will illuminate when its respective gear is down and locked. Power is supplied by the 28 volt dc bus.

LANDING GEAR WARNING LIGHT AND AUDIBLE SYSTEM

A red warning light, located within each wheel-shaped knob on the landing gear lever (2, figure 1-4) will illuminate at any time the landing gear is not in the position selected by the landing gear lever. When a throttle is retarded to approximately 70% rpm and the gear is not down and locked, the light will be illuminated and the warning signal will send an audio tone to both the pilot's and instructor's headset. The warning lights can be checked by pressing the test switch (4, figure 1-4). The landing gear audible silencing switches (9, figure 1-9), will silence the warning signal but will automatically be reset each time the retarded throttle(s) is advanced past approximately 70%. Power to operate the landing gear warning light switch and gear audible warning signal system silencing switches is received from the 28 volt dc bus.

NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is provided for directional control during taxiing and for portions of the takeoff and landing roll as desired. The system is electrically engaged, and controlled by the rudder pedals, and powered by the hydraulic power supply system. Steering is engaged by a switch on each control stick grip. The hydraulically powered nose wheel steering unit will position the nose wheel within approximately 40 degrees of each side of center when the aircraft is on the ground. The nose wheel can swivel to 50 degrees either side of center when wheel brakes are used. The steer-damper, controlled by rudder pedal movement, directs the hydraulic fluid to an actuator which turns the nose gear strut. The steer-damper device serves two purposes; during power controlled operations it steers the nose wheel, and it serves as a shimmy damper with power on or off. Nose wheel steering may be selected at any time while the weight of the aircraft is on the nose wheel, and hydraulic and electrical power is available. The nose gear centering spring centers the nose gear strut during retraction and extension operations. Regardless of the position of the nose gear when the aircraft is on the ground, when the nose gear steering switch is actuated, the nose gear will turn to correspond to the position of the rudder pedals. In the event of a complete hydraulic or electrical failure, steering is then controlled by rudder movement and aircraft brakes. All electrical components used to operate the nose wheel steering mechanisms are powered by current from the 28 volt dc bus.

NOSE WHEEL STEERING SWITCH

When the nose wheel steering switch (4, figure 1-15) is held in the depressed position, power from the 28 volt dc bus actuates a solenoid shutoff valve, which permits hydraulic pressure to be supplied to the nose wheel steering system. A limit switch on the nose gear prevents turning the nose wheel when weight is not on the nose gear.

BRAKE SYSTEM

The brake system is a manually operated, independent, hydraulic system set apart from the hydraulic power supply system. The brakes are multi-disc type and are actuated by toe pressure applied to either set of rudder pedals. No emergency braking provisions are provided on the aircraft.

PARKING BRAKE

Setting the brakes is accomplished by applying toe pressure to the rudder pedals and pulling out on the parking brake handle (20, figure 1-4). To release the parking brakes, apply toe pressure to either set of rudder pedals.

Note

Use wheel chocks instead of parking brakes whenever possible.

INSTRUMENTS

Note

This paragraph covers the information on flight instruments which pertain only to this aircraft. For detailed information on the flight instruments, consult AFM 51-37.

The flight and engine instruments are mounted on the left instrument panel (figure 1-6). An altimeter, turn and slip indicator, and airspeed indicator are also mounted on the right instrument and circuit breaker panel (figure 1-12).

ACCELEROMETER

The accelerometer (8, figure 1-4), indicates the positive and negative acceleration forces being exerted on the aircraft. One indicating needle records the positive "G" forces, one the negative "G" forces, and the other continuously indicates existing "G" loads. A push-to-reset knob on the lower left portion of the instrument resets the needles to the one "G" position.

J-8 ATTITUDE INDICATOR ⚠7

The J-8 attitude indicator (9, figure 1-6) receives its power from the 115 volt three phase ac bus. See AFM 51-37 for description and operating instructions.

MM-3 ATTITUDE INDICATOR ⚠8

The MM-3 attitude indicator (35, figure 1-6) receives its power from the 115 volt three phase ac bus. See AFM 51-37 for description and operating instructions.

WARNING

- A slight reduction in ac power, or failure of certain electrical components within the system will not cause the "OFF" flag to appear even though the system is not operating properly.
- It is possible that a malfunction of the attitude indicator might be determined only by checking it with the heading indicator and the turn and slip indicator.

MM-3 Attitude Indicator Fast Erection Switch

The MM-3 attitude indicator fast erection switch (34, figure 1-6) provides fast erection for the MM-3 system. The switch has two positions, NORMAL and FAST, and is spring-loaded to the NORMAL position. When the switch is held to the FAST position, gyro erection is at a rate of 20 degrees per minute.

CAUTION

To avoid damage to the internal components of the MM-3 attitude indicator system, the fast erection switch should not be held in the FAST position longer than two minutes, and an allowance of five minutes between actuation of the fast erection switch should be observed.

⚠7 Aircraft 54-2729 thru 57-2352
⚠8 Aircraft 58-1861 and on

J-2 HEADING INDICATOR

(Refer to AFM 51-37.) The heading indicator (7, figure 1-6) consists of a directional gyro that is automatically kept on the magnetic heading of the aircraft by a flux valve located in the wing tip. Electrical power for the heading indicator system is supplied by the 28 volt dc bus and the 115 volt ac three-phase bus.

Note

Should either the dc or ac power supply fail, the heading indicator system is automatically disconnected from all electrical power.

The gyro is energized when the heading indicator circuit breaker is in, the inverter switch is in the MAIN or SPARE position, and the aircraft battery switch is ON, or when external power is applied and the inverter switch is in the MAIN or SPARE position. For the first two or three minutes of operation, the gyro is on a fast slaving cycle, during which it reaches operating speed and aligns with the magnetic heading of the aircraft. Then the gyro begins a slow slaving cycle.

Note

After the gyro reaches operating speed, observe the indicator and compare the indication with the actual heading of the aircraft by the indication of the magnetic compass. If the difference is over 5° the heading indicator is not operating properly and should be checked for malfunction.

A knob on the lower left side of the heading indicator permits the settable dial indicator to be rotated to a preselected heading.

Heading Indicator Cut-Out and Fast Slave Switch

The switch (6, figure 1-6) has three positions, OUT, IN, and FAST. When the switch is in the IN position, electrical power is supplied to the transmitter and the system operates as a slaved gyro heading indicator. Except for special circumstances, the switch should always be in the IN position. With the switch in the FAST position, it provides a means of stabilizing the gyro after it has been upset by overbanking or acrobatics. Holding switch in the FAST position interrupts 28 volt dc power to the indicator. When the switch is released, it will return to the IN position, and power will be restored and the fast slaving cycle is initiated to permit faster gyro recovery to the corrected heading. With the switch in the CUT-OUT position, the magnetic function of the heading indicator is discontinued by shutting off the power supply to the slaving torque motor. The CUT-OUT position of the switch is designed to navigate in polar areas where the excessive dip of the earth's magnetic field causes indications to become inaccurate. The heading indicator may still be used for a relatively accurate indication of heading change during turns.

CAUTION

- Since there is no means of resetting the reading to correct for gyro precession, the heading indicator should not be used for heading information when the cut-out and fast slave switch is in the OUT position.
- To avoid damage to the slaving torque motor, the switch should not be positioned to the FAST position too frequently. Allow 10 minutes between actuations, and hold switch no longer than two seconds.

MAGNETIC COMPASS

The magnetic compass (6, figure 1-4) can be used in the event of malfunctions of the heading indicator system. It requires no outside power source except for lighting of the instrument. A compass correction card (7, figure 1-4) indicates deviation in the system.

CLOCK.

The clock (28, figure 1-6) contains an elapsed-time mechanism which uses a sweep-second hand and a minute totalizer. The elapsed-time mechanism is started, stopped, and reset by pushing in on the control knob located at the upper right hand corner of the clock face.

TURN AND SLIP INDICATOR

The turn and slip indicators (32, figure 1-6) and (figure 1-12) receive their power from the 28 volt dc bus. They operate whenever dc power is supplied to the aircraft.

PITOT STATIC INSTRUMENTS

Five flight instruments operate from the pitot static system. They include two airspeed indicators (3, figure 1-6) and (figure 1-12); two altimeters (31, figure 1-6) and (figure 1-12) and a vertical velocity indicator (29, figure 1-6).

EMERGENCY EQUIPMENT

ENGINE FIRE AND OVERHEAT DETECT SYSTEM

An engine fire and overheat detect system (figure 1-20) is provided to show a visible warning of a fire in either engine nacelle forward of the fire seal and an overheat or fire condition in either engine nacelle aft of the fire seal. The fire detect system forward of the fire seal and overheat detect system aft of the fire seal are separate circuits. A heat sensitive detector cable is installed in each nacelle compartment and is electrically connected to the warning lights in the cockpit.

Engine Fire and Overheat or Fire Detect Warning Lights

The warning lights are mounted in the fuel shutoff "T" handles. A steady illumination of the red warning light indicates a fire forward of the fire seal and a flashing red light indicates an overheat or fire condition aft of the fire seal in the corresponding engine nacelle compartments. Operation of the fire and overheat detect system and lights can be checked by the system test switches. The lights receive their power from the 28 volt dc bus.

Engine Fire and Overheat Detect Switches

The fire detect test switch (13, figure 1-6), when pressed, energizes the entire fire detect circuit and a steady red light in both fuel shutoff "T" handles should come on. The overheat detect switch (17, figure 1-6), when pressed, energizes the entire overheat circuit and a flashing red light in both fuel shutoff "T" handles should come on. The switches receive their power from the 28 volt dc bus.

Note

Pressing to test the light in the fuel shutoff "T" handle only checks the bulb and does not check the fire or overheat circuit.

CANOPY

The canopy is opened or closed electrically by internal or external canopy switches. In the closed position, manually operated canopy downlocks, on each side of the canopy, are engaged to lock the canopy to the closed position. During all normal canopy operations, the downlock handles must be manually pulled aft before the canopy can be raised or lowered electrically; however, a thruster provision in the jettison mechanism unlocks the downlocks automatically during canopy jettisoning. Emergency jettisoning of the canopy is accomplished by pulling up on the ejection seat arming handles, or by pulling the canopy jettison "T" handle. In the event no electrical power is available to operate the canopy actuator, a mechanical declutch provision allows the canopy to be manually opened or closed from inside or outside of the aircraft. During taxiing operation, the canopy should be full open or down and locked.

CANOPY CONTROL SWITCH ⚠

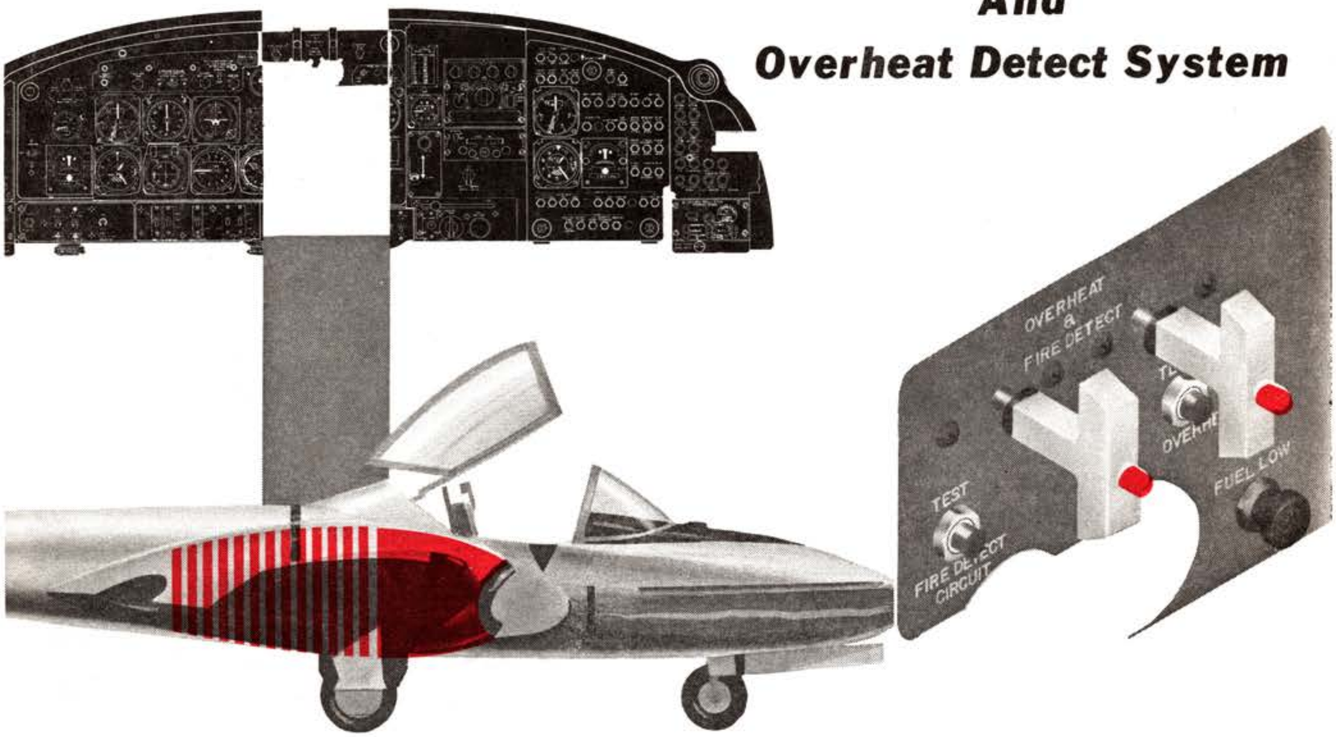
The canopy control switch (figure 1-21) has two positions, EXTERNAL and INTERNAL. The EXTERNAL position disconnects the internal canopy switch from the circuit and allows normal operation of the external canopy switches. The INTERNAL position deactivates the external canopy switches and the canopy will move to the full open position if the canopy is unlocked and battery power is available. This switch must be in the INTERNAL position for all normal operations.

INTERNAL CANOPY SWITCH ⚠

The internal canopy switch (16, figure 1-5) has two positions, OPEN and CLOSED and is spring-loaded to the center off position. Releasing the canopy downlocks and placing the internal canopy switch to the OPEN position opens the canopy. Travel limit switches within the canopy actuator automatically disengages the actuator motor when travel to the full open or closed position has been reached. To close the canopy, move the switch to the CLOSED position. The switch receives its power from the 24 volt dc battery.

⚠ Aircraft 54-2729 thru 64-13441 except when modified per T.O. 1T-37-540
⚠ Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

Engine Fire And Overheat Detect System



OVERHEAT AFT OF FIRE SEAL (FLASHING LIGHTS)

FIRE FOWARD OF FIRE SEAL (STEADY LIGHT)

Figure 1-20

INTERNAL CANOPY SWITCH ▲15

The internal canopy switch (16, figure 1-5) has two positions, OPEN and CLOSED, and is spring-loaded to the OPEN position. With the canopy closed and locked, moving either canopy downlock handle back to the unlocked position will automatically open the canopy. To close and lock the canopy, this switch must be held in the CLOSED position until the canopy downlock handle is forward and locks the canopy. Travel limit switches within the canopy actuator automatically disengages the actuator motor when travel to the full open or closed position is reached. This switch is deactivated by a microswitch on the canopy downlock handles whenever they are moved forward to the locked position, and by a microswitch on the right main landing gear whenever the landing gear is off the ground. The switch receives its power directly from the 24 volt dc battery.

CANOPY DOWNLOCK HANDLES

The canopy downlock handles (16, figure 1-7; 1, figure 1-8) are interconnected to permit manually locking and unlocking of the canopy from either the pilot's or instructor's seat. Moving either handle forward locks the canopy. Before the canopy can be opened or closed normally, the canopy downlock handles must be moved back to the unlocked position.

▲15 Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

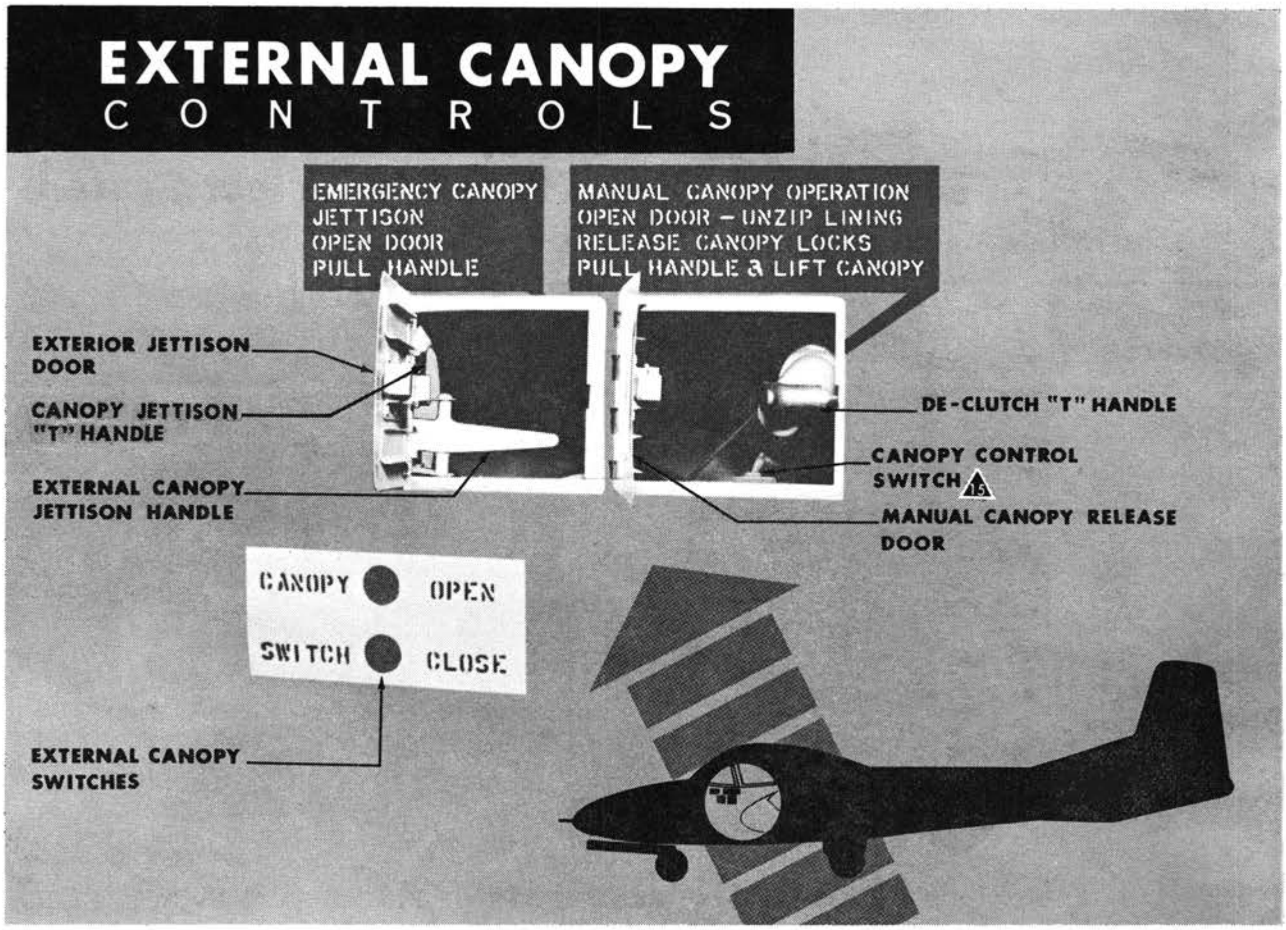


Figure 1-21

CANOPY-NOT-LOCKED WARNING LIGHT

The red, canopy-not-locked warning light (8, figure 1-6) illuminates when the battery switch is ON and the canopy downlock handles are not fully forward. The warning light receives its power from the 28 volt dc bus.

CAUTION

The light will go out whether the canopy is down and locked or not, as long as the handles are in the forward LOCKED position.

EXTERNAL CANOPY SWITCHES

The external, spring-loaded canopy switches (figure 1-21), are used to open and close the canopy. The switches use 24 volt dc power from the battery to operate the canopy actuator motor. Each button must be held IN until canopy travel has reached the desired position.

On aircraft 15 the external canopy switches will operate only when the canopy control switch is in the EXTERNAL position.

CANOPY JETTISON "T" HANDLE

The canopy jettison "T" handle (figure 1-21 and 5, figure 1-7) permits the pilot to jettison the canopy from the cockpit when seat ejection is not contemplated or for a ground crew to jettison the canopy for emergency entrance to the cockpit.

AUXILIARY POWER UNIT (APU) CANOPY SWITCH

The auxiliary power unit (APU) canopy switch in the left nose compartment of the aircraft allows the canopy to be opened or closed using an auxiliary power unit. The switch is a toggle

15 Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

type, spring-loaded from the CANOPY to the APU position. When positioned to CANOPY, the switch directs 28 volt dc power from the auxiliary power unit to the external canopy switches. To raise the canopy using the auxiliary power unit, position the switch to CANOPY, and simultaneously press the external canopy switch marked OPEN. To close the canopy, repeat procedure using external canopy switch marked CLOSE.

CANOPY DE-CLUTCH "T" HANDLE

The canopy de-clutch "T" handle (figure 1-21 and 1, figure 1-7) is provided for maintenance operation when 28 volt dc power is not available to operate the canopy actuator motor. Opening or closing the canopy can be accomplished manually using the canopy de-clutch "T" handle in the following manner:

1. Open the manual canopy release door.
2. Release downlocks if locked.
3. Pull and hold de-clutch "T" handle located just inside the canopy manual release door and lift canopy open.
4. Release de-clutch "T" handle to hold canopy open.
5. To close the canopy, manually hold canopy and pull the de-clutch "T" handle gently lowering canopy until closed.

CAUTION

Due to the weight of the canopy, two crew members, one on each side, are required to open and close the canopy using the canopy de-clutch "T" handle.

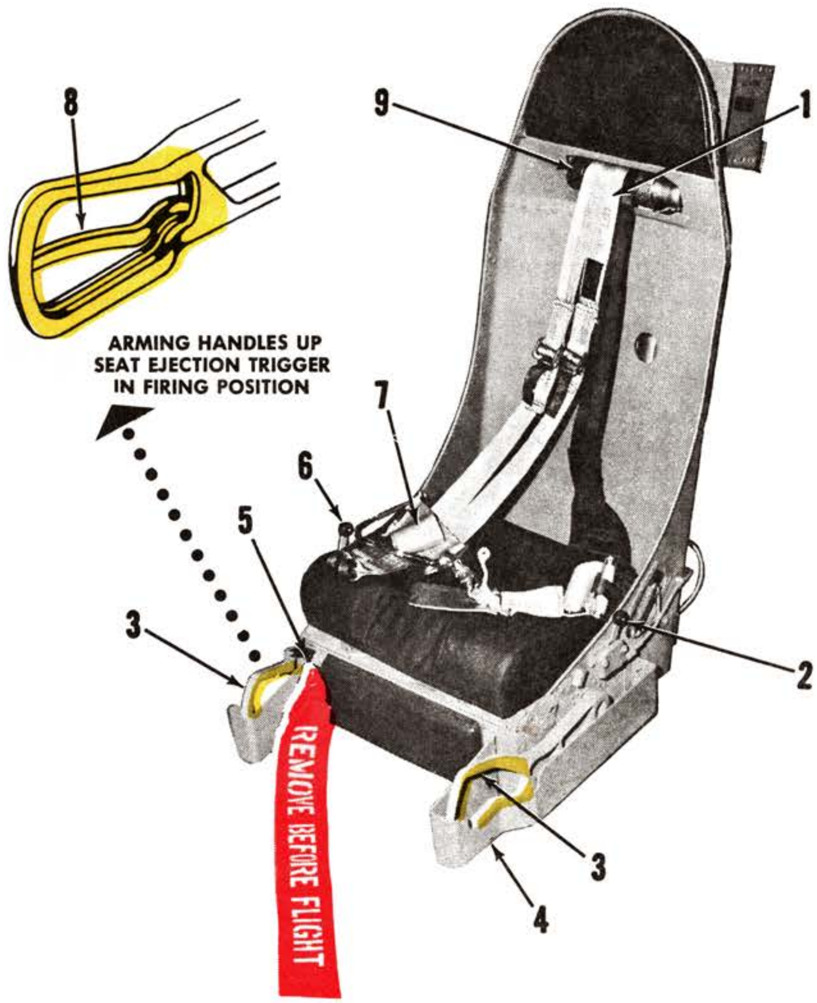
EJECTION SEATS

Ejection seats (figure 1-22), are installed in the aircraft. The ejection seats will catapult the occupants clear of the aircraft at any speed, altitude, or attitude. A catapult fired by a ballistic charge supplies the necessary force to eject the seat and occupant upward from the aircraft. Each seat accommodates a back type parachute, and is provided with an inertial reel-type shoulder harness, an automatic opening safety belt and a seat-man separator. Each seat is manually adjusted up or down by actuating a seat adjustment lever (6, figure 1-22) to release the seat adjustment catches. Each seat has an emergency disconnect unit on the lower left side of each seat, containing a headset, receiver, and microphone leads and the oxygen hose which automatically disconnects at the time of seat ejection.

WARNING

- Safety pins are inserted above the right arming handle of each seat and the canopy initiator on the left side of the cockpit, when the aircraft is on the ground and during maintenance operations, and must be removed before takeoff. If the pins are left in place, canopy jettisoning and seat ejection are prevented on that seat.
- The arming handle safety pins do not safety the canopy jettison system if the canopy jettison "T" handle is pulled.
- It is necessary to check that the seat catches have engaged after a seat has been adjusted up or down. If the catches are not engaged, the seat may not eject from the aircraft during ejection, or may inadvertently move during flight.
- Do not use any additional seat cushions except those which are furnished with the aircraft. If additional seat cushions are used, and if ejection becomes necessary, serious spinal injuries can result when the ejection force compresses the cushions, enabling the seat to gain considerable momentum before exerting a direct force on the pilot or instructor. Chance of injury during forced landing is also increased.
- Before lowering seat, check area for objects that would prevent the arming handles from lowering with seat, resulting in jettisoning of canopy and arming of the seat.
- After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

EJECTION SEAT



1. SHOULDER HARNESS
2. SHOULDER HARNESS LOCKING LEVER
3. ARMING HANDLE
4. ARMING HANDLE GUARD
5. ARMING HANDLE SAFETY PIN
6. SEAT ADJUSTMENT LEVER
7. SAFETY BELT
8. SEAT EJECTION TRIGGER
9. SEAT-MAN SEPARATOR

Figure 1-22

EJECTION SEAT ARMING HANDLES

When the arming handles (3, figure 1-22) are raised to the full up position they lock in the up position exposing the seat ejection trigger, locking the shoulder harness, and jettisoning the canopy. The linkage is such that both arming handles are interconnected and will raise together.

SEAT EJECTION TRIGGER

The seat ejection trigger (8, figure 1-22) is located within the ejection seat right arming handle on each seat and is accessible only when the arming handles are in the full up position. Squeezing the trigger fires an initiator. The expanding gases produced are routed to the seat catapult which ejects the seat.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC OPENING PARACHUTES

AUTOMATIC OPENING SAFETY BELTS

In order to provide a quick, sure, and dependable separation from the seat after ejection, an automatic safety belt release mechanism is incorporated in each ejection seat. The system consists of a trigger, a safety belt release initiator, necessary ballistics tubing, and an automatic opening safety belt (figure 1-23). The safety belt initiatior is triggered by the seat as it leaves the aircraft; after a one-second delay, the initiator fires and the expanding gas operates the safety belt automatic opening mechanism. The safety belt is designed to allow the shoulder harness and the parachute arming lanyard anchor to be installed by manual operation of the belt. Upon automatic opening of the belt, only the shoulder harness will be released; the parachute arming lanyard will be securely attached to the safety belt and thus to the seat. The opening of the safety belt and release of the shoulder harness leaves the occupant free to separate from the seat, and since the parachute arming lanyard is attached to the safety belt, the automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figure 1-23 shows the automatic opening safety belts in the locked, manually opened, and automatically opened conditions. If the safety belt is opened manually the parachute arming lanyard anchor will not be retained to pull the parachute arming lanyard and the parachute will not open automatically unless the parachute arming lanyard knob is pulled by hand.

WARNING

Do not open the automatic safety belt prior to ejection, regardless of altitude. Manually opening the safety belt prior to ejection creates a hazardous condition since immediate seat-man separation would occur thus exposing the body to excessive decelerative forces. This could result in the parachute pack being blown open and injuries caused by a high opening shock of the parachute. The seat-man mass will decelerate at a more acceptable rate. Manual separation also negates automatic features of the parachute.

TYPE MA-5 OR MA-6 AUTOMATIC OPENING SAFETY BELTS

On the type MA-5 or MA-6 safety belts as installed in the aircraft, the parachute arming lanyard anchor is looped over the safety belt swivel link in the same manner as the shoulder harness loops. To close the belt, the right shoulder harness loop is placed on the tongue, followed by the left loop and finally by the parachute arming lanyard anchor, then locking the swivel link in the safety belt. See figure 1-23 for detailed illustration. The seat occupant should be certain that the shoulder harness loops are not binding on the safety belt automatic release cylinder (to which the release initiator hose is attached). This should be checked when the belt is fastened and frequently during flight.

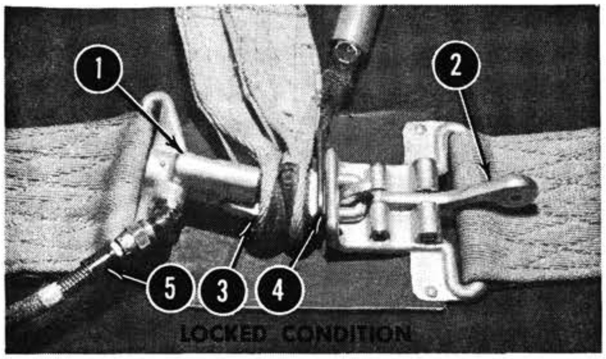
WARNING

- The order of installation of shoulder harness loops and parachute arming lanyard anchor must not be varied. If wrongly installed, it is possible to prevent automatic separation from the seat, in which case the belt must be manually opened to accomplish separation from the seat, and the parachute arming knob must be pulled manually to arm or open the parachute.
- If the shoulder harness loops pass over the safety belt automatic release cylinder, the loops can hangup and delay separation from the seat after ejection.

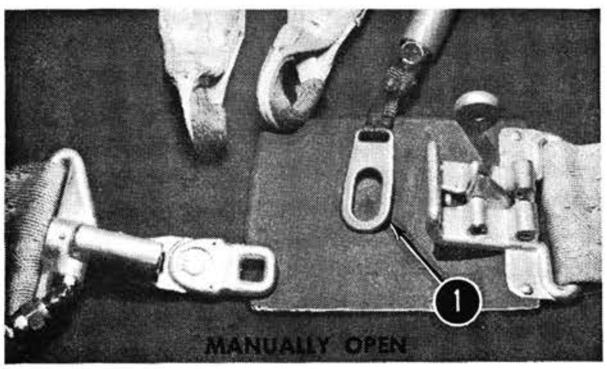
SAFETY BELT

AUTOMATIC OPENING TYPE

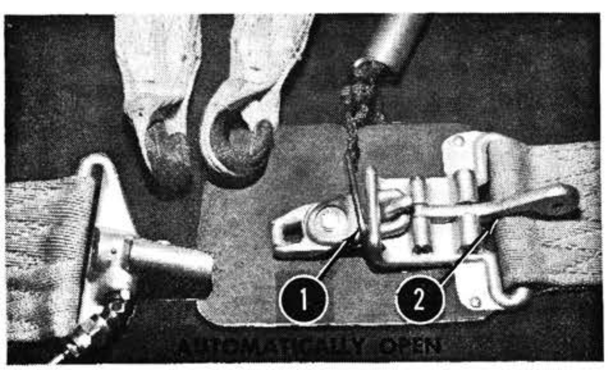
TYPE M-5 OR M-6 BELT



1. Automatic Release
2. Manual Release
3. Swivel Link
4. Parachute Arming Lanyard Anchor
5. Hose From Safety Belt Initiator



1. Parachute Arming Lanyard Anchor Free



1. Parachute Arming Lanyard Anchor Retained By Shoulder On Swivel Link
2. Manual Release Handle Locked

Figure 1-23

- If the automatic opening safety belt is opened manually, the automatic parachute release will not be actuated unless the parachute arming knob is pulled.

Note

The ballistics hose fitting (figure 1-23) on the safety belt should be checked to ascertain that it has been tightened to a position that allows the hose to lay as close to the belt as possible. If the fitting is pointing down it can force the hose down against the seat occupant's leg causing discomfort. If the fitting is pointing up it forces the hose to extend up and form a loop which could hang on aircraft structure or entangle the seat occupant's arm.

AUTOMATIC OPENING PARACHUTES

The ejection seats are designed to utilize a back type automatic opening parachute. Automatic release from the seat following ejection and automatic opening of the parachute results in safer and quicker deployment of the parachute. In order to accomplish automatic opening, the parachute is equipped with an automatic ripcord release mechanism. An aneroid device and timer are incorporated in the release mechansim to pull the ripcord when the desired altitude is reached. The parachute timer is set for the number of seconds delay. The aneroid device is set according to instruction contained in applicable technical publications. The chain of events in the release mechanism is activated by the parachute arming lanyard which is attached to the automatic opening safety belt by a metal parachute arming lanyard anchor for automatic operation. An orange knob is attached to the parachute arming lanyard for manual operation. Upon separation from the seat, the parachute arming lanyard remains attached to the safety belt thus activating the ripcord release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached then after the delay set on the timer expires, the parachute will open. When the release mechanism is activated below the preset altitude, the parachute will open after the number of seconds delay set on the timer. The parachute is equipped with a parachute ripcord handle for opening the parachute manually.

WARNING

For automatic parachute deployment:
1. The automatic safety belt initiator pin must be removed.
2. The parachute arming lanyard anchor must be fastened to the safety belt.
3. The safety belt must open automatically.

If any one of the above conditions is not met the parachute arming knob must be pulled for automatic parachute deployment.

Note

- The automatic opening parachute can be opened manually at any time by pulling the parachute ripcord handle.
- If it is necessary that either the parachute ripcord handle or the parachute arming knob be pulled to open the parachute, it is desirable to use the parachute ripcord handle if below 14,000 feet and the parachute arming knob if above.

ONE AND ZERO EJECTION SYSTEM

Figure 1-24

ONE AND ZERO SYSTEM

In order to provide an improved low altitude escape capability, a system incorporating a one-second safety belt delay and a zero-second parachute delay ("one and zero" system) is provided for ejection seat escape. This system (figure 1-24) makes use of a detachable zero delay lanyard attached to the parachute arming knob. When the hook on the other end of the zero delay lanyard is attached to the parachute ripcord handle, the automatic timer is by-passed and, upon separation from the seat after ejection, the parachute ripcord handle is pulled immediately without any delay. A stowage ring is provided to stow the hook when it is not attached to the parachute ripcord handle. At altitude of 10,000 feet pressure altitude or less the zero delay lanyard must be hooked to the parachute ripcord handle to provide parachute actuation immediately after separation from the ejection seat. At altitudes above 10,000 feet pressure altitude, the zero delay lanyard may be disconnected from the parachute ripcord handle, thus allowing the parachute timer or the aneroid device to actuate the parachute.

WARNING

The emergency minimum ejection altitudes specified for one second safety belt and zero-second parachute setting apply when the zero delay lanyard is attached to the parachute ripcord handle and the parachute arming lanyard anchor is attached to the automatic opening safety belt.

Before takeoff the zero delay lanyard must be hooked to the parachute ripcord handle, after takeoff the zero delay lanyard must remain connected for all flying below 10,000 feet pressure altitude including flights in which 10,000 feet pressure altitude may be temporarily exceeded.

Before penetration or prior to passing 10,000 feet pressure altitude during descent, the zero delay lanyard must be hooked up. After landing it is not necessary to disconnect the zero delay lanyard from the parachute ripcord handle since it connects the parachute ripcord handle to the parachute arming lanyard knob and is not attached to the safety belt. The minimum emergency ejection altitude paragraph in Section III will permit the determination of the emergency minimum altitude for successful ejection with different combinations of automatic parachute timing sequence. The "one and zero" system has been successfully flight tested at speeds between 120 knots IAS and the maximum safe parachute opening speeds. Therefore, data for these systems are applicable between 120 knots IAS and the maximum safe ejection speed for the "one and zero" system.

Refer to Section III for additional information and seat ejection procedures.

SHOULDER HARNESS LOCKING LEVER

The locking lever (2, figure 1-22) with LOCKED and UNLOCKED positions provides for manual control of the shoulder harness locking feature. A latch is provided for positively retaining the lever at either position on the quadrant. When the shoulder harness is not manually locked, an inertia reel will automatically lock it when a sudden deceleration force of approximately two to three G's is applied. If the locking lever is placed in the LOCKED position while the occupant is leaning forward, the inertia reel will automatically retract slack harness with each aft movement of the occupant until the fully retracted position has been reached. After automatic locking of the shoulder harness, it will remain locked until the lever is moved to the LOCKED position and back into the UNLOCKED position.

SEAT-MAN SEPARATOR

A seat-man separator (9, figure 1-22) on each seat provides automatic and positive separation of the seat and occupant after ejection from the aircraft. The separator is actuated by a one-second delay initiator mounted on the seat back. After ejection, the separator, actuated by the initiator, winds-up the strap attached to the separator and seat bottom, separating the seat and occupant.

AUXILIARY EQUIPMENT

Information concerning the following auxiliary equipment is supplied in Section IV: heating, ventilating and defrosting system, pitot heater, communication and associated electronics equipment, lighting equipment, gaseous oxygen system, navigation equipment, and miscellaneous equipment.

		NATO SYMBOL
FUEL	MIL-F-5624	
FUEL GRADE	JP-4	F-40*
HYDRAULIC FLUID	MIL-H-5606	H-515
OIL	MIL-L-7808	O-148
OXYGEN	MIL-O-27210	
EMERGENCY AIR BOTTLE	NITROGEN OR AIR	

*COMMERCIAL DESIGNATION AND FREEZE POINT JET B, -76° F

SERVICING DIAGRAM

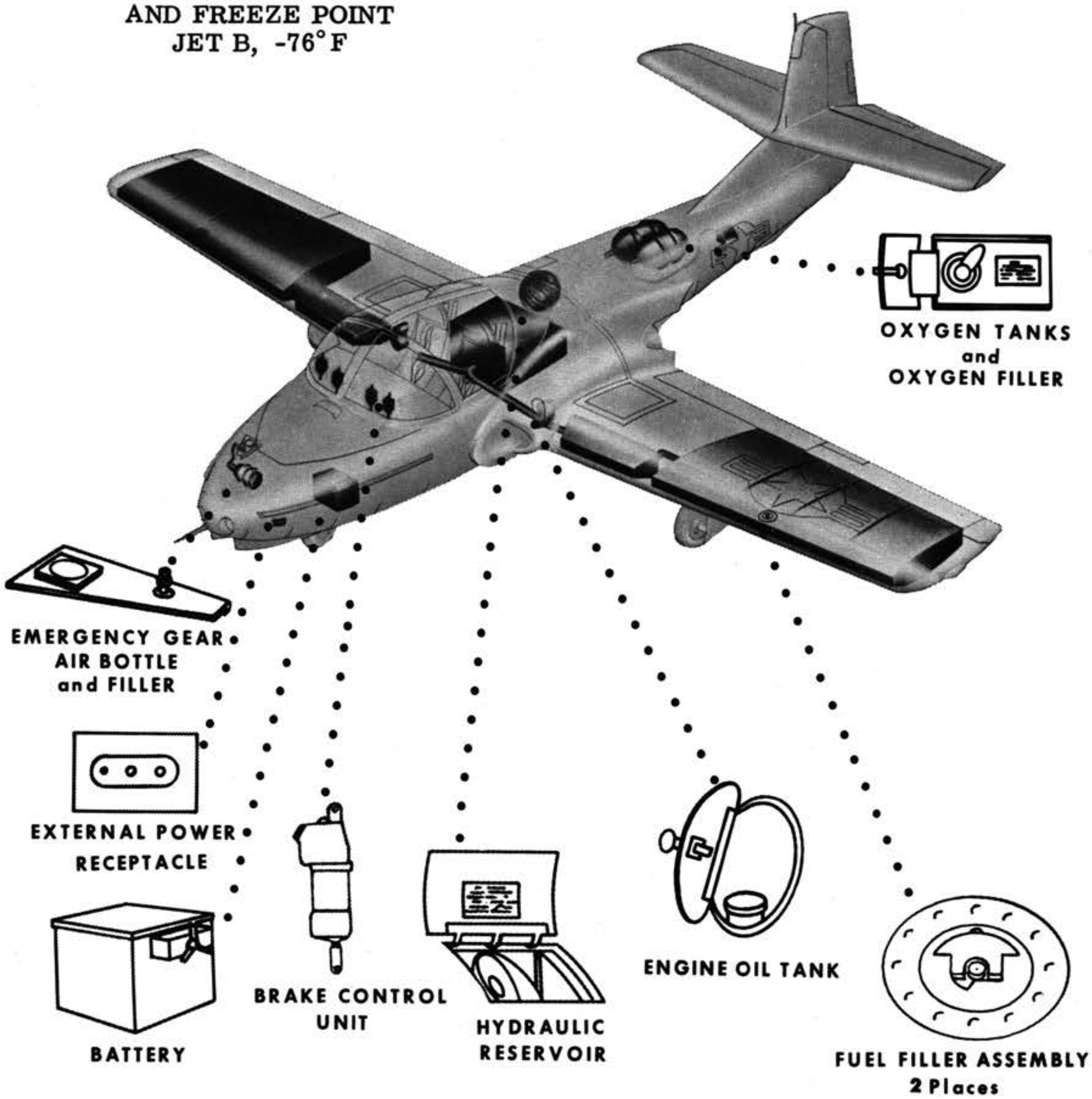


Figure 1-25

REVERSE SIDE INTENTIONALLY LEFT BLANK

SECTION II

Normal Procedures

TABLE OF CONTENTS

PREFLIGHT CHECK

The exterior inspection will be influenced to some extent by the type of operation encountered, i.e. cold weather, hot weather, etc. Refer to Section IX for additional weather information. During normal operation, proceed as follows:

1. Canopy jettison and seat ejection system - Check before entering the aircraft.
   a. Canopy jettison "T" handle safety pin - INSTALLED. (Refer to Figure 1-7.)
   b. Seat arming handle safety pins - INSTALLED.
   c. Seat ground safety pins (3) - REMOVED.
   d. Seat-man separator - CHECK for cuts and frays.
   e. Canopy ground safety pin - REMOVED.

WARNING

- If any discrepancies are noted during inspections of the system, do not enter the aircraft until the system is checked by a maintenance technician.

2. Form 781 - CHECK.
   Check for status, exceptional release, fuel, oxygen, oil, and remarks pertaining to the condition of the aircraft.
3. Oxygen - Line connections secure, check quantity. Lines are located behind the seats. Quick-disconnect plates should be saftied together.
4. Flight controls - UNLOCK.
5. Landing gear levers - DOWN.
6. Required publications - ON BOARD.
7. Pitot heater - CLIMATIC.
   If visual moisture or icing conditions are anticipated, the pitot heat should be checked as follows:
   a. Battery switch - ON.
   b. Pitot heater switch - CHECK FOR HEAT.
   c. Battery switch - OFF.

WARNING

To avoid overheating and possible injury when checking pitot heat, do not leave the pitot heater switch in the ON position for more than 25 seconds.

8. Canopy de-clutch "T" handle access zipper closed and canopy control switch to internal.

EXTERIOR INSPECTION.

Perform the following checks in accordance with Figure 2-1.

A. Fuselage Forward Left Side.
   1. Nose compartment doors - CHECK SECURE.
   2. Air conditioning inlets - CHECK for OBSTRUCTIONS. ⚠2

B. Nose Section.
   1. Gear safety pin - REMOVE.

⚠2 Aircraft 55-4302 and 56-3492 and on

EXTERIOR INSPECTION

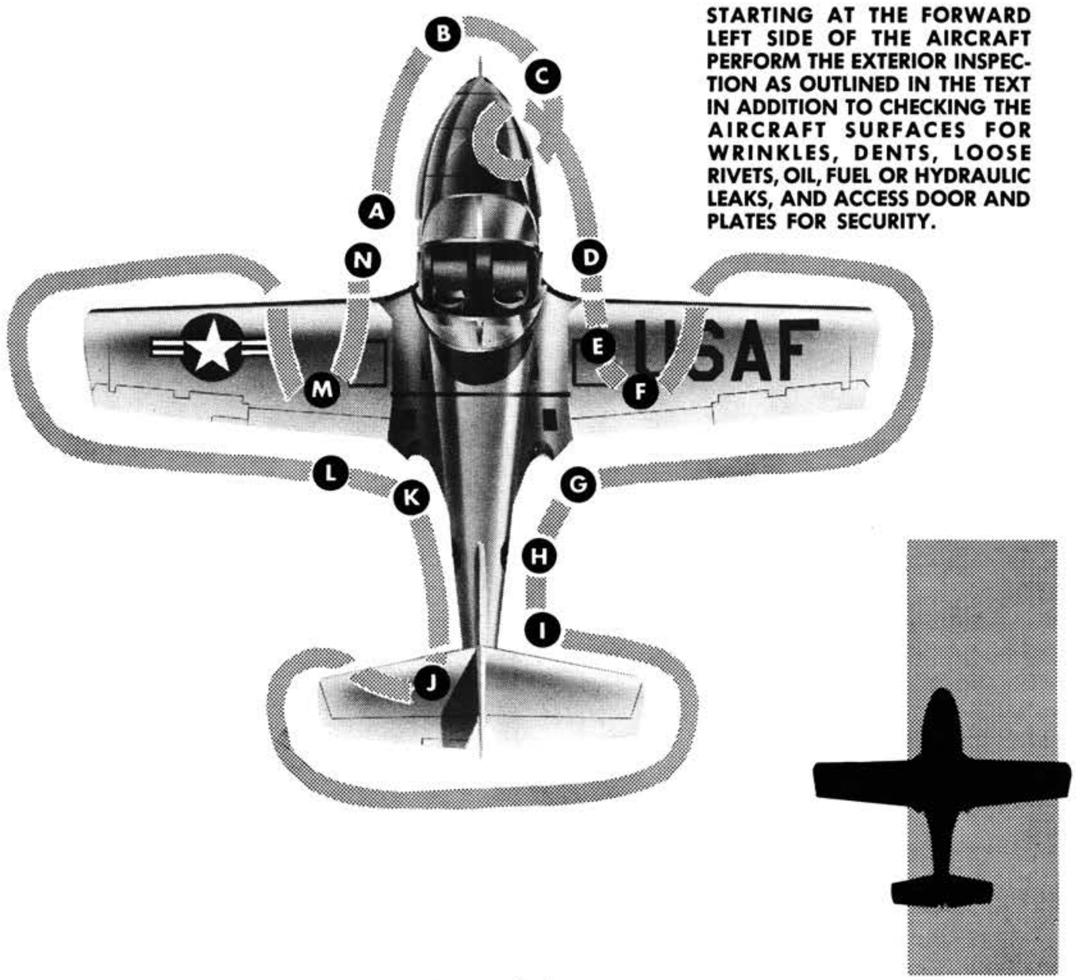


Figure 2-1

2. Access door - CLOSED and LOCKED.
3. Pitot tube - CHECK.
   Remove pitot tube cover, check that tube is free of obstructions.
4. Wheel well - CONDITION.
5. Tire - CONDITION.
   Check tire for proper inflation, excessive wear, cuts and blisters.
6. Strut - EXTENSION (minimum one and one-half inches).
7. Torque link - CONDITION.
   Check that towing pin is installed.

C. Fuselage Forward Right Side.
1. Nose compartment door - CHECK SECURE.
2. Right seat - CHECK (for solo flight).
   If solo flight is anticipated, check right seat for the following:
   a. Equipment - SECURE.
      (1) Seat belt.
      (2) Shoulder harness.
      (3) Seat cushion.
      (4) Oxygen hose.
      (5) Radio cord.
   b. Oxygen diluter lever - 100% OXYGEN.

D. Right Engine Nacelle (Intake Section).
1. Oil filler door - SECURE.
2. Air inlet duct - CHECK.
   Check that duct is free of foreign objects.
3. Engine access doors - CHECK SECURE.

E. Right Main Landing Gear.
1. Wheel well - CONDITION.
   Inspect for general condition and fluid leaks.
2. Strut - EXTENSION (minimum one and one-half inches).
3. Gear doors - CONDITION.
4. Tire - CONDITION.
   Inspect tire for inflation, cuts, blisters and excessive wear.
5. Gear safety pin - REMOVE.

F. Right Wing.
1. Fuel tank - CHECK QUANTITY and CAP SECURED.

Note

- Check that probe moves to the up position when cap is removed. If probe is stuck in the down position, the outboard fuel cells may not have been filled, yet the wing tank may show a visual indication of full.
- Install the cap so that the handle folds rearward. If the handle is folded forward, the slip stream may lift it and loosen the cap to streamline the handle with the airflow causing fuel siphoning and loss of the cap.

WARNING

When fuel caps are removed, be extremely careful. Thermally expanded fuel vapor may cause the caps to blow off with considerable force.

2. Wing tip - CONDITION.
3. Fuel vents - CLEAR OF OBSTRUCTIONS.
4. Trailing edge - CONDITION.
5. Flap - CONDITION.

Note

Do not apply any force to flap or use for hand hold or step as damage to the flap synchronizer valve may occur.

G. Right Engine Nacelle (Tailpipe Section).
1. Tailpipe - CONDITION.
   Check condition of tailpipe and thermocouples and inspect for accumulation of oil or excessive fuel and condition of thrust attenuator.

Note

A small amount of fuel accumulation in the tailpipe is normal and does not indicate a defective fuel system.

H. Fuselage Right Side.
1. Static port - CLEAN.

I. Empennage.
1. Vertical and horizontal stabilizers - CONDITION.
2. Rudder and elevator - CONDITION.
   Check for alignment and security of attachments. Check rudder for vertical play.

J. Fuselage Left Side.
1. Fuel vent - CLEAR OF OBSTRUCTION.
2. Static port - CLEAN.
3. Oxygen filler door - SECURE.

WARNING

Avoid contact in area around oxygen filler door with greasy or oil materials (i.e. gloves, rags, etc.) as fire or explosion may result when oxygen under pressure comes in contact with oil or grease.

K. Left Engine Nacelle (Tailpipe Section).
1. Tailpipe - CONDITION.

L. Left Wing.
1. Flap - CONDITION.
2. Trailing edge - CONDITION.
3. Fuel vents - CLEAR OF OBSTRUCTIONS.
4. Wing tip - CONDITION.
5. Fuel tank - CHECK QUANTITY and CAP SECURE

M. Left Main Landing Gear.
1. Static wire - CHECK for grounding.
2. Wheel well - CONDITION.
3. Strut - EXTENSION (minimum one and one-half inches).
4. Gear doors - CONDITION.
5. Tire - CONDITION.
6. Gear safety pin - REMOVE.

N. Left Engine Nacelle (Intake Section).
1. Air inlet duct - CHECK.
2. Oil filler door - SECURE.
3. Engine access doors - CHECK SECURE.

INTERIOR CHECK (ALL FLIGHTS)

1. Control lock - STOWED.
2. Safety belt, shoulder harness, and parachute arming lanyard anchor - INSPECT, ATTACH AND ADJUST. Inspect safety belt, shoulder harness, and parachute arming lanyard for cuts or frayed edges. Attach parachute arming lanyard anchor to safety belt and latch safety belt. Adjust safety belt and shoulder harness to fit snug.

WARNING

To permit clean separation from the seat during ejection, the parachute arming lanyard must be outside the parachute harness and not fouled on equipment.

3. Zero delay lanyard - HOOK UP.
4. Oxygen system - PRICE, refer to Section IV.
5. Seat - ADJUST HEIGHT.

WARNING

Check arming handles safety pin installed and area under seat clear of foreign objects before lowering seat to prevent inadvertant canopy jettison.

WARNING

After adjusting seat to proper height, check that adjustment lever is locked. If seat is not locked, G-loads in flight may cause it to move, or prevent safe ejection.

6. Rudder pedals - ADJUST.
7. Flight controls - CHECK for free and proper movement.
8. Speed brake switch - IN.
   IP switch - SOLO.

CAUTION

The speed brake switch must be in the IN position during engine ground operation to prevent damage to the thrust attenuators and aft engine nacelle areas.

9. Air vent - AS DESIRED.
10. Landing and taxi light switch - OFF.
11. Altimeter - SET.

WARNING

Special attention should be given to the altimeter, when setting the barometric scale, to assure that the 10,000 foot pointer is reading correctly. The low altitude symbol should be visible below 16,000 feet.

12. Vertical velocity - READS ZERO.
13. Clock - SET.
14. Fuel shut-off "T" handles - PUSH-ON.
15. Fuel system switch - EMERGENCY.

CAUTION

If the fuel system switch is placed in the NORMAL position and the float switch located in the fuselage fuel tank is stuck, the fuel proportioner pump will operate continuously when electrical power is applied to the aircraft. If the engines are not running, the fuel proportioner pump can supply enough pressure to damage the fuselage fuel tank.

16. Accelerometer - RESET.
17. Radios - OFF.
18. Hot air "T" handle - PUSH-CLOSED (if applicable). [1]
19. Cold air knob - AS DESIRED (if applicable). [1]
20. Air conditioner - SET. [2]
    a. Cockpit air lever - VENT.
    b. Cockpit air temperature control switch - AUTOMATIC.
    c. Cockpit air temperature control rheostat - AS DESIRED.
    d. Defrost knob - IN.
21. Circuit breakers - IN.
22. Fuselage tank fuel boost pump switch - OFF.
23. Inverter switch - OFF.
24. Generator switches - ON.
25. Pitot heat switch - OFF.
26. Throttles - CUT-OFF.
27. Auxiliary power - CONNECTED (if required).
28. Battery switch - ON (if auxiliary power is not used).

CAUTION

The battery switch must be turned OFF when auxiliary power is being used to start the engines or damage to the battery will result.

[1] Aircraft 54-2729 thru 56-3491 except 55-4302

[2] Aircraft 55-4302 and 56-3492 and on

29. Inverter switch - SPARE then MAIN.
30. Interior lights - AS REQUIRED.
31. Exterior lights - AS REQUIRED.
    a. Taxi light - ON.
    b. Navigation lights - AS REQUIRED.
    c. Anti-collision beacon - OFF.
32. Landing gear lever - CHECK DOWN.
33. Landing gear warning lights - CHECK OPERATION.
    Press warning light test switch - lights should come on in both handles.
34. Landing gear position indicator lights - CHECK ON.
35. Fuselage tank boost pump warning light - CHECK ON.
36. Elevator trim - NEUTRAL (green light on).
37. Aileron trim - NEUTRAL (check visually).
38. Canopy-not-locked warning light - CHECK ON.
39. Engine ice warning light - PRESS-TO-TEST.
40. Engine fire detect circuit - TEST.
41. Engine overheat detect circuit - TEST.
42. Fuel low level warning light - PRESS-TO-TEST.
43. Gravity fuel light - CHECK ON.
44. Heading indicator:
    a. Proper heading.
    b. Indicator slaving switch - IN.
45. Attitude indicator:
    a. J-8 - CAGE and UNCAGE. ADJUST the minature aircraft to coincide with the 90° indices.

Note

The indicator should be energized for approximately 30 seconds prior to caging.

    b. MM-3 - CHECK for proper operation and adjust the horizon bar to coincide with the minature aircraft.
46. Fuel quantity - CHECK RIGHT and LEFT wing tanks and TOTAL fuel.

Note

- To determine the correct amount of fuel in the right and left wing tanks, the fuel gaging selector switch must be held in the corresponding position until the fuel quantity indicator needle stabilizes.
- If a gage reading difference of more than 70 pounds between left and right wing tank is noted, the fuel system should be checked and brought within tolerance prior to takeoff.

STARTING ENGINES

1. Fuselage tank fuel boost pump switch - ON.
2. Fuselage tank fuel boost pump warning light - OFF.

Note

If the fuel boost pump warning light fails to go out, do not start engines and note in Form 781.

3. Left engine start:
    a. Starter switch - GND and hold.

Note

Do not leave starter switch in the GND position for more than 20 seconds if there are no indications of combustion (EGT rise). Wait one minute before repeating start procedure to allow accumulated fuel to drain from engine.

    b. Left ignition switch - ON at 5% rpm and hold.
    c. Left throttle - IDLE at 8% rpm.

Note

Use instructor's throttle for starting so that cut-off feature is available if shutdown is necessary.

    d. Left ignition switch - OFF at rapid EGT rise.
    e. Left starter switch - OFF at 25% rpm.

Note

- A high heat peak is reached at 20-22% rpm. Holding the starter in GND position beyond this peak, will result in a cooler, more stabilized start.
- If EGT exceeds 780°C during start, shut engine down immediately. Have maintenance personnel check the turbine section and tailpipe before attempting a restart. If a second hot start occurs, shutdown engine and abort aircraft.

4. Left engine instruments - CHECK.
5. Hydraulic pressure - Check for 1250 to 1550 psi.
6. APU - DISCONNECT (if applicable).
7. Battery switch - ON.

Danger Areas

EXHAUST GAS TEMPERATURE AND VELOCITY				
ENGINES AT	DISTANCE FROM TAILPIPE			
	15 FEET	30 FEET	45 FEET	60 FEET
MAX. & MIL. THRUST 100% RPM	190° F 196 MPH	125° F 76 MPH	103° F 40 MPH	100° F 30 MPH
TAXIPOWER 36—38% RPM	135° F 32 MPH	94° F 14 MPH	80° F 10 MPH	70° F 5 MPH

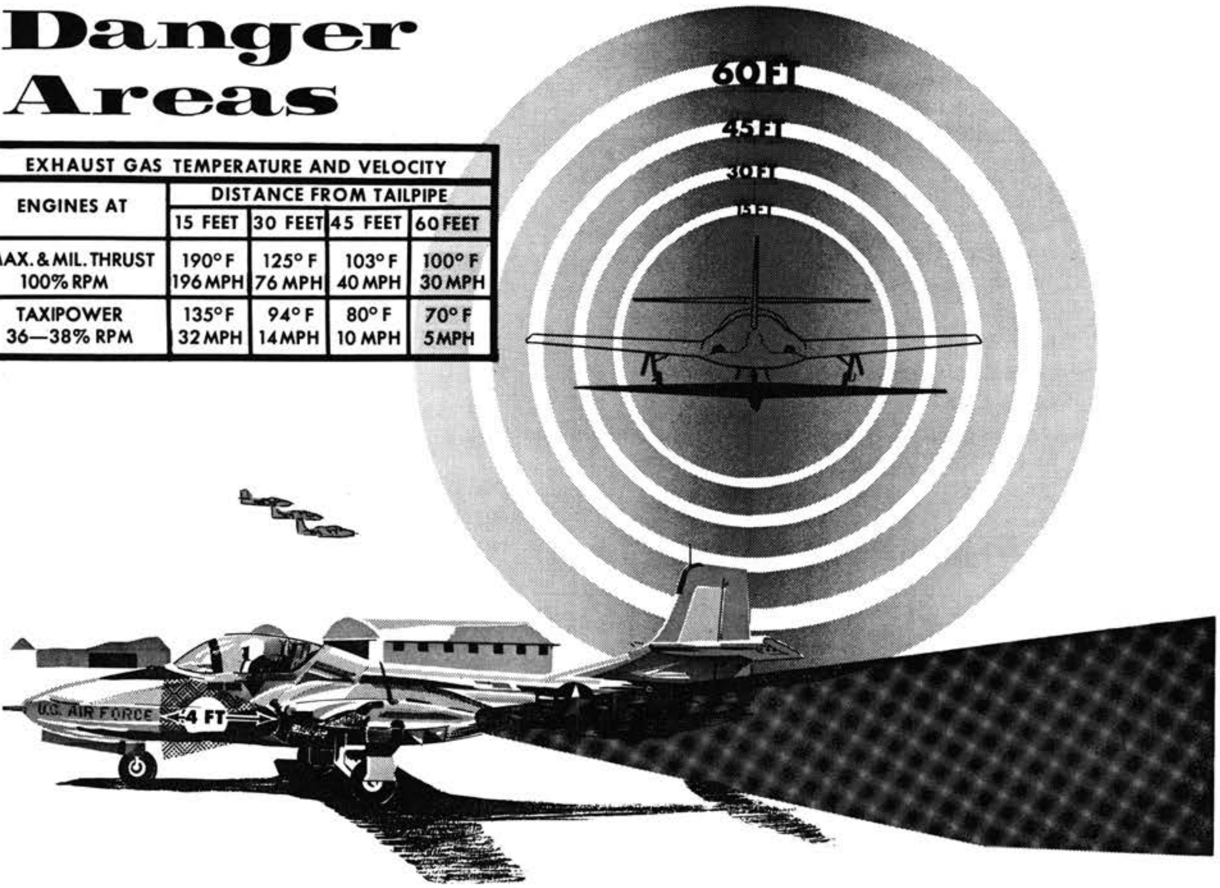


Figure 2-2

CAUTION

After engine starter switch is released and checked to be in the OFF position, advance throttle until generator cuts in at approximately 38-42% rpm and check loadmeter for rise in indication. If loadmeter shows no rise, increase rpm to 60%. If still no loadmeter indication, shutdown both engines and write up in Form 781.

8. Loadmeter - CHECK.
9. RPM - Advance to 60%.
10. Right engine start:
    a. Right starter switch - GND and hold.
    b. Right ignition switch - ON at 5% rpm and hold.
    c. Right throttle - IDLE at 8% rpm.
    d. Right ignition switch - OFF at rapid EGT rise.
    e. Right starter switch - OFF at 25% rpm.
11. Right engine instruments - CHECK.

BEFORE TAXIING

Before taxiing, perform the following:

1. Fuel system switch - NORMAL.
2. Radios - ON.
3. Cockpit air lever - AIR COND. △2
4. Ejection seat safety pins - REMOVE and visually display.
5. Canopy jettison "T" handle safety pin - REMOVE and visually display.

WARNING

- When removing ejection seat arming handles safety pin, place left hand on the left arming handle to insure that the arming handles are held down while the pin is removed and streamer is cleared from the seat.
- During all ground operation, if seat adjustments become necessary, install arming handles safety pin before moving the seat adjustment lever.

△2 Aircraft 55-4302 and 56-3492 and on

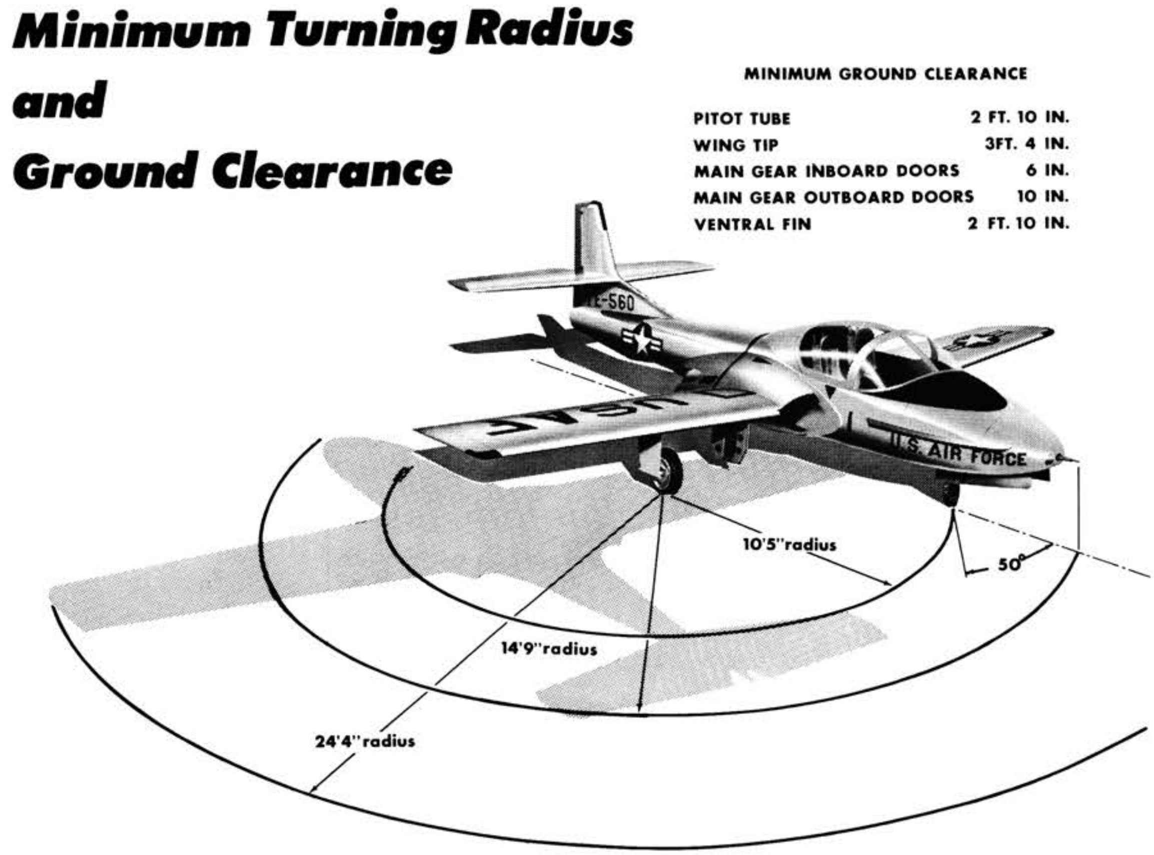


Figure 2-3

- If seat adjustment is necessary in flight, check that no obstruction is below either arming handle to insure the handles will not move as the seat is lowered.

6. Oxygen diluter lever - AS DESIRED.

WARNING

Depending on wind conditions, it is possible during ground operation to have carbon monoxide contamination of the cockpit air. This contamination may be caused by your own or other aircraft engine exhaust.

7. Speed brake - CHECK OPERATION.
8. Wing flap level - DOWN 50%.

Note

Verify flap extension with ground crew.

9. Radios - CHECK OPERATION (UHF and VOR).

Note

RPM may have to be increased above idle to insure a positive loadmeter indication for operation of the UHF comm radio and VOR NAV radio.

10. Flight instruments - CHECK.
    a. Altimeter - CHECK.
    b. Airspeed indicator - CHECK READING.
    c. Heading indicator - CHECK READING.
       Set takeoff heading under top index; check heading against magnetic compass.
    d. Magnetic compass - CHECK.
       Determine that bowl is full of fluid.

   e. Attitude indicator - CHECK for attitude warning flag not showing.
11. Toe to head check:
   a. All zippers closed.
   b. Seat belt fastened.
   c. Gold key installed.
   d. Shoulder harness adjusted.
   e. Leg and chest strap fastened.
   f. Oxygen connections secured.
   g. Zero delay lanyard hooked up.
   h. Chin strap fastened and adjusted.
12. Wheel chocks - REMOVED.

TAXIING

Observe the following precautions for taxiing:

1. Area - CHECK clear for taxiing.
2. Power steering switch - DEPRESS and hold. Maintain directional control with steerable nose wheel by use of rudder pedals.

Note

Nose wheel steering should be used with care to prevent over-controlling while taxiing. Attempts to use a combination of nose wheel steering and brakes to maintain direction may result in over-controlling. Avoid braking during turns, taxiing over foreign objects, holes and ruts.

3. Brakes - TEST.
   When aircraft is moving straight forward, apply brakes evenly and firmly to check for adequate braking action.

CAUTION

To prevent inadvertent jettisoning or damage to the canopy, do not unlock or open canopy above 40 knots IAS.

4. Turn and slip indicator - CHECK.
   During turns, check that turn needle indicates the proper direction and ball is free in the glass tube.

BEFORE TAKEOFF

Before takeoff, complete the following checks:

1. Flight controls - CHECK.
2. Zero delay lanyard - Hooked up
3. Radio - CHECK PROPER FREQUENCY
4. Anti-collision beacons - ON.
5. Canopy - CLOSE - LOCK (CHECK LIGHT OUT).
   Before closing canopy, check that canopy sill is free of obstructions and notify other crew member. Wait for confirmation that he is clear. Then hold canopy switch in the CLOSED position until the canopy is fully closed, the locking handle is forward, and the "canopy-not-locked" red warning light goes out. On aircraft ▲ if the canopy fails to operate, check the canopy control switch is in the INTERNAL position.

▲ Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

LINEUP CHECK

1. Canopy-not-locked warning light - CHECK OFF.
2. Heading indicator - SET.
   Check that the pointer of the heading indicator is aligned with the index at the top of the case.
3. Attitude indicator - CHECK for precession.
4. Pitot heat and defroster - CLIMATIC.
   The pitot heat and canopy and windshield defrost should be on when flying into areas of visible moisture.
5. Throttles - MAXIMUM THRUST.
6. Engine instruments - CHECK for proper indication.
   a. Hydraulic pressure gage.
   b. Tachometers.
   c. Exhaust gas temperature indicators.
   d. Fuel flow indicators.
   e. Oil pressure indicators.
   f. Loadmeters.

Note

- Nickle cadmium batteries may be charged at a much greater rate without damage than can the conventional lead-acid batteries. Engine starts using battery power will normally be followed by extremely high loadmeter readings. High loadmeter readings may persist for as long as 10 minutes after takeoff. Loadmeter reading will gradually decrease as the battery becomes charged unless some electrical malfunction is present.
- The loadmeters should be checked immediately after takeoff and every 15 minutes thereafter. After 10 minutes of flight, loadmeter reading should be .5 or below. Maximum loadmeter for takeoff is .8.

TAKEOFF

Note

At high RPM settings under humid atmospheric conditions, it is normal to observe vapor coming out of the air scoop on the nose section.

NORMAL TAKEOFF

Refer to Appendix I for takeoff charts showing distances required at varying gross weights, temperatures, field elevations, wind and runway conditions. After completion of the "Line-up Checks," release brakes and establish a straight takeoff roll.

Directional control should be maintained by use of nose wheel steering until rudder becomes effective at approximately 60 knots IAS. Care should be used to prevent over-controlling when using nose wheel steering. As the elevators become effective (at approximately 65 knots IAS), raise the nose smoothly to takeoff attitude. Maintain this attitude and allow the aircraft to fly off the ground.

CROSSWIND TAKEOFF

Release brakes and maintain directional control by the use of nose wheel steering, ailerons, and rudder. Release nose wheel steering at the computed minimum nose wheel lift off speed (refer to crosswind chart in Appendix) and raise nose to the normal takeoff attitude. Continue to use rudder and ailerons for maintaining directional control. After becoming airborne, correct for drift by turning into the wind. Observing the minimum nose wheel lift-off speed will insure sufficient rudder control to maintain runway heading prior to becoming airborne.

AFTER TAKEOFF - CLIMB

When definitely airborne, proceed as follows:

1. Landing gear lever - UP at 100 knots IAS (minimum).
2. Landing gear position indicators - CHECK.
   a. Landing gear position indicator lights - OFF.
   b. Landing gear warning lights - OFF.
3. Wing flap lever - UP at 110 knots IAS (minimum).
4. Engine instruments - CHECK.

10,000 FEET PRESSURE ALTITUDE CHECK (CLIMBING)

1. Zero delay lanyard - Disconnect after passing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.

Note

If operating above terrain over 8000 feet high, the zero delay lanyard should remain connected until the aircraft is at least 2000 feet above terrain.

2. Oxygen system - CHECK.
   a. Diluter lever - NORMAL OXYGEN.
   b. Pressure gauge - QUANTITY.
   c. Flow indicator - BLINKING.
   d. Hose connection - RECHECK.

WARNING

Leaving the oxygen diluter lever in the 100% OXYGEN position will greatly shorten the duration of the oxygen system. Refer to figure 4-10 for oxygen duration.

3. Fuel quantity - CHECK.
   Check total fuel quantity on board for excessive fuel consumption.

CLIMB

Maintain technical order climb speeds. (Refer to Appendix I.)

LEVEL OFF

1. Altimeter - Set to 29.92" Hg when required.
2. Oxygen system - CHECK.
   a. Diluter lever - NORMAL OXYGEN.
   b. Pressure gauge - QUANTITY.
   c. Flow indicator - BLINKING.
   d. Hose connections - RECHECK.
3. Loadmeters - CHECK.
4. Fuel quantity - CHECK.

Note

- It takes approximately 10 minutes of flight to determine if both wing fuel tanks are feeding. Check fuel level only when aircraft is in straight and level coordinated flight.

- A three per cent decrease in maximum obtainable engine rpm can be expected above 20,000 feet.

CRUISE

Refer to Section VII for fuel system management and Appendix I for cruise data.

Note

The defrosting system should be operated at the highest temperature possible (consistent with pilot comfort) during high altitude flight in order to provide sufficient preheating of the windshield and canopy to preclude the formation of frost or fog during descent.

FLIGHT CHARACTERISTICS

Refer to Section VI for information regarding flight characteristics of the aircraft.

BEFORE DESCENT

Refer to Appendix I for data concerning descents from various altitudes. Power settings, speed brake and thrust attenuator position depends on the performance desired. Any speed brake and power settings may be used during the descent, providing the airspeed limitations in Section V are not exceeded.

Before making any descent, perform the following:

1. Defroster - CLIMATIC.
   Rapid descents may cause fogging inside the canopy. Therefore, it is necessary that the canopy and windshield be kept as warm as possible to maintain proper visibility.
2. Pitot heat - CLIMATIC.
3. Oxygen system - CHECK OPERATION.
4. Fuel quantity - CHECK.
5. Altimeter - RESET AS REQUIRED.
6. Zero delay lanyard - HOOK UP prior to high fix for penetration descent or prior to 10,000 feet pressure altitude during enroute descent.

Note

If operating above terrain over 8000 feet high, the zero delay lanyard should be connected prior to the aircraft reaching 2000 feet above terrain.

BEFORE LANDING

APPROACH TO FIELD

During the approach to the field and before entering the traffic pattern, perform the following checks:

1. Zero delay lanyard - HOOKED UP.
2. Radio - PROPERLY TUNED.
3. Fuel quantity - CHECK.
4. Hydraulic pressure - CHECK.
5. Airspeed - 200 knots IAS (45° entry leg).
   The entry leg and airspeed will be determined by local field conditions. Unless otherwise specified, the entry leg and initial approach will be flown at 200 knots IAS and 1000 feet above the terrain.

180° TURN TO DOWNWIND LEG

As bank is established for the 180° turn to downwind, reduce throttles to 50-60% rpm.

DOWNWIND LEG

Maintain altitude on downwind leg while reducing airspeed and perform the following:

1. Speed brake switch - OUT.
2. Landing gear lever - DOWN below 150 knots IAS.
3. Landing gear position indicators - CHECK.
   a. Landing gear position indicator lights.
   b. Landing gear warning lights.
   c. Audio tone signal.

Maintain altitude and 120 knots IAS until starting final turn.

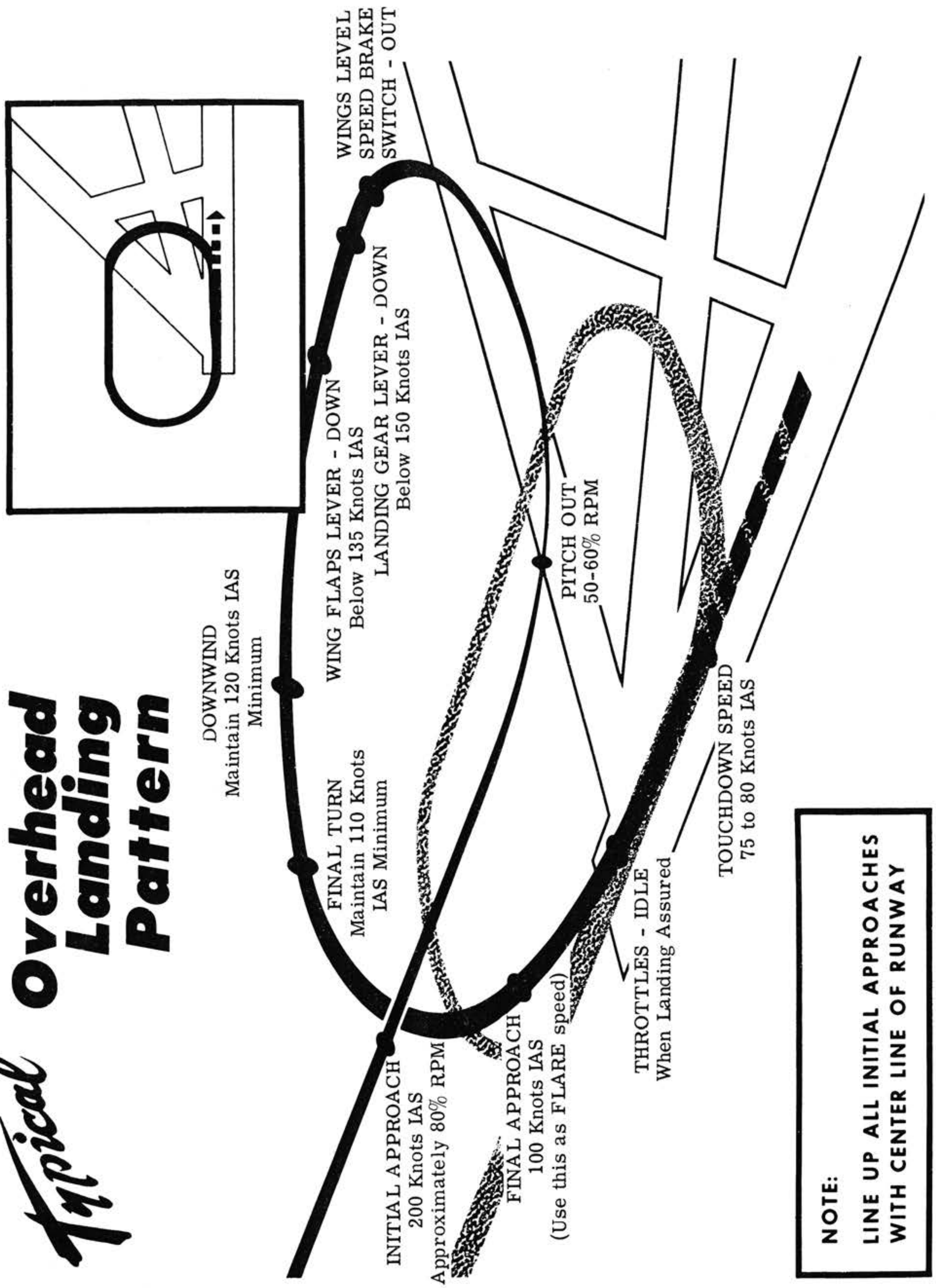
4. Wing flap lever - DOWN below 135 knots IAS.

FINAL TURN

1. Airspeed - 110 knots IAS (minimum).

FINAL APPROACH

1. Airspeed - 100 knots IAS (minimum).
2. Landing lights - AS REQUIRED.
3. Throttles - IDLE (when landing is assured).
   Pattern should be planned so that a minimum of 50% rpm will be used on final approach, because of the slow acceleration of jet engines.



NOTE:

LINE UP ALL INITIAL APPROACHES WITH CENTER LINE OF RUNWAY

Figure 2-4

LANDING

Refer to Figure 2-4 for typical overhead landing pattern and recommended procedure. Refer to Appendix I for recommended approach and touchdown speeds for varying gross weights, wind conditions, and configurations.

On final approach use wing-low technique for crosswinds in order to maintain runway alignment. If strong crosswinds are encountered, increase final approach speed 5 to 10 knots. Just before reaching the end of the runway, start the roundout by smoothly establishing a nose-high attitude. Continue to maintain the wing-low attitude for a crosswind. This will require increased control deflections as airspeed decreases during the roundout. Plan touchdown at recommended main gear touchdown speed. (See Appendix I.) Touchdown on the main wheels in a nose-high attitude.

If crosswinds are not significant, maintain a nose-high attitude after touchdown to take advantage of aerodynamic braking. This will require increasing back stick pressure as airspeed dissipates. Leave flaps down and speed brake and thrust attenuators extended to take advantage of increased drag and reduced thrust. Lower the nose wheel to the runway while there is still sufficient elevator control to avoid damage to the aircraft and raise the speed brake. Use wheel brakes as necessary to stop on the remaining runway.

Note

To avoid excessive swerve, neutralize the rudder prior to engaging nose wheel steering.

The aircraft weathervanes when landing in strong crosswinds. Lower the nose to the runway as soon as possible after touchdown and use nose wheel steering, rudder, and brakes if necessary to maintain directional control. Continue to maintain ailerons deflected into the wind during the landing roll and raise the speed brake.

If a high gusty wind condition is encountered, half flaps should be used in the pattern, and final approach speed should be increased 5 to 10 knots.

The procedure for landing without flaps is the same as for a normal landing. Plan a longer final approach (normally a minimum of one mile), increase final approach airspeed by 10 knots, and expect an extended flare and longer landing roll.

When landing in crosswinds or high gusty winds which require less than full flap configuration, speed brake may be used to improve airspeed and glide path control. They may be lowered anytime after the 180° turn to downwind is complete.

BRAKING PROCEDURES

Wheel brake effectiveness increases as forward speed decreases. On landing, use wheel brakes only as required to decelerate the aircraft to normal taxi speed on the remaining runway. If maximum braking is required after touchdown, lower the nose wheel to the runway, leave speed brake extended and raise the flaps. This will decrease lift and put more weight on the main wheels for increased friction. Use a single smooth application of brakes with constantly increasing pedal pressure. Optimum braking is achieved when maximum aircraft weight is on the main wheels and a very slight skid is maintained (approximately 15-20% rolling skid). Braking action decreases if a wheel is locked and the tire is in an excessive skid. If a skid results, brake pressure must be released and then reapplied to achieve normal braking action. Braking effectiveness can be increased by pulling back on the stick just short of raising the nose wheel.

Note

Brakes, themselves, can merely stop the wheels from turning, but stopping the aircraft is dependent on the friction of the tires on the runway.

WARNING

If maximum braking is used, aircraft should not be taxiied into a congested area. Peak temperatures occur in the wheel and brake assembly five to fifteen minutes after maximum braking operation. This could result in brake failure or possible fire or explosion. Insure all personnel remain clear of the main wheels until they have cooled.

STRAIGHT-IN APPROACH

If it is necessary to land from a straight-in approach, proceed as follows: Plan to arrive at initial approach altitude 3 to 5 miles from the end of the runway. Establish final approach configuration and airspeed as required by the situation and intercept the desired glide path. Continue the landing approach using a minimum of 50% rpm until the landing is assured.

LANDING ON SLIPPERY RUNWAYS

Touchdowns should be planned close to the approach end of the runway in order to utilize all the available runway length. Use recommended pattern and touchdown speeds since excessive landing speeds will result in longer stopping distance. Use aerodynamic braking as much as possible and leave speed brake extended. Use brakes lightly, applying pedal pressure evenly and slowly. If brakes are applied hard and suddenly a skid will result. Use nose wheel steering primarily for directional control Differential braking may be used to aid in directional control unless it results in skidding. If skidding occurs, reduce or release brake pedal pressure and use nose wheel steering for directional control. Landing roll distances will be considerably increased over the minimum for a dry runway, but since maximum braking is seldom required in normal operation, the distances will not normally appear excessive.

PORPOISING

CAUTION

Avoid landing on the nose wheel first or porpoising may result.

Porpoising is a condition encountered during landing, wherein the aircraft bounces back and forth between the nose wheel and the main gear after initial ground contact. This porpoising condition is caused by an incorrect landing attitude upon touchdown, which brings the nose wheel in contact with the runway before the main gear touches down. This condition most likely will occur when landing is attempted with an incorrect landing attitude and at an excessive airspeed. If immediate corrective action is not initiated, the porpoise will progress to a violent, unstable oscillation of the aircraft about the lateral axis. These repeated heavy impacts of the aircraft on the runway ultimately will result in structural damage to the landing gear and airframe. Therefore, a proper landing attitude immediately prior to touchdown is imperative to preclude the occurrence of the porpoise.

If porpoising should be encountered, immediately reposition the controls (stick NEUTRAL or slightly aft) to establish the normal landing attitude. Maintain this attitude and simultaneously advance throttles to 100 per cent rpm. Do not attempt to counteract each bounce with opposite stick movement, because the combined reaction time of pilot and aircraft is such that the cited control movement will aggravate the porpoising action. Repositioning and holding the controls (restricting movement) will dampen out the oscillation. The addition of power will increase control effectiveness by increasing airspeed and permit the aircraft to become safely airborne once again and eliminate further porpoising.

Note

Directional control may be difficult to maintain if uneven engine acceleration occurs when throttles are advanced or when a crosswind exists.

GO-AROUND

WARNING

Decide early in the approach if it is necessary to go-around and start go-around before too low an altitude and airspeed is reached. The acceleration of a jet aircraft is very slow.

Observe the following procedures:

1. Throttles - 100% rpm.
2. Speed brake switch - IN.
3. Landing gear lever - UP at 100 knots IAS (minimum).

CAUTION

Do not raise the landing gear until definitely airborne.

4. Landing gear position indicators - CHECK.
   a. Landing gear position indicator lights.
   b. Landing gear warning lights.
5. Landing lights switch - OFF (if used).
6. Wing flap lever - UP at 110 knots IAS (minimum).

AFTER LANDING

After lowering nose wheel to runway:

1. Speed brake - UP.

After completing landing roll, clear runway and perform the following:

2. UHF radio - AS REQUIRED.
3. Canopy - AS DESIRED.
4. Anti-collision beacons switch - OFF.
5. Pitot heat switch - OFF (if used).
6. Landing lights - TAXI (if used).

Note

It is permissible to shut one engine down to reduce taxi speed, thereby reducing braking action and increasing brake life. When an engine is shut down, check the hydraulic pressure for proper operation of the hydraulic pump. If hydraulic pressure is lost, stop aircraft on taxiway or ramp, shut the other engine down, and have gear safety pins installed before aircraft is towed to the parking area.

ENGINES SHUTDOWN

Before stopping the engines allow exhaust gas temperature to stabilize and note any signs of engine roughness. To shutdown engines, proceed as follows:

1. Fuel system switch - EMERGENCY.
2. Throttles - CUT-OFF.
3. Seat and canopy jettison "T" handle safety pins - REPLACE.
4. Radios - OFF.
5. Fuselage tank fuel boost pump switch - OFF.
6. Inverter switch - OFF.
7. Trim - NEUTRAL.
8. All electrical switches (except generators) - OFF.
9. Battery switch - OFF.
10. Oxygen diluter lever - 100% OXYGEN.

WARNING

Stand clear of tailpipes after engine shutdown, and at all times when vapors exit from tailpipes. Danger to personnel exists because of explosive qualities of fuel vapors.

BEFORE LEAVING AIRCRAFT

1. Wheel chocks - IN PLACE.

Note

Be sure chocks are in place before releasing brakes.

2. Flight controls - LOCK.
3. Form 781 - COMPLETE.

CAUTION

Make appropriate entries in the Form 781 covering any limits in the Flight Manual that have been exceeded during the flight. Entries must also be made when in the pilot's judgement the aircraft has been exposed to unusual or excessive operations such as hard landings, excessive braking action during aborted takeoffs, long taxi runs at high speeds, etc.

4. Gear safety pins - CHECK INSTALLED.
5. Pitot head cover - CHECK INSTALLED.

Refer to Section IX for canopy positions and the use of dust shields for various climatic conditions.

Note

During cross-country flights, pilots are urged to maintain surveillance during oil tank servicing. Overfilling the oil tank can cause depletion of oil supply through the oil tank vent line during flight. The oil level should be checked immediately after engine shutdown. After engine remains idle for a period of time, oil will drain into the engine lines, bearings, etc., and give a false low reading in the tank.

CHECKLIST

The normal abbreviated checklist is contained in T.O. 1T-37B-1CL-1.

SECTION III

Emergency Procedures

TABLE OF CONTENTS

INTRODUCTION

This section includes procedures to be followed to correct an emergency condition. The procedures, if followed, will insure safety of the pilots and airplane until a safe landing is made or other appropriate action is accomplished. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. Therefore, it is essential that pilots determine the correct course of action by use of common sense and sound judgment. Procedures appearing in bold face capital letters are considered critical action. Procedures appearing in small letters are considered noncritical action. Each is defined as follows:

CRITICAL ACTION

Those actions which must be performed immediately if the emergency is not to be aggravated, and injury or damage are to be avoided. These critical steps will be committed to memory.

NONCRITICAL ACTION

Those actions which contribute to an orderly sequence of events, assure that all corollary preparations are made prior to initiating the critical emergency actions, slightly improve the chances for the emergency action to be successful, and serve as "clean-up" items.

To assist the pilot when an emergency occurs, three basic rules are established which apply to most emergencies occurring while airborne. They should be remembered by each pilot. The rules follow:

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as conditions permit.

GROUND OPERATIONS

ENGINE FIRE OR OVERHEAT DURING START (STEADY OR FLASHING LIGHT)

If a fire or overheat detect warning light illuminates during an engine start, or if there are visual indications of fire or overheat existing in the engine nacelles, proceed as follows:

1. THROTTLES - CUT-OFF.
2. FUEL SHUTOFF "T" HANDLES - PULL OFF.
3. BATTERY - OFF (APU disconnected if used).

TAKEOFF

ABORT

If an abort on takeoff is necessary due to engine failure, fire, overheat warning, or other unsafe condition, accomplish the following:

1. THROTTLES - IDLE (CUT-OFF FOR AFFECTED ENGINE(S).

Note

Cut-off both engines if stopping distance is marginal.

2. BRAKES - AS REQUIRED.

If Time Permits:

3. Fuel shutoff "T" handle - PULL OFF for affected engine.
4. Battery and generators - OFF.
5. Ejection seat safety pin - INSERT prior to evacuating the aircraft.

Note

To afford protection against explosion, heat, or fire, the canopy should be retained during aborted takeoff. After the abort, normal canopy opening should be attempted prior to jettisoning the canopy.

WARNING

Avoid contacting raised barriers.

Note

In the event of imminent contact with obstruction during landing or takeoff roll or other ground operations, the aircraft is capable of extremely short radius turns even at fairly high speeds with nose wheel steering. However, nose wheel steering is not available with both engines inoperative.

LANDING GEAR EMERGENCY RETRACTION

If it is necessary to retract the landing gear while the aircraft is on the ground, proceed as follows:

1. PRESS LANDING GEAR EMERGENCY OVERRIDE SWITCH AND SIMULTANEOUSLY MOVE THE LANDING GEAR LEVER TO THE UP POSITION. (See figure 3-1.)

CAUTION

- The landing gear will retract only if hydraulic pressure and electrical power are available.
- Do not use emergency override switch to raise landing gear lever in flight.

If nose gear torque link is broken, normal gear retraction will not occur. Subsequent use of override switch to effect retraction may cause nose wheel to bind in wheel well.

TWO ENGINE FAILURE DURING TAKEOFF (AFTER AIRBORNE)

If both engines fail immediately after becoming airborne and altitude precludes the possibility of an airstart or ejection, maintain aircraft

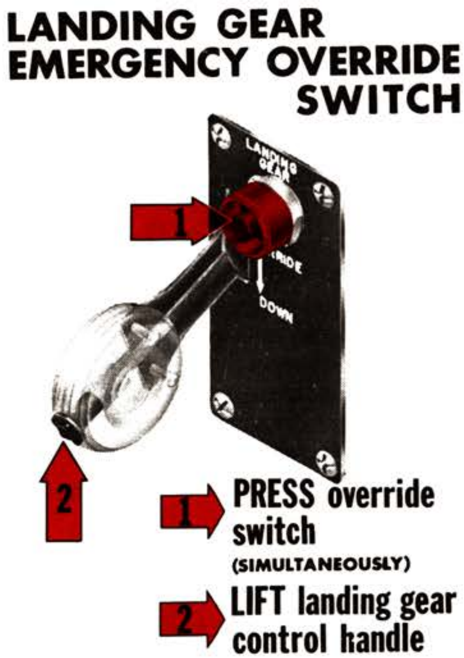


Figure 3-1

control and land straight ahead turning only as necessary to avoid obstructions. The following procedure should be used:

1. GLIDE - 100 KNOTS IAS MINIMUM.
2. LANDING GEAR - DOWN.
3. THROTTLES - CUT-OFF.

If Time Permits:

4. Fuel shutoff "T" handles - PULL OFF.
5. Battery - OFF.

Note

To afford protection against explosion, heat, or fire, the canopy should be retained during crash landing. After landing, normal canopy opening should be attempted prior to jettisoning the canopy.

FLIGHT CHARACTERISTICS UNDER PARTIAL POWER CONDITIONS

Single-engine operation in this aircraft introduces a very small amount of yaw and out-of-trim effect because both engines are mounted close to the center of the aircraft. Aircraft flight controls provide adequate directional control during single-engine operation. Rudder trim may not be adequate to relieve all rudder force required to maintain wings-level constant-heading flight.

Figure 3-2

WARNING

It is imperative for the pilot to realize that with full flaps the aircraft will not accelerate or climb during single-engine operation until the flaps are retracted to 50% or less. Flaps may be raised to 50% at any flying airspeed with very little loss of lift and a large reduction in drag. Any time a single-engine situation is encountered (engine failure on takeoff) or anticipated (engine fire or overheat on takeoff) with full flaps extended, flaps should be raised to 50% immediately.

Note

- Retracting the landing gear will increase the rate of climb approximately 150 feet per minute.
- Best single-engine climb speed for best angle of climb - 125 knots IAS.
  Best single-engine climb speed for best rate-of-climb is 160 knots IAS at sea level. (Minus 1 knot per 1000 feet.)

ONE ENGINE FAILURE, FIRE OR OVERHEAT DURING TAKEOFF (AFTER AIRBORNE)

If an engine fails immediately after takeoff, the decision to continue depends upon airspeed, altitude, and length of runway remaining. If the decision is made to abort, check landing gear down, land the aircraft and follow ABORT procedures. If the decision is made to continue, it is imperative that the gear and flaps be raised as soon as possible. Rate-of-climb with one engine inoperative will be slower, depending on such conditions as air density, gross weight, and configuration. Proceed as follows:

1. FLAPS - 50%.
2. LANDING GEAR - UP.
3. FLAPS-UP (MINIMUM 100 KNOTS IAS).
4. If a fire or overheat condition exists, proceed as covered elsewhere in this section.
5. Maintain a positive rate-of-climb and accelerate to 125 knots IAS.
6. Attempt airstart if warranted at safe altitude.

IF AN AIRSTART ATTEMPT IS UNWARRANTED

7. Throttle (Dead Engine) - CUT- OFF.
8. Fuel shutoff "T" handle (Dead Engine) - PULL OFF. Land as soon as conditions permit using single-engine procedures.

INFLIGHT

ENGINE FAILURE

Engine failure can be detected by a sudden loss in engine exhaust gas temperature accompanied by a sudden loss of thrust. Fluctuating rpm, fuel flow indications, and exhaust gas temperature indicate erratic fuel flow to the engines which often precede engine failure, thus giving the pilot prior warning. When time and altitude permit, airstarts can be successfully accomplished providing fuel supply to the engines is sufficient for normal operation, and no mechanical defects exist which make normal operation hazardous. The fuel flowmeters will provide a visual indication if fuel flow is steady or unstable.

ONE ENGINE FAILURE DURING FLIGHT

If an engine fails in flight, try to determine cause of failure before attempting to restart the engine and continue as follows:

1. Throttle (Dead Engine) - CUT-OFF.
2. Speed Brake, landing gear, and flaps - UP.
3. Airstart - ATTEMPT (if warranted).

If airstart attempt is unsuccessful or deemed inadvisable, proceed with single-engine flight and land as soon as conditions permit using single-engine landing procedures. If an attempted airstart is unwarranted:

4. Fuel shutoff "T" handle --PULL-OFF.

Refer to Appendix I for single-engine performance data.

TWO ENGINE FAILURE DURING FLIGHT

1. THROTTLES - CUT-OFF.
2. GLIDE - 125 KNOTS IAS.
3. SPEED BRAKE, LANDING GEAR, AND FLAPS - UP.
4. AIRSTART - ATTEMPT (IF WARRANTED).

IF AN ATTEMPTED AIRSTART IS UNWARRANTED:

5. Fuel shutoff "T" handle - PULL-OFF.

Refer to forced landing in this section.

ENGINE FIRE AND OVERHEAT

A steady red light in the center of either fuel shutoff "T" handle indicates fire forward of the fireseal in the nacelle of the corresponding engine. A flashing red light in the center of either fuel shutoff "T" handle indicates an overheat or fire condition aft of the fireseal in the nacelle of the corresponding engine.

Note

It is possible the warning system may malfunction and give an erroneous indication. If there is a fire or an overheat condition, it is generally supported by other indications. Fire or overheat is generally accompanied by one or more of the following indications: Excessive exhaust gas temperature, erratic engine operation, roughness, fluctuating fuel flow, visual indications such as smoke in the cockpit or smoke trailing behind the aircraft. If the aircraft is being flown solo, the mirror on the right side can be used as an aid in detecting smoke from the right engine. Any time the warning lights illuminate, attempt to verify the condition by other indications before abandoning the aircraft.

ENGINE FIRE DURING FLIGHT

(Forward Engine Compartment - Steady Light).

If a fire detect warning light illuminates during flight, proceed as follows:

1. FUEL SHUTOFF "T" HANDLE (AFFECTED ENGINE) - PULL-OFF.
2. THROTTLE (AFFECTED ENGINE) - CUT-OFF.

If the warning light goes out and no evidence of fire exists proceed to the nearest base and land as soon as conditions permit. Do not attempt to restart. After engine shutdown, attempt to verify the presence of fire by checking for other indications such as smoke in cockpit, nacelle smoke or smoke trailing behind the aircraft or verification from ground or another aircraft. If corrective action has not extinguised the fire, EJECT.

Note

If fire detect warning light extinguishes after remedial action, actuate test circuit to determine if circuit is still functional. If test circuit fails to illuminate light, continue investigation for actual fire.

OVERHEAT WARNING DURING FLIGHT

(Aft Engine Compartment - Flashing Light.)

If an overheat warning light illuminates during flight, proceed as follows:

1. THROTTLE (AFFECTED ENGINE) - RETARD.

If the light goes out and no evidence of fire exists, proceed on reduced power and land as soon as conditions permit. If the overheat light does not go out, shutdown affected engine as follows:

2. FUEL SHUTOFF "T" HANDLE (AFFECTED ENGINE) - PULL-OFF.
3. THROTTLE (AFFECTED ENGINE) - CUT-OFF.

WARNING

If the warning light stops flashing, indicating the overheat condition has been alleviated, land as soon as conditions permit. If the warning light continues to flash after engine shutdown, indicating possible fire rather than overheat, proceed as stated in the procedure for Engine Fire During Flight.

Note

If fire detect warning light extinguishes after remedial action, actuate test circuit to determine if circuit is still functional. If test circuit fails to illuminate light, continue investigation for actual fire.

FUSELAGE, WING, OR ELECTRICAL FIRE

If fuselage, wing, or electrical fire occurs, turn off all electrical equipment. If fire continues out of control, determine if altitude permits and eject. If ejection is impossible, land the aircraft as soon as conditions permit.

SMOKE AND FUME ELIMINATION

In the event smoke or fumes enter the cockpit during flight, the following procedure should be used:

1. OXYGEN DILUTER LEVER - 100% OXYGEN.
2. CHECK FOR PRESENCE OF FIRE.
3. BATTERY AND GENERATORS - OFF.

Note

- Turn both the battery and generator switches OFF until it is determined the smoke is not caused by a short in the electrical system.
- If battery and generators must be left off and instrument flying must be continued, switch to spare inverter. AC

power will be supplied to the attitude indicator and on aircraft ▲8 primary flight instrument lights.

4. Hot air "T" handle - PUSH CLOSED. ▲1
5. Cockpit air lever - VENT. ▲2
6. Canopy jettison "T" handle - PULL (if necessary).

If smoke is severe and continued flight is anticipated, jettison canopy if necessary.

CAUTION

Smoke may be encountered in the cockpit after negative "G" flights due to oil siphoning from the engines. A landing should be made as soon as conditions permit in order to check the oil level and identify the source of the smoke.

ENGINE RESTART DURING FLIGHT

All airstart attempts should be made at an altitude of 20,000 feet or below.

CAUTION

Prior to attempting an airstart observe tachometer for engine windmilling. If there is no indication of windmilling, the engine may have seized and no attempt should be made to restart until a windmilling indication is noted.

Following is the procedure to be accomplished when airstarting a dead engine.

1. Throttle (Dead Engine) - CUT-OFF.

Note

Use instructor's throttles when attempting a restart in order to have cut-off feature available.

2. Fuel shutoff "T" handle - PUSH ON.
3. Fuel system - EMERGENCY.
4. Fuselage tank fuel boost pump - ON.
5. Inverter - MAIN or SPARE.
6. Battery - ON.
7. Cockpit air lever - VENT ▲2.
8. Hot air "T" handle - PUSH CLOSED ▲1.

Step 7 or 8 required to prevent fuel fumes from entering the cockpit during engine starting.

9. Starter switch - GND and hold 30% rpm and below. If rpm is above 30%, allow the engine to windmill below 30% rpm before attempting restart.
10. Ignition - ON and HOLD.
11. Throttle - IDLE.

Note

A start will not occur immediately. RPM may drop as low as 12% before signs of a start are observed.

12. Exhaust gas temperature - MONITOR. The first indication of a start is a rise in exhaust gas temperature.
13. Starter and ignition - RELEASE at 30% rpm.
14. Throttle - As required when rpm stabilizes.
15. Engine instruments - CHECK.

IF STARTING ATTEMPT WAS UNSUCCESSFUL

16. Electrical load - REDUCE.
17. Attempt another start if warranted.

ENGINE RESTART - LOW ALTITUDE

If sufficient time is not available to accomplish the procedures described in Engine Restart During Flight, the following procedure should be used:

1. STARTER - AIR POSITION, 16% RPM OR ABOVE.
2. PLACE THE FUEL SYSTEM SWITCH TO EMERGENCY AND DO NOT RETURN IT TO NORMAL FOR REMAINDER OF FLIGHT.

IF RPM DROPS BELOW 16%.

3. STARTER AND IGNITION - GND - ON AND HOLD SIMULTANEOUSLY UNTIL RPM REACHES 30% RPM.

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302
▲2 Aircraft 55-4302 and 56-3492 and on
▲8 Aircraft 58-1861 and on

WARNING

Throttle(s) must be in the operating range to accomplish an airstart.

MAXIMUM GLIDE.

For the maximum distance this aircraft will glide with clean configuration, both engines windmilling, refer to Figure 3-3. During descents from altitude at the airspeed necessary for maximum glide, engine windmilling speed will be below the required rpm necessary to maintain pressure in the hydraulic system. Hydraulic pressure may be increased by positioning the engine starter switch to the GND position.

EJECTION VS FORCED LANDING

Normally, ejection is the best course of action in the event both engines flameout (windmilling or frozen), or positive control of the aircraft cannot be maintained. Because of the many variables encountered, the final decision to attempt a flameout landing or to eject must remain with the pilot. It is impossible to establish a pre-determined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed below, combined with the pilot's analysis of the condition of the aircraft, type of emergency, and his proficiency are the prime importance in determining whether to attempt a flameout landing or to eject. These variables make a quick and accurate decision difficult. If the decision is made to eject, prior to ejection, if possible, the pilot should attempt to turn the aircraft toward an area where injury or damage to persons or property on the ground or water is least likely to occur. Before a decision is made to attempt a flameout landing, the following basic conditions should exist.

a. Flameout landing should only be attempted by pilots who have satisfactorily completed simulated flameout approaches in the aircraft.

b. Flameout landing should only be attempted on a prepared or designated suitable surface.

c. Approaches to the runway should be clear and should not present a problem during flameout approach.

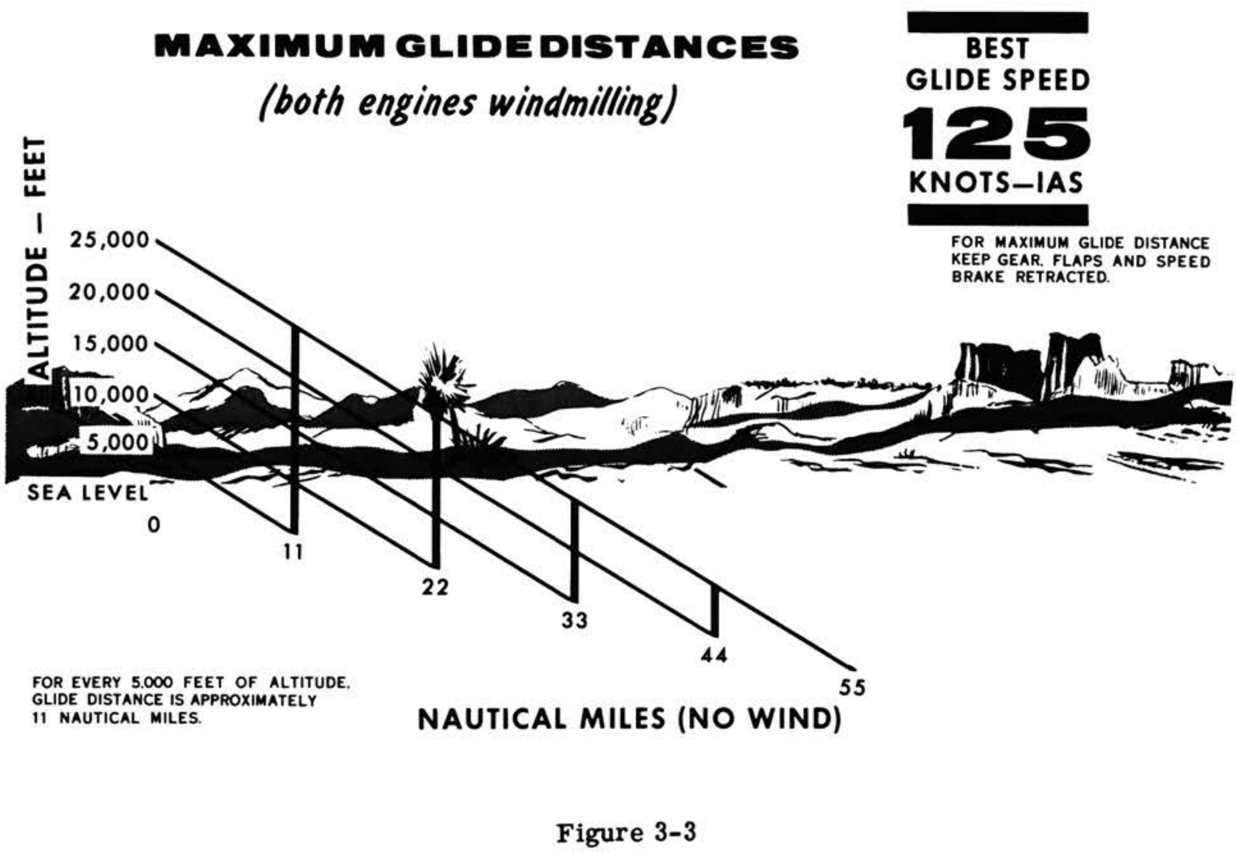


Figure 3-3

Note

No attempt should be made to land a flamed out aircraft at any field where approaches are over heavily populated areas. If possible, prior to ejection, the pilot should attempt to turn the aircraft toward an area where injury or damage to persons or property on the ground or water is least likely to occur.

d. Weather and terrain conditions must be favorable. Cloud cover, visibility, turbulence, surface wind, etc., must not impede in any manner the establishment of proper flameout landing pattern.

Note

Night flameout landings or flameout landings under poor lighting conditions, such as at dusk or dawn should not be contemplated regardless of weather or field lighting.

e. Flameout landings should only be attempted when either a satisfactory "High Key" or "Low Key" position can be achieved.

f. If at anytime during the flameout approach conditions do not appear ideal for successful completion of the landing, ejection should be accomplished. EJECT no later than the "Low Key" altitude.

AIRSTART ATTEMPTS DURING FLAMEOUT LANDING PATTERN

In the event of a double engine flameout:

a. Attempt to complete all airstart efforts before high key is reached so that full attention may be devoted to accomplishing a successful flameout landing.

b. If the circumstances of flameout have precluded conclusive airstart attempts prior to high key, further airstarts may be attempted but primary attention should be devoted to proper execution of the flameout landing.

FORCED LANDING (NO POWER)

In the event both engines flameout during flight and airstarts are unsuccessful or not deemed advisable and the pilot does not elect to eject, the following should be accomplished. See Figure 3-3, Maximum Glide Distances, and Figure 3-4, Typical Forced Landing Pattern.

1. Establish glide - 125 KNOTS IAS.
   The landing gear, wing flaps, and speed brake may be raised, if necessary, to increase maximum glide distance.
2. Landing gear - DOWN.
   The landing gear should be lowered over the field or at high key. Airspeed 120 knots IAS after landing gear is down.

Note

- Emergency landings shall be made with any landing gear extended. This also applies to overshooting or undershooting prepared runways when touchdowns cannot be avoided.
- If helmet is equipped with a visor, the visor should be in the down position to decrease the possibility of injury.
- For a simulated forced landing, lower speed brake and adjust throttles to 65% rpm. When landing gear is lowered, readjust throttles to 55% rpm.

3. Throttles - CUT-OFF.
4. Fuel shutoff "T" handles - PULL-OFF.
5. Zero delay lanyard - HOOKED UP.
6. Shoulder harness - LOCK.
7. Battery and generators - OFF.

Note

- The forced landing pattern should be planned as a no-flap pattern, as hydraulic pressure may not be available to lower flaps. To prevent landing long, if the engines are not seized, flaps may be lowered by motoring an engine with the starter switch and increasing hydraulic pressure.
- An airspeed of 120 knots IAS during the forced landing pattern provides the optimum glide speed for that configuration. Any deviation from 120 knots will result in an increased rate of descent.

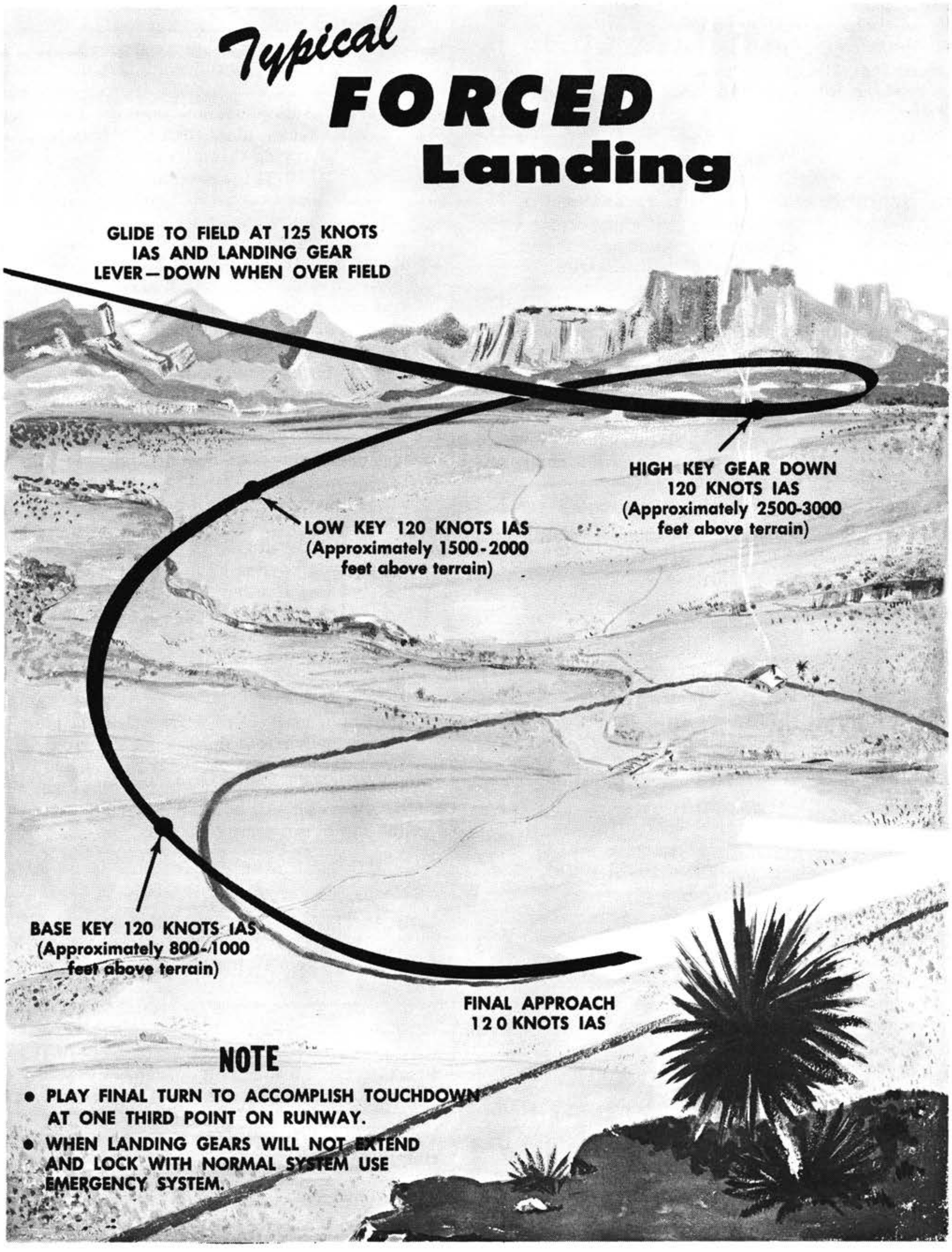

Typical
FORCED
Landing
GLIDE TO FIELD AT 125 KNOTS IAS AND LANDING GEAR LEVER—DOWN WHEN OVER FIELD
HIGH KEY GEAR DOWN 120 KNOTS IAS (Approximately 2500-3000 feet above terrain)
LOW KEY 120 KNOTS IAS (Approximately 1500-2000 feet above terrain)
BASE KEY 120 KNOTS IAS (Approximately 800-1000 feet above terrain)
FINAL APPROACH 120 KNOTS IAS
NOTE
• PLAY FINAL TURN TO ACCOMPLISH TOUCHDOWN AT ONE THIRD POINT ON RUNWAY.
• WHEN LANDING GEARS WILL NOT EXTEND AND LOCK WITH NORMAL SYSTEM USE EMERGENCY SYSTEM.

Figure 3-4

- The base key position can be adjusted to compensate for excess altitude in the pattern. If additional altitude must be lost, a slip is recommended. Full rudder deflection may be used.

WARNING

Retention of the canopy is recommended during a forced landing. It will afford protection against fire, smoke, flying objects, and barrier cables or wires. The inability to open the canopy by electrical means, manual means, or by jettisoning is remote. Normal canopy opening should be attempted before jettisoning.

CAUTION

Directional control must be maintained by use of wheel brake only, as nose wheel steering will not be available when making a forced landing with both engines inoperative.

EJECTION

The following information should be observed when ejection must be accomplished:

1. UNDER LEVEL FLIGHT CONDITIONS, EJECT AT LEAST 2000 FEET ABOVE THE TERRAIN WHENEVER POSSIBLE.

WARNING

Do not delay ejection below 2000 feet above the terrain in futile attempts to start the engine or for other reasons that may commit you to an unsafe ejection or a dangerous flameout landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.

2. UNDER SPIN OR DIVE CONDITIONS, EJECT AT LEAST 10,000 FEET ABOVE THE TERRAIN WHENEVER POSSIBLE.
3. Attempt to slow the aircraft as much as practicable prior to ejection by trading airspeed for altitude.
   a. Below 120 KIAS, airflow is insufficient to affect rapid parachute deployment. Therefore, it becomes extremely important during low altitude ejection to obtain at least 120 KIAS, if possible, to assure more rapid parachute deployment.
   b. During high altitude ejection, observing this minimum airspeed (120 KIAS) becomes less important since time (altitude) for parachute deployment is a much less important factor.
4. If the aircraft is not controllable, ejection must be accomplished at whatever speed exists, as this offers the only opportunity for survival. At sea level wind blast will exert minor forces on the body up to about 525 knots IAS, appreciable forces from about 525 to 600 knots IAS and excessive forces above about 600 knots IAS. As altitude is increased, these speed ranges will be proportionately lower.
5. The automatic safety belt must not be opened manually before ejection, regardless of altitude. If the automatic seat belt is opened manually, the automatic opening feature of the parachute is eliminated and seat separation may be too rapid at high speeds.

Note

Improper routing of personal leads may cause inadvertent opening of the lap belt latch during ejection. Care must be taken to insure that flight clothing, such as sleeves, will not catch and release the lap belt during ejection.

LOW ALTITUDE EJECTION

During any low altitude ejection, the chances for successful ejection can be greatly increased by zooming the aircraft (if airspeed permits) to exchange airspeed for altitude. Ejection should be accomplished while the airplane is in a wings level climb at a minimum airspeed of 120 knots. This will result in a more nearly vertical trajectory for the seat and crew member thus providing more altitude and time for seat separation and parachute deployment.

Emergency Minimum Ejection Altitudes

BA-15 or BA-18 Back Pack/C-9 Canopy

1. With F-1B Timer (1 Second Parachute)
   200 Feet
2. With Zero Delay Lanyard Connected to Parachute Ripcord Handle (0 Second Parachute)
   100 Feet

WARNING

Emergency minimum ejection altitudes quoted were determined through extensive flight tests and are based on distance above terrain on initiation of seat ejection (i.e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude above the terrain that must be achieved in the event of such low-altitude emergencies as fire on takeoff. They must not be used as the basis for delaying ejection when above 2000 feet, since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2000 feet. Therefore, whenever possible, eject above 2000 feet. To ensure survival during extremely low-altitude ejections, the automatic features of the equipment must be used and relied upon.

ZERO DELAY LANYARD CONNECTION REQUIREMENTS

The zero delay parachute lanyard will be connected and disconnected as follows:

1. Connect prior to takeoff.
2. Leave connected at all times below 10,000 feet pressure altitude including flights in which 10,000 feet may be temporarily exceeded.
3. Disconnect after passing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.
4. Connect prior to initial penetration, or prior to 10,000 feet pressure altitude during enroute descent.
5. When ejecting under controlled conditions and at more than 2000 feet above ground level, disconnect the zero delay lanyard.

Note

If operating above terrain over 8000 feet high, the zero delay lanyard should remain connected until the aircraft is at least 2000 feet above the terrain.

EJECTION IF CANOPY FAILS TO JETTISON

If the canopy does not jettison when the seat arming handles are raised, an attempt should be made to release the canopy by pulling the canopy jettison "T" handle, or positioning the canopy downlock lever in the OPEN position and pulling the canopy de-clutch handle. If the canopy cannot be jettisoned by any of the above procedures, the seat can be ejected through the canopy; however, this should be a last resort method and should only be attempted after all manual or electrical attempts at opening the canopy have failed. On aircraft ⚠, the canopy cannot be opened electrically with the canopy switch.

BAILOUT IF SEAT FAILS TO EJECT.

If ejection seat fails to eject when the trigger in the right arming handle is squeezed, a manual bail out will be required. Proceed as follows:

1. Reduce airspeed as much as practicable.
2. Release safety belt, shoulder harness, radio and oxygen connections.
3. If aircraft is controllable, trim full nose down and apply back pressure to attain a nose high attitude.
4. Roll aircraft to an inverted wings level position while maintaining a positive "G" load.
5. Abruptly release stick and push free.
6. If aircraft is not controllable, bail out by diving over the trailing edge of the wing.
7. a. If above 14,000 feet, pull the parachute arming lanyard knob.
   b. If below 14,000 feet, pull parachute ripcord handle.

WARNING

After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

⚠ Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

EJECTION PROCEDURE

BEFORE EJECTION IF TIME AND CONDITIONS PERMIT:

1. Notify appropriate ground agency of ejection (include type of aircraft, number of occupants, location, and altitude).
2. Stow all loose equipment.
3. Actuate bailout oxygen bottle.
4. Attain proper airspeed, altitude, and attitude.
5. Pull helmet visor down.

EJECTION

1. LIFT ARMING HANDLES.
2. ATTAIN CORRECT BODY POSITION
   Place feet firmly on floor, sit errect with head hard against head rest and chin tucked in.
3. SQUEEZE SEAT EJECTION TRIGGER.
4. IMMEDIATELY AFTER EJECTION, ATTEMPT TO OPEN THE SEAT BELT.
5. PUSH AWAY FROM EJECTION SEAT.
6. BELOW 14,000 FEET, PULL PARACHUTE RIPCORD HANDLE.

AFTER EJECTION

1. If automatic seat belt fails, automatic features of parachute will be lost. Open seat belt manually.
   a. If above 14,000 feet, pull the parachute arming lanyard knob.
   b. If below 14,000 feet, pull parachute ripcord handle.
2. If automatic seat belt operates properly and parachute arming lanyard is connected, parachute will open one second after seat separation if below 14,000 feet or one second after passing 14,000 feet if ejection occurs above that altitude.

Figure 3-5

STRUCTURAL DAMAGE

If structural damage occurs in flight, the pilot must decide whether to leave the aircraft or attempt a landing. If aircraft is controllable, proceed as follows:

1. Notify appropriate ground agency of intentions.
2. Climb to 10,000 feet above terrain at a controllable airspeed.
3. Simulate a landing approach (normally a straight-in approach).

WARNING

In no case allow airspeed to decrease below 90 knots IAS.

4. Determine airspeed at which aircraft becomes difficult to control.

Note

If aircraft becomes difficult to control or approaches a stall, lower the nose and increase power for recover. Maximum reccommended airspeed for touchdown is 130 knots IAS with no flaps.

5. Abandon aircraft if not controllable at 130 knots IAS or below.
6. Airspeed - 20 knots IAS above minimum or controllable airspeed during descent and landing.
7. Traffic pattern - Fly a straight-in approach.

NOSE ACCESS DOOR OPENING IN FLIGHT (HIGH AIRSPEED)

The opening of an unlatched or improperly adjusted nose access door is related to the angle of attack of the aircraft. Nose access door openings have occurred at high angle of attack with both low and high airspeeds. Openings have also occurred during takeoffs, approaches, and landings. If nose access door comes open at high airspeed:

1. THROTTLES - IDLE
2. SPEED BRAKE - OUT.
3. ESTABLISH LEVEL FLIGHT ATTITUDE.

CAUTION

If nose access door opens at high airspeed, severe buffeting and structural damage may occur. The aircraft speed should be reduced as rapidly as possible without pulling G's as an increased angle of attack will cause the door to open wider.

If the door closes then begins to open again as speed is reduced:

1. Maintain an airspeed at which the door will remain closed.
2. Avoid any abrupt changes in pitch attitude.
3. Airspeed - 20 to 30 knots IAS above normal final approach speed.
4. Land as soon as conditions permit.

Experience indicates that the door will probably begin to open at 120 to 130 knots IAS as airspeed is decreased and will be fully open at 90 knots IAS. Use a straight-in approach with gentle turns and smooth control techniques. Fly the aircraft down very close to the runway. Do not attempt to spike the aircraft on the runway and do not allow the aircraft to balloon.

ON TAKEOFF

If the nose access door opens on takeoff, the takeoff should be aborted if sufficient runway remains. If takeoff is continued, maintain an airspeed that will keep the door closed and land as soon as conditions permit using procedures described above.

CANOPY UNLOCKED DURING FLIGHT ⚠

If the canopy was not locked prior to takeoff, the canopy will begin to open shortly after takeoff, and may separate from the aircraft if airspeed is allowed to increase. If the canopy not-locked warning light is observed to be illuminated during flight, or it is obvious the canopy is not properly locked or opening during flight, the following procedure will apply:

1. SLOW TO 100 KNOTS IAS WHILE AVOIDING ABRUPT PITCH CHANGES.

Note

Speed brake should not be lowered to reduce airspeed. Retard throttles slowly to reduce airspeed without making abrupt pitch changes.

2. Make a straight-in approach (maintain 100 knots IAS) using shallow turns and land as soon as conditions permit.

WARNING

Avoid flying over populated areas.

⚠ Aircraft 54-2729 thru 64-13441 except when modified per T.O. 1T-37-540

CAUTION

Do not touch canopy downlock handle until landing roll is completed.

Note

The internal canopy switch is inoperative unless the canopy downlock handle is in the UNLOCK position.

CANOPY UNLOCKED DURING FLIGHT ⚠

If the canopy-not-locked warning light is observed to be illuminated during flight, or it is obvious the canopy is not properly locked during flight, proceed as follows:

1. SLOW TO 100 KNOTS IAS WHILE AVOIDING ABRUPT PITCH CHANGES.

Note

Speed brake should not be lowered to reduce airspeed. Retard throttles slowly to reduce airspeed without making abrupt pitch changes.

2. Canopy control switch - EXTERNAL

   Access to this switch in flight is through the zippered opening in the canopy de-clutch "T" handle.

3. Make a straight-in approach (maintain 100 knots IAS) using shallow turns and land as soon as conditions permit.

WARNING

Avoid flying over populated areas.

CAUTION

Do not touch canopy downlock handle until landing roll is complete.

Note

During flight, the internal canopy control switch is inoperative. After landing is complete, the canopy control switch must be positioned to INTERNAL to open the canopy.

⚠ Aircraft 64-13442 and on and aircraft modified per T.O. 1T-37-540

LOSS OF CANOPY IN FLIGHT

1. MAKE A STRAIGHT-IN APPROACH MAINTAINING A MINIMUM OF 110 KNOTS IAS ON FINAL.

RUNAWAY TRIM

1. THROTTLE AND SPEED BRAKE - AS NECESSARY.
2. AIRSPEED - 110 TO 150 KNOTS IAS.

Note

If the nose has pitched up to a dangerous attitude, add power and roll the aircraft into a banked attitude to bring the aircraft back to level flight.

3. Attempt use of trim button on opposite control stick. If trim is regained, do not use trim again unless the extreme condition recurs.

4. Land as soon as conditions permit.

ERRATIC TRIM TAB FLUCTUATION

If the trim tab fluctuates from stop to stop, accomplish the procedure for runaway trim and attempt to turn off battery and generator switches at a position as near neutral trim as possible. After the aircraft is under control, pull the trim circuit breaker and turn battery and generator switches back on.

LANDING

LANDING WITH ONE ENGINE INOPERATIVE

Single-engine landings can be made using procedures similar to those used for two-engine operation. Careful planning should be used to make the first attempt successful, since recovery from an aborted landing with single-engine power requires more time and distance. Turns should be more shallow than normal. The normal overhead pattern should be flown, except 50% flap setting should be used. The speed brake should not be used until on final approach and landing is assured. The airspeed on final approach should be 110 knots IAS. Full flaps may be used to prevent landing long.

WARNING

When landing with one engine inoperative the time for actuating of hydraulic components will be noticeably longer due to single-engine operation and reduced power.

CAUTION

If porpoising occurs upon touchdown, do not increase power on good engine because the unequal thrust will make directional control difficult. Position and hold controls to establish normal landing attitude. Do not attempt to counteract each bounce with opposite stick movement.

GO-AROUND WITH ONE ENGINE INOPERATIVE

WARNING

The chances for a successful single-engine go-around are greatly increased if an early decision is made to go-around.

1. THROTTLE - 100%.
2. SPEED BRAKE - IN.

WARNING

It is imperative the speed brake be retracted.

3. WING FLAPS - 50%.

WARNING

Go-around with full flaps is not possible; 50% flaps is permissible.

4. LANDING GEAR - UP.
   Raise the landing gear only after you ascertain that touchdown will not occur.
5. WING FLAPS - UP AT 100 KNOTS IAS MINIMUM.

HYDRAULIC POWER SUPPLY SYSTEM FAILURE

Hydraulic system failure will be indicated by a loss of pressure on the hydraulic pressure indicator. As soon as hydraulic system failure is detected during flight, a landing should be made as soon as conditions permit. If a complete hydraulic failure occurs, the flaps, speed brake, spoilers, thrust attenuators, and nose wheel steering will be inoperative. Landing gear extension will have to be made by using the emergency air system.

LANDING GEAR EMERGENCY EXTENSION

In case of a complete hydraulic system failure, the landing gear can be lowered with the emergency system as follows:

1. Airspeed - 150 Knots IAS or below.
2. Landing gear - DOWN.

Note

If landing gear lever will not lower, attain sufficient altitude and lower both levers simultaneously while maintaining slight negative "G's".

3. Landing gear emergency "T" handle - TURN, PULL, and HOLD until all gear indicate DOWN and LOCKED. Turn handle in direction shown by arrow. (See Figure 3-6.)

CAUTION

- Do not pull emergency landing gear "T" handle unless landing gear lever is in the down position. Damage to landing gear and aircraft may result.

- To prevent rupturing of the hydraulic reservoir, do not attempt to recycle landing gear after actuating emergency system. Rupturing of hydraulic reservoir could result in an inflight fire.

A malfunction of one of the main gear door sequencing switches could result with the main gear door open and the landing gear remaining retracted. The affected landing gear may be extended by pulling the gear retract circuit breaker. Gear position indicators should be checked for a down and locked indication.

Landing Gear Emergency "T" Handle

Figure 3-6

Note

If any type of landing gear malfunction occurs, and the landing gear is subsequently lowered by either normal or emergency methods, leave the landing gear extended and land as soon as conditions permit.

LANDING WITH A GEAR MALFUNCTION

If a condition exists in which one or more landing gear remains up or unlocked, make a straight-in approach with whatever landing gear can be extended or partially extended and proceed as follows:

WARNING

If time permits, have runway foamed to reduce possible damage to the aircraft and fire hazard.

1. Seat arming handles safety pin - INSTALLED.
2. Shoulder harness - LOCK.
3. Wing flaps - DOWN.

4. Speed brake - OUT.

Before contact with the ground:
5. Throttles - CUT-OFF.
6. Fuel shutoff "T" handles - PULL OFF.
7. Battery - OFF.

WARNING

Retention of the canopy is recommended. It will afford protection against fire, smoke, flying objects, and berrier cables and wires. The pilot may clear the aircraft by use of the canopy declutch T-handle, the canopy breaker tool, or the canopy jettison handle.

Note

- If a nose gear malfunction occurs, holding it off the runway can be aided by trimming the elevator full nose down. Do not use brakes until the nose wheel is on the runway and then only as necessary to maintain directional control.
- If a main gear malfunction occurs, land on the side of the runway corresponding to the extended gear. Hold retracted or unlocked gear off as long as possible. Use brake on lowered gear to maintain directional control.
- If both main gears are retracted or unsafe, land on foamed runway if possible using rudder for directional control.

DITCHING

Eject rather than ditch this aircraft. All emergency survival equipment is carried by the pilot, consequently, there is no advantage of staying with the aircraft.

LANDING WITH A FLAT TIRE

If a flat tire occurs on takeoff with insufficient runway remaining to abort, leave landing gear extended and land as soon as conditions permit. If nose tire is flat, hold nose gear off the runway until just prior to losing elevator control. After touchdown, trim elevator full nose down to assist holding nose tire off runway. Use nose wheel steering and brakes for directional control. With one main tire flat, land on the side of the runway corresponding to the good tire. Use brakes and nose wheel steering for directional control.

ASYMMETRICAL FLAP CONDITION

Attempt to correct an asymmetrical flap condition by reversing the wing flap lever. If it is not possible to eliminate an asymmetrical flap condition, use rudder and ailerons as necessary to maintain aircraft control and land as soon as conditions permit from a straight-in approach maintaining a minimum of 110 knots IAS on final.

WHEEL BRAKE FAILURE

When making a landing with a wheel brake inoperative, land on the side of the runway corresponding to the inoperative brake.

Note

Each brake master cylinder is independent. In case of wheel brake failure (during dual flight) check both sets of brake pedals.

After touchdown, use nose wheel steering and the good brake to maintain directional control and stop the aircraft. If both wheel brakes fail, use maximum aerodynamic braking upon landing. Nose wheel steering may be used for short radius turns into taxiways or other suitable areas if runway is of insufficient length. As a last resort, in the event of imminent contact with obstructions, press the emergency override switch and raise the landing gear lever to the UP position.

WARNING

Avoid contacting raised barriers.

MISCELLANEOUS

ILLUMINATED FUSELAGE TANK FUEL BOOST PUMP WARNING LIGHT DURING FLIGHT

If the fuselage tank fuel boost pump warning light light illuminates during normal flight, place fuel system switch to EMERGENCY. Do not perform the nagative "G's" or inverted flight maneuvers. Land as soon as conditions permit.

NOTE

The fuselage tank fuel boost pump warning

EMERGENCY ENTRANCE

WARNING

WHEN JETTISONED. THE CANOPY WILL FALL IN THE IMMEDIATE AREA AFT OF THE AIRPLANE.

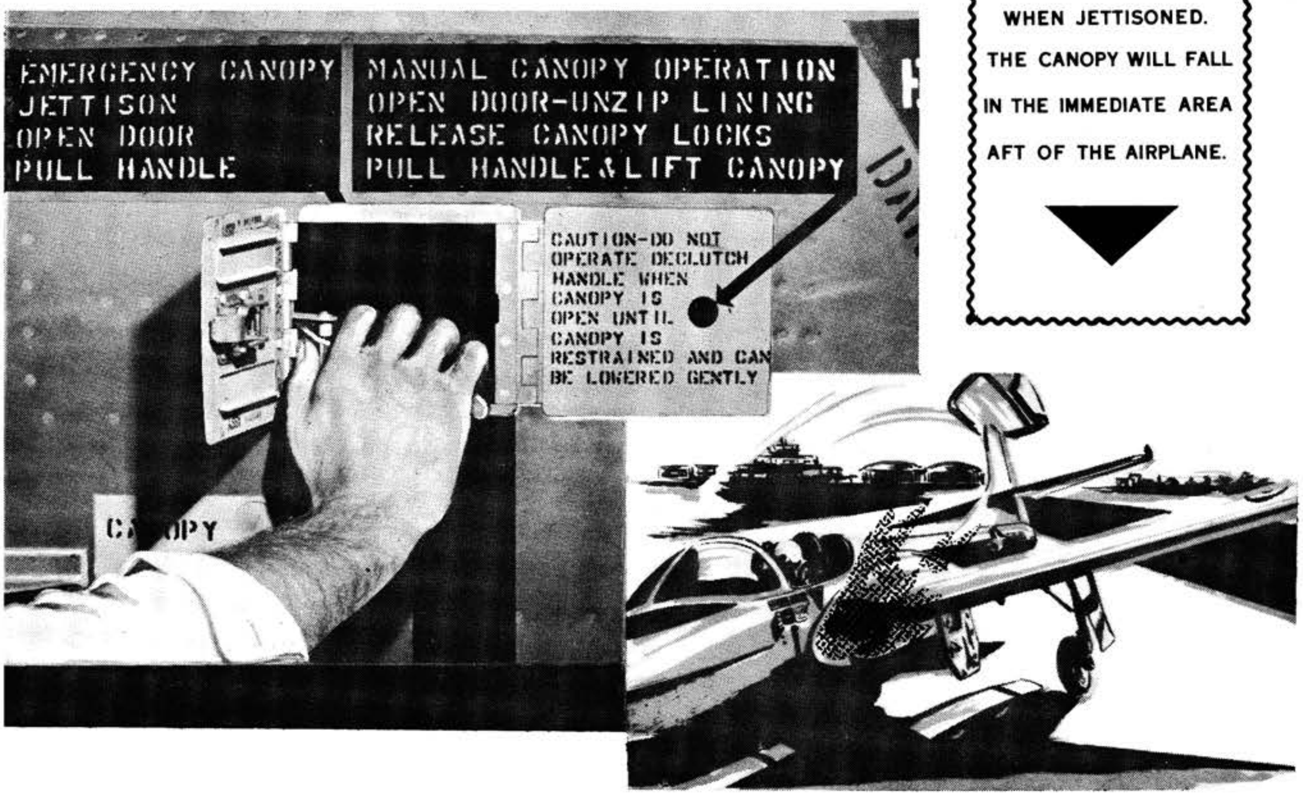


Figure 3-7

light may flicker momentarily near zero "G" conditions due to a momentary lack of fuel at the fuselage tank fuel boost pump inlet.

COMPLETE ELECTRICAL FAILURE

Complete electrical failure is evidenced by a zero reading from both loadmeters and failure of all electrically operated equipment. This condition primarily arises because of failure of the generators. If failure of the generators is not detected, the battery will not support the heavy load required for normal flight. A frequent check of the loadmeter readings, especially during night flights is good insurance. Complete electrical failure will render all electrical equipment inoperative. The important things to remember are:

1. All electrical indicators and warning systems will be inoperative.
2. Neither the lights nor any of the radios will operate.
3. Speed brake, spoilers, thrust attenuators and nose wheel steering cannot be operated.
4. Fuel system will automatically be on emergency gravity feed system.
5. Trim tabs will remain as set prior to electrical failure. A landing should be made as soon as conditions permit.

Note

With a complete electrical failure the flaps will be operative but the flap position indicator will be inoperative.

WARNING

Instrument flying is impossible, because all radio communication equipment and essential flight instruments will be inoperative.

If conditions require the battery and generator switches to be left off and instrument flying must be continued, switch to spare inverter, AC power will be supplied to the attitude indicator and on aircraft [8], the primary flight instrument lights.

GENERATOR FAILURE

If both generators fail and battery power is still available, turn off all non-essential electrical equipment to conserve battery and land as soon as conditions permit.

INVERTER FAILURE

Inverter failure can be detected by observing the instruments receiving AC power. (See Figure 1-13). If the attitude indicator, heading indicator, fuel quantity gage, or fuel flowmeters cease to function, place the inverter switch in the SPARE position.

HIGH LOADMETER READING

Continued operation at idle or battery engine starts may result in loadmeter reading above 0.5. If one or both loadmeters show a reading above 0.8 during first 10 minutes of flight or 0.5 thereafter, proceed as follows:

1. Battery - OFF.
2. Loadmeter - CHECK.
   If loadmeter returns to normal, battery is faulty. Leave battery switch OFF and land as soon as conditions permit.

If loadmeter remains high:

3. Inverter - SPARE.
4. Both generators - OFF.
5. All electrical accessories - OFF.
6. Monitor loadmeters while turning battery and generators ON. Turn each electrical accessory ON, one at a time, until faulty system is located. Turn defective unit OFF unless it is essential for flight, and land as soon as conditions permit.

Note

A high loadmeter reading usually results in battery failure, battery burning, battery explosion and/or complete electrical failure.

ZERO LOADMETER READING

If a loadmeter indicates a zero reading, proceed as follows:

1. Opposite generator - OFF.
2. Battery - OFF.
   If electrical accessories continue to operate, the loadmeter is inoperative.
3. Battery and opposite generator - ON, if loadmeter is inoperative and continue mission.
4. If accessories fail when battery and opposite generator switches are OFF, generator is inoperative.
5. Battery and opposite generator - ON, if generator is inoperative.
6. Land as soon as conditions permit.

ENGINE OIL SYSTEM FAILURE

If an oil system malfunctions (as evidenced by high or low oil pressure) has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as: condition of the bearings prior to oil starvation, operating temperature of bearings, and bearing loads. A good possibility exists for 10 to 30 minutes of operation after experiencing a complete loss of lubricating oil. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration. When the vibration becomes moderate to heavy, complete failure is only seconds away and in most instances the pilot will increase his chances of a successful ejection or single-engine landing by shutting down the affected engine. Since the end result of oil starvation is engine seizure, the following procedures should be observed in an attempt to forestall engine seizure as long as possible. At first sustained indication of oil system malfunction:

1. Affected engine - SHUTDOWN IMMEDIATELY, unless a critical thrust condition exists.
2. Thrust (affected engine) - REDUCE TO MINIMUM. Reduce thrust to minimum on affected engine if thrust is required. Avoid rapid and large variations in thrust setting on the affected engine. The initial minimum thrust setting established after malfunction is detected should be high

[8] Aircraft 58-1861 and on

enough to avoid the necessity for subsequent variations.

3. "G" forces - MINIMIZE. Avoid all abrupt maneuvers causing high "G" forces.
4. Affected engine - SHUTDOWN. After the critical thrust condition no longer exists, immediately shutdown the affected engine and land as soon as conditions permit.

SECTION IV

Description and Operation of Auxiliary Equipment

TABLE OF CONTENTS

HEATING, VENTILATING AND DEFROSTING SYSTEM ▲1

Air for cabin heat is taken from the inboard side of the combustion section of each engine. The ventilating system uses outside air, which enters the system through an air scoop located forward of the windshield and is distributed to the cabin by three outlets. Heat and ventilation can be maintained by regulating the temperature control knob, the cold air knob and the hot air "T" handle. Hot air ducting is interconnected, permitting operation of the heating system with either or both engines operating.

HOT AIR "T" HANDLE

The hot air "T" handle (3, figure 4-2), is labeled PUSH-CLOSED and PULL-OPEN and controls the hot air from the engine compressors for heating and defrosting. With the "T" handle full in, hot air cannot enter the heating or defrosting system. As the "T" handle is pulled out, the amount of hot air entering the heating and defrosting system is increased.

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302

WARNING

Always close the hot air "T" handle during engine starting to prevent fumes, smoke, and excessive heat from entering the cockpit.

TEMPERATURE CONTROL KNOB

The temperature control knob (2, figure 4-2), labeled Hot Air, provides for manual control of the cabin air temperature and windshield and canopy defrost. By pulling the hot air "T" handle full out or to any intermediate position and positioning the control knob to the CABIN position, hot air will enter the cabin through hot air outlets located between each set of rudder pedals. When the knob is positioned to DEFROST, hot air is routed to the windshield and canopy for defrosting. When the control knob is positioned to any intermediate position between CABIN and DEFROST, a proportional amount of hot air is supplied for both cabin heat and defrosting.

VENTILATING SYSTEM

The ventilating system uses outside air which enters the system through an air scoop forward of the windshield. This air is distributed to the cabin by three outlets, one on each side of the cockpit and one located on the glare shield, which is controlled by a cold air valve.

COLD AIR KNOB

A cold air knob (1, figure 4-2), labeled Cold Air, has two marked positions, OFF and HIGH. When the knob is in the OFF position, cold air is not permitted to enter the cabin through the cold air outlet located on the glare shield. As the knob is moved to the HIGH position, the amount of cold air entering the cabin is increased.

HEATING, VENTILATING and DEFROSTING SYSTEM SCHEMATIC

Aircraft 54-2729 thru 56-3491 except 55-4302

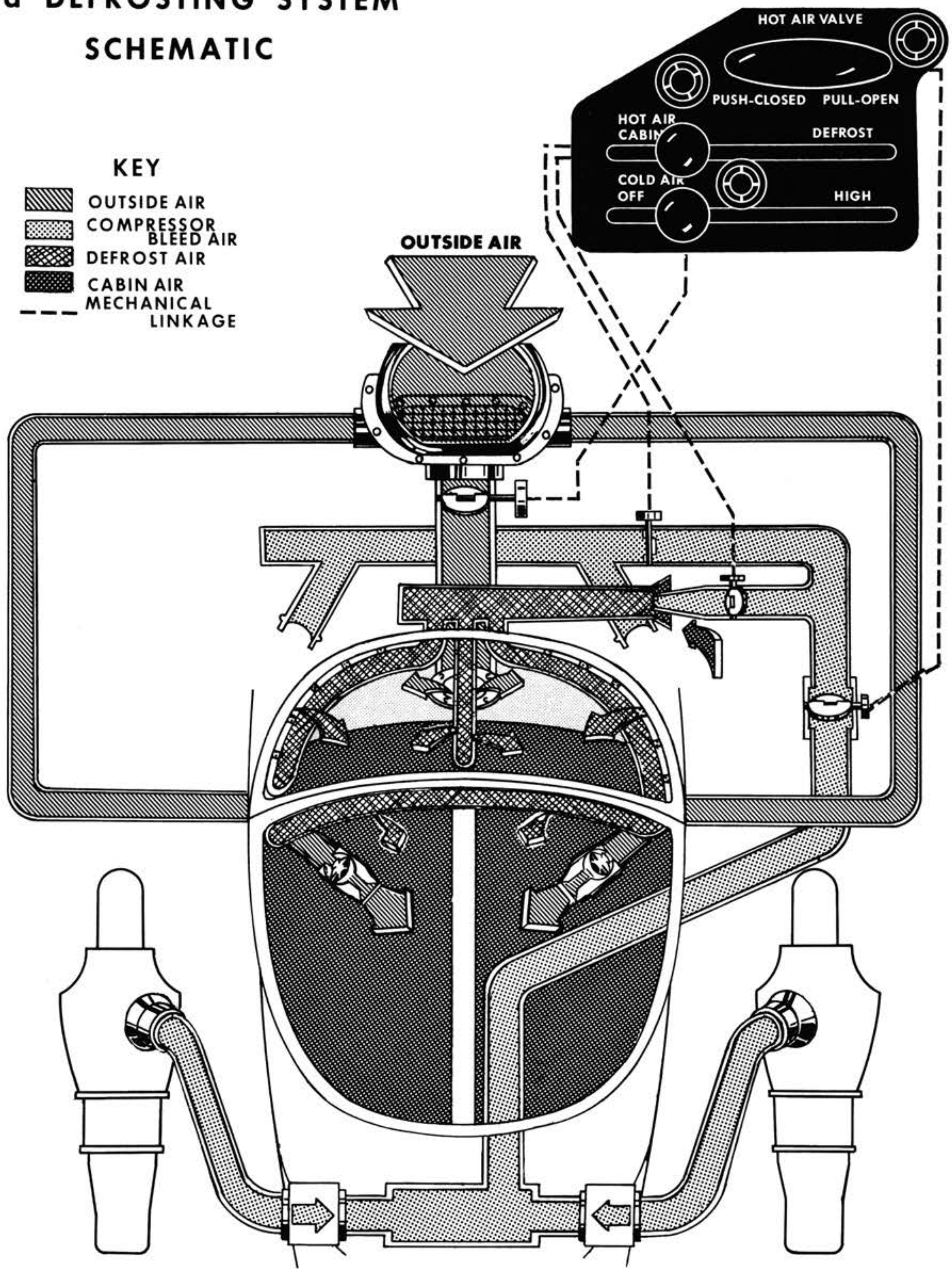
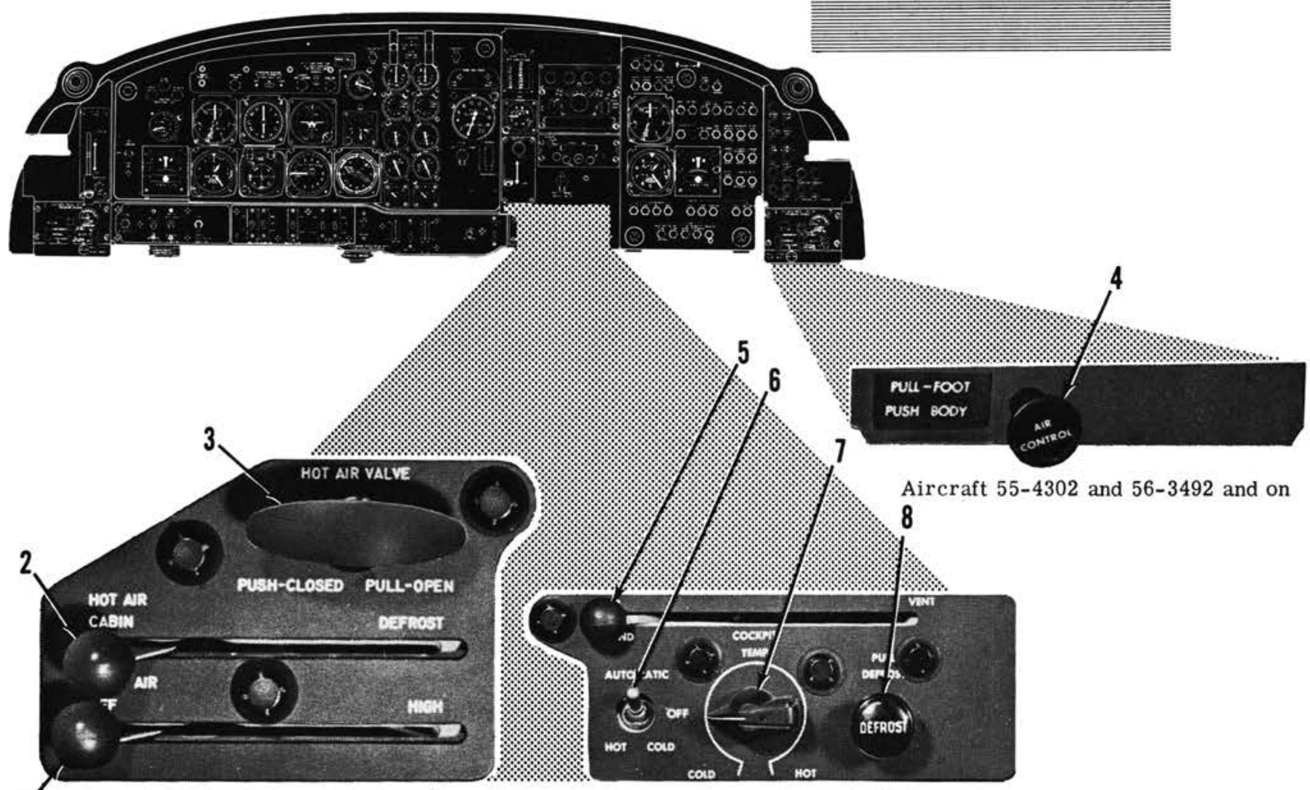


Figure 4-1

Temperature Controls



Aircraft 55-4302 and 56-3492 and on

Aircraft 54-2729 thru 56-3491 except 55-4302

Aircraft 55-4302 and 56-3492 and on

1. COLD AIR KNOB
2. TEMPERATURE CONTROL KNOB
3. HOT AIR "T" HANDLE
4. AIR CONTROL KNOB
5. COCKPIT AIR LEVER
6. COCKPIT AIR TEMPERATURE CONTROL SWITCH
7. COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT
8. WINDSHIELD AND CANOPY DEFROST KNOB

Figure 4-2

AIR OUTLETS

There are swivel type air outlets (15, figure 1-4). The swivel position of each duct can be manually adjusted to direct air in any direction. Each duct can be manually regulated or shutoff completely by a valve located in each air outlet.

DEFROSTING SYSTEM

The hot air duct which supplies hot compressor air to the heating system, also provides hot compressor air for the defrosting system. The hot air enters the defrosting system through a defrost shutoff valve which is controlled by the temperature control knob. From the defrost shutoff valve, the heated air is routed to the windshield and canopy for defrosting.

Note

The defrosting system should be operated at the highest temperature possible (consistent with the pilot's comfort) during high altitude flight in order to provide sufficient preheating of the windshield and canopy surfaces to preclude the formation of frost or fog during descent.

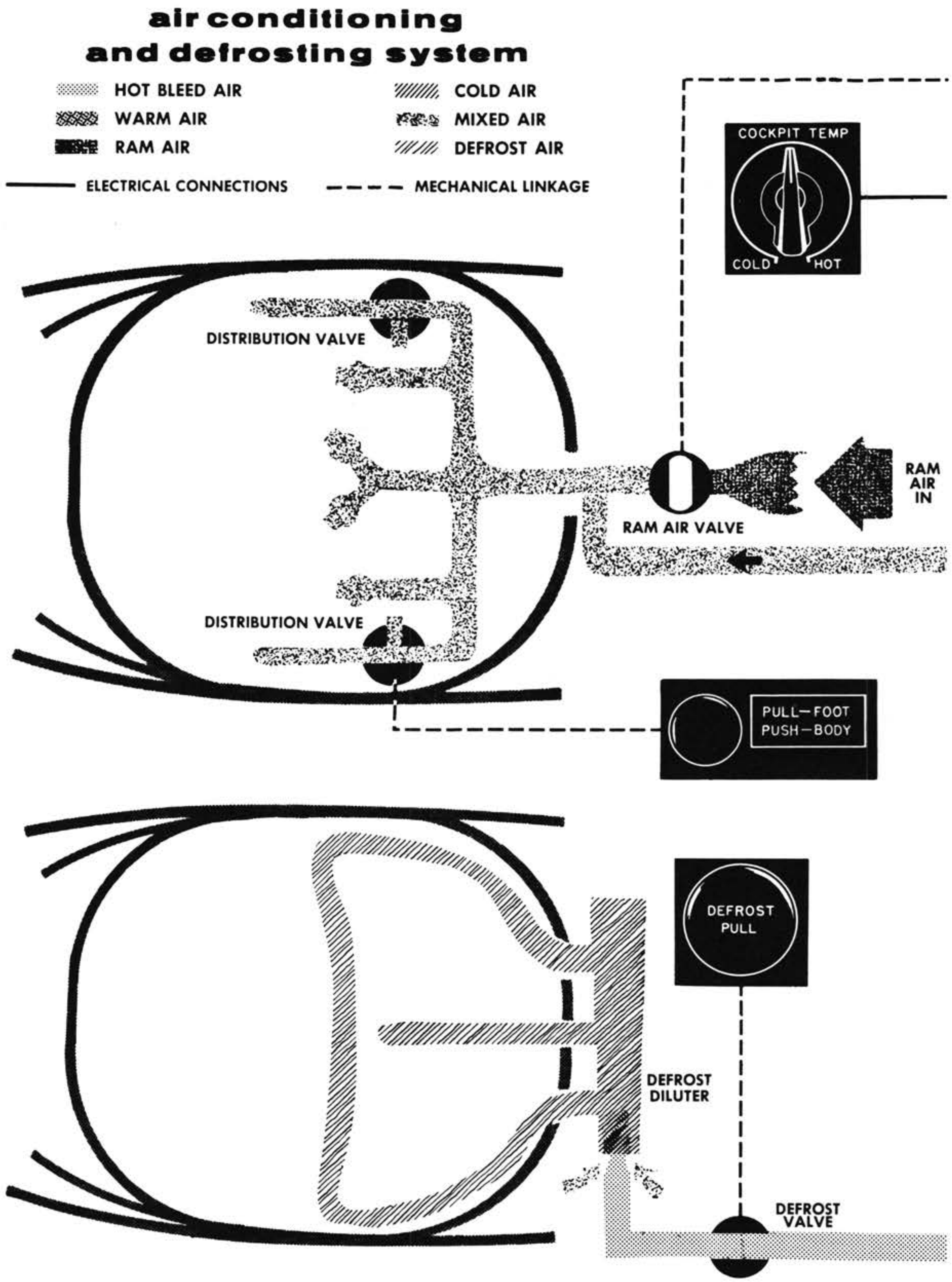


Figure 4-3. (Sheet 1 of 2)

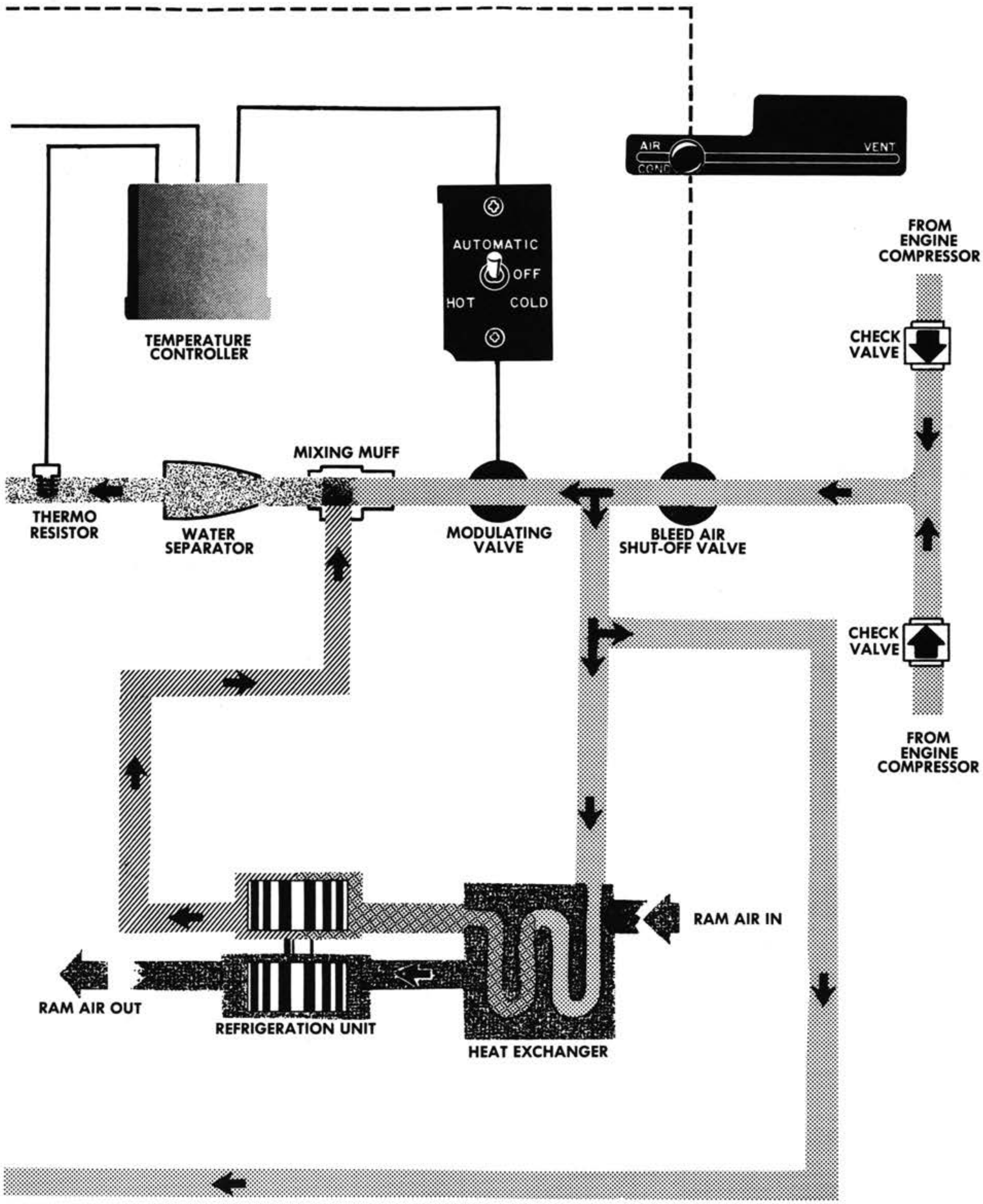


Figure 4-3. (Sheet 2 of 2)

COCKPIT AIR CONDITIONING AND DEFROSTING SYSTEM [2]

The air conditioning system utilizes bleed air from the engine compressors to supply air for heating or cooling the cockpit. Bleed air from each engine compressor passes through check valves and a manually operated shutoff valve to a modulating valve. The modulating valve diverts a selected amount of air through a heat exchanger and then a refrigeration unit. Bleed air and refrigerated air are then mixed in the mixing muff and pass through a water separator where moisture is condensed from the air. The air enters the cockpit a a pre-selected temperature through air outlets on the glare shield, on both sides of the cockpit, on each side of the instructor's quadrant, and in the area just forward of the feet along each side of the cockpit. The air conditioning system is powered by the 28 volt dc bus and 115 volt ac single-phase bus.

CAUTION

With high outside air temperature an engine overtemperature condition can occur, if air conditioning is used when one engine is flamed out and the other engine is at 100% rpm.

COCKPIT AIR CONDITIONING CONTROLS

Cockpit Air Temperature Control Switch

Temperature of the air admitted to the cockpit is controlled by a four-position cockpit air temperature control switch (6, figure 4-2). Temperature control is maintained automatically when the switch is in the AUTOMATIC position. When the switch is in the OFF position, the automatic control system is inoperative and the modulating valve remains fixed in the position at the time the switch was set to the OFF position. If the automatic control system fails or if desired temperature cannot be obtained with the switch in the AUTOMATIC position, the switch may be held in the HOT or COLD position until the desired temperature of the cockpit air is reached. The switch is spring loaded to the center OFF position from the HOT or COLD position. The switch receives power from the 28 volt dc bus.

Note

If inverters fail, resulting in complete loss of ac power, the automatic temperature control system will be inoperative. and the manual HOT or COLD position must be selected to maintain desired cockpit temperature.

[2] Aircraft 55-4302 and 56-3492 and on

COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT

The rheostat (7, figure 4-2) controls cockpit air temperature and functions only when the cockpit air temperature switch is in the AUTOMATIC position and when ac power is available at the cockpit temperature control unit.

Cockpit Air Lever

If air conditioning is not desired, positioning the cockpit air lever (5, figure 4-2) to the VENT position shuts off the bleed air to the air conditioning system, and opens the ram air system, allowing outside air to enter the cockpit through the same air outlets as used by the conditioned air. With the lever in the AIR COND position, ram air is shut off, allowing bleed air to enter the air conditioning system. Both ram air and conditioned air cannot be selected at the same time.

Note

The cockpit air lever should be in the AIR COND position during flights in rainy weather and while the aircraft is not in use to prevent the collection of water in the ram air valve.

WARNING

Always place the cockpit air lever to VENT during engine starting to prevent harmful fumes and/or smoke from entering the cockpit.

Air Control Knob

A manually operated air control knob (4, figure 4-2), is labeled PUSH-BODY and PULL-FOOT. When either knob is pulled out, it directs conditioned air or ram air to the area just forward of the feet. With the knob pushed in, air is directed to the piccolo tubes. Either knob may be placed in any intermediate position to permit distribution of air from both outlets at the same time.

DEFROSTING SYSTEM

Part of the bleed air from the engines that conditions the cockpit air is also used for windshield and canopy defrosting. The bleed air enters the defrosting system through a manually controlled defrost shutoff valve. Cabin air is then mixed with the hot bleed air, and released from outlets along the bottom and center of either side of the windshield and on the forward edge of the canopy.

Windshield and Canopy Defrost Knob

The windshield and canopy defrost knob (8, figure 4-2), controls the amount of defrosting air entering the cockpit. Pulling the knob out increases defrosting. Heat for defrosting will not be available unless the cockpit air lever is in the AIR COND position.

NORMAL OPERATION OF COCKPIT AIR CONDITIONING SYSTEM

1. Cockpit air lever - AIR COND.
2. Cockpit air temperature control switch - AUTOMATIC.
3. Cockpit air temperature control rheostat - To desired temperature.
4. Air control knob - To desired position.

CAUTION

Placing the cockpit air lever in the AIR COND position while the engines are at a high rpm, may cause a separation of the air conditioning ducting located under the instrument panel, causing an explosive sound with considerable heat in the cockpit. If this occurs, place the cockpit air lever in the VENT position and decrease rpm.

PITOT AND STALL WARNING TRANSDUCER VANE HEAT

PITOT HEAT SWITCH

The pitot tube, located in the nose section and the stall warning transducer vane located in the left wing tip, are heated by power from the 28 volt dc bus which is controlled by a pitot heat switch (8, figure 1-9). The switch has two positions, ON and OFF.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

See figure 4-4.

Communications and Associated Electronic Equipment

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
INTERPHONE	AN/AIC-10	CREW INTERCOMMUNICATION	PILOT AND INSTRUCTOR	COCKPIT	PILOT'S-LEFT SIDE COCKPIT INSTRUCTOR'S-RIGHT SIDE COCKPIT
UHF COMMAND RADIO	AN/ARC-34	AIRCRAFT-TO-AIRCRAFT AIRCRAFT-TO-GROUND COMMUNICATION	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL
VHF (VOR) RECEIVER	COLLINS 101	VOR VAR NAVIGATION VOICE RECEPTION LOCALIZER	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL

Figure 4-4

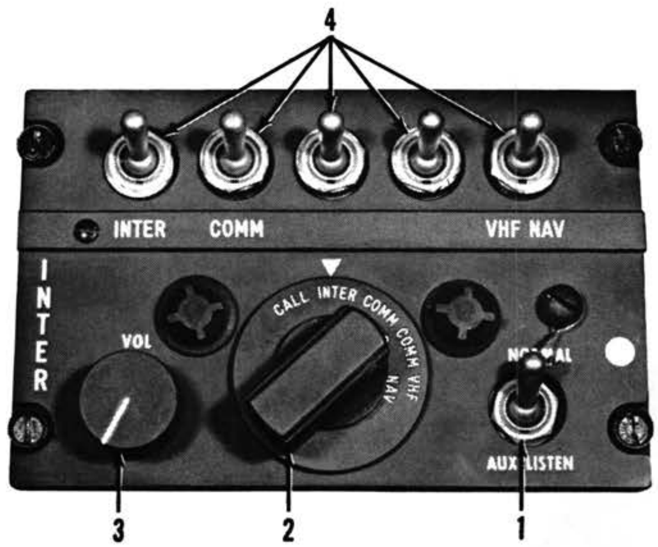
INTERPHONE SYSTEM AN/AIC-10

The interphone system provides: communication within the aircraft with or without the use of microphone buttons; communication beyond the aircraft by integration with its radio equipment; monitoring of received signals either individually or simultaneously; and a call facility which permits transmission of urgent communications to both headsets regardless of individual control panel switch setting. The control panel (figure 4-5) for both pilots is located on the side panels (17,figure 1-7, 9,figure 1-8). The system acts as a master control for the associated communication and navigation equipment. The system is powered by the 28 volt dc bus. The control panel does not contain an on-off switch; therefore, when dc power is turned on and the interphone circuit breaker is pushed in, the system is on. Each panel has a volume control knob, five (toggle) monitoring switches (two of which are not used on this aircraft), a rotary selector switch, and a normal-auxiliary listen switch. The volume control knob (3, figure 4-5), is provided for the adjustment of aural signal intensity. The monitoring switches (4, figure 4-5), marked INTER, COMM, and VHF-NAV enable the pilot and instructor to monitor incoming signals from all three sources. The rotary selector switch (2, figure 4-5), has positions CALL, INTER, COMM-INTER, COMM, and VHF-NAV. When either the pilot's or instructor's rotary selector switch is held in the spring-loaded CALL position, the other crew member is contacted simulatneously regardless of his rotary selector switch position. Normal intercommunication between pilot and instructor is provided when their rotary selector switches are in the COMM-INTER position. With the rotary selector switch at COMM-INTER or CALL, the microphone is open for interphone communication. With the switch at COMM position, transmissions are restricted to command radio only and the microphone button (4, figure 1-5), must be pressed. With the switch at INTER position, communication is restricted to interphone and the microphone button (4, figure 1-5) must be pressed. The normal-auxiliary listen switch (1, figure 4-5) has NORMAL and AUX LISTEN positions. The toggle is safetied to the NORMAL position. With the switch positioned in the AUX LISTEN position only one signal can be received at a time. The first toggle switch from the left on the interphone control panel that is turned ON will be the only signal received by the pilot, i.e. if the pilot wants to identify the VOR signal, all four toggle switches prior to VHF NAV must be placed to the OFF position. A radio interrupt call switch (2, figure 1-15), located on the instructor's control stick grip only, is provided to cut out all incoming signals to both the pilot and instructor, but permits intercommunication and radio transmission beyond the aircraft.

Interphone Operation

1. Rotary selector switch - COMM-INTER.
2. Interphone monitoring switch - INTER.
3. Normal-auxiliary listen switch - NORMAL.
4. Volume control knob - Adjust as desired.

INTERPHONE CONTROL PANEL



1. NORMAL - AUXILLARY LISTEN SWITCH
2. ROTARY SELECTOR SWITCH
3. VOLUME CONTROL KNOB
4. MONITORING SWITCHES

Figure 4-5

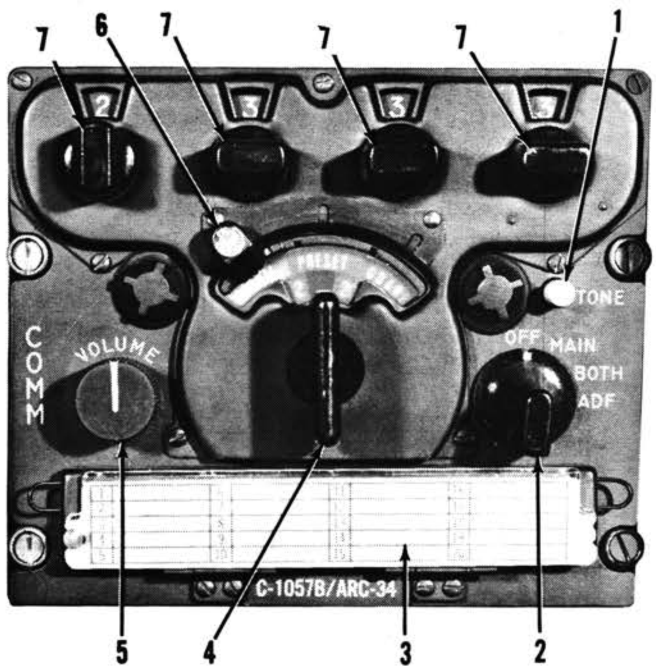
UHF COMMAND RADIO - AN/ARC-34

Note

No transmission will be made on emergency (distress) frequency channels except for emergency purposes.

An AN/ARC-34 command radio set has a line-of-sight reception and provides voice transmis-

UHF COMMAND RADIO CONTROL PANEL



1. TONE BUTTON
2. FUNCTION CONTROL SWITCH
3. CHANNEL FREQUENCY CARD
4. CHANNEL SELECTOR KNOB
5. VOLUME CONTROL KNOB
6. MODE CONTROL SWITCH
7. MANUAL FREQUENCY SELECTOR KNOB

Figure 4-6

sion and reception on 1750 frequencies in the range of 225.0 to 399.9 megacycles. The control panel (figure 4-6) for the set is on the stationary instrument panel and permits selection of any of 20 frequencies which can be preset in any order. In addition, an operating frequency can be set up manually without disturbing any of the preset frequencies. The set uses two receivers, a main and a guard receiver. The guard receiver is set and fixed to receive frequency 243.0 megacycles. The functions of the set are selected by the four-position function control switch (2, figure 4-6). The switch, when moved from the OFF position, connects 28 volt dc power from the 28 volt dc bus to the set. When the switch is in the MAIN position, the transmitter and receiver are operative on the same selected main frequency. The BOTH position allows transmission and reception on the main selected channels and simultaneous reception on the guard channel. The ADF position of the switch is inoperative in this installation. The tone button (1, figure 4-6), marked TONE, is adjacent to the function control switch. A mode control switch (6, figure 4-6), is used to select the desired operating mode. The MANUAL position of the switch permits any desired frequency within the operating range of the set to be manually selected by the manual frequency selector knobs (7, figure 4-6). The GUARD position selects the fixed guard frequency for the main receiver and transmitter, and PRESET is used to allow selection of any of the 20 preset frequencies. When the mode control switch is at PRESET, subsequent movement of the channel selector knob changes the frequency to the desired preset channel. A numerical indication of the selected channel appears in a window above the channel selector knob. A record of the frequencies that have been preset and assigned to the 20 channels can be noted on a channel frequency card (3, figure 4-6). The preset frequencies can be changed in flight if necessary. Audio volume is adjusted by a volume control knob (5, figure 4-6).

Operation of UHF Command Radio - AN/ARC-34

1. Select PRESET position with the mode control switch.
2. Rotate function control switch to BOTH position and allow approximately one minute to warm-up main and guard receiver units.
3. With channel selector knob, select the desired channel after warm-up. Set is now ready for use.
4. Adjust volume control for desired audio level.
5. For manual selection of a frequency that is not included in the preset channels, set mode control switch to MANUAL. Turn the four manual frequency selector knobs at the top of the panel until the numerals indicating the desired frequency appear in the windows. The function control switch must be at MAIN or BOTH for manual frequency selection. This procedure places the set in receive condition.

Note

The microphone button should be released before changing transmitter frequency. Approximately four seconds should elapse before transmission begins on a new frequency.

If a stuck mike button is suspected, proceed as follows. Position the rotary selection switch to INTER. If you can transmit over the interphone without depressing the mike button, you have a stuck mike button. If this condition exists, turn radio OFF if on the ground. If airborne, turn the COMM monitoring switch ON and leave the rotary selector switch in INTER. To transmit, turn rotary selector switch to COMM/INTER and then back to INTER when transmission is complete.

If continuous channelization occurs, select another channel. If channelization continues, place the function switch to the OFF position and allow a 30 second cooling period before turning the set to the BOTH position.

Do not attempt to tune the receiver to any frequency below 225.0 megacycles, as the radio will not operate in this range. If a frequency is set manually below 225.0 megacycles, continuous operation of the channeling drive motor results.

6. To obtain transmission and reception of the guard frequency, move mode control switch to GUARD.
7. To turn off receiver-transmitter, move function control switch to OFF.

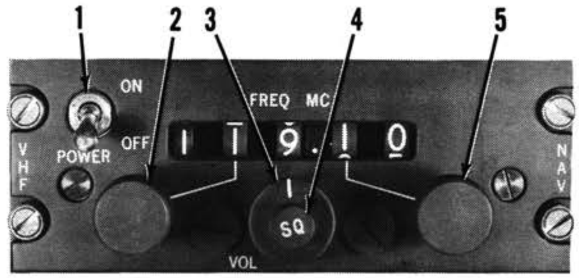
VOR RECEIVER - COLLINS 101

The VHF navigation receiving set consists of a control panel on the stationary instrument panel, a course indicator (ID-351), and a radio magnetic indicator (ID-250), both located on the lower portion of the left instrument panel. The system has a line-of-sight reception and may be tuned in the frequency range from 108.0 to 151.95 megacycles, spaced .05 megacycles apart. The system is powered by the 28 volt dc bus and the 115 volt ac 400-cycle, three-phase bus.

VOR Receiver Control Panel

The VOR receiver control panel (figure 4-7), has a power switch (1, figure 4-7), with ON and OFF positions, two frequency selector control knobs (2, 5, figure 4-7), a frequency window, a volume control knob (3, figure 4-7), and a squelch control knob (4, figure 4-7). The left frequency selector control knob (2, figure 4-7) selects the whole megacycles of the desired frequency and the right frequency selector control knob (5, figure 4-7) selects the tenths of a megacycle of the desired frequency.

VOR CONTROL PANEL



1. POWER SWITCH
2. WHOLE MEGACYCLE FREQUENCY SELECTOR CONTROL KNOB
3. VOLUME CONTROL KNOB
4. SQUELCH CONTROL KNOB
5. TENTH MEGACYCLE FREQUENCY SELECTOR CONTROL KNOB

Figure 4-7

Operation of VOR Receiver - Collins 101

1. Turn the power switch to ON.
2. Select desired frequency.
3. Adjust volume to desired level.
4. To turn equipment off, turn power switch to OFF.

Note

The VOR antenna is located on the canopy. If the canopy is lost, the VOR equipment is unusable.

COURSE INDICATOR (ID-351) (identical to ID-249)

Refer to AFM 51-37 for indications and operations of this instrument. This aircraft does not have glide slope receiver or marker beacon receiver making that portion of the instrument inoperative. The alarm flag for the glide slope indicator is visible at all times. The course indicator receives its power from the 28 volt dc bus and 115 volt ac three-phase bus. Failure of either electrical source will render the course indicator inoperative. ILS fre-

COURSE INDICATOR

(ID-351)

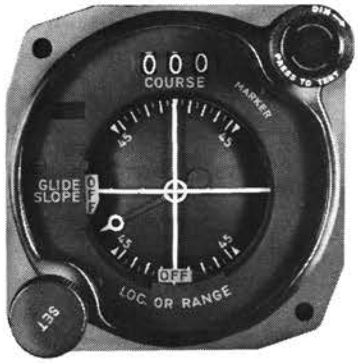


Figure 4-8

quencies may be selected and the CDI will indicate correct localizer indications, but the GSI will be inoperative making complete ILS approaches impossible.

WARNING

If the station identification does not get transmitted, the receiver may still be getting a signal of sufficient strength to keep the warming flag from showing. Therefore, the indicator is reliable only if the warning flag is not displayed and the station identification is being received.

RADIO MAGNETIC INDICATOR

(ID-250)

Figure 4-9

RADIO MAGNETIC INDICATOR (ID-250)

Refer to AFM 51-37 for indications and operations of this instrument. On this aircraft, both bearing indicators are locked together and indicate correct magnetic bearing.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Two position lights, four navigation lights, one passing light, two landing lights, one taxi light, and two anti-collision beacons, provide exterior lighting for both in-flight and ground operation. The position and navigation lights are controlled by a switch in the cockpit which provides a selection of dim and steady or bright and flashing circuits. One white position light is located on the upper center line of the fuselage aft of the canopy and the other on the lower center line of the fuselage, these lights are not on the flashing circuit. One navigation light is located on each wing tip, a green light on the right and a red light on the left. The two tail lights, one white and one amber, are located on the tailcone stinger. One landing light is flush mounted on the under side of each wing, aft of the landing gear and the taxi light is mounted in the nose. These lights are controlled by a single selector switch. One red anti-collision beacon is located on the upper surface of the aircraft, aft of the canopy, and the other on the lower surface of the fuselage. The anti-collision beacons and the passing light are controlled by a switch located on the switch panel. With the switch in the ON position, the anti-collision beacons will be operating to show a rotating red beacon. The red passing light in the nose of the aircraft will operate as a frontal anti-collision beacon as well as indicating the position of the landing gear. If the landing gear is down and locked, the passing light will be flashing. If the landing gear is in any other position, except down and locked, the passing light will be steady.

Navigation Light Switch

The position and navigation lights are operated by one switch (20, figure 1-9). The switch has three positions: BRIGHT & FLASH, OFF, and DIM & STEADY. In the BRIGHT & FLASH position, the navigation lights will be bright and flashing and the position lights will be bright. In the DIM & STEADY position, the navigation and position lights will be dim and steady. The lights receive their power from the 28 volt dc bus.

Anti-collision Beacon Lights Switch

The anti-collision beacons switch (19, figure 1-9), has two positions: ON and OFF. In the ON position, the two red anti-collision beacons and the red passing light are turned on. The anti-collision beacons and passing light receive their power from the 28 volt dc bus.

Note

> The anti-collision beacons switch should be in the OFF position during flight through conditions of reduced visibility when the pilot could experience vertigo as a result of the rotating reflections of the lights against the clouds.

Landing and Taxi Light Switch

The landing and taxi light switch (33, figure 1-6), has LANDING, OFF, and TAXI positions. When the switch is in the LANDING position, the flush-mounted landing light in each wing is extended and automatically turned on. In the OFF position, the landing lights are retracted flush with the wings and automatically turned off. In the TAXI position, the taxi light in the nose section is turned on. The landing and taxi lights receive their power from the 28 volt dc bus.

INTERIOR LIGHTING

Interior lighting equipment includes two cockpit lights, five secondary instrument lights, individual instrument lights and edge lighting for the switch panel, radio control panels, oxygen regulators, portions of the left instrument panel, lower portion of the stationary instrument panel and the interphone control panels located on either side of the cockpit. Intensity for all lighting equipment except the two cockpit lights is controlled by four rheostats.

Primary Flight Instrument Lights Rheostat

The primary flight instrument lights rheostat (13, figure 1-5), controls the intensity of the compass, clock, and all of the flight instruments including the course indicator (ID-351) on aircraft [8]. On aircraft [7] power for the rheostat comes from the 28 volt bus. On aircraft [8] the rheostat receives its power from the 115 volt ac 400-cycle single-phase bus through a stepdown transformer which supplies five-volt ac 400-cycle single-phase power.

Primary Instrument Lights Rheostat

The primary instrument lights rheostat (14, figure 1-5), controls the intensity for the edge lighting of the switch panel and parts of the left instrument panel and lower portion of the stationary instrument panel on aircraft [8], course indicator (ID-351) on aircraft [7], flap position indicator, both oxygen regulators, accelerometer and all the engine and pressure instruments. Power to the rheostat comes from the 28 volt dc bus.

Secondary Instrument Lights Rheostat

The secondary instrument lights rheostat (15, figure 1-5) controls the intensity of the five lights located under the glare shield, that illuminate the instrument panel. Power to this rheostat comes from the 28 volt dc bus.

Radio Lights Rheostat

The radio lights rheostat (9, figure 1-4) controls the intensity of the edge lighting for the UHF command radio control panel, VOR receiver control panel and the interphone control panels located on either side of the cockpit. Power for this rheostat is supplied by the 28 volt dc bus and the circuit is protected by the same circuit breaker that protects the primary instrument lights circuit.

Warning Lights Dimming Switch

The warning lights dimming switch (21, figure 1-9), has three positions: BRIGHT, DIM, and neutral. It is spring-loaded to the neutral position. The switch controls the intensity of all the warning lights, elevator trim tab light, landing gear indicator lights, gravity fuel indicator light and fuel boost pump warning light. The circuit receives its power from the 28 volt dc bus, and on aircraft [7] is protected by the same circuit breaker that protects the primary flight instrument lights circuit and on aircraft [8] is protected by an individual circuit breaker.

Note

> The fire and overheat warning, canopy not locked, engine ice, gear position indicator and boost pump lights will illuminate bright when pressed-to-test. The fuel low level, elevator trim, gravity

[7] Aircraft 54-2729 thru 57-2352
[8] Aircraft 58-1861 and on

feed and gear handle warning light will illuminate dim when pressed-to-test.

COCKPIT LIGHT

Two cockpit lights (4, Figure 1-7 and 10, Figure 1-8) provide a portable light source for each pilot. Their intensity can be controlled from off to full bright, they can be used as either a source of white or red light, and they are adjustable as either a spot or a flood light.

GASEOUS OXYGEN SYSTEM

The gaseous oxygen system has two supply cylinders with an original charge pressure of 425 ±25 psi (full) and are located in the forward part of the tailcone. On aircraft ▲1 two type D2A, and on aircraft ▲2 two type MD-1, demand regulators are located on the lower outboard edges of the instrument panel. These regulators automatically control pressure and quantity to the pilot's face masks according to cockpit altitude requirements. A pressure gage and flow indicator are included as part of the regulator assemblies. A filler valve located on the upper left side of the tailcone aft of the wing provides a means for replenishing the supply from a ground source. Refer to servicing diagram, figure 1-25. Approximate duration of the oxygen supply is shown in figure 4-10.

Note

- As the aircraft ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. This may result in a rapid decrease in pressure. A rapid fall in oxygen pressure while the aircraft is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.
- The variance in duration with altitude, with the diluter lever at 100% OXYGEN, is a function of the amount of oxygen it takes to fill the lungs, i.e. at 25,000 feet it takes approximately one-half as much oxygen to fill the lungs as at sea level. With the diluter lever at the NORMAL position, the duration is a function of both the amount of oxygen required to fill the lungs and the amount of mixing with ambient air accomplished by the regulator.

GASEOUS OXYGEN REGULATORS

On aircraft ▲1, the D2A and on aircraft ▲2, the MD-1 demand oxygen regulators (figure 4-11) mix air with oxygen in varying amounts according to cockpit altitude, and deliver a quantity of mixture each time the users inhale. At high altitudes, approximately 30,000 to 40,000 feet, the regulators supply positive safety pressure; above 40,000 feet the delivery pressure automatically increases with an increase in altitude. The deliver pressure automatically changes with altitude.

GASEOUS OXYGEN SYSTEM REGULATOR LEVERS

Diluter Lever

Each oxygen regulator panel incorporates a diluter lever. On aircraft▲1, the lever (3, figure 4-11) is located on the top right corner of the regulator, on aircraft▲2, the lever (3, figure 4-11), is located on the lower portion of the regulator. This lever is used to select NORMAL OXYGEN or 100% OXYGEN. The lever in the NORMAL position allows the normal flow of oxygen to the mask at all altitudes. When the lever is at the 100% OXYGEN position, cockpit air is shutoff and only 100% oxygen enters the mask.

Note

Whenever an oxygen regulator is not used, the diluter lever for that regulator should be in the 100% OXYGEN position. This closes the mixer port on the regulator helping to keep it clean. Also in the 100% OXYGEN position with the supply lever OFF you cannot breathe with the mask on, thereby serving as a caution to not forget to place the supply lever to the ON position if the system is to be used. With the supply lever in the OFF position and the diluter lever in the NORMAL OXYGEN position, you will get air to the mask through the mixer port, but no oxygen will be mixed with it.

Emergency Lever

On aircraft▲1, the emergency lever (1, figure 4-11), is labeled EMERGENCY-PRESS TO

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302

▲2 Aircraft 55-4302 and 56-3492 and on

Gaseous OXYGEN
• duration chart– HOURS

GAGE PRESSURE (PSI)	400	350	300	250	200	150	100
CABIN ALTITUDE FEET 35,000	4.36 **4.36**	3.82 **3.82**	3.27 **3.27**	2.54 **2.54**	2.18 **2.18**	1.63 **1.63**	1.09 **1.09**
30,000	3.24 **3.17**	2.84 **2.78**	2.43 **2.38**	2.03 **1.99**	1.62 **1.58**	1.21 **1.19**	.82 **.79**
25,000	3.08 **2.45**	2.63 **2.14**	2.31 **1.83**	1.96 **1.53**	1.54 **1.22**	1.15 **.91**	.77 **.61**
20,000	3.22 **1.87**	2.82 **1.63**	2.41 **1.39**	2.02 **1.16**	1.61 **.92**	1.20 **.69**	.80 **.46**
15,000	4.24 **1.49**	3.71 **1.31**	3,17 **1.12**	2.65 **.93**	2.12 **.75**	1.58 **.56**	1.06 **.37**
10,000	5.63 **1.20**	4.94 **1.05**	4.21 **.89**	3.52 **.75**	2.80 **.60**	2.10 **.45**	1.41 **.29**

EMERGENCY

BELOW 100 PSI

DESCEND TO ALTITUDE NOT REQUIRING OXYGEN

• LIGHT FIGURES INDICATE DILUTER LEVER - **NORMAL**

• **BOLD FIGURES INDICATE DILUTER LEVER-100%**

2 CREW MEMBERS

Figure 4-10

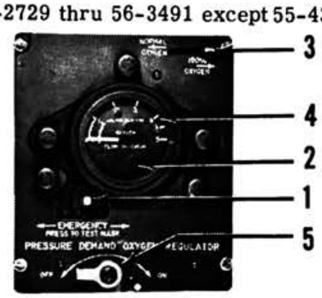
Gaseous OXYGEN REGULATORS

Aircraft 55-4302 and 56-3492 and on

TYPE MD-1

Aircraft 54-2729 thru 56-3491 except 55-4302

TYPE D2A



1. EMERGENCY LEVER
2. FLOW INDICATOR
3. DILUTE LEVER
4. PRESSURE GAGE
5. SUPPLY LEVER

Figure 4-11

TEST MASK. The lever is provided as a means of manually selecting positive pressure to the mask for emergency use. The lever is a toggle type, spring-loaded to the center position only. When pressed, positive pressure will be delivered to the mask; as soon as pressure on the lever is relaxed, it will automatically return to the OFF position. On aircraft ▲2, the emergency lever (1, figure 4-11), is labeled EMERGENCY, NORMAL, and TEST MASK. The lever is a toggle type, spring-loaded from the TEST MASK position only. When depressed to the TEST MASK position, positive pressure will be delivered to the mask; as soon as pressure is relaxed, the lever will automatically return to the NORMAL position. On aircraft ▲1, positioning the lever to either side of the center off position, will deliver continuous positive pressure to the mask. On aircraft ▲2, positioning the lever to EMERGENCY causes continuous positive pressure to be delivered to the mask. On aircraft ▲1, moving the lever to the center off position or on aircraft ▲2, moving the lever to the NORMAL position, will return the system to normal operation.

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302
▲2 Aircraft 55-4302 and 56-3492 and on

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to insure no leakage, then continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

Note

Oxygen masks can be tested at any altitude by pushing in on the emergency toggle lever on aircraft ▲1, or placing the emergency lever to the EMERGENCY position on aircraft ▲2.

Supply Lever

The supply lever (5, figure 4-11) has two positions, ON and OFF. When the lever is positioned ON, oxygen is permitted to enter the regulator, and in the OFF position, the oxygen supply is cut off.

GASEOUS OXYGEN SYSTEM REGULATOR INDICATORS

Pressure Gage and Flow Indicator

On aircraft ▲1, with D2A regulators, a combination pressure gage and flow indicator (2, figure 4-11) indicates oxygen pressure on the upper half of the gage and oxygen flow on the lower half of the gage. Four slots, evenly spaced on the flow indicator, are luminous when oxygen is flowing through the regulator. The slots are a dull black when not in use. On aircraft ▲2, with MD-1 regulators, the oxygen pressure gage (4, figure 4-11) and the flow indicator (2, figure 4-11) are separate. As oxygen flows from the regulator, the flow indicator blinks. The indicator is white on some aircraft and black on others when not in use.

▲1 Aircraft 54-2729 thru 56-3491 except 55-4302
▲2 Aircraft 55-4302 and 56-3492 and on

OXYGEN HOSE HOOK UP

Proper attachment of the oxygen mask connector is extremely important to assure that:

a. The oxygen hose does not become accidentally disconnected during flight resulting in loss of oxygen supply to a crewmember.
b. The oxygen hose does not prevent quick separation from the seat during ejection.
c. The oxygen hose does not fail during ejection causing injury to the crewmember.

CRU-8/P Connector

The following procedures shall be employed in hooking up the gaseous oxygen supply system through the CRU-8/P connector: Refer to figure 4-12.

1. Insert connector into the mounting plate attached to the parachute harness. Check that the connector is firmly attached and that the lockpin is locked.
2. Insert male bayonet connector, on the end of the oxygen mask hose, into the female receiving port of the CRU-8/P connector. Turn bayonet connector to lock prongs into the recess in the lip of receiving port.
3. Couple the seat oxygen hose to the lower port of the connector.
4. Attach the bail-out bottle hose (if available), to the swiveling port of the connector by inserting the male coupling of the bail-out bottle hose and turning it clockwise against the spring-loaded collar.

CRU-60/P Connector

A multi-directional quick-disconnect, CRU-60/P, is a replacement for the CRU-8/P connector. Its use is the same as shown for the CRU-8/P. Refer to figure 4-12.

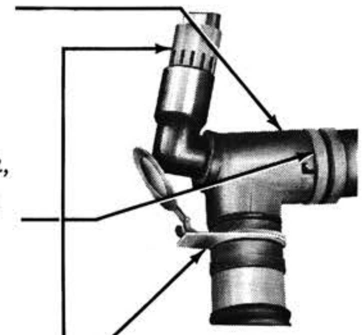
GASEOUS OXYGEN SYSTEM PREFLIGHT CHECK

Refer to figure 4-12 for the correct method of oxygen hose attachment. Both crew members should complete the following preflight check.

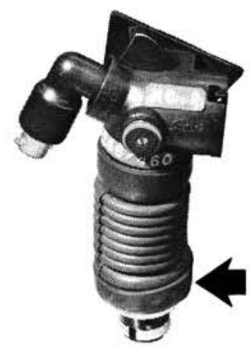
Oxygen Hose Hookup

for CRU-8/P Connector

1. INSERT CONNECTOR INTO THE MOUNTING PLATE ATTACHED TO THE PARACHUTE HARNESS. CHECK THAT THE CONNECTOR IS FIRMLY ATTACHED AND THAT THE LOCK-PIN IS LOCKED.
2. INSERT MALE BAYONET CONNECTOR, ON THE END OF THE OXYGEN MASK, INTO THE FEMALE RECEIVING PORT OF THE CRU-8/P CONNECTOR. TURN BAYONET CONNECTOR TO LOCK PRONGS INTO THE RECESS IN THE LIP OF RECEIVING PORT.
3. COUPLE THE SEAT OXYGEN HOSE TO THE LOWER PORT OF THE CONNECTOR.
4. ATTACH THE BAIL-OUT BOTTLE HOSE (IF AVAILABLE) TO THE SWIVELING PORT OF THE CONNECTOR BY INSERTING THE MALE COUPLING OF THE BAIL-OUT BOTTLE HOSE AND TURNING IT CLOCKWISE AGAINST THE SPRING-LOADED COLLAR.



1. CRU-8/P CONNECTOR
2. MALE BAYONET CONNECTOR
3. SEAT OXYGEN HOSE STRAP
4. SEAT OXYGEN HOSE
5. BAIL-OUT BOTTLE HOSE



CRU-60/P CONNECTOR

Figure 4-12

P - PRESSURE - The pressure gage should read 425 ± 25 PSI and should agree approximately with the other regulator pressure gage.

R - REGULATOR - Check Regulator ON. Perform a blow-back check on the regulator hose for five seconds on both the NORMAL and 100% OXYGEN position. Little or no resistance to blowing indicates a leaking regulator diaphragm, faulty check valve in diluter air inlet, or a leak between regulator and quick disconnect. Hook up your mask and perform a pressure check. Place the emergency lever to the EMERGENCY position, take a deep breath and hold it. If mask leakage occurs, readjust mask and reaccomplish the check. The oxygen should stop flowing. If the mask appears to be properly fitted, but the oxygen continues flowing, the valve is not holding pressure and should be replaced. Return the emergency level to NORMAL. If you cannot exhale, the valve is obstructed, defective, or improperly seated and should be corrected or replaced.

I - INDICATOR - With the diluter lever in 100% OXYGEN position, check blinker for proper operation.

C - CONNECTIONS - Check connection secure at the seat. Check regulator hose for kinks, cuts, or cover fraying. Check that male part of the quick disconnect is not warped and the rubber gasket is in place. A 10 to 20 pound pull should be required to separate the two parts. Check mask hose properly installed to connector.

E - EMERGENCY - Check bailout bottle (if used) properly connected and a minimum pressure of 1800 PSI. (Pressure gage must be checked during parachute preflight.)

GASEOUS OXYGEN SYSTEM NORMAL OPERATION

D2A Regulators [1]

1. Before each flight, be sure oxygen pressure gage indicates 425 ±25 psi. If pressure is low have the oxygen system charged to capacity before takeoff.
2. Diluter lever - NORMAL OXYGEN.
3. Supply lever - ON.
4. Emergency lever - Center position.

MD-1 Regulators [2]

1. Before each flight, be sure oxygen pressure gage indicates 425 ±25 psi. If pressure is low, have the oxygen system charged to capacity before takeoff.
2. Diluter lever - NORMAL OXYGEN.
3. Supply lever - ON.
4. Emergency lever - NORMAL.

GASEOUS OXYGEN SYSTEM EMERGENCY OPERATION

D2A Regulators [1] and MD-1 Regulators

In the event either pilot detects the symptoms of nausea, immediately:

1. Diluter lever - 100% OXYGEN.
2. Emergency lever - EMERGENCY.

Note

- In the event of regulator failure, or a leaking mask or hose; a descent to a lower altitude should be made immediately.
- Oxygen supply is rapidly reduced when either or both crew members demand 100% oxygen or when the emergency lever is held in the EMERGENCY position.

3. When it is evident that an emergency condition no longer exists return diluter lever to - NORMAL OXYGEN.

---

[1] Aircraft 54-2729 thru 56-3491 except 55-4302
[2] Aircraft 55-4302 and 56-3492 and on

MISCELLANEOUS EQUIPMENT

MAP AND DATA CASE

A combination flight report holder and map and data case (11, figure 1-7), is located between the ejection seats just aft of the instructor's quadrant. An additional map and data compartment (3, figure 1-8), is also provided on the right side of the cockpit. This map and data compartment is a part of the upholstery. A safety pin storage compartment is located on the left side of the cockpit and is part of the upholstery. A box in the right-hand nose section is also provided for safety pin storage.

REAR VISION MIRROR

Adjustable rear-vision mirrors are mounted on the inner surface of the canopy just aft of the canopy bow. Mirrors are provided for both the pilot's and instructor's side of the canopy.

ESCAPE TOOL

On aircraft ⚠12 a knife is mounted in a bracket on the canopy bow. This knife is used for cutting through the canopy during an emergency, whenever the canopy fails to jettison.

⚠12 Aircraft 54-2729 and on when modified per T.O. 1T-37-527.

SECTION V

Operating Limitations

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OPERATING LIMITATIONS

This section includes aircraft and engine limitations which must be observed during normal operation. These limitations are derived from extensive wind tunnel and flight testing to insure your safety and to help obtain maximum utility from the equipment. The instrument dials are marked as shown in figure 5-1 as a constant reminder of airspeed and engine limitations; however, additional limitation on operational procedures, aerobatics, and aircraft loading are given in the following paragraphs.

MINIMUM CREW REQUIREMENTS

The minimum crew requirement for this aircraft is one pilot in the left seat.

INSTRUMENT MARKINGS.

Cognizance must be taken of the instrument markings as shown in figure 5-1, since they represent limitations that are not necessarily repeated elsewhere in the text.

ENGINE LIMITATIONS

Engine limitations are shown in figure 5-1.

ENGINE RPM LIMITATIONS

98.5% rpm to 100.5% rpm - limits for full throttle operation. 103% rpm - overspeed limit.

Flight conditions during climbs and dive may result in temporary rpm increases, as high as 103% rpm, which are characteristic of the engine fuel control combination and are permissible. When these conditions occur, however, throttles should be adjusted to maintain engine speeds below 100% rpm. If rpm reaches between 100.5% and 103% during a stable condition of flight (constant altitude and airspeed), an appropriate entry will be made in Form 781 at the completion of the mission and corrected prior to the next flight. Operation of the engine in excess of 103% rpm constitutes an engine overspeed. Appropriate entry will be made in Form 781, indicating highest rpm, exhaust gas temperature and duration (in seconds) of overspeed above 103% rpm.

EXCESSIVE ENGINE EXHAUST GAS TEMPERATURE

If temperature limits are exceeded in flight, the throttles should be adjusted immediately to maintain the exhaust gas temperature within limits. Whenever the above operating limits are exceeded, make appropriate entry in Form 781, indicating highest rpm, exhaust gas temperature, and duration (in seconds of overtemperature condition).

FUEL FLOW FLUCTUATION LIMITATIONS

Fuel flow fluctuation of up to 100 pounds per hour when not accompanied by EGT or rpm fluctuations, are acceptable, providing the fluctuation ceases when the boost pump is momentarily turned off. Fuel flow fluctuation accompanied by EGT or rpm fluctuations or actual engine surge are not acceptable.

INSTRUMENT

The instrument setting is such that the maximum allowable airspeed pointer will move to indicate the limiting structural airspeed of 382 knots IAS or airspeed representing limiting Mach No. of .70 indicated whichever occurs first.

AIRSPEED

135 knots IAS flap-down limit airspeed

135 knots IAS landing lights-down limit

150 knots IAS gear-down limit airspeed

LOADMETER

.8 maximum for takeoff

.5 maxium after 10 minutes of flight

FUEL GRADE JP-4

TACHOMETER

38-95% rpm continuous operation

100% rpm maximum-military (30 minutes)

HYDRAULIC PRESSURE

1250-1550 PSI normal

1750 PSI maximum

Figure 5-1 (Sheet 1 of 2)

MARKINGS

EXHAUST GAS TEMPERATURE

- 280°C minimum for flight (red)
- 280°C to 650°C continuous operation (green)
- 680°C maximum for flight for 30 minutes at 100% rpm (red)
- 780°C instantaneous limit for starting and acceleration (red)

FUEL GRADE JP-4

OIL PRESSURE

- 3 PSI minimum idle (red)
- 10-45 PSI continuous operation (green)
- 65 PSI maximum (red)

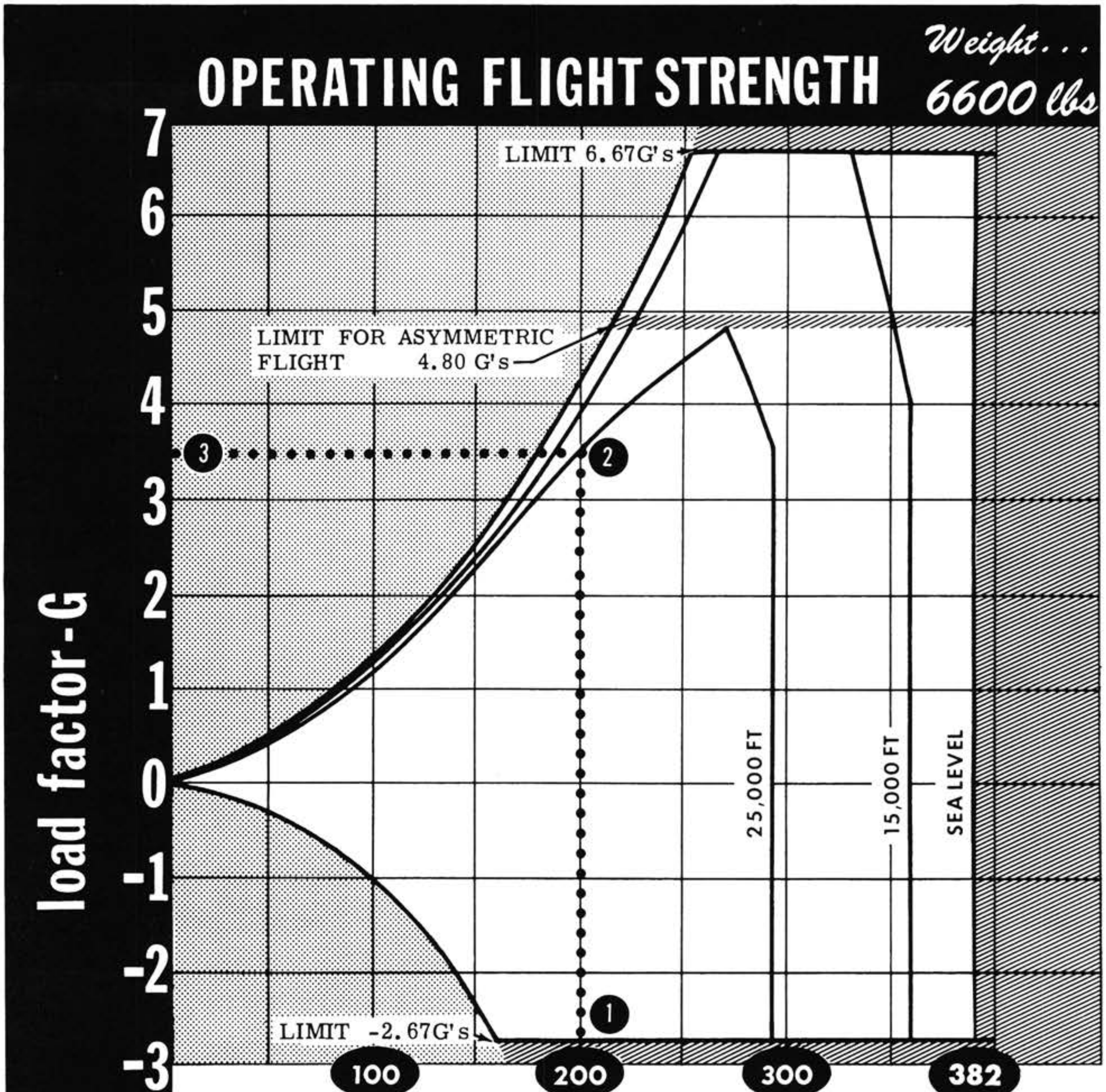
10 PSI fluctuation allowable if mean pressure is in normal operating range.

ACCELEROMETER

- 6.67 G maximum at design gross weight (red)
- -2.67 G maximum at design gross weight (red)

4.80 G maximum asymmetric flight

Figure 5-1 (Sheet 2 of 2)



HOW TO READ CHART . . .

stall
safe
unsafe-structural limits

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" YOU CAN PULL AT THAT AIRSPEED AND ALTITUDE BEFORE STALLING.

NOTE:

The limiting structural air speed is 382 knots IAS OR .70 indicated Mach No. whichever occurs first.

Figure 5-2.

PROHIBITED MANEUVERS

The following maneuvers are prohibited:

1. Vertical (whip) stalls.
2. Snap rolls.
3. Spins, with fuel unbalance in excess of 70 pounds indicated.
4. Intentional fish tail type maneuver by repeated rudder reversal.
5. Maneuvers performed by trim alone.
6. Trimming in a dive at a speed within 20 knots of the limiting structural airspeed.
7. Practice maneuvers with one engine inoperative.
8. Inverted flight for more than 30 seconds.

Note

Any maneuver resulting in prolonged negative acceleration will result in engine flameout. There is no means of insuring a continuous flow of fuel for more than 30 seconds in this attitude.

CENTER OF GRAVITY LIMITATIONS

The aircraft is always loaded so that any expenditure of load or shift in crew members will result in a center of gravity which is always within satisfactory limits. Refer to T.O. 1T-37B-5 for the current applicable operation restrictions.

WEIGHT LIMITATIONS

The maximum gross weight should not exceed 6600 pounds. Above this weight, structural failure may result if a load factor in excess of 6.67G's is obtained. Hard landing at high gross weights may result in structural damage to the aircraft. If a hard landing is experienced, this condition and the accelerometer indication should be entered in Form 781 in order that proper inspection for structural damage may be accomplished prior to subsequent flight.

Snap rolls
Spins (w/ fuel imbalance > 70 lbs)
Single engine maneuvers
Whip stalls
Inverted flight (more than 30 sec) - also prolonged - G
Fishtailing
Trim (maneuvers by trim alone
Trim (in dive within 20K of limiting structural airspeed)

REVERSE SIDE INTENTIONALLY LEFT BLANK

SECTION VI

Flight Characteristics

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FLIGHT CHARACTERISTICS

This aircraft is designed for stability, safety, and good flight characteristics throughout its operational speed range. The flight controls are effective through all permissible maneuvers.

WARNING

Be sure to check fuel boost pump before doing any inverted flying or other maneuvers resulting in prolonged negative "G" forces (5 seconds or more). This is in addition to the fuel boost pump check required during ground operation prior to takeoff. If boost pump is inoperative, the engines will flameout during inverted flying or negative "G" force conditions, and an airstart will be prevented by an air lock. If boost pump is inoperative, land as soon as practical.

STALLS

Clean configuration stalls will be preceeded by heavy buffeting occurring about four knots above the stalling speed. On accelerated stall entries, stall warning occurs approximately eight knots above stalling speeds. Power settings influence the stall warning airspeed but not the characteristics of the aircraft. When an artificial stall warning device is not used, there is no stall warning when 25 percent or more flaps are down. Lateral control throughout the stall maneuvers is good, and no uncontrollable rolling tendencies occur; however, holding the control stock full back will cause pitch oscillation of the aircraft. Elevator control is very good throughout the stall. A rapid forward movement on the control stick will cause the aircraft to pitch sharply which is followed by immediate recovery. Lowering the flaps decreases the stall speed markedly, but heavy buffeting still occurs well above the stalling speed. Aileron and elevator control remains good in a flap-down stall, and good recovery is easily obtained. Stalls with gear and flaps extended usually result in a roll-off to the left or right. This roll-off is easily controlled by prompt application of aileron control.

NOTE

The occupant in the right seat should use caution when performing maneuvers that could result in negative Gs with the throttles in idle. If negative Gs are encountered, it is possible to inadvertently lift the throttles over the idle detent.

SPINS

SPIN CHARACTERISTICS

The T-37 has three spin modes: erect normal, erect accelerated, and inverted. The primary characteristics of each mode is well defined; however, minor characteristics will vary depending on the fuel remaining and type of entry. Although these variations appear minor, they have a definite effect on recovery and, also, on the pilot's ability to recognize what kind of a spin exists.

NORMAL SPINS

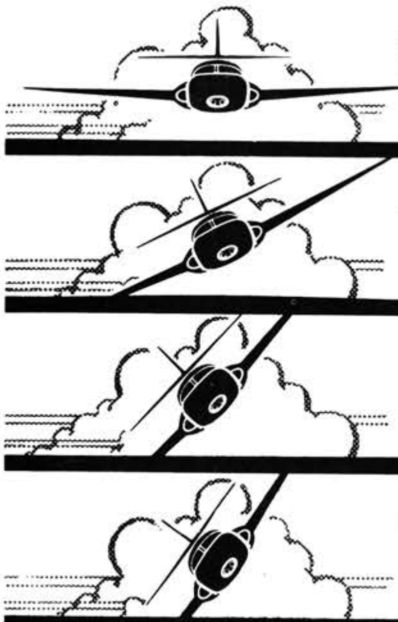
The T-37 will spin in either direction, from 1.0G stall approach or from accelerated entry conditions by applying full back stick and full rudder in the direction of the desired spin. Spin entry is not violent in any manner, but will vary depending on the pitch attitude at time of stall (the higher the pitch attitude, the slower the spin entry) and with gross weight (the higher the gross weight, the slower the entry). This is not to imply that the aircraft is more reluctant to spin at higher gross weights.

The first turn of the spin is more like a roll with the nose dropping below the horizon in the first half and then above the horizon in the last half. Succeeding turns will cause the nose to

STALL SPEED CHART

* POWER OFF ... KNOTS IAS

DATA BASIS: FLIGHT TEST
DATA AS OF: 1 MAR. 1961



GROSS WEIGHT	4,400 LBS			5,400 LBS			6,400 LBS		
FLAP POSITION	UP	HALF	FULL	UP	HALF	FULL	UP	HALF	FULL
LEVEL FLIGHT	71	64	60	79	71	66	86	77	72
30° BANK	77	69	64	85	77	71	93	83	77
45° BANK	85	76	72	94	85	79	102	92	86
60° BANK	101	91	85	112	101	91	122	109	102

* FOR POWER-ON Stall Speeds, (Approx. 85%) Subtract 4 Knots.

Figure 6 -1.

progressively drop below the horizon and finally stabilize at about -30° pitch attitude. Gross weight and type of entry will vary the number of turns to stabilize. The left spin is more oscillatory and takes slightly longer to stabilize than does the right spin. Once the aircraft has entered a stabilized spin the altitude loss is approximately 500 feet per turn, completing a full turn in about three seconds. The aircraft will spin at different rates, depending on the amount of fuel on board. Also, an unbalanced fuel condition can be noticed by aircraft oscillation and varying yaw rates during one revolution. The heavier the aircraft, the slower the spin rate and vice versa. Accelerated entries in general, take longer to stabilize. At very low fuel remaining, the spin tends to be initially flat and the nose may remain above the horizon for as long as three turns.

Accelerated Spins

The accelerated spin is caused by placing the elevator control in some position other than full back stick. The highest rotation rate is encountered with the stick full forward and rudder opposite to the direction of rotation. This maneuver is difficult to perform as the controls must be moved abnormally slow, requiring a minimum of four seconds to full deflection. If controls are moved too fast, the aircraft will recover. The accelerated spin is characterized by lowering of the nose and increasing rate of rotation. As the spin progresses from normal to the accelerated condition, lateral accelerations will be felt and the aircraft will whip as the rate of rotation increases. A new stabilized rotation rate is reached shortly after the accelerated control position is established.

Inverted Spins

The inverted spin can occur from either an inverted stall condition or transitioning from an erect spin by using improper recovery technique. The spin can be accelerated by allowing the controls to free float or by holding rudder in the direction of rotation and moving the stick aft. As with the erect accelerated spin, the nose drops and rotation rate increases until a new stabilized rate is reached. A light fuel weight below 1,000 pounds remaining tends to prevent a spin from occurring from the inverted stall condition. However, entries out of an erect spin are not noticeably affected.

SPIN RECOVERIES

Single Spin Recovery.

One procedure which will recover the aircraft from any spin under all conditions:

1. THROTTLES - IDLE.
2. RUDDER AND AILERONS - NEUTRAL.
3. STICK - ABRUPTLY MOVE FULL AFT AND HOLD.
   a. If the spin is inverted, a rapid and positive recovery will be affected within one-half turn.
   b. If the spinning stops, neutralize controls and recover from the ensuing dive.

If spinning continues, the aircraft must be in an erect normal spin (it cannot spin inverted or accelerated with the controls held in this position). Determine the direction of rotation and proceed with the following steps:

4. RUDDER - ABRUPTLY APPLY FULL RUDDER OPPOSITE TO THE DIRECTION OF SPIN AND HOLD.
5. STICK - ONE TURN AFTER APPLYING RUDDER, ABRUPTLY MOVE THE STICK FULL FORWARD.
   a. As the nose pitches down, relax forward pressure while continuing to hold rudder until spinning has stopped. Do not allow the stick to move aft of neutral until recovery is effected.
   b. Recovery should be accomplished within one and one-half turns from the point at which recovery rudder was applied.

Note

If forward stick is applied before rudder effectiveness is obtained, the spin will momentarily speed up and recovery will take slightly longer.

WARNING

One of the major reasons for missing a recovery is not waiting long enough after the recovery controls have been initiated.

6. CONTROLS - NEUTRAL AFTER SPINNING STOPS AND RECOVER FROM THE ENSUING DIVE.

Note

It is not necessary to relax the forward pressure after the nose pitches down in order to effect recovery; however, if the stick is held full forward, the aircraft attitude upon recovery can be past the vertical. In this position, the aircraft will transition into an inverted spin unless controls are neutralized immediately.

WARNING

The characteristics of the spin and the effectiveness of the recovery procedure will vary: (1) If the stick is not held full aft with rudder neutral during the spin; (2) If the aircraft is spun with over 70 pounds asymmetric wing fuel; (3) If the application of recovery controls is not executed briskly; (4) If the recovery procedure is varied so that less than full rudder or full-down elevator is obtained; (5) If forward stick is applied before rudder effectiveness is obtained.

SPIN RECOVERY CHARACTERISTICS

Recovery characteristics using the Single Spin Recovery Procedure are as follows:

Normal Spins

From an initial condition of stick aft and rudder in the direction of spin, the nose will lower slightly when the rudder is neutralized and, initially, the rotation rate will increase slightly; then as the neutral rudder becomes effective, the rotation rate will decrease slightly and remain constant. When rudder opposite to the direction of rotation is applied, the nose drops slightly and the apparent rotation rate will increase slightly. After approximately one-half turn, the apparent rotation rate will be constant or decreasing slightly; aircraft buffet may be apparent. Full rudder effectiveness will be developed by one full turn. As the forward stick is applied, the nose drops sharply and rotation will stop within one-fourth to one-half turn from this point. If the forward stick pressure is eased off as the nose pitches down, the dive angle will not become excessive.

Accelerated Spins

From any control position, neutralize the rudder and briskly move the stick full aft and hold. As the stick is moved full aft, the nose raises and the rotation rate will start to decrease. The decrease in rotation rate may not be immediately apparent; however, it should be emphasized that as soon as this control position has been established, the aircraft immediately transitions to a normal condition for recovery, i.e., a normal spin recovery (opposite rudder for one turn and forward stick) can then be made without further delay. Recovery will occur within one and one-half turns after opposite rudder is applied.

Inverted Spins

With the aircraft spinning inverted, neutralize rudder and move the stick full aft. A rapid and positive recovery will occur within one-half turn. The aircraft rolls rapidly into an erect stalled condition and rotation stops within one-half turn. When the rotation has definitely stopped, ease forward on the stick and break the stall. The aircraft can be held in the stalled condition for prolonged periods of time; however, if it is held in the stall long enough, it may eventually fall into a normal spin. Although the recovery is very abrupt, it is not excessively violent and is well within the structural limits of the aircraft.

Landing Configuration Spins are not recommended as practice maneuvers; however, if entered inadvertently, use the normal Single Recovery Procedure.

CAUTION

If a landing configuration spin is entered inadvertently, both gear and flaps should be retracted as soon as possible after recovery to prevent excessive structural loads.

FLIGHT CONTROLS

PRIMARY CONTROLS

The primary flight controls (ailerons, elevators, and rudder) are very effective. The ailerons will remain effective throughout the speed range from limiting speed to stall speed. The elevators provide adequate pitch control to maneuver to the limiting load condition in the useful speed range. Caution should be exercised with regard to over-control during maneuvers because of sensivitity of the elevators. Directional control (rudder and ailerons combined) is ample to hold an on-course heading down to stall with only one engine operating.

CONTROL TRIM TABS

The control surface trim tabs will effectively reduce the control forces to zero for the useful flight range and operating extremes of the aircraft. Caution should be exercised in trimming the aircraft in high-dive speeds. See Section V, Operating Limitations. Out-of-trim stick forces caused by operation of the flaps, landing gear, and speed brake are controllable throughout the operating speed range. Refer to Section III for runaway trim procedures.

DIVING

The aircraft performs well in high speed dives and let-downs. A slight decrease in directional stability may occur at high speeds and high altitudes in dives with the speed brake extended, and will be noticeable to the pilot by a "hunting" motion of the nose.

The limit Mach number is .70 at low load factors, and it decreases as "G's" are pulled. Above this Mach number the aircraft tends to tuck under, the dive angle increases and considerable back pressure is required to prevent the dive angle from increasing. Because forward speed must decrease before recovery from this type of dive can be accomplished, a large loss in altitude results. The aircraft will also experience heavy buffeting at high speeds above the critical Mach number.

CAUTION

The critical Mach number can be exceeded when the aircraft is deliberately dived at very steep angles. Never allow the aircraft speed to exceed that indicated by the maximum allowable airspeed pointer which marks limit Mach number.

If critical speed is exceeded it can be detected by:

1. A rapid change in trim which requires considerable back pressure to keep the dive angle from increasing.
2. Buffeting of the aircraft and controls.

When steps one and two occur the recovery procedure is as follows:

1. MAINTAIN STICK FORCE TO KEEP AIRCRAFT FROM INCREASING DIVE ANGLE.
2. THROTTLES - IDLE.
3. SPEED BRAKE - OUT.

As altitude is lost and speed decreases below critical, a normal pull-out may be executed.

WARNING

If you are lower than 10,000 feet above the terrain before buffeting stops and pull-out begins - EJECT.

Care should be taken not to dive at steep angles for prolonged periods without monitoring airspeed and executing pull-out if critical speed is approached. For a more complete breakdown on the effect of a normal acceleration on critical speed, see figure 5-2.

SPEED BRAKE AND THRUST ATTENUATORS

The speed brake is used to increase the aircraft drag for recovery from a high speed dive, to improve descent rate from altitude, and to increase the approach angle during landing. The speed brake is designed to give a minimum pitching moment change and only a small amount of nose UP trim is necessary on brake extension. Extension of the speed brake causes a noticeable buffet which decreases in intensity as airspeed is reduced.

The thrust attenuators are designed to reduce the effective thrust of the engine and serve the same purpose as the speed brake. Extension of the attenuators causes no noticeable pitch change. They enable the pilot to maintain a higher engine rpm on landing in order that faster accelerations will be available for go-around situations without flattening the approach angle. Both the speed brake and the attenuators may be safely extended at any speed within the useful range of operation. Since the speed brake and the thrust attenuators are intended to supplement each other, actuation is simultaneous by the same control switch.

ALTITUDE LOSS IN DIVE

CONSTANT 3G PULL-OUT

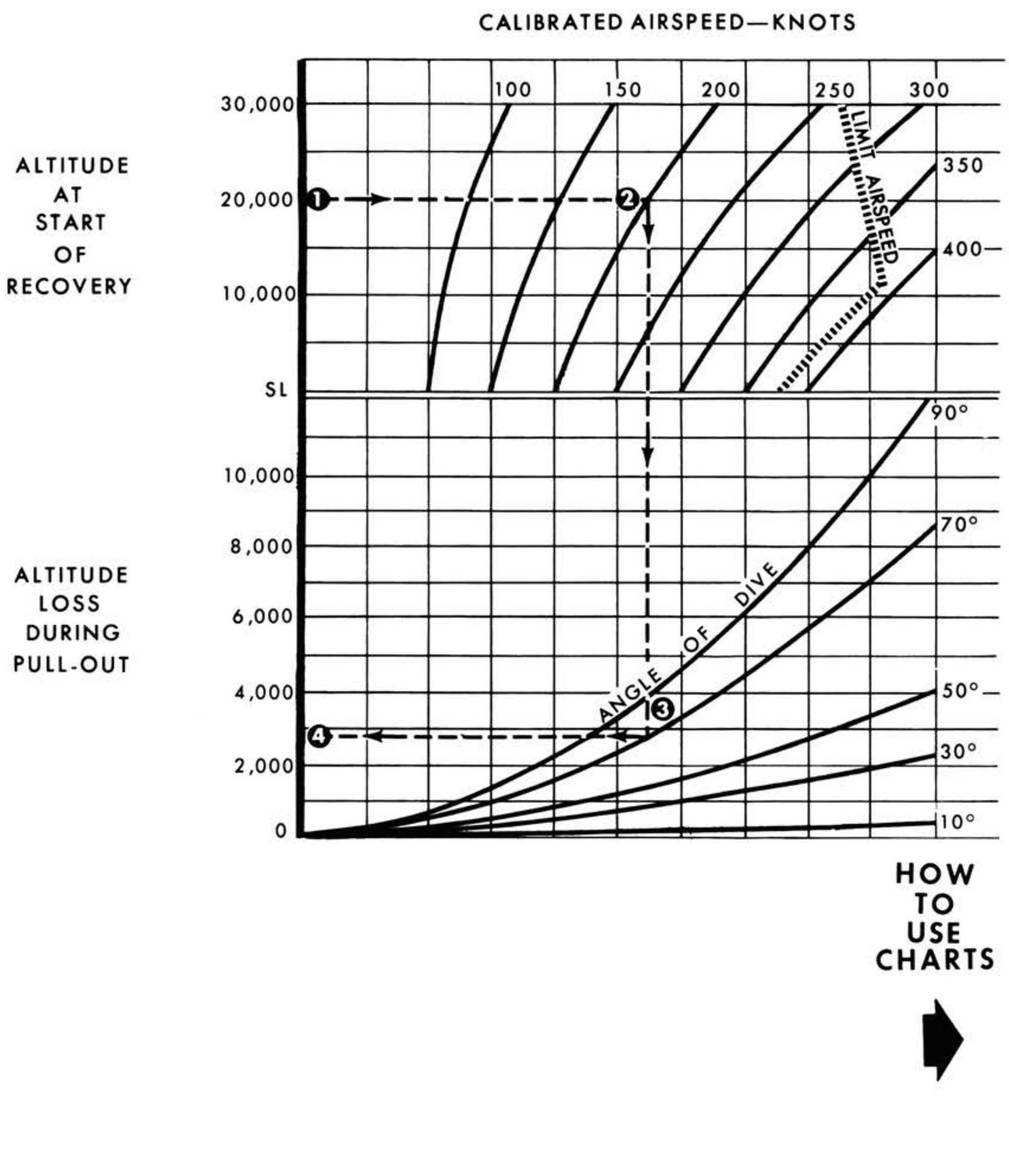
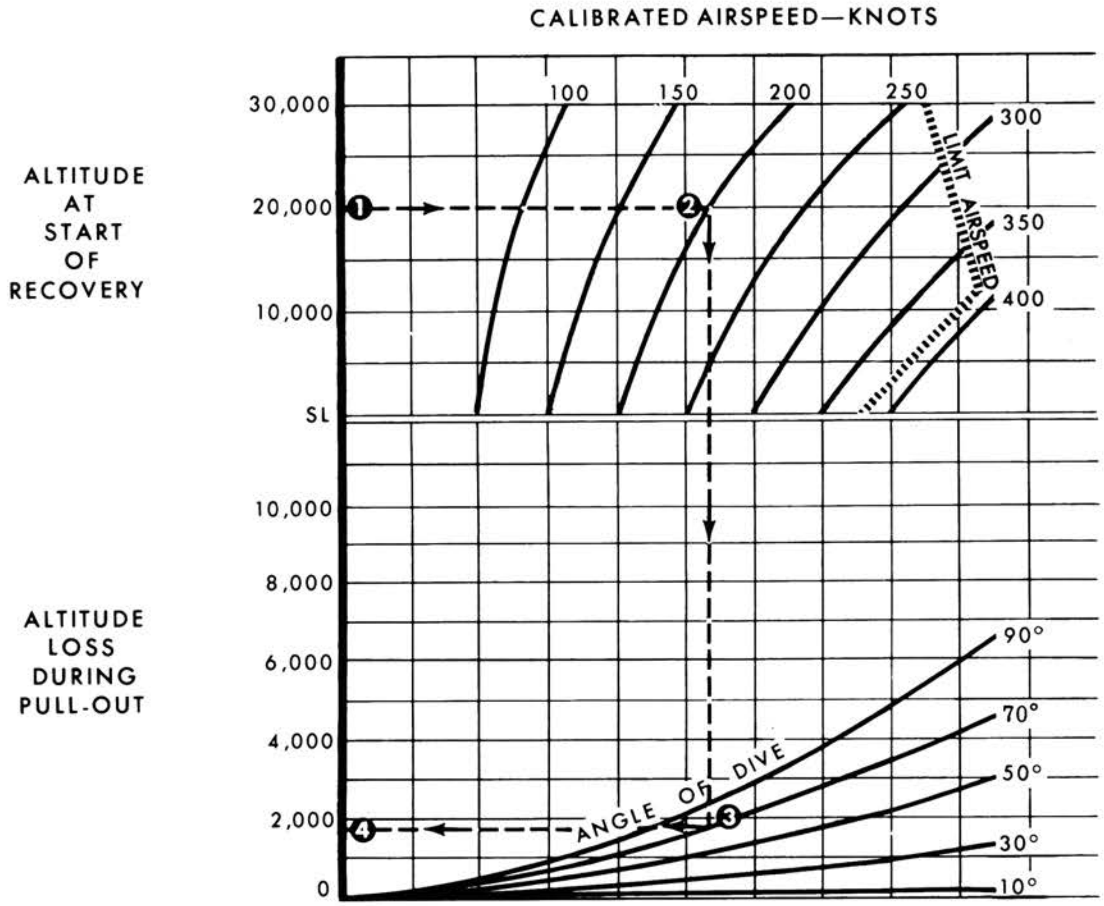


Figure 6-2. (Sheet 1 of 2)

RECOVERY

CONSTANT 5G PULL-OUT



Select appropriate chart, depending upon acceleration (3G or 5G) to be held in pull-out; then—

1. Enter chart at altitude line nearest actual altitude at start of pull-out—Example 20,000 feet.
2. On scale along altitude line, select point nearest the CAS at which pull-out is started (200 knots CAS).
3. Sight vertically down to point on curve of dive angle—70° directly below airspeed.
4. Sight back horizontally to scale at left to read altitude loss during pull-out.

Figure 6-2. (Sheet 2 of 2)

REVERSE SIDE INTENTIONALLY LEFT BLANK

SECTION VII

Systems Operation

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ENGINE ACCELERATION

Each engine fuel control system is equipped with an acceleration control, which determines the amount of fuel an engine will receive for various operating conditions, and maintains a selected rpm regardless of altitude and airspeed changes. When increasing power, move throttles slowly, and as rpm increases the throttles may be advanced more rapidly. The throttles should not be rapidly retarded when reducing power to IDLE position.

WARNING

At an altitude of 25,000 feet or above, avoid rapid throttle movement. Avoid flight above 35,000 feet since flameout may occur when engine speed is changed. In the event of engine flameout, refer to Emergency Procedures, Section III.

ENGINE SURGE

It is possible to experience an engine surge at high altitudes. Such a condition is not hazardous unless allowed to continue, in which case it may eventually result in flameout. To correct an engine surge, reduce the power on the affected engine.

ENGINE NOISE AND ROUGHNESS

A compressor whine may occur at high altitudes, or any altitude when throttles are advanced rapidly. Engine roughness may be experienced at various engine speeds and altitudes. Either of these conditions may usually be eliminated by change in rpm. However, unusual noises or roughness noticed in flight that can be attributed to the engine and cannot be eliminated when the engine speed or altitude is varied indicates some mechanical failure and requires an immediate landing.

FUEL SYSTEM MANAGEMENT

Operation of the fuel system is essentially automatic, requiring no action from the pilot during flight. However, it is important to keep in mind the following conditions which will convert the fuel system from normal to emergency operation automatically.

1. The fuel system switch should be in the NORMAL position for all normal operation.

Note

Refer to paragraph, Fuel Unbalance, of this section for operation of fuel system switch when a fuel unbalance is detected.

2. If the fuel level descends, for any reason, to the low level float switch, the switch actuates the red low level warning light and automatically shuts off the proportioner pump and de-energizes the solenoid locked shutoff valve, which allows fuel to bypass the proportioner pump and enter the fuselage tank by gravity. The amber gravity feed light will be turned on when the solenoid-locked fuel shutoff valve has opened. As gravity feed raises the fuel level in the fuselage tank above the low level float switch, the red low level warning light will go out. If there has not been an electrical failure in the proportioner pump circuit, the amber light will also go out and the proportioner will be turned on. The red low level warning light will not come on again until the fuel level in the fuselage tank is below the low level float switch in the fuselage tank.

CAUTION

Extended operation above 95% rpm at low altitude may result in premature actuation of the low level warning light. Temporarily retarding the throttles to allow the fuel proportioner to exceed engine fuel requirements will correct the situation.

3. If an electrical failure in the proportioner pump circuit occurs, the fuel system will automatically convert to gravity feed and the amber gravity feed light will come on. If an electrical or mechanical failure occurs in the proportioner pump, the fuel system will automatically convert to gravity feed when the fuel level in the fuselage tank descends below the low level float switch, and both the low level warning light and the amber gravity feed light will come on. As the fuel level rises above the low level float switch, both warning lights will go out. However, due to proportioner pump failure, the fuel will again descend below the low level switch and the cycle will be repeated. The fuel system switch should be positioned to EMERGENCY to insure continued gravity flow of available wing fuel to refill the fuselage tank and the aircraft landed as soon as conditions permit.

Note

In the event of fuel system malfunction, check the fuel quantity to determine fuel on board.

4. A complete loss of electrical power will automatically convert the fuel system to gravity feed, but the red low level warning light or the amber gravity feed light cannot be illuminated, because of the loss of electrical power.
5. If the high level flow switch fails to shutoff the fuel proportioner pump, excess fuel will be pumped overboard through the fuselage tank vent valve to prevent fuselage fuel tank rupture.

Note

If an excessive drop in fuel quantity is indicated on the fuel quantity indicator (40 to 50%) it is possible the high level float switch is malfunctioning and fuel is being pumped overboard through the fuselage tank vent valve. The fuel system switch should be positioned to EMERGENCY and the fuel quantity indicator monitored for a normal drop in fuel quantity the remainder of the flight. The malfunction should be entered in Form 781 and the high level float switch checked prior to the next flight.

FUEL UNBALANCE

Unbalance in wing fuel quantities may result due to improper refueling on the ground when the lateral attitude of the aircraft is sloping (due to ramp, unequal shock struts, etc.). Wing fuel quantities should be checked for balance prior to takeoff. Fuel unbalance because of improper fueling may not be noticed until approximately 10 minutes after takeoff because of unsensed fuel in the tanks. In order to insure an accurate check of wing fuel quantity make the balance check after 2 to 3 minutes of straight and level coordinated flight. An unbalance of 160 pounds can exist with no malfunction of the system, If at any time an unbalance greater than 160 pounds is detected in flight, the fuel system switch should be placed in the EMERGENCY position. Fuel should be checked at frequent intervals to ascertain if placing the fuel system switch in the EMERGENCY position is having remedial effect. A landing should be made as soon as conditions permit if fuel unbalance is becoming more pronounced. Although the aircraft can easily be controlled, the increasing unbalance indicates a malfunction and aircraft should be landed, and the condition noted in Form 781.

Note

- A wing heavy condition should be anticipated in the traffic pattern; however, full control of the aircraft can be maintained.
- Avoid confusion between actual wing unbalance and improper aileron and/or rudder trim.
- If fuel quantity remaining in either wing tank does not decrease, that fuel may be trapped in the wing cells. Note the amount of fuel in that tank and subtract it from the total fuel on board to determine useable fuel remaining.

Section VIII
CREW DUTIES

Not Applicable to This Aircraft

SECTION IX
All-Weather Operation

TABLE OF CONTENTS

Note

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ or are in addition to the normal operating instructions covered in Section II and Section IV. Any discussion relative to system operations is covered in Section VII.

INSTRUMENT FLIGHT PROCEDURES

INTRODUCTION

This aircraft has the same stability and flight handling characteristics during instrument flight conditions as when flown under VFR conditions. Instrument flight through thunderstorms, icing conditions, or reliance upon radar control for instrument approaches in heavy or severe weather conditions is not recommended. Radio and navigation equipment in the aircraft will enable the pilot to make three types of instrument approaches; VOR, radar, and ILS (localizer only). Since the aircraft does not have a marker beacon, some other aid must be used to establish your position on ILS final approach. Because of poor radar return characteristics, a VOR approach is considered to be the preferred instrument approach method. Special attention should be given to preflight fuel planning, since certain phases of instrument flying may require unexpected delays such as departure delays, holding, and the additional time required for approach procedures. Particular attention should be given to the flight instrument, radio, and navigation equipment to insure that each is operating properly. To save fuel, the Air Traffic Control clearance should be obtained prior to starting engines. Consult Appendix I for flight planning information and use particular care in planning an alternate destination. The following techniques are recommended from takeoff to touchdown under instrument or night flying conditions.

INSTRUMENT TAKEOFF

Complete the normal TAXI and BEFORE TAKEOFF check as prescribed in Section II and rotate the heading indicator so as to align it with the top index. Use nose wheel steering for directional control until rudder becomes effective at approximately 60 knots IAS. While runway markings remain visible, they should be used as an aid in maintaining proper heading. At approximately 65 knots IAS, increase pitch attitude by two bar widths on the J-8 attitude indicator or 5° on the MM-3. By maintaining this attitude, the aircraft will normally become airborne at approximately 90 knots IAS.

CAUTION

Instrument takeoffs should not be attempted when a crosswind component of 10 knots or more exists.

When the altimeter and vertical velocity indicator indicate a climb, retract the landing gear at a minimum of 100 knots IAS. Retract the flaps at a minimum of 110 knots IAS and maintain a vertical velocity of 500 to 1000 feet per minute climb until tech order climb speed has been attained.

INSTRUMENT CLIMB

Refer to Appendix I for the best climb data.

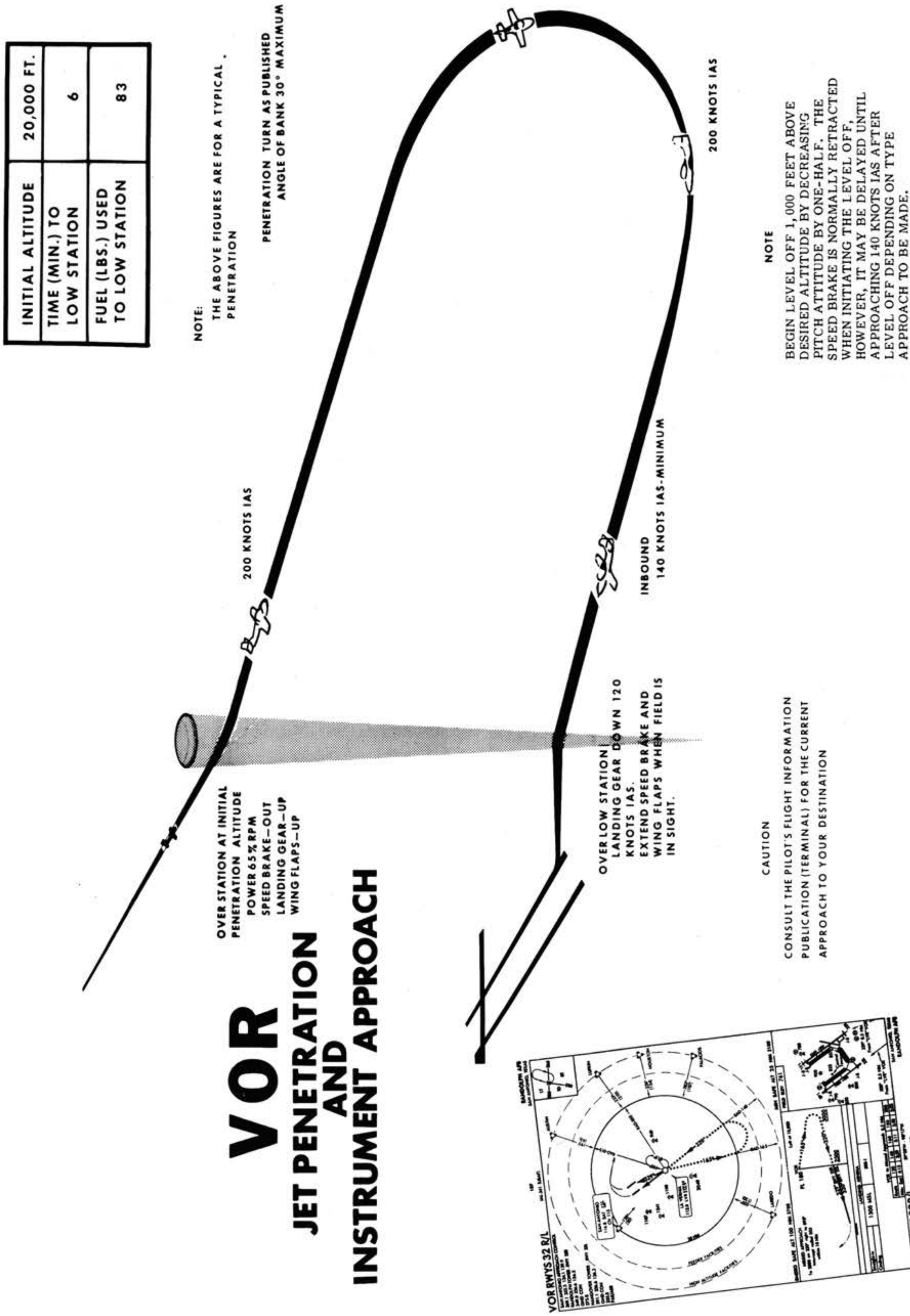

VOR
JET PENETRATION
AND
INSTRUMENT APPROACH
INITIAL ALTITUDE 20,000 FT.
TIME (MIN.) TO LOW STATION 6
FUEL (LBS.) USED TO LOW STATION 83
NOTE:
THE ABOVE FIGURES ARE FOR A TYPICAL PENETRATION.
PENETRATION TURN AS PUBLISHED
ANGLE OF BANK 30° MAXIMUM
200 KNOTS IAS
200 KNOTS IAS
INBOUND
140 KNOTS IAS-MINIMUM
NOTE
BEGIN LEVEL OFF 1,000 FEET ABOVE DESIRED ALTITUDE BY DECREASING PITCH ATTITUDE BY ONE-HALF. THE SPEED BRAKE IS NORMALLY RETRACTED WHEN INITIATING THE LEVEL OFF, HOWEVER, IT MAY BE DELAYED UNTIL APPROACHING 140 KNOTS IAS AFTER LEVEL OFF DEPENDING ON TYPE APPROACH TO BE MADE.
OVER STATION AT INITIAL PENETRATION ALTITUDE
POWER 65% RPM
SPEED BRAKE-OUT
LANDING GEAR-UP
WING FLAPS-UP
OVER LOW STATION
LANDING GEAR DOWN 120 KNOTS IAS.
EXTEND SPEED BRAKE AND WING FLAPS WHEN FIELD IS IN SIGHT.
CAUTION
CONSULT THE PILOT'S FLIGHT INFORMATION PUBLICATION (TERMINAL) FOR THE CURRENT APPROACH TO YOUR DESTINATION
VOR RWYS 32 R/L

Figure 9-1.

Turns after takeoff should not be attempted below 500 feet above the terrain and for ease and precision of flight, limit all turns to 30° bank angle.

INSTRUMENT CRUISING FLIGHT

It is seldom necessary in routine flight to exceed 30° bank angle; however, the aircraft can be controlled in steep turns up to 60° bank angle.

SPEED RANGE

The aircraft has satisfactory handling characteristics, throughout the speed range at all altitudes. The trim system will effectively reduce the stick pressure to zero throughout the speed range. If trim is properly used, the aircraft can be controlled with ease at all airspeeds within the speed range.

Note

The aircraft has a tendency to bounce and yaw when flying in light to moderate turbulence.

RADIO AND NAVIGATION EQUIPMENT

Refer to Section IV for radio and navigation equipment installed in the aircraft.

DESCENT AND PENETRATION

When cruising at altitudes above 20,000 feet, a descent to initial penetration altitude, prior to reaching the destination fix, may be made at the airspeed and power settings given in the descent charts in Appendix I. When cruising or continuing a letdown below 20,000 feet, descent should be made at the airspeed, power setting, and configuration given for normal penetration. The angle of bank should be limited to 30° during the instrument penetration.

Note

- The cockpit and windshield should be kept as warm as possible before and during descents to eliminate fogging conditions on the canopy during rapid descents.
- Pilot should be aware that aerobatics will induce gross precession errors in the attitude indicator.
- Check the heading indicator against the magnetic compass prior to starting descent.

Various power settings can be used and descents can be made at speeds up to the limiting Mach number of the aircraft. However, 180 knots IAS produces the most satisfactory flight characteristics in turbulence. For a penetration, starting at initial penetration altitudes, reduce power to 65% rpm and lower the pitch attitude of the aircraft (approximately 10°) to establish 200 knots IAS, and extend the speed brake.

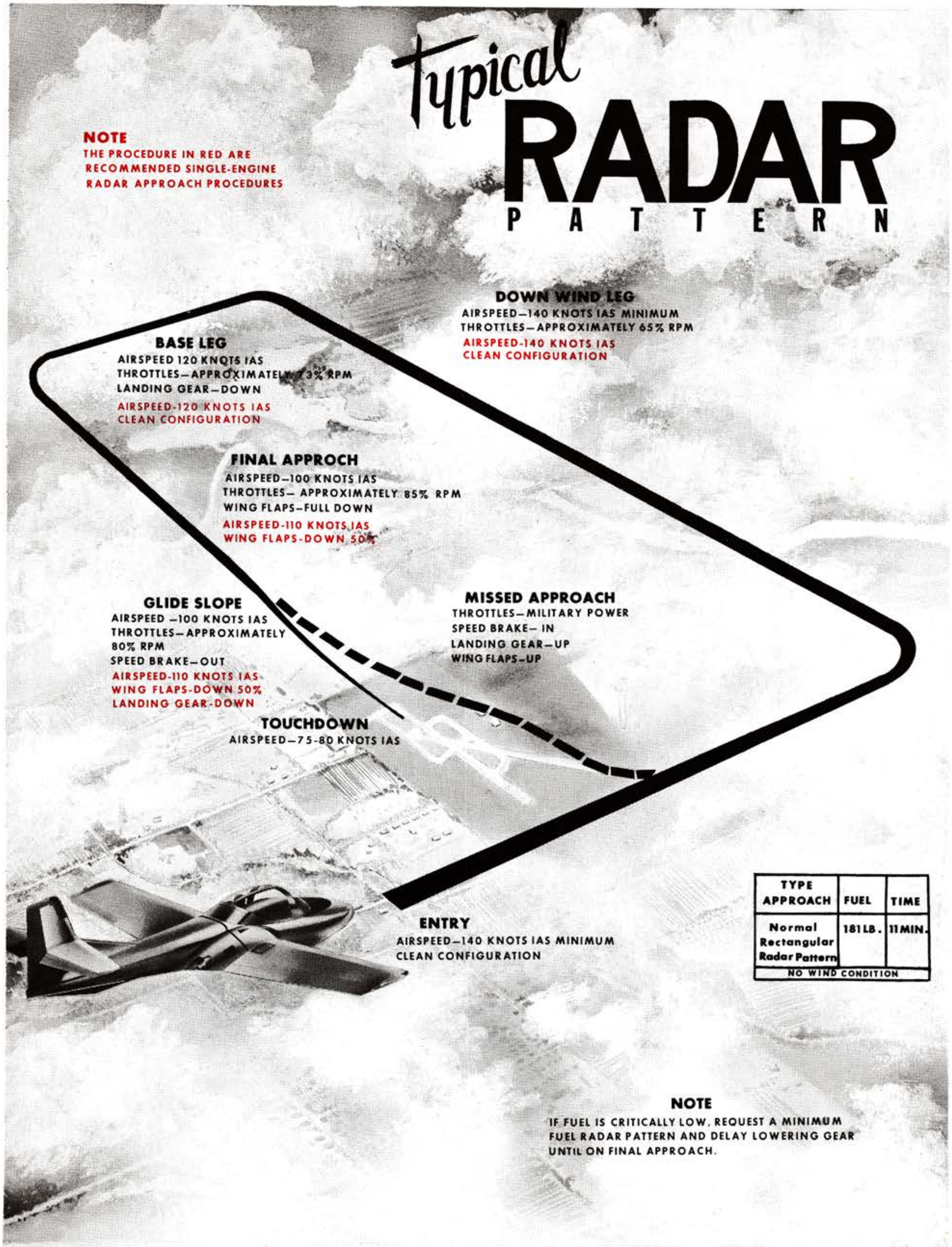
Figure 9-1 shows a typical VOR jet penetration and instrument approach; however, the published procedures for jet penetration may vary at USAF, Navy, and civil installation. Consult the Flight Information Publication (Terminal) for current approach to your destination during the planning phase of your flight.

Start level off from the penetration descent at 1000 feet above the desired altitude by decreasing the pitch attitude on the attitude indicator by one-half. When reaching the normal lead point (10% of the vertical velocity), slowly raise the nose of the aircraft to level off at the desired altitude. The speed brake is normally retracted when initiating the level off, however, it may be left extended to obtain the desired airspeed and configuration at the low station. This will depend upon when the descent was begun, the type approach to be made, and the distance/time from the station to the field. After level off, maintain a minimum of 65% RPM and a minimum of 140 knots IAS to the station. Lower the landing gear and maintain 120 knots IAS prior to or over the station depending on the type of approach to be executed.

If a single-engine penetration is required, proceed as in a normal penetration except use 75% RPM on the operating engine and raise the speed brake when initiating the level off at 1000 feet above the desired altitude. After level off, maintain a minimum of 120 knots IAS. For a straight-in approach, attain landing configuration - landing gear down and half flaps - on final approach and maintain a minimum of 110 knots IAS. For a circling approach, attain landing configuration - landing gear down and half flaps - on base leg or final and maintain a minimum of 110 knots IAS.

HOLDING

Recommended holding pattern airspeed is 160



TYPE APPROACH	FUEL	TIME
Normal Rectangular Radar Pattern	181LB.	11MIN.
NO WIND CONDITION		

Figure 9-2

knots IAS above 14, 000 feet and 140 knots IAS at or below 14, 000 feet. To descend when holding at high altitude reduce power to 65% rpm minimum and maintain holding pattern airspeed, using speed brake as desired. To descend when holding at low altitude, lower speed brake and maintain holding pattern airspeed. No power reduction is normally required.

INSTRUMENT APPROACHES

If instrument flight conditions exist at minimum penetration altitude, it will be necessary to execute an instrument approach. Figure 9-1 shows a typical VOR approach, and Figure 9-2 shows a standard rectangular version of the basic radar pattern. With heavy fuel loads or turbulent conditions, it may be necessary to use higher than normal power to maintain the desired indicated airspeeds. Normally, 140 knots IAS is used for all maneuvering prior to the actual approach. For the approach lower the landing gear and maintain 120 knots IAS. For a straight-in approach, extend the speed brake and wing flaps when the field is in sight and maintain a minimum of 110 knots IAS during the base leg and a minimum of 100 knots IAS on final approach. Descents during approaches are normally made at a rate of approximately 500 feet per minute and should not exceed 1, 000 feet per minute. To descend with a clean aircraft configuration, extend the speed brake and maintain a minimum of 65% rpm. To descend in the landing configuration, vary the power to maintain the recommended approach airspeed with speed brake extended. Occasionally, conditions may require the execution of a missed approach. The recommended procedure for executing a missed approach is to apply power to 100% rpm, retracing speed brake as power is applied, and establishing an instrument takeoff attitude. Gear and flaps should be retracted in the same manner as during an instrument takeoff. When the climb airspeed reaches a minimum of 140 knots IAS, reduce power to approximately 85% until reaching missed approach altitude. When the desired altitude is reached, reduce power to maintain a minimum of 140 knots IAS or a minimum power setting of 65% rpm.

RADAR APPROACH

The procedure for a radar approach is outlined in figure 9-2. Refer to Section III and figure 9-2 for single engine landing procedures.

RADAR APPROACH

The procedure for a radar approach is outlined in Figure 9-2. Refer to Section III and Figure 9-2 for single-engine landing procedures. When a straight-in radar approach is required, lower the landing gear at approximately 10 miles and full flaps at approximately 7 miles from touchdown.

CAUTION

Because of the poor radar return, a short pattern should be requested. Lowering the landing gear will improve the radar return

Note

If speed brake is used on final approach, opening and closing of the thrust attenuators will occur when power is adjusted near the 70% rpm power setting.

ILS APPROACH

An ILS cannot be accomplished since the radio navigational equipment does not include a glide slope receiver, but the ILS localizer may be used.

RADAR LETDOWNS

Radar letdowns of various types can be made in this aircraft. By proper radar control techniques for the letdown and turn onto final approach, maximum economy of fuel and time can be realized. Because of the poor radar return of the aircraft, attempt a radar controlled descent only if VOR penetration is not available.

ICE AND RAIN

ICE

WARNING

There is no deicing equipment installed on this aircraft. Ice on the air intake, when ingested, may cause the engines to flameout. Cruising in icing conditions should, therefore be avoided. If engine flameout occurs due to ice ingestion, immediate restart is possible without engine damage.

Icing of the air intake area is an ever-present possibility during operation in weather with temperature near the freezing point. An engine ice warning light, located on the instrument panel, will illuminate when ice forms over the ice detect probe located in the left engine air inlet duct. This may be the only noticeable indication of ice formations until ice ingestion occurs.

Cruising in areas of known or suspected icing conditions is not recommended. Ice will normally adhere to the windshield, wing leading edges, empennage, and air inlet areas. Altitude should be changed immediately upon the first sign of ice accumulation. Ice accumulation on the empennage will cause the elevators to freeze to the horizontal stabilizer. Ice accumulation on the air intake area may cause both engines to flameout by ice ingestion. The windshield defroster is not effective in preventing the formation of ice or removing ice from the windshield. The resultant drag associated with aircraft icing acts to reduce the airspeed and to increase the power requirements, with a consequent reduction of range.

WARNING

- When flying in icing conditions be constantly alert for the elevators freezing to the horizontal stabilizer. Considerable force is required to break the elevators loose. Leave the area of icing as soon as possible.
- Ice accumulations will greatly increase the stalling speed; therefore, extreme caution must be exercised when landing under such conditions.

Note

Ice breaking loose from the nose area will strike the tail; the impact will be alarming but normally will cause no damage.

If icing conditions are encountered at freezing atmospheric temperatures, change altitude rapidly by climbing or descending.

RAIN

Flight in heavy to severe rain showers need not be avoided except to maintain radar contact. Prior to entering an area of precipitation, close the outside air ventilating ducts and turn pitot heat on.

TURBULENCE AND THUNDERSTORMS

CAUTION

Intentional flight through a thunderstorm is not recommended.

Constant throttle settings and level flight attitude are recommended for safe flight through thunderstorms. An established power and attitude combination prior to actual thunderstorm penetration will result in an approximately constant airspeed throughout the storm, regardless of probable false reading of the airspeed indicator.

Note

The recommended speed for the aircraft in severe turbulence and thunderstorms is 180 KNOTS IAS.

APPROACHING THE STORM

When a thunderstorm penetration cannot be avoided, prepare for the penetration by adjusting power to obtain the best penetration speed. Trim the aircraft to fly straight and level. Turn on the pitot heat, tighten safety belt, and lock shoulder harness. At night, remove the red filters from the cockpit lights to minimize blinding effect of lightning. Do not lower the gear or flaps.

Note

Make every effort to avoid looking up from the instrument panel at lightning flashes. The blinding effect of lightning can be reduced by lowering the seats.

IN THE STORM

When in the storm, maintain power setting and level flight attitude. Do not attempt to compensate for changes in indicated airspeed or altitude. Concentrate on maintaining a constant attitude and heading. Do not make any turns unless absolutely necessary.

Note

Thunderstorm turbulence increases in intensity with altitude to within 5000 to 10,000 feet of the tops. The thunderstorm can normally be circumnavigated.

NIGHT FLYING

NIGHT FLYING

Be thoroughly familiar with the lighting equipment of the aircraft, know the location of all switches in the cockpit, and carry a flashlight. Check all lights for proper operation. Leave the navigation and required cockpit light on. During night weather flight, place the navigation lights switch in the DIM and STEADY position and place the anti-collision beacons switch in the OFF position to prevent any distraction created by cloud reflections. During normal VFR flight, unfiltered lights should be used sparingly.

Note

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

COLD WEATHER PROCEDURES

The success of low temperature operation depends primarily upon the preparations made during the post flight inspection, in anticipation of the requirements for operation on the following day. In order to expedite preflight inspection and insure satisfactory operation for the next flight, normal operating procedures outlined in Section II should be adhered to with the following additions and exceptions.

BEFORE ENTERING AIRCRAFT

Remove all protective covers and dust plugs and check that the entire aircraft is free from frost, snow, and ice. Brush off all light snow and frost. Remove ice by a direct flow of air from a portable ground heater.

WARNING

Care should be taken to insure that water from melted ice is sponged so that it will not drain to some critical area and refreeze. Dangerous loss of lift may result if the aircraft is not adequately cleaned of all frost, snow, and ice before takeoff.

Insure that water is drained from the fuel tanks before cold weather operations.

If during operation of the canopy, it is found that the raising or lowering puts undue strain on the canopy motor or hinges, preheat should be applied to insure normal operation. Be sure that the fuel tank vents, fuel filter, and drain cocks are free from ice and drain condensate. Check that the static air, pitot tube, and transducer vane are free of ice. If ice within the engine is suspected, check the engine for freedom of rotation. If engines are not free, external heat must be applied to forward engine section to melt the ice. Check shock struts and actuating cylinders for dirt and ice.

ON ENTERING THE AIRCRAFT

Check flight controls for proper operation and insure that canopy can be closed and locked. To conserve the battery, use external power to operate all electrical and radio equipment.

STARTING ENGINES

Start the engines using the normal starting procedure outlined in Section II. Oil pressure may be high after starting cold engines. This is not dangerous unless the pressure remains high. Takeoff should not be made until oil pressure drops to normal.

Note

If normal starting rpm (8 - 12%) cannot be obtained, shutdown the engine and connect an adequate power source.

WARM-UP AND GROUND CHECK

Turn on cabin heat and windshield defrosting system, as required, immediately after starting engines. Check the speed brake, thrust attenuators, and trim tabs for proper operation. Check the wing flaps and flap indicator for operation. If questionable readings result, recycle the flaps three to four times as a check on the indicator action.

WARNING

Make sure all instruments have warmed up sufficiently to insure normal operation. Electric gyro instruments require approximately two minutes for warm-up.

CAUTION

Because of low ambient temperatures, the thrust at all engine speeds is noticeably greater than normal. This should be remembered during all ground operations, and firmly anchored wheel chocks used for all engine runups.

TAXIING INSTRUCTIONS

Avoid taxiing in deep snow. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds. Increase space between aircraft while taxiing to provide safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice in the jet blast of preceding aircraft. Taxi speed should be reduced when taxiing on slippery surfaces to avoid skidding.

WARNING

Make sure all instruments have been sufficiently warmed up to insure normal operation. Check for sluggish instruments during taxiing.

TAKEOFF

Make final instrument check during the first part of the takeoff as the brakes will not hold the aircraft on snow-covered or icy runways at full throttle. Advance throttles smoothly or swerving may result.

Note

Nose wheel steering is essential for takeoff from icy runway.

AFTER TAKEOFF

If takeoff from a snow or slush-covered field is made, the brakes should be operated several times to expel wet snow or slush, and the landing gear and wing flaps operated through several cycles to prevent their freezing in the retracted position.

CAUTION

Do not exceed the landing gear and wing flap down limit airspeed during this operation.

DESCENT

Rapid descents generally cause a fogging condition to exist inside the canopy and windshield. Therefore, it is necessary that the pilot preheat the canopy and windshield approximately 10 minutes before a descent is made. A slight discomfort to the pilot may be encountered but pre-heating aids in preventing canopy and windshield fog.

WARNING

The collection of snow, frost, and ice on the aircraft constitutes one of the major flight hazards in low temperature operation and will result in the loss of lift and in treacherous stalling characteristics.

APPROACH TO PATTERN

Make normal pattern and landing as outlined in Section II.

BEFORE LEAVING THE AIRCRAFT

Release brakes after wheels are chocked and leave canopy partly open to allow circulation within the cockpit to prevent canopy cracking from contraction and to reduce windshield and canopy frosting. Whenever possible, leave the aircraft parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering the fuel system. Check that protective covers and dust plugs are installed, and that the battery is removed when aircraft is outside in temperatures below -29°C (-20°F), for more than four hours or any extended period of time.

DESERT AND HOT WEATHER PROCEDURES

Hot weather and desert operation is identical with normal operation with few exceptions. Takeoff and landing rolls are longer due to lower air density. Added precautions should be taken to protect the rubber or plastic parts of the aircraft from damage by excessive heat.

BEFORE ENTERING THE AIRCRAFT

Inspect intake ducts for sand or other foreign objects. If excessive sand is found, do not start the engine. Inspect tires for blisters, deterioration, and proper inflation. Check for hydraulic system leaks as heat and moisture may cause packing and valves to swell.

TAXIING INSTRUCTIONS

Taxi with minimum power to minimize the blowing of dust and sand onto other aircraft. Keep adequate distance from any other aircraft taxiing ahead of you, and use brakes as little as possible to prevent over-heating.

TAKEOFF

During takeoff, the aircraft will accelerate slowly and ground run will be longer because the air is less dense in hot weather. Ground speed will be increased for the same IAS.

AFTER TAKEOFF

Follow the normal flight procedures, being particularly careful to maintain throttle settings that will keep the exhaust gas temperature within the prescribed engine limitations.

DESCENT

Turn on defroster prior to descent since warm humid air is likely to cause canopy frosting in hot weather descents.

APPENDIX I

Performance Data

The appendix is divided into eight parts as follows: Part I, Introduction; Part II, Takeoff; Part III, Climb; Part IV, Range; Part V, Endurance; Part VI, Descent; Part VII, Landing and Part VIII, Mission Planning. These Parts are presented in proper sequence for preflight planning. Discussions and sample problems are given in each part.

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PART I INTRODUCTION

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INTRODUCTION

The flight performance charts provide the pilot with sufficient data for preflight and in-flight planning. All charts are based on ICAO (International Civil Aviation Organization) Standard Day conditions. When necessary, temperature corrections for non-standard atmosphere have been included on the charts. Charts for climb, cruise, endurance and descent performance are presented in drag index form, however, since the aircraft has only one external loading configuration (no external stores), a Drag Configuration Index of 0 is used throughout.

ALTITUDE CORRECTION

The error in indicated altitude is negligible and is, therefore, ignored throughout the appendix.

AIRSPEED CORRECTION

Charts are provided to obtain calibrated airspeed (CAS), equivalent airspeed (EAS) and true airspeed (TAS), ground speed (GS) is TAS corrected for wind.

INDICATED AIRSPEED

Indicated airspeed (IAS) is read directly from the airspeed indicator.

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for both error in the airspeed sensing system and in the airspeed indicator. The error in the indicator is usually very small and not available to the pilot and is, therefore, normally ignored for routine flying. Calibrated airspeed as used in this manual shall then be indicated airspeed corrected for airspeed sensing system (installation) error only by the values given in figure A1-1.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for the effects of compressibility. Although this correction is negligible at low speed and low altitude, it may be as much as seven or eight knots at higher speeds and altitudes. The corrections shown in the Compressibility Correction Charts (figure A1-2) are subtracted from the calibrated airspeed to obtain equivalent airspeed.

TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for atmosphere density. The Type CPU-26P dead-reckoning computer or figure A1-3 may be used for this correction.

SPEED CONVERSION CHART

The Speed Conversion Chart (figure A1-3) is used to convert calibrated airspeed (CAS) directly to true airspeed (TAS). The compressibility effect has been included in this chart.

SYMBOLS AND DEFINITIONS

SYMBOLS	DEFINITIONS
IAS	Indicated airspeed, airspeed indicator uncorrected. Where this symbol (IAS) is used on the performance charts, mechanical error in the instrument is assumed to be zero.
ΔV_i	Airspeed position error correction.
CAS	Calibrated airspeed, indicated airspeed corrected for position error: $CAS = IAS + \Delta V_i$.
ΔV_c	Airspeed compressibility correction.
EAS	Equivalent airspeed, calibrated airspeed corrected for compressibility: $EAS = CAS - \Delta V_c$.
TAS	True airspeed, equivalent airspeed corrected for atmospheric density: $TAS = EAS \times \frac{1}{\sqrt{\sigma}}$
OAT	Outside air temperature.
GS	Ground speed, true airspeed corrected for the wind component velocity: $GS = TAS + V_W$.
h_d	Density altitude, that value obtained from the density altitude chart, figure A1-4, at which air density at the observed pressure altitude equals air density as defined by the International Civil Aviation Organization.
σ	Sigma-ratio of ambient air density to standard day sea level air density.
V_W	Wind velocity component. Headwinds considered (-), tail winds considered (+).
Kn or Kts	Knots, Nautical miles per hour

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

AIRSPEED POSITION CORRECTION

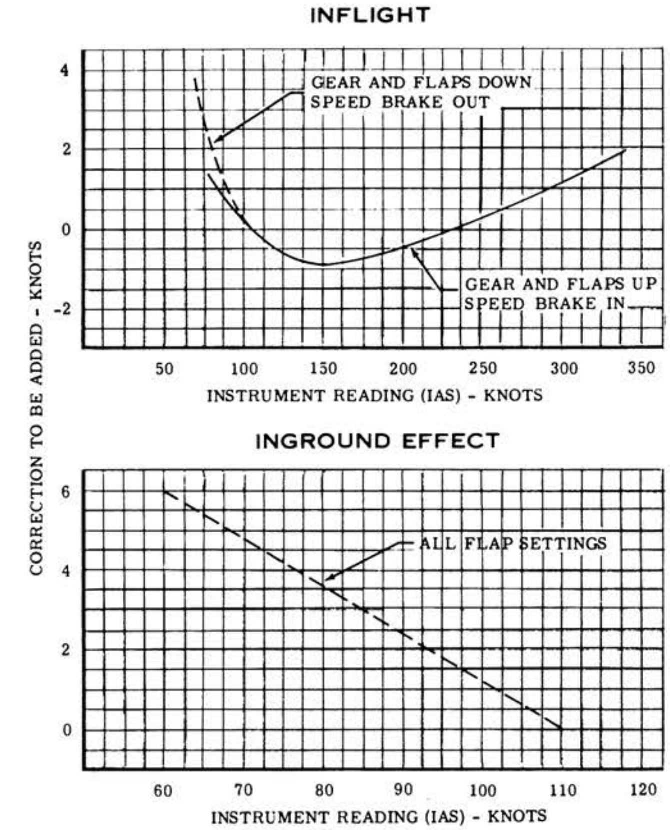


Figure A1-1

COMPRESSIBILITY CORRECTION CHART

SPEED CORRECTION FROM CALIBRATED
AIRSPEED TO OBTAIN EQUIVALANT AIRSPEED

EXAMPLE: During flight at 20, 000 feet and 200 knots CAS, correction factor is 3 knots. Subtract 3 from 200 to obtain 197 knots equivalent airspeed (EAS).

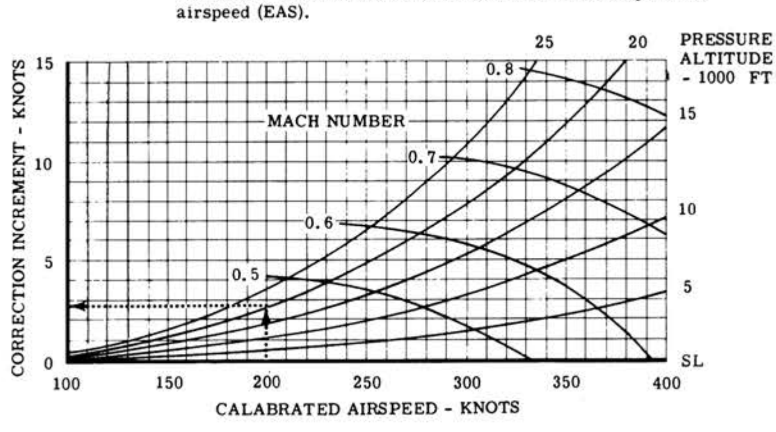
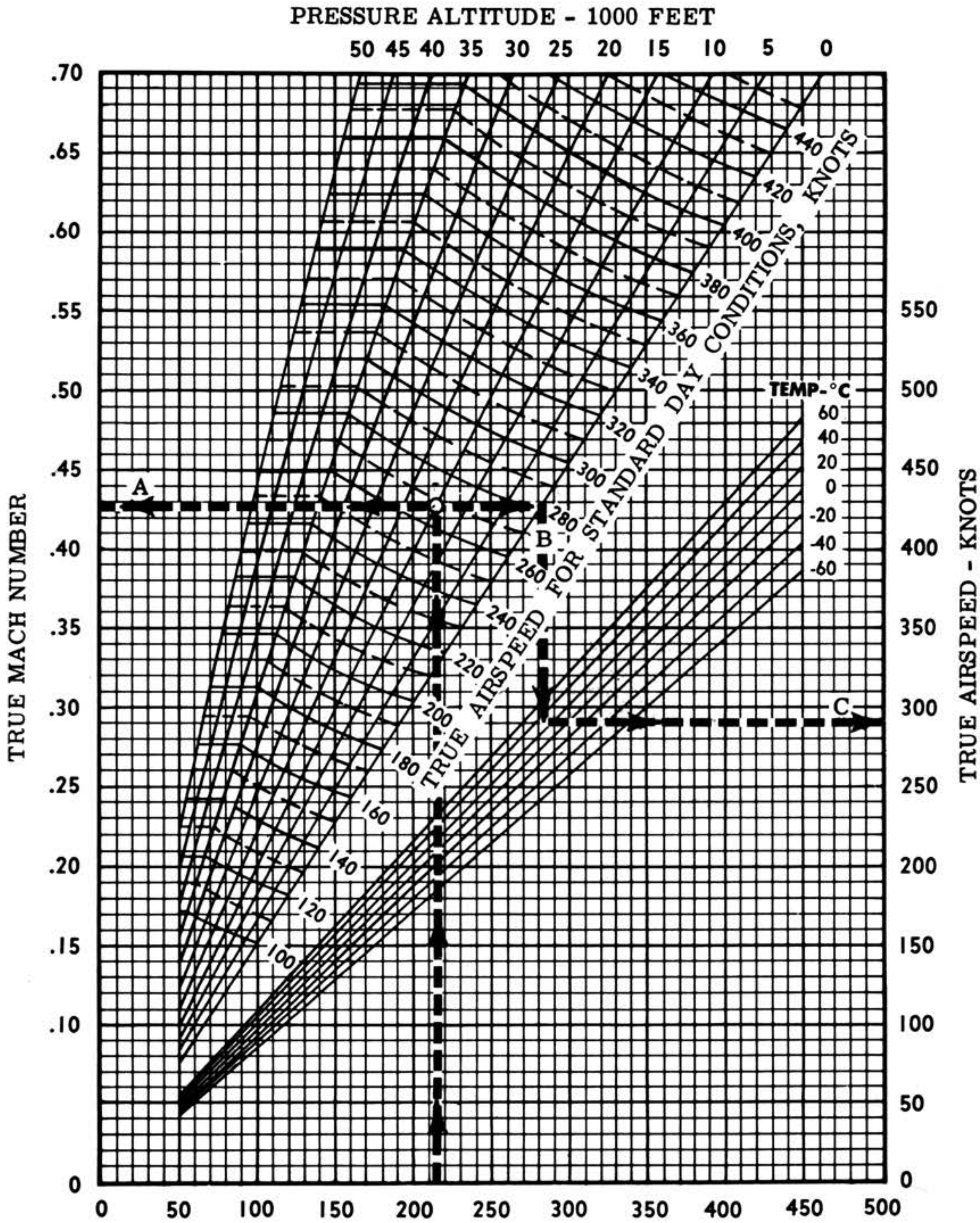


Figure A1-2

SPEED CONVERSION CHART



EXAMPLE: CAS = 215 Knots
Alt = 15,000 Feet
A TMN = .428
B TAS = 267 Knots at Standard Temp (-14.7°C)
C TAS = 290 Knots at temp of 30°C

Figure A1-3

DENSITY ALTITUDE CHART

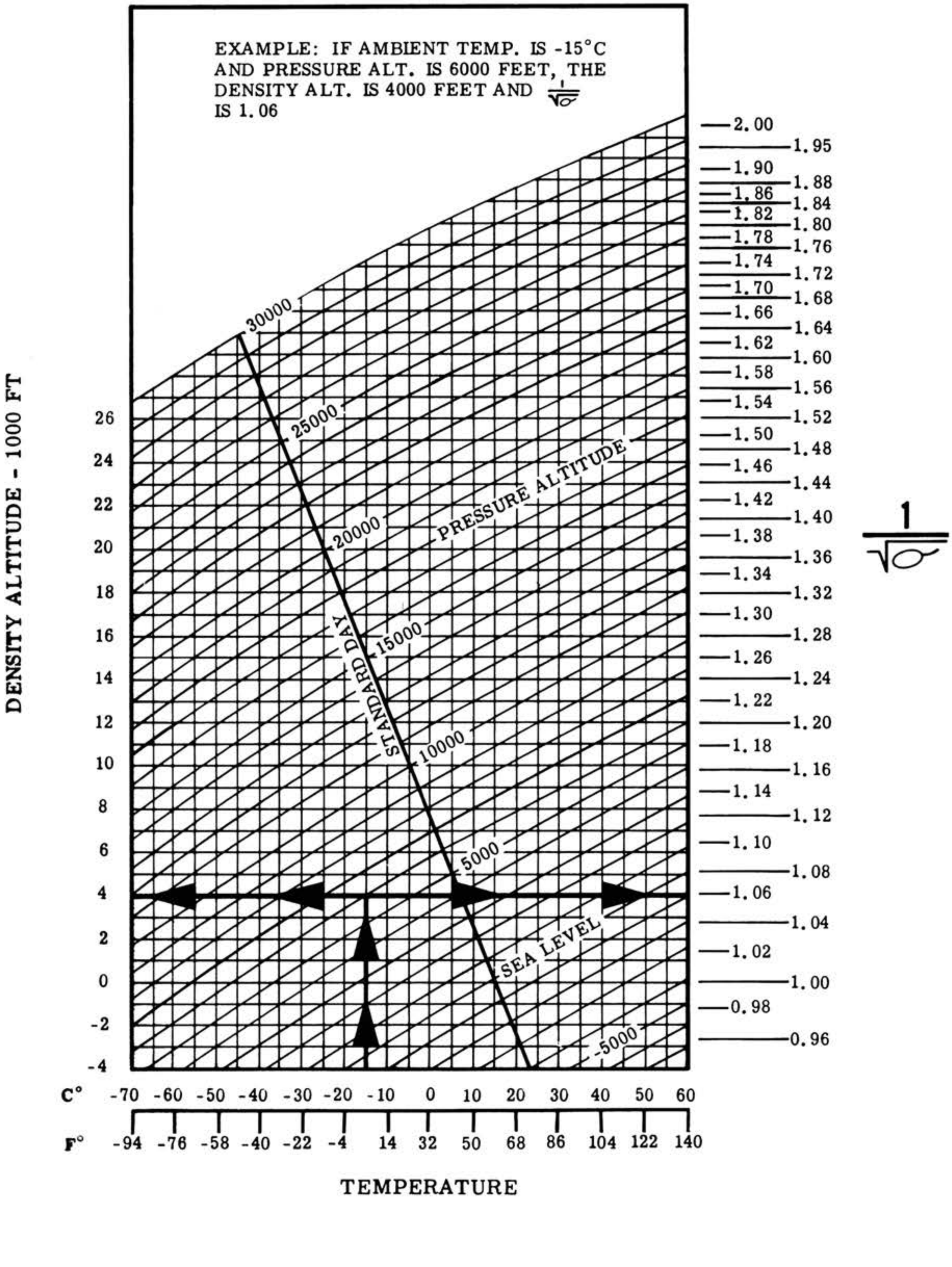


Figure A1-4

STANDARD ATMOSPHERIC TABLE

Standard Sea Level Air:
T = 15°C. W = .07651 lb/cu. ft. ρ_o = .002377 slugs/cu.ft.
P = 29.921 in. of Hg. 1" of Hg. = 70.732 lb/sq. ft. = 0.4912 lb/sq. in.
This tabel is based on ICAO Technical Report No. 3182 - 1116 ft. /sec.

Altitude feet	Density Ratio ρ/ρ_o	$\frac{1}{\sqrt{\sigma}}$	Temperature Deg. C	Temperature Deg. F	Speed of Sound Ratio a/a_o	Pressure In. of Hg.	Pressure Ratio P/Po
0	1.0000	1.0000	15.000	59.000	1.0000	29.92	1.0000
1000	.9710	1.0148	13.019	55.434	.997	28.86	.9644
2000	.9428	1.0299	11.038	51.868	.993	27.82	.9298
3000	.9151	1.0454	9.056	48.301	.990	26.81	.8962
4000	.8881	1.0611	7.075	44.735	.986	25.84	.8636
5000	.8616	1.0773	5.094	41.169	.983	24.89	.8320
6000	.8358	1.0938	3.113	37.603	..979	23.98	.8013
7000	.8106	1.1107	1.132	34.037	.976	23.09	.7716
8000	.7859	1.1280	-0.850	30.471	.972	22.22	.7427
9000	.7619	1.1456	-2.831	26.904	.968	21.38	.7147
10000	.7384	1.1637	-4.812	23.338	.965	20.58	.6876
11000	.7154	1.1822	-6.793	19.772	.962	19.79	.6614
12000	.6931	1.2012	-8.774	16.206	.958	19.03	.6359
13000	.6712	1.2206	-10.756	12.640	.954	18.29	.6112
14000	.6499	1.2404	-12.737	9.074	.950	17.57	.5873
15000	.6291	1.2608	-14.718	5.507	.947	16.88	.5642
16000	.6088	1.2816	-16.699	1.941	.943	16.21	.5418
17000	.5891	1.3029	-18.680	-1.625	.940	15.56	.5202
18000	.5698	1.3247	-20.662	-5.191	.936	14.94	.4992
19000	.5509	1.3473	-22.643	-8.757	.932	14.33	.4790
20000	.5327	1.3701	-24.624	-12.323	.929	13.75	.4594
21000	.5148	1.3937	-26.605	-15.890	.925	13.18	.4405
22000	.4974	1.4179	-28.586	-19.456	.922	12.63	.4222
23000	.4805	1.4426	-30.568	-23.022	.917	12.10	.4045
24000	.4640	1.4681	-32.549	-26.588	.914	11.59	.3874
25000	.4480	1.4940	-34.530	-30.154	.910	11.10	.3709

Figure A1-5

PART II TAKEOFF

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TAKEOFF AND LANDING CROSSWIND CHART

The Takeoff and Landing Crosswind Chart (figure A2-1) is used to resolve the prevailing wind into headwind and crosswind components and to determine the minimum nose wheel lift-off and main gear touchdown speed and configuration for the crosswind component. The speed obtained from the chart is the lowest speed that a heading and course along the runway can be maintained with full rudder and ailerons deflected, when the nose wheel is off the runway. A maximum of 110 knots IAS is recommended for nose wheel lift-off speed. A maximum of 100 knots IAS is recommended for main gear touchdown speed with zero flaps.

SAMPLE PROBLEM:

The wind is from 40° at 20 knots with gusts to 32 knots. Runway 01 is the active runway. Find the headwind and crosswind components and the minimum nose wheel lift-off and main gear touchdown speed and configuration.

SOLUTION: (See figure A2-1)

Wind direction from runway 40° - 10° = 30°.

A. Is wind direction from centerline of runway (30°)
B. Is maximum gust velocity (32 knots)

NOTE

Use maximum reported gust velocity for determining crosswind component and minimum nose wheel lift-off and main gear touchdown speed and configuration. Use reported steady wind velocity for determining headwind component.

C. Proceed down and read crosswind component (16 knots)
D. Proceed up along crosswind component line to intersection of guide line
E. Proceed to the right and read minimum nose wheel lift-off and main gear touchdown speed (90 knots) and recommended landing configuration (50% flaps)

NOTE

Since the maximum main gear touchdown speed with 100% flaps is 85 knots, landing must be made with no more than 50% flaps.

F. Is reported steady wind velocity (20 knots)
G. Is headwind component (17 knots)

NOTE

If crosswind component falls short of guide line, use 65 knots IAS for minimum nose wheel lift-off speed.

TAKEOFF SPEEDS

The Takeoff Speed Chart (figure A2-2) gives the indicated airspeeds for stall and initial stall warning as a function of gross weight. The normal takeoff speed for all gross weights is 90 knots IAS unless crosswind conditions require higher speeds. The charts also include speeds for takeoff and climb for minimum distance to clear an obstacle.

SAMPLE PROBLEM:

Gross weight is 6300 lbs. Find the stall and initial stall warning speeds.

SOLUTION: (See figure A2-2)

A. Is takeoff gross weight (6300 lbs.)
B. Is stall speed (72 knots IAS)
C. Is initial stall warning speed (79 knots IAS)

NORMAL TAKEOFF DISTANCE

The Normal Takeoff Distance Chart (figure A2-3) is used to determine the ground run and total distance required to clear obstacles up to

200 feet high. The ground run is defined as the distances along the runway from the start of the takeoff run to the point where the aircraft leaves the ground. The total distance to clear an obstacle is the distance along the runway from the start of the takeoff run to the point where the obstacle height is reached.

Distances may be determined for various atmospheric conditions, gross weight, wind conditions, runway slope and obstacle height. The distances are based on using 50% flaps, 100% rpm, and 90 knots IAS takeoff speed and 105 knots IAS over the obstacle. The distance required when using 98% rpm may be found by adding 15% to the distance obtained from the chart.
If takeoff speed exceeds 90 knots IAS, instructions for computing takeoff distance is covered under Velocity During Takeoff Ground Run, figure A2-7.

SAMPLE PROBLEM:

It is desired to lead a formation takeoff with the following conditions:
Temperature 27°C
Pressure altitude 4000 feet
Gross weight 6500 lbs.
Headwind component 15 knots
The active runway has a 1% uphill grade and is 5000 feet long
Find the distance required to clear a 50-foot obstacle.

SOLUTION: (See figure A2-3)

A. Is temperature (27°C)
B. Is pressure altitude (4000 feet)
C. Is gross weight 6500 lbs.
D. Is wind base line
E. Is headwind components (15 knots)
F. Is slope base line
G. Is runway grade (1% uphill)
H. Is ground run with 100% rpm (2260 feet)
The ground run using 98% rpm is then
2260 feet x 1. 15 = 2600 feet.
I. Is obstacle height
J. Is total distance to 50 feet altitude with 100% rpm (3450 feet)
The total distance to 50 feet altitude using 98% rpm is then:
3450 feet x 1. 15 = 3968 feet.

CRITICAL FIELD LENGTH

The Critical Field Length Chart (figure A2-4) gives the length of runway required to accelerate to the critical engine failure speed on two engines with 100% rpm and then, in case of engine failure, either continue the takeoff on single engine or abort the takeoff and stop. Critical engine failure speed is defined as the speed at which engine failure permits acceleration to takeoff speed on the remaining engine in the same distance that the aircraft may be decelerated to a stop.

The chart assumes a three-second delay for reaction time and the use of normal braking with idle rpm. If 98% rpm is to be used for takeoff, the critical field length is increased by 10%.

SAMPLE PROBLEM:

The sample conditions used under NORMAL TAKEOFF DISTANCE are continued. Find the critical field length.

SOLUTION: (See figure A2-4)

A. Is temperature (27°C)
B. Is pressure altitude (4000 feet)
C. Is gross weight (6500 lbs.)
D. Is runway condition (dry runway)
E. Is wind base line
F. Is headwind component (15 knots)
G. Is critical field length using 100% rpm (3950 feet)
The critical field length using 98% rpm is then 3950 feet x 1. 10 = 4345 feet.

MAXIMUM REFUSAL SPEEDS

The highest indicated airspeed to which an aircraft can accelerate and then be stopped in the available runway remaining is called the maximum refusal speed. This speed may be determined from the Maximum Refusal Speed Chart (figure A2-5) for existing takeoff conditions and runway length. The chart is based on a 100% rpm acceleration to the refusal speed and normal braking to complete stop. A three-second delay for reaction time is included. The stopping distance for figure A2-5 is based on a dry, hard surface runway and idle rpm. For wet or icy conditions the stopping distance is increased and the corrected maximum refusal speed is obtained from figure A2-6. If 98% rpm is used for takeoff, reduce the effective runway length by 10%.

SAMPLE PROBLEM: (See figure A2-5)
The sample conditions used under NORMAL TAKEOFF DISTANCE are continued. Find the maximum refusal speed.

SOLUTION: (See figure A2-5)

A. Is actual runway length (5000 feet)
B. Is headwind component (15 knots)
C. Is effective runway length (7000 feet) using 100% rpm for takeoff
The effective runway length using 98% rpm for takeoff is then:
7000 feet - 700 feet = 6300 feet.
D. Is gross weight (6500 lbs.)
E. Is pressure altitude (4000 feet)
F. Is temperature (30°C)
G. Is maximum refusal speed (71 knots IAS)

SAMPLE PROBLEM: (See figure A2-6)

For the sample conditions above find the corrected maximum refusal speed for a wet runway.

SOLUTION:

A. Is wet runway maximum refusal speed (71 knots IAS)
B. Is runway condition (wet)
C. Is corrected maximum refusal speed (54 knots IAS)

The critical engine failure speed may also be determined from the Maximum Refusal Speed Chart. Since at this speed either the aircraft may be stopped or the takeoff executed on single engine in the same distance, the critical engine failure speed may be determined by considering the critical field length (from figure A2-4) as the effective runway length.

VELOCITY DURING TAKEOFF GROUND RUN

The Velocity During Takeoff Ground Run Chart (figure A2-7) is used to monitor the aircraft speed at fixed points along the runway during the takeoff ground run. The normal speed at any point along the runway may be determined by first determining the distance required to attain the normal takeoff speed (90 knots IAS) for the prevailing conditions and following the guide lines to the fixed point distance.

SAMPLE PROBLEM:

The takeoff ground run (from figure A2-3) for the prevailing conditions is determined to be 1600 feet. Find the normal speed after 1000 feet of ground run.

SOLUTION: (See figure A2-7)

A. Is normal takeoff ground run (1600 feet)
B. Is normal takeoff speed (90 knots IAS)
C. Is distance at which normal speed is to be determined (1000 feet)
D. Is guide line
E. Is normal speed after 1000 feet of ground run (67 knots IAS)

If normal takeoff speed exceeds 90 knots IAS, compute takeoff distance using the Velocity During Takeoff Ground Run Chart (figure A2-7). Enter the chart with the normal takeoff distance. Proceed horizontally to the normal takeoff speed line (90 knots IAS). Proceed up and to the right on the guide lines until intersecting the computed takeoff speed. Proceed horizontally to the left to find takeoff distance.

SAMPLE PROBLEM:

Normal takeoff distance of 1600 feet. Takeoff speed of 100 knots IAS.

SOLUTION: (See figure A2-7)

A. Is normal takeoff ground run (1600 feet)
B. Is normal takeoff speed (90 knots IAS)
F. Is actual takeoff speed (100 knots IAS)
G. Is actual takeoff ground run (1960 feet)

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

TAKEOFF AND LANDING CROSSWIND CHART

ALL FLAP SETTINGS
MAXIMUM (FULL RUDDER DEFLECTION) SIDESLIP

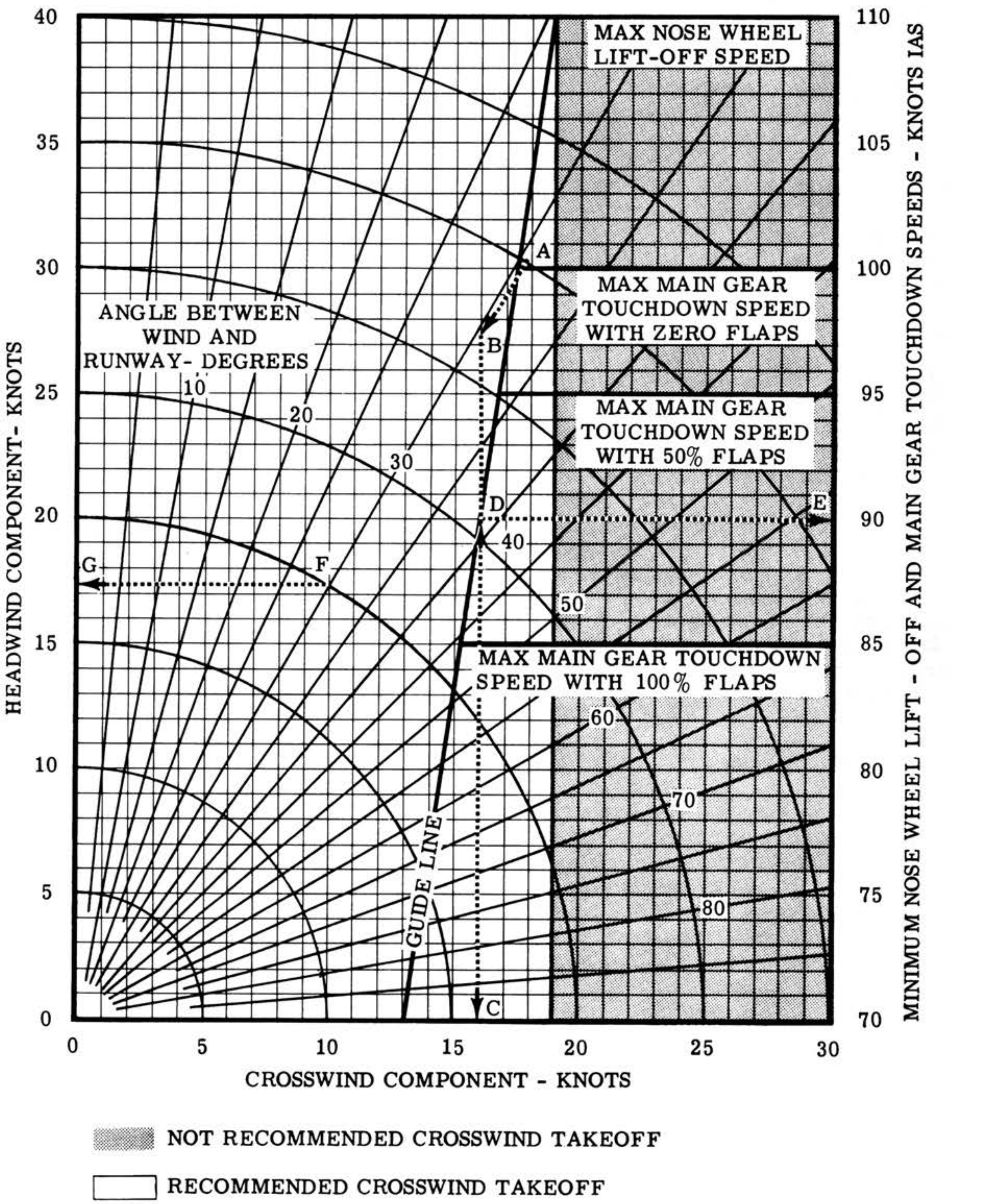


Figure A2-1

TAKEOFF SPEED
HALF (50%) FLAP—100 % RPM
LANDING GEAR DOWN

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

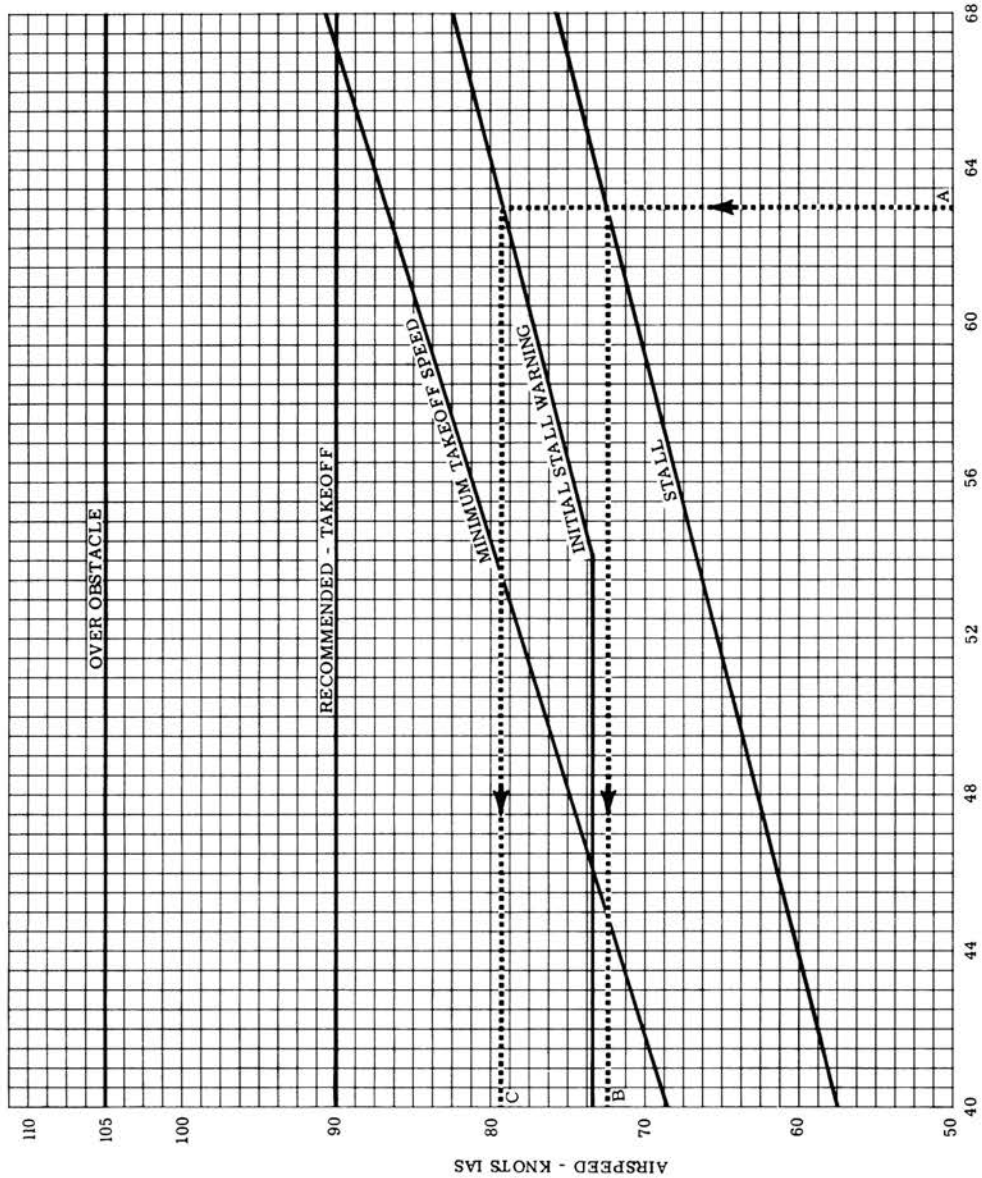


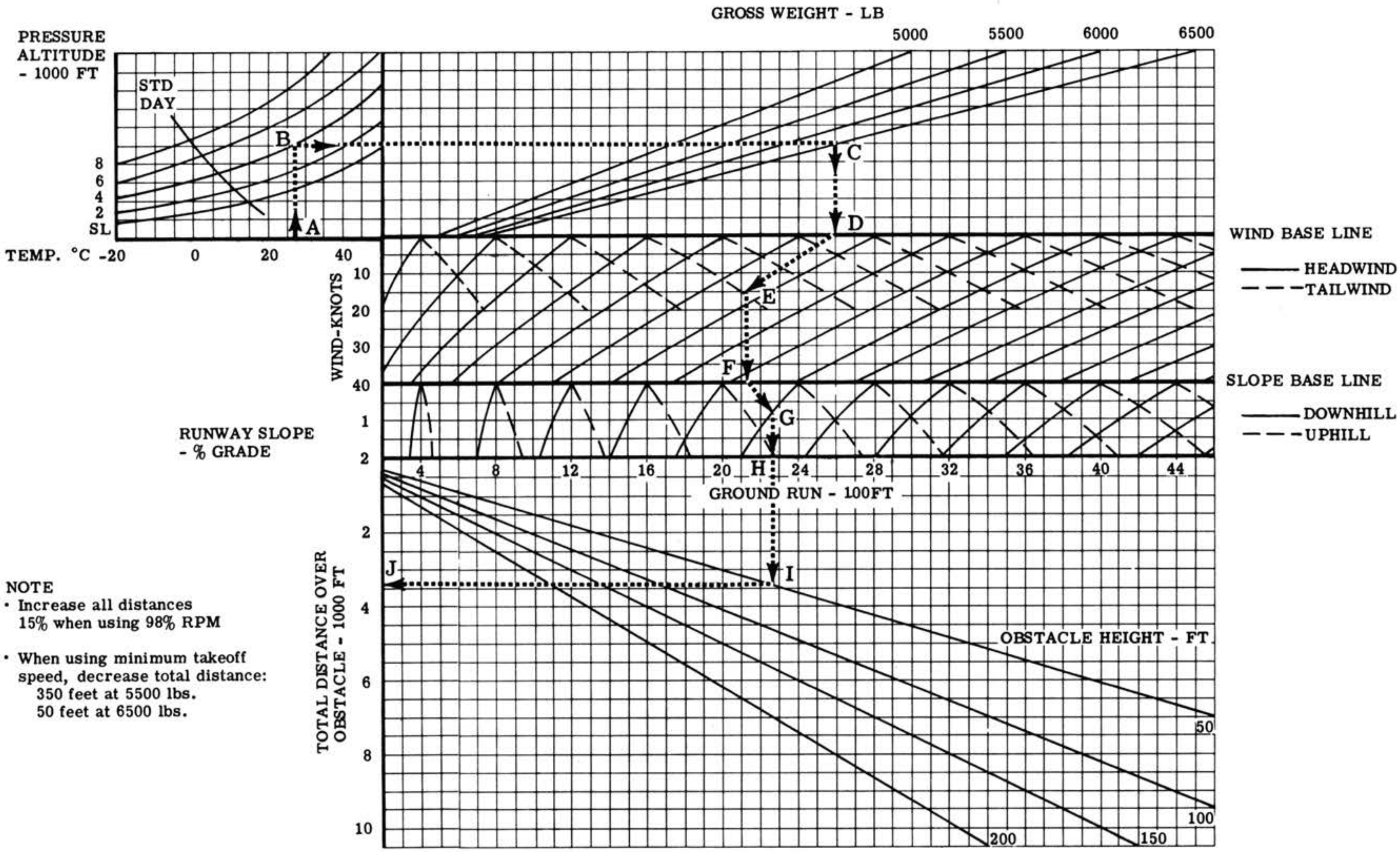
Figure A2-2

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

NORMAL TAKEOFF DISTANCE

100% RPM
50% FLAPS

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



NOTE
- Increase all distances 15% when using 98% RPM
- When using minimum takeoff speed, decrease total distance:
  350 feet at 5500 lbs.
  50 feet at 6500 lbs.

Figure A2-3

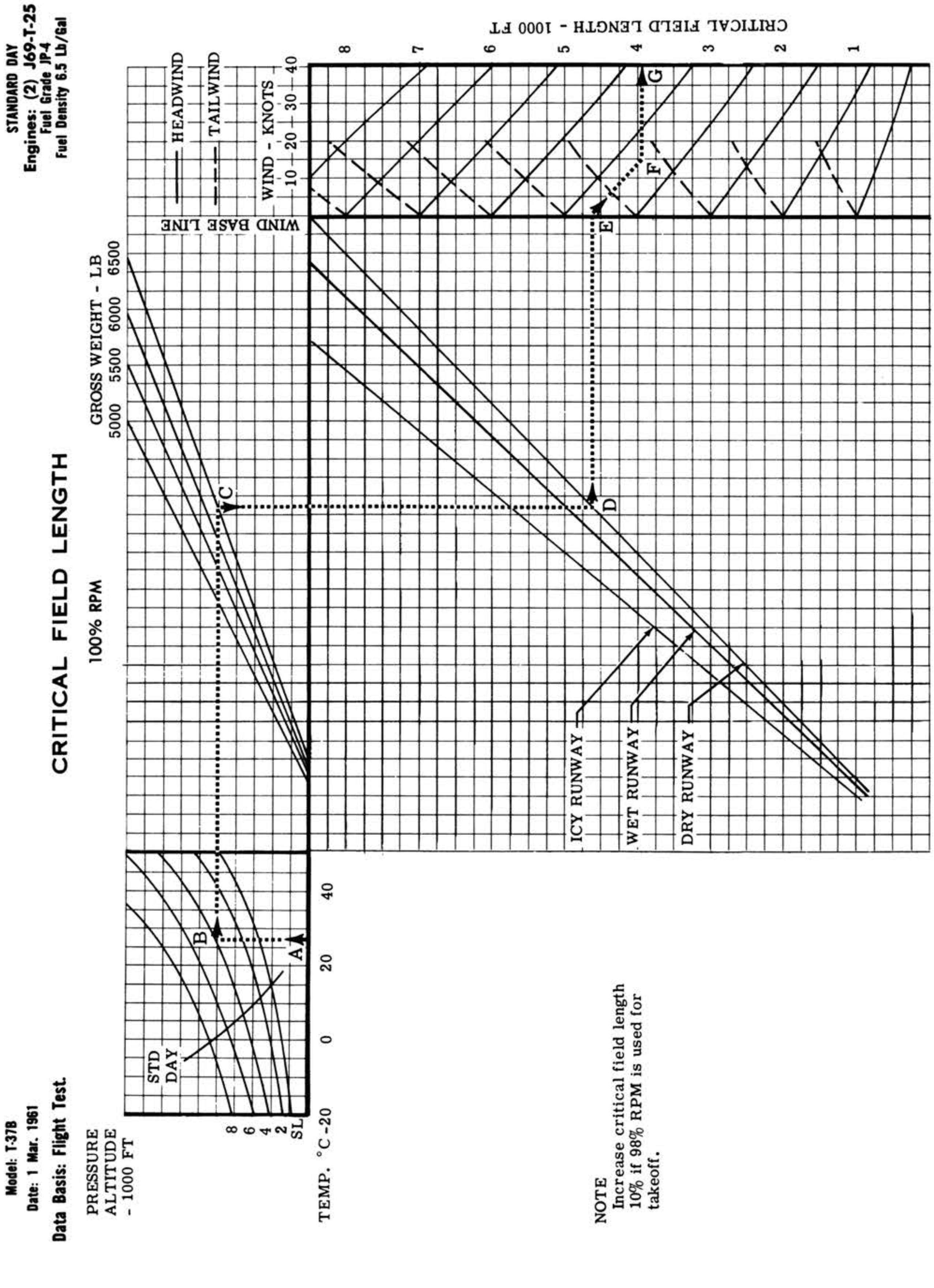

CRITICAL FIELD LENGTH
100% RPM
Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.
STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal
PRESSURE ALTITUDE - 1000 FT
8
6
4
2
SL
STD DAY
TEMP. °C -20
0
20
40
A
B
C
D
E
F
G
GROSS WEIGHT - LB
5000 5500 6000 6500
ICY RUNWAY
WET RUNWAY
DRY RUNWAY
WIND BASE LINE
HEADWIND
TAILWIND
WIND - KNOTS - 10 - 20 - 30 - 40
CRITICAL FIELD LENGTH - 1000 FT
8
7
6
5
4
3
2
1
NOTE
Increase critical field length 10% if 98% RPM is used for takeoff.

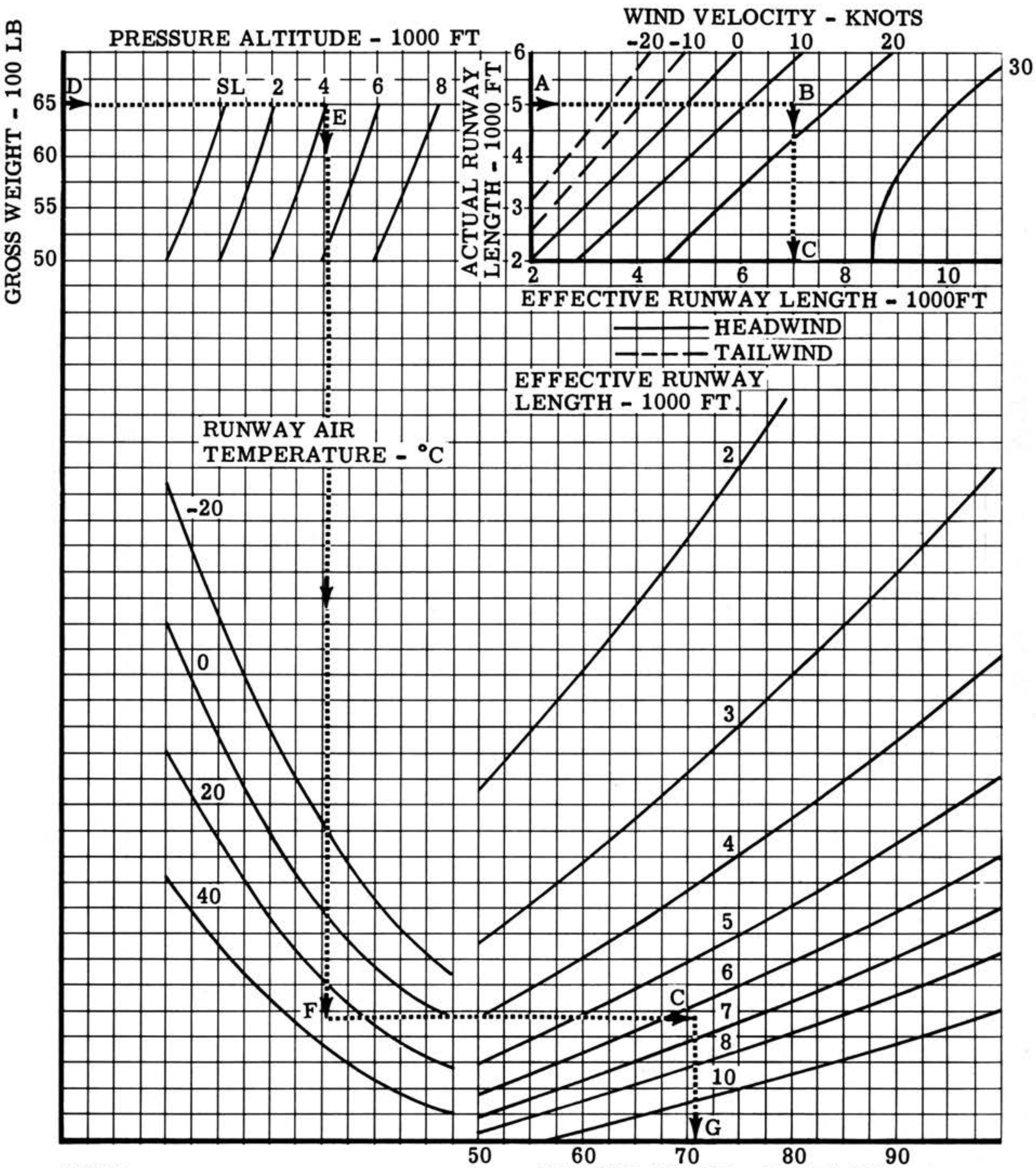
Figure A2-4

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

MAXIMUM REFUSAL SPEEDS

100% RPM



NOTES
- DECREASE EFFECTIVE RUNWAY LENGTH 10% IF 98% rpm IS USED FOR TAKEOFF

Figure A2-5

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CORRECTION TO MAXIMUM REFUSAL SPEED FOR RUNWAY CONDITION

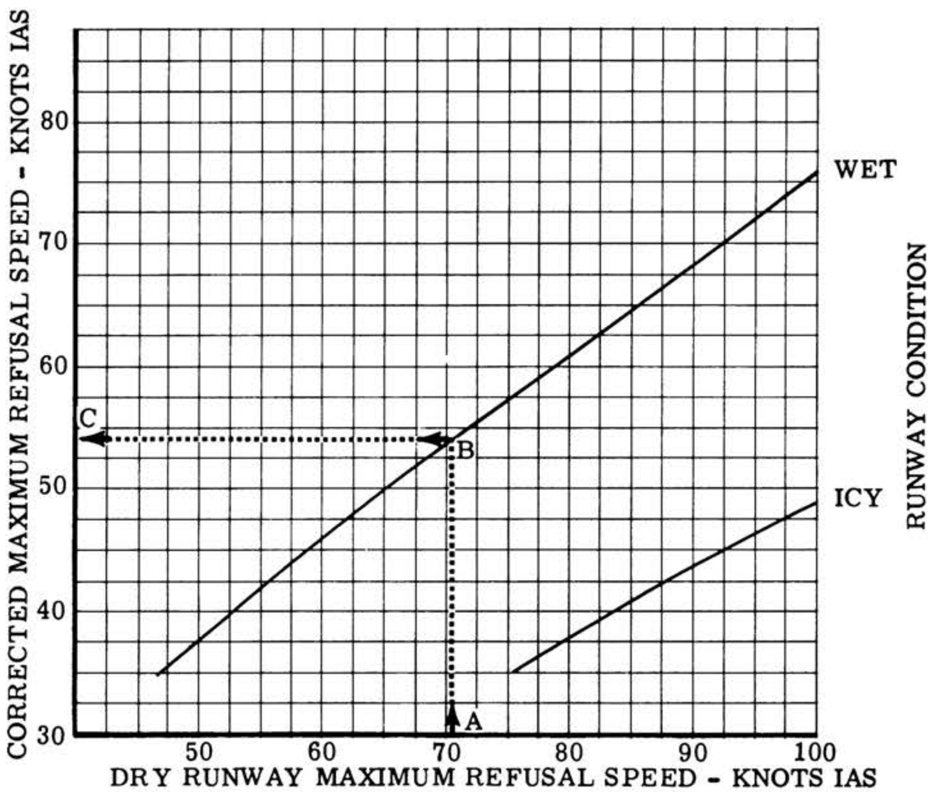


Figure A2-6

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test

VELOCITY DURING TAKEOFF GROUND RUN

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

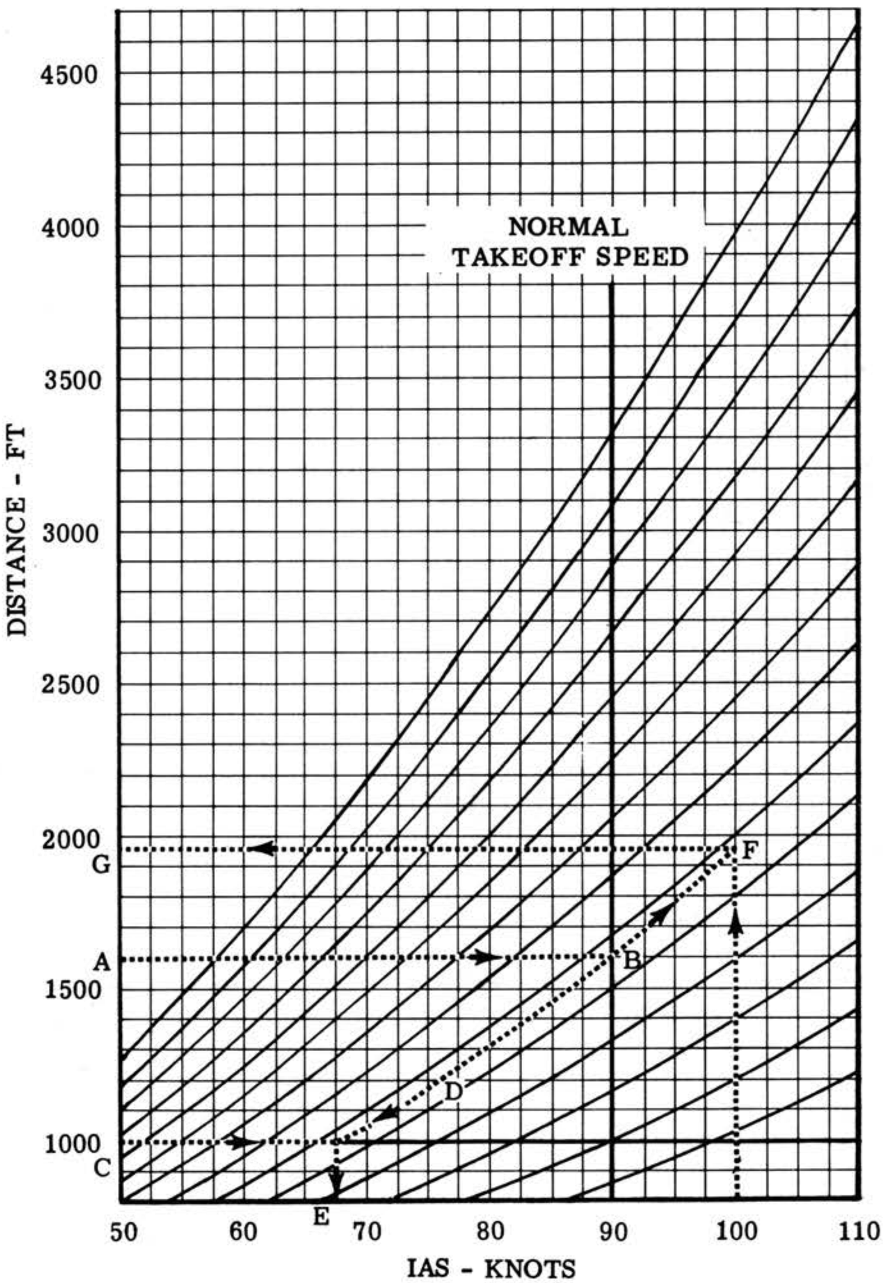


Figure A2-7

PART III CLIMB

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CLIMB PERFORMANCE

The Climb Performance Charts (figures A3-1 thru A3-3) two engine and (figures A3-4 thru A3-6) single engine are used to determine the fuel consumed, time elapsed, and horizontal air distance traveled during an "on course" climb. The charts assume adherence to the climb speed schedules shown in figure A3-1 (two engines) and figure A3-4 (single engine) and full throttle at all altitudes. At altitudes above 15,000 feet, full throttle may be slightly less than 100% rpm. This condition is normal and has been accounted for in the charts.

USE

For a climb from sea level the charts are entered with initial gross weight, final altitude and temperature deviation from standard day, and the fuel used, time to climb and horizontal distance traveled are read directly. To climb from an initial altitude other than sea level, the fuel used, time and distance are the difference between those quantities for a climb from sea level to the final altitude, and a climb from sea level to the actual initial altitude.

EXAMPLE:

Conditions:

Initial altitude	2500 ft
Initial gross weight	6400 lb
Temperature at initial altitude	25° C
Final altitude	25,000 ft
Temperature at final altitude	-24° C

Find: Fuel used, time to climb, horizontal distance traveled.

SOLUTION: (See figures A3-2 and A3-3)

1. Determine temperature deviation (△ Temp) at final altitude:
   Reported temperature at 25,000 ft: -24°C
   Standard day temperature at 25,000 ft: -35°C
   Temperature deviation: 35 -24 = 11°C (hotter)

2. Enter figure A3-2:
   At initial gross weight = 6400 lb (A)
   Move horizontally to altitude = 25000 ft (B)
   Drop vertically to guide line (C)
   Move horizontally to base line (D)
   Move parallel to "Hotter" guide lines to △ Temp = 11°C (E)
   Move horizontally to the fuel used scale and read fuel used = 356 lb (F)

3. Enter figure A3-3:
   At initial gross weight = 6400 lb (G)
   Move horizontally to altitude = 2500 ft (H)
   Drop vertically to time guide line (I)
   Move horizontally to base line (J)
   Move parallel to "Hotter" guide lines to △ Temp = 11°C (K)
   Move horizontally to the time scale and read time = 13.8 min (L)
   Drop vertically from (I) to distance guide line (M)
   Move horizontally to base line (N)
   Move parallel to "Hotter" guide lines to △ Temp = 11°C (O)
   Move horizontally to the distance scale and read distance = 51.5 Naut mi (P)

4. Determine temperature deviation (△ Temp) at initial altitude:
   Reported temperature at 2500 ft: 25°C
   Standard Day temperature at 2500 ft: 10°C
   Temperature deviation: 25 -10 = 15°C (hotter)

5. Re-enter figures A3-2 and A3-3 and repeat steps (A) through (P) using Altitude = 2500 ft and △ Temp = 15°C hotter. Read:
   Fuel used = 31 lb
   Time = 1 minute
   Distance = 3.3 miles

6. Determine fuel used from 2500 ft to 25000 ft:
   Fuel used from sea level to 25,000 ft: 356 lb
   Fuel used from sea level to 2500 ft: 31 lb
   Fuel used: 356 -31 = 325 lb

7. Determine time to climb from 2500 ft to 25,000 ft:

Time from sea level to 25,000 ft:
13.8 minutes
Time from sea level to 2500 ft:
1 minute
Time to climb: 13.8 -1 = 12.8 minutes

8. Determine horizontal distance traveled in climb from 2500 ft to 25,000 ft:
Distance to climb from sea level to 25,000 ft: 51.5 Naut miles
Distance to climb from sea level to 2500 ft: 3.3 Naut miles
Horizontal distance traveled in climb:
51.5 -3.3 = 48.2 Naut miles

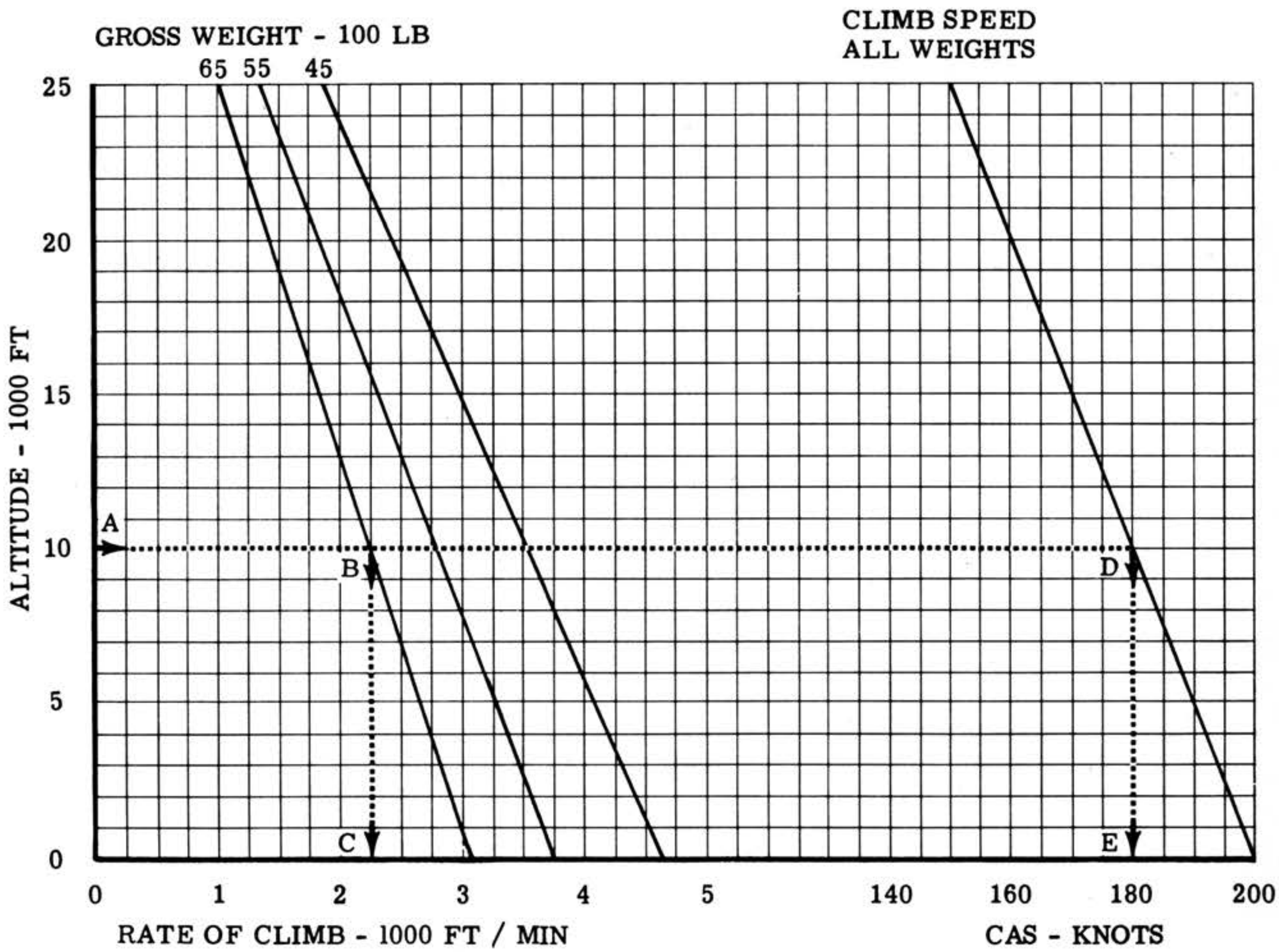
The climb speed schedule to be followed is taken from figure A3-1.

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

BEST CLIMB SPEED AND RATE OF CLIMB

TWO ENGINES
MILITARY POWER



A. is altitude (10, 000 FT.)
B. is gross weight (6500 LB)
C. is rate of climb (2250 FT/MIN.)
D. is climb speed guide line
E. is climb speed (180 knots CAS)

Figure A3-1

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

FUEL USED TO CLIMB

TWO ENGINES
FULL THROTTLE

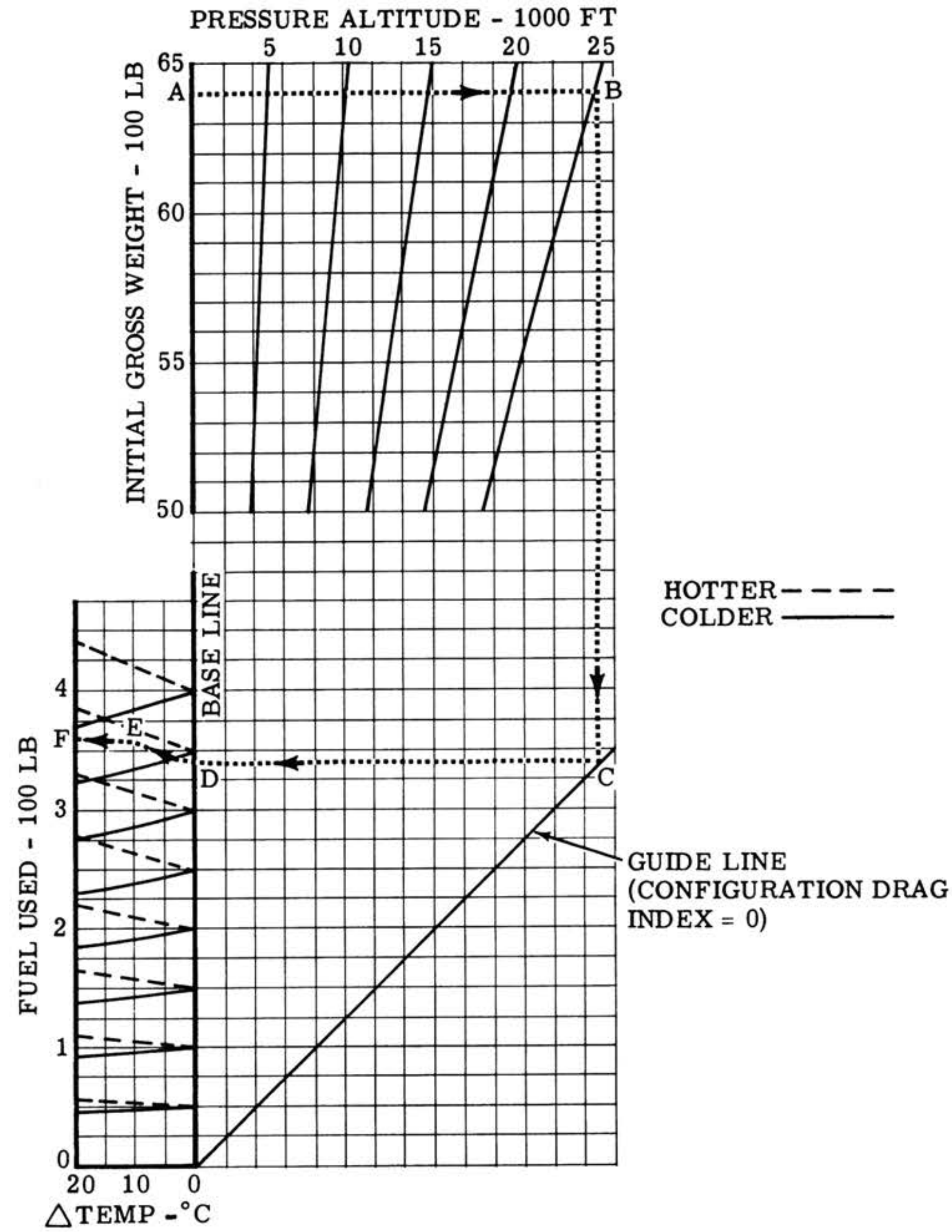


Figure A3-2

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

TWO ENGINES
FULL THROTTLE

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

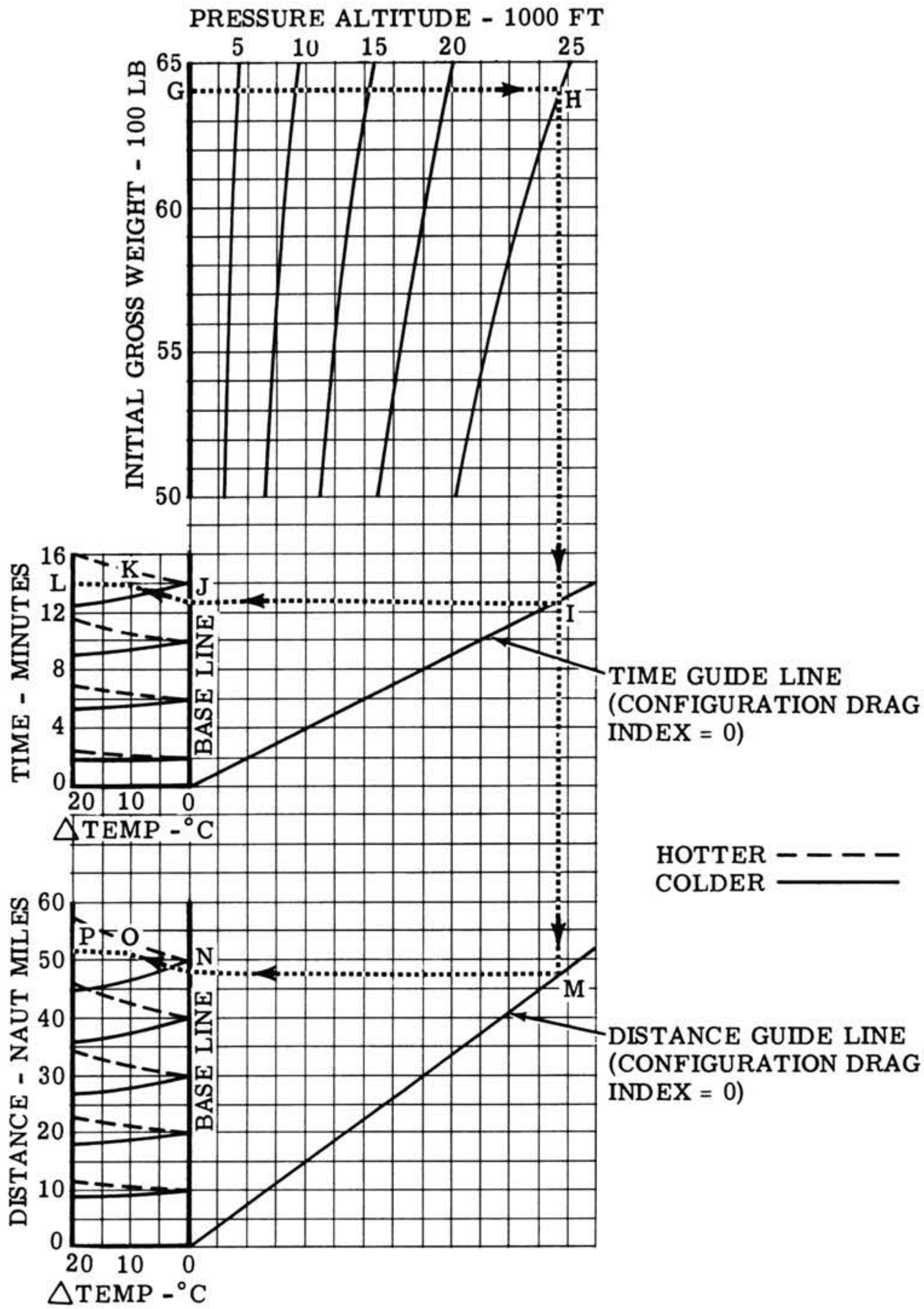


Figure A3-3

REVERSE SIDE INTENTIONALLY LEFT BLANK

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

BEST CLIMB SPEED AND RATE-OF-CLIMB

SINGLE ENGINE
MILITARY POWER

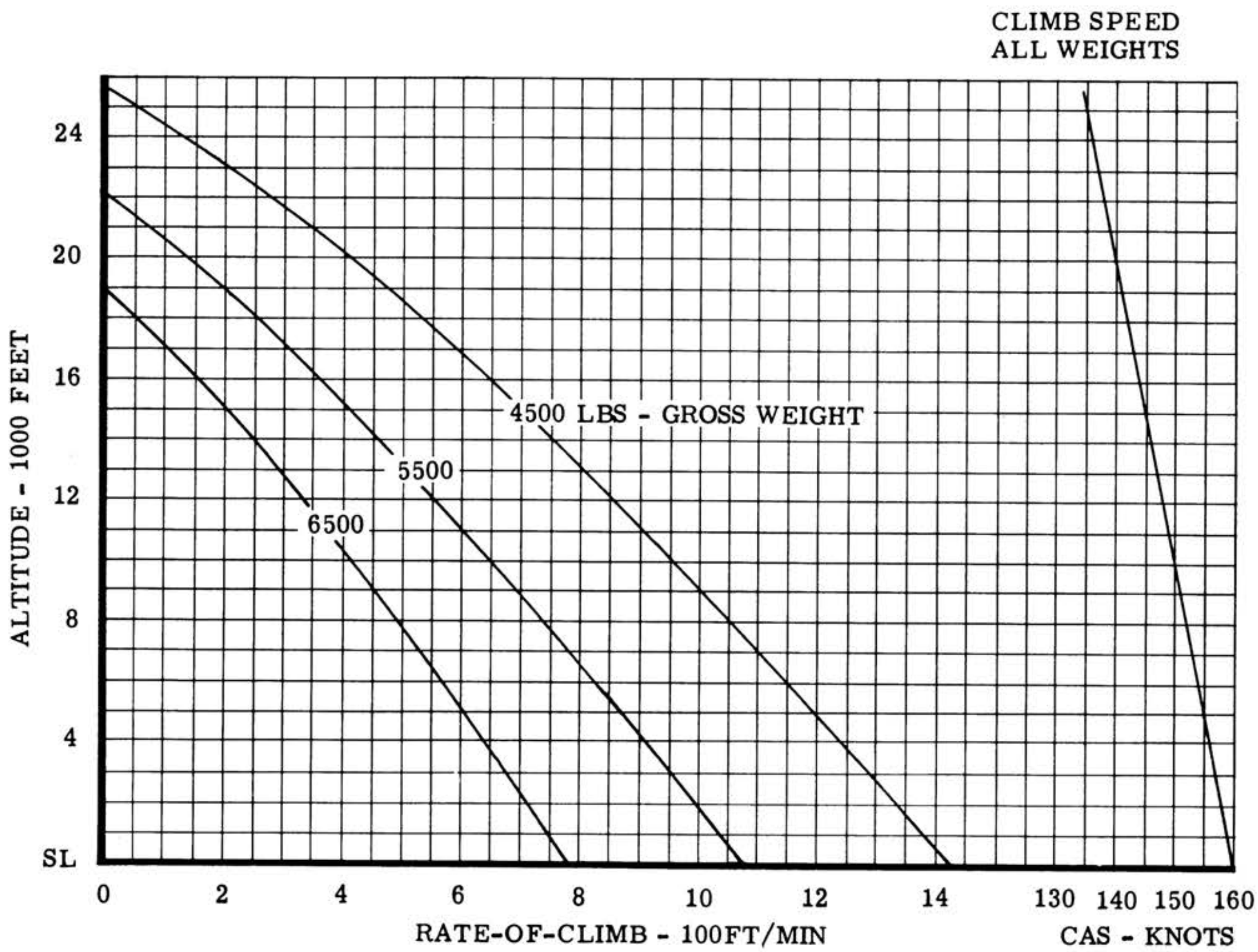


Figure A3-4

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

FUEL USED TO CLIMB

SINGLE ENGINE
FULL THROTTLE

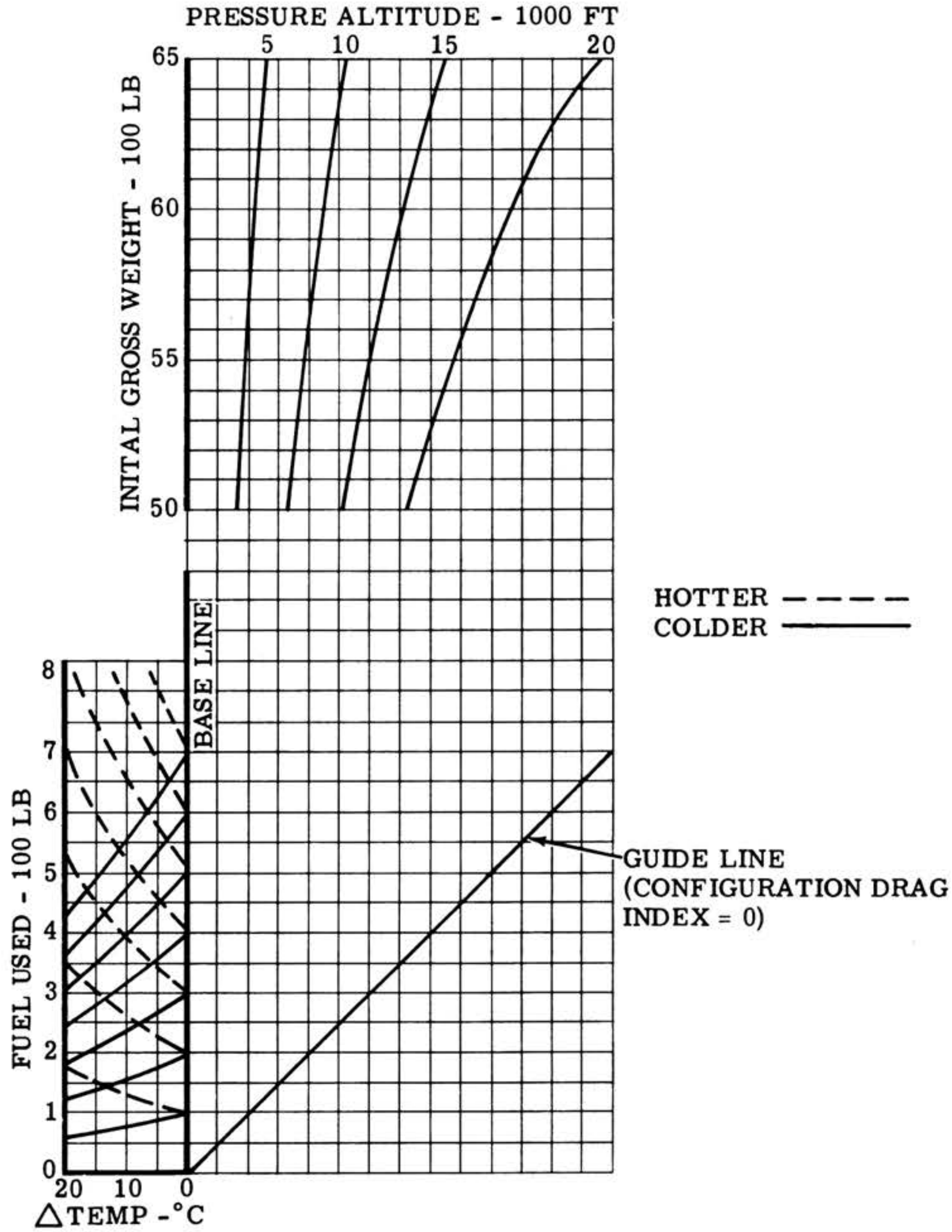


Figure A3-5

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED

SINGLE ENGINE
FULL THROTTLE

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

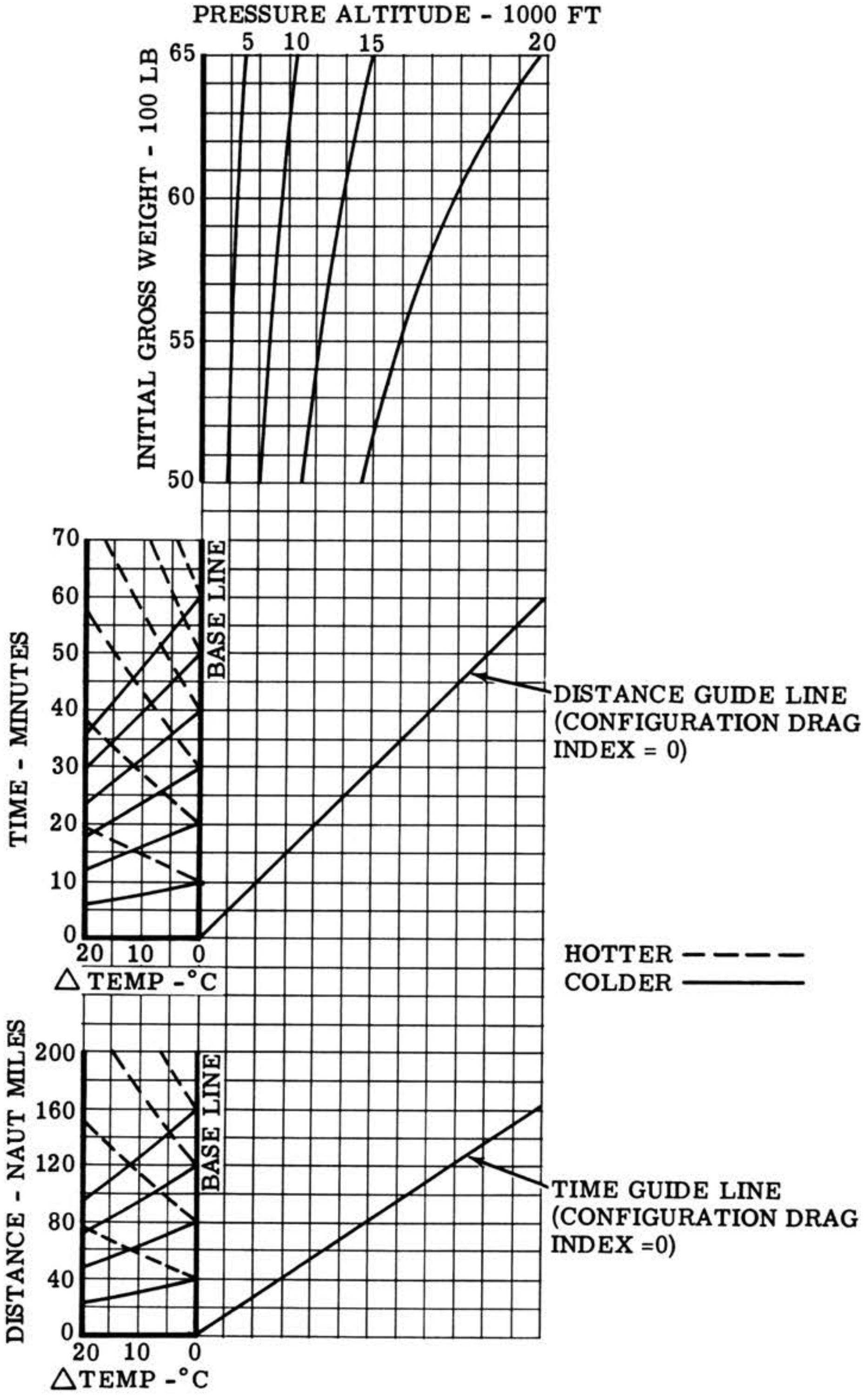


Figure A3-6

REVERSE SIDE INTENTIONALLY LEFT BLANK

PART IV RANGE

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MACH NUMBER - CALIBRATED AIRSPEED CONVERSION

Using the Mach Number - Calibrated Airspeed Conversion Chart (figure A4-1) the pilot may obtain calibrated airspeed from Mach number or Mach number from calibrated airspeed at any desired altitude. Compressibility has been accounted for in the chart and no further correction is necessary.

EXAMPLE:

Enter chart (figure A4-1):
At altitude = 15,000 feet (A)
Move up to Mach number = .40 (B)
Move horizontally to the left to Calibrated Airspeed scale and read calibrated airspeed = 200 knots (C)

CONSTANT ALTITUDE CRUISE (99% MAXIMUM RANGE)

The 99% Maximum Range Charts (figures A4-2 and A4-3) are used to obtain near maximum range for a given quantity of fuel while maintaining speeds higher than those required for peak maximum range. From these charts the pilot can determine: (1) cruise speed, (2) cruise distance for a given fuel quantity or fuel required to fly a given distance, (3) time elapsed during cruise, and (4) wind correction to range.

The calibrated airspeeds given must be used to obtain the distances shown. These charts are based on standard temperature at the indicated altitudes. Although fuel flow and true airspeed vary with atmospheric conditions, these variations are proportional to temperature and the air miles per pound of fuel remains the same at any given calibrated airspeed. Elapsed time given, however, becomes less accurate as temperature deviates from standard.

USE

To find cruise distance and time elapsed, the charts are entered with known values of fuel available for cruise, cruise altitude and winds. To find fuel required for a desired distance or time an estimated quantity of fuel is used to compute tentative distance and time, which are in turn used to compute a fuel quantity. This process is repeated, if necessary, using computed fuel for the next estimate, until the estimated and computed values approximate each other.

EXAMPLE I:

Conditions:

Initial Gross Weight: 5800 lb
Cruise Altitude: 20,000 ft
Cruise Fuel: 1000 lb
Wind: Average 20 knot tailwind

Find: Cruise Speed, Ground Distance, Time Elapsed.

Solution:

1. Determine Average Gross Weight:
   Initial Gross Weight: 5800 lb
   Cruise Fuel: 1000 lb
   Final Gross Weight: 5800-1000 = 4800 lb
   Average Gross Weight: $\frac{5800+4800}{2} = 5300$ lb

2. Enter Sample Chart:
   At Average Gross Weight - 5300 lb (A)
   Move horizontally to Altitude = 20,000 ft (B)
   Drop vertically to Fuel Used = 1000 lb (C)
   Move horizontally to Guide Line (D), then drop to Distance scale and read Distance = 315 Naut. Mi. (E)

3. Enter Sample Chart:
   At Average Gross Weight = 5300 lb (F)
   Move horizontally to Altitude = 20,000 ft (G)
   Drop vertically to Guide Line (H), then move to the left to Mach Number scale and Mach Number = .430 (I) (Read Cruise Speed = 196 knots CAS from figure A4-1)
   Move to the right from (H) to Distance = 315 Naut. Mi. (J)
   Move up to the Time scale and read Time = 1 hr 12 min (K).

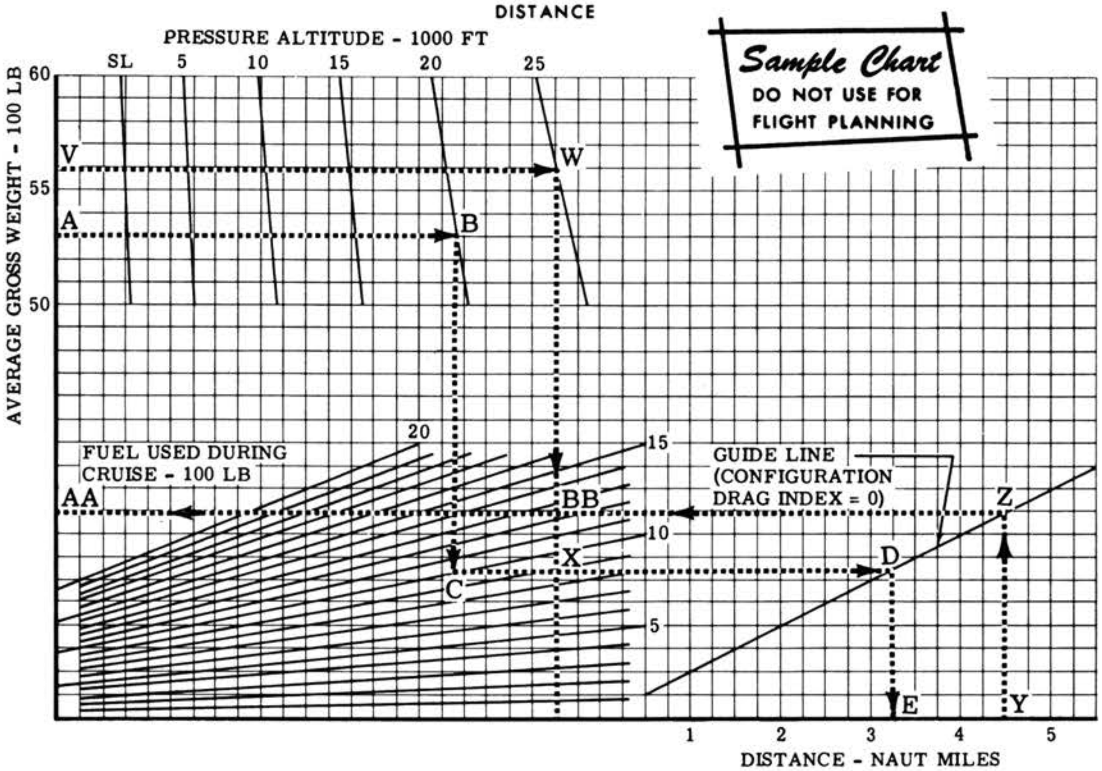
Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)

DISTANCE



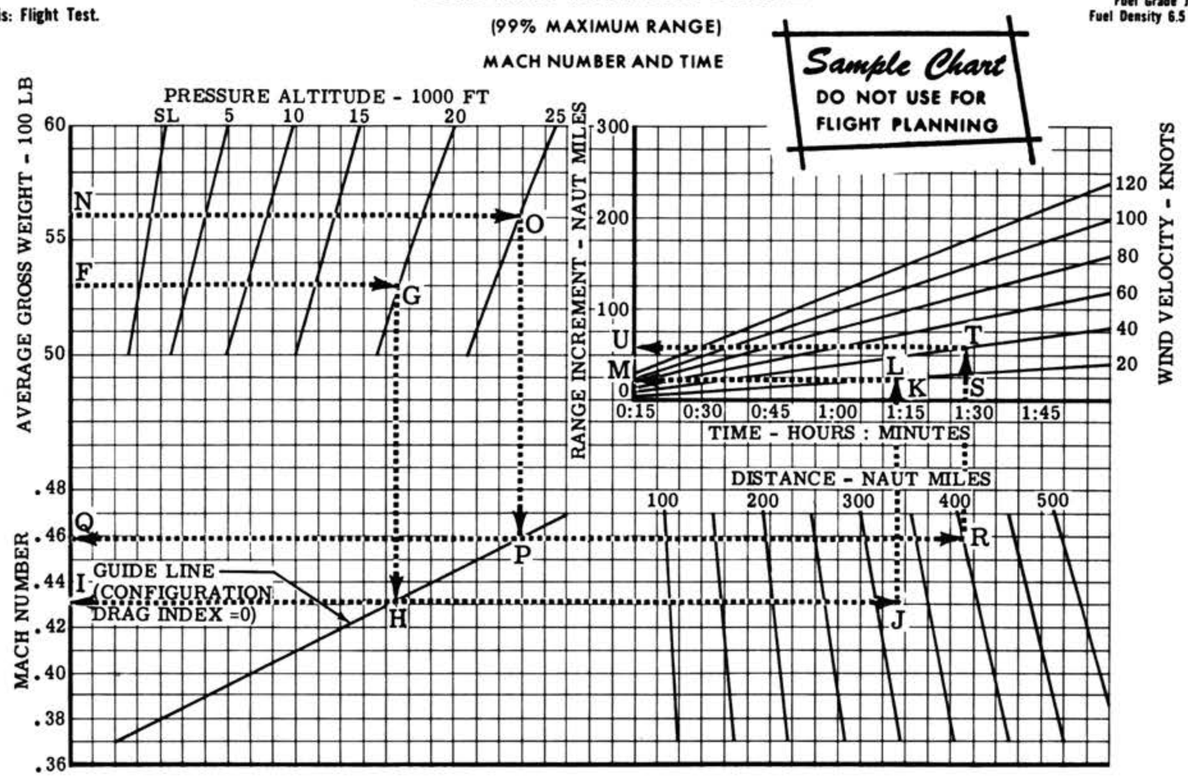
Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)

MACH NUMBER AND TIME



Continue up to Wind Velocity = 20 knots (L)
Move to the left to Range Increment scale and read Range Increment = 24 Naut. Mi. (M)
Since the wind is a tailwind add the Range Increment to the no-wind reading of (E) above:
Ground Distance - 315 + 24 = 339 Naut. Mi.

EXAMPLE II:

Conditions:

Initial Gross Weight:	6050 lb
Cruise Altitude:	25,000 ft
Cruise Distance:	400 Naut. Mi.
Wind: Average 40 knot headwind	

Find: Fuel Used, Cruise Speed, Elapsed Time.

Solution:

1. Estimate Fuel Used: 900 lb

2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 6050 lb
   Estimated Fuel Used: 900 lb
   Estimated Final Weight: 6050-900 = 5150 lb
   Estimated Average Gross Weight: $\frac{6050+5150}{2} = 5600$ lb

3. Enter Sample Chart:
   At Average Gross Weight = 5600 lb (N)
   Move horizontally to Altitude = 25,000 ft (O)
   Drop vertically to Guide Line (P), then move to the left to Mach Number scale and read Mach Number = .458 (Q) (Read Cruise Speed = 188 knots CAS from figure A4-1)
   Move to the right from (P) to Distance = 400 Naut. Mi. (R)
   Move up to Time scale and read Time = 1 hr 28 min (S).
   Continue up to Wind Velocity = 40 knots (T)
   Move to the left to Range Increment scale and read Range Increment = 58 Naut. Mi. (U)
   Since the wind is a headwind, the ground distance is equal to the air distance minus the range increment due to the headwind. Therefore, the air distance is equal to the ground distance plus the range increment due to headwind. The air distance required for this example is then: 400 +58 = 458 Naut. Mi.

4. Enter Sample Chart:
   At Average Gross Weight = 5600 lb (V)
   Move horizontally to Altitude = 25,000 ft (W)
   Construct vertical line (WX)
   Enter Distance scale at 458 Naut. Mi. (Y)
   Move up to Guide Line (Z), then construct horizontal line (ZAA)
   Read at the intersection of constructed lines (WX) and (ZAA) Fuel Used = 1270 lb (BB)

5. Since there is considerable difference between estimated fuel used and the fuel used determined above, the entire computation should be reworked as follows:
   Revised Average Gross Weight:
   Initial Gross Weight: 6050 lb
   Revised Cruise Fuel: 1270 lb
   Revised Average Gross Weight: 5415 lb

6. Enter Sample Chart:
   Recompute steps 3 and 4 using the revised average gross weight. Mach Number will now read .455 (187 knots CAS from figure A4-1), but time and range increments will be essentially unchanged.

7. Enter Sample Chart:
   At the revised Average Gross Weight of 5415 lb and reconstruct vertical line (WX). The intersection of the new (WX) line with (ZAA) will now occur at 1250 lb fuel used. The revised estimated and computed fuel quantities now closely approximate each other and the computation is not repeated.

CONSTANT ALTITUDE CRUISE (95% RPM)

The 95% RPM cruise charts (figures A4-4 and A4-5) represent the maximum cruise speed that can be used with any given set of conditions and should be restricted to flights where time is an important factor. From these charts the pilot can determine: (1) cruise speed, (2) cruise distance for a given fuel quantity or fuel required to fly a given distance, (3) time elapsed during cruise, and (4) wind correction to range.

These charts are based on standard temperature at the indicated altitudes. Since, at constant RPM, calibrated airspeed, true airspeed and fuel flow vary with atmospheric conditions, these charts become less accurate as temperature deviates from standard.

USE

The 95% RPM Cruise Charts are used in the same manner as the 99% Maximum Range

Charts. For sample problems refer to CONSTANT ALTITUDE CRUISE (99% MAXIMUM RANGE).

AIR NAUTICAL MILES PER POUND OF FUEL

These charts (figures A4-6 and A4-7) provide cruise control data for various speeds and gross weights from sea level to 25,000 feet altitude, as well as recommended cruise speeds for obtaining maximum range with headwind, for 99% maximum range and for maximum endurance. Also included are data for cruise at 95% RPM, and for reading true airspeed and fuel flow for any conditions of gross weight, altitude Mach Number and ambient temperature. Charts for both two engine and single engine operation are included.

The Air Nautical Miles Per Pound of Fuel charts are included to provide the pilot with a means of planning flights whenever the standard Constant Altitude Cruise charts (figures A4-2 through A4-5) cannot be used. This would be if: (1) it is desired to cruise at speeds other than those given in the Constant Altitude Cruise charts or, (2) atmospheric conditions differ appreciably from standard.

It should be emphasized that the air miles per pound of fuel will remain constant at the Mach Number and calibrated airspeed shown in the charts, regardless of the prevailing temperature, although the % RPM required, true airspeed and fuel flow will vary with atmospheric conditions. It is then recommended that, when planning a mission with the air nautical miles per pound of fuel charts, calibrated airspeed be used as the cruise control for obtaining the desired range.

USE

Air nautical miles per pound of fuel, true airspeed, and fuel flow are found directly by entering the charts with gross weight, cruise altitude, Mach number and temperature. To find fuel required to cruise a given distance or length of time, an estimated average gross weight for the cruise segment is used, and fuel required determined from the resulting fuel flow and elapsed time. If this value of fuel required results in an average gross weight appreciably different from the estimated weight, the computation is then reworked using the new gross weight.

It should be noted that the line labeled "Maximum Range" is also the base line for the family of guide lines in this portion of the chart. This base line is always intercepted first before proceeding parallel to the guide lines to the desired cruise Mach number. (See Example, steps 3.A through 3.D.)

EXAMPLE:

Conditions:

Initial Gross Weight: 6100 lb
Cruise Altitude: 15,000 ft
Temperature: -20°C
Wind: Average 60 knots headwind

Find: Cruise speed for maximum range and fuel required to fly 200 Naut. Mi.

Solution:

1. Estimate Fuel Used: 700 lb

2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 6100 lb
   Estimated Fuel Used: 700 lb
   Estimated Final Weight: 6100-700 = 5400 lb
   Estimated Average Gross Weight: $\frac{6100+5400}{2} = 5750$ lb

3. Enter Sample Chart:
   At Gross Weight = 5750 lb (A)
   Move up to Cruise Altitude = 15,000 ft (B)
   Move across horizontally to Base Line (C)
   Move parallel to Guide Lines to 60 knots Headwind (D) (Use linear interpolation between Base Line and Recommended Cruise-100 knots Headwind line)
   Move horizontally to Transfer scale and read Transfer scale = 14.95 (E)
   Enter Sample Chart:
   At Transfer scale = 14.95 (E)
   Move to Altitude = 15,000 ft (F)
   Drop vertically to Naut. Mi/Lb scale and

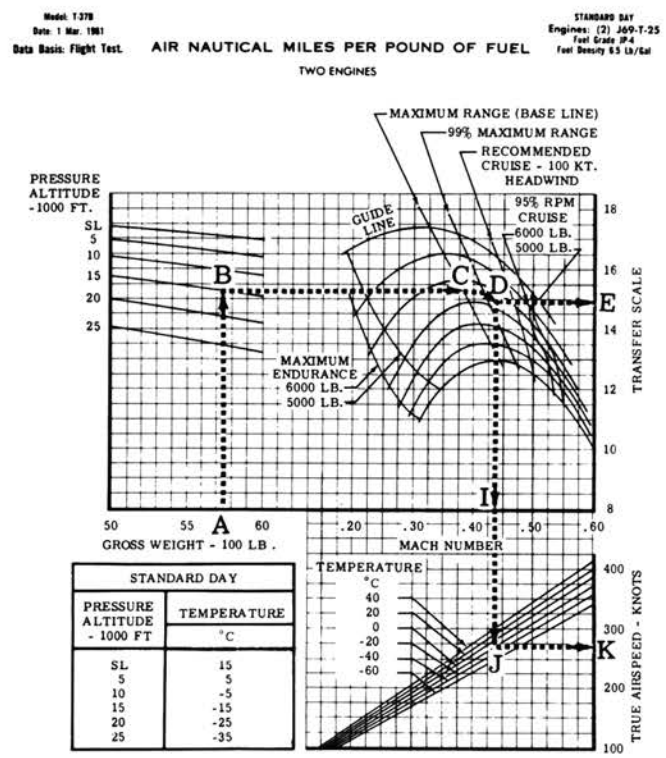
read Naut. Mi/Lb = .265 (G)
Construct vertical line (GH)
Return to Sample Chart
Drop vertically from (D) to Mach Number scale and read Mach Number - .437 (I)
(Read Cruise Speed = 219 knots CAS from figure A4-1)
Continue down to Temperature = -20°C (J)
Move horizontally to True Airspeed scale and read True Airspeed = 269 knots (K)
Enter Sample Chart:
At True Airspeed = 269 knots (K)
Construct horizontal line (KL)
At the intersection of constructed lines (GH) and (KL) read Fuel Flow = 1020 lb/hr

4. Compute Ground Speed:
Ground Speed = TAS - Headwind =
269 - 60 = 209 knots
Compute Time to fly 200 Naut. Mi.
Time = Distance ÷ Ground Speed =
200 Naut. Mi. ÷ 209 Naut. Mi/Hr = .957 hr
Compute Fuel Used in cruise:
Fuel Used = Fuel Flow x Time =
1020 lb/hr x .956 hr = 976 lb

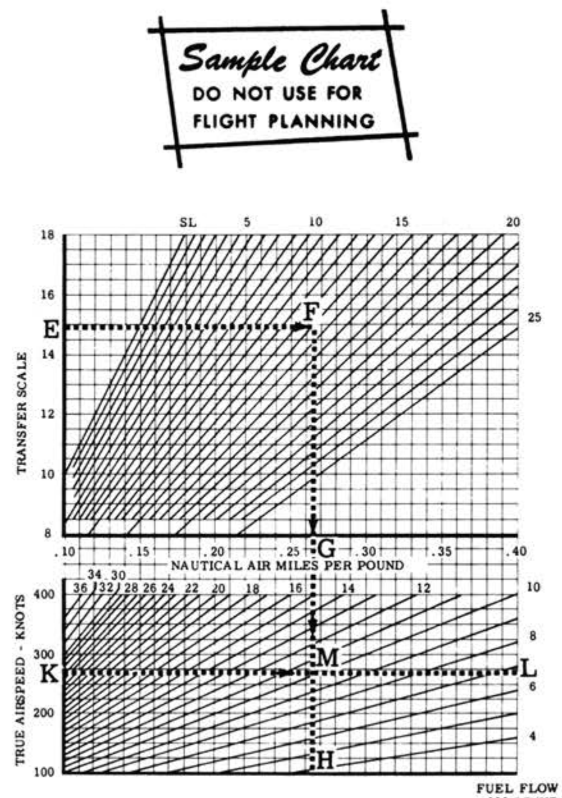
5. Revise Estimated Average Gross Weight:

Initial Gross Weight:	6100 lb
Computed Fuel Used:	976 lb
Final Gross Weight:	6100-976 = 2154 lb
Average Gross Weight:	$\frac{6100+5124}{2}$ = 5612 lb

6. Entering the chart at 5612 lb Gross Weight it is evident that this would result in essentially the same solutions as above, therefore, the problem is not reworked.



STANDARD DAY	
PRESSURE ALTITUDE - 1000 FT	TEMPERATURE °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35



Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

MACH NUMBER - CALIBRATED AIRSPEED CHART

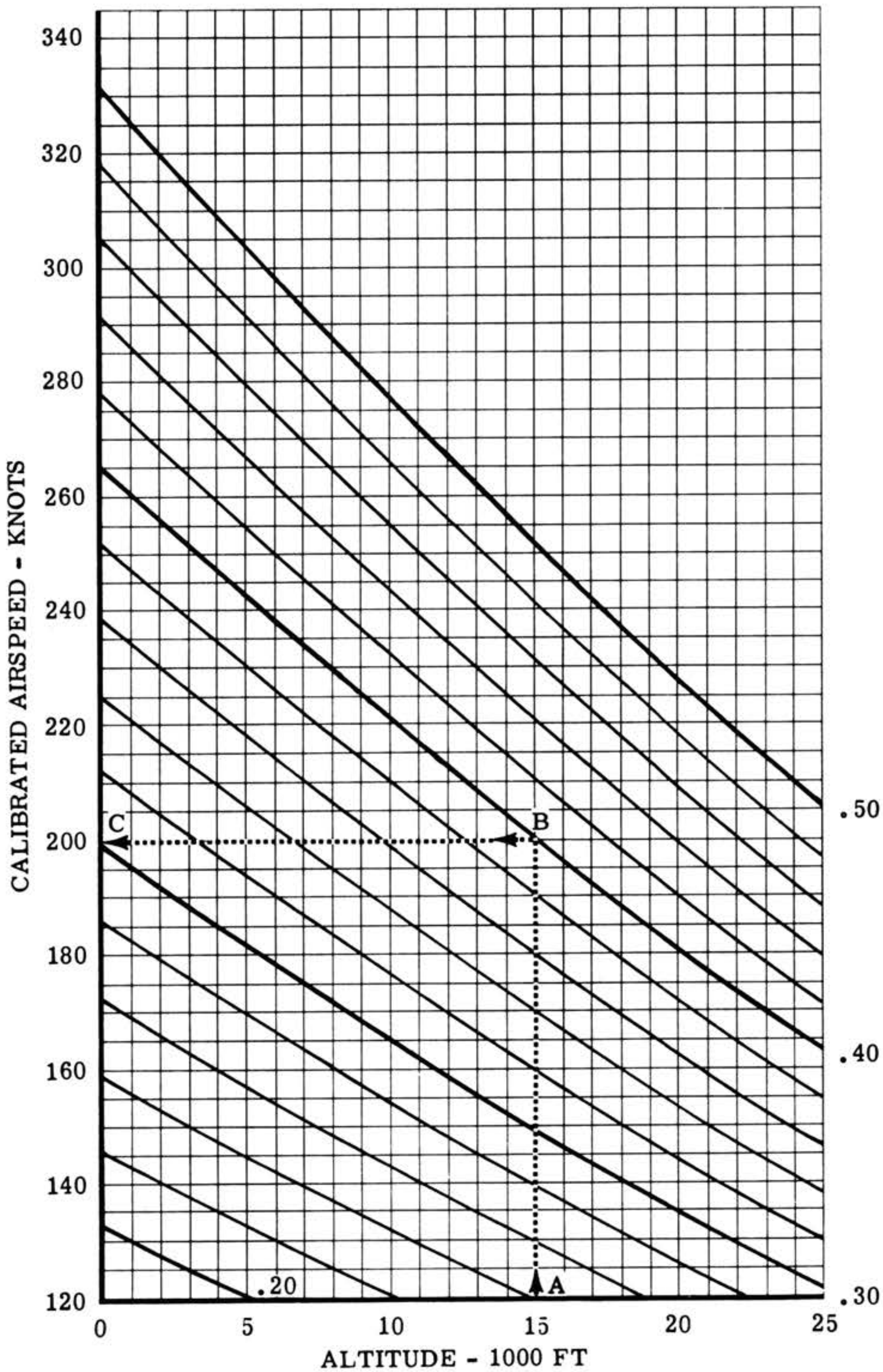


Figure A4-1

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)

DISTANCE

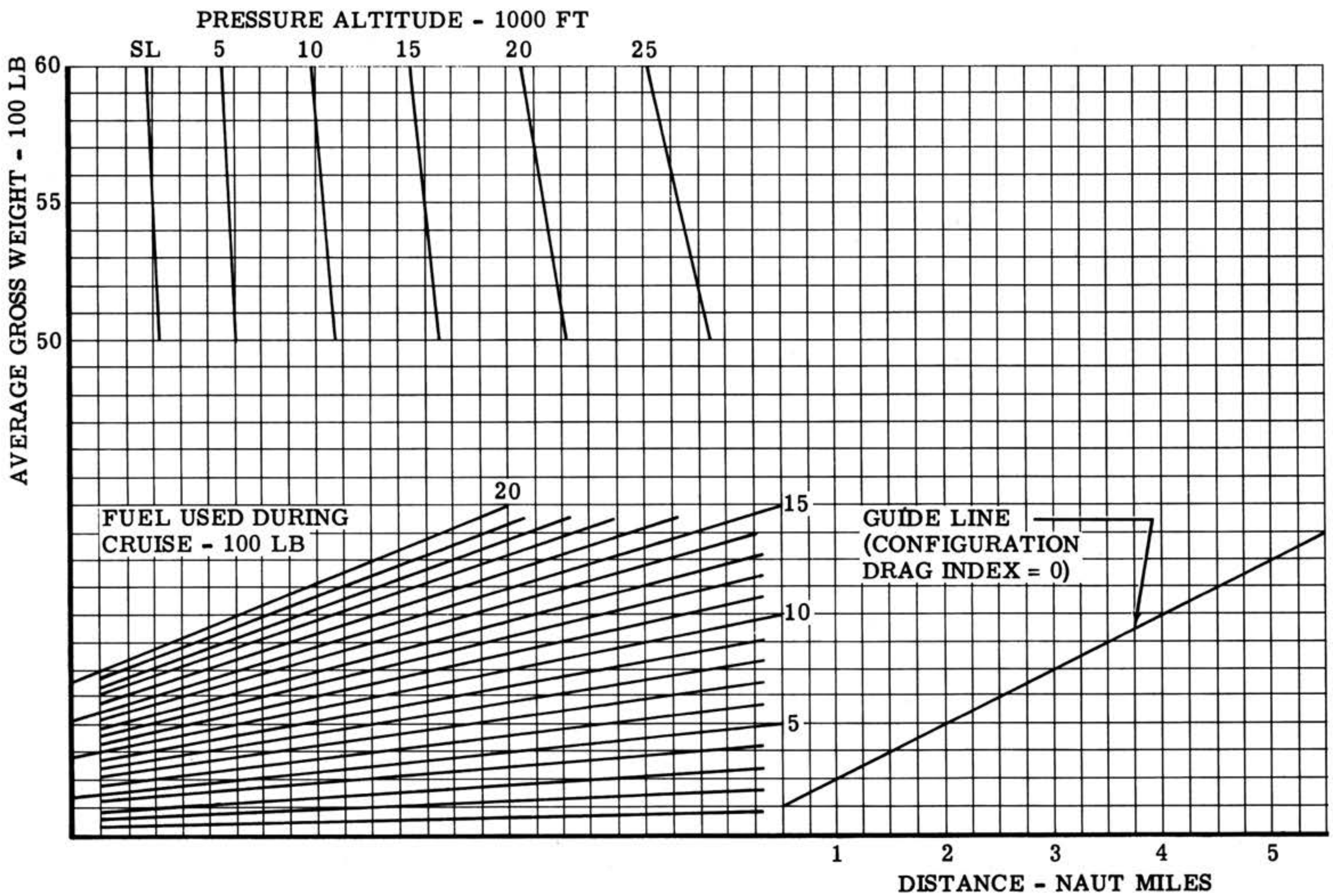


Figure A4-2

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)

MACH NUMBER AND TIME

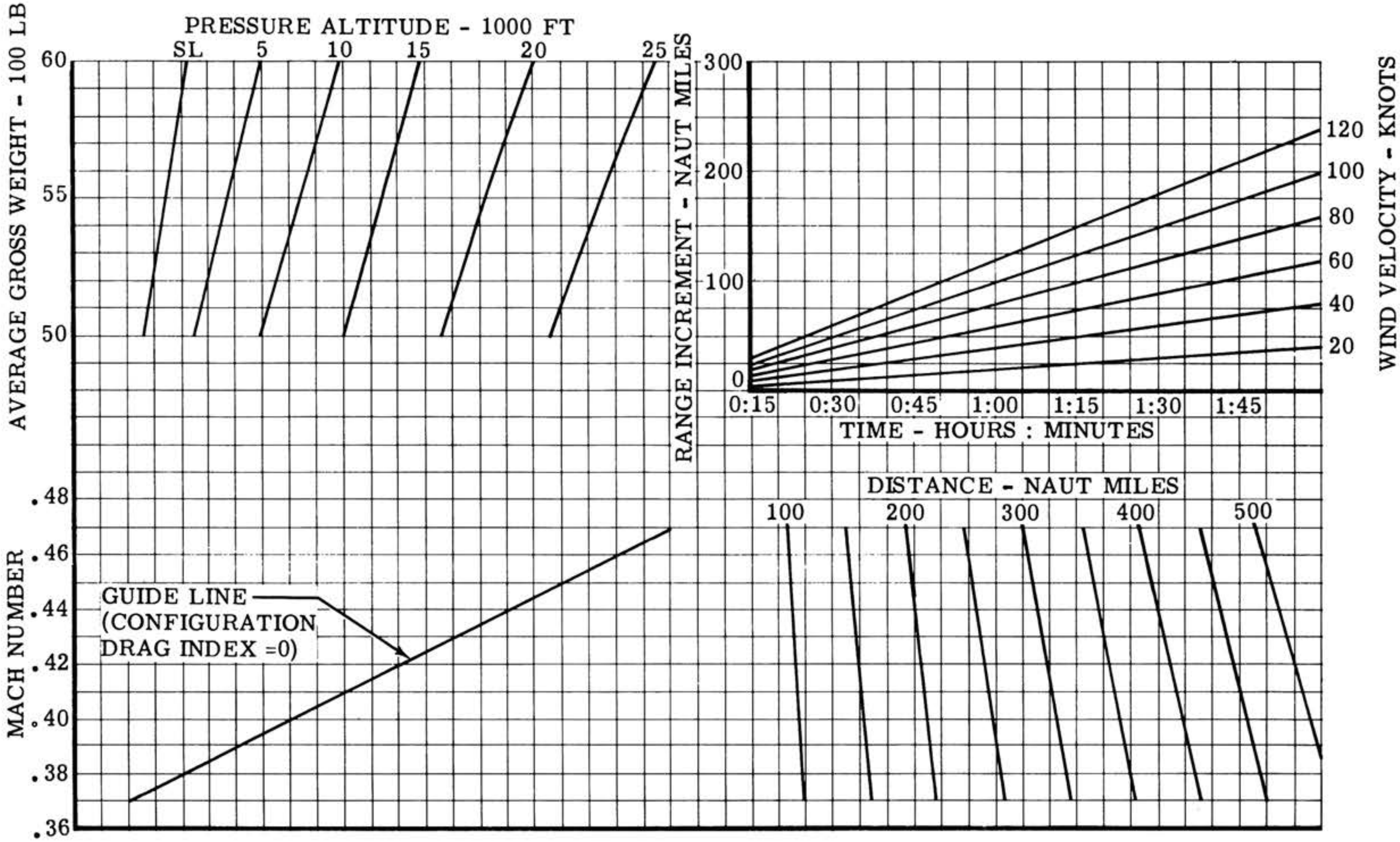


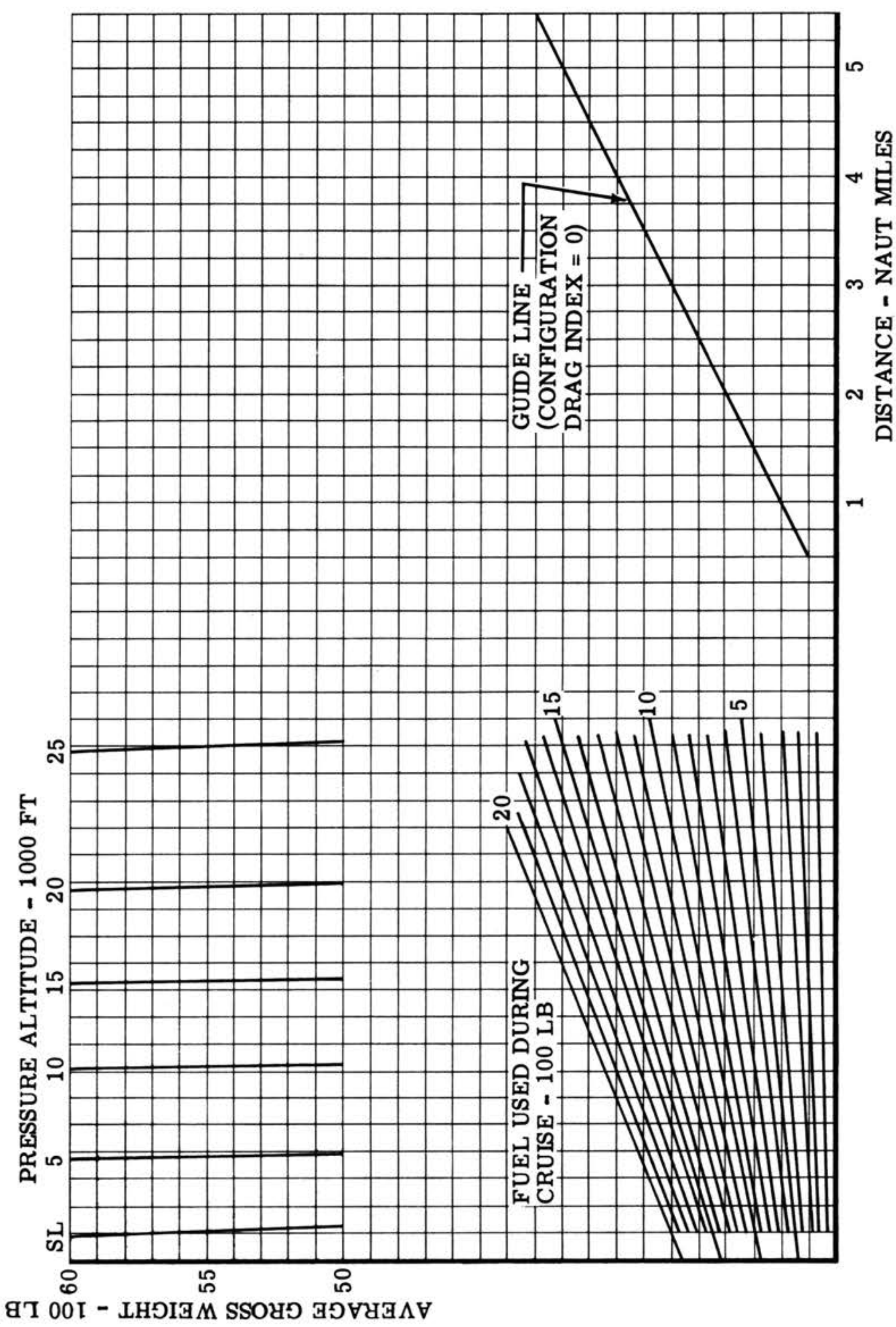
Figure A4-3

CONSTANT ALTITUDE CRUISE

(95% RPM)

DISTANCE

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

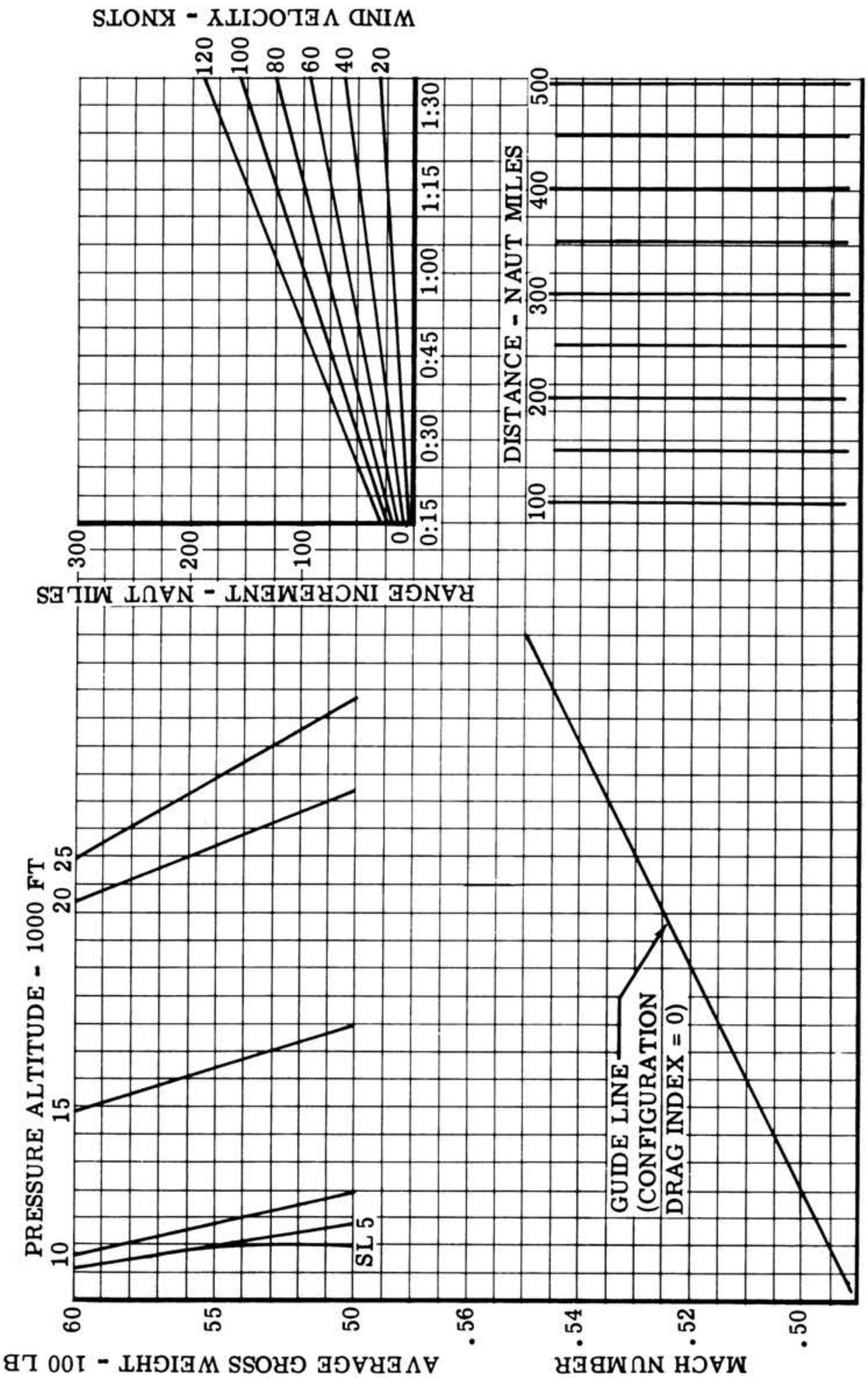
Figure A4-4

CONSTANT ALTITUDE CRUISE

(95% RPM)

MACH NUMBER AND TIME

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

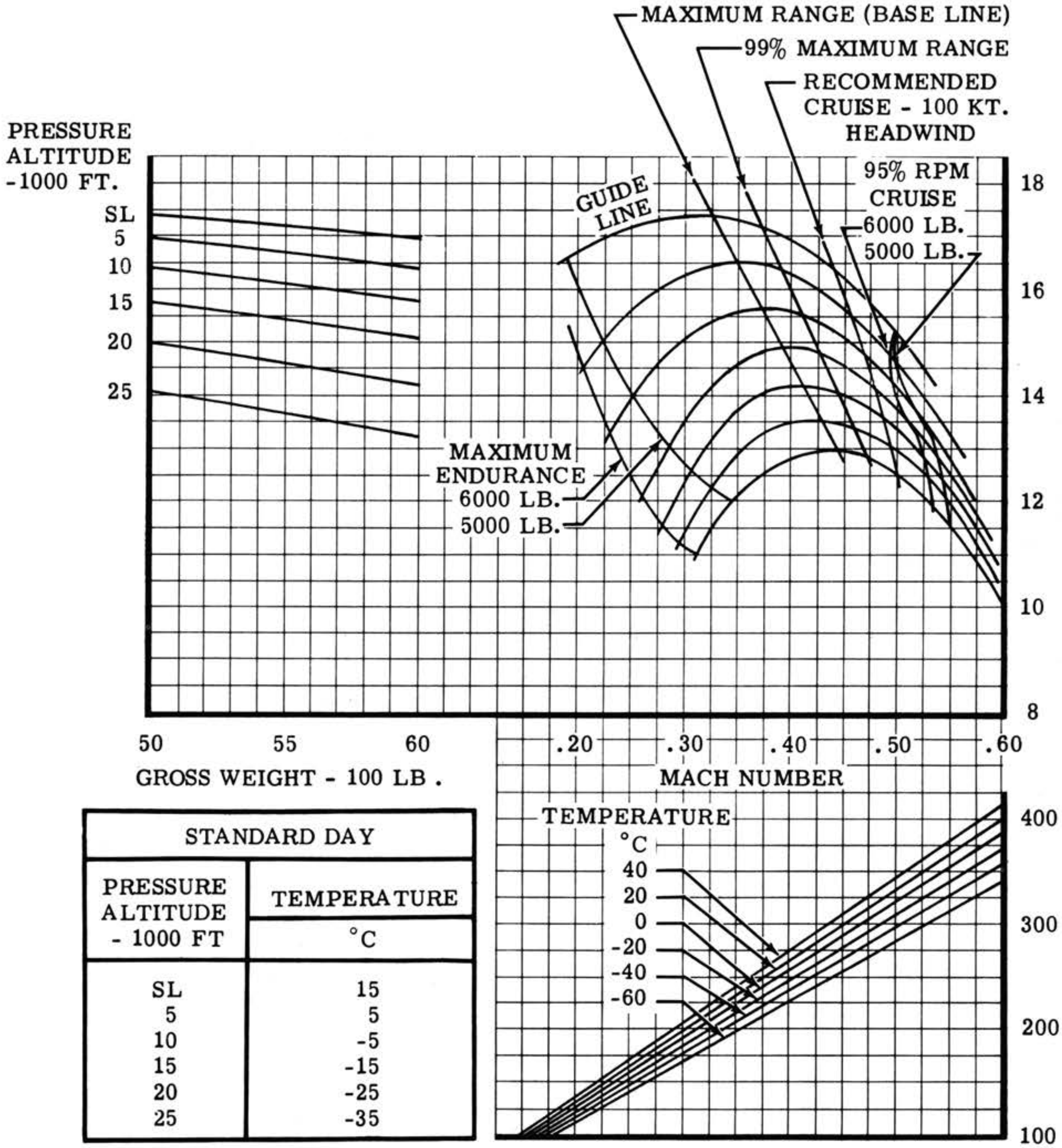
Figure A4-5

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



STANDARD DAY	
PRESSURE ALTITUDE - 1000 FT	TEMPERATURE °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-6 (Sheet 1 of 2)

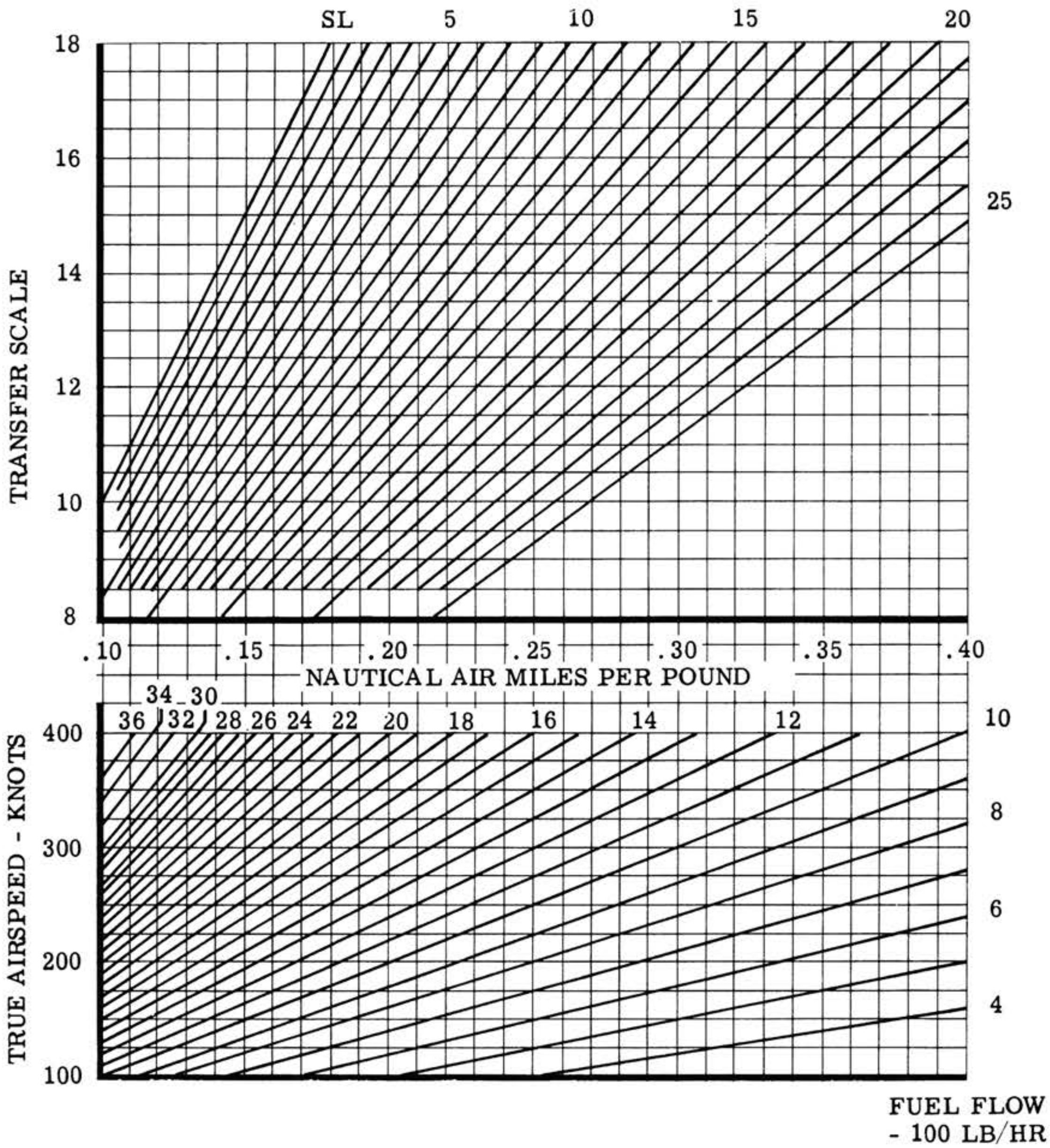


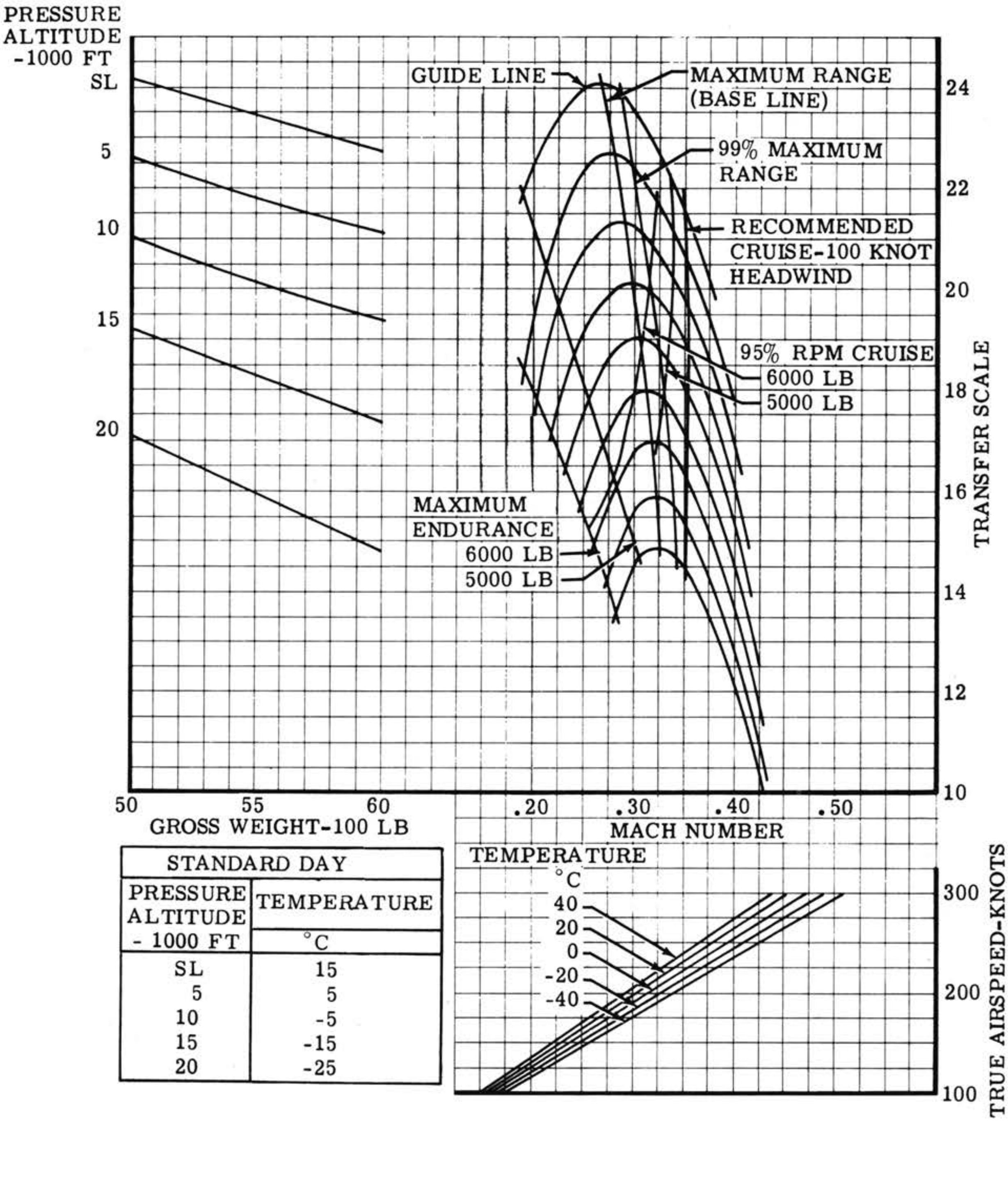
Figure A4-6 (Sheet 2 of 2)

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE



STANDARD DAY	
PRESSURE ALTITUDE - 1000 FT	TEMPERATURE °C
SL	15
5	5
10	-5
15	-15
20	-25

Figure A4-7 (Sheet 1 of 2)

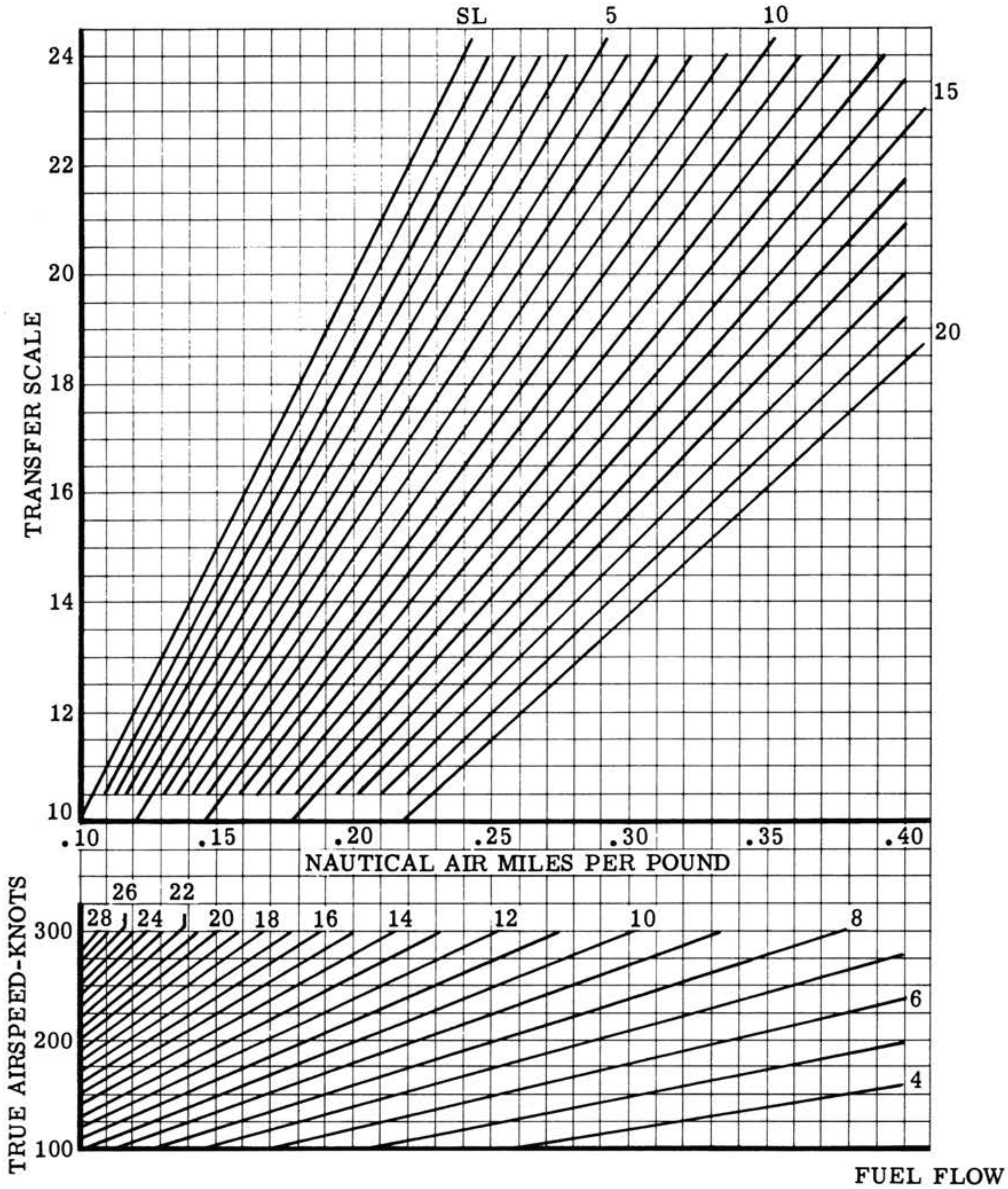


Figure A4-7 (Sheet 2 of 2)

REVERSE SIDE INTENTIONALLY LEFT BLANK

PART V ENDURANCE

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MAXIMUM ENDURANCE

The Maximum Endurance charts (figures A5-1 and A5-2) enable the pilot to determine loiter time available for a given fuel quantity, or fuel required for a specified loiter time, at maximum endurance speed, for any given conditions of altitude and gross weight. Charts for both two engine and single engine operation are included.

Recommended maximum endurance speed is 125 knots CAS for all altitudes and gross weights.

USE

Loiter time available for a given quantity of fuel is read from the chart at the intersection of a line representing average gross weight and loiter altitude, and a line representing loiter fuel. To find fuel used during a specified loiter time, the chart is entered with an estimated average gross weight, required altitude and time. If the required fuel indicated results in an average gross weight which is appreciably different from the estimated weight, the computation is then reworked using the new gross weight.

EXAMPLE I:

Conditions:

Initial Gross Weight:	5900 lb
Loiter Altitude:	25,000 ft

Find: Loiter time available with 1200 lb fuel.

Solution:

1. Determine Average Gross Weight:
   Initial Gross Weight: 5900 lb
   Loiter Fuel: 1200 lb
   Final Gross Weight: 5900-1200 = 4700 lb
   Average Gross Weight: $\frac{5900+4700}{2} = 5300$ lb

2. Enter Sample Chart:
   At Average Gross Weight = 5300 lb (A)
   Move horizontally to Altitude = 25,000 ft (B)
   Construct vertical line (BC)

3. Re-enter Chart at Fuel Used = 1200 lb (D)
   Move up to Guide Line (E)
   Construct horizontal line (EF)

4. At the intersection of constructed lines (BC) and (EF) read Time = 2 hours:7 minutes (G)

EXAMPLE II:

Conditions:

Initial Gross Weight:	5500 lb
Loiter Altitude:	5000 ft

Find: Fuel used to loiter for 1 hour.

Solution:

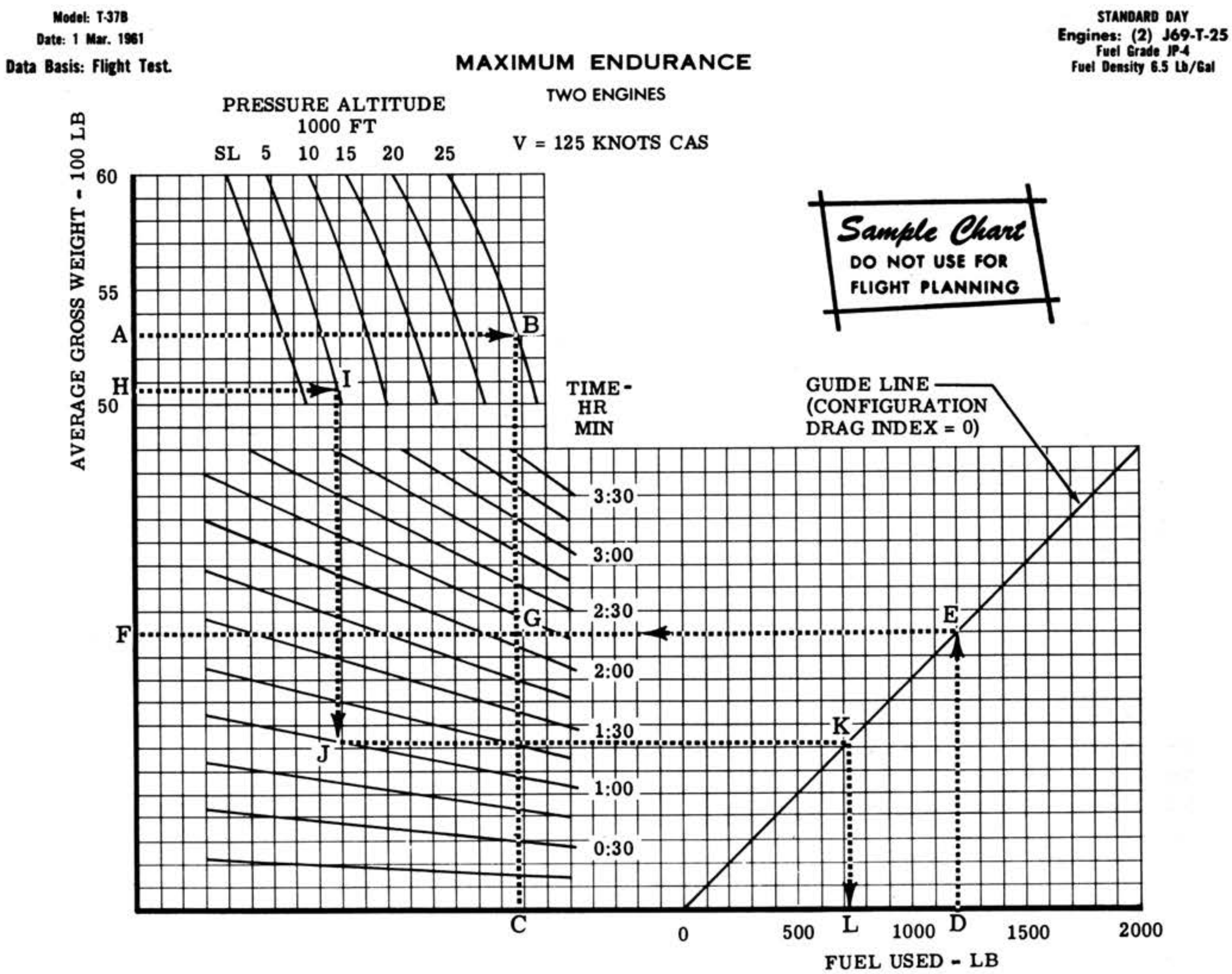
1. Estimate Fuel Used: 900 lb

2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 5500 lb
   Estimated Fuel Used: 900 lb
   Estimated Final Weight: 5500-900 = 4600 lb
   Estimated Average Gross Weight: $\frac{5500+4600}{2} = 5050$ lb

3. Enter Sample Chart:
   At Average Gross Weight = 5050 lb (H)
   Move horizontally to Altitude = 5000 ft (I)
   Drop vertically to Time = 1 hr (J)
   Move horizontally to Guide Line (K)
   Drop to Fuel Used scale and read
   Fuel Used = 720 lb (L)

4. Revise Estimated Average Gross Weight:
   Initial Gross Weight: 5500 lb.
   Computed Fuel Used: 720 lb
   Final Gross Weight: 5500-720 = 4780 lb
   Average Gross Weight: $\frac{5500+4780}{2} = 5140$ lb

5. Entering the chart at 5140 lb. Average Gross Weight it is evident the solution would be essentially the same as shown above, therefore, the problem is not reworked.


Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.
MAXIMUM ENDURANCE
TWO ENGINES
STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal
PRESSURE ALTITUDE
1000 FT
SL 5 10 15 20 25
V = 125 KNOTS CAS
Sample Chart
DO NOT USE FOR
FLIGHT PLANNING
AVERAGE GROSS WEIGHT - 100 LB
60
55
50
A
B
H
I
TIME-
HR
MIN
GUIDE LINE
(CONFIGURATION
DRAG INDEX = 0)
3:30
3:00
2:30
2:00
1:30
1:00
0:30
F
G
E
J
K
C
L
D
0 500 1000 1500 2000
FUEL USED - LB

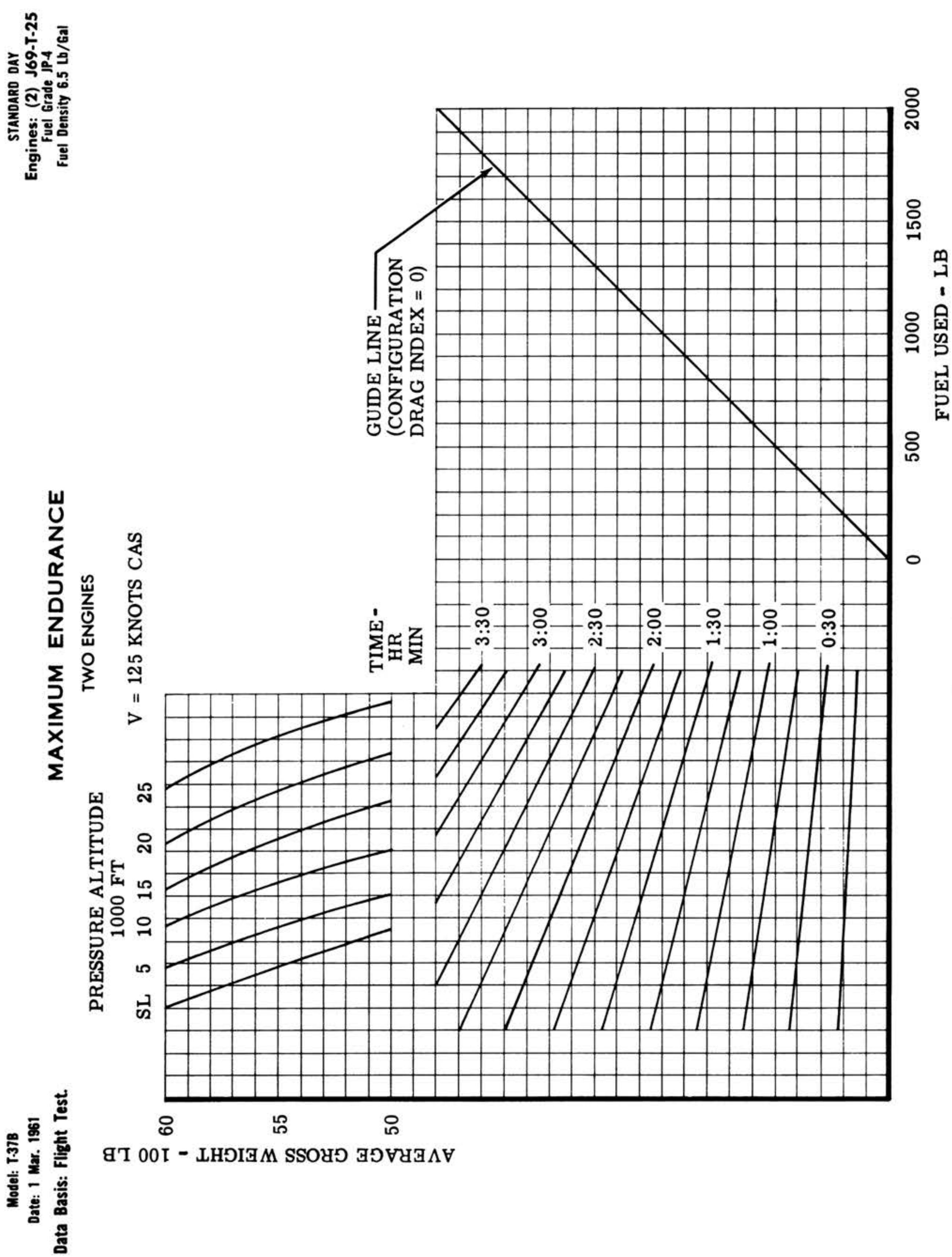

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.
MAXIMUM ENDURANCE
TWO ENGINES
V = 125 KNOTS CAS
STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal
PRESSURE ALTITUDE
1000 FT
SL
5
10
15
20
25
TIME - HR MIN
3:30
3:00
2:30
2:00
1:30
1:00
0:30
GUIDE LINE
(CONFIGURATION
DRAG INDEX = 0)
AVERAGE GROSS WEIGHT - 100 LB
60
55
50
FUEL USED - LB
0
500
1000
1500
2000

Figure A5-1

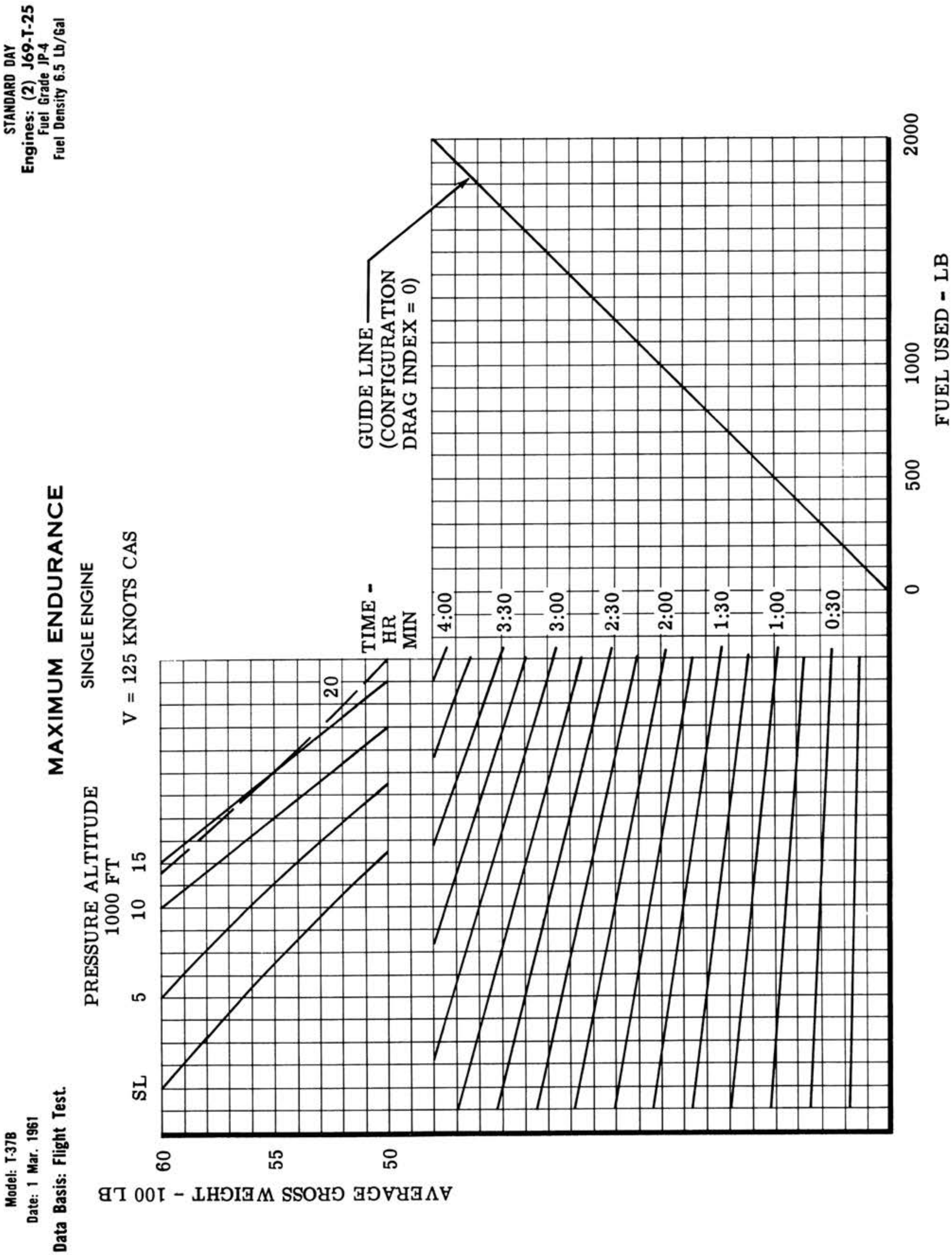

MAXIMUM ENDURANCE
SINGLE ENGINE
V = 125 KNOTS CAS
STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal
Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.
PRESSURE ALTITUDE
1000 FT
SL
5
10
15
20
TIME - HR MIN
4:00
3:30
3:00
2:30
2:00
1:30
1:00
0:30
GUIDE LINE
(CONFIGURATION
DRAG INDEX = 0)
AVERAGE GROSS WEIGHT - 100 LB
60
55
50
FUEL USED - LB
0
500
1000
2000

Figure A5-2

PART VI DESCENT

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DESCENT

Two types of descents are shown in the Descent Charts (figures A6-1 and A6-2).

1. The maximum range descent with idle rpm, speed brake retracted and 200 knots CAS.
2. The rapid descent is made with idle rpm, speed brake extended and limit CAS and should be used only when it is necessary to descend in the minimum possible time.

Descent performace with 65% rpm, speed brake extended and 200 knots IAS may be determined by using the time elapsed, distance traveled and rate-of-descent from the maximum range descent and increasing the maximum range fuel used by 50%.

PROBLEM:

Obtain rate-of-descent, time to descend, horizontal distance traveled and fuel used to descend from 20,000 feet using maximum range descent.

SOLUTION: (See figure A6-1)

A. Is entry altitude, 20,000 feet
B. Is rate-of-descent guide line
C. Is rate-of-descent - 3,000 Ft/Min.
D. Is drag index guide line
E. Is time to descend guide line
F. Is time to descend - 7.6 minutes
G. Is fuel used guide line
H. Is fuel used - 58 pounds
I. Is horizontal distance traveled - 29 nautical miles

PROBLEM:

Obtain rate-of-descent, time to descend, horizontal distance traveled and fuel used to descend from 20,000 feet using rapid descent.

SOLUTION: (See figure A6-2)

A. Is entry altitude - 20,000 feet
B. Is CAS 293 knots
C. Is rate-of-descent guide line
D. Is rate-of-descent - 22,000 Ft/Min.
E. Is drag index guide line
F. Is time to descend guide line
G. Is time to descend - 44 seconds
H. Is fuel used guide line
I. Is fuel used - 5 pounds
J. Is horizontal distance - 2.7 nautical miles

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

MAXIMUM RANGE DESCENT

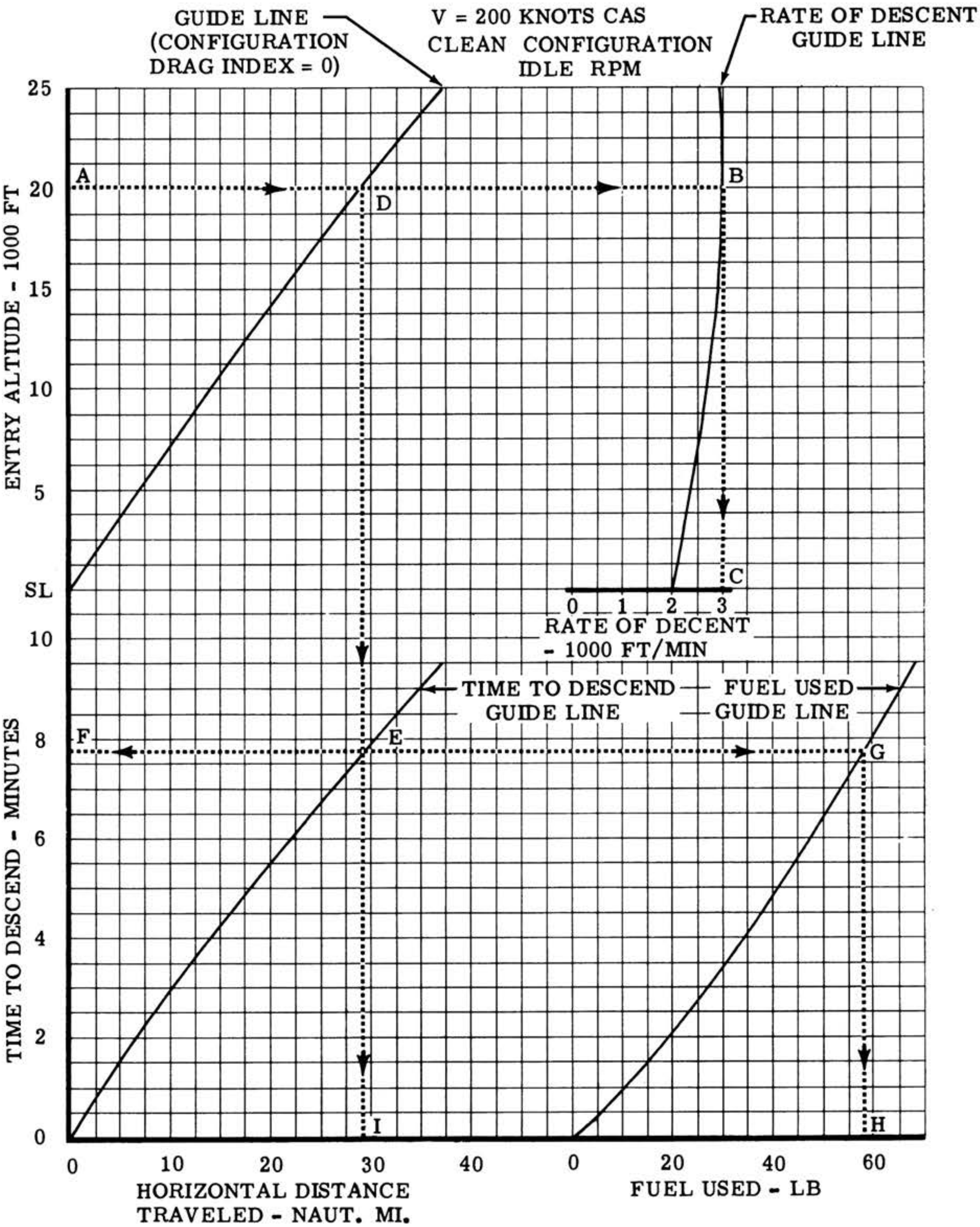

Figure A6-1

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

RAPID DESCENT

IDLE RPM
SPEED BRAKE OUT

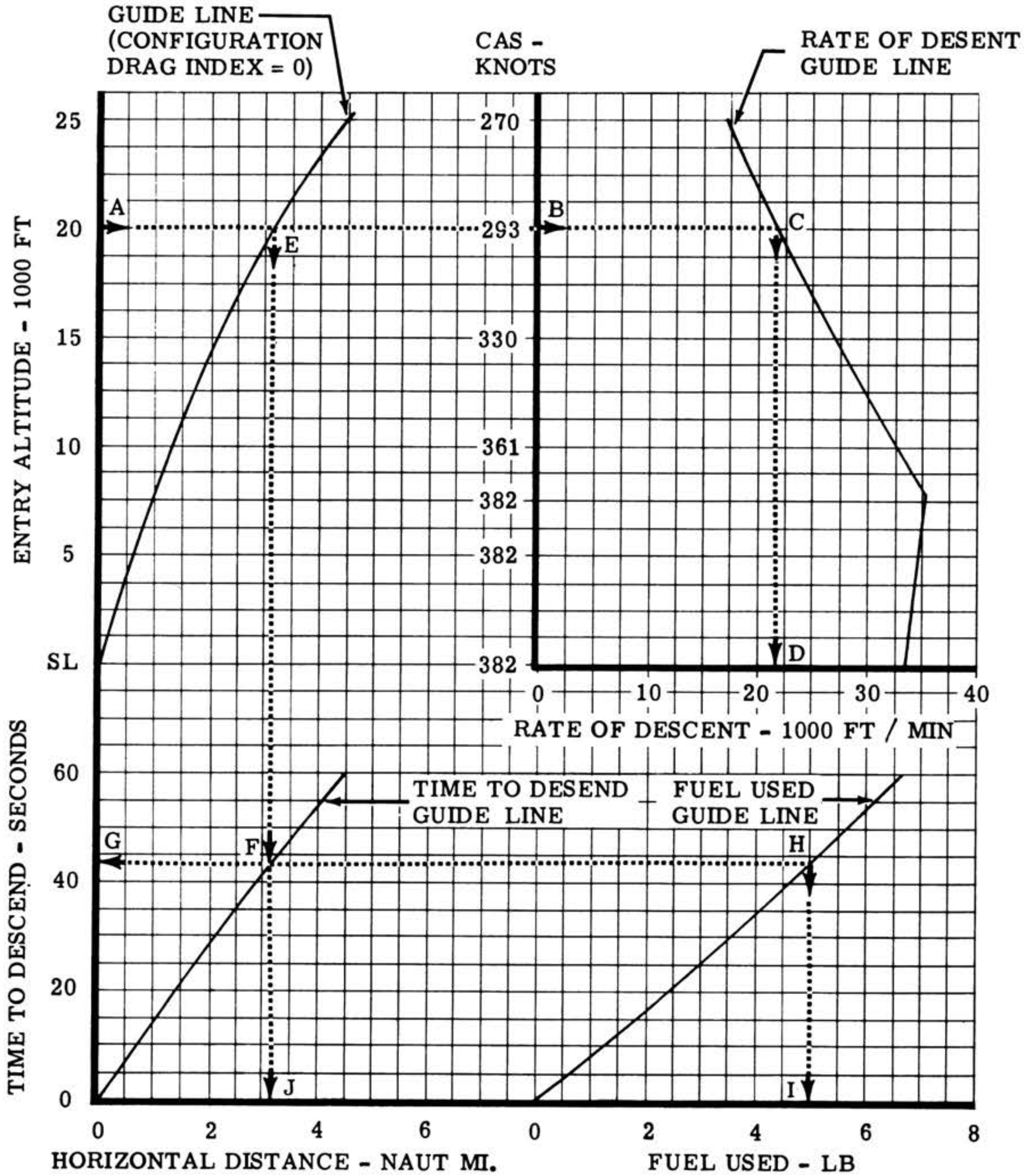

Figure A6-2

REVERSE SIDE INTENTIONALLY LEFT BLANK

PART VII LANDING

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LANDING SPEEDS

The Landing Speed Chart (figure A7-1) gives the stall, initial stall warning, and minimum approach speeds with 100% flap deflection, as a function of gross weight. The recommended normal approach speed for all gross weights is 100 knots IAS with 100% flaps and 110 knots IAS with zero flaps.

NORMAL LANDING DISTANCE

The Normal Landing Distance Chart (figure A7-2) is used to determine the distance required to clear a 50-foot obstacle, touchdown and come to a complete stop. The chart assumes a normal approach speed of 100 knots IAS, 100% flaps, speed brake extended, idle rpm below 50 feet and normal braking during the ground roll. The distance required for flaps up landings may be found by adding 20% to the distance with 100% flaps. The ground roll is increased by 75% when landing on wet, slippery runway.

The normal landing distance may be reduced by 30% by approaching with the minimum approach speed (see figure A7-1); however, this is only recommended when the available runway length will not permit the use of 100 knots IAS approach speed.

SAMPLE PROBLEM:

A landing is to be made on a dry, hard runway at 2000 feet pressure altitude. The temperature is 27°C (80°F) and the headwind component is 10 knots. A normal approach at 100 knots with 100% flaps is to be used. The aircraft gross weight is 6000 lbs.

SOLUTION: (See figure A7-2)

A. Is temperature 27°C (80°F)
B. Is pressure altitude (2000 feet)
C. Is gross weight (6000 lbs.)
D. Is wind base line
E. Is headwind component (10 knots)
F. Is ground roll (1715 feet)
G. Is total distance line intersection
H. Is total distance from 50 feet altitude to stopping point (3300 feet)

CORRECTION TO LANDING GROUND ROLL FOR RUNWAY CONDITION READING

When other than dry conditions exist on active runways, base operation officers are responsible for determining and relaying to the base weather station the type of runway covering and the relative slickness of the runway, as determined by the James brake decelerometer. This information will be transmitted as part of the teletype weather sequence. The relative slickness of the runway is determined as outlined in T.O. 33-1-23. This number will either be a one or two digit number and is referred to as the runway condition reading. This number will be followed by the letter "P" if the runway is patchy. A report of SLR14P would indicate slush on the runway, RCR of 14, and patchy conditions. Explanation of terms is as follows:

RCR -- Runway condition reading
P -- Patchy
WR -- Wet runway
SLR -- Slush on runway
LSR -- Loose snow on runway
PSR -- Packed snow on runway
IR -- Ice on runway

The ground roll distances given in figure A7-2 are for an RCR of 23, which represents a normal dry hard surface runway. The corrected ground roll for an RCR less than 23 may be found from figure A7-3 using the dry runway distance and the latest reported RCR for the destination runway. To determine the corrected total distance over a 50 foot obstacle, first subtract the dry runway ground roll from the total distance shown in figure A7-2 to find the air distance, then add the corrected ground roll. If the reported RCR is equal to or greater than 23 use the distances shown directly in the Normal Landing Distance chart without any further corrections.

Note

If no RCR is available, use 12 for wet runways and 5 for icy runways.

SAMPLE PROBLEM:

From the previous sample problem, the dry runway ground roll was 1715 feet and total distance was 3300 feet. Find the ground roll and total distance if the latest reported RCR = 12.

SOLUTION: (See figure A7-3)

A. Is dry runway ground roll (1715 feet)
B. Is RCR = 12
C. Is corrected ground roll (2960 feet)

Determine corrected total distance:

Dry runway total distance:	3300 Ft
Dry runway ground roll:	1715 Ft
Air distance: 3300 - 1715 =	1585 Ft
Corrected ground roll:	2960 Ft
Corrected total distance: 1585 +2960 =	4545 Ft

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

LANDING SPEEDS

FULL (100%) FLAP, GEAR DOWN, SPEED BRAKE OUT

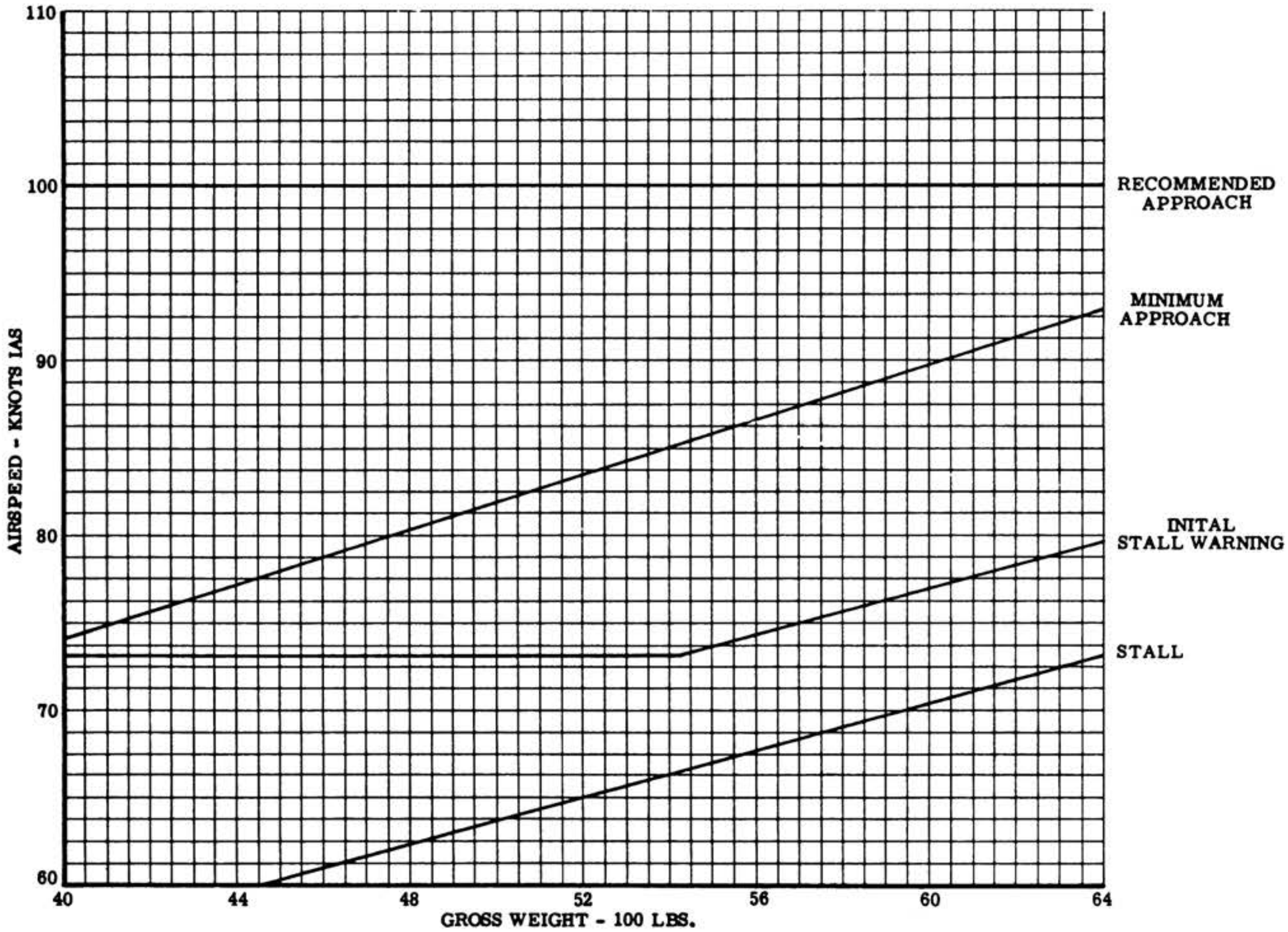

Figure A7-1

NORMAL LANDING DISTANCES

100% FLAPS

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

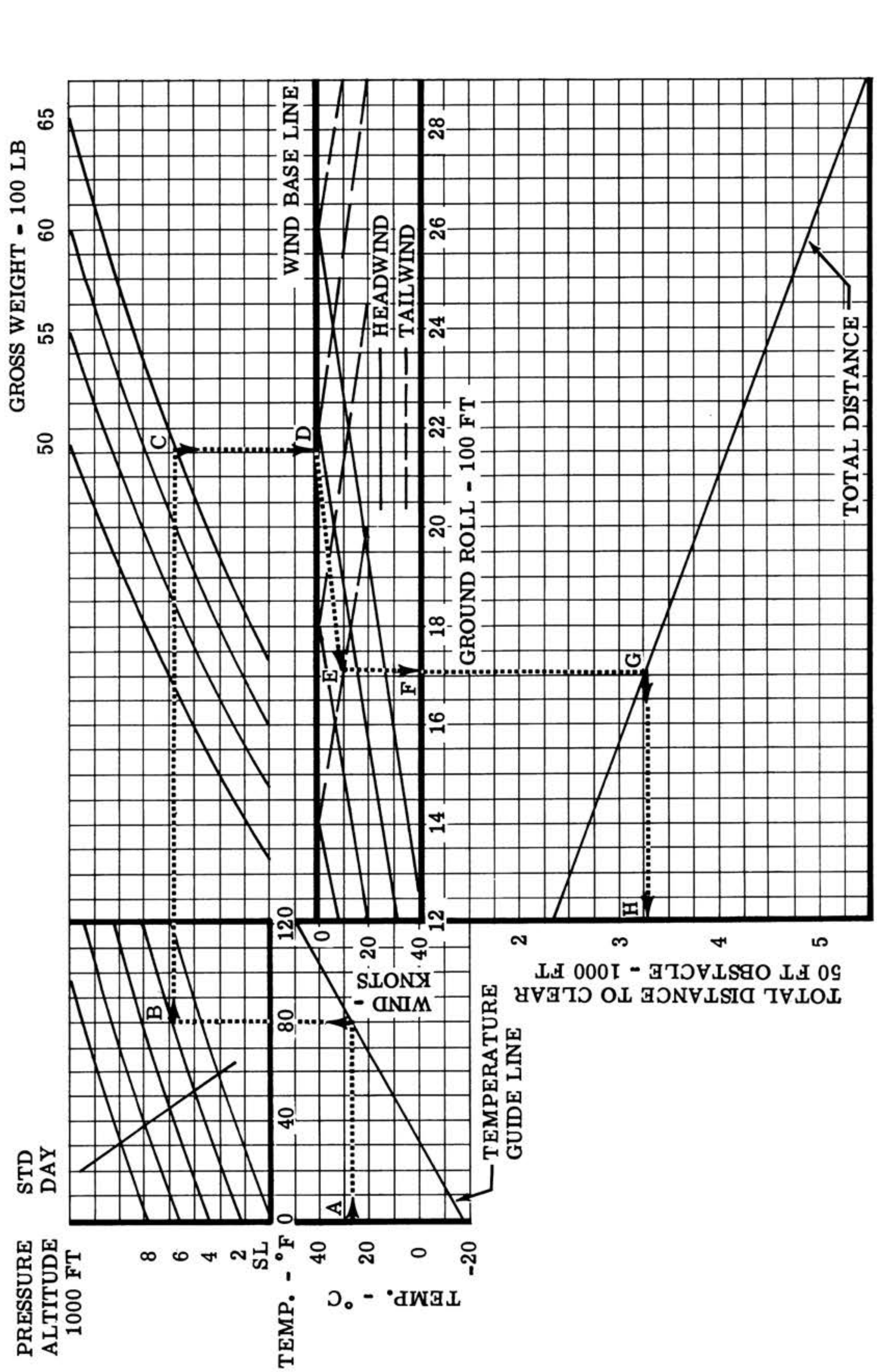

Figure A7-2

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

CORRECTION TO LANDING GROUND ROLL FOR RUNWAY CONDITION READING (RCR)

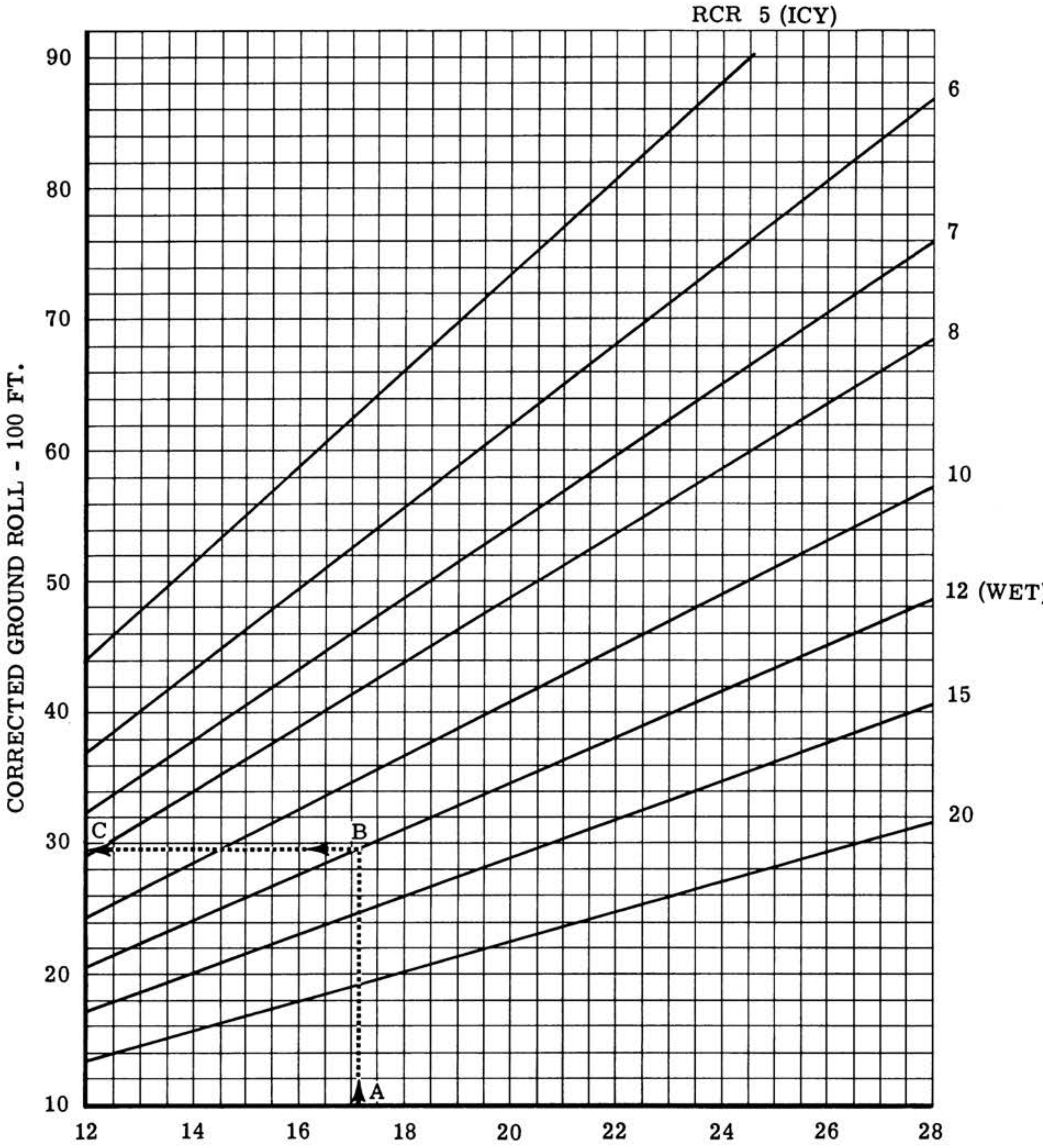

Figure A7-3

REVERSE SIDE INTENTIONALLY LEFT BLANK

PART VIII MISSION PLANNING

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TAKEOFF AND LANDING DATA CARD

The takeoff and landing data card is included in the Flight Crew Checklist. The takeoff and landing information for the planned mission should be entered on the data card and used as a ready reference for review prior to takeoff and landing. A complete sample problem of a mission, to familiarize the pilot with the use of the charts and procedures to fill out the take-off and landing data card, is shown at the end of this Section

The takeoff and landing data card definitions are as follows:

CONDITIONS

GROSS WEIGHT

Gross weight of the aircraft at start of mission in pounds.

RUNWAY AIR TEMPERATURE

Runway air temperature in degrees centigrade.

FIELD PRESSURE ALTITUDE

Altimeter reading in feet for dial set at 29.92 inches of mercury.

EFFECTIVE WIND

Reported wind conditions.

RUNWAY LENGTH

Useable length of runway in feet.

CRITICAL FIELD LENGTH

The distance required to accelerate to critical engine failure speed and either stop or continue to takeoff on single engine.

TAKEOFF DATA

TAKEOFF RUN

The distance required to accelerate to takeoff speed.

TAKEOFF SPEED

The speed at which the aircraft will leave the ground. (Normal takeoff speed is 90 knots IAS.)

REFUSAL SPEED

The refusal speed (knots IAS) is the maximum speed at which the aircraft can be stopped in the remaining runway length.

ONE ENGINE FOR BEST ANGLE OF CLIMB

The speed that will result in the maximum angle of climb for single engine conditions (125 knots IAS).

LANDING DATA

GROSS WEIGHT

Gross weight of the aircraft at end of mission in pounds.

MINIMUM TOUCHDOWN SPEED

The speed at which the aircraft will contact the runway.

LANDING ROLL

The distance required to decelerate from the touchdown speed to full stop.

SAMPLE PROBLEM

This mission planning problem is included as an additional aid in the application of the data presented in Appendix I. A typical navigation mission will be planned in the succeeding paragraphs and each of the charts will be used in the progress of the flight.

For this mission, the following conditions are assumed:

a. This mission is to be a navigation flight to a check point 200 nautical miles due west of the home field and return. The cruise altitude shall be 25,000 feet.

b. The weather report over the intended route includes a 25 knot wind from 270° at 25,000 feet.

c. The home field conditions are: elevation 500 feet, altimeter setting 29.75 and temperature 27°C, wind soutwest at 20 knots, runway 18 which is 4000 feet long is the active runway, RCR = 12 (surface wet).

PLANNING THE MISSION

The first step is to fill out the takeoff and landing data card contained in T.O. 1T-37B-1CL-1.

Conditions

a. Gross weight
(Full fuel and crew of two) ..... 6575 lbs.

b. Runway air temperature
(Weather data) .... 27°C

c. Field pressure altitude .... 670 ft.

d. Effective wind
Headwind component (From figure A2-1) .... 14 kts.
Crosswind component (From figure A2-1) .... 14 kts.

e. Runway slope 0%

It must also be noted from figure A2-1 that the minimum nose wheel liftoff and touchdown speed is 76 knots IAS.

f. Runway condition reading (RCR) 12

g. Runway length .... 4000 ft.

TAKEOFF DATA

a. Critical field length
(From figure A2-4) .... 3050 ft.

b. Takeoff run
(From figure A2-3) .... 1480 ft.

c. Takeoff speed
(From figure A2-2) .... 90 kts.

d. Refusal speed
(From figure A2-5) .... 67 kts.

e. One engine out, best angle of climb speed
(From figure A3-4) .... 125 kts.

LANDING IMMEDIATELY AFTER TAKEOFF

a. Landing roll
(From figure A7-2) .... 2940 ft.

LANDING DATA

In order to determine the landing gross weight, complete the airborne portion of the mission at this point and add landing data as the last step.

a. Gross weight .... 5133 lbs.

b. Minimum touchdown speed...76 knots IAS

T-37B TAKEOFF AND LANDING DATA CARD

CONDITIONS

	TAKEOFF	LANDING
Gross Weight	6575 Lbs	Lbs
Runway Air Temperature	27 °C	27 °C
Field Pressure Altitude	670 Ft	670 Ft
Effective Wind (Dir & Vel)	SW 14 Kn	SW 14 Kn
Runway Condition Reading (RCR)	12	12
Runway Length	4000 Ft	4000 Ft

TAKEOFF

Takeoff Run	1480 Ft
Takeoff Speed	90 Kn
Refusal Speed	67 Kn
Critical Field Length	3050 Ft
One Engine for Best Angle of Climb (Clean)	125 Kn

LANDING

	IMMEDIATELY AFTER TAKEOFF	FINAL LANDING
Gross Weight	6527 Lbs	5133 Lbs
Minimum Touchdown Speed	76 Kn	76 Kn
Landing Roll	2940 Ft	2940 Ft

It is assumed that the initial wind conditions still prevail and it can be seen from figure A1-2 the minimum touchdown speed cannot be less than 76 knots IAS.

c. Landing roll
(Form figure A7-2) .... 2127 ft.

The airborne portion of the mission is planned as follows:

OUTBOUND LEG

The outbound leg consists of a climb from field elevator to cruise altitude and then cruise at speeds for 99% maximum range to the turning point.

a. Climb from 500 to 25,000 feet
   1. Gross weight at start of climb (allow 145 pounds for ground operation and takeoff)
   (Engine start gross weight - ground allowance = 6575 -145)...... 6430 lb.

   2. Fuel used
   (Figure A3-2).............. 360 lb.

   3. Time required
   (Figure A3-3) .... 13 min.

   4. Horizontal distance covered
   (Figure A3-3) .... 46 Naut. Mi.

b. Cruise at 25,000 feet
   1. Initial cruise gross weight
   (Engine start gross weight - ground allowance - climb fuel =
   6575 -145 -360)........... 6070 lb.

   2. Distance
   (Mission radius - climb distance =
   200 -46)............. 154 Naut. Mi.

   3. Fuel used
   (Figure A3-2) .... 475 lb.

   4. Time required
   (Figure A3-3) .... 38 min.

c. ETA at turning point
(Climb + cruise = 13 +38) .... 51 min.

RETURN LEG

The return leg consists of cruise at speeds for 99% maximum range and then a maximum range descent to field elevation.

a. Cruise at 25,000 feet
   1. Initial cruise gross weight
   (Outbound initial cruise weight - outbound cruise fuel =
   6070 -475) .... 5595 lb.

   2. Distance required to descend at end of cruise
   (Figure A6-1).......... 36 Naut. Mi.

   3. Cruise distance
   (Mission radius -descent distance =
   200 -36) ....164 Naut. Mi.

   4. Fuel used
   (Figure A3-2) .... 400 lb.

   5. Time required
   (Figure A3-3) .... 33 min.

b. Descent
   1. Fuel used
   (Figure A6-1) .... 67 lb.

   2. Time required
   (Figure A6-1) .... 9 min.

AT DESTINATION

a. ETA after turn point
(Cruise + descent = 33 +9) ...... 42 min.

b. Total mission time
(Outbound leg + return leg =
0 +51 +0 +42)............. 1 hr. 33 min.

c. Total fuel used
(Ground allowance + climb + outbound cruise + return cruise + descent =
145 +360 +470 +400 +67) .... 1442 lb.

d. Fuel reserve
(Initial fuel - total fuel used =
2000 -1442) .... 558 lb.=

e. Landing gross weight
(Engine start gross weight - total fuel used = 6575 - 1442) ....5133 lb.

The landing data for 5133 lb. gross weight may now be entered on the Takeoff and Landing Data Card.

SUMMARY

Check your flight plan during the actual flight to determine whatever deviations exist. These deviations may be applied to the reserve expected at the destination. The most important factors to consider are:

Fuel used during start, taxi and takeoff (example was based on 145 pounds for this phase).

Deviation from recommended climb schedule.

Deviation from recommended cruise control.

Variation in engine performance.

Navigational errors, formation flight.

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